Exploration of the sexual division of labour in prehistoric Cyprus: an integrated study of skeletal activity patterns and archaeological data

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Abstract

Activity-related stress markers have successfully provided biomechanical models to reconstruct nuanced understandings of daily life among ancient as well as modern populations. Whilst caution is advised in relating skeletal activity markers with specific occupations, the insight they offer into activity patterns when combined with data from archaeological records, ethnographical parallels, and large datasets of comparative skeletal evidence allows bioarcheologists to achieve in-depth reconstructions of everyday tasks and activities. This doctoral thesis provides the first substantial body of data on muscle development, articular degradation, and activity-induced dental modifications of Middle Chalcolithic (ca 3600/3400-2700 BC) to Late Bronze Age (ca 1680/1650-1100 BC) Cypriot communities. The primary aim of this research is to fill the gap in knowledge concerning this significant period and location. Indeed, a bioarchaeological approach in documenting lifestyles of past populations has been recently adopted in several archaeological settings, yet, there remain very few reconstructions from ancient Near Eastern populations (Baker, Terhune & Papalexandrou 2012; Boutin 2012) and none focused on prehistory (Sheridan 2017, p. 129). For Cyprus, the evaluation of these indicators has been addressed in appendices of final site monographs or, more rarely, synthesized in regional journals, which has slowed down its integrations into the wider bioarchaeological literature (Sheridan 2017, p. 115).

Standardized and widely-adopted methods to score entheseal changes, osteoarthritis, and extra-masticatory dental wear were employed to produce a dataset which enabled comparisons of the level of muscle and joint development and non-masticatory dental wear of the examined samples. The analysis of data was conducted on two levels: the intra-population level ensured a greater understanding of the variation in activity patterns within each community; the inter-population level examined changes in workload over time resulting from the transition from household to more intensive, specialized production.

The site-by-site and diachronic analysis highlighted differences in the use of the muscles under consideration between the different communities; and between the periods. These differences were essentially sex-based in each context: females displayed muscle development which could be compatible with tasks related to food processing (pounding, grinding), in the Chalcolithic; textile and food processing (milking) in the Philia Middle Bronze Age; textile and food processing in the Late Bronze Age. Males seem to have experienced increasing stress in muscles traditionally associated with digging or hoeing in all the periods.

The discussion of the results has benefited from a large amount of information concerning flora and fauna existent at the timing of occupation of the relevant sites, ceramic or stone assemblages mostly designed for the satisfaction of primary needs such as food processing or textile production. All these types of evidence were integrated into a broader exploration of the activity patterns which had arisen, and this allowed to hypothesize the distribution of archaeologically-documented activities within the groups under consideration. In conclusion, activity-related stress markers have proven to be a powerful tool in generating behavioural models and corroborating hypotheses based on other aspects of the archaeological record.

Declaration

I, Martina Monaco, confirm that the Thesis is my own work. I am aware of the University's Guidance on the Use of Unfair Means. This work has not previously been presented for an award at this, or any other, university.

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Chapter 1 Introduction

Social complexity is acknowledged to be a cultural construct that can be measured and documented through the interpretation of the archaeological record. Traditionally, archaeological evidence has been perceived as a straightforward source of knowledge about social status, occupation and lifestyle of past populations (Goring 1989). However, modern, stereotyped assumptions have promoted misguided conclusions that each ancient population experienced the same developmental trajectory towards social reorganization regardless of their historical, economic and social background (Peterson 2002, p. 3). One of the most debated issues related to the concept of social complexity is the division of occupational roles between sexes in prehistory. Women were naturally placed into the role of raising children or domestic care, occupations tacitly suggested by biological factors arising from their role in giving birth but rarely demonstrated through clear bioarchaeological evidence (Mies 1981). In turn, it was argued, human biology would have endowed males "with taller stature, heavier musculature, and more of the hormones that are useful for aggression" (Divale & Harris 1976, p. 526). These arguments, which have for a long time depended on the consensus of a large part of the literature and which embody the core of the so-called theory of the "power of patriarchy", have exacerbated the idea that certain categories of tasks were perceived by the same members of the past communities as low-reward and thus would have made difficult for women "the access to power and prestige" (Bird & Codding 2015, p. 2). Yet, whilst these theoretical reconstructions have been substantiated for a number of ancient hunter-gathering populations which, in effect, yielded skeletal evidence suggesting greater or exclusive involvement of males in hunting (Bird & Codding 2015; Bridge 1989; Dutour 1986; Peterson 1998; Weiss 2007), recent scholarship suspects that, with the spread of farming, new labour allocations and schedules imposed a more rational organization of tasks which favoured the greater participation of women in traditionally male-dominated labour spheres with a consequent increase in workload (Bar-Yosef & Meadow 1995; Bridges 1989; Eshed *et al*. 2004). Compared with hunting and gathering, in fact, agricultural processes consisted of a variety of tasks - from the cultivation of the fields to the food processing and cooking - entailing a greater consumption of time and physical efforts which may, potentially, be shared by both the sexes (Eshed *et al*. 2004). Bar-Yosef and Meadow (1995, p. 50) found that women were responsible for the domestication of a number of plant species in the Near East; in the same way, Roth (2006, p. 527) demonstrated that in the transition from a hunting and gathering economy to farming subsistence in the Santa Cruz River villages (Tucson

Basin, Middle-Late Archaic) women actively contributed to the harvesting and processing of new plants. Goodman and colleagues, by examining the material culture and the reproductive patterns of the Agta population in the Nanadukan valley of Cagayan, proved that women participated in deer hunting (Goodman *et al*. 1985).

Highlighted by recent scholars has been the need to move beyond stereotyped visions of "division of labor" based on ill-supported assumptions which see the social organization of labour as a static element of social progression (Bird & Codding 2015; Peterson 2002). The interpretation of independent evidence, such as graphic portrayals, material culture or textual sources, can only partially reveal facets of social complexity, such as a hierarchical distribution of activities in past societies; and, if this has been ascertained, whether it reflects any sexual differentiation within the communities. Very few, to date, are the archaeological contexts in which this issue has been explored by incorporating data from archaeological sciences into the examination of skeletal remains.

This thesis advances the hypothesis that the earlier, documented forms of the social organization of labour in prehistoric Cyprus were determined by individual strategies aiming at reaching efficiency and increasing productivity. In doing this, it has sought to highlight the deep-rooted processes of the social organization of labour by using a bioarcheological approach. Skeletal markers extensively recognized as the most powerful indicators of physical activity were combined with pre-existing activity models produced by considering alternative lines of archaeological evidence, such as zooarchaeological data and material culture. For this purpose, different funerary and domestic contexts were identified and selected from the most representative and well documented in Middle Chalcolithic to Late Bronze Age Cyprus (ca 3600/3400-1125/1100 BC).

Hence, this work has four objectives:

1. To highlight the activity pattern of each sample under study through the evaluation of the following skeletal markers: entheseal changes, osteoarthritis, and extra-masticatory dental wear.
2. To explore variation in activity patterns within and between periods.
3. To integrate anthropological data with multiple lines of evidence (archaeobotanical, zooarchaeological, archaeological), provided by previous studies and utilized to generate activity reconstructions, to deepen understanding of aspects related to the distribution of tasks within the communities.

4. To explore the socio-economic significance of potential differences in labour.

This first chapter is intended to situate this thesis within the wider context of bioarchaeological research in the southern Levant and, more specifically, studies which reconstruct patterns of habitual activity through a suite of data commonly known as activity-related stress markers. A critical revision of past and current studies has been provided (section 1.1). After this brief synopsis, the chapter moves on to provide a chronological context for the study by outlining the characteristics of the main periods of Cypriot prehistory, more specifically between the Middle Chalcolithic and the Late Bronze Age. The afore-mentioned chronological framework was divided into three macro-phases: Middle-Late Chalcolithic, Philia-Middle Bronze Age II, Middle Bronze Age III-Late Bronze Age III (Table 1.1). This organization of the arguments in phases was intended to highlight discontinuity traits reflecting cultural, technological and socio-economic innovations which characterized the development of the considered Cypriot communities. Indeed, for each chronological phase, an extended description has been provided of evidence for the organization of settlements, the architectural techniques adopted, subsistence activities, material culture, and burial customs. As the focus of this thesis is on exploring the social organization of labour across this period, emphasis here will be placed on archaeological evidence that has been amassed in previous studies to document working tasks.

Table 1.1. Chalcolithic and Bronze Age chronology. (Derived by Manning 2013, p. 521).

Period	Phase/Culture	Dates (BC)
Chalcolithic	Early Chalcolithic	4000/3900-3600/3400
	Middle Chalcolithic	3400-2700
	Late Chalcolithic	2700-2500/2400
Prehistoric Bronze Age	Philia-Middle Cypriot II	2400-1690/1650
Protohistoric Bronze Age I	Middle Cypriot III	1750-1680/1650
	Late Cypriot I (A-B)	1680/1650-1450
Protohistoric Bronze Age II	Late Cypriot II (A-C)	1340/1325-1200
Protohistoric Bronze Age III	Late Cypriot II-III (A)	1200-1125/1100

1.1 The status of bioarchaeological research in Cyprus and Levant

Over the last three decades, bioarchaeological research in Cyprus has experienced significant growth. New excavations during which the recording and recovery of human remains in funerary contexts have been prioritized have given rise to new data sets and research questions, and novel research projects based on these data are growing in number and scale (Albertini & Monaco 2017; Fischer & Bürge 2014; 2015; 2016; 2017; 2018; Lorentz 2016; 2017; 2019).

Traditionally, however, human remains have received little attention from scholars of Cypriot prehistory. The nineteenth-century excavators' interest was principally directed to the recovery of burial goods, in particular jewellery and other valuable artefacts; they rarely recorded structures, state of preservation of the human remains, or spatial relationships between the contents of the tomb (Keswani 2004). In consequence, this produced a gap in knowledge that is unlikely to ever be filled. Indeed, although anthropological work in Cyprus is growing in scale and scope, it remains the case that not all of the osteological collections excavated from archaeological sites in Cyprus have been published (Harper & Fox 2008, p. 2). According to the reviews of published cemeteries undertaken by Keswani (2004, Table 3.1, 3.2), it appears that only a low percentage, ranging between 30% and 60%, of the Chalcolithic-Late Bronze Age cemeteries has been subjected to anthropological study. These rates are the result of a combination of factors including the commingled nature of the human remains exhumed from Cypriot prehistoric cemeteries which have often made the identification of satisfactory methods for age and sex assessment difficult and thus deterred researchers (Osterholtz 2015).

Even where anthropological analysis has been undertaken, the analysis of human remains recovered from many archaeological sites across the island has been relegated to appendices of site publications or included only in reports issued by the Department of Antiquities (e.g., Domurad 1987;1996; Lunt, Parras & Watt 2006; Lunt, Peltenburg & Watt 1998; Moyer 1985;1989; Schwartz 1976). Most osteological reports have presented general data related to the sex and age composition of the collections, but more detailed analysis, including assessment of palaeopathological data, has rarely been reported (Gamble 2011, p. 29). Exceptions to this trend are the publications of the Vasilikos Valley Project, the Lemba Archaeological Project, and, most recently, the excavations at Erimi *Laonin tou Porakou* and Souskiou *Laona* (Bombardieri 2017; Lorentz 2016; 2019; Todd 2005, Todd & Croft 2004). All these works stand out for a variety of reasons including the fact that they have devoted entire chapters to the presentation of the results of anthropological analysis, with specific mentions of the preservation status of each skeletal element recorded (both in terms of bone surface preservation and completeness of the skeleton); their position within the burial context, by accompanying detailed description with graphic/photographic documentation; the presence/absence of dental or skeletal disease; and diet.

Skeletal evidence attributable to occupation stress represents the core of this dissertation. With few remarkable exceptions represented by the works of Lorentz and co-authors (Lorentz, Casa & Miyauchi 2021), Casa (2016), and Gamble (2011), this topic has never been attracted the attention of specialists. Yet, as previously stated, it represents a valuable source of knowledge about the health and lifestyle of ancient populations (Goring 1989). This does not mean that this issue has been entirely neglected, but rather that the site-by-site approach has prevented the possibility of investigating the changing activity patterns of Cypriot populations diachronically, and, consequently, of advancing activity reconstructions (Peterson 2002, p. 85). It is this gap in knowledge that this thesis seeks to fill.

Looking at osteological research from Levant, only a few studies were designed to explore the object of this dissertation, namely the evaluation of the activity-induced stress markers to document activity patterns and workload changes of prehistoric communities. Among the most recent works, it must be reported the study conducted by Jane Peterson (2002) on 14 skeletal collections from 14 Natufian, Neolithic, and Early Bronze Age sites located in Israel and Jordan. Its methodological strategy, consisting of the combination of data related to the muscle developments of the examined collections with the archaeological records available from excavations, led to understanding forms of sex-based distributions of labour within these communities. Additionally, this study has contributed to highlight differences in the activity patterns between hunter-gatherer and agricultural groups.

A similar approach has been previously adopted by Theya Molleson (1994) to reconstruct the working activities of the population which occupied the site of Abu Hureyra (Syria) from the Natufian to the Neolithic period. In this case, three skeletal indicators were considered: dental wear, joint modifications, and entheseal changes. She was able to establish that grinding in a kneeling position was one of the most physically impacted activities conducted within the group. Additionally, she was able to demonstrate that females used to manipulate plant fibres to produce baskets by using teeth.

This selective review of past osteological examinations centred on activity-induced skeletal emphasizes, through key examples, the importance of employing repeatable methods to evaluate these skeletal features in order to favour the formulations of models embeddable in other studies.

1.2 The concepts of sex and gender in bioarchaeological studies

Before we dive into the debate related to the sexual distribution of labour in Prehistoric Cyprus, it was considered appropriate to clarify some key terminology. Although frequently used interchangeably, the terms sex and gender have different values and meanings. Sex, to quote the definition provided by Zuckerman and Crandall (2019, p. 162) was used to indicate a "demographic feature discernible on the basis of chromosomes, gonads, internal reproductive organs, external genitalia"; and it can be estimated at skeletal level, by evaluating a series of morphometric traits. Gender indicates cultural and social sex-based constructed roles derived by archaeological, ethnographical, and historical studies; this concept has only recently been approached by offering empirical substantiations (Conkey & Spector 1984; Walker & Cook 1998; Zuckerman & Crandall 2019).

It is important to note that increasing numbers of studies on gender have been published since the early 1980s (Walker & Cook 1998, p. 257). Yet, 50% of these failed to explore the differences between gender and sex in their meanings. Bioarcheologists were among the "worst offenders": indeed, as Walker and Cook (1998, p. 257) pointed out, a very low percentage of papers, reported on the *American Journal of Physical Anthropology*, provided useful definitions of the two terms. Yet, it appears evident that any discussion about gender roles in archaeology is virtually impossible without a clear determination of the sex composition of that communities. In other words, sex and gender must be considered as culturally contingent features, equally important to interpret human behaviours in past populations (Walker & Cook 1998). The combined use of paleodemographic data and archaeological evidence inherent in the social identities of the occupants of the ancient sites may provide insights into economic and social strategies reproduced by past communities (Larsen 2015; Zuckerman & Crandall 2019).

1.3 The Archaeological background

The chronological period ranged between the Middle Chalcolithic (hereafter, MChal) and the end of the Late Bronze Age (hereafter, LBA) was delineated by significant socio-economic and technological developments which resulted in a more nuanced organization of labor and, consequently, in an increasing social complexity leading to the rise of the town in the LBA. The beginning of the Early Chalcolithic (ca 4000/3900-3600/3400 BC) (hereafter, EChal) was accompanied by an abrupt abandonment/dislocation of the previously-occupied settlements (Steel 2004). This feature together with the significant changes in the pottery/ground-stone technology, the intensification of the picrolite processing, the declining of the importance of deer in diet, the introduction of the curvilinear architectural solutions led the scholars to recognize in this chronological framework the origin of the first forms of social differentiations (Bolger 2002). Unfortunately, as previously stated, our knowledge of the working activities performed by the inhabitants of the island, from Chal to Middle Bronze Age (hereafter, MBA), was exclusively based on the recovery of archaeological, botanical, and osteological remains as no written accounts were left behind by these populations. Additionally, during the Chalcolithic, graves yielded relatively few mortuary items (Peltenburg *et al*. 1985;1998; Knapp 2013; Steel 2004); consequently, for chronological range considered in this dissertation, the most valuable information on the occupations of these groups were deducible exclusively by the domestic context. This issue prevented the possibility to extend the range of analysis to the EChal as the investigated sites for this chronological sequence, including the only site which provided evidence of human depositions (Kissonerga *Mylouthkia*), are only known from survey work (Harper & Fox 2008; Knapp 2013). However, in the following MChal, the development of expansive trade, the establishing of specific spaces for communal activities/ceremonies, the increasing demand for valuable materials destined to the realization of symbolic objects, such factors are regarded as indicative of the emergence of social inequalities (Lorentz & Casa 2021; Peltenburg, Bolger & Crewe 2019). Concerning the second macro-phase which cover the period between Philia to MBAII, a variety of features including the adoption of the plough, the exploration of the cattle, the introduction of a specific set of items (spindle whorls and loom weights) employable in the textile manufacturing, the intensification of the copper production, was regarded as indicative of the transformation of isolated, village-based communities into important centers integrated in a dense network of economic and cultural exchanges. Finally, from the MBAIII, pottery and copper industries were based in organized workshop complexes designed for a mass-production, this latter destined to the overseas consumption (Knapp 2013). In general, this new way to conceive pottery, metal and also textile production reflect, to quote

Knapp (2013, p. 406), "the ability of a larger polity to attract specialized labour, the necessary materials and services, and support the manufacture of prestige goods for elite consumption".

Researchers agree that sharply defined labour roles were crucial for a successful economy and, consequently, to ensure the surviving of the community itself (Peterson 2002, p. 1). It must be presumed that, before the rise of social elites, hunter-gatherer groups, first, and farming communities, then, had to schedule working activities according to rigorous schemes, which certainly included all the component of the society including females. Understanding the levels of engagement of all the members of these communities in the economic processes which marked such crucial chronological framework represents the key to interpreting events and factors which led to the spread of social inequalities.

1.3.1 The first macro phase: Middle-Late Chalcolithic

The archaeological evidence, available to date, of the MChal settlements comes from southwestern Cyprus and comprises the sites of Kissonerga *Mosphilia (*period 3), Lemba *Lakkous (*period 1), and Erimi *Pamboula* (period 1). Among these, the smaller settlement, Lemba *Lakkous* (hereafter, Lemba), which hardly attained 3 ha with a population of possibly approximately 240 inhabitants, contrasts with the larger, longer-lived villages of Kissonerga *Mosphilia* (hereafter, *Mosphilia*) and Erimi *Pamboula* (hereafter, *Pamboula*) which occupied respectively an area of 12 ha and 13 ha (Manning 1993, p. 43; Peltenburg 1990, pp. 17-22). [1]

[1] These figures have been obtained by accepting Renfrew's (1972, p. 251) estimate of 200 persons per hectare.

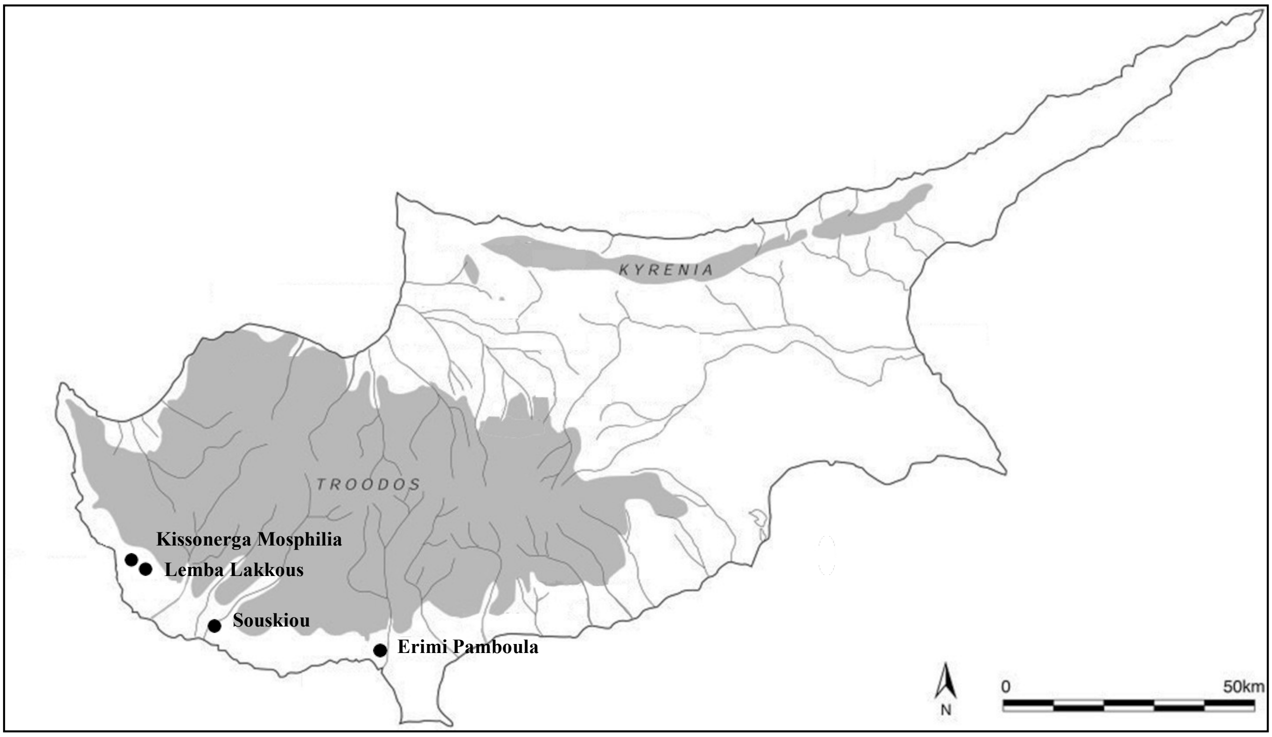


Figure 1.1. Map of Cyprus showing the location of the Chal sites mentioned in the text.

The architecture of MChal settlements displays a suite of similar characteristics: buildings are circular in plan (but different in size), with floors and walls realized in plaster and erected on stone foundations (Peltenburg *et al*. 1985;1998; Knapp 2013; Steel 2004). This latter element implies not only, to quote Steel (2004, p. 89), "a greater investment of time and labour" but also a change in the nature of the settlement perceived as sedentary. The living space, radially divided into four parts, was articulated around the central hearth platform and covered by a roof (Frankel 2000, p. 171; Steel 2004, p. 88). Furthermore, working, sleeping, and eating areas were clearly delimited (Steel 2004, p. 88). Some of these circular domestic structures (e.g., Building 994 at *Mosphilia*) have also revealed a significant concentration of figurines in the interface between the cooking and the living spaces, below the floor (Knapp 2013, p. 233). This element, which makes its first appearance in this phase, undoubtedly suggests the symbolic value of these liminal spaces (Steel 2004, p. 89). In addition to the circular structures widely attested at *Mosphilia* excavations have provided evidence of small rectangular structures (e.g., Building 1161) which seem to be different in terms of size and function (Peltenburg 1990, p. 23). To a mature phase of the MChal is dated the establishment of areas designed for specific activities. An example is offered by the so-called "Ceremonial Area" of *Mosphilia*. It consisted of a group of structures, separated from the rest of the settlement but which displayed similarities in sizes and architecture. In contrast with the other structures, the foundations of these buildings were formed from a specially selected type of calcarenite, and the floors lined with a thicker layer of plaster (Steel 2004). They also faced onto an open area which likely served communal ceremonies. In fact, the recovery of a less utilitarian pottery assemblage (decorated bowls) and the presence of earth ovens have led to a supposition of a “communal mobilization of labor” (Steel 2004, p. 91).

Regarding the subsistence strategies performed by these people, archaeobotanical remains and tools (e.g., mortars, querns, and rubbers) associated with food processing testify to a gradual increase in agricultural production accompanied by a corresponding decline in hunting (Steel 2004, p. 92). Among the productive activities in which MChal communities were involved, pottery production certainly took place within the domestic context. The ceramic repertory of the MChal chronological phase shows the introduction of new ceramic shapes which comprisedhemispherical or deep bowls with spouts or lugs and storage jars. The Red on White style which characterized the entire course of EChal culture “developed into a vibrant complex of linear and curvilinear designs” (Bolger 2013, p. 4). Similarly, the production of picrolite objects, another category of artefacts which plays a central role in the material culture of this period, was basicallya household activity.[2] Extracted from the Kouris valley, this green or blue stone was certainly marked by a new symbolic value proved by limited circulation and inclusion in selected funeraryrites (Peltenburg 1991). The development of a more complex symbolic system is also suggested by the introduction of a wide range of terracotta, stone, and picrolite figurines. The majority of these represent females in different attitudes (standing, squatting, seating), even if the cruciform type dominates the MChal. Multiple interpretations and functions of these items have been postulated; [3] what is undoubted is that the cruciform types are related to aspects of childbirth (Bolger 2013, p. 8; Goring 1991, p. 160; Peltenburg 1991). In fact, they refer to female figures represented with outstretched arms in the act of being supported during childbirth (Steel 2004, p. 101).

The transition between the end of the MChal and the beginning of the Late Chalcolithic (2700/2600-2500/2400 BC) (hereafter, LChal) appears to be a pivotal moment in the development of Cypriot social identity (Peltenburg 1993, p. 18). The settlements of *Mosphilia* and Lemba were abandoned for 200 years and when people reoccupied the two sites (period 4 at the former and period 3 at the last) they brought with them new, higher quality, standardized pottery (Knapp 2013, p. 246; Peltenburg *et al*. 1998, p. 249; Peltenburg *et al.* 1985, p. 18; Steel 2004, p. 106). In fact, the Red-on-White ware of the MChal was replaced with Red and Black burnished ware in various new forms, such as spouted vessels clearly influenced by contacts with the Levantine coast. This

[2] The absence of specialized production has been assumed by Peltenburg (1991, p. 116) on the basis of the limited variability in the repertoire.

[3] Some scholars, such as Karageorghis (1977), argue that these figurines symbolized deities; others, such as Morris (1985) maintain that they were used as birth charms.

ceramic typology attested in the western part of the island coexists with another ware, commonly known as Red and Black Lustrous, found in the district of Nicosia. The excavation of the sequence in period 4 at *Mosphilia* turned out to be particularly useful in documenting cultural, social, and economic changes which characterized the LChal. Here, the excavators have identified two different phases: period 4a which corresponds to the early LChal, and period 4b dated to the final stages of the LChal. The first phase is marked by buildings furnished with storage deposits, indices of the exceptional economic resources available to the occupants, and communal areas intended for crafting activities (Knapp 2013, p. 248; Steel 2004, pp. 106-10). An example of this type of building is represented by the so-called "Pithos House". Similar to other contemporary buildings in plan but notable for its exceptional size, it contained traces of copper-working and oil production: this latter activity has been suggested because of the large number of storage vessels found on the floor and a stone basin which, according to Peltenburg, could be used as a press (Peltenburg *et al*. 1998, p. 39). Copper-working activity is inferred from the recovery of crucibles, ores and, a few finished objects (Peltenburg *et al*. 1998, p 42). In addition, the recovery of standardized bowls piled up in the pithoi implies a distribution practice involving their use (Peltenburg *et al*. 1998, p. 42). The second phase of the LChal (4b) at *Mosphilia* is marked by radical changes in the organization of the settlement as well as in the spatial arrangement of the domestic sphere. Indeed, the MChal trend to devote specific spaces to communal activity, such as feasting, working, and rituals, becomes partially offset by the increase in the number of small units related to "major establishments" such as Building 3 at *Mosphilia* or buildings 1052 and 1046 at Lemba (Peltenburg 1990; Peltenburg *et al*. 1985). These features provide evidence of the fragmentation of the community into small groups (Steel 2004, pp. 109-110).

The LChal ceramic repertoire is not the only aspect which attests to increasing contacts with the Levantine coast. The transitional phase between the MChal and LChal, in fact, yielded 11 copper-based objects from clear contexts (*Mosphilia*, Lemba, and Souskiou) most of them personal adornments from funerary contexts (Gale 1991, p. 57). A lower percentage has been recovered from settlements, including, for example, the chisel found in Pamboula (Bolger 2007; Gale 1991). Interestingly, lead isotope analysis of the raw material of these metal objects indicates an origin in Anatolia (Gale 1991, p. 57). Hence, this data is crucial in revealing contact between Cypriot communities and Anatolia, and, consequently, in the understanding of the so-called "incipient stages" of social complexity traced by Knapp (1990, p. 147) in the M-LChal (Bolger 2013, p. 4). More specifically, the waste and the crucible fragments recovered at *Mosphilia* may perhaps be interpreted in the context of a first attempt to adopt knowledge and skills widespread in Anatolia (Bolger 2013, p. 4).

A variety of evidence has been presented to argue in favour of an unprecedented asymmetrical social organization within Cypriot M-LChal communities (Knapp 1993, 2013; Manning 1993; Peltenburg 1990;1993). This includes variation in size of the buildings, therefore differential requirements in terms of material resource and physical effort required to build them, the equipping of some buildings with storage and/or ceremonial areas whereas others had simpler layouts, and the variability in the provision of funerary facilities. A combination of these factors provides the most compelling evidence for variation in the status of the inhabitants.

MChal burial practices, according to Steel (2004, p. 96), attest "the development of formalized and differential mortuary rituals". These burials were typically located outside the wall of the house, beyond the living area, and consisted of simple pit graves often closed by a capstone (Bolger 2013; Knapp 2013, p. 207; Peltenburg *et al*. 1985; 1998; Steel 2004). Differences between adult and subadult burials seem not to be related to the type of grave or the position of the bodies, which were generally flexed on the right, but rather to the few objects associated with the corpse. Children were adorned with picrolite pendants, dentalium necklaces, and other common objects like bowls and bottles. The necklaces, in particular, may be considered markers of social status; according to Peltenburg (1992), these objects may represent a family's possession rather than items worn by the children. Traces of attrition, in fact, testified that they were worn in life but unlikely by children given their weight. On the basis of the EChal and MChal evidence only a restricted number of families could access them (Peltenburg 1992, p. 33). In marked contrast, the adults were not accompanied by any kind of grave goods which are preserved archaeologically (Steel 2004, p. 63). The same grave was sometimes used for multiple inhumations, and in doing so, the previous burials were removed to make space for subsequent interments. The introduction of multiple interments indicates as Peltenburg suggests, "new attitudes towards access to certain tombs and perhaps a great emphasis on distinctive social relationships" (Peltenburg 1990, p. 30). Anexception to the above-mentioned convention was offered by the case of the extra-mural MChal multiple bell-shaped chambers of Souskiou *Laona*, characterized by the predominance of adults equipped with unusual assemblages composed of cruciform figurines, dentalia, zoomorphicvessels, shell and copper (Bolger 2013; Christou 1989; Crewe *et al*. 2005; Keswani 2004). The majority of these graves had been looted; therefore the most valuable information has been derived from the examination of the few intact contexts. They revealed a primary deposition represented by an articulated skeleton associated with a "bone stack" composed of a number of bones belonging to a secondary deposition placed at the feet of the first one (Crewe *et al*. 2005, p. 6).

As far as funerary contexts are concerned, the beginning of the LChal is accompanied by several changes involving both the types of graves and the treatment of the dead. Elaborated chamber tombs, comprising a vertical shaft leading to one or two sub-circular chambers appear, and are utilized in addition to traditional pit graves (Peltenburg *et al*. 1985;1998; Steel 2004, p. 115). These tombs seem to be preferred for adult burials, while children and infants continued to be deposed in simple pits or scoops, irregular depressions made from an existing pit. Single and double inhumations have been attested: double interments have been attested at *Mosphilia* in three cases (Steel 2004, p. 115). The corpse continues to be placed in flexed position on the right side, but in the LChal period, it is accompanied by an increasing number of items, which are not merely possessions of the buried. These include flat-bottomed spouted jugs, which are rarely identified in settlements but appear widely in mortuary contexts. These jugs provide insights into new ritual practices which entailed the use of liquids (Steel 2004, p. 115). In addition, and probably as a consequence of the supposed increasing trade contacts with Anatolia, a restricted number of tombs began to show the newly acquired position of their builders or owners through the display of exotic items such as faience beads (Steel 2004, pp. 116-7). The decrease in the number of picrolite figurines included in assemblages associated with infants has been interpreted as a sign of "a new ideology in which children play a very minor role" (Steel 2004, p. 115).

1.3.2 The second macro phase: Philia-Middle Bronze Age II

The transitional phase between the end of the LChal and the beginning of the Early Bronze Age (hereafter, EBA) (2400/2350-2250 B.C.) reflects, to quote Steel (2004, p. 119), "the major break in the cultural sequence of prehistoric Cyprus". It is marked by the appearance of an assemblage of materials and an array of technological innovations which became the object of long-term debate (Webb 2013). As is evident in the map (Figure 1.2) new sites "with incursive Philia technology" have been identified in the Ovgos valley, in the northern and southern foothills of Troodos (Steel 2004: Webb 2013, p. 137; Webb & Frankel 2007). Their distribution indicates a shift in settlement pattern from the LChal; Philia inhabitants seem to deliberately prefer strategic regions in proximity to the copper mines, which is taken as proof of a nascent interest in copper exploitation (Georgiou, Webb & Frankel 2011; Steel 2004, p. 121).

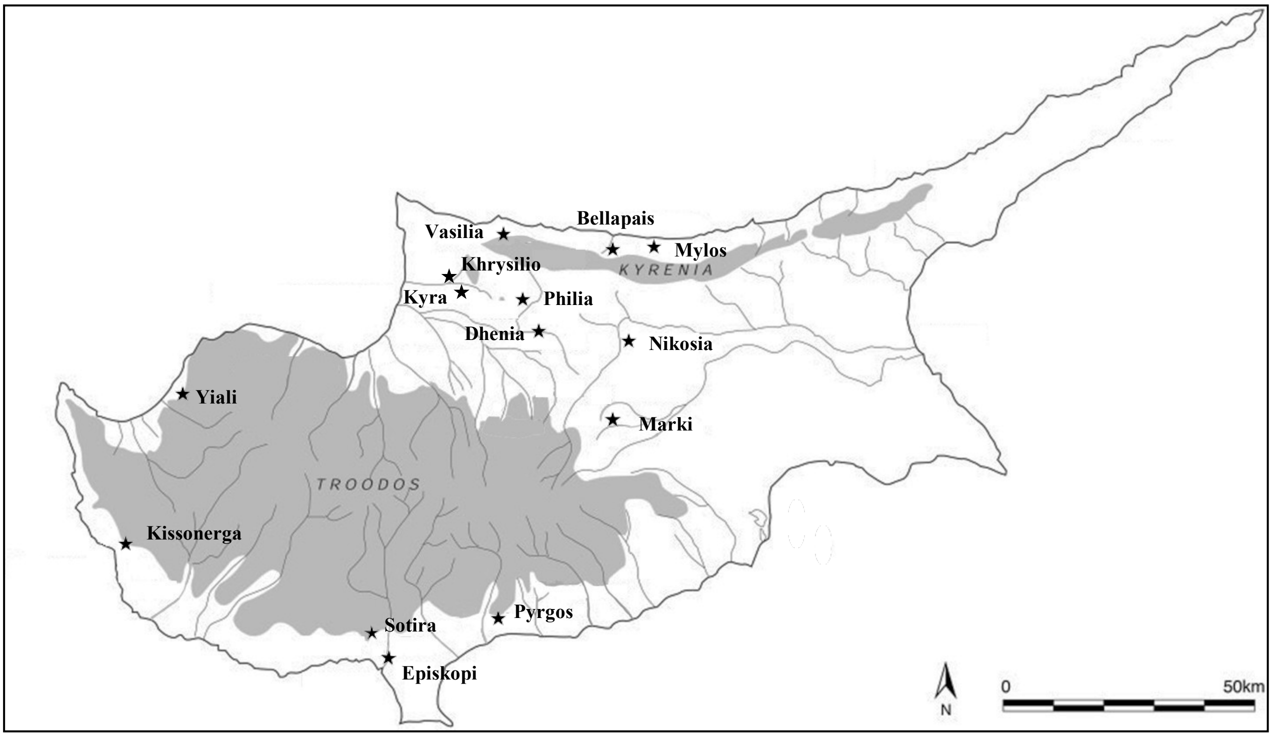


Figure 1.2. Map of Cyprus showing the location of Philia sites mentioned in the text.

The major novelties provided by the material assemblage of the so-called "Philia culture" consist of the introduction of new pottery classes (Red Polished, White Painted, Black Slip and Combed) marked by a uniform fabric, the appearance of consistent series of copper objects (weapons, ornaments, and tools) and new textile manufacturing (spindle whorls and loom weights) (Bolger 1991; Manning & Swiny 1994, p. 166; Webb 2013; Webb & Frankel 1999). More specifically, the Philia ceramic repertoire includes new forms such as flat-based jugs with tall necks and cut-away spouts, hemispherical bowls with lugs, flasks, amphorae, and jars (Knapp 2013; Steel 2004, p. 124; Webb & Frankel 2007, p. 197). Most of these forms, commonly used for serving, pouring, and mixing (jugs and bowls especially) are widely attested in funerary deposits (Manning 1993, p. 45; Webb & Frankel 2008). Some scholars such as Manning (1993, p. 45) and Webb and Frankel (2007, p. 199) have connected these vessels with the consumption of alcoholic drinks, presuming a specific connotation related to the strategies of social integration and elite competition (Sherratt 1987). These social strategies, it is suggested, were intended not merely as mechanisms to reinforce alliances but rather as a way to ensure access to raw materials (Webb 2013, p. 137). The excavation of the Philia levels at Marki *Alonia* (hereafter, Marki) has also revealed evidence of the use of the vertical warp-weighted loom and low-whorl spinning, a specialized practice that seems to have originated in contacts with South-western Anatolia (Webb & Frankel 2007, pp. 201-2). More significantly in terms of social implications is the introduction of the technology related to the casting and smelting of copper. In fact, although the island was particularly rich in copper resources, it played a marginal role in the smelting of copper sulfide ore until the middle of the third millennium. Chemical and lead isotopic analysis carried out on the materials recovered in the Philia levels of Marki and in the funerary context of Vasilia has further revealed that copper used by Philia inhabitants arrived in Cyprus from the Cyclades and Anatolia in the form of ingots or finished products (Kassianidou & Knapp 2005). This clearly suggests the involvement of Cyprus in a wider metal trade, mainly managed by Anatolian and Aegean coastal sites (Kassianidou & Knapp 2005, p. 215; Webb & Frankel 2007, p. 196). This advanced production certainly impacted the social organization of the communities involved because it required an efficient system of management of the activities of producing, transporting, and distributing copper (Kassianidou & Knapp 2005). Hence, it contributed to the creation of the basis of a social distinction within the community.

Turning to the novelties in terms of organization of the settlements, the monocellular "roundhouses" widespread in Chal settlements were abandoned in favour of more elaborate, multi-roomed rectilinear houses (Keswani 2004; Webb & Frankel 2007). These were constructed of mould-made mud bricks on a stone foundation and were sometimes provided with a rectangular courtyard (Knapp 2013; Webb & Frankel 2007, p. 195). To complete the picture of the major innovations which marked the Philia culture, it is necessary to mention the adoption of the plough and the reintroduction of cattle (Webb & Frankel 2007). They may be linked to the exploitation of more extensive fertile areas, as strategies aimed at increasing agricultural production in order to obtain the necessary economic surplus while minimizing human physical labour. Cattle were also used as sources of milk and meat (Keswani 2004; Knapp 1990; 2013; Webb & Frankel 1999; 2007).

Two opposing interpretative models have been developed by scholars over time to contextualize these cultural transformations. The first, strongly endorsed by Frankel and Webb, suggests that migration of people from southwestern Anatolia occurred during this period. It is argued that these people directly introduced into Cyprus a package of materials but, above all, new ideas, skills, and behaviours (Bolger 2007, 2013; Webb & Frankel 2007). For Frankel, the "material differences within the island may be seen as representing two ethnic groups, the indigenous Chalcolithic and the intrusive Philia groups from Anatolia" (Knapp 2001, p. 36). Hence, direct contacts between the two ethnic groups would have generated cultural, economic, and social transformation of the indigenous communities. In the opposing argument, Knapp strongly defends the idea that the "incipient stages" of this social evolution must be sought in the dynamics established by the LChal communities as a result of involvement in long-distance trade prompted by the demand for copper (Knapp 1993; 2013; Manning 1993).

Unfortunately, social interpretations of the Philia/EBA transition still remain controversial because of the limited number of stratified deposits (Manning 1993, p. 39; Philip 1991; Webb & Frankel 1999). Indeed, only three sites offer stratigraphical sequences which document this transitional period: *Mosphilia* (period 5), Marki and Sotira *Kaminoudhia* (hereafter, Sotira) (Knapp 2013, p. 278).[4] The earlier EBA funerary assemblages have been found in the northern cemeteries of Vounous *Bellapais* and Lapithos *Vrysi tou Barba* (Catling 1971, p. 809; Steel 2004, p. 119). These are dominated by the presence of Red Polished ware which finds its precursor in the Philia Red Polished ware but is distinguished by different fabric and new shapes (Catling 1971; Manning 1993, p. 39; Steel 2004; Webb & Frankel 1999). On the contrary, the combed and painted wares are not represented in these assemblages. Outside this area, some funerary contexts document the coexistence of Philia and EBA assemblages (e.g., tombs 14 and 12 at Nicosia *Ayia Paraskevi*). This led Manning to suppose that while in the northern contexts the EBA "fashion" replaced the previous Philia tradition, in other areas it remained in use at a time when some aspects of typical EBA material culture were regarded as particularly prestigious (Manning 1993, p. 39).

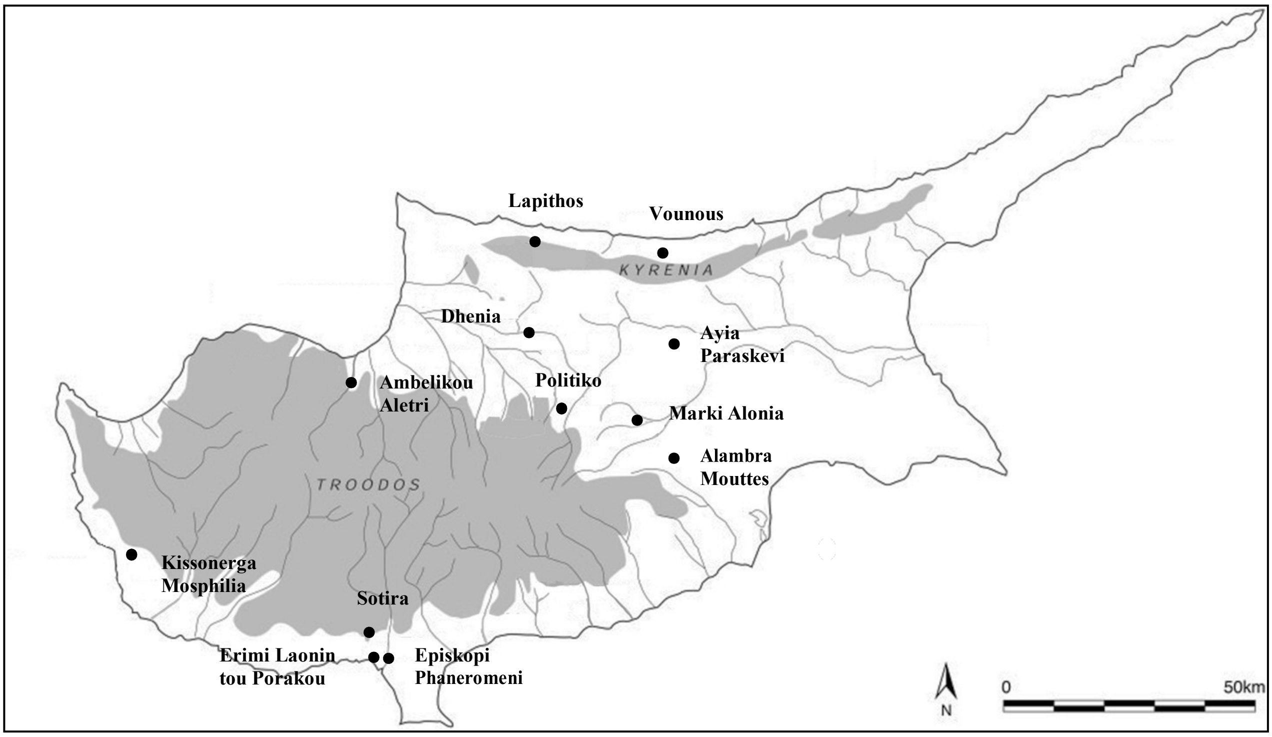


Figure 1.3. Map of Cyprus with the location of the Philia-MBA sites mentioned in the text.

In the subsequent chronological stages (2250-1700 BC), the number of sites increases from 44 (EBAI-II) to 345 (EBAIII-MBAI/II) (Webb & Frankel 1999, p.7). The sites continued to be

[4] *Mosphilia* and Marki yielded funerary and settlement evidence dated to the Philia phase, Sotira only funerary evidence.

distributed in strategic areas for the exploitation of mineral resources (e.g., the Troodos Massif) but also in fertile plains, a clear indicator of the increasing importance of the arable economy (Steel 2004, p. 128). The layout of the Middle Bronze Age (hereafter, MBA) settlements excavated at Marki, Alambra *Mouttes* (hereafter, Alambra), Sotira, and Erimi *Laonin tou Porakou* (hereafter, Erimi) displays the recurrence of standardized rectangular structures composed of two or three rooms, sometimes opening onto a courtyard. The entrances were indicated by the presence of monolithic thresholds and the walls were erected on large stone foundations with mudbrick courses in the upper levels (Bombardieri 2017; Coleman *et al.* 1996; Frankel & Webb 1996). The examination of pottery assemblages, as well as internal features (e.g., ovens, benches) within the different rooms, sheds light on the different types of activities practised there, which included food preparation and storage, weaving, spinning, metal, and pottery production (Bombardieri 2017; Coleman *et al.* 1996; Frankel & Webb 1996; Swiny 1989). With regard to the last, the excavation of the EBA sequences of Marki has documented the introduction of new vessels used for cooking, storing, and serving, such as circular pans (Frankel & Webb 1996; Steel 2004, p. 134). The EBA burials, on the other hand, were enriched by zoomorphic vessels, double-spouted juglets, multi-bodied bowls, sometimes decorated with figured motifs (Steel 2004, p. 134). Two different fabrics have been attested at EBA Alambra and they consist of a first type of calcareous paste obtained from the limestone formation of the Troodos region, and a second type composed of a dark, coarse paste (Coleman *et al.* 1996; Steel 2004, p. 134). There is no evidence in support of the thesis that this activity was performed exclusively by females as Frankel once suggested (1974, p. 204); in addition, the lack of standardized forms would seem to suggest the absence of a standardized industry. Nevertheless, the acquisition of the necessary skills to realize this product (control of high temperatures) may be considered as the first step towards the development of a specialized industry (Coleman *et al.* 1996, p. 255). Similarly, metalworking continued to be practised within specific areas of the settlement although as a more specialized craft activity. Casting moulds and crucibles, as well as finished artefacts (e.g., gold or copper earrings, arm-rings, hook-tangs, flat axes, razors, scrapers, and chisels), have been found in several EBA-MBA sites such as Marki, Alambra*,* Sotira, Ambelikou *Aletri,* Episkopi *Phaneromeni* (*hereafter*, Episkopi), Politiko *Troulla* (Coleman *et al*. 1996, pp. 129-137; Falconer *et al*. 2010; Knapp 2013, p. 298; Swiny 1986; Webb & Frankel 2006; 2013). This archaeological record is particularly significant in the discussion relating to the emergence of elites in Cyprus because, from this period onwards, metal objects begin to be included in the mortuary assemblages of select burials and have been used by excavators to infer social differences among the dead (Keswani 2004, pp. 63-70). The EBAIII-MBAII phase is documented by a very limited number of archaeological contexts. Excavations carried out at Marki as well as Erimi have documented a "new trend towards increased privacy and security, probably connected to the control of household resources" (Bombardieri 2017; Knapp 2013, p. 284; Frankel & Webb 2006). The basis of the economy continued to be represented by agricultural production, but at the same time, a pastoral economy developed strongly (Croft 2003; Knapp 2013, p. 304; Manning 1993; Sherratt 1981). Evidently, participation in specialized activities entailed a high level of social organization and compartmentalized distribution of labour.

The transition from Chal to Bronze Age in the funerary record is marked by a shift to extra-mural cemeteries, although, as previously stated, cases of extra-mural rock-cut chamber tombs had existed in Cyprus since the LChal (Peltenburg *et al*. 1998). The discontinuity in standard practice is particularly apparent at *Mosphilia* 5, where Philia burials were placed within the settlement (Keswani 2004, p. 39). The EBA-MBA rock-cut tombs were generally composed of oval or circular chambers, to which access was gained by a narrow, circular passage (a *stomion*), which led from a square or oblong *dromos* (Keswani 2004; Knapp 2013; Webb & Frankel 2010). The earlier EBA funerary types (EBAI-II) tended to comprise a single chamber; from the end of EBA onwards, multi-chamber complexes make their appearance. The ritual practice entailed the deposition of the body in the centre, or along the sides of the chamber, generally in flexed position or, as in the case of the MBAII-III tombs of Ayios Iakovos *Melia*, seated in a circle around the walls (Gjerstad *et al.* 1934; Keswani 2004, p. 46). This choice probably depended on the availability of space in the chamber (Webb 1992). Interesting insights concerning grave goods and ritual activities were provided by a study conducted by Webb and Frankel on the burial data from sites across the northern coast of Cyprus (Webb & Frankel 2010). The study suggested that grave goods in this period tended to be composed of several categories of materials with different significance. Among the ceramic artefacts, jars were particularly frequent in the chamber as well as in the *dromos*, suggesting different stages of ceremony: the first stage occurred in the chamber during the deposition and probably consisted of the ritual washing of the dead, libations, and offerings; the second after the closure of the tomb in the *dromos* (Webb & Frankel 2010, p. 195). Jugs and amphorae were generally placed at the foot of the corpse, small bowls at the sides, and flasks near the head (Webb & Frankel 2010, p. 195). Small and large bowls have been generally regarded as indicating the consumption of food and/or drink as part of the ritual; this is also confirmed by the presence of animal bones within the chamber. From the Philia phase onwards, funerary assemblages began to include gendered personal objects such as spindle-whorls, pendants, earrings, and rings in the case of women, or knives, stones, or copper tools, flint blades for men. The recovery of such items within the funerary assemblage suggests women and men were deposited completely clothed and adorned by their personal objects (Webb 1992). Examples of both primary and multiple inhumations are attested in the EBA-MBA period. To conclude, the intensive labour required for such architectural constructions, the prestigious goods exposed in the tombs as symbols of the high status of the dead, and the cost of the funerary events throws light on the economic resources available to the inhabitants of these villages and on-going social competition (Webb & Frankel 2010, p. 197).

1.3.3 The third macro phase: Middle Bronze Age III-Late Bronze Age III

Between MBAIII and LBAI (1700-1450 BC) a number of fortified sites appear in many areas of the island, particularly in southern and southeastern Cyprus (Peltenburg 2008). The erection of these forts has been associated with social instability, a conclusion also supported by evidence of destruction and burning at some sites, such as Enkomi, Kalopsidha, Toumba *tou Skourou*, Episkopi (Keswani 1989, p. 136). Several hypotheses have been produced to explain this increasing instability. Struggles for access to copper resources, raiding between communities in order to secure valuables or agriculturally productive lands, involvement of foreign groups such as the Hyksos (Catling 1962; Keswani 1989, p. 136; Merrillees 1971; Peltenburg 2008, p. 147). Despite the absence of relevant evidence to support these arguments, the distribution of these fortified sites along the routes which connected the mines of the Troodos and coastal centres seems to suggest the intention to "protect the movement of the copper" (Steel 2004, p. 152). By the end of MBAIII, the size and distribution of sites changes drastically in response to a new political and economic organization which involved the entire island. Several newly established sites have been excavated for the LBA period; the most significant examples being Kalavasos *Ayios Dhimitrios* (hereafter, *Ayios Dhimitrios*) and Maroni *Tsaroukkas/Vournes*, in the south, Hala *Sultan Tekke* (hereafter, Hala), Kition, Enkomi and *Ayios Iakovos* in the southeast and east (Åström 1986; Dikaios 1969-1971; Schaeffer 1971; South 1996; South & Todd 1985). The geographical locations of both old and new sites suggest they served different purposes. Knapp (2013, pp. 354-56) has recognized a four-tiered settlement hierarchy according to the major archaeological features which characterized most of them. The primary coastal centres such as Kition, Maroni, Hala, and Morphou *Toumba tou Skourou* exerted a form of control over pottery, agricultural, and copper production.[5] The inland administrative towns such as *Ayios Dhimitrios* and Alassa were engaged in administrative and ceremonial activities (Catling 1962; Keswani 1993;2004;2005; Knapp 1997; 2013; Webb & Frankel 1994, p. 6). The basis of this hierarchy was formed by the specialized centres which included mining sites, agricultural settlements, and religious sites (Knapp 2013; Steel 2004).

[5] Some undeniable archaeological evidence has suggested the importance of these centers such as seals, impressed pithoi, inscriptions in Cypro-Minoan, imported goods (Knapp 2013, p. 356).

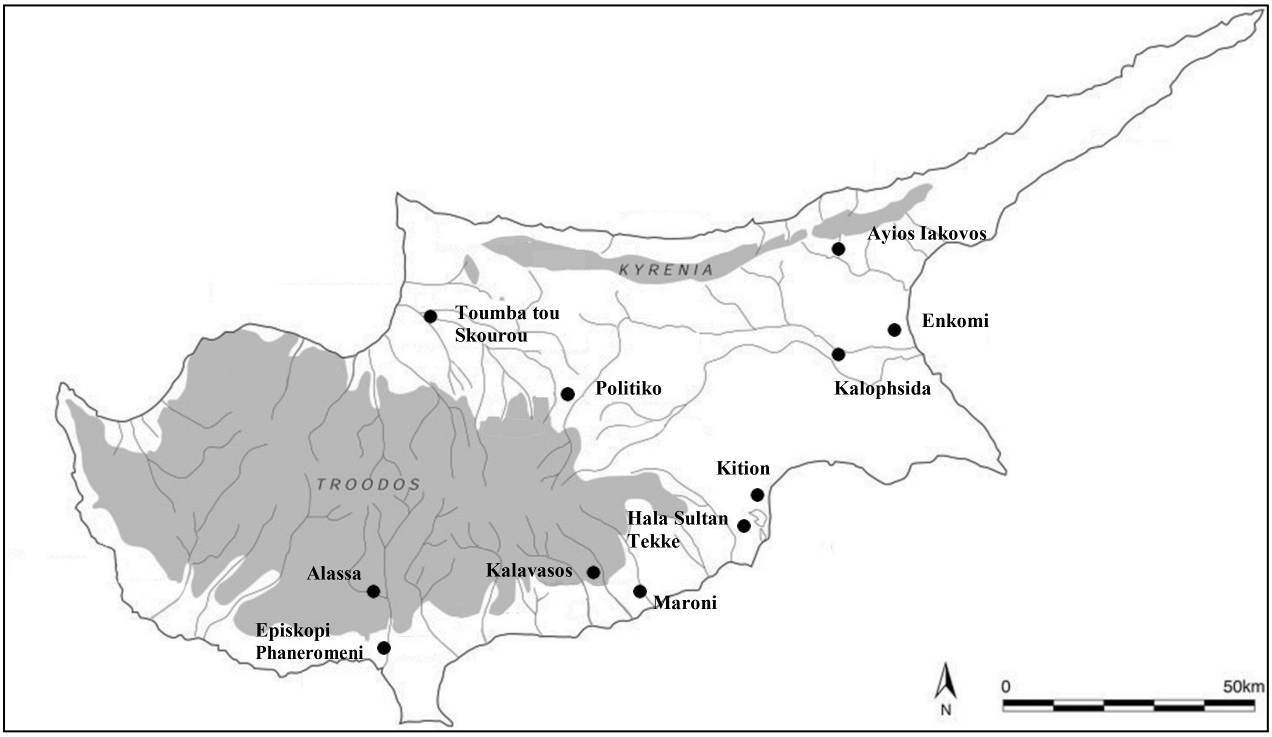


Figure 1.4. Map of Cyprus showing the location of the MBA-LBA sites mentioned in the text.

The urban organization of some of the major centres (e.g., Enkomi) entailed a grid plan and displays use of ashlar masonry for the erection of monumental buildings (Knapp 2013; Steel 2004, p. 157). To quote Fischer (2009, p. 184) they rapidly became the place of the "constitution of asymmetrical relationships of power". This happened through a public display of resources and prestige which, in the past, had been exclusively exercised within the funerary sphere (Fischer 2009, p. 205). These impressive buildings, attested at the major LBA sites, served different purposes: administrative, productive, ceremonial, and also religious uses have been widely attested. Excavations at Enkomi, for instance, have identified a monumental ashlar building with two internal areas interpreted as sanctuaries devoted to a horned god, based on the number of figurines recovered inside (Webb 1999, pp. 98-9). Although the identification of specific areas dedicated to cults cannot be certainly ascertained until LBAII, the identification of a recurrent series of installations (e.g., altars, hearths, horns of consecration) and architectural forms (pillared courtyards, two or three rooms) and the recovery of objects such as bucrania or figurines may be considered valuable indicators (Steel 2004, p. 175). The material assemblages recovered from these contexts are also dominated by the presence of imported pottery (Mycenaean kraters or rhyta), astragali and ox scapulae, alabaster, faience and ivory vessels, terracotta, and bronze figurines (Ingot God). This latter represents a warrior in smiting pose and has been interpreted as a symbol of divine control of copper production (Steel 2004, pp. 180-1). In reference to the development of craft activity, by LBAII the existence of specialized workshops such as at Toumba *tou Skourou* (Knapp 2013, p. 402; Steel 2004, p. 163) has been ascertained. The distribution of the finished products was carried out by urban centres such as Enkomi (Knapp 2013, p. 402). Advances in technology and organization in production were marked by the introduction of the potter's wheel. This implied the development of new technological skills and probably a particularly full-time perennial production. Between MBAIII and LBAI, the traditional Red Polished Ware declined in favour of new types of wares such as Monochrome, White Slip, and Base-Ring which appeared first in northern and central Cyprus (Merrillees 1971). Red on Black, Red on Red, and Bichrome mainly circulated in eastern Cyprus. In addition, White Painted, Red/Black Slip continued to be used in traditional forms while Plain White and Bichrome ware gradually changed in their stylistic characteristics as a consequence of foreign influences (Knapp 2013, p. 404). Concerning the functions of these vessels, the Bichrome wares were probably related to the preparation and the consumption of food; the Plain White jars were commonly used for storage purposes (Knapp 2013, p. 404). In the period between LBAII-LBAIII, production became more standardized although regional decorative variants are also attested (Knapp 2013, p. 405). If the villages in the hinterland sustained the pottery industry, other centres such as Enkomi, Kition, and Hala developed, in this period, the necessary technologies (e.g., tuyeres) for large-scale copper production (Kassianidou 2012; Muhly 1989). Among these, Politiko *Phorades* has been interpreted as the primary site for the smelting processes (Kassianidou & Knapp 2005; Knapp 2013, p. 409).

The MBAIII-LBAIII funerary sphere experiences deep changes, reflecting the major transformations which involved society. Variability is seen in all aspects of mortuary practice: this may be discerned in the different burial types occurring throughout the island, in the varied location of cemeteries, and, finally, in the quality and quantity of burial goods (Keswani 2007; Steel 2004). Extra-mural tombs prevailed in the hinterland, while intra-settlement burials were generally associated with residential/administrative buildings or workshops (South 1997,2002). As in the previous periods, the association between tombs and residences served to enhance the relationship between "households and dead ancestors" (Keswani 2007, p. 517). In terms of burial type, the rock-cut chamber tombs seem to prevail in the majority of the settlements. In addition, three other burial forms have been widely attested: shaft/pit graves, tholoi, and ashlar tombs. [6] An example of variability inside the settlement is, for instance, demonstrated in the LBAII phases at Enkomi (Keswani 2004; Knapp 2013). All of the burial forms listed above have been identified at this site, but the tholoi and ashlar tombs, in particular, have offered the most interesting insights,

[6] The tholoi present a circular chamber covered by corbelled structure built in mudbricks and stones. The ashlar tombs consisted of rectangular chambers with walls realized in ashlar blocks (Steel 2004, pp. 172-3).

suggesting a differential status between them. According to Knapp (2013, p. 383), the tholoi cannot be thought as elite burials because of the absence of any spatial correlation with monumental residences; on the contrary, the ashlar tombs of Enkomi have been found in Quartiers 3E and 4E in proximity to monumental residential buildings (Knapp 2013, p. 383; Keswani 2004). Nevertheless, both these forms document the assimilation of foreign models from the Near East. Hence, if the realization of these funerary complexes may be thought of as a "validation of the users' rights of ownership or control over lands" as Keswani argues (2004, p. 88), the destruction of some of the related buildings has been read as a sort of suppression of the earlier authorities and competition for political legitimacy (Knapp 2013, p. 386). This happens, for instance at Maroni (e.g., Ashlar Building) where some elite tombs have been found emptied or destroyed; in some cases, new tombs were built over them (Knapp 2013, p. 386). The funerary customs entail the deposition of the individual on benches constructed along the walls of the chamber or on the floor (Steel 2004, p. 174). The occurrence of seated as well as flexed positions for the body is also attested and has resulted in comparison with the MBA practices described above (Keswani 2004). The burial gifts which accompanied the LBA dead included a wide range of pottery, including the so-called drinking-set (krater, bowl, jugs, tankards) in White Slip, Base Ring, and Bichrome ware. The Mycenaean vessels found in specific contexts allow us to predict the importance of such tombs and the ceremonies which were held during the funerals. The alabastra and the stirrup jars were, for instance, were used for libations or to anoint the dead (Knapp 2013, p. 387; South 2002). Silver and gold jewellery, metal items such as mirrors, spatulae and bowls, and a number of imported products, including faience, glass vessels, and ivories bear witness to the social and political relationship existing between Cypriot elites and Egypt, Asia, and the Aegean (Keswani 2004; Knapp 2013).

To summarize, this dissertation was focused on three chronological macro-phases: the first, M-LChal, characterized by the presence of village-based communities, which stood out in virtue of a new sense of communal aggregation archaeologically documented by the discovery of areas intended for feasting or working activities; the second, Philia-MBAII, marked by significant changes in the social organization of communities, certainly prompted by the development of craft activities; the third, MBAIII-LBAIII, marked by the growth of towns and the appearance of a defined social elite. Several categories of archaeological records have been used over time by scholars to discuss changes in social structure and labour organization of prehistoric Cypriot communities. While it is readily apparent that these periods represent times of significant social change, many of the arguments as to the scale and causes of this change remain contested because of the non-homogenous documentary processes which often produced data that were not comparable outdated theoretical underpinning, or lack of evidence. For this reason, a combined archaeological-anthropological approach appears to be more crucial than ever to approach the question of social transformation from a different perspective.

Chapter 2 Methods and materials

2.1 Methods

2.1.1 Introduction

This section introduces the materials and illustrates the methodological strategy adopted in this research to produce reliable data to infer differences in activity patterns among the prehistoric Cypriot communities under study. The chapter begins by explaining the process for selection of the osteological sample created to represent the MChal-LBA populations of Cyprus. Next, in the first part of the analytical methods, the process of gathering preliminary information related to the sex and age of the individuals is presented. This includes a brief account of the methods used in previous bioarchaeological examinations to restore fragmentary skeletal remains. The second section presents the three pathological features used to investigate activity patterns. Each paragraph is introduced by a brief description of the lesions and the literature concerning their identification and interpretation, followed by an exhaustive presentation of the method identified to obtain research data. The third section summarizes the statistical methods used to infer meaningful patterns from the data generated in this research.

2.1.2 Selection of the archaeological contexts and the osteological sample

As previously stated, the chronological period considered for this research range from the MChal to the LBA. In the early part of this period, M-LChal, village-based communities experimented with new forms of communal aggregation indicated by the construction of areas reserved for feasting, rituals, and working activities. In order to explore the effect of regular and repetitive mechanical stimuli on the skeleton, three skeletal collections were selected to represent this period: *Pamboula*, *Mosphilia,* and Lemba. It must be clarified that these populations are unlikely to be fully representative of the whole M-LChal population of the Island. Two important funerary complexes, Souskiou *Vathyrkaka*s and Souskiou *Laona* were excluded from the sample in this thesis: the first because of the highly fragmentary status of the exhumed human remains (Gamble 2011, p. 2) which precluded the collection of reliable and comparable data, the second because it was undergoing preliminary studies by the excavators at the timing of the collecting data and was therefore not accessible to other researchers. Hence, until other skeletal series from other geographical regions are found, these three osteological collections offer the best sample with which to characterize the M-LChal period in Cyprus. Although biased to one region of the island, in fact, their contemporary dating, cultural homogeneity, and geographical proximity generate the ideal conditions to reconstruct the activity patterns of these populations. The interaction with the same environmental context and same local resources to carry out a similar set of tasks is hypothesized here to have resulted in a homogenous articular/muscle involvement and comparable extra-masticatory dental wear patterns.

The second chronological stage, Philia-MBAII, is characterized by a significant development of craft activities which impacted the internal organization of the communities, laying the groundwork for the rise of elites. Small-scale production was the likely occupation of a certain number of inhabitants, resulting in the daily or seasonal repetition of a set of movements with consequent, regular strain on specific functional complexes. Six osteological collections were examined to explore the activity patterns of the Philia-MBAII communities: Sotira, Marki, Alambra, Erimi, Kalavasos Village Tombs, and Episkopi. It must be stressed that the last two sites yielded evidence of occupation between the end of the EBA to the beginning of the LBA (Osterholtz 2015, p. 86). Indeed, tomb 51 and tomb 57 from the site of Kalavasos Village Tombs were dated to the LBAI-LBAII, and tombs 105A, 105C, and J14 at Episkopi were dated to MBAIII-LBAI so both were included in the evaluation of the activity patterns of the third phase (MBAIII-LBAIII). As for the case of the Chal remains, they were not fully representative of the whole Philia-MBAII population of the Island. They were selected because of their status of preservation and because the skeletons were excavated from discrete funerary contexts which reflect the complex and diverse mortuary programs developed in this chronological phase on the island. Indeed, archaeological evidence from extra-mural funerary contexts and intra-settlement depositions provided different insights into the organization of these communities or the tasks performed by the existent groups. In addition, the related settlements offered evidence attesting the wider range of activities practised by the Cypriot inhabitants of this chronological period.

The third chronological stage, MBAIII-LBAIII, is marked by the growth of towns and the appearance of a clearly stratified society. The four osteological collections selected for this period are Hala, Enkomi, *Ayios Dhimitrios,* and Episkopi (*Phaneromeni* A). Among these, the first three are the most widely documented and were the larger, primary towns which served as administrative, commercial, and ceremonial centres. The agricultural, mining, and pottery outputs produced in the interlards converged in them (Knapp 2013, p. 355). Episkopi *Phaneromeni* "A" was, in contrast, a small-size agricultural village which supplied agricultural products to the primary centres (Knapp 2013, p. 357). Unfortunately, no other excavated, agricultural villages provided evidence of burials. It can be stated, thus, that the selected sites represent the best background to compare the activity patterns of the elites which inhabited the administrative centres and the communities which occupied the productive villages.

2.1.3 Preparation of the materials: cleaning, reconstruction, and selection of the study sample

2.1.3.1 Cleaning and reconstruction

Although the majority of the collections selected for this research were already cleaned and had been subject to previous analyses, long-term storage in cardboard boxes necessitated additional cleaning in some cases. Techniques used to clean osteological materials vary according to the condition of the bone and the context of its recovery (White & Folkens 2005, p. 335). In the specific case of the Cypriot osteological materials, given their fragile nature, the use of soft brushes is recommended (Lorentz 2017). Therefore, material utilized in this study was brushed where necessary. In cases of persistent soil concretions "dabs" of water were applied directly to areas affected by pathological bone remodelling or on the teeth to facilitate the recording of data directly relevant to this study (Lorentz 2017, p. 509).

Consolidation interventions were not undertaken as part of the current project as the methods of analysis did not require it, however past restoration had been undertaken on 20% (n=4) of the collections analyzed: Lemba, *Mosphilia*, Alambra, and Erimi. The first three bear the signs of improper reconstructions that served to obscure the features recorded in the present study. In some cases, a mesh fabric was applied on the bone surface to preserve the integrity of its structure (Figure 2.1) (Gamble 2011, p. 53).

Figure 2.1. Example of incorrect consolidation process executed on a skull from Tomb 506 of Kissonerga Mosphilia.

The impossibility of removing the fabric meant the exclusion of the abovementioned cases from the analysis because of the inability to observe the surfaces under consideration. Skeletal remains excavated at Alambra were deemed by the excavators too fragile and consequently reinforced with polyvinyl acetate (Domurad 1996 p. 515). Albeit unnecessary and conspicuous in the quantity used, this chemical product did not prevent the macroscopic observation of the long bones and teeth for pathological evidence because of its transparency. Polyvinyl acetate in alcoholic solution (K60) was also used on the skeletal materials recovered from the Erimi cemetery. In this case, however, the consolidant was spread only on the post-mortem fractures rather than on the entire cortex (Albertini & Monaco 2017, p. 306).

Hence, except for the afore-mentioned cases from *Mosphilia*, previous consolidation interventions did not represent a significant impediment to the analysis.

2.1.3.2 Assessing preservation status

In literature, the expression "well-preserved" is often used to describe a skeleton which is complete or almost complete, as all or most of the bones are present; but also, to indicate the absence of consistent alterations of the bone cortex (Bello *et al*. 2006, p. 24). This lack of specificity in the terminology motived Bello and co-authors (2003; Bello & Andrews 2006) to formulate three methods of classification to evaluate the completeness of the bone/skeleton, the preservation of the cortex, and the frequency of the bone elements separately.

The Anatomical Preservation Index (API) provides insight into the number of recovered bone materials by calculating a ratio of the percentage of osseous material preserved in each bone element and the total number of bone elements which constitute a skeleton (Bello & Andrews 2006). The percentage of osseous material preserved was quantified through six categories (class 1=0%, class 2=1-24%, class 3=25-49%, class 4=50-74%, class 5=75-99% and class 6=100% preserved) (Bello & Andrews 2006, p. 3). It must be noted, however, that this approach was deemed inadequate to highlight the presence of crucial anatomical parts such as the epiphyses, for instance, which were the object of specific palaeopathological observations (e.g., osteoarthritis) in the present study. The second index, the Bone Representation Index (BRI), provides insight on the frequency of the skeletal specimens and corresponds to the ratio between the bones recovered and the theoretical number of bones that should have been presented based on the number of the individuals of the sample (Bello & Andrews 2006, p. 3). In this case, only two categories were adopted: "well-represented bone" is present in the sample at more than 50%, "not well represented" at less than 50% (Bello & Andrews 2006, p. 3). The third index, the Quantitative Bone Index (QBI), reflects the ratio between the sound cortical surface and that one which appears damaged. Six classes of preservation were assigned: class 1=0%, class 2=1-24%, class 3=25-49%, class 4=50-74%, class 5=75-99% and class 6=100% (Bello *et al*. 2006, p. 26). In all three cases, an index of more than 50% indicates good preservation/representation.

Since the focus of this research was the modifications of specific skeletal sites (entheses, joint surfaces, and teeth), the second index was assessed. Indeed, as specified in the subsequent paragraph (2.1.4), one of the criteria of inclusion in the study sample is that more than 50% of the bone surface must be well preserved; additionally, the information related to the quantity of bone material present in that determined skeletal element was not deemed relevant for the aims of this study. Thus, the frequency of these sites was assessed through the BRI index that was adapted to the requirements of this research by increasing the number of the ranges:

- class 1 = 0%, enthesis/joint surface not represented
- class 2 = 1-24%
- class 3 = 25-49%
- class 4 = 50-74%
- class 5 = 75-99%
- class 6 = 100% enthesis/joint surface represented.

All the entheses/joint surfaces with an index of more than 50% were deemed well represented and, thus, are expected to offer more reliable data for the discussion of activity patterns.

2.1.4 <u>Criteria for inclusion in the skeletal sample</u>

All the observations undertaken as part of the skeletal analysis were carried out macroscopically. Cases of extra-masticatory dental wear were also examined in more detail using a portable-USB digital microscope (Jiusion Wifi Microscope) capable of resolving down to 10 nm and operating at 1000 x magnification. Photographs to document the different forms and severity of activity markers were taken using a digital camera Nikon D7000.

<u>First criterion for inclusion: preservation of the key skeletal regions</u>

Muscle insertions, joint surfaces, and teeth were the key skeletal regions examined for this study. Inclusion of any enthesis, as well as joint surface in the database, was determined by their fulfilling the criteria described by the authors of the specific recording protocols adopted. For recording entheses and joints, surfaces in poor states of preservation where more than 50% of their area was obliterated were excluded (Mariotti, Facchini & Belcastro 2004, p. 148).

Regarding the dentition, only teeth with crown and root preserved were considered. Thus, in summary, the first inclusion criterion was those individuals with at least one tooth, one enthesis, and one joint surface preserved more than 50% were included.

Second criterion for inclusion: skeletal maturity

Since osteoarthritis, as well as entheseal changes, rarely occur before skeletal maturation, only adult subjects were included in this thesis (Foster, Buckley & Tayles 2014, p. 518; Lovell 1994, p. 152). Regarding entheseal changes, it has been widely demonstrated that muscle markings begin to accumulate only after skeletal maturity, specifically, when the migration of the enthesis to their relative final positions on the bone is concluded (Drapeau 2008, p. 95; Robb 1998, p. 371). Nevertheless, occasional cases of bone remodelling typical of entheseal changes (osteolytic lesions) in juvenile subjects have been reported by some authors (Benjamin *et al.* 2007, p. 231). Indeed, the same morphological evidence accompanies the natural growth process of the bone; for this reason, it is difficult to differentiate these two processes before skeletal maturity (Milella *et al*. 2012, p. 385; Mariotti, Facchini & Belcastro 2004, p. 155). Similarly, forms of osteoarthritis may occur also in juvenile individuals. These have been categorized by Ortner (2003, p. 547) as "secondary" since they develop as a result of other pathological conditions such as slipped femoral epiphysis or metabolic disorders rather than biomechanical stress (Felson 2013, p. 11; Kellgren & Moore 1952, p. 181; Lovell 1994, p. 159; Zampetti *et al.* 2016, p. 684). In sum, since the potential for some of the osteological expressions considered in this thesis to appear in immature skeletons, ambiguities associated with their identification and aetiology before skeletal maturity necessitated the decision to exclude the immature skeletons from the present dataset. Therefore, only individuals with an age at death of 20 years or above were included.

Third criterion for inclusion: biological sex and age at death assessment

There is also substantial agreement amongst researchers that both biological sex and age at death, together with body mass and genetic background, are potentially confounding factors of entheseal change and joint disease (Felson 2013, p. 12; Foster, Buckley & Tayles 2014, p. 514; Johnson & Hunter 2014, pp. 6-8; Novak & Šlaus 2011, p. 270). Hence, in the light of this, biological sex and age at death are crucial data for the interpretation of all three markers of activity as the practices that dictate activity patterns may be gendered or restricted to those of certain age. All the osteological collections included in this research had already been subject to preliminary anthropological examinations, and both sex and age assessment performed to a suitably rigorous standard (Albertini & Monaco 2017; Domurad 1996; Guest 1936; Lorentz

2006a;b; Moyer 1989;2007; Osterholtz 2015; Schulte Campbell 2003). Thus, the extant data was deemed suitably accurate for the present study. Additional evaluations (application of quantitative methods for sex estimation) were performed only to corroborate the extant data.

Sexing skeletal human remains is generally accurate and repeatable but may result in "tentative" estimations when the most reliable dimorphic traits are not well enough preserved to be evaluated (Işcan & Steyn 2013, p. 143). However, even when present, sexually dimorphic traits may generate misclassifications as they vary between individuals and populations as a result of factors other than sex and, in particular, tend to change in their appearance and shape during the individual's lifetime. According to Walker (2005, p. 388), the shape of the sciatic notch, for instance, may appear wider, suggesting a female classification, among younger males. Conversely, the appearance of the mandible may shift in a masculine direction as a consequence of senility (Işcan & Steyn 2013, p. 144).

Individuals included in this research were categorized as males, females, or not determined on the basis of combined morphological (descriptive) and metric (quantitative) approaches. The former encompasses a variety of methods relying on the visual inspection of diagnostic features. The use of scoring systems combining images and descriptions undoubtedly facilitates the diagnosis but, at the same time, relying on variations in shape and form introduces an element of subjectivity (Işcan & Steyn 2013, p. 144). The pelvis is widely regarded as the most dimorphic bone as, being involved in childbirth, it displays sex-specific characteristics (Işcan & Steyn 2013, p. 146). Considering the extent osteological examinations that had been conducted on the collections included in this research, it was found that, where present, the *os coxa* was predominantly assessed by combining the most repeatable morphological methods including Acsádi-Nemeskéri (1970), Buikstra-Ubelaker (1994), and Phenice (1969) (Albertini & Monaco 2017; Gamble 2011; Lorentz 2006a; 2006b; Moyer 2007). Indeed, by considering the whole hip bone the combined application of the afore-mentioned protocols has been found to achieve 80-93% of correct sex estimations with a level of error of 11.3% (MacLaughlin & Bruce 1990; Novotný 1986; Rogers & Saunders 1994). Less dimorphic than the pelvis, the skull is the second skeletal element which is traditionally considered for sex estimation (Işcan & Steyn 2013). Looking at the previous examinations conducted on the collections included in this research, it was found that, where present, the skull was predominantly assessed by combining the most recommended methods including Acsádi-Nemeskéri (1970), Buikstra-Ubelaker (1994), Bass (1971), and Krogman (1962) (Albertini & Monaco 2017; Fox 2006; Gamble 2011; Lorentz 2006a;2006b; Moyer 2007; Osterholtz 2015; Schulte Campbell 2003). The assessment of five features in particular (mastoid size, glabella, zygomatic, supraorbital ridges, and nasal aperture) outlined in the afore-mentioned protocols, yielded an accuracy of 77.9%-88.4% with a bias of 0.1% (Walker 2008; Walrath, Turner & Bruzek 2004; William & Rogers 2006).

Metric methods of sex assessment were not extensively used in past Cypriot bioarchaeological publications. Whereas the reliability of this approach may be affected by the extent of intra-population sexual dimorphism or the size-based differences[7] (Işcan & Steyn 2013), it is less subjective and more repeatable than the qualitative approach. In the specific case of the Cypriot materials, previous physical anthropological studies have established that sexual dimorphism was pronounced (Osterholtz 2015, p. 71). Thus, the use of metric methods in this specific geographical context is advisable (Osterholtz 2015, p. 70; White & Folkens 2005, p. 392). As for the size-based parameters which are population-specific, it must be noted that no sex-prediction equations tailored to ancient Cypriot populations have been developed yet. In these cases, it is appropriate to take into considerations measurements collected from the closest chronologically and geographically samples. Hence, for this research, I personally integrated data from morphological assessments reported in past publications with a new set of data obtained by measuring the vertical diameters of heads of bones which are more extensively studied for sex estimations: humerus, femur, and radius (Işcan & Steyn 2013, pp. 171-3). Indeed, the vertical diameter of the long bone epiphyses provides more accurate estimations than the circumference of the same bones (Işcan & Steyn 2013, p. 173). Results were compared with a set of measurements derived by a discriminant formula tested on the prehistoric samples from Mycenae, Greece (Chovalopoulou *et al*. 2018) for the humeral and radial epiphyses, and from central California (Dittrick & Suchey 1986) for the femoral head. Overall, the level of accuracy of these measurements ranges between 72.0% to 82.8% with a rate of error < 17.0%.

Table 2.1. Thresholds for the interpretation of metric data as evidence of biological sex (Dittrick & Suchey 1986; Chovalopoulou et al. 2018).

Diameter	**Female**	**Male**
Radial head	≦ 19.0 mm	≧ 20.0 mm
Humeral head	≦ 40.9 mm	≧ 41.2 mm
Femoral head	≦ 46.0 mm	≧ 47.0 mm

[7] This depends on the testosterone production which, in males, result in greater muscle mass with consequence large overlaps in size (Işcan & Steyn 2013, p. 146)

Assessing age at death in adult skeletal remains is a challenging process whose accuracy and precision vary according to the status of preservation of the remains. Firstly, it must be emphasized that the term “age” was diversely used in literature to refer to a) the chronological age, meaning the sum of the ages effectively lived by the subject from birth; and b) biological age, as a result of the experiences accumulated by the skeleton from birth to death (Işcan & Steyn 2013, p. 59). The last is the most appropriate data to obtain from archaeological skeletons for whom no records of their lives exist. It must be noted that whilst, during childhood and adolescence, skeletal growth is marked by predictable “milestones”, when an individual is skeletally mature, sequences of morphological skeletal developments are not so easily discernable (Falys & Lewis 2011, p. 704). Most specifically, age assessment in adults requires the macroscopic assessment (quantitative methods) of degenerative changes in immobile joints including the symphysial face of the *os pubis*, the auricular surface of the *os coxa,* and the sternal ends of the ribs (Buikstra & Ubelaker 1994). Whilst the evaluation of more than one parameter is widely advocated, this approach entails a variety of drawbacks (Falys & Lewis 2011, p. 705; Işcan & Steyn 2013, p. 59). Although the intent of this section is not to extensively discuss these criticisms, some specifics may be useful to clarify the methodological strategy adopted in this research. As with sex assessment, there are two major pitfalls associated with age estimations: the subjectivity of the observer and the fact that the methods are tailored to specific populations. Considering the preliminary assessments carried out on the collections selected for this research, it was noted that the most accurate and replicable methods were employed in combination in order to crosscheck the data. They include Brooks-Suchey (1990), Lovejoy *et al.* (1985), and Işcan-Loth-Wright (1984;1985) methods (Gamble 2011; Moyer 1989; Osterholtz 2015). All these methods have been tested on a variety of samples (see, for instance, Berg 2008; Oettle & Steyn 2000) leading to a quantified accuracy of approximatively 75% (Merritt 2013, p. 109). In sum, each method provides a specific age range; this means that for each individual may be available in literature more than one age range provided by the variety of methods applied. Determining central tendency (mean age) for each age range is essential for the further step in which the final central tendency was calculated by adding up all the mean ages previously determined and then dividing the result for the number of methods used; this leads to allowed to identify the age category in which the individual must be allocated. In this regard, it was adopted the classification proposed by Işcan and Steyn (2013) which outlines a partition in four groups by fixing the beginning of young adulthood at the age of 20 (Table 2.2).

Table 2.2. Thresholds for the interpretation of morphological data as evidence of biological age.

Age category	Age range
Young adults	20-24
Middle adults	25-34
Mature adults	35-44
Old adults	45+

Indeed, at this stage of the skeletal growth, the epiphyseal plates have fused to the metaphysis, the third molar has erupted, and the spheno-occipital synchondrosis fused (Falys & Lewis 2011, p. 707; Işcan & Steyn 2013, p. 88). The evaluation the dental wear offers another approach to the assessment of age at death. Caution, in this case, must be observed as confounding factors including diet and inter-population variations in dental size, are not wholly predictable (White & Folkens 2005, p. 365). In Cypriot preliminary examinations, age assessment based on dental wear using Lovejoy (1985), Smith (1984), and Brothwell (1981) were found to be applied only when the other, more diagnostic features were absent (Albertini & Monaco 2017; Domurad 1996; Gamble 2011).

In sum, skeletal remains were incorporated into the dataset for this thesis only where preservation was sufficient for analysis, the skeleton was mature, and there were data available concerning biological sex and age at death.

2.1.5 Entheseal Changes

The enthesis is the region where a tendon, a ligament, or a joint capsule attaches to the bone (Benjamin *et al.* 2002, p. 931). Consequently, entheseal changes (hereafter, ECs) denote alterations of the normal characteristics of these sites. It has been widely accepted that the morphological characteristic of the entheses reflects the cumulative effect of strain placed on them during life. For this reason, they are argued to be an ideal source of evidence for reconstructing past activity patterns and lifestyles (Weiss 2004, p. 232). According to Mariotti and colleagues (2007) ECs may occur in three forms:

- robusticity, rugosity, or, in extreme expression, a crest on the entheseal extension
- osteolytic lesions (hereafter, OLs), cortical defects
- enthesophytic formations (hereafter, EFs), deposition of new bone or osteophytes at the enthesis margins.

While the former is always detectable as it refers to the normal response of the bone of the muscle and ligament solicitations, the last two (collectively, enthesopathies) are not always present suggesting potentially a different cause, for example, pathological conditions or excessive loading (Mariotti, Facchini & Belcastro 2007, p. 292).

Until the 1990s, bioarchaeological literature was dominated by simplistic deductions in terms of reconstruction of past lifestyle or, as Jurmain stresses, by a "convenient approach" which ignored the complex and multifactorial aetiology of ECs and tended to make bold and generalizing statements about their significance (Jurmain *et al.* 2011, p. 537). The idea, for instance, that higher scores of robusticity in males compared with females were directly attributable to major or exclusive involvement in subsistence activities was common (Munson-Chapman 1997). However, more recent studies have aimed to explore in greater depth the biological processes behind ECs and have resulted in a new, enthusiastic interest in clinical evidence. It is now widely appreciated that sex, age, body mass, and genetic background affect the development of enthesis size in addition to regular and repetitive mechanical stimuli (Foster, Buckley & Tayles 2014, p. 520; Munson-Chapman 1997; Steen & Lane 1998). Age is regarded as the most important confounding factor: this relationship is biologically plausible, as older adults have more time to accumulate change in bone morphology (Weiss 2015, p. 285; Weiss & Jurmain 2007, p. 439). Sex also plays an important role in entheseal development because of the hormonal influences on growing cortical bone during puberty. Moreover, Frost (1999, p. 1475) states that estrogen deficiency in postmenopausal females increases osteoclastic activity causing loss of bone. Indeed, only a few works have documented a higher development of muscle insertion in females than in males (see, for instance, al-Oumaoui, Jiménez-Brobeil & du Souich 2004; Munson-Chapman 1997). In those cases, however, as Weiss (2004, p. 232) stressed, a reduction of the sex differences may be observed by using functional aggregated entheses[8] to reduce error variance in the results.

Since the first pioneers of ECs studies such as Merbs (1983), many protocols have been developed to extract information concerning the activity from the examination of the entheses. Three criteria led to the identification of the most appropriate method to the characteristics of the osteological materials included in this research: (1) the recognizability on dry bones of the relevant entheses (2) the possibility to record both the fibrous and the fibrocartilaginous entheses, avoiding the loss of valuable information in cases of poor-preservation contexts (3) that the method had been tailored to examine muscle systems which were used frequently in a range

[8] The functional complex is constituted by the aggregation of the entheses which participate at the same movement (Mariotti, Facchini & Belcastro 2007, p. 294)

of activities common to prehistoric populations (Porčić & Stefanović 2009, p. 261). Indeed, some widely adopted methods (the Coimbra method, for instance) have been designed to exclusively record fibrocartilaginous entheses which occur at the secondary ossification sites (epiphysis) of the bones and on the carpals, tarsal, and vertebrae. These anatomical areas are unlikely to be found in Cypriot skeletal materials given the level of the incompleteness of the skeletons.

For this dissertation, the Mariotti protocol was selected. Each enthesis was macroscopically scored for three categories of bone alteration. Robusticity was scored in 5 stages: 1a, 1b, 1c (mild), 2 (moderate) and 3 (severe). To facilitate statistical analysis of the data, and in line with the advice of Mariotti, the first three degrees (1a, 1b, 1c) were aggregated (Mariotti, Facchini & Belcastro 2007) (Figure 2.2). OLs and EFs were evaluated on the basis of a three-point scale as in the protocol (Mariotti, Facchini & Belcastro 2004) (Figure 2.3). Twenty-one postcranial entheses from eight skeletal elements (clavicle, scapula, humerus, radius, ulna, femur, tibia, and patella) were rated using both left and right elements (Table 2.3); and examined in relation to sex and age categories within each skeletal collection. The second level of investigation relied on the evaluation of the development of the five functional complexes according to each chronological period considered.

Table 2.3. List of the entheses divided according to the functional complex to which they belong. Based on Mariotti, Facchini & Belcastro 2007, p. 292.

Joint surface	**Functional complex**
Costoclavicular ligament (clavicle) *Conoid ligament* (clavicle) *Trapezoid ligament* (clavicle) *M deltoideus* (clavicle) *M pectoralis major* (clavicle) *M pectoralis major* (humerus) *M deltoideus* (humerus) *M teres major* (humerus)	Shoulder
M triceps brachii (scapula) *M brachioradialis* (humerus) *M biceps brachii* (radius) *M triceps brachii* (ulna) *M brachialis* (ulna)	Elbow

M pronator teres (radius) *Interosseous membrane* (radius) *M supinator* (ulna)	Forearm
M gluteus maximus (femur) *M iliopsoas* (femur)	Hip
M vastus medialis (femur) *Quadriceps tendon* (patella) *Quadriceps tendon* (tibia)	Knee

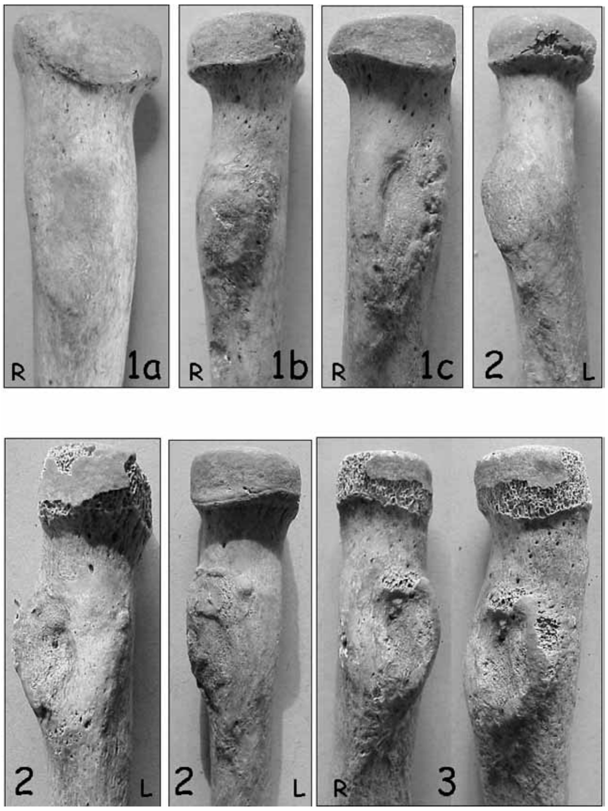
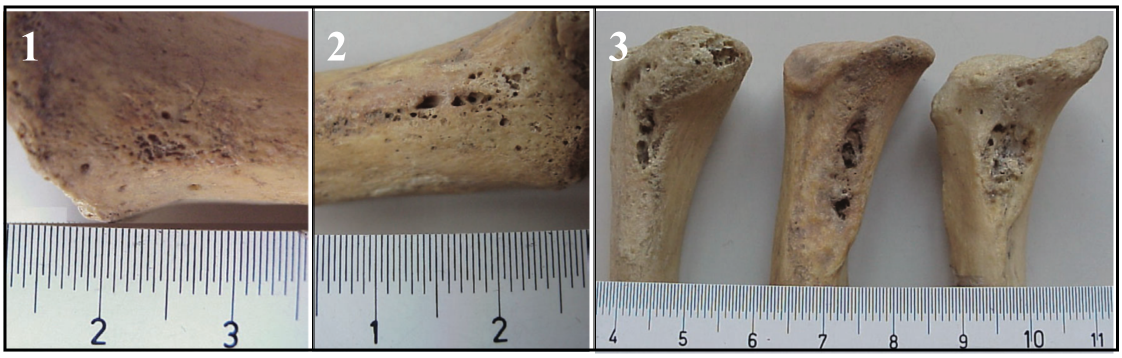


Figure 2.2. Severity degrees of the robusticity. After Mariotti, Facchini & Belcastro 2007, fig. 12.



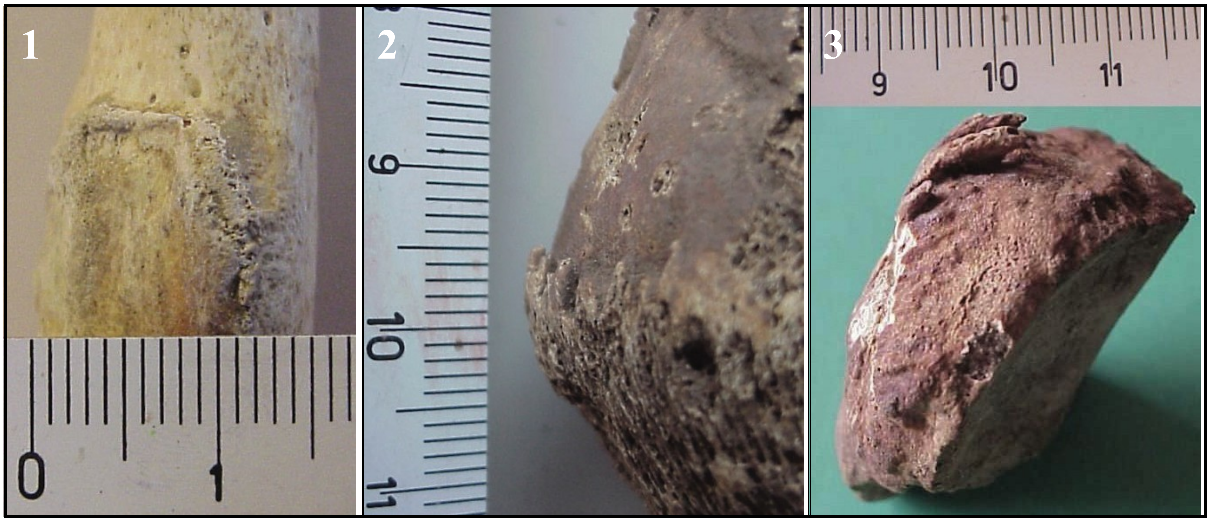


Figure 2.3. Severity degrees of the OLs and EFs. After Mariotti, Facchini & Belcastro 2004, fig. 8, 9b, 11, 2, 4, 4.

2.1.6 Osteoarthritis

The second category of activity-related skeletal traits explored in this research was osteoarthritis (hereafter, OA). Although OA is already one of the most common chronic disorders attested in archaeological human remains, if we consider that all the damage to cartilage and soft tissues are not discernable in archaeological remains, it is possible to assert that OA prevalence in past populations is certainly underrepresented (Waldron 2009, p. 27). Physical stress is a primary factor in causing articular degenerations and therefore OA. Indeed, anthropological literature abounds with examples of studies which have documented positive relationships between this bone degenerations and stereotyped repetitive use patterns (Bridges 1991; Felson 2013; Jurmain 1977; Lovell 1994; Merbs 1983; Molnar, Ahlstrom & Leden 2011; Novak & Šlaus 2011; Sofaer-Derevenski 2000; Waldron & Rogers 1991). Furthermore, Jurmain (1991, p. 249) found that degeneration of some joints (as the knee and shoulder) is more substantially under the influence of physical stress and impacted less by systemic factors than others.

OA firstly involves the articular cartilage which, as a result of repeated stress, breaks down causing inflammation in the synovial membrane with consequent formation of new blood vessels (Ortner 2003, p. 547). Secondly, at the skeletal level, the loss of the cartilage may result in:

- a proliferative reaction consisting in new bone formation around the margins of the joint (marginal lipping or spur) or on its surface in forms of outgrowths or bony excrescences defined as "osteophytes"

- an erosive reaction with consequent exposure of the underlying trabeculae commonly in the forms of small pits (porosity) or in form of cysts, herniation of the synovial fluid into the subchondral bone
- alteration of the natural curvature of the bone surface in case of convex joint surfaces
- polished area (eburnation). This represents the most severe manifestation of the OA, and it occurs in response to the rubbing of the bone directly on the surface of the corresponding bone
- fusion of two articular surfaces.

There is substantial consensus on the criteria to be met for a correct OA determination. Eburnation is widely regarded as a pathognomonic factor (Waldron 2009, p. 27). In absence of this, at least two of the aforementioned markers must be observable (Jurmain & Kilgore 1995; Molnar, Ahlstrom & Leden 2011; Waldron & Rogers 1991).

As for ECs, the multifactorial origin of the OA has been widely proven; these include age, sex, genetic background, obesity, trauma, occupational overuse, and posture (Conde *et al.* 2011; Felson 2013, p. 12; Johnson & Hunter 2014; Novak & Šlaus 2011). Until the end of the 1980s, major efforts were concentrated on understanding the effects of repetitive mechanical loading together with age as the strong determinants of OA (Weiss & Jurmain 2007, p. 439). Among these, age, as Jurmain (1977, p. 353) argues, is the most "obvious" cause. In fact, the more severe forms of OA that involve the bones rarely appear before the fourth decade (Loeser 2013, Ortner 2003, p. 547; p. 108; Sofaer-Derevenski 2000, p. 339). Concerning the role played by body weight, it is likely intuitive why heavier people are generally more affected by this pathological condition than subjects with lower body mass as obesity represents chronic excess loading which weight on weight-bearing joints (such as the knee) (Felson 2013, p. 12).

No unanimous consensus exists in reference to the recording format for OA (Roberts & Manchester 2010, p. 137). Indeed, many different protocols have been developed by several authors over time. Roberts and colleagues (2010, p. 137) stress the importance of recording basic data in a standardized format as an essential procedure to make results comparable. This means the inclusion of photographs and definitions of severity in order to clearly communicate our own observation. Five bone markers were evaluated separately for each surface present: porosity, lipping, osteophytes, eburnation, and fusion. To record the severity level of each marker the scoring system elaborated by Zampetti and colleagues (2016, p. 686) was regarded as the most appropriate as it integrates accurate and detailed descriptions with photographic references

(Figure 2.4). Porosity (hereafter, PO), where present, was scored according to a three-degree scale:

1) presence of a diffuse and fine porosity on the articular surface (hole < 1 mm)
2) presence of holes about 1 mm in diameter on the joint surfaces or concentrated on a smaller area
3) presence of a big and deep area of macroporosity or erosion on the articular surface.

Marginal lipping (hereafter, ML), where present, was scored according to a three-degree scale:

1) presence of slight rim
2) presence of a clear rim 1-3 mm
3) severe rim.

Osteophytes (hereafter, SO), where present, were scored according to a three-degree scale:

1) small exostosis < 1 mm in any dimension
2) clear exostosis 1-4 mm in at least one dimension
3) clear exostosis > 4 mm.

Eburnation (hereafter, EB), where present, was scored according to a three-degree scale:

1) presence of eburnation covering < 25% of the joint surface,
2) presence of eburnation on 25-50% of the joint surface,
3) presence of eburnation in > 50% of the joint surface.

Fusion was scored in terms of presence/absence.

Figure 2.4. Severity degrees of ML, PO, SO and EB. After Zampetti et al. 2016, fig. 1-4.

Thirteen articular areas were rated for both left and right scapula, humerus, radius, ulna, femur, patella, and tibia (Table 2.4); and examined in relation to sex and age categories within each skeletal collection. Secondly, four large articular complexes, which encompass the joints which participate in the same movements, were created and the data for OA was considered for each complex (Table 2.4). It must be noted that they correspond to the functional complexes already examined using ECs. In this manner, OA has the potential to enhance and support the findings related to the use of these anatomical and functional structures.

Table 2.4. List of the joint surfaces selected and scored for OA divided according to the functional complex to which they belong.

Joint surface	**Functional complex**
Glenoid fossa (scapula)	Shoulder
Humeral head	
Humeral capitulum	Elbow
Radial capitulum	
Proximal radio-ulna (ulna)	
Proximal radio-ulna (radius)	
Trochlea	
Proximal ulna	
Femoral head	Hip
Proximal tibia	

Acetabulum	
Distal femur	Knee
Patella	

2.1.7 Extra-masticatory dental wear

Artificial dental modifications identified in skeletal remains are diverse, but one macro-category, in particular, is deemed indicative of activity patterns: extra-masticatory dental wear (Alt & Pichler 1998; Minozzi *et al.* 2003; Molnar 2011, p. 682). It is crucial to clarify the distinction between general dental attrition, extensively used to assess age at death, and dental abrasion which can be associated with dental wear of non-masticatory origin (Molnar 2011, p. 682). Both indicate an exterior loss of enamel with a consequent exposition of the dentine, but the former consists of a progressive diminishing of dental tissues physically compatible to the frictional contact between the upper and lower teeth during mastication; the last appears in its aspect as an unusual wear pattern not imputable to mastication but rather "intentionally caused by human or animal activity" (Lukacs & Pastor 1988, p. 377; Molnar 2011, p. 682).

Extra-masticatory dental wear has not received comparable scholarly attention to ECs and OA for several reasons. Indeed, while every mechanical effort involves an energy expenditure with variable demand of muscles and joints, and so can be assessed through the study of bone in all populations, by contrast, not all of the tasks performed by past and present populations required the use of the teeth as a third hand, and so they may be absent in any given group. Furthermore, whereas in living populations this kind of modification is easily interpretable thanks to the knowledge of the environmental context from which they derive, in archaeological skeletal remains the evaluation of dental modifications has proven to be more challenging. This issue can in part explain the lack of a standardized categorization of these dental defects (Alt & Pichler 1998, p. 390).

The examination of dental abrasion began to be used to make inferences about occupational habits and health patterns in the 1980s (Alt & Pichler 1998, p. 394; Molnar 2011, p. 681; Smith 1984, p. 39), and several different types of extra-masticatory wear were identified. Some of these are unlikely to be detectable without the use of a microscope, and so it was not feasible to focus on these in the present study which required the researcher to travel to numerous locations to record data. Others cannot be confidently attributed to intentional activity (for instance chipping) and are therefore not valuable for a study of activity patterns (Bonfiglioli *et al.* 2004, p. 449).

Aside from these cases, three sub-categories of extra-masticatory dental defects have been widely attested in archaeologically derived human remains and more confidently associated with specific activities performed by past populations (Alt & Pichler 1998; Lucaks & Pastor 1988; Molnar 2011):

a) Grooving
b) Lingual surface attrition of the maxillary anterior teeth (LSAMAT)
c) Notching.

Grooving is tubular channels which may occur: i) on the occlusal plane of the teeth (occlusal grooves) in mesiodistal or linguolabial direction; or ii) on the inter-proximal surface of teeth, more frequently at the cementoenamel junction, in linguolabial direction (Berryman, Owsley & Henderson 1979; Brown & Molnar 1990; Lorkiewicz 2011; Minozzi *et al.* 2003). The former has been associated with plant fibres processing for basket manufacture or cordage, for instance (Larsen 1985; Lorkiewicz 2011, p. 542; Minozzi *et al.* 2003; Molleson 1994; Schulz 1977, p. 90). In support of this proposal, photographic documentation published by Wheat (1967) shows how women involved in the basket production grip willow strands with the anterior teeth and pull them in the opposite direction, across the tooth, using the hands (Figure 2.5).

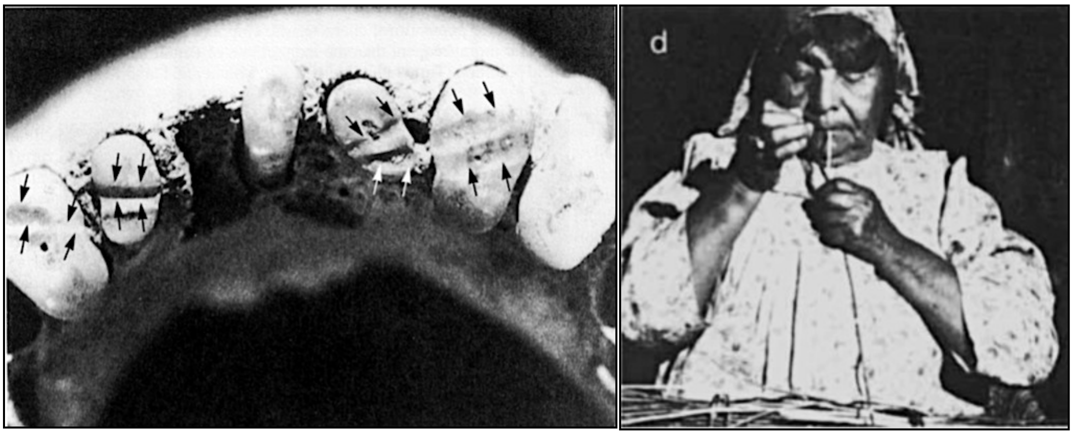


Figure 2.5. Evidence of occlusal grooves on the mandibular arch from Humboldt Lake Basin (on the left). After Larsen 1985: fig 2. The use of teeth in the process of basket construction (on the right). After Wheat 1967.

The inter-proximal grooving was associated with a variety of tasks including manipulation of animal sinew (Bermudez de Castro, Arsuaga & Perez 1997; Bonfiglioli *et al*. 2004; Brown & Molnar 1990; Erdal 2008; Formicola 1988; Frayer 1991, Irvine, Thomas & Dietrich-Schoop 2014; ; Lukacs & Pastor 1988; Sperduti *et al.* 2018; Ungar *et al.* 2001; Wallace 1974); and therapeutic, palliative or hygienic practices executed through the insertion of a toothpick between the mesial and distal face of the teeth (Figure 2.6) (Bermudez de Castro, Arsuaga &

Perez 1997; Berryman, Owsley & Henderson 1979; Brown & Molnar 1990; Erdal 2008; Formicola 1988; Frayer 1991; Lucaks & Pastor 1988;; Schulz 1977; Tanga *et al.* 2016; Ubelaker, Phenice & Bass 1969; Ungar *et al*. 2001).

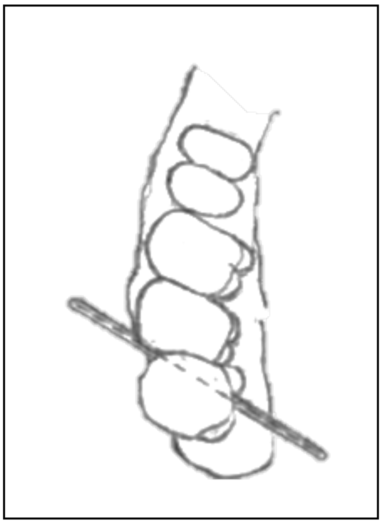


Figure 2.6. Drawing of a probable mode of grooves formation: insertion of a toothpick. After Schulz 1977, p. 89.

LSAMAT is an advanced wearing involving exclusively the lingual surface of the anterior, maxillary teeth (Turner & Machado 1983). This dental defect was associated with the peeling and shredding, or alternatively the pulling and holding of abrasive plant fibres (Figure 2.7) (Irish & Tuner 1987;1997; Liu *et al*. 2010; Pechenkina, Benfer & Zhijun 2002; Tanga *et al.* 2016; Watson & Haas 2017).

Figure 2.7. A SEM image of a case of LSAMAT from a medieval skeleton from Eichstetten, Germany. After Alt & Pichler 1998.

Notching is an indentation occurring on the occlusal plain associated with the keeping of rounded objects (a needle for leatherworking, for instance) between two correspondent teeth, one maxillary and the other mandibular (Bonfiglioli *et al.* 2004; Irvine, Thomas & Dietrich-Schoop 2014; Lorkiewicz 2011; Molnar 2011).

All osteological collections under study were scored for the three categories of dental defects previously described. Their grade of severity and type were evaluated on the basis of the most recommended procedures.

Grooving (both occlusal and interproximal), according to the three-degrees scale readapted by Brown and Molnar (1990, p. 548) on the basis of the method provided by (Frayer & Russell 1987):

1. shallow, highly polished depression
2. the shallow groove takes on a more precise semicircular appearance with a diameter of about 2-4 mm
3. deep grooving with pulp exposure followed by alveolar abscess formation

No photographic references for this scale were provided by the author.

LSAMAT, on the basis of the two-degrees scale provided by Tanga *et al.* (2016, p. 17):

1. only enamel involved
2. both enamel and dentine involved.

No photographic references for this scale were provided by the author.

Notching, according to the method developed by Bonfiglioli and colleagues (2004, p. 449):

1. slight superficial, it affects only the enamel
2. wider and deeper indentation with polished dentine
3. very deep with heavily polished dentine.

Photographic references for this scale were provided by the author (Figure 2.8).

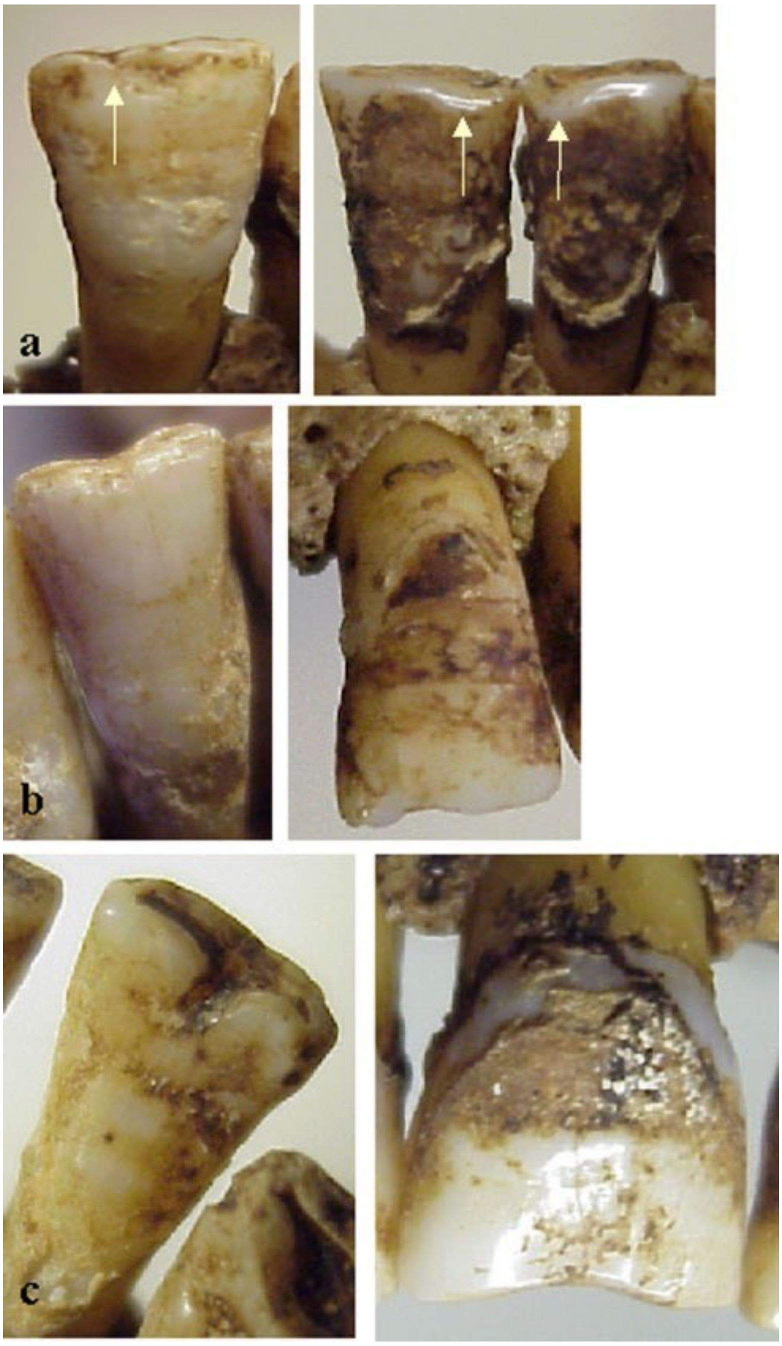


Figure 2.8. Severity degrees of the notching:(a) mild, (b)moderate, (c)severe. After Bonfiglioli et al. 2004, fig. 2.

2.1.8 Statistical analyses

After that appropriate severity degrees of the three groups of activity-related markers were assigned to each enthesis, joint surface or teeth evaluated as sufficiently preserved, data were reported in three Microsoft Excel spreadsheets, but all the statistical analyses were carried out by using IBM® SPSS® Statistics 25.0. The level of significance was set at p-values < 0.05. Microsoft Excel was preferred to other programs to generate graphs and charts for its graphic rendering. *SPSS*, on the contrary, is one of the most popular software for statistical data processing because it makes use of a descriptive menu and simple dialogue boxes for most of the procedures. Three independent spreadsheets were created in order to i) facilitate the identification of a distributional pattern of each marker by muscle insertion, joint, and teeth; ii) ascertain whether prevalence or severity of three groups of activity-related markers varied by age, sex, and/or period.

All the collected data were processed on two different levels: at the intra-population level and inter-population level. Before exploring the values related to the activity patterns, sex and age distribution of the skeletons examined for each site was graphically depicted (table and bar chart) to ascertain potential disparity in representation of each category which could have affected the reliability of the comparisons. Additionally, a curve of representation of the observed entheses/joint surfaces was realized in order to discuss the impact of the taphonomic factors on the prehistoric skeletal materials excavated on the Island.

In the site-by-site section, descriptive results and specific statistical tests were integrated in order to highlight potential differences in the use of muscles, joints, and teeth by the groups under study and whether these differences were sex or age-based. The descriptive approach allowed:

1. to compare the percentage of representation of the skeletal surfaces (joint or enthesis) understudy
2. to highlight the frequency of each parameter under consideration (robusticity, OLs, EFs, ML, PO, SO) by enthesis/joint surface
3. to infer the prevalence of mild, moderate, or severe expressions of each parameter by side, sex, and age.

Comparisons between sides and sex were conducted on separated surfaces and, then, by grouping together surfaces belonging to the same functional complex (shoulder, elbow, forearm, hip, and knee). As for age, these comparisons were conducted only at the functional complex level. Indeed, whether the evaluation of the single muscle/joint development by type may be useful to obtain the activity patterns, age effect on these manifestations was expected to do not be different according to the type of surface considered. Furthermore, aggregating muscles or joints on the basis of their primary physiological function in case of poor sample preservation was widely known as the best strategy to reduce statistical biases (Schrader 2012). The standard bar chart was identified as the more intuitive graphic format to depict the number of entheses/joint surfaces observed for each category (sex, side, age), separately or pooled in functional complexes. A stacked bar chart was preferred to the standard bar chart to compare percentages of mild, moderate, and severe degrees by functional complexes between sides, sex, and age groups as this format is best suited to compare a part of the total with the total.

Once frequencies and prevalence were determined, the Mann-Whitney *U*-test was done to test for significant differences in the use of the five functional complexes by side. It must be specified, in this case, that the Mann-Whitney *U*-test was preferred to the Wilcoxon test as not all the entheses were recorded in pairs. Thus, to avoid any additional dispersal of data, sides were considered as independent variables. The Mann-Whitney *U*-test was also applied to evaluate sexual dimorphism. Finally, the Kruskal-Wallis test and the *H*-statistic were chosen to test for significant differences in the distribution of the ranks (for each considered parameter) between age categories. Both the tests are considered the best suited while working with ordinal data (Norušis 1990).

Concerning the extra-masticatory dental wear, dental defects were reported in a table grouping the specimens by dental arch with an indication of the sex and age of the affected individual.

The second level of investigation - the interpopulation level - involved the comparison of samples aggregated per period in order to establish whether changes in work activities resulted in a differential workload on muscles and joints, or whether some kind of task was carried out through the use of teeth. In this case, the most severe expressions (degrees 2 and 3) were combined in order to facilitate the discussion of the data and make clearer their distribution between sides, sex, and age categories.
As for the inter-site analysis, descriptive results and statistical tests were integrated. The descriptive approach allowed:

- to compare the percentage of representation of each functional complex (pooled entheses/pooled joint surfaces) between the osteological collections aggregated per period
- to compare the frequency of each considered parameter (robusticity, OLs, EFs, ML, PO, SO) between the osteological collections aggregated per period
- to compare the distribution of severe expressions of each parameter by side, sex, and age between the osteological collections aggregated per period.

When the frequencies were determined, the Mann-Whitney *U*-test and the Kruskal-Wallis test were employed to test for significant differences in the distribution of the severity ranks of each parameter by side, sex, and age between the periods.

Concerning the evaluation of the extra-masticatory dental wear between the three periods, a first table was provided in order to clarify the number and distribution of the individuals who yielded dentition by sex and age. A second table was designed to illustrate the distribution of the examined teeth (by arch) between the three periods. These first two assessments were necessary to highlight the potential disparity in representation i) of two sexes and/or of the four age categories; ii) of the specimens (teeth) between the three periods. A third table was produced to show the distribution of the grooving, LSAMAT and notching by sex and age.

Considering the aim of this research, the biocultural approach was regarded as the most appropriate to successfully investigate the interactions between the communities which occupied Cyprus in considered chronological period and the cultural, social, and physical environment in which they were immersed. Indeed, researchers have widely demonstrated that the mere anthropological analysis of the osteological collections is inadequate to produce convincing results concerning the effects of the socio-economic processes - control of the resources, production and distribution of the material resources - on the human biology (Zuckerman &Armelagos 2011). In other words, patterns of distribution of given skeletal markers can be only interpretated considering the environmental factors which could have potentially contributed to their occurrence. In this specific case, for instance, the identification of instruments or animal or plant fibers processed for the realization of textiles, might suggest the gestures behind their utilization. The combination of the archaeological, botanical and anthropological data is thus essential to identify the patterns of occupations of the considered populations.

2.2 Materials

2.2.1 Introduction

The osteological collections selected for this research cover the chronological period between MChal/LChal (3400-2700 BC) and LBA III (1125/1100 BC) (Table 1.1). The criteria that formed the sampling strategy of this study have already been discussed in the Methods alongside the rationale for selecting the sites which formed the dataset for this study. The funerary sites from which the skeletal samples derive, and their associated settlements are relatively evenly spread across southern and central Cyprus (Figure 1.1; Figure 1.2; Figure 1.3; Figure 1.4). This has enabled the assessment of the grade of preservation of the skeletal materials according to the period and the geographical location. This data is crucial to correctly interpret the physical stress level of each anatomical district observed. Indeed, it has been common practice to exclude important skeletal collections from studies and publications as they were perceived as undeserving of attention because of their fragmentation (Knüsel & Robb 2016, p. 656). It must be borne in mind, instead, that information related to the taphonomic effects recorded by the bone materials as well as the level of fragmentation of the skeletons and the representativeness of the bones may provide the fundamental key to understanding social aspects of funerary context (Knüsel & Robb 2016, p. 656).

This section aims to introduce the osteological collections that have been selected for this study, providing a brief description of their archaeological setting: the topography of the sites and the history of their excavation. The sex and age composition of the samples gathered by previous bioarchaeological analysis as well as their present status of preservation was included in order to highlight the opportunities, challenges, and limitations arising from the examination of this material category in Cyprus. This comprises a particular focus on those cases where laboratory taphonomy (occurring between the previous study and the current examination) has significantly impacted their status of conservation and therefore the feasibility and findings of the present study.

2.2.2 The Middle-Late Chalcolithic osteological collections

Three skeletal collections from southwest Cyprus were used to explore the activity patterns of Chalcolithic communities of the island: Lemba *Lakkous*, Kissonerga *Mosphilia,* and Erimi *Pamboula* (Figure 1.1). The first two collections are currently curated in the Paphos District

Museum; the third is stored in the Cyprus Museum (Nicosia). The study sample for the M-LChal period consists of 32 individuals: nine males, 20 females, and three for whom sex was not determined.

Most of the individuals examined for this chronological phase were buried in pits cut in the local, dense limestone (*kafkalla*), just outside the walls of contemporary houses (Crewe *et al.* 2005, p. 4; Peltenburg *et al.* 1985, p. 241). From the end of the MChal onwards, more elaborated burial forms were introduced; among these, chamber tombs comprised a vertical or oblique shaft leading to one or two sub-circular chambers, which was to become the predominant grave typology throughout the Bronze Age in Cyprus. Five chamber tombs were uncovered at *Mosphilia*, all dated to the LChal. Single inhumations were the most recurrent custom, though several examples of multiple interments were also attested (Niklasson 1991).

2.2.2.1 Lemba *Lakkous*

The M-LChal village of Lemba lies on a southwest slope overlooking the fertile coastal strip known as Ktima Lowlands ca. 4 km from northern Paphos (Peltenburg *et al.* 1985, pp. 2-5). The first mention of the ruins of Lemba can be found in an archaeological report dated to 1975 which referred to the results of the survey conducted by S. Hadjisavvas in the Paphos District (Hadjisavvas 1977, p. 224). As a result of this survey, seven seasons of excavation, carried out from 1976 to 1983 by the Lemba Archaeological Research Project under the direction of E. Peltenburg, brought to light the remains of the settlement, extending presumably for 3 ha on the basis of the scattered materials, and 56 graves spread between two areas, Area I (22 tombs) and Area II (34 tombs) (Niklasson 1991; Peltenburg *et al.* 1985). The excavated burials cover the entire lifespan of the settlement (M-LChal), although the majority of them have been dated to the second period in the MChal. Focusing on the number of interments, on the basis of the number of teeth recovered, Lunt determined the deposition of 52 individuals (Lunt, Campbell & Green 1995, p. 57). Recent re-examination of the skeletal material conducted by M. Gamble in 2011 (p. 100) has revealed that this reconstruction does not correspond to the status of the material which is conserved and accessible in the Paphos museum. She found, in addition, one individual, bringing the total number of interred individuals to 53 (Gamble 2011, p. 100). Figure 2.9 summarizes the age composition of the sample examined by D. Lunt (1995) in the 90s compared with the composition of the sample studied by Gamble. Based on the criteria detailed in the previous section, a total of 10 individuals were selected for this dissertation (Table 2.6).

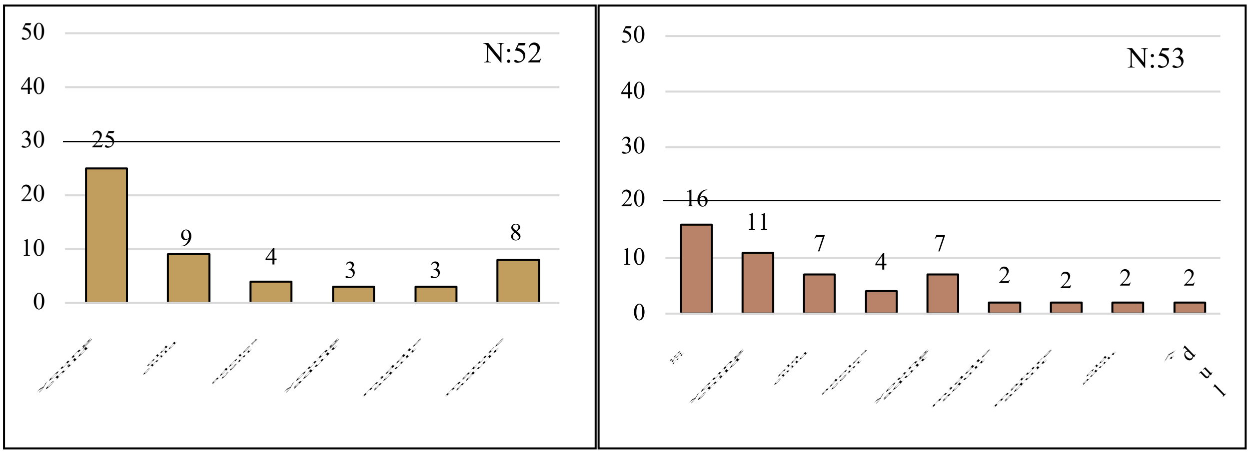


Figure 2.9. Lemba: Age composition of the sample provided by Lunt, Campbell & Green (1995, pp. 57-58), on the left, and by Gamble (2011, p. 104) on right.

Table 2.5. Lemba: List of the tombs included in the research. ND: not determined.

Dates	Period	Context	Tomb	Skeleton inventory	Sex	Age category
ca. 3600-2700 BC	MChal	Area I	23	LL444	F	20-24
ca. 3600-2700 BC	MChal	Area I	25	LL483	F	20-24
ca. 3600-2700 BC	MChal	Area II	26	LL550	M	35-44
ca. 2700-2400 BC	LChal	Area II	29	LL1032	F	20-24
ca. 3600-2700 BC	MChal	Area I	30	LL1033	F	20-24
ca. 3600-2700 BC	MChal	Area I	35	LL1038	F	35-44
ca. 2700-2400 BC	LChal	Area II	37	LL1040	F	25-34
ca. 3600-2700 BC	MChal	Area II	40	LL1043	ND	25-34
ca. 2700-2400 BC	LChal	Area II	50	LL1211	F	20-24
ca. 2700-2400 BC	LChal	Area II	56	LL1254	F	25-34

2.2.2.2 Kissonerga *Mosphilia*

The intermittently occupied archaeological site of *Mosphilia*, located 6 km from the northern Paphos, lay along the coastline (which has now receded to a distance of ca. 500 m) and was bordered to the south by the Skotinis stream (Figure 2.10) (Peltenburg *et al*. 1998, p. 1).

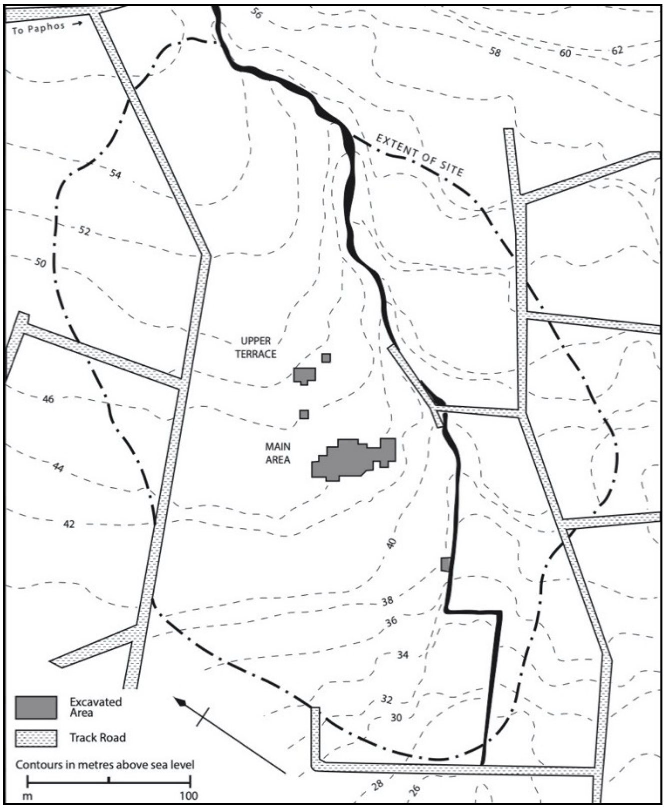


Figure 2.10. Mosphilia: Topographic plan showing the location of the Upper terrace and the Main Area. After Peltenburg 1998, fig. 15.

The site was systematically investigated by the University of Edinburgh under the direction of E. Peltenburg between 1979 and 1992; but it was identified, for the first time, by A.H.S. Megaw (1957) who found and studied some materials coming from the areas occupied by the ancient settlement in the Cyprus Museum. In 1975, S. Hadjisavvas (1977) led the first survey of the area: on this occasion, some prehistoric structures were exposed, and several artefacts were recovered and handed to the Paphos Museum. The site publication which encompassed the results of the 1976-83 excavation seasons appeared in 1998 (Peltenburg *et al.* 1998). The site extended for ca. 12 ha. and was dense with habitations erected since the EChal which spread across two major areas, the Main Area and the Upper Terrace (Peltenburg *et al.* 1998). The majority of the burials discovered at *Mosphilia* were inserted into abandoned structures of the settlement: 60 in the Main Area and 13 in the Upper Terrace (Lunt, Peltenburg & Watt 1998, p. 65, Niklasson 1991). However, the mortuary records from *Mosphilia* do not reflect the entire lifespan of the village. Indeed, the first periods of occupation (IA, IB, and 2), corresponding to the Late Neolithic and the EChal strata, are not represented. In contrast, funerary contexts are most abundant in Period 4 (LChal) (72.1%) (Lunt, Peltenburg & Watt 1998, p. 84), with periods 3 (MChal) and 5 (Philia *facies*) yielding evidence of only 15 (24.5%) and 2 burials (3.3%) respectively.

Human remains exhumed from the settlement of *Mosphilia* were, firstly, analyzed by D. Lunt and colleagues in 1985: they identified 61 individuals on the basis of the number of teeth identified (Figure 2.11) (Lunt, Peltenburg & Watt 1998, p. 74). M. Gamble, who re-examined the remains in 2011, recorded the presence of another additional 10 individuals, on the basis of the existent discrete post-cranial elements (Figure 2.11) (Gamble 2011, p. 112). A total of 20 individuals were selected for this dissertation according to the criteria presented in the previous section (Table 2.7).

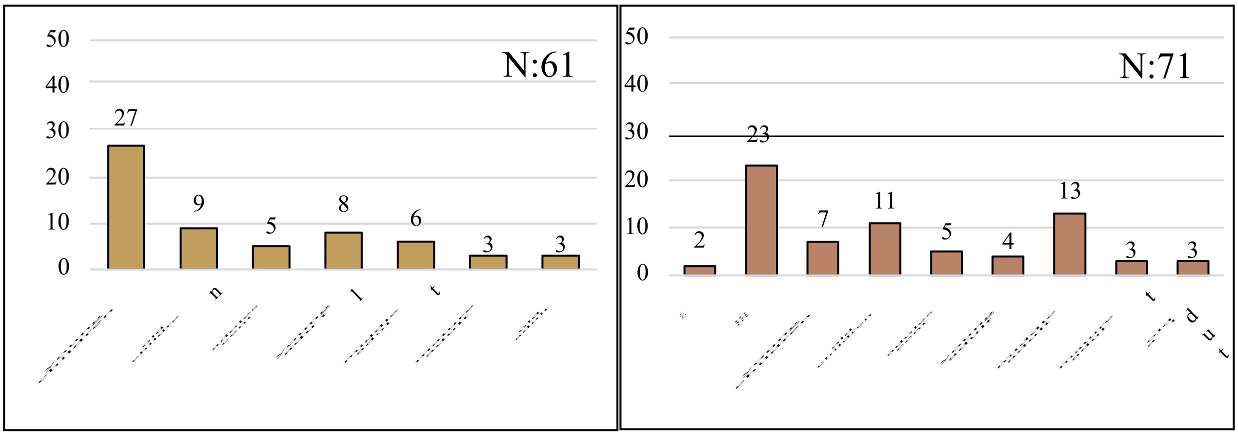


Figure 2.11. Mosphilia: Age composition of the sample provided by Lunt, Peltenburg & Watt (1998, p. 74), on the left, and by Gamble (2011, p. 112) on the right.

Table 2.6. Mosphilia: List of the tombs included in the research. ND: not determined.

Dates	Period	Context	Tomb	Skeleton inventory	Sex	Age category
ca. 2700-2400 BC	LChal	Main Area	505	KM553.1	F	20-24
ca. 2700-2400 BC	LChal	Main Area	508	KM662	M	25-34
ca. 2700-2400 BC	LChal	Main Area	515	KM769	M	25-34
ca. 2700-2400 BC	LChal	Main Area	515	KM770	ND	25-34
ca. 2700-2400 BC	LChal	Main Area	520	KM1066	F	35-44
ca. 2700-2400 BC	LChal	Main Area	526	KM1175.1	F	20-24
ca. 2700-2400 BC	LChal	Main Area	528	KM1219	F	35-44
ca. 2700-2400 BC	LChal	Main Area	539	KM1754	M	25-34
ca. 2700-2400 BC	LChal	Main Area	539	KM1753	M	25-34
ca. 2700-2400 BC	LChal	Main Area	545	KM2827	F	25-34
ca. 2700-2400 BC	LChal	Main Area	545	KM2830	ND	25-34
ca. 2700-2400 BC	LChal	Main Area	546	KM1912	F	25-34
ca. 2700-2400 BC	LChal	Main Area	550	KM2005	F	35-44
ca. 2700-2400 BC	LChal	Main Area	557	KM2455	F	25-34

ca. 2700-2400 BC	LChal	Main Area	559	KM2315	F	20-24
ca. 2700-2400 BC	LChal	Main Area	561	KM2338	F	25-34
ca. 2700-2400 BC	LChal	Main Area	562	KM2636	F	20-24
ca. 2700-2400 BC	LChal	Main Area	565	KM2887	M	25-34
ca. 3600-2700 BC	MChal	Upper Terrace	571	KM3079	F	35-44
ca. 3600-2700 BC	MChal	Upper Terrace	574	KM3478	M	25-34

2.2.2.3 Erimi *Pamboula*

The Chal site of *Pamboula* lies on the edge of an alluvial plain overlooking the east bank of the Kouris river and it is bordered on east and north by hillocks which form the lowest, southern foothills of the Troodos Mountain (Figure 2.12) (Dikaios 1936; Niklasson 1991, p. 119).

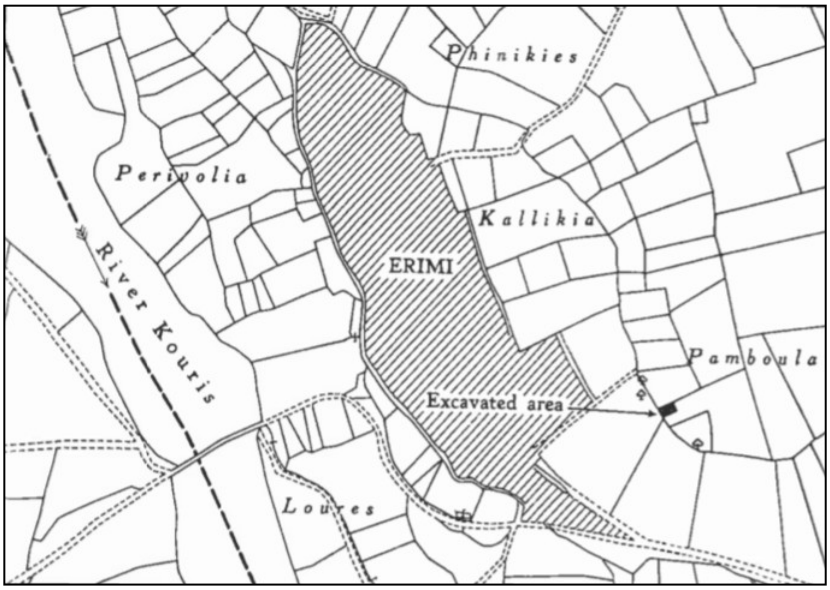


Figure 2.12. Pamboula: Topographic plan showing the location of the excavated area. After Dikaios 1936, plate IIA.

Remains of the ancient settlement were discovered by P. Dikaios in 1933 and excavated between 1933 and 1935 by the Department of Antiquities in conjunction with the Cyprus Museum. Since the intention behind this operation was to "make a preliminary study of the settlement and its culture" to quote the excavator, only a restricted area measuring less than 1 ha. was investigated (Dikaios 1936, p 2). Thirteen superimposed layers of occupation evidence were brought to light together with a series of circular structures erected during the course of the MChal (Dikaios 1936, p. 80). Four graves, located below the floors of four structures, were exposed. The four skeletons exhumed from the site were analyzed by M. Rix and M. Guest in 1936, and then again, by Angel in 1953 (Niklasson 1991, p. 119). They identified two adult males, one of these (skeleton 2) in its 30s (middle adult), one older child, and one individual of undetermined sex and age. Only two skeletons were selected for this thesis (Table 2.8).

Figure 2.13. Pamboula: Skeleton 2 from Erimi Pamboula exposed in the Cyprus Museum.

Table 2.7. Pamboula: List of the tombs included in the research. ND: not determined.

Dates	**Period**	**Context**	**Tomb**	**Skeleton inventory**	**Sex**	**Age category**
ca. 3600-2700 BC	MChal	VIA	1	1	M	ND
ca. 3600-2700 BC	MChal	IXA	2	2	M	25-34

2.2.3 The Philia-Middle Bronze Age II osteological collections

Six osteological collections were selected to explore the activity patterns of the Philia-MBAII communities: Marki *Alonia*, Alambra *Mouttes,* and Kalavasos Village Tombs in the Larnaka District (central-southeast Cyprus), Sotira *Kaminoudhia*, Erimi *Laonin tou Porakou,* and Episkopi *Phaneromeni* in Limassol District (southwest coast of the island) (Figure 1.3). The afore-mentioned collections are presently housed in three different museums: the former two in Terra Umbra storage (Larnaka); Alambra in the Cyprus Museums, the last three in the Kourion Museum (Episkopi). The study sample for the Philia-MBAIl period consists of 53 individuals: 22 males, 28 females and three of undetermined sex.

The most recurrent mortuary practice throughout Philia-MBA entailed the deposition of the deceased in pit or rock-cut chambers set some distance from the settlement but within sight of it (Knapp 2013, p. 311). Occasionally, some individuals were deposited in abandoned domestic areas; this finding sheds light on a different practice. Indeed, when the first cases were uncovered within the settlement of Sotira they were ascribed to a catastrophic event such as an earthquake (Swiny, Rapp & Herscher 2003, p. 51). Later, similar cases were attested in other sites like Marki and Erimi (Frankel & Webb 2006, p. 283). Two possible scenarios were proposed to explain this evidence: a) that these bodies were initially deposed in open areas beyond the houses to be moved, for the final burials, to chambers or pits (Frankel & Webb 2006, p. 283); or b) that alternative treatments were reserved for individuals excluded from the extra-mural deposition for as yet obscure reasons (Keswani 2004, p. 40). The most frequently occurring burial facility, the chamber, was usually cut into sloping limestone and consisted of three components: the *dromos*, the *stomion,* and the chamber. Only upon the last interment (in case of multiple, sequential depositions) and/or the completion of the funerary rituals, was the *stomion* sealed by a large stone slab and the dromos filled with earth (Knapp 2013, p. 311).

2.2.3.1 Sotira *Kaminoudhia*

The EBA archaeological site of Sotira covered an area of around 2 ha on a gently sloping terrace which stood 300 m above sea-level, five km from Cyprus' south coast (Figure 2.14) (Swiny, Rapp & Herscher 2003, pp. 1, 5; Stanley Price 1979, p. 46).

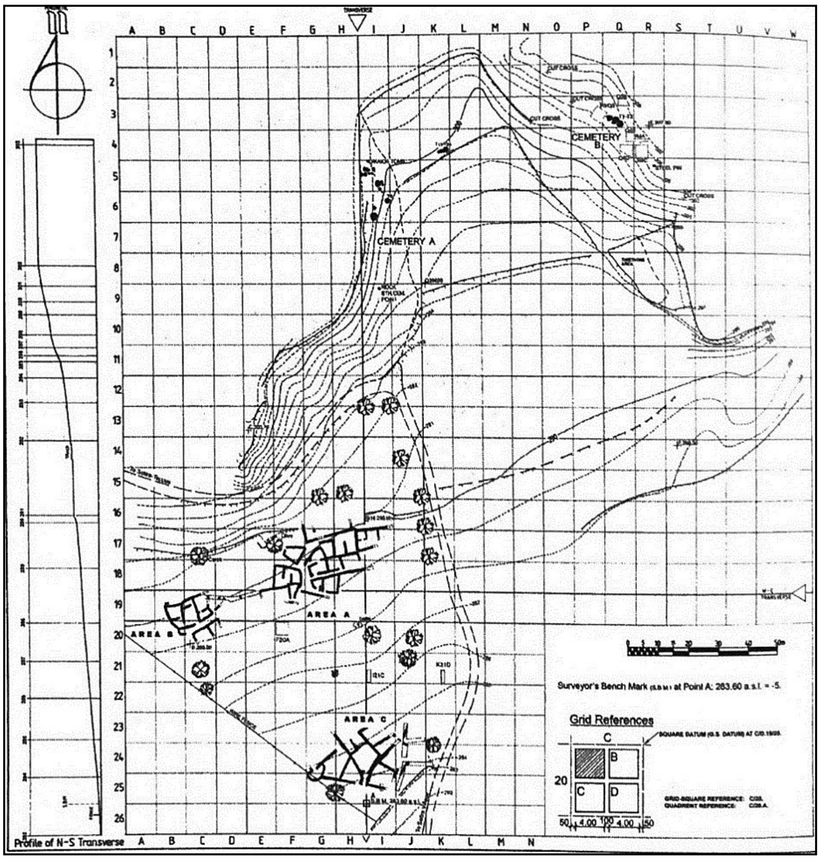


Figure 2.14. Sotira: Topographic plan showing the location of the excavated areas including the two funerary clusters, Cemetery A and Cemetery B. After Knapp 2013, fig. 72.

The site was excavated by the University of Pennsylvania under the direction of S. Swiny from 1981 to 1983. Before this period, in 1934, P. Dikaios had conducted a preliminary sounding to investigate the “ill-defined beginning of the EC period” (Swiny, Rapp & Herscher 2003, p. 5). On this occasion, two graves were brought to light in the area subsequently designed as Cemetery C. In 1978, while the Kent State University had been excavating the near Bronze Age site of Episkopi *Phaneromeni*, Swiny proceeded to re-investigate the northern border of Episkopi Bay, between the Kouris and Evdhimou river valleys, with the intention of relocating the tombs previously excavated by Dikaios. This expectation was disappointed, but the operation led to the identification of two funerary clusters named Cemetery A, on the west side of a small valley located at the north of the eastern margin of the excavated settlement area, and Cemetery B, 70 m to the east of Cemetery A, as well as an EBA I-III settlement covering at least 1 ha. (Monahan 2010, p. 83; Swiny & Mavromatis 2000). A total of 21 tombs were exposed and excavated in Cemetery A (Knapp 2013, p. 285; Swiny, Rapp & Herscher 2003, pp. 3-6). They cover the range between the Philia phase and EBA III. Only three looted burials were excavated in Cemetery B (Swiny, Rapp & Herscher 2003, pp. 3-6).

The human remains from Sotira included in this thesis come from the residential context and the cemetery. The majority of the identified tombs hold single depositions except tomb 15 which contained more than one individual. Schulte Campbell (2003, p. 437), who first accessed the materials, referred to the deposition of at least 13 (Figure 2.15). In the course of her doctoral thesis, Osterholtz re-examined the collection and observed a significant loss of materials especially from tombs 4, 15, 16, and Unit 16 (Osterholtz 2015, p. 91). In addition to the list of materials reported in the inventory of Schulte Campbell, she found another four skeletons from Units 18, 71, 44, determined as females, in the storage rooms of the Kourion museum. Thus, the list provided by Osterholtz includes 12 individuals as shown in figure 2.15. It must be noted, in this circumstance, the high rate of undetermined individuals examined by A. Osterholtz 12 years after the first publication (Figure 2.15). [9]A total of 10 individuals was selected for this dissertation on the basis of the criteria presented in the methodological section (Table 2.9).

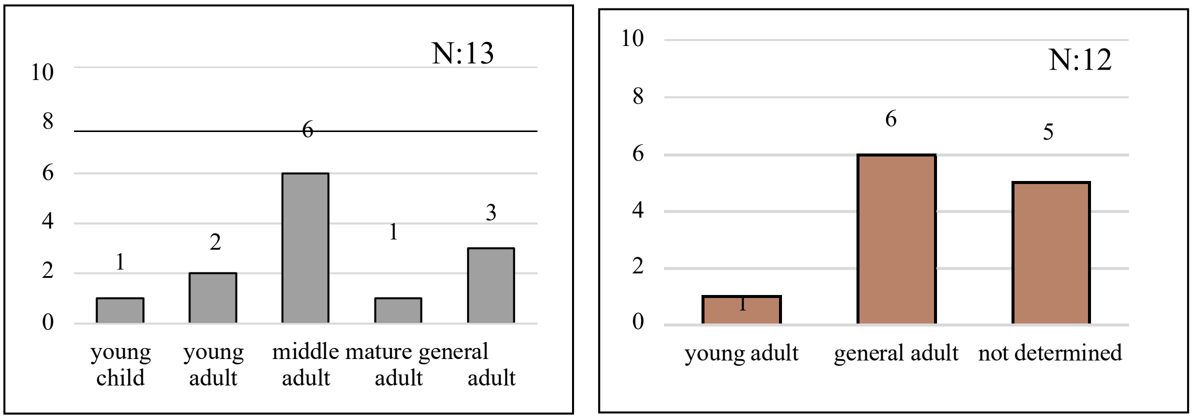


Figure 2.15. Sotira: Age composition of the sample provided by Schulte Campbell (2003, p. 437) on the left, by Osterholtz (2015, p. 93) on the right.

Table 2.8. Sotira: List of the tombs included in the research. ND: not determined.

Dates	Period	Context	Tomb/ Unit	Skeleton inventory	Sex	Age category
ca. 2000-1700 BC	EBAIII-MCII	Cemetery B	2		ND	35-44
ca. 2500-2250 BC	Philia	Cemetery A	6		ND	25-34
ca. 2000-1700 BC	EBAIII-MCII	Cemetery A	11		F	25-34
ca. 2000-1700 BC	EBAIII-MCII	Cemetery A	14		F	25-34
ca. 2500-2250 BC	Philia	Cemetery A	15	3	M	35-44
ca. 2000-1700 BC	EBAIII-MCII	Area B	Unit 12		F	20-24
ca. 2000-1700 BC	EBAIII-MCII	Area C	Unit 22		F	20-24
ca. 2000-1700 BC	EBAIII-MCII	Area A	Unit 44	2	F	35-44
ca. 2000-1700 BC	EBAIII-MCII	Area A	Unit 44	1	F	25-34

[9] Only in a single case (tomb 11), A. Osterholtz provides an indication of the age range of the deceased who determined as young.

ca. 2000-1700 BC	EBAIII-MCII	Area A	Unit 71		F	20-24

2.2.3.2 Marki *Alonia*

The Philia-MBA archaeological site of Marki lies in a valley circumscribed by the southern bank of the Alykos River and the lower foothills northeast of the Troodos Massif, in Central Cyprus.

Figure 2.16. Marki: Google Earth image showing the location of the Marki settlements and the surrounding cemeteries. After Monahan 2010, fig. 12.

The excavation was carried out between 1990 and 2000 by the Australian Trobe Expedition directed by D. Frankel and J. Webb. As a result of the preliminary survey conducted in 1990, the excavators were able to highlight the area occupied by the Philia-MBA settlement of Marki (5-6 ha. according to the distribution of surface remains) and to identify the surrounding cemeteries of *Kappara* (310 tombs)*, Davari* (130 tombs), Davari/Kappara (7 tombs), *Vounaros* (38 tombs) and *Vounaros/Pappara* (107 tombs) (Frankel & Webb 1996, p. 2). The earlier clusters in use were the *Davari* and the *Davari/Kappara* which yielded pottery dated to the Philia phase. The remaining three cemeteries were in use from EBAIII to MBAI (Frankel & Webb 1996, p. 11). Unfortunately, no tomb was saved from looters and only three from the *Davari* cluster were excavated: tombs 5, 6, and 7 (Frankel & Webb 1996). This latter, however, did not yield discrete elements that could be included in this research, which, thus, has focused on the mere osteological remains recovered from the abandoned layers of ruinous structures of the settlement (Frankel & Webb 2006, p. 283).

A total of 16 units yielded human remains as shown in figure 2.17 (Lorentz 2006a, p. 293). A total of five individuals were selected for this dissertation on the basis of the criteria presented in the methodological section (Table 2.10).

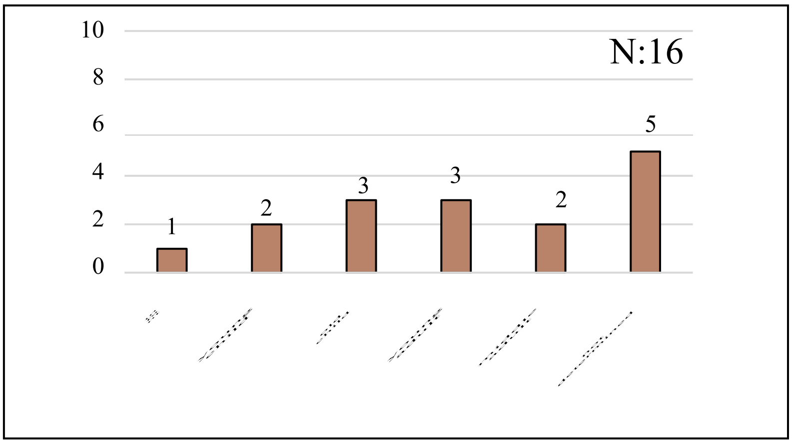


Figure 2.17. Marki: Age composition of the sample provided by Lorentz (2006a, p. 293).

Table 2.9. Marki: List of the tombs included in this research.

Dates	**Period**	**Context**	**Unit**	**Sex**	**Age category**
ca. 2500-1650 BC	Philia-EBAII	360	XX	M	20-24
ca. 2500-1650 BC	Philia-EBAII	963	LVII	F	35-44
ca. 2000-1650 BC	EBAIII-MBAII	1379	XIII	F	25-34
ca. 2350-1950 BC	EBAI-MBAI	1910	XCVIII	M	20-24

2.2.3.3 Alambra *Mouttes*

The MBAII archaeological site of Alambra lies in the interface between Cyprus' central *Mesaoria* and the pillow-lava foothills of the Troodos Massif. On the basis of the surface, materials scatter, the excavator fixed a probable extent of the settlement at around 6 ha (Figure 2.18) (Coleman *et al.* 1996, pp. 1, 17-18).

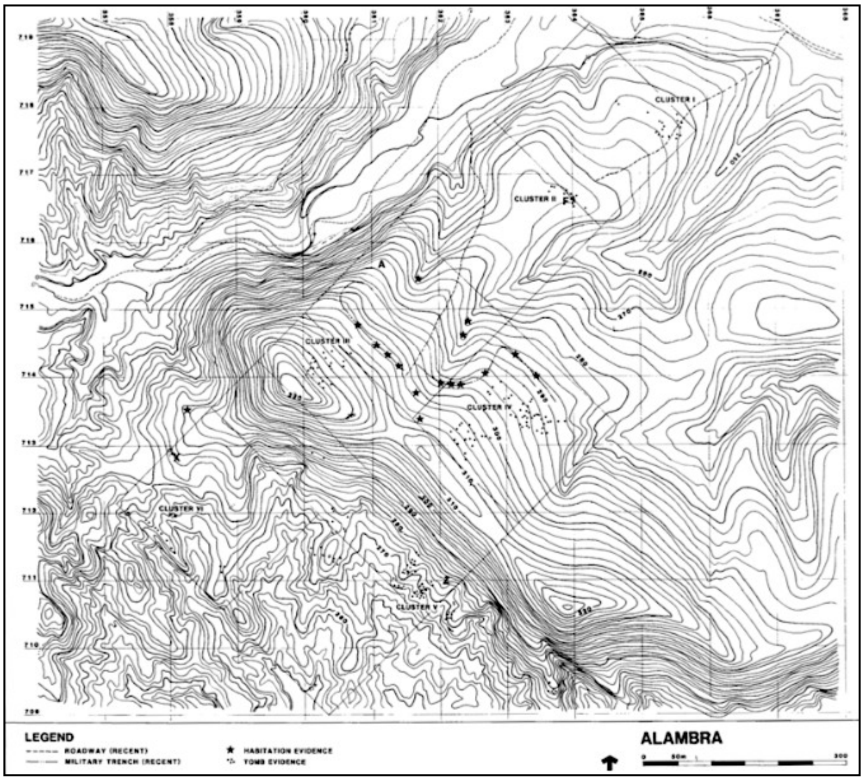


Figure 2.18. Alambra: Topographic plan showing the location of the settlement and the surrounding clusters. After Coleman 1996, fig. 8.

The site has been known since 1868 when L.P. di Cesnola pointed out the presence of 82 tombs (Coleman *et al*. 1996, pp. 7-8). From 1868 to 1872, R.H. Lang claimed to have excavated several tombs at Alambra; the recovered materials were moved to Glasgow. From 1883 M. Ohnefalsch worked on the site bringing to light around 12 tombs (Coleman *et al*. 1996, pp. 7-8). Finally, Cornell University under the direction of J. Coleman conducted a ten-year program of excavation between 1974 and 1984, succeeding in identifying the boundaries of the ancient settlement (Sneddon 2015, p. 141). From 1980 to 1984 six different funerary clusters (I-VI) were identified on the east, west, and south of the settlement: cluster I comprised around 18 tombs, cluster II around 14 tombs, cluster III around 22 tombs, cluster IV around 57, cluster V around 87 tombs and cluster VI 8 possible tombs. Of these, only six tombs in Cluster II were excavated. According to the excavators, all the tombs carved in the proximity of the Alambra settlement (Clusters I, II, III, and IV) were contemporary with the settlement (Coleman *et al.* 1996, p. 124). More uncertain is the date of the mortuary evidence interred in the other clusters (Knapp 2013, p. 289). Radiocarbon dates and pottery assemblages seem to suggest a single occupation phase which fell in the MBAII (Coleman *et al.* 1996, pp. 334-5).

Thus, the human remains from Alambra under study were selected from among the six excavated single tombs (only tomb 102 contained two individuals) which, according to Domurad (1996), held a total of seven individuals (Figure 2.19) (Coleman *et al.* 1996, p. 125). In the evaluation of the extra-masticatory dental wear process, it emerged that the individual deposited in tomb 103 was younger than the assessment provided by Domurad: it was no more than 25 years old at death. Six individuals in total were selected for this dissertation on the basis of the criteria presented in the methodological section (Table 2.11).

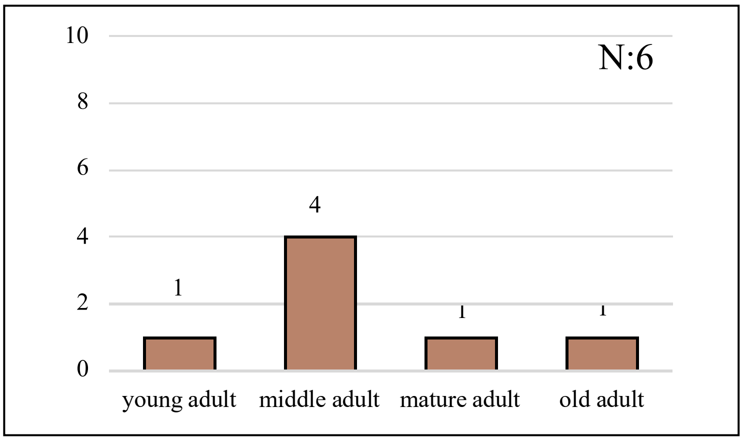


Figure 2.19. Alambra: Age composition of the sample provided by Domurad (1996, p. 515).

Table 2.10. Alambra: List of the tombs included in this research.

Dates	Period	Context	Tombs	Sex	Age category
ca. 2350-2000 B.C.	EBAI-EBAII	Cluster II	101	M	25-34
ca. 2350-2000 B.C.	EBAI-EBAII	Cluster II	102	M	25-34
ca. 2250-2000 B.C.	EBAI-EBAII	Cluster II	103	F	25-34
ca. 2250-2000 B.C.	EBAI-EBAII	Cluster II	104	M	25-34
ca. 2250-2000 B.C.	EBAI-EBAII	Cluster II	105	M	45+
ca. 2250-2000 B.C.	EBAI-EBAII	Cluster II	106	F	25-34

2.2.3.4 Erimi *Laonin tou Porakou*

The EBA-MBA village of Erimi arose on the highest hilltop of the eastern bank of the Kouris River, bordered by the modern villages of Ypsonas and Erimi, in southern Cyprus (Figure 2.20) (Bombardieri 2017, p. 1).

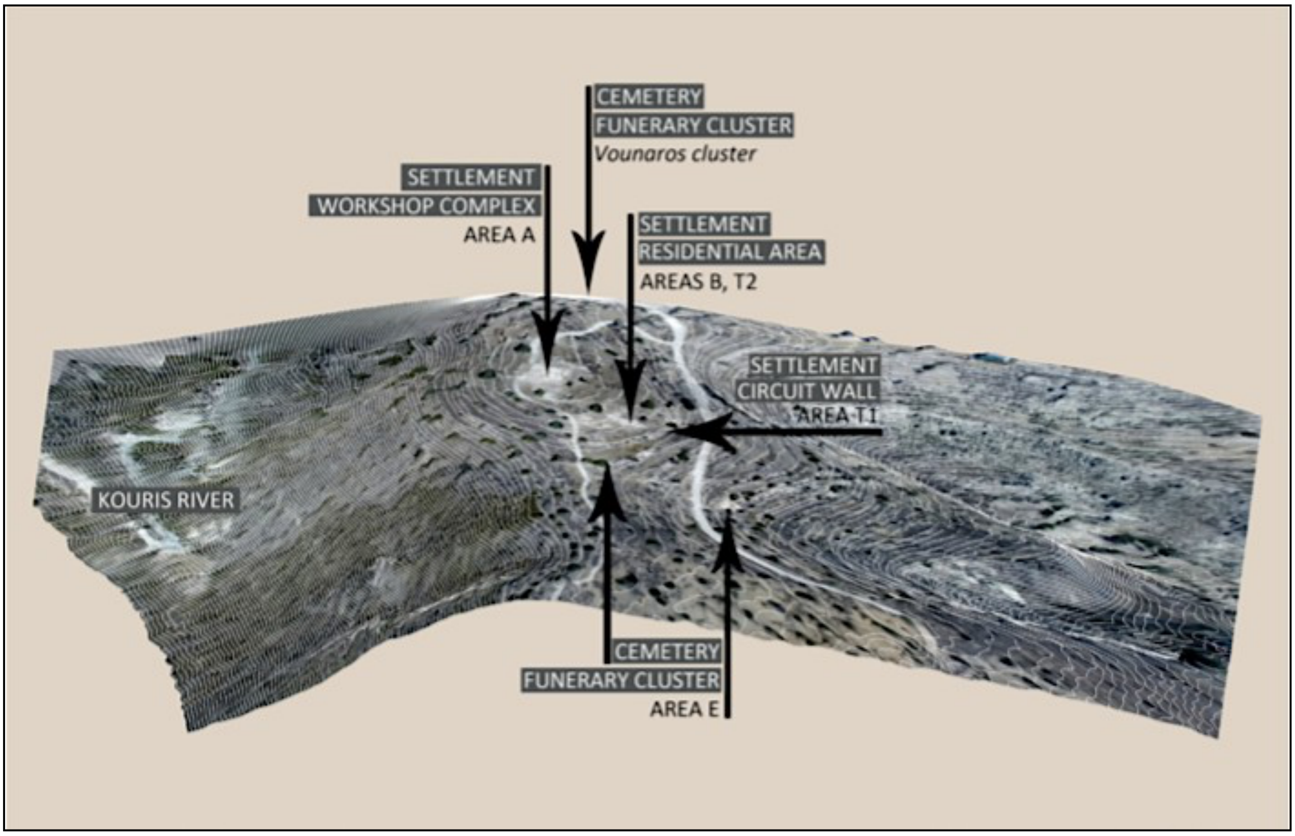


Figure 2.20. Erimi: Topographical layout of the site with the location of the excavated areas. After Bombardieri & Muti 2018, fig. 2.

Currently under excavation by the Italian Archaeological Expedition (Erimi-LtP Project) directed by L. Bombardieri in collaboration with the Department of the Antiquities of Cyprus, the site was noted for the first time in 2007 on the occasion of a survey conducted in the middle and lower Kouris Valley which aimed to outline the sequence of occupation and the landscape use in the prehistoric period (Bombardieri 2017, p. 1). The high density of surface materials, mostly dated to the MBA, as well as the topographical peculiarities in terms of spatial arrangement, paved the way for the further, extensive excavation which began in 2009 (Bombardieri 2017, pp. 1-2). It was focused on three major areas: the workshop complex (Area A) on the top of the hill, the domestic units (Area B) in the first lower terrace, and the cemetery extending outwards along the lowest terraces. Two different clusters of burial have been identified to date: the southern one, designed as Area E, and the *Vounaros* cluster, some 400 m east of the hilltop (Bombardieri 2017, p. 3; Chelazzi *et al*. 2011, pp. 89-90). Concerning the *Vounaros* cluster, these tombs were located in the course of building constructions: bulldozing operations had destroyed at least six of them (tombs 35 A-F), another three were in the plot under construction (tombs 35-37). Thus, they yielded traces of 10 interments: three in the first two tombs and four in the last one (Christofi, Stefani & Bombardieri 2015). Fifteen tombs in total were excavated in Area E (Bombardieri *et al*. 2017). Only eight yielded traces of human depositions. The ceramic assemblage obtained as well as the radiocarbon analysis indicated the use of both the clusters throughout EBAII to the LBAI. Thus, they are contemporary with the occupation sequences of the settlement and the domestic quarter (Christofi, Stefani & Bombardieri 2015, p. 94). This thesis took into consideration only the ten tombs excavated in Area E which have provided evidence related to the deposition of at least 21 individuals categorized as shown in figure 2.21 (Albertini & Monaco 2017).

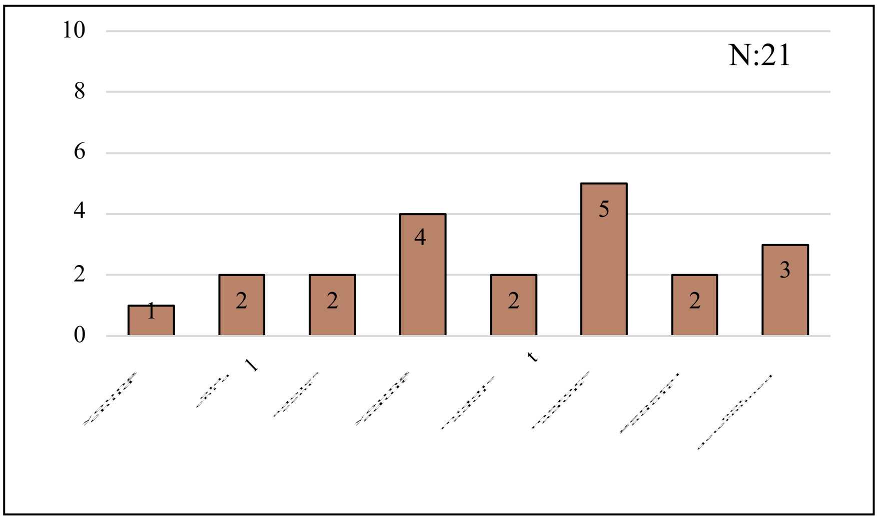


Figure 2.21. Erimi: Age composition of the sample provided by Albertini & Monaco (2017, p. 305).

Four individuals were selected for this dissertation on the basis of the criteria presented in the methodological section (Table 2.12). It must be noted that tomb 248 covers the entire MBA period. Consequently, since the statistical analysis forces us to allocate each burial to a specific chronological period (Philia-MBAII or MBAIII-LBAIII), it was assigned to the second period (Philia-MBAII) which is the phase best represented in the ceramic assemblage.

Table 2.11. Erimi: List of the tombs included in this research. ND: not determined.

Dates	**Period**	**Area**	**Tomb**	**Skeleton inventory**	**Sex**	**Mean Age**
ca. 2000-1700 BC	EBAIII-MBAIII	E	230	A	F	ND
ca. 2000-1700 BC	EBAIII-MBAIII	E	248	1	M	35-44
ca. 2000-1700 BC	EBAIII-MBAIII	E	248	2	M	35-44
ca. 2000-1700 BC	EBAIII-MBAIII	E	248	3	F	25-34

2.2.3.5 Kalavasos Village Tombs

The EBAI-LBAII site of Kalavasos lies at the narrowest point of the central area of the Vasilikos Valley, 5 km from the south coast of Cyprus (Monahan 2010, p. 95). The tombs which were selected for this dissertation were spread across three main areas designed as the “Cinema” (7 tombs), the “Mosque” (7 tombs), and the “Panaya Church” (43 tombs) according to the current civic landmarks (Todd 2007). These areas were located within the borders of the modern village of Kalavasos; and specifically, the Mosque lies in the centre of the village, the Cinema, at the southern edge, and the Church around 250 m south of the Mosque (Todd 2007, pp. 4-32). Their location in the modern village prevents a possible expansion of the limits of the investigated area necessary to establish whether the three burial areas are part of the same cemetery or constituted different clusters. The systematic excavation of these areas commenced in 1987 when the construction of new shops in the proximity of Panaya Church and the Mosque required a rescue excavation which led to the discovery of a series of Bronze Age tombs. At that time, the works were directed by the Archaeological Officer of the Cyprus Survey; later, it was entrusted to the Vasilikos Valley Project under the direction of I. Todd and A. South (Todd 1986;2007). The cemetery has been known since 1897 when H.B. Walters had conducted a survey for the British Museum. It is mentioned in two publications, namely *Studies on Prehistoric Cyprus* by S. Przeworski and E. Gjerstad (1926, p. 14) and *Patterns of Settlement in Bronze Age Cyprus* by H.W. Catling (1962, p. 150); this latter assigned the tombs uncovered to the EBA. Karageorghis in 1940 reports that they identified three EBA and one LBA tombs close to the Panaya Church (Karageorghis 1940-48, p. 116).

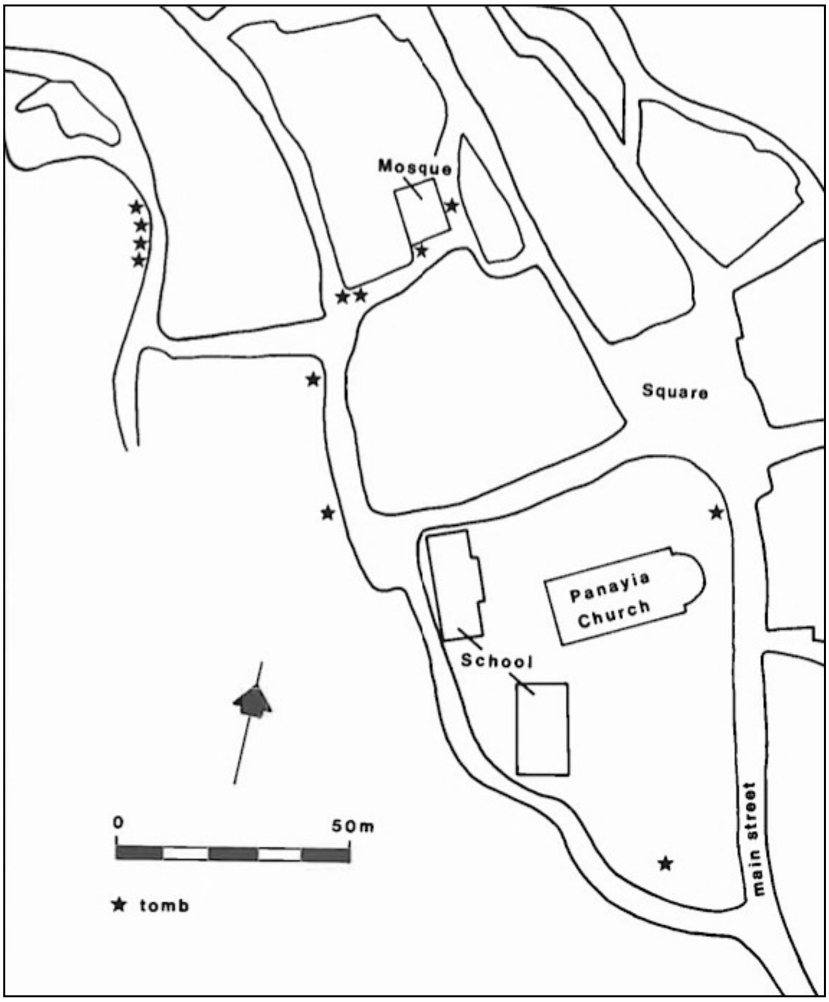


Figure 2.22. Kalavasos: Topographical layout of the site with the location of the excavated areas. After Todd 2007, fig. 5.

Subsequently, as a result of the different burial assemblages, Todd and colleagues re-dated the areas to different chronological sequences: the burials in the Cinema area covered EBAII-EBIII; Panaya Church tombs were dated to EBAIII-LBAII; the Mosque cemetery area was in use between EBAIII and LBAII (Todd 2007).

A total of 58 tombs were uncovered at the Kalavasos village but only the tombs excavated by the Vasilikos Valley Project, numbered from 36 to 46 and from 52 to 79, were accompanied by full anthropological documentation (Moyer 2007; Schulte Campbell 1986). Not all the chambers contained multiple depositions: 13 of these were used for single interments, the remaining held from two to seven burials (Todd 1986;2007). According to Schulte Campbell (1986) and Moyer (2007) who examined the above-mentioned skeletal materials, they comprised a total of 70 individuals determined as shown in figure 2.23. In contrast, among the 12 tombs (1-12) excavated and published by Karageorghis (1940-48), only in four cases was the presence of human remains mentioned;[10] and no evidence of the recovery of the human remains emerge from the report dealing with the excavation of the subsequent eight tombs (tombs 22-23, 25-26, 29-31) by the Department of Antiquities (Todd 1986). A more recent study carried out by Osterholtz (2015) has revealed an undoubted loss of material, as she recorded only 63 individuals (Figure 2.23). Comparing the two graphs below, it appears evident that the loss of discrete elements suitable for sex and age estimation led Osterholtz to make a more generalized categorization among the adult component.

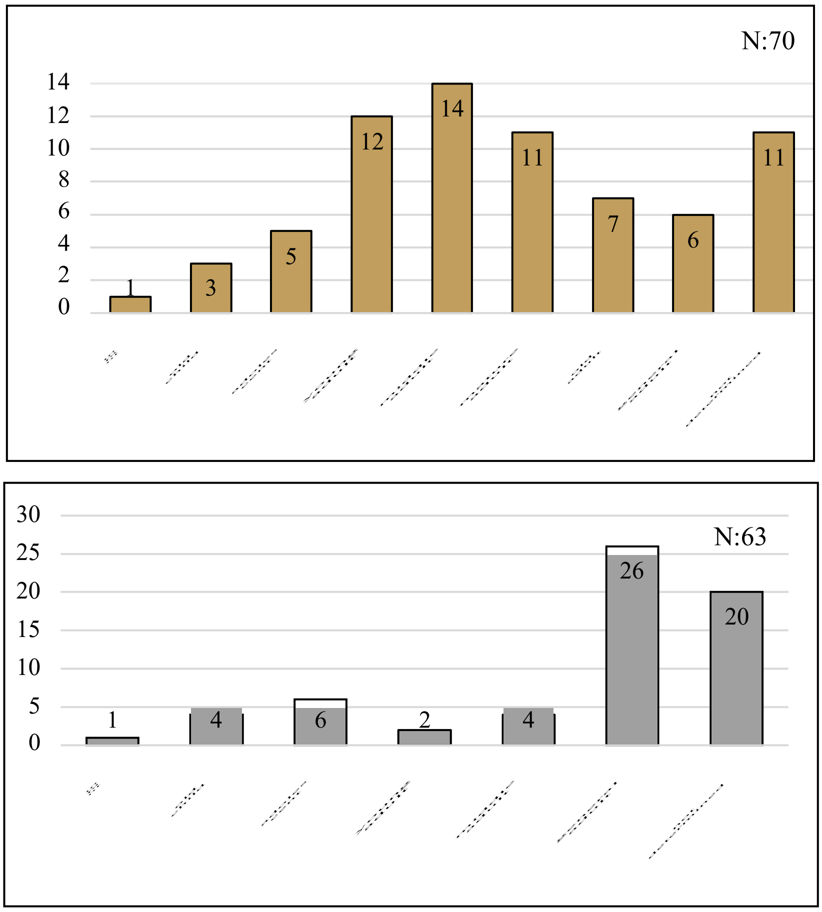


Figure 2.23. Kalavasos: Age composition of the sample provided by Schulte Campbell (1986) and Moyer (2007) above, and by Osterholtz (2015) below.

A total of 22 individuals were selected for this dissertation on the basis of the criteria presented in the methodological section (Table 2.13). Since one of the aims of this study is to seek for variations at intra/inter populations level, the human remains discovered in Panaya Church tomb 51 and tomb 57 were allocated to the third chronological period (MBAIII-LBAIII) which is the phase best represented in the ceramic assemblage while the rest of the sample was included in the evaluation of the activity patterns of the second period (Philia-MBAII).

[10] The excavators referred the existence of three layers of burials in tomb 5, one skeleton in tomb 9, two skulls in tomb 11 and few fragments in tomb 12.

Table 2.12. Kalavasos: List of the tombs included in this research. ND: not determined. T51 and T57 were the only ones allocated to the third macrophase on the basis of the recovered ceramic assemblage.

Dates	**Period**	**Context**	**Tomb**	**Skeleton Inventory**	**Sex**	**Age category**
2000-1700 BC	EBAIII-MBAII	Panaya Church	36	2	M	45+
2000-1700 BC	EBAIII-MBAII	Panaya Church	39	1	ND	20-24
2000-1700 BC	MBAIII-LBAI	Panaya Church	51	1	F	35-44
2000-1700 BC	LBAII	Panaya Church	57	1	M	25-34
2000-1700 BC	EBAIII-MBAII	Panaya Church	57	2	M	45+
2000-1700 BC	EBAIII-MBAII	Panaya Church	58	1	M	35-44
2000-1700 BC	EBAIII-MBAII	Panaya Church	58	2	M	25-34
2000-1700 BC	EBAIII-MBAII	Panaya Church	59	1	F	20-24
2000-1700 BC	EBAIII-MBAII	Panaya Church	59	2	M	35-44
2000-1700 BC	EBAIII-MBAII	Panaya Church	63	1	F	20-24
2000-1700 BC	EBAIII-MBAII	Panaya Church	63	2	M	25-34
2000-1700 BC	EBAIII-MBAII	Panaya Church	65	1	F	20-24
2000-1700 BC	EBAIII-MBAII	Panaya Church	66	1	F	35-44
2000-1700 BC	EBAIII-MBAII	Panaya Church	66	2	M	25-34
2000-1700 BC	EBAIII-MBAII	Panaya Church	68	1	M	ND
2000-1700 BC	EBAIII-MBAII	Panaya Church	70	1	M	25-34
2000-1700 BC	EBAIII-MBAII	Panaya Church	70	2	F	20-24
2000-1700 BC	EBAIII-MBAII	Panaya Church	71	1	M	25-34
2000-1700 BC	EBAIII-MBAII	Panaya Church	71	2	M	45+
2250-2000 BC	EBAII-EBAIII	Cinema	76	1	F	25-34
2250-2000 BC	EBAII-EBAIII	Cinema	77	1	F	25-34
2250-2000 BC	EBAII-EBAIII	Cinema	78	1	M	35-44

2.2.3.6 Episkopi *Phaneromeni*

The EBAIII-LCI village of Episkopi lies on land bordered on the northwest by the Limassol-Paphos highway, on the east by the Kouris river, and on the south by a road leading from the village to the river (Carpenter 1981; Duryea 1965, p. 3).

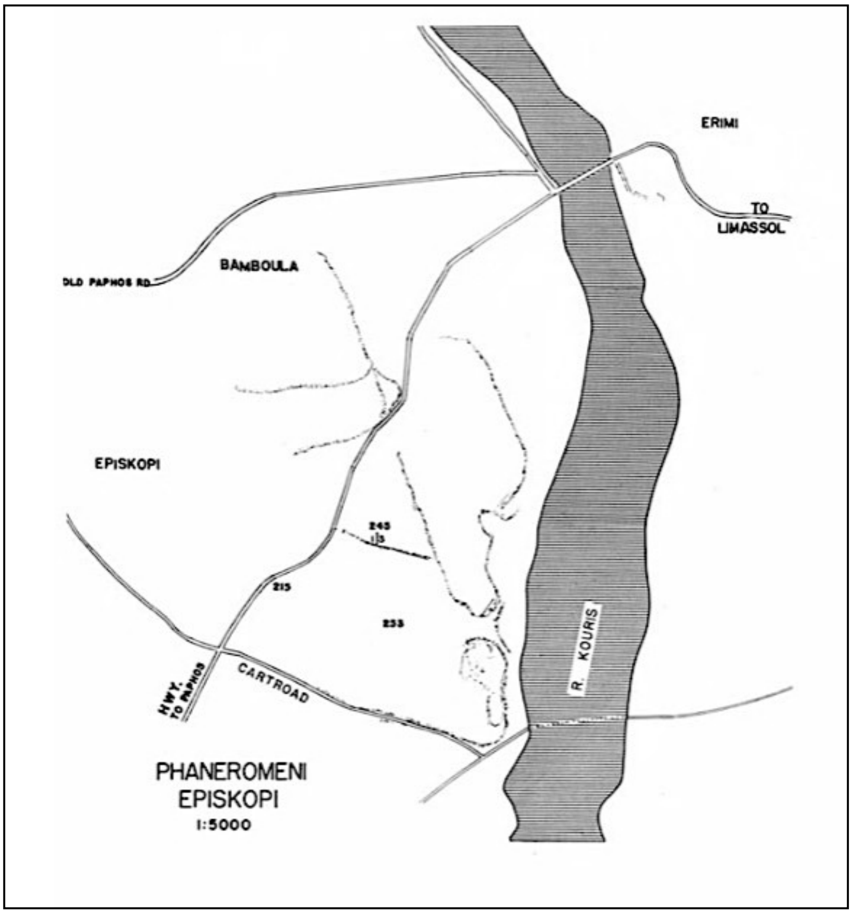


Figure 2.24. Episkopi: Topographical layout of the geographical area with the location of the site. After Weinberg 1956, p. 113, fig. 2.

The site was identified by S.S. Weinberg who visited it in 1951; on the occasion of the first ploughings carried out on the land, a large number of potsherds was brought to light (Weinberg 1956, p. 116). The investigation of the site began in the spring of 1955 under the aegis of the University of Missouri. A total of six trenches were opened during this season (Weinberg 1956). Five of these were dug just above the ruins of a domestic structure dated to EBAII; trench 4 brought to light an additional 12 tombs in the area subsequently designed as Cemetery C. Thus, this finding enabled the excavators to locate the extra-mural cemetery which served the village on the western edge of the ridge. The pottery assemblages recovered in this first operation were published in 1965 by D. Duryea as part of her doctoral thesis and were used to determine the period of use of the cemetery between EBAII and LBAI. Only a single page in this work was devoted to descriptions of the position and the orientation of the skeletons which, according to the author, occupied the middle of the chambers (Weinberg 1956, p. 120). Thus, the exact number of the individuals deposited in the excavated tombs is not clear nor whether they were collected and, if so, their present location. From 1975 to 1978, Kent State University under the direction of S. Swiny conducted a deeper investigation of this archaeological area with the intent to “develop lithic, metal and terracotta typologies” and to expand the knowledge of the Bronze

Age settlements in southern Cyprus (Swiny 1979, p. 12). This excavation season helped to highlight the MBA-LBAI settlement (Areas G and A), which occupied a commanding position over the Kouris river valley, and the funerary complex which extended into Area C and J, on the west side of the rocky outcrop (Carpenter 1981). Human remains exhumed in the course of this second season were never published by the excavators. In her PhD thesis, A. Osterholtz referred to the existence in the museum of Kourion of some osteological materials coming from a total of 14 tombs excavated by Kent State University: five of these contained multiple inhumations while the remaining contexts contained single depositions (Osterholtz 2015, p. 110).

The present thesis has taken into consideration human remains recovered by S. Swiny and colleagues from Area C and J. It must be noted that, because of the long chronological span covered by this site, some of the tombs listed below (Table 2.14) ranged in date from the EBA to the MBA; others were contemporary with the LBA settlement and, thus, were allocated to the third chronological period (MBAIII-LBAIII) (Table 2.14). According to the analysis undertaken by A. Osterholtz, a total of 21 individuals were buried in these 14 tombs (Osterholtz 2015, p. 111). No specific age ranges for the adults or the children were provided by the author (Figure 2.25).

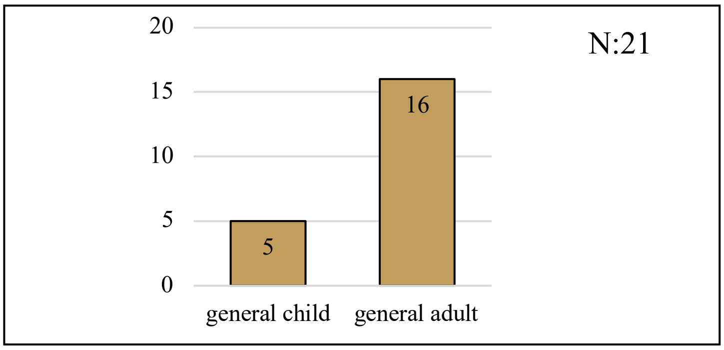


Figure 2.25. Episkopi: Age composition of the sample provided by Osterholtz (2015, p. 111).

During the present research, I personally examined the collection in the museum of Kourion and added to the above-mentioned list two additional adult females buried in tomb 22D and tomb 25C. Thus, 14 individuals were selected for this dissertation on the basis of the criteria presented in the methodological section (Table 2.14).

Table 2.13. Episkopi: List of the tombs included in this research. ND: not determined. Tomb 105A, 105C, and J14 were the only ones allocated to the third macrophase on the basis of the recovered ceramic assemblages.

Dates	Period	Context	Tomb	Sex	Age category
ca. 2000-1650 BC	EBAIII-MBAIII	Area C	22A	F	20-24

ca. 2000-1650 BC	EBAIII-MBAIII	Area C	22D	F	20-24
ca. 1950-1650 BC	EBAIII-MBAIII	Area C	23A	F	ND
ca. 1950-1650 BC	MBAII-MBAIII	Area C	23D	F	ND
ca. 2000-1650 BC	EBAIII-MBAIII	Area C	24B	M	45+
ca. 2000-1650 BC	EBAIII-MBAIII	Area C	24C	F	ND
ca. 2000-1650 BC	EBAIII-MBAIII	Area C	25A	M	35-44
ca. 2000-1650 BC	EBAIII-MBAIII	Area C	25B	F	ND
ca. 2000-1650 BC	EBAIII-MBAIII	Area C	25B	M	ND
ca. 2000-1650 BC	EBAIII-MBAIII	Area C	25C	F	ND
ca. 2000-1650 BC	EBAIII-MBAIII	Area C	25D	F	25-34
ca. 1950-1450 BC	MBAIII-LBAI	Area A	105A	M	ND
ca. 1950-1450 BC	MBAIII-LBAI	Area A	105C	F	ND
ca. 1950-1450 BC	MBAIII-LBAI	Area J	J14	F	20-24

2.2.4 The Middle Bronze Age III-Late Bronze Age III osteological collections

Four osteological collections derived from sites spread from the west to the east along the southern coast of Cyprus were selected and examined to represent the activity patterns of MBAIII-LBAIII Cypriot communities: Episkopi *Phaneromeni* in the Limassol District, Hala *Sultan Tekke,* and Kalavasos *Ayios Dhimitrios* in the Larnaka District, and Enkomi *Ayios Iakovos* in the Famagusta District. The human remains recovered in Episkopi are presently curated at the Kourion Museum, those exhumed from Enkomi (Swedish expedition) are housed in the Medelhavsmuseet of Stockholm, and the osteological collections from Hala *Sultan Tekke* and Kalavasos *Ayios Dhimitrios* are currently stored in the Larnaka District Museum (Terra Umbra). The study sample for the MBAIII-LBAIII period consists of 40 individuals: 11 males, 26 females and three individuals of undetermined sex. It must be noted that the total number of individuals examined for this period also includes the three skeletons exhumed from the tombs 105A, 105C, J14 of Episkopi and those excavated in tombs 51 and 57 of Kalavasos Village tombs; in both the cases, the related grave goods led to dating the deposition to the LBA (Carpenter 1981, p. 59; Todd 2007, p. 8). The individuals examined for this chronological period were all exhumed from rock-cut chamber tombs located in extra-mural or intra-mural cemeteries; in this second case, they appear in association with workshops, administrative or residential buildings. In the majority of the cases, these chamber tombs hold collective depositions, although single inhumations are also attested.

2.2.4.1 Enkomi *Ayios Iakovos*

The LBA site of Enkomi lies on the alluvial plain of the Mesaoria, bordered on the west by the plateau occupied by the site of *Ayios Iakovos* and, on the south, by the Pedieos River (Crewe 2004, p. 137).

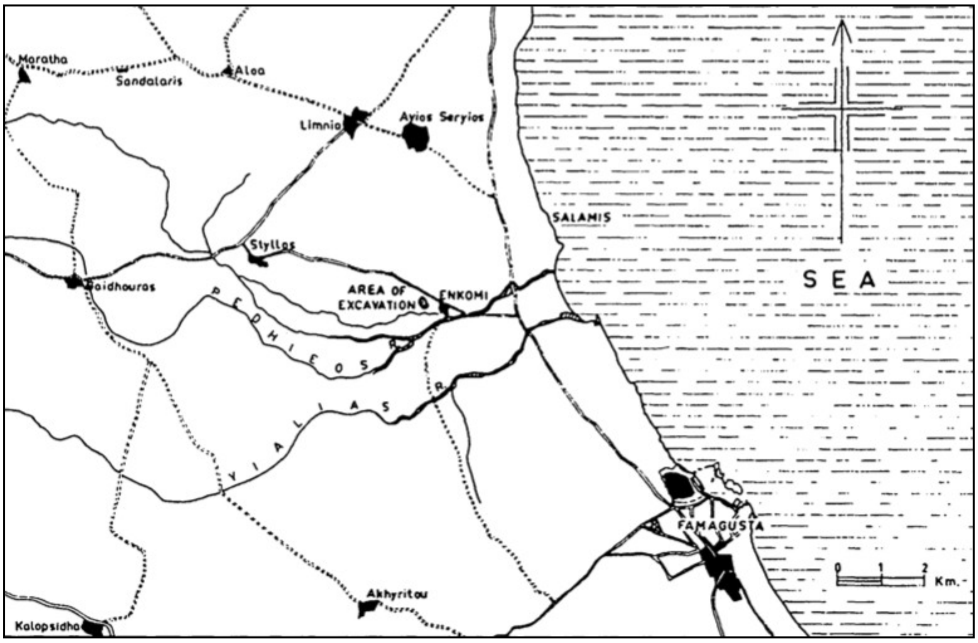


Figure 2.26. Enkomi: Topographical layout of the geographical area with the location of the site. After Dikaios 1967-71, plate 240.

The first systematic attempt to investigate the site was made by the British Museum (1895-1898) in response to the discovery of two looted tumuli yielding Mycenaean artefacts. Around 100 tombs were exposed in this phase of the research together with the remains of a few architectural ruins initially misinterpreted as "Byzantine" (Murray, Smith & Walters 1900, pp. 30-54). A. Murray and colleagues believed that the cemetery and the settlement were topographically separate; the first being located on the plateau above the site (Murray, Smith & Walters 1990, p. 3). These findings paved the way for further investigations. Indeed, in 1930, the Swedish Cyprus Expedition under the direction of E. Gjerstad carried out a second large-scale operation on the site (Gjerstad *et al.* 1934) with the declared purpose of verifying the extent of the cemetery: they sank a series of trenches to west of tomb 69 (excavated by Murray) and documented the presence of about 22 additional tombs dating between MBAIII and LBAIII (Gjerstad *et al.* 1934, p. 468). From 1934 to 1973, a third large excavation was conducted by the French Mission directed by C.F.A. Schaeffer in collaboration with the Cypriot Department of Antiquities directed, at that time, by P. Dikaios (Dikaios 1969-71; Schaeffer 1952). This operation brought to light other 63 tombs but, most importantly, led Schaeffer to a) re-examine the results of the previous excavations and re-date the architectural ruins, improperly attributed to the Byzantine period, to the MBAIII-LBAIII period and b) establish, consequently, that the excavated tombs were contemporary with the settlement and surrounded by its wall (Courtois, Lagarce & Lagarce 1986; Courtois 1981;1984; Pelon & Lagarce 1973; Schaeffer 1952).

A total of 185 tombs were uncovered on the site of Enkomi by all missions (Crewe 2009, p. 27). Even so, even though Enkomi is one of the most extensively explored and published Bronze Age sites in Cyprus, scant attention was paid to the recovery, documentation, and examination of the human remains. Where reported, the number of the chamber occupants was referred to in more general sections dealing with the spatial distribution of items inside the chamber; rarely, the skeletons were categorized as child or adult (Dikaios 1969-71; Gjerstad *et al.* 1934; Courtois, Lagarce & Lagarce 1986; Schaeffer 1952). The only exception to this approach focused on a selection of skulls from 57 individuals excavated by the French and Swedish expeditions which received greater attention: they were comprehensively described and analyzed for sex and age (Fisher 1986; Hjortsjö 1947).

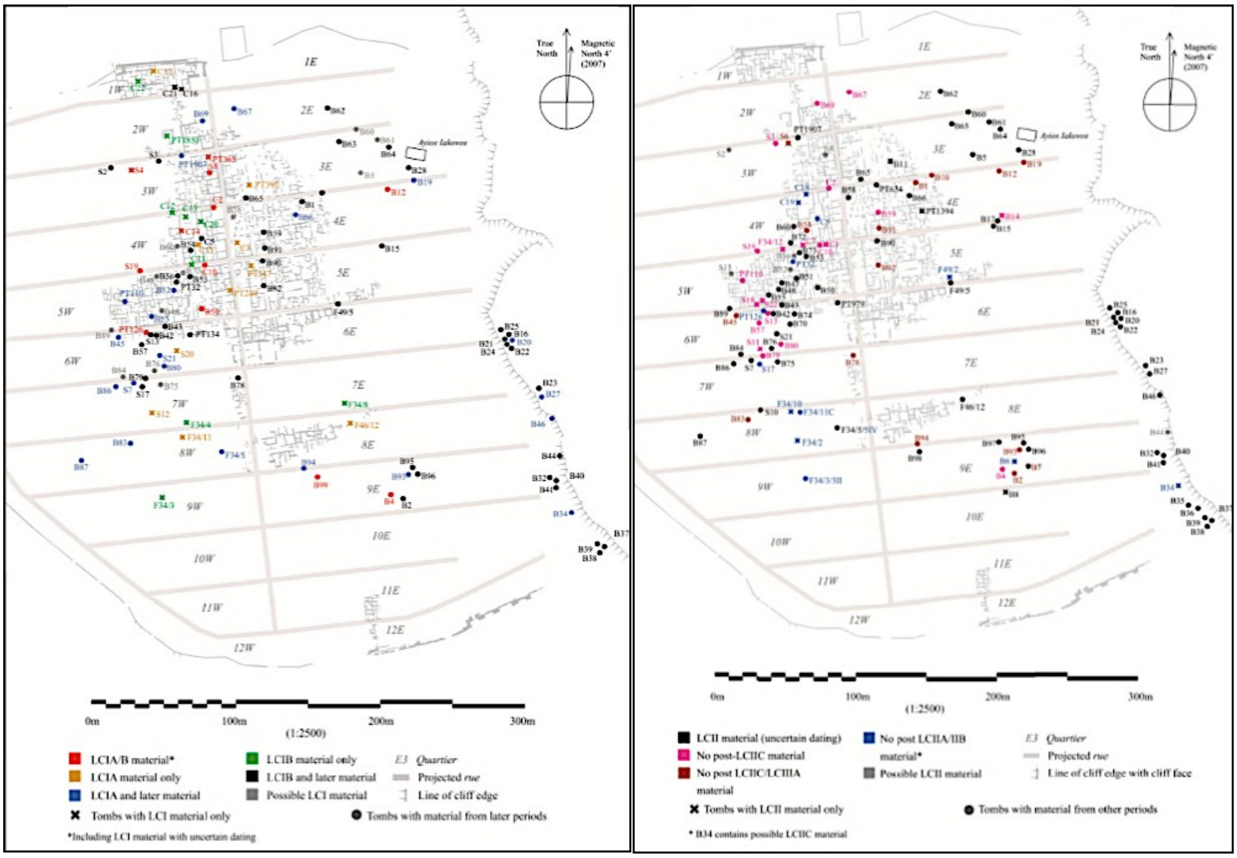


Figure 2.27. Enkomi: Topographic plan showing the location of the LCI tombs, on the left, and LCII-III tombs, on the right. After Dalton 2007, pp. fig. 2, 3.

The present location of almost all of the skeletal materials from Enkomi remains unclear: if they are not lost, we must assume that they remained in Famagusta and are not accessible. According to the literature, it can be assumed that:

- from the excavations carried out by the Swedish Cyprus Expedition (1930) around 130 skeletons were identified (including 4 females, six males, and 3 children) (Gjerstad *et al.* 1934)

- from the Cypriot expedition led by Dikaios (1948-58) at least 37 skeletons (including 14 adults and 19 children) were uncovered (Dikaios 1969-71)
- in the publications of the French mission (1946-70), a total of 67 skeletons (including four males, four females, and three infants) were mentioned (Schaeffer 1952)
- during the operations conducted by Pelon (1970-73) three skeletons were identified and mentioned in the publication (Pelon & Lagarce 1973).

This dissertation is concerned with the sole skeletal selection (33 femurs) relocated in the Medelhavsmuseet of Stockholm and, thus, presently available for study. They pertained to a total of 20 adults from five tombs excavated by the Swedish expedition which I personally analyzed for sex (Table 2.15).

Table 2.14. Enkomi: List of the tombs included in this research. ND: not determined.

Dates	**Period**	**Tomb**	**Skeletal inventory**	**Sex**	**Age category**
ca. 1300-1100 BC	LBAIIC-III	6	1	F	ND
ca. 1300-1100 BC	LBAIIC-III	6	2	F	ND
ca. 1300-1100 BC	LBAIIC-III	6	3	M	ND
ca. 1300-1100 BC	LBAIIC-III	6	4	F	ND
ca. 1300-1100 BC	LBAIIC-III	6	5	F	ND
ca. 1300-1100 BC	LBAIIC-III	6	6	M	ND
ca. 1300-1100 BC	LBAIIC-III	6	7	M	ND
ca. 1300-1100 BC	LBAIIC-III	6	8	F	ND
ca. 1300-1100 BC	LBAIIC-III	6	9	F	ND
ca. 1375-1100 BC	LBAIIA-C	10	1	M	ND
ca. 1375-1100 BC	LBAIIA-C	10	2	F	ND
ca. 1450-1200 BC	LBAIIA-C	11	1	F	ND
ca. 1450-1200 BC	LBAIIA-C	11	2	M	ND
ca. 1450-1200 BC	LBAIIA-C	11	3	M	ND
ca. 1300-1200 BC	LBAIIC	18	1	F	ND
ca. 1300-1200 BC	LBAIIC	18	2	F	ND
ca. 1300-1200 BC	LBAIIC	18	3	M	ND
ca. 1550-1200 BC	LBAIIA-B	19	1	F	ND
ca. 1550-1200 BC	LBAIIA-B	19	2	F	ND
ca. 1550-1200 BC	LBAIIA-B	19	3	F	ND

2.2.4.2 Hala *Sultan Tekke*

The LBAII site of Hala was located on the south-eastern coast of Cyprus, bounded on the north by the Larnaka's Salt Lake and on the east the Mosque of Umm Haram. The site was identified by J. Myres after a number of pottery sherds was found west of Salt Lake (Fischer & Bürge 2016, p. 33). The first extensive excavation season of the site was supported by the British Museum and directed by H.B. Walters in 1897 (Bailey 1976). With the assistance of "no more than 40 workers", he excavated ten partially looted tombs in the area of CQ1 (presently Area 6), dated to LBAII (Fischer & Bürge 2017, p. 162) (Figure 2.28). In the subsequent year, the investigation of the area was entrusted to J.W. Crowfoot, who is reported to have exposed another 50-60 looted tombs in the same quarter; but accurate documentation was provided only for ten of these (tombs 1-11) (Bailey 1976, p. 2). From 1968 to 1974, the Cypriot Department of Antiquities extended the area of investigation to encompass Area A: here, V. Karageorghis brought to light an additional four LBA tombs (Fischer & Bürge 2017, p. 163; Karageorghis 1984, p. 922). Throughout the course of the civil war in the early 1960s, the excavation was interrupted; it resumed in the late 1970s under the direction of P. Åström (1986;1989). In the eighties, the Swedish Expedition intervened in Area A and brought to light two rich tombs dated to LBAII-III (Fischer 1980; Karageorghis 1983;1984; Schulte Campbell 1983). After 20 years of interruption, in 2010 Fischer returned to Hala to resume the project (Fischer & Bürge 2014;2015;2016; Fischer 2011;2012).

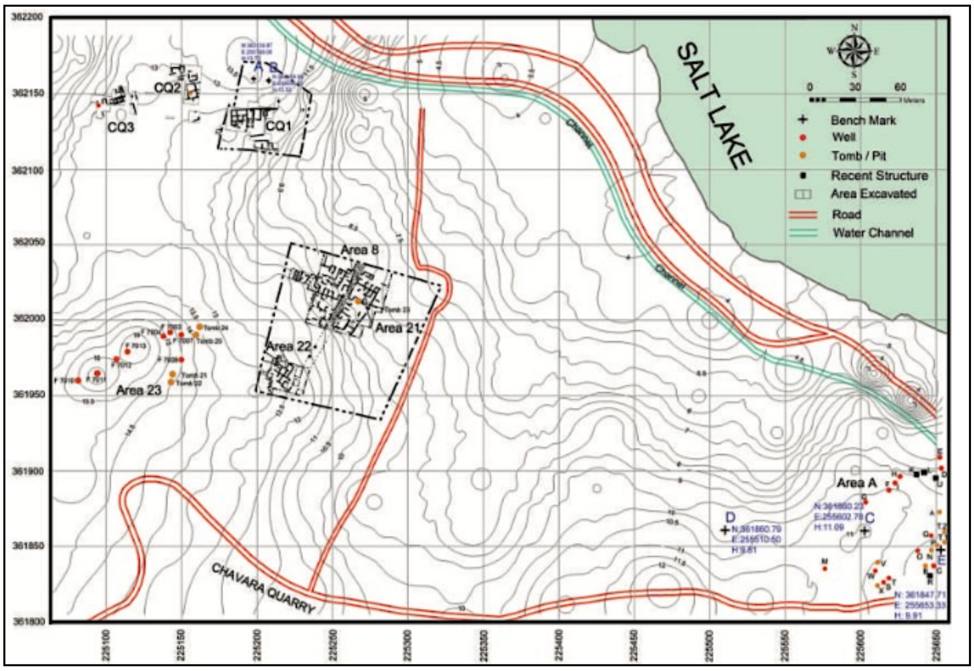


Figure 2.28. Hala: Topographical plan of the site showing the location of the areas investigated by Bailey. After Fisher & Burge 2017, fig. 1.

Not all the afore-mentioned publications documented the recovery of human remains. More specifically:

- from the excavation carried out in 1968 by Karageorghis, two tombs (tombs 1 and 2) yielded the remains of a total of 20 individuals: 18 in tomb 1 including two infants, four old children, one adolescent, one young adult, one mature adult and another nine adults of undetermined age; and two mature adults in Tomb 2 (Osterholtz 2015, p. 126)
- During the excavation season (1975-1977) directed by Åström (1986), fragmentary remains of at least five individuals have recovered: a mature skeleton in Area 22, a fetus in Area 8, an adult in its 30s in Area 23, and adolescent in tomb 21 and another adult of undetermined age in tomb 22
- Fischer (1980) recovered the remains of a mature male
- Schulte Campbell (1983) exhumed the fragmentary remains of an adult
- The Swedish Expedition, from 2013 to 2018, exhumed a total of 32 individuals including six infants, one young child, seven old children, four young adults, five middle adults, and nine mature adults (Fischer and Bürge 2014; 2015; 2016; 2018; Fischer *et al*. 2013).

Hence, a total of 59 skeletons have been exhumed since the initial investigation at Hala (Figure 2.29) (Åström 1986; Fischer 1980;2014;2015;2017; Osterholtz 2015; Schulte Campbell 1983).

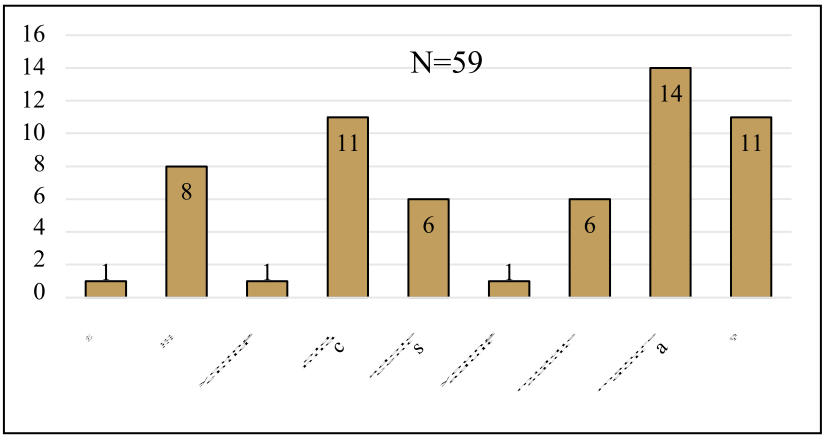


Figure 2.29. Age composition of the sample provided by Osterholtz (2015), Fischer (1980,2014,2015,2017), Åström (1986), Schulte Campbell (1983).

Of these, only the material recovered by Karageorghis in 1968 together with the series of skeletons recently excavated by the Swedish Expedition is actually available for study. These burials were therefore considered for this thesis. More specifically, I analyzed the osteological remains exhumed by Dr. V. Karageorghis in tomb 1, together with the skeletons exhumed by Fischer and colleagues from 2013 to 2018 (Tomb A, Pit Z9, Pit RR L 104, and Pit RR L105).

Concerning tomb 1, the MNI (=18) was established by A. Osterholtz (2015, p. 87) on the basis of the number of teeth, foot, and hand bones. The bones were placed in different boxes, differentiated by the anatomical district. This prevented the possibility of associating the upper-limb bones with the related ones of the lower limbs. Where the epiphyseal extremity was preserved, I personally determined the sex of each skeletal element by evaluating the vertical head diameter. Thus, nine individuals were selected for this dissertation on the basis of the criteria presented in the methodological section (Table 2.15).

Table 2.15. Hala: List of the tombs included in this research. ND: not determined.

Dates	**Period**	**Tomb**	**Skeleton**	**Sex**	**Mean Age**
ca. 1300-1100 BC	LBAIIC-III	1	1	F	ND
ca. 1300-1100 BC	LBAIIC-III	1	2	F	ND
ca. 1300-1100 BC	LBAIIC-III	1	3	M	ND
ca. 1300-1100 BC	LBAIIC-III	A	4	F	25-34
ca. 1300-1100 BC	LBAIIC-III	A	5	F	20-24
ca. 1300-1100 BC	LBAIIC-III	Pit Z9	1	M	35-44
ca. 1300-1100 BC	LBAIIC-III	Pit Z9	2	F	35-44
ca. 1300-1100 BC	LBAIIC-III	Pit RR LL 104	1	F	20-24
ca. 1300-1100 BC	LBAIIC-III	Pit RR LL 105	2	F	20-24

2.2.4.3 Kalavasos *Ayios Dhimitrios*

The LBA site of *Ayios Dhimitrios* lies on sloping land, 3.75 km north of the south coast of the Island and 8 km south of the Kalavasos mining area (South 2002, p. 60). Eleven archaeological seasons from 1979 were carried out by the Vasilikos Valley Project under the direction of I. Todd and A. South exposing more than 11 ha occupied from LBAIIA to LBAIIC. Extensive architectural remains ranging from prosperous domestic structures to large, ashlar administrative buildings were uncovered (Figure 2.30). A total of 20 tombs were excavated from the full extent of the investigated area. Among these, the richest ones were located in the street adjacent to Building X (South 2000). According to the excavators, hundreds of more tombs have yet to be identified (South 2000, p. 346). Indeed, a series of holes noted along the slope at the edge of the site seems to suggest the existence of other chambers (South 1997, p. 159). Tombs 2, 3, 7, 8, and 10 did not contain human remains.

The first inventory, in fact, was published by Moyer (1989) and A. South (2000) reported the presence of more than 65 individuals; but A. Osterholtz, who re-examined the collection in 2015, identified only 44 individuals (Figure 2.30).

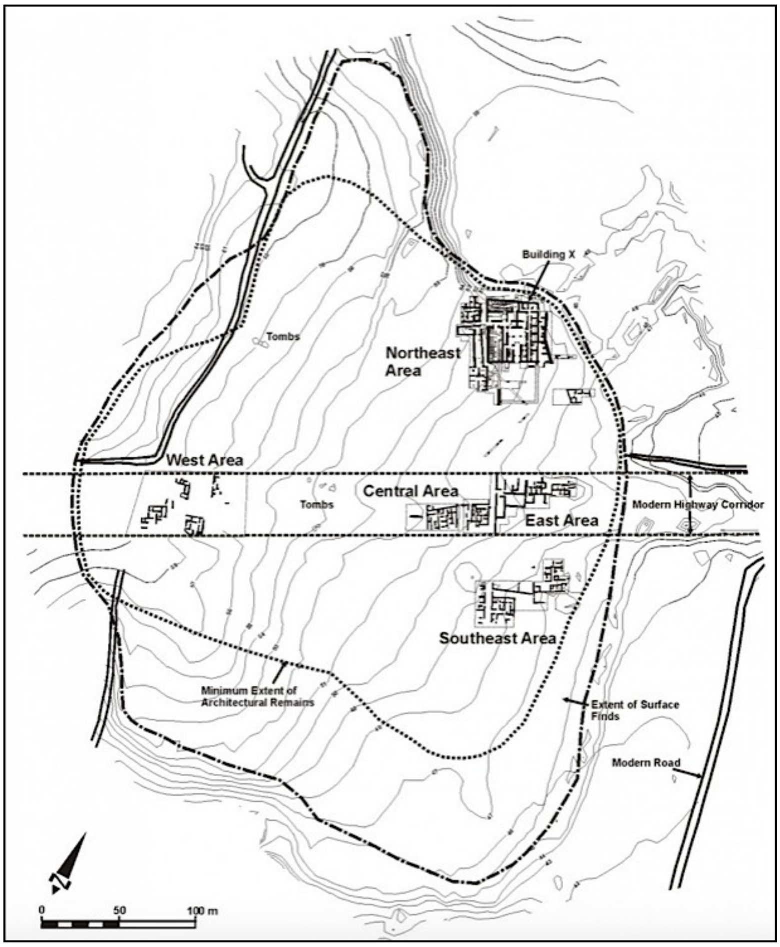


Figure 2.30. Ayios Dhimitrios: Topographical plan of the site showing the location of the areas investigated by the Vasilikos Valley Project. After Urban et al. 2014, fig. 2.

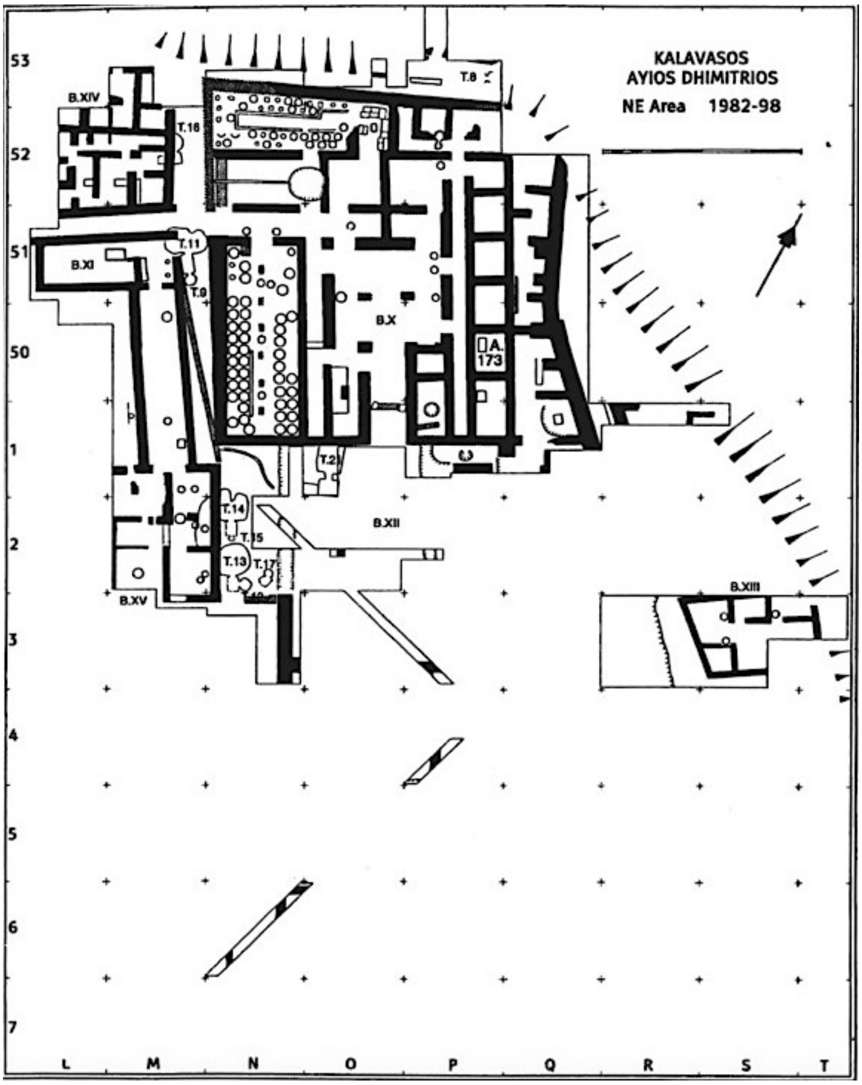


Figure 2.31. Ayios Dhimitrios: Topographical plan of the North-East Area showing the location of the tombs.

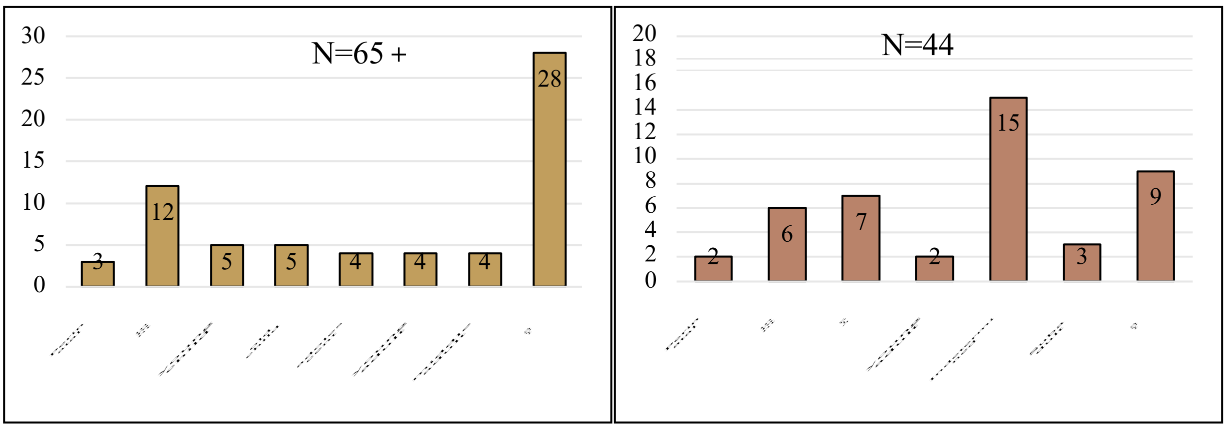


Figure 2.32. Ayios Dhimitrios: Age composition of the sample provided by Moyer (1989, p. 59), on the left, by Osterholtz (2015, p. 187), on the right.

Thus, seven individuals were selected for this dissertation on the basis of the criteria presented in the methodological section (Table 2.17).

Table 2.16. Ayios Dhimitrios: List of the tombs included in this research. ND: not determined.

Dates	**Period**	**Tomb**	**Skeleton**	**Sex**	**Age category**
ca. 1450-1300 BC	LBAIIA-C	4	1	ND	20-24
ca. 1450-1300 BC	LBAIIA-C	6	1	ND	20-24
ca. 1450-1300 BC	LBAIIA-C	11	1	F	20-24
ca. 1450-1300 BC	LBAIIA-C	13	1	F	20-24
ca. 1450-1300 BC	LBAIIA-C	18	1	F	25-34
ca. 1450-1300 BC	LBAIIA-C	18	2	ND	20-24

Chapter 3 Results: the site-by-site analysis

3.1 Introduction

The results of this research were presented in two different chapters according to the adopted approach. The present chapter was focused on the intra-site analysis, which was deemed as a useful, initial means of presenting the data obtained through skeletal analysis. This assessment also offered a foundation for the next chapter, concerning the diachronic comparisons, by clarifying the extent to which different sites from the same period presented homogenous or heterogeneous patterns of activity-related data. This approach has produced a substantial set of data too large to include here in full. Thus, in order to favour a more streamlined presentation, only the largest sites which proved most significant to the overall discussion were included the main text of this dissertation. The remaining assemblages were extensively presented in the Appendices. The following sites are presented below: for the Chal, the cases of Lemba and *Mosphilia*; for the Philia-MBAII, the cases of *Kaminoudhia* and Kalavasos Village tombs; for the MBAIII-LBAIII the cases from Hala and *Ayios Dhimitrios*.

The next stage of the data analysis was conducted using a diachronic perspective, namely by grouping sites of the same period and comparing between them; this enables any diachronic variations to be identified and the aims of this project addressed. Indeed, the samples sizes are very small and therefore the extent to which the research questions posed in this project can be addressed is limited. Results of this process were reported in the subsequent chapter (4). Both the chapters were structured in the same way. A brief introduction concerning the paleodemography of the site/period is followed by three separate sections presenting the results of the evaluation of each indicator: entheseal changes (hereafter, ECs), osteoarthritis (hereafter, OA), and extra-masticatory dental wear. In the first section reporting the ECs, the three markers - robusticity, osteolytic lesions (hereafter, OLs), and enthesophytic formations (hereafter, EFs) - were considered separately. Indeed, as explained in the methodological section, the three markers might provide different insights into the level of muscle development. Hence, the distribution of the robusticity scores, which should indicate “the physiological reaction to the muscle solicitations” (Mariotti *et al*. 2007, p. 292) were examined by comparing between left and right sides, with sex and age categories. The OLs and EFs, which could result from an “excessive mechanical loading”, were evaluated in terms of presence and absence and in terms of severity distribution between sides, sexes, and age categories (Mariotti *et al*. 2007, p. 292). In the second section which reports data concerning OA, the three markers - marginal lipping (hereafter, MI), porosity (hereafter, PO), and osteophytes (hereafter, SO) - were combined in order to assess the distribution of the OA between sides, sexes and age categories. Fusion and eburnation were assessed in terms of presence and absence. In the third section, the extra-masticatory dental defects (grooving, lingual surface attrition of the maxillary anterior teeth (hereafter, LSAMAT) and notching), were reported grouping the specimens by dental arch with an indication of the sex and age of the affected individual.

3.2 Middle-Late Chalcolithic

3.2.1 Lemba *Lakkous*

3.2.1.1 Paleodemography

The biological sex and mortality profile of adults from the M-LChal site of Lemba is presented in table 3.1. Sex estimation was possible for 9 of the 10 individuals. The proportion of female individuals (8/10, 80.0%) greatly exceeded the proportion of males (1/10, 10.0%). Age estimation was possible for all the skeletons included in the study. Three of the four age categories are represented: young (20-24 years), middle (25-34 years), and mature (35-44 years) adults. No old adults (45+) were identified. Thus, the majority of adults fell within the range of young adults.

Table 3.1. Lemba: Age and sex composition of the sample. ND: not determined. %: within the sex.

	Yo ng adult 20-24		Middle adult 25-34		Mature adult 35-44		Old adult 45+		Total	
	N	%	N	%	N	%	N	%	N	%
Male	0	0.0	0	0.0	1	100.0	0	0.0	1	10.0
Female	5	62.5	2	25.0	1	12.5	0	0.0	8	80.0
ND	1	100.0	0	0.0	0	0.0	0	0.0	1	10.0
Total	6	60.0	2	30.0	2	20.0	0	0.0	10	100.0

The bar chart in figure 3.1 illustrates the age distribution of the sample by sex. Overall, the female age distribution reflected younger groups; while the only examined male was a mature adult.

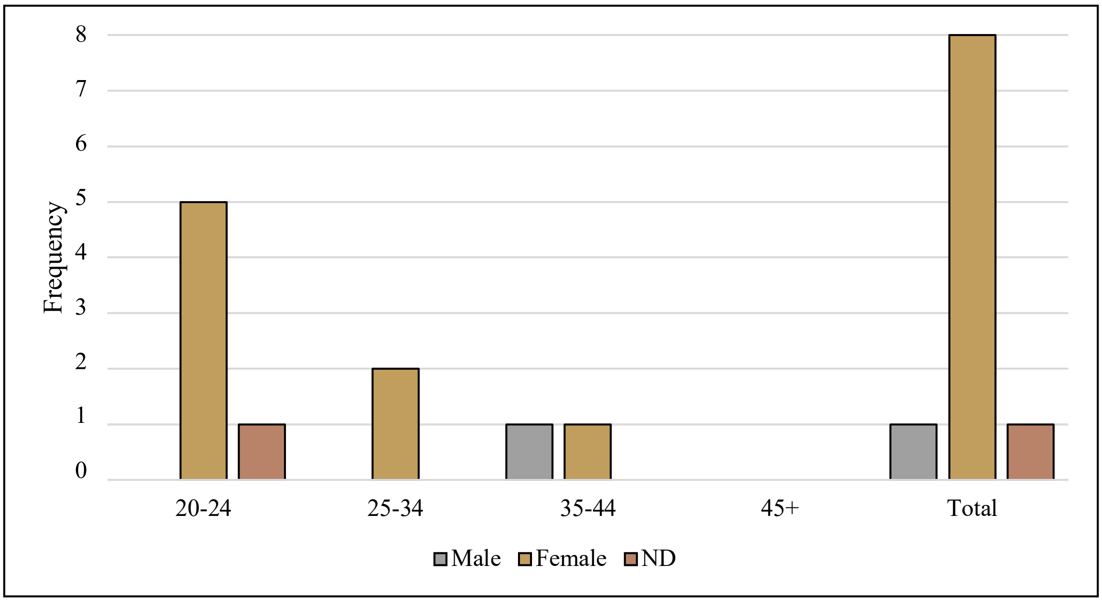


Figure 3.1. Lemba: Age distribution of the sample by sex. ND: not determined. N:10.

3.2.1.2 Entheseal Changes

3.2.1.2.1 <u>Robusticity: relationship between score development, enthesis, and functional complex</u>

The evaluation of the ECs of this sample was carried out on a total of 90 entheses belonging to eight individuals. Figure 3.2 shows the entheses distribution within the whole sample. Only two entheses, the *biceps brachii* and the *interosseous membrane*, were well-represented as their BRI value was 63.0%, in the former, and 50.0%, in the last case.

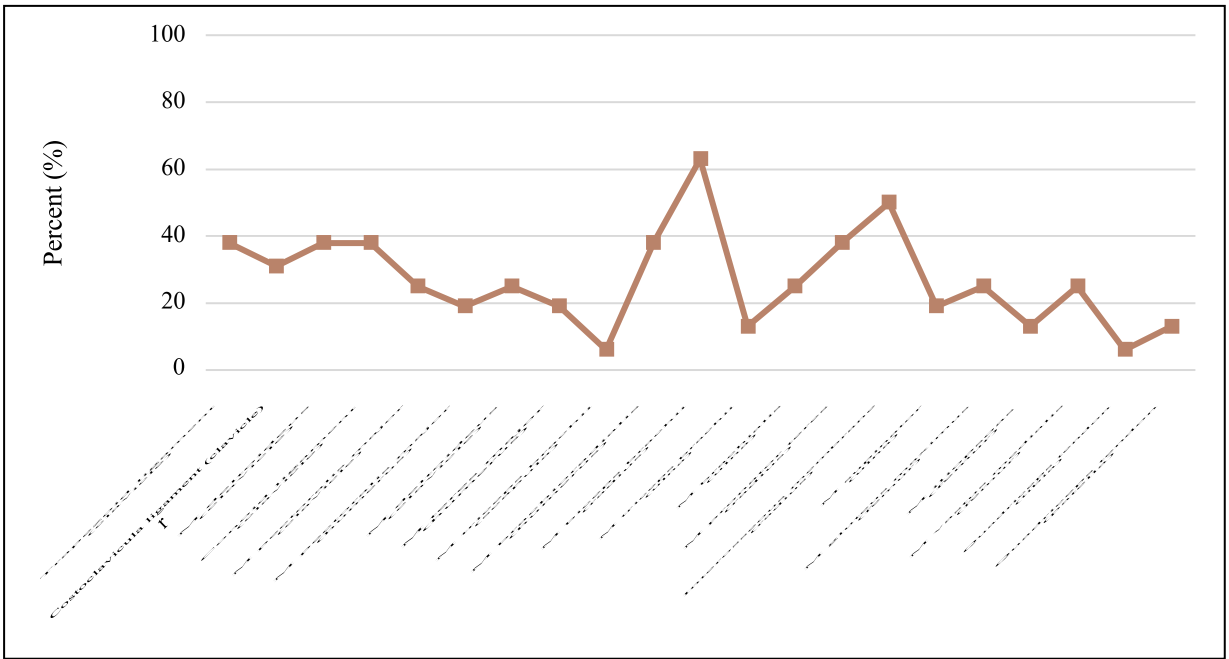


Figure 3.2. Lemba: Entheses representation (%) within the whole sample. N:90.

Thus, the two afore-mentioned entheses were the most frequently assessed: 10/90, 11.1%, the *biceps brachii,* and 8/90, 8.9%, the *interosseous membrane* (Figure 3.3). In contrast, the *triceps brachii* (scapula) and the *quadriceps tendon* (tibia) were the less well-preserved entheses (1/90, 1.1%).

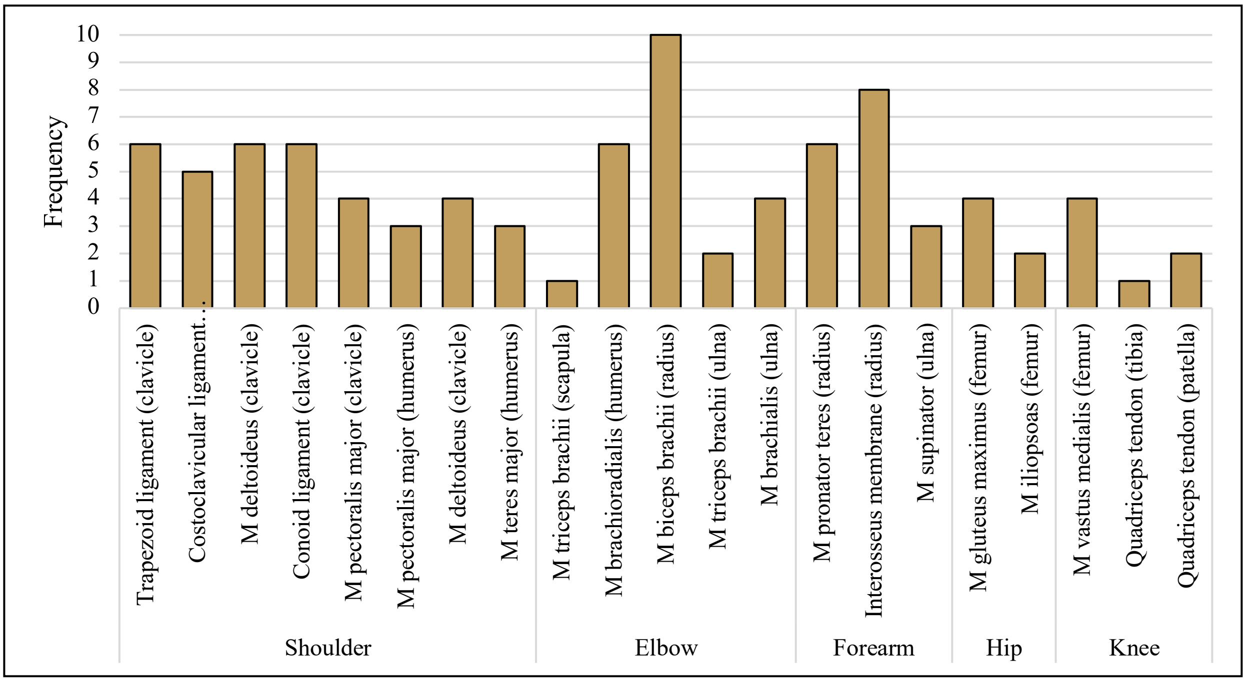


Figure 3.3. Lemba: Frequency distribution of observed entheses by muscle. N:90.

This first assessment indicated a bias between the most *(biceps brachii*) and the least represented enthesis (*triceps brachii*) of the order of 10:1. This certainly impacted the comparability of the data. As for the robusticity ranks distribution (pooled sexes), it was observed a marked prevalence of mild modifications (57/90, 63.3%) compared with the moderate (31/90, 34.4%) and severe forms (2/90, 2.2%). These latter were detected on the *pectoralis major* (humerus) (1/3, 33.3%) and the *gluteus maximus* (¼, 25.0%). Moderate scores were detected in high percentages (100.0%) on the *costoclavicular ligament* (5/5) and *triceps brachii* (scapula) (1/1). This latter evidence was not used for any evaluation, since the very low number of entheses observed for this muscle. The best-represented *biceps brachii* and *interosseous membrane* displayed an almost equal distribution of mild and moderate scores: around 40.0% moderate degrees and 60.0% mild robusticity (Figure 3.4).

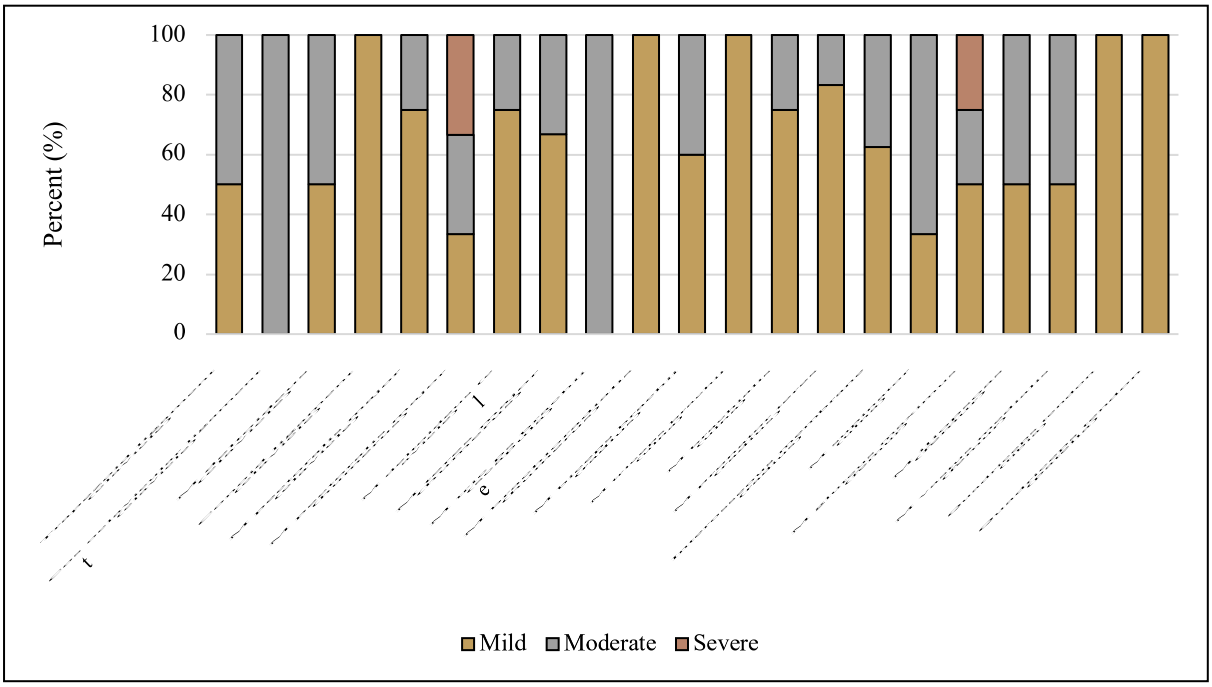


Figure 3.4. Lemba: Frequency distribution of mild, moderate, and severe robusticity ranks by muscle. N:90.

At the functional complex level, it is evident that the greatest percentage of observed entheses belonged to the shoulder (37/90, 41.1%); while the hip was the least well-represented complex (6/90, 6.7%). Thus, this second assessment highlighted a bias of the order of 6:1 between the most and the least represented functional complex.

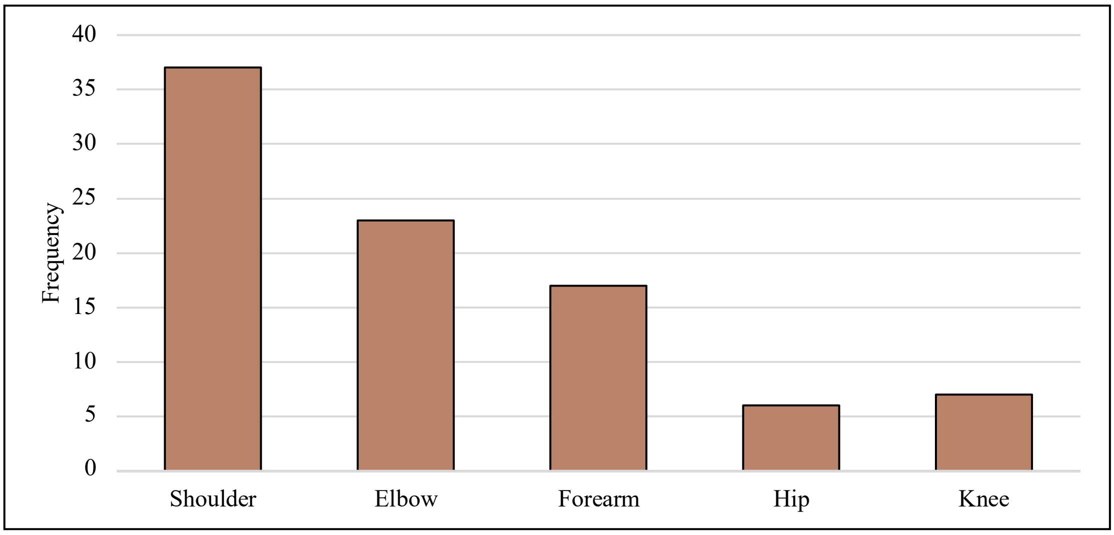


Figure 3.5. Lemba: Frequency distribution of the observed entheses by functional complex. N:90.

As for the distribution of the robusticity ranks by functional complex, figure 3.6 shows that the only recorded severe modifications were found on the hip and the shoulder. However, the former refers to a single enthesis (1/6, 16.7%); thus, this finding was not sufficient to assume a greater development of the entire complex. More reliable was the distribution of the severe degrees on the shoulder (1/37, 2.7% severe and 15/37, 40.5% moderate robusticity) which was the best-represented complex. In the remaining three functional complexes, only mild and moderate degrees were scored with a clear prevalence of the former to the last.

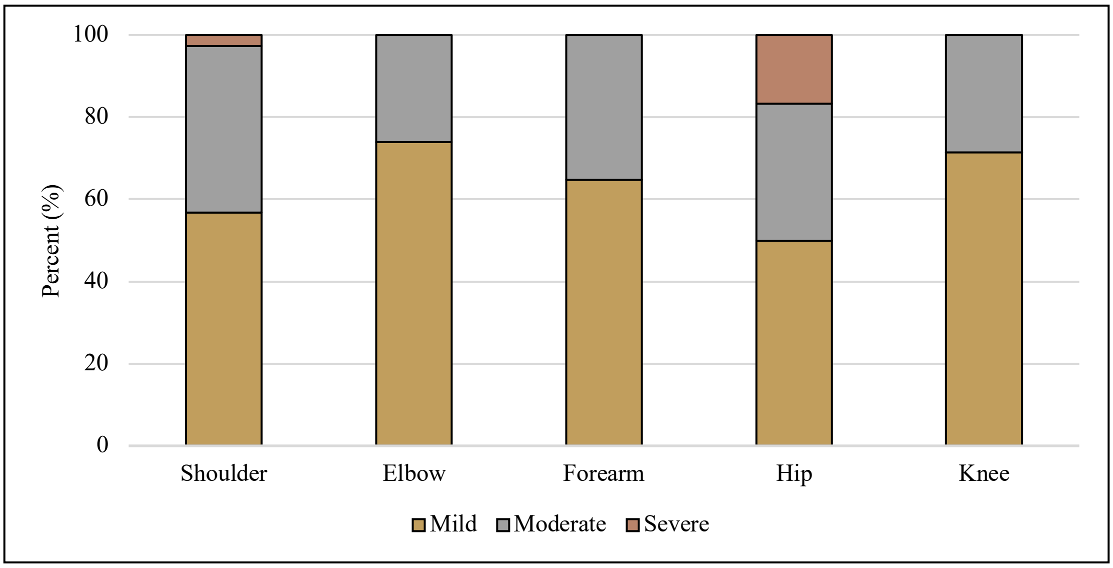


Figure 3.6. Lemba: Frequency distribution of mild, moderate, and severe robusticity ranks by functional complex. N:90.

3.2.1.2.2 Robusticity: relationship between score development, side, sex, and age

Concerning the bilateral asymmetry, figure 3.7 shows that the right entheses prevailed in number (=56) over the left (=34). *Triceps brachii* (scapula), *iliopsoas,* and *quadriceps tendon* (*tibia*) were represented only on the right side. *Deltoideus* (clavicle and humerus), *brachioradialis*, *triceps brachii* (ulna), *interosseous membrane,* and *quadriceps tendon* (patella) were equally represented.

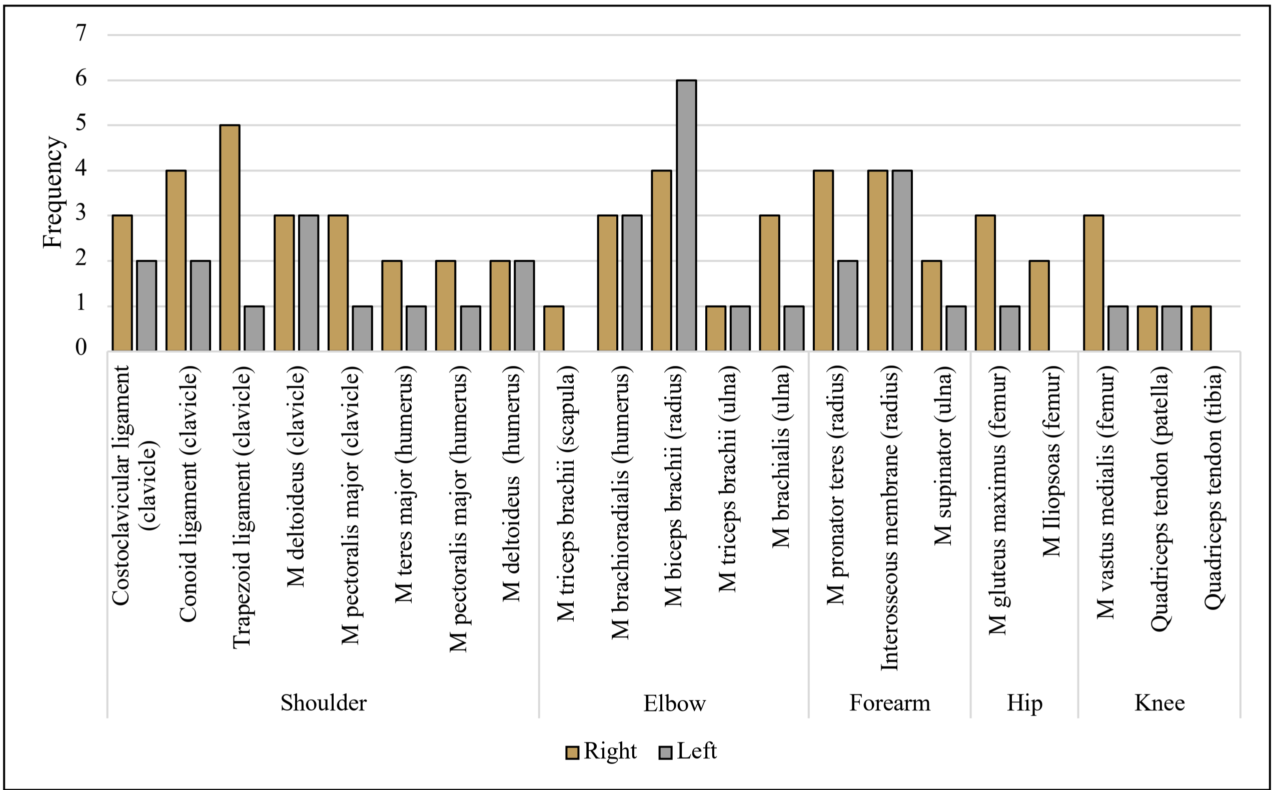


Figure 3.7. Lemba: Frequency distribution of the observed entheses by side. N:90.

The evaluation of the robusticity ranks distribution between sides indicated a right-side asymmetry of all muscles belonging to the upper limb except the *pectoralis major* (humerus) and the *teres major*. The opposite pattern was instead observed on the lower limb as the left side provided a greater percentage of moderate and severe forms (Figure 3.8).

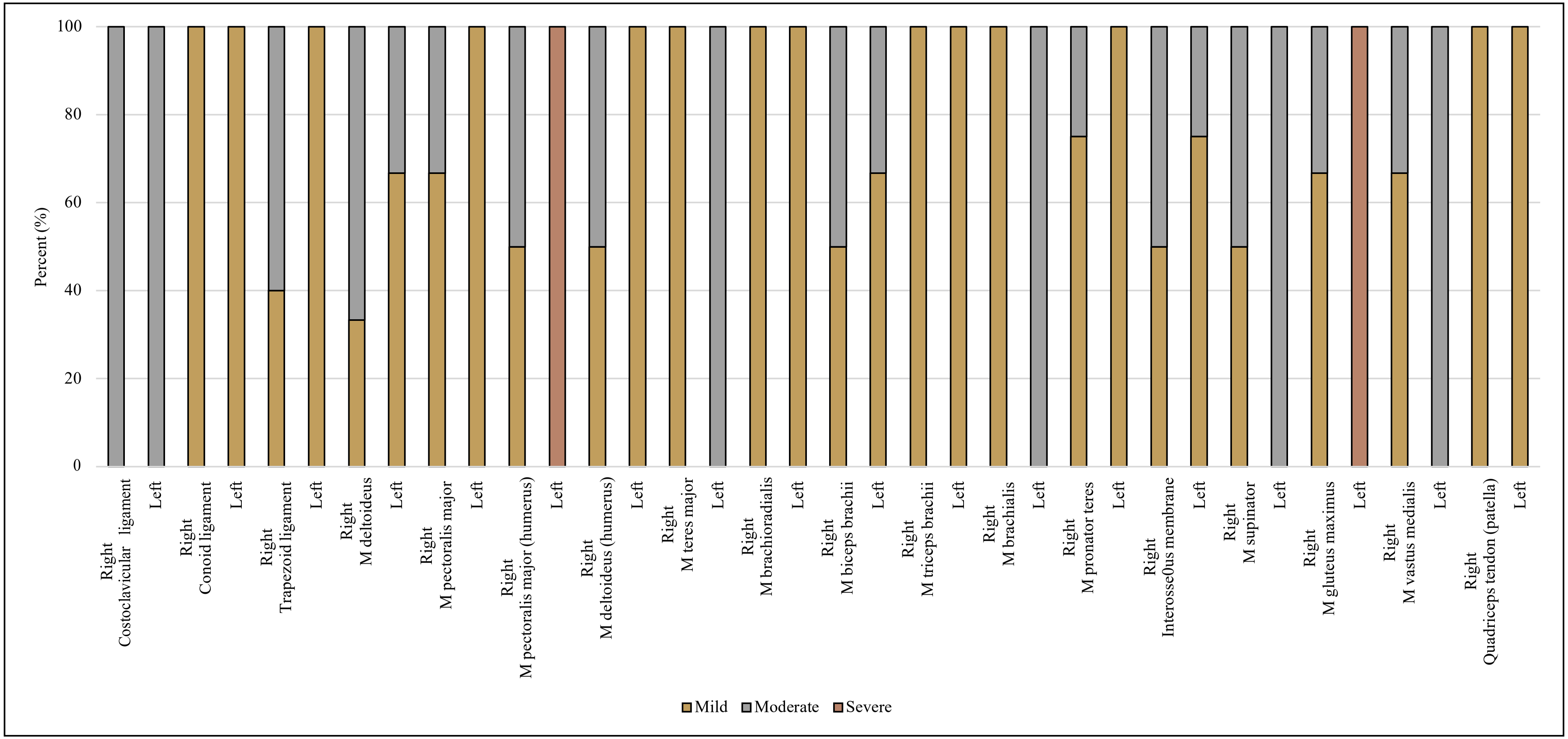


Figure 3.8. Lemba: Frequency distribution of mild, moderate, and severe robusticity ranks by side. N:90.

By combining the entheses in functional complexes (Figure 3.9), as expected, the right entheses prevailed over the left entheses in all the functional complexes; and the most consistent bias was observed on the knee (2:1) and the hip (5:1).

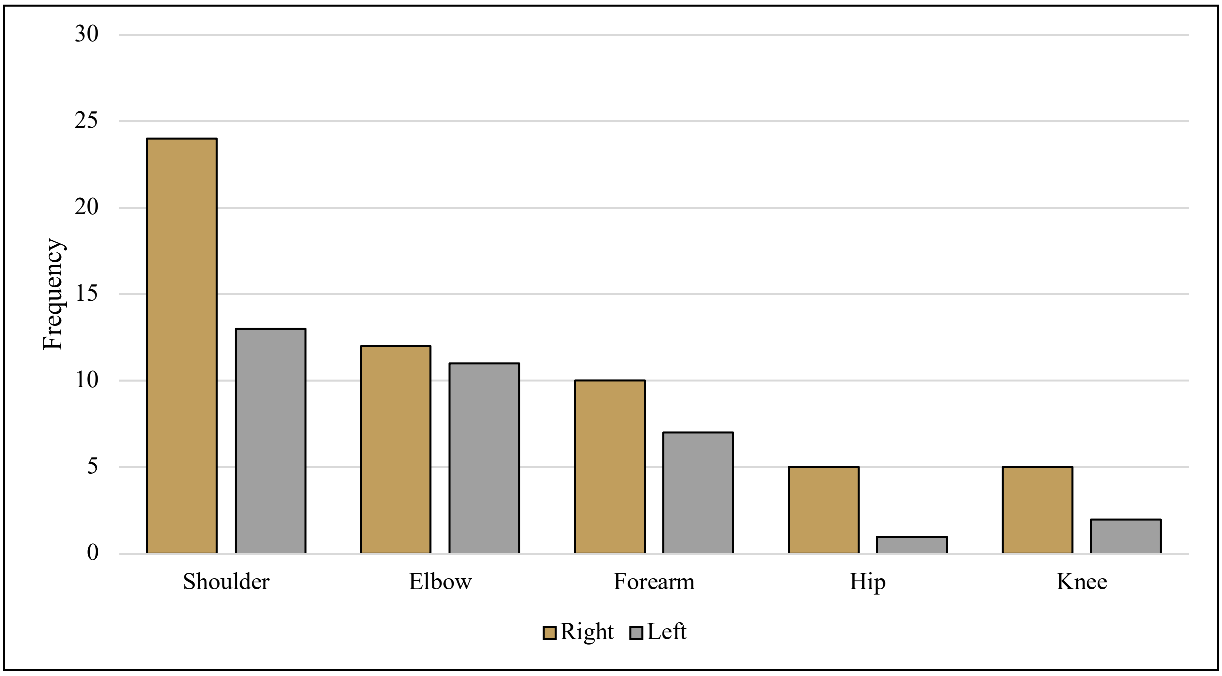


Figure 3.9. Lemba: Frequency distribution of the observed entheses by side (pooled functional complexes). N:90.

The shoulder and forearm, as shown in figure 3.10, provided greater rates of moderate degrees on the right side compared with the left side. As for the elbow, the number of entheses, by side, exhibiting moderate degrees was the same (3/12 for the right and 3/11 for the left); here, the lower rate of moderate degrees (25.0%) on the right entheses can be ascribed to the bias between the sides. Overall, this finding suggested an equal level of utilization of the muscles pertaining to the elbow. Concerning the lower limb, the graph indicates a prevalence of moderate and severe robusticity on the left side. However, it must be specified that in both cases, these data refer to a very low number of observations; thus, they cannot be considered for any comparison.

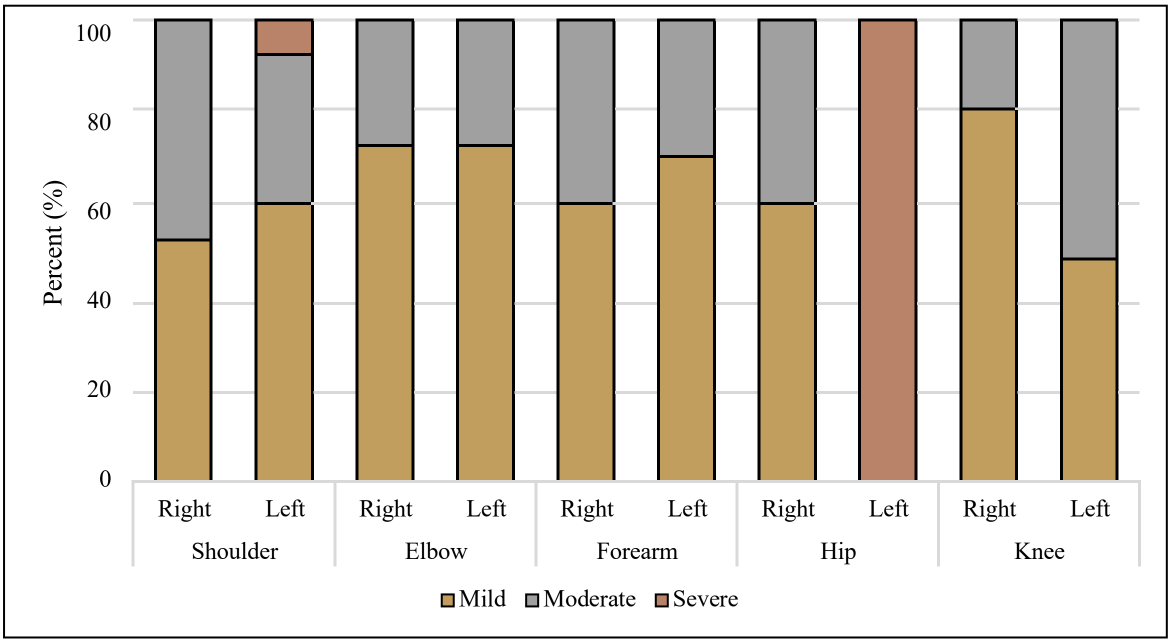


Figure 3.10. Lemba: Frequency distribution of mild, moderate, and severe robusticity ranks by side (pooled functional complexes). N:90.

These differences in severity distribution were however not significant (shoulder p-value = 0.863, elbow p-value = 0.928, forearm p-value = 0.740, hip p-value = 0.333, knee p-value = 0.571).

Looking at the distribution of the observed entheses by sex, figure 3.11 shows that, as expected, since the prevalence of the female skeletons (=8) over the males (=1), the female entheses (=75) prevailed in number over the male entheses (=15). Only ten muscles were represented by both sides; among these, only three, the *gluteus maximus*, the *iliopsoas,* and the *vastus medialis,* were equally represented. As for the remaining, the most consistent bias was observed on the *biceps brachii* (4:1).

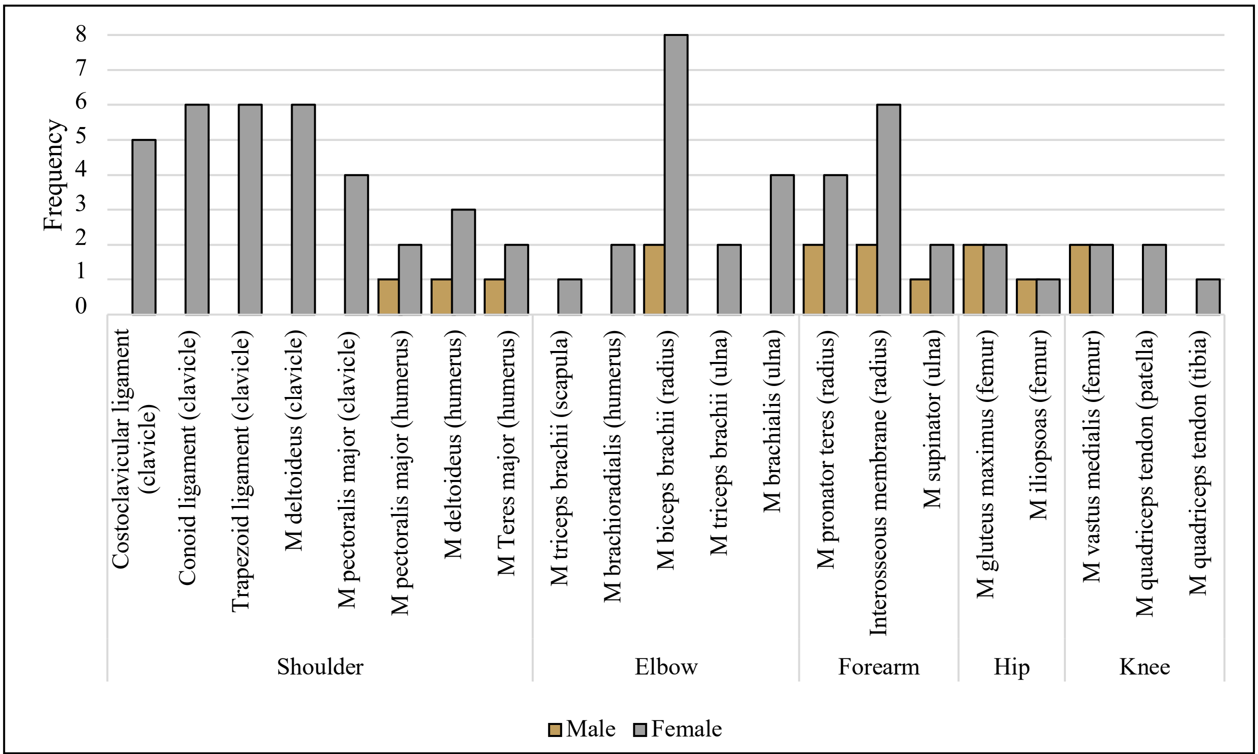


Figure 3.11. Lemba: Frequency distribution of the observed entheses by sex. N:90.

However, despite this bias in representation, the only male skeleton included in this thesis displayed greater development of all the observed muscles except on the *deltoideus* (humerus) where females displayed 1/3 (33.3%) moderate degrees (Figure 3.12; Figure 3.13). Overall, females exhibited high ranks on the *trapezoid* and *conoid ligaments,* the *pectoralis major,* the *brachioradialis,* the *deltoideus*, the *teres major,* the *biceps brachii,* and the *supinator*. Males displayed high ranks at the *pectoralis major* (humerus) and the *gluteus maximus*.

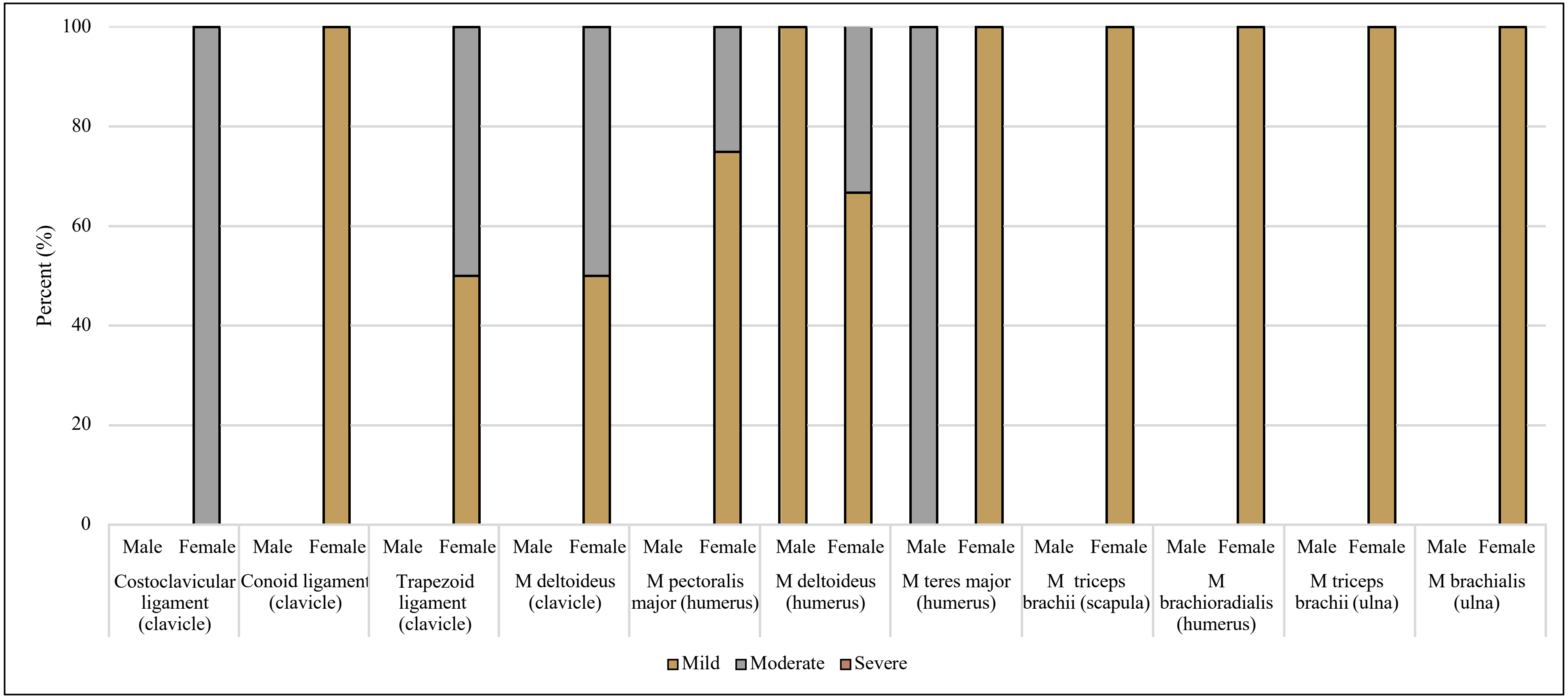


Figure 3.12. Lemba: Frequency distribution of mild, moderate, and severe robusticity ranks by sex (shoulder and elbow). N:60.

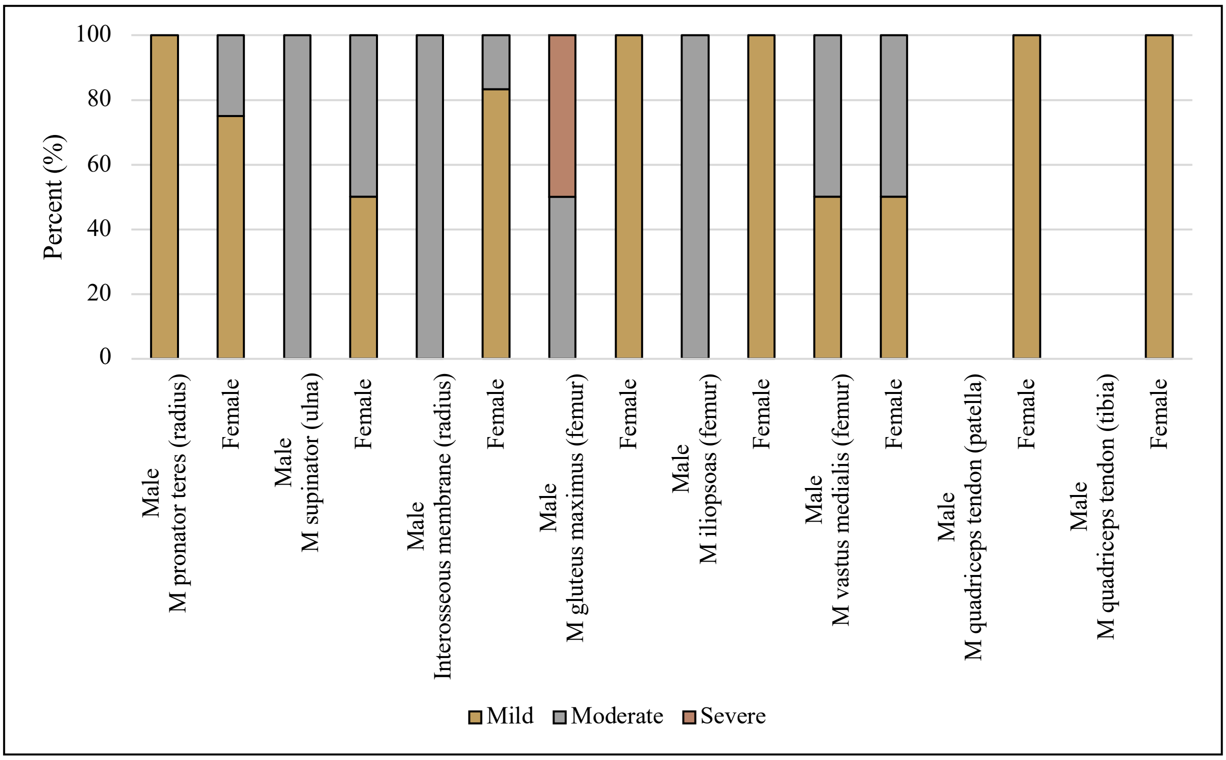


Figure 3.13. Lemba: Frequency distribution of mild, moderate, and severe robusticity ranks by sex (forearm, hip, and knee). N:30.

By combining the entheses in functional complexes, it appears evident that in all the functional complexes, except in the hip, the females were better represented. The bias between the best and least represented sex was more consistent in the shoulder (10:1).

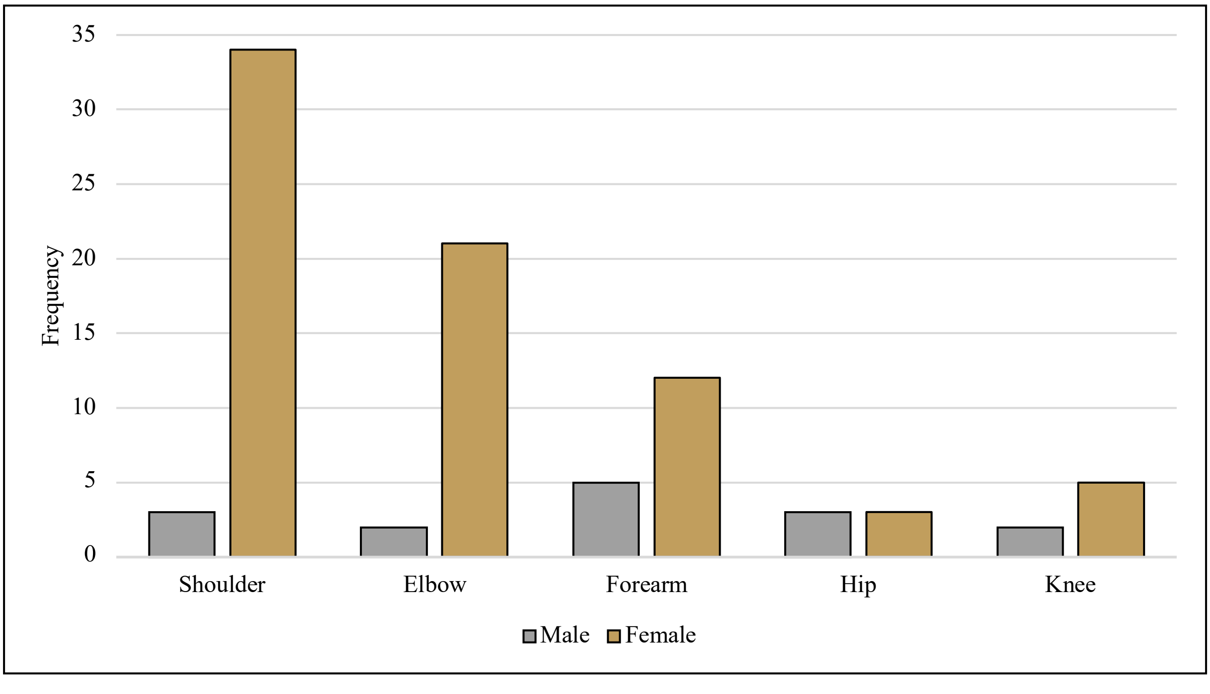


Figure 3.14. Lemba: Frequency distribution of the observed entheses by sex (pooled functional complexes). N:90.

While taking into account this great disparity in representation and the very low number of male entheses, it can be only said that the most utilized functional complex by the male was the hip (2/3, 66.7% moderate degrees, and 1/3, 33.3% severe degrees), followed by the elbow (2/2, 100.0%), and the shoulder (1/3, 33.3% moderate degrees and 1/3, 33.3% severe degrees). For which concern the females, the most developed functional complexes were the shoulder (14/34, 41.2% moderate degrees) and the forearm (25.0%, 3/12 moderate degrees).

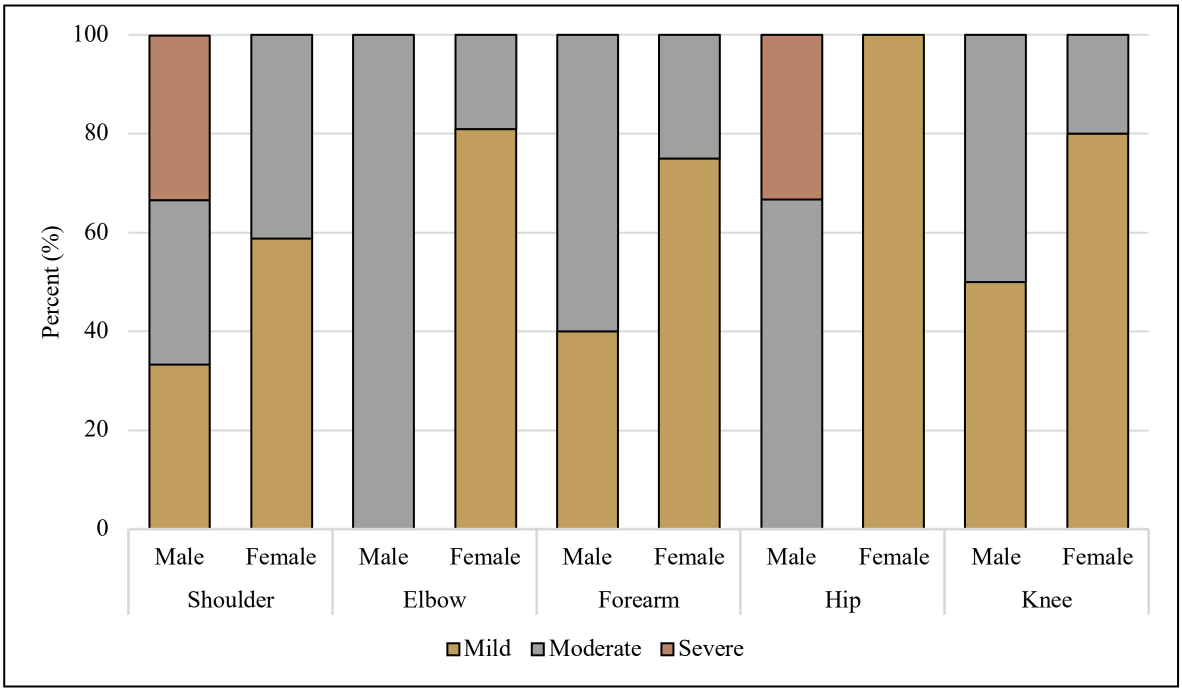


Figure 3.15. Lemba: Frequency distribution of mild, moderate, and severe robusticity ranks by sex (pooled functional complexes). N:90

On the basis of the sub-mentioned disparities in representation, no statistical comparisons between the sexes were conducted.

As for the relationship between severity degrees and age, as anticipated in section 2.1.8, the examination was conducted exclusively on the data aggregated in functional complexes. The frequency assessment in figure 3.16 shows that only two functional complexes were almost equally represented in all the considered categories: the hip and the knee. In the other cases, the large disparity in representation prevented any comparison between age categories. Overall, the young adults (20-24 years) were the best-represented category, followed by the mature adults (35-44 years) and the middle adults (25-34 years).

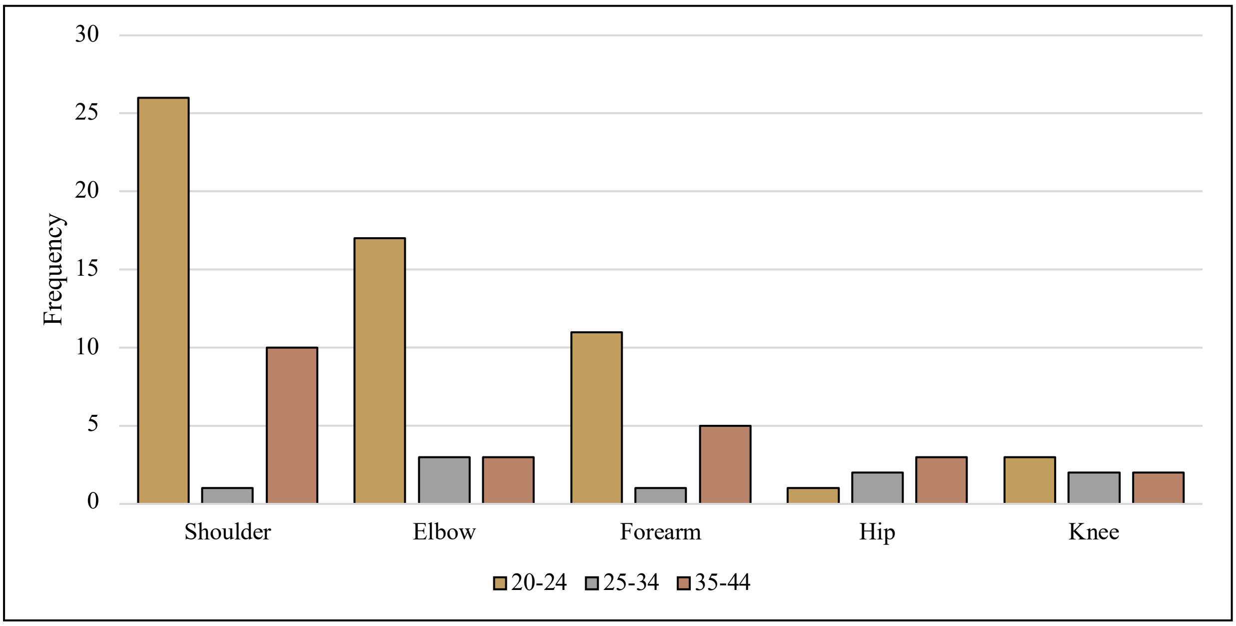


Figure 3.16. Lemba: Frequency distribution of the observed entheses by age category (pooled functional complexes). N:90.

Overall, it was noted that the percentages of moderate + severe robusticity degrees increased from the younger (18/58, 31.0%) to the mature adults (14/23, 58.3%) (Figure 3.17). No statistical test was conducted to verify the existence of any significant difference between the age categories and the robusticity ranks on the basis of the great bias in representation previously described.

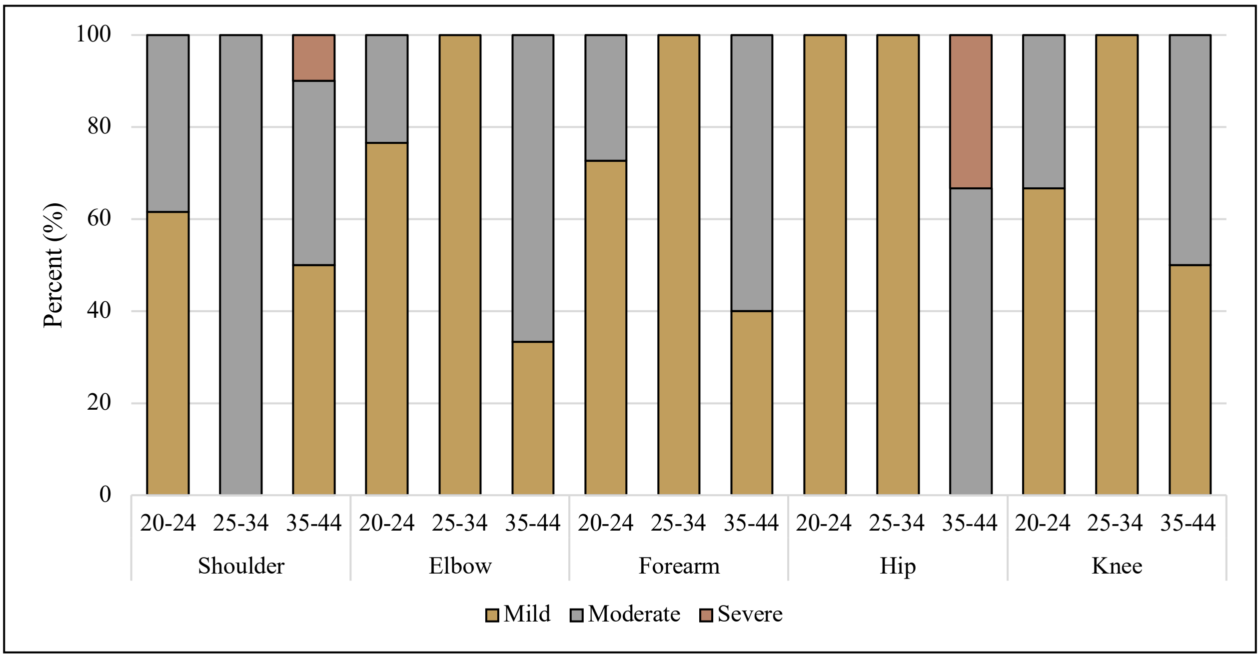


Figure 3.17. Lemba. Frequency distribution of mild, moderate, and severe robusticity ranks by age group (pooled functional complexes). N:90.

3.2.1.2.3 Osteolytic lesions and enthesophytic formations: relationship between score development, enthesis, and functional complex

OLs and EFs were not present on all the observed entheses. More specifically, the OLs were rare, affecting only 4.4% (4/90) of the recorded entheses; while the EFs were more frequent and were detected on 28.9% (26/90) of the surfaces observed.

Three of the four entheses affected by OLs - *trapezoid ligament*, *conoid,* and *quadriceps tendon* (patella) - were ranked as mild; the fourth, the *biceps brachii,* was ranked as moderate (Figure 3.18). This latter belonged to a mature adult male; while the other three to young and middle adult females. It is also evident that only three functional districts were affected: the shoulder (2/37, 2.4%), elbow (1/23, 4.3%), and knee (1/7, 14.3%).

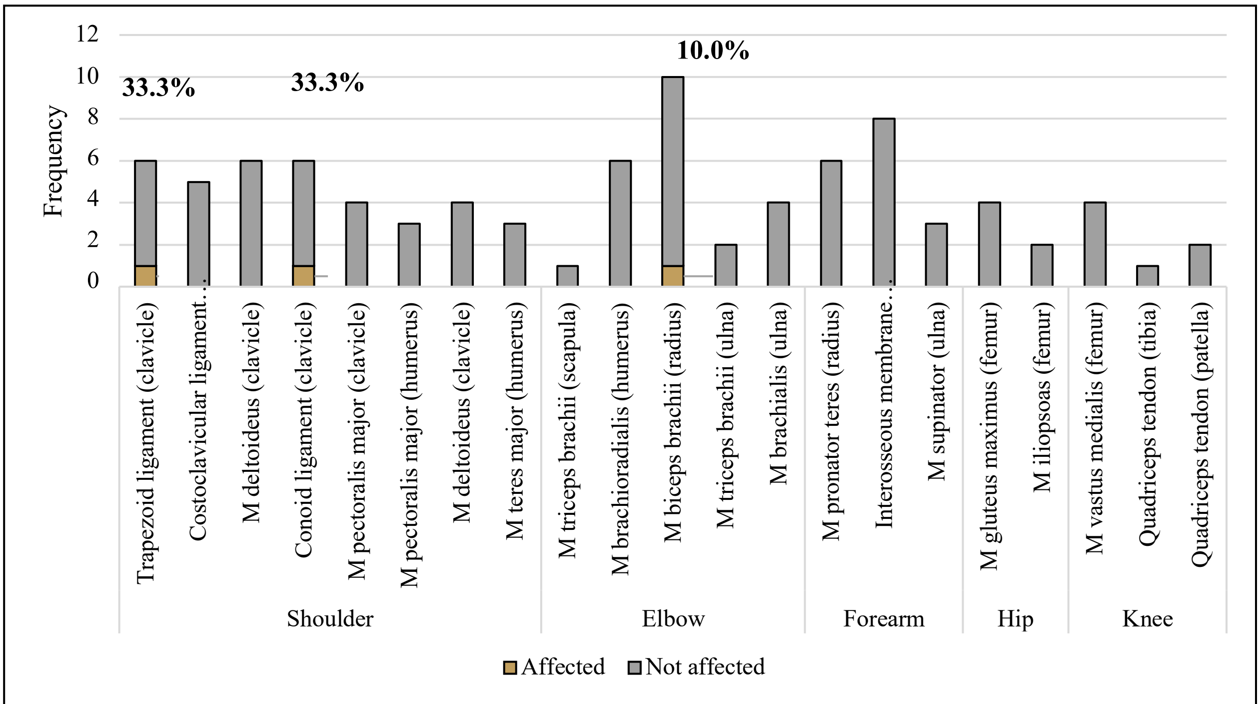


Figure 3.18. Lemba: Frequency distribution of the entheses affected by OLs by muscle. N:90.

Concerning the distribution of EFs by enthesis, the most frequently affected entheses were the *costoclavicular ligament* (5/5, 100.0%) and the *biceps brachii* (7/10, 70.0%) (Figure 3.19).

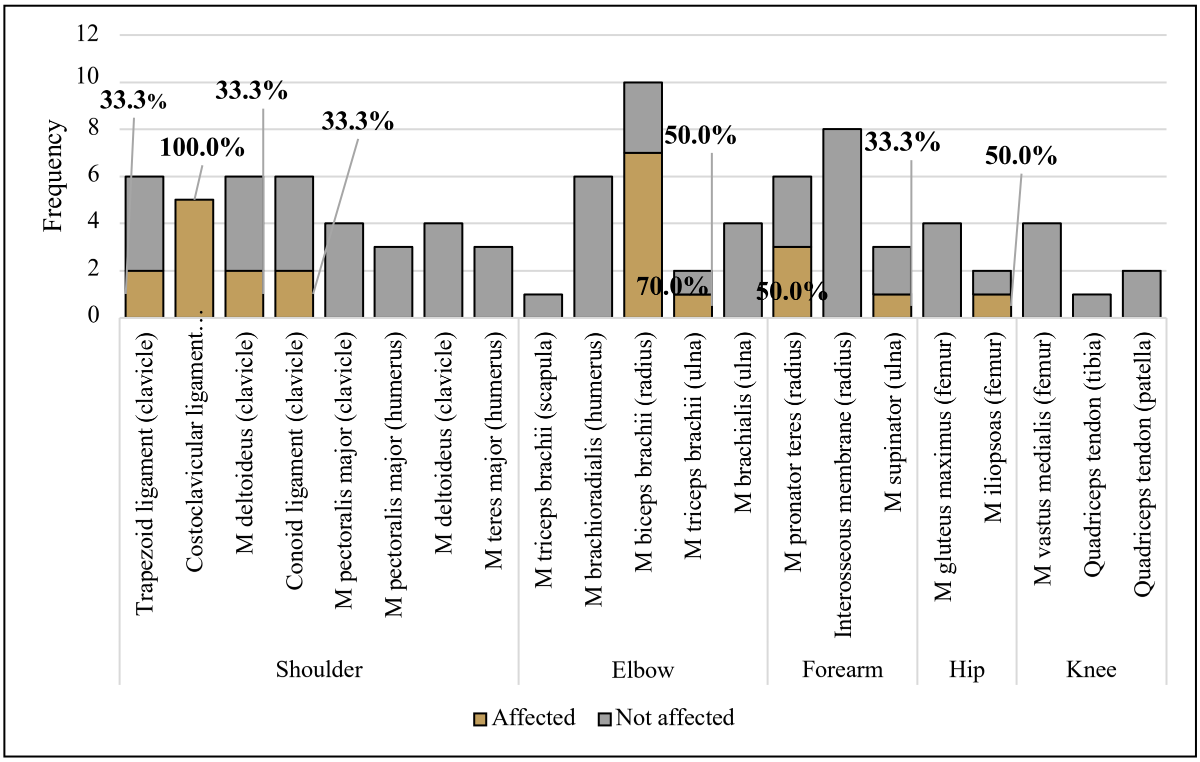


Figure 3.19. Lemba: Frequency distribution of the entheses affected by EFs by muscle. N:90.

The *biceps brachii* was the most severely affected (4/7, 57.1% moderate degrees).

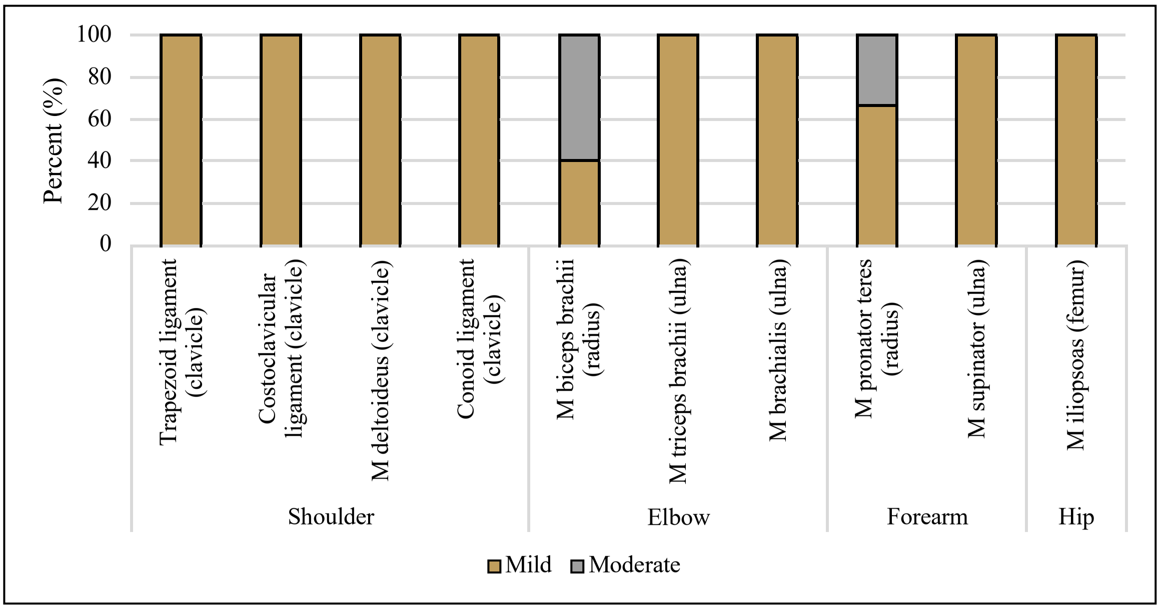


Figure 3.20. Lemba: Frequency distribution of mild and moderate EFs by muscle. N:26.

By pooling the entheses in functional complexes, the elbow was found to be the most affected complex (10/23, 43.5%) followed by the shoulder (11/37, 29.7%) and forearm (4/17, 23.5%) (Figure 3.21). No affections were recorded on the entheses belonging to the knee.

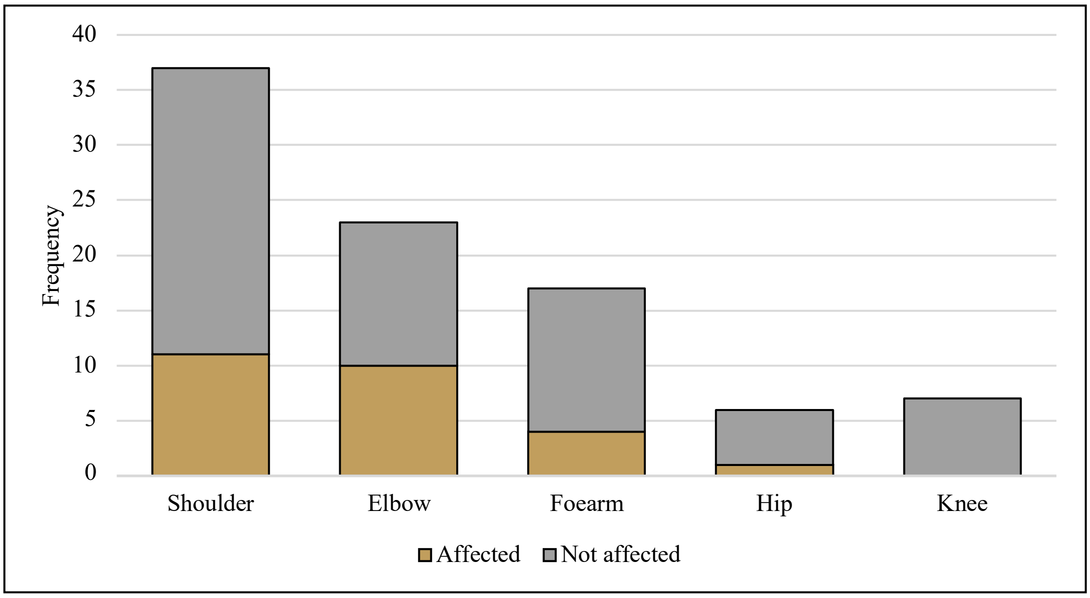


Figure 3.21. Lemba: Frequency distribution of the entheses affected by EFs by functional complex. N:90.

In terms of severity rank distribution, the elbow (4/10, 40.0%) and the forearm (1/4, 25.0%) were the only two functional complexes which exhibited moderate degrees (Figure 3.22).

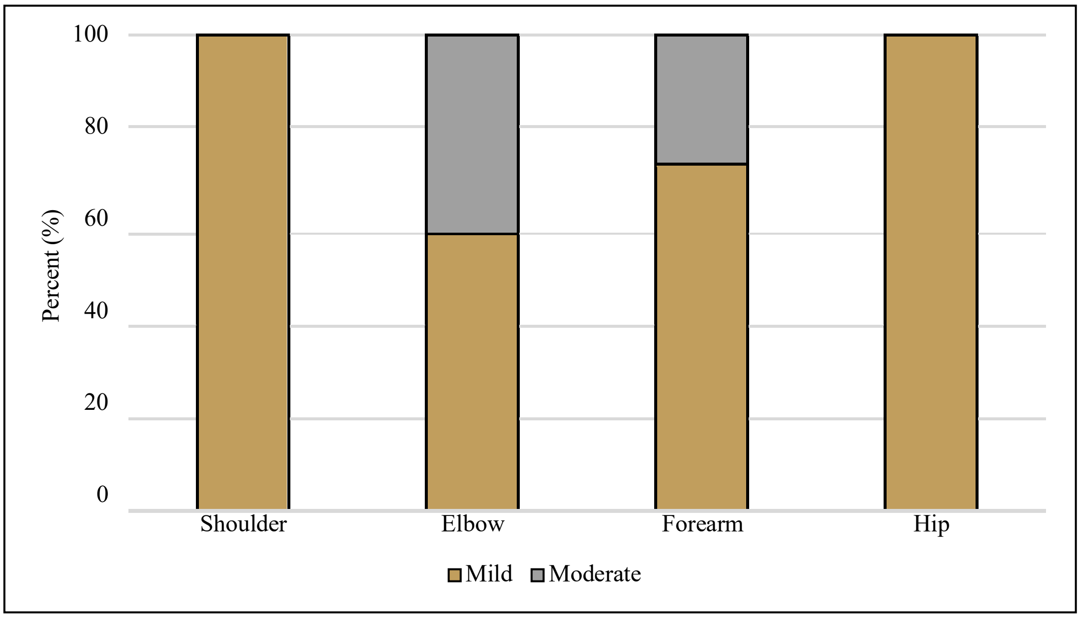


Figure 3.22. Lemba: Frequency distribution of mild and moderate EFs ranks by functional complex. N:26.

3.2.1.2.4 Enthesophytic formations: relationship between score development, side, sex, and age

Concerning the bilateral asymmetry, it must be specified that only two functional complexes were comparable, the shoulder and the elbow, as no affections were observed on the left hip, left forearm, and knee (Figure 3.23). In the case of the shoulder, the right side was more affected

(8/24, 33.3%) than the left (3/13, 23.1%). Also, in this case, it must be stressed that the greater representativity of the right side might have affected the reliability of the comparison. As for the elbow, the two sides were almost equally represented, and the right side was more affected (6/12, 50.0%) than the left (4/11, 36.4%).

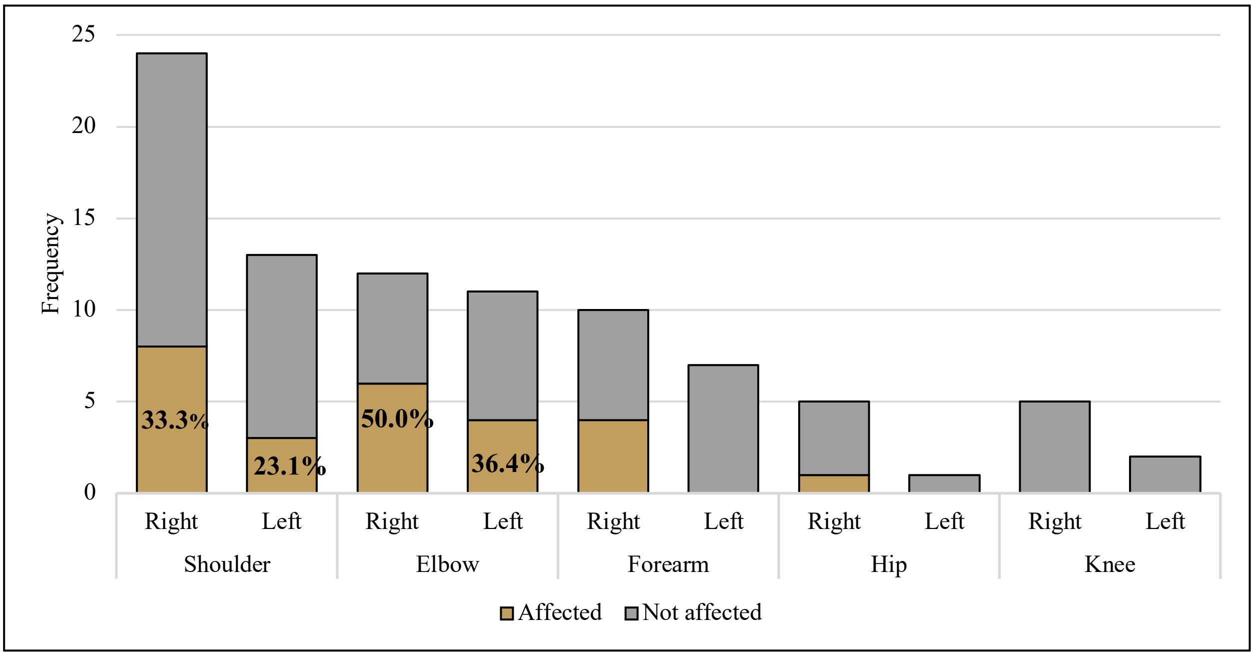


Figure 3.23. Lemba: Frequency distribution of the entheses affected by EFs by side (pooled functional complexes). N:90.

Focusing on these two functional complexes, the shoulder exhibited only mild forms on both sides, while the elbow exhibited a higher percentage of moderate EFs on the left side (2/4, 50.0%) compared with the right (2/6, 33.3%) (Figure 3.24).

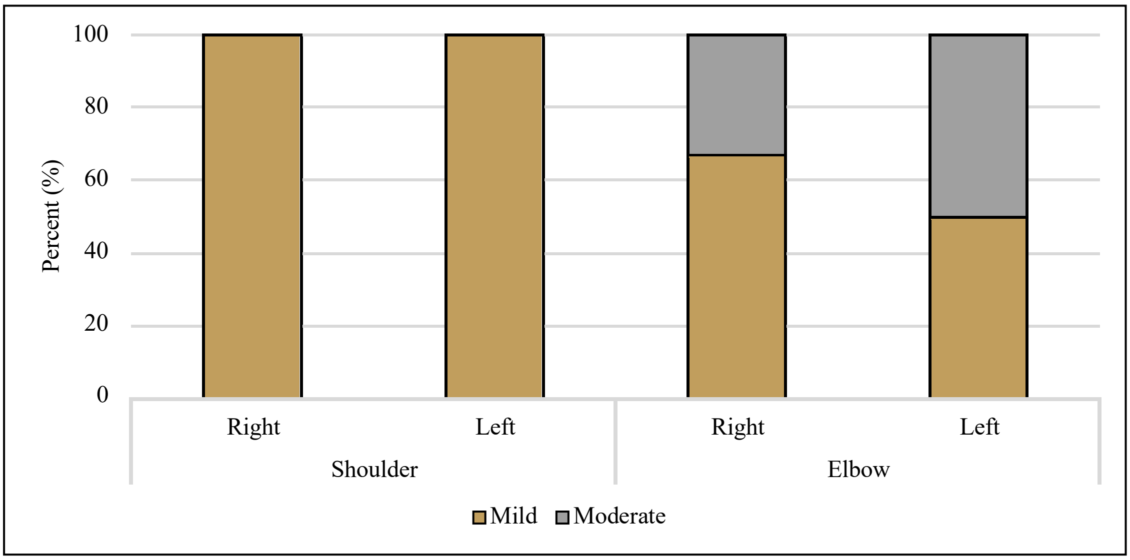


Figure 3.24. Lemba: Frequency distribution of mild and moderate EFs ranks by side (pooled functional complexes). N:26.

No significant differences were however revealed by the statistical analysis (shoulder p-value = 1.000, elbow p-value = 0.762).

Concerning the distribution of the EFs between sexes, only two functional complexes were considered for comparisons: the elbow and the forearm. For which regard the shoulder, only female entheses exhibited evidence of EFs. This can be ascribed to the significant prevalence of the female entheses over the male entheses. Hip, equally represented by sex, displayed evidence only on the male sub-sample. As for the elbow and the forearm, the observed entheses were distributed between males and females by creating a bias of the order of 1:4 and 1:3 towards females, respectively (Figure 3.25). This certainly affected the availability of the results of the comparisons. This is particularly evident on the elbow, where only two entheses were recorded on the male skeletons, both exhibited EFs, while 38.1% (8/21) of the female entheses exhibited this marker.

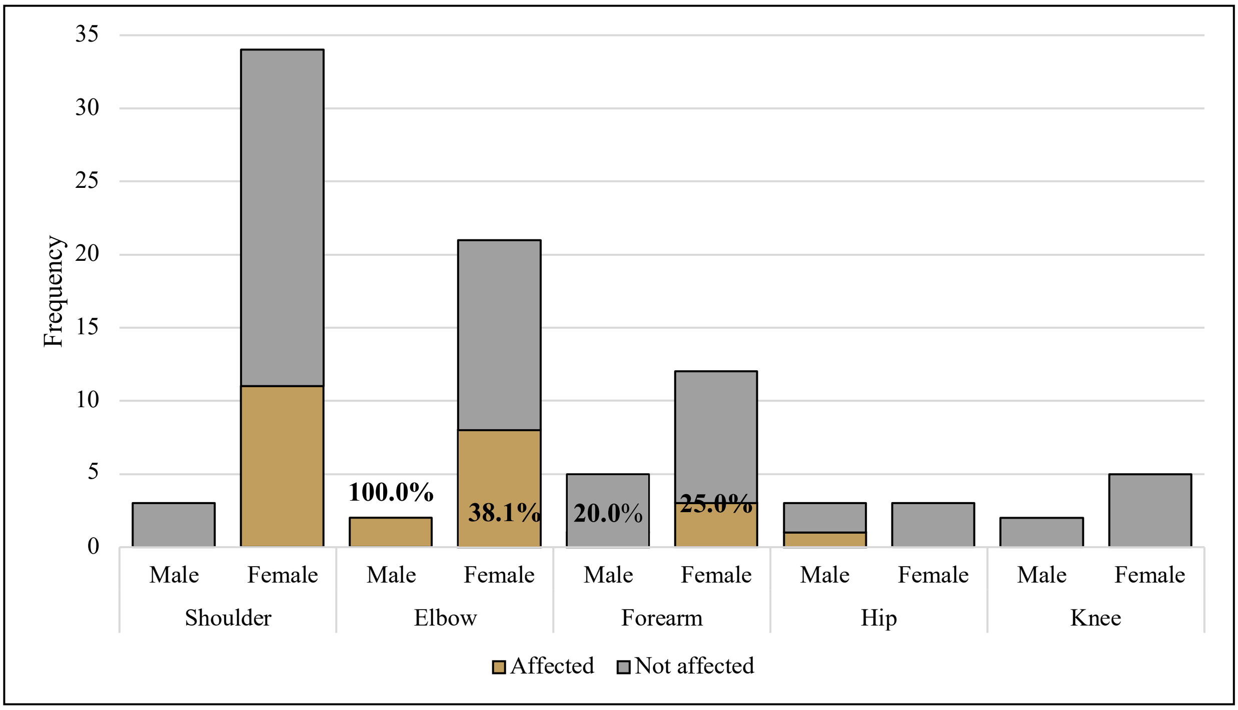


Figure 3.25. Lemba: Frequency distribution of the entheses affected by EFs by sex (pooled functional complexes). N:90.

While taking into account these disparities, males displayed more severe degrees on the elbow compared with the females, while females displayed a higher percentage of moderate degrees on the forearm compared with the males (Figure 3.26).

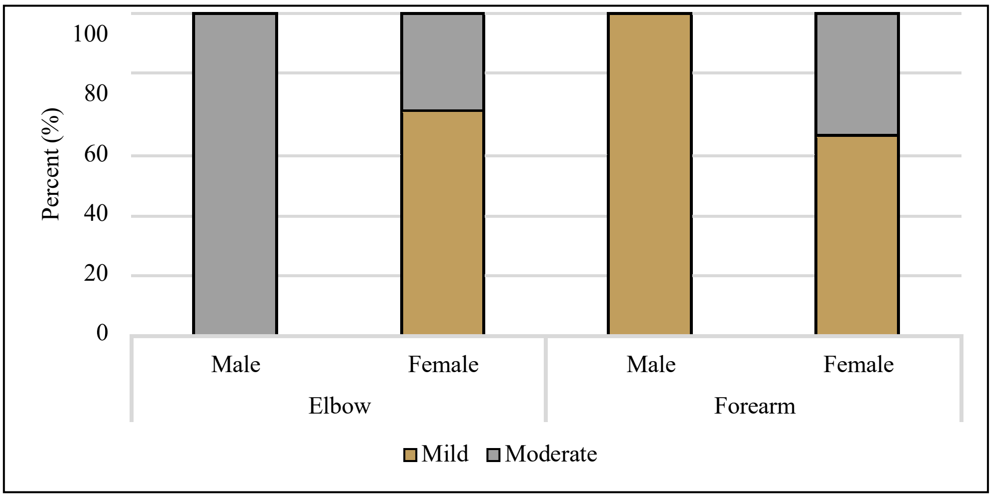


Figure 3.26. Lemba: Frequency distribution of mild and moderate EFs ranks by sex (pooled functional complexes). N:26.

The Mann-Whitney *U*-test did not reveal any significant difference in the severity ranks distribution between the sex groups (elbow p-value = 0.178, forearm p-value = 1.000).

Finally, concerning the distribution of the EFs between the age groups, it must be stressed that the very low number of surfaces recorded for each age category would result in an underestimation of the distribution of this marker. The middle adult category (25-34 years), for instance, was not represented by more than three entheses in each functional complex. Overall, it can be noted that the distribution of this evidence varied according to the number of observed entheses (Figure 3.27).

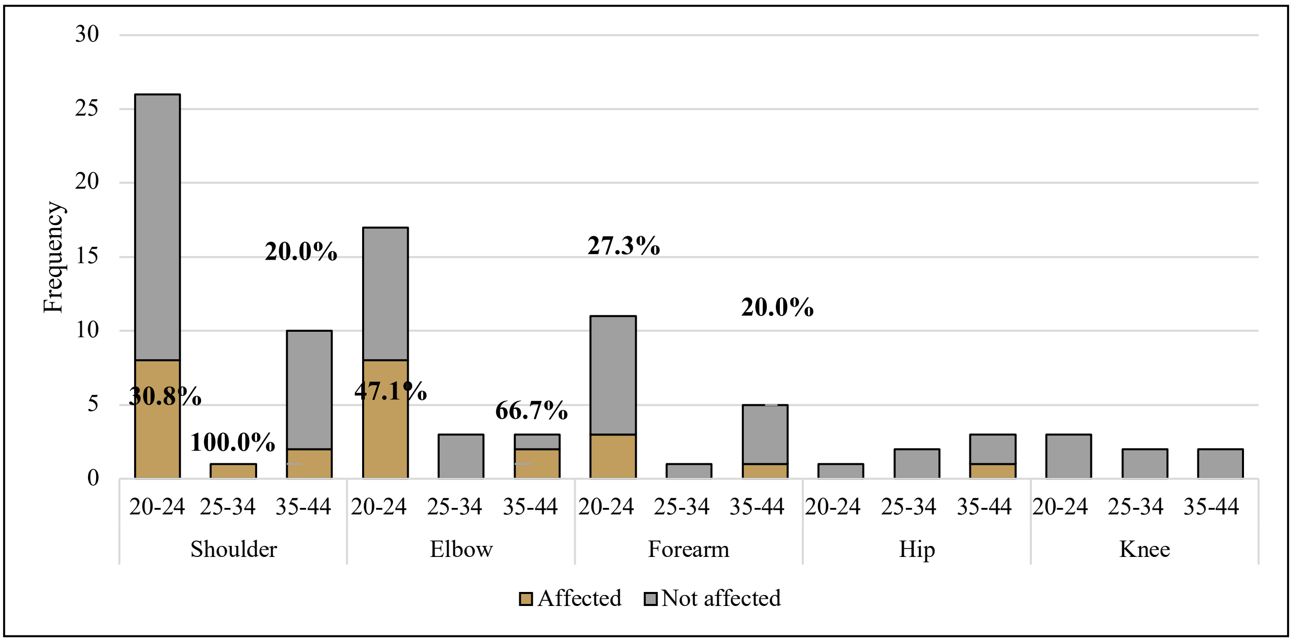


Figure 3.27. Lemba: Frequency distribution of the EFs ranks by age category (pooled functional complexes). N:90.

Moreover, the not equal distribution of the recorded entheses in the three age categories hindered the assessment of the severity distribution of this manifestation. Indeed, except for the shoulder, which provided only mild EFs in all compared groups, the high rate of moderate degrees found on the elbow of the mature adults (2/2, 100.0%) can be ascribed to the low number of observations included in this category. Similarly, for the forearm, the young adults, namely the best-represented category, exhibited 33.3% moderate EFs, while only mild forms were noted on the mature adults.

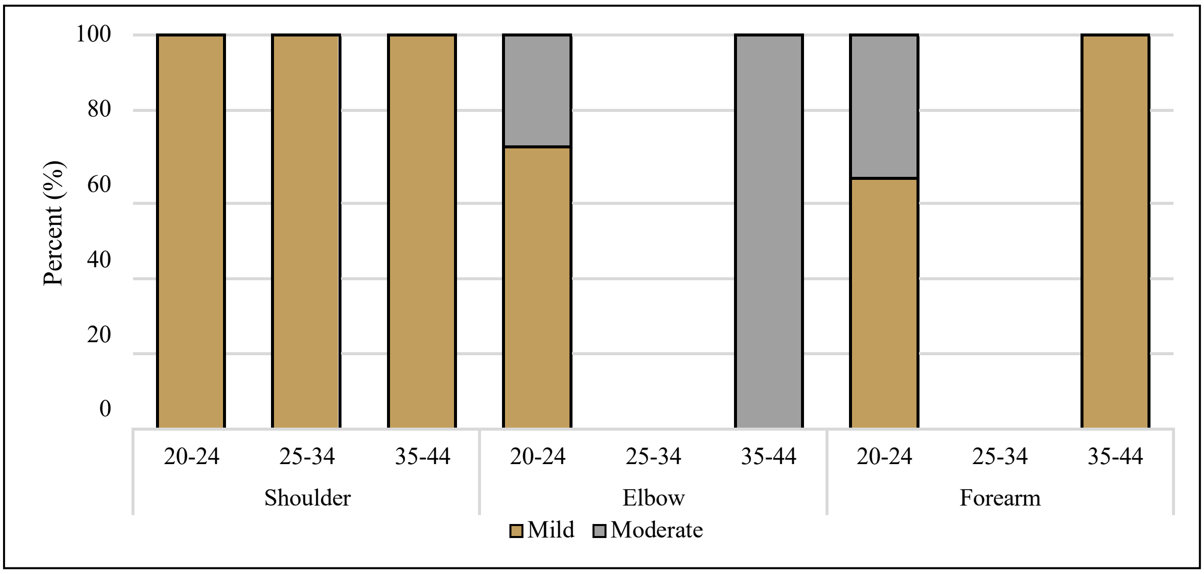


Figure 3.28. Lemba: Frequency distribution of mild and moderate EFs ranks by age category (pooled functional complexes). N:25.

3.2.1.3 Osteoarthritis

A total of seven joint surfaces - one glenoid fossa, one humeral head, two femoral heads, two proximal tibias, and one patella - from five skeletons were evaluated for OA. As figure 3.29 shows, they were very poorly represented as they did not rise above 25.0%.

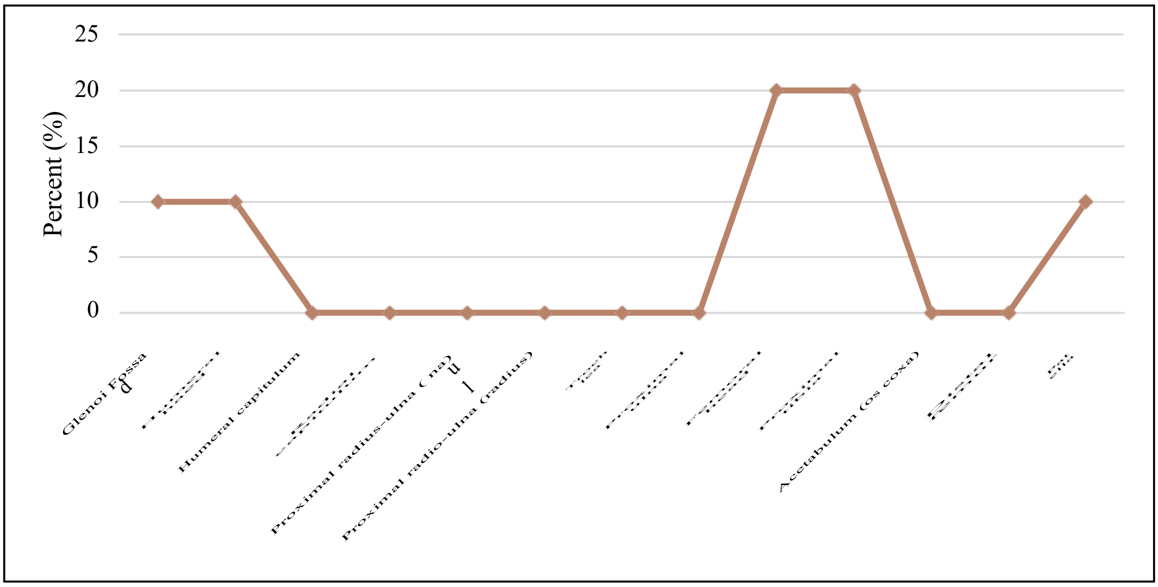


Figure 3.29. Lemba: Joint surfaces representation (%) within the sample. N:7.

No cases of eburnation and fusion were observed. No one of the observed joint surfaces exhibited evidence of OA since they did not display more than one of the following markers: ML, PO and SO (Figure 3.30).

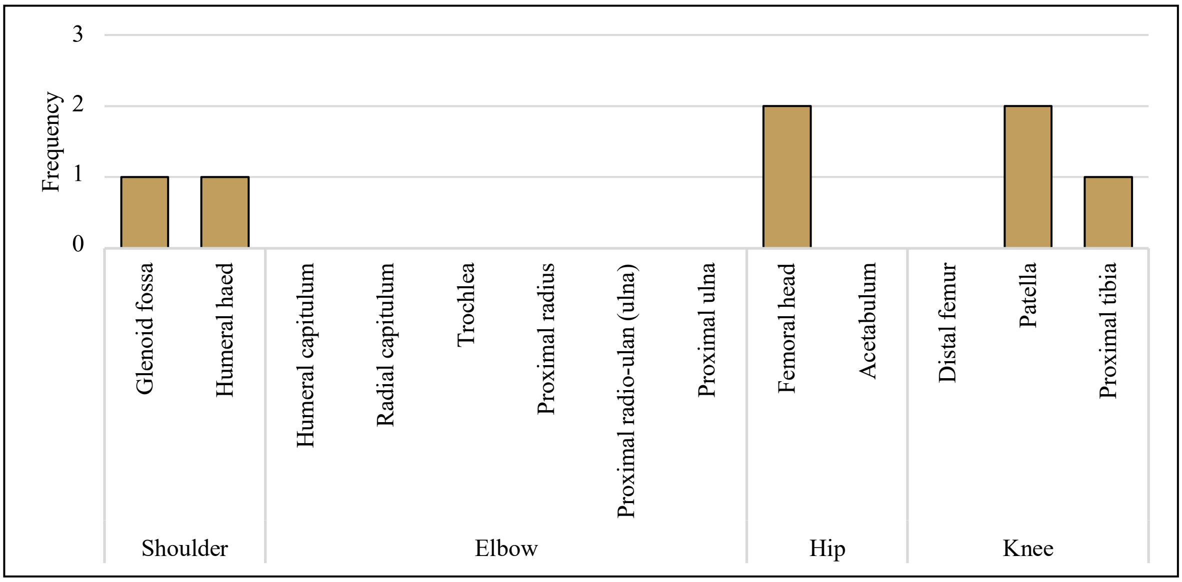


Figure 3.30. Lemba: Frequency distribution of the observed articular surfaces by joint. N:7.

3.2.1.4 Extra-masticatory dental wear

A total of 40 maxillary and 34 mandibular teeth belonging to five individuals were examined for evidence of extra-masticatory dental wear. No case was noted. Thus, no comparison between sexes and age groups was allowed.

3.2.1.5 Summary

In sum, the population from Lemba was small and highly biased towards females which fell within the younger age range. On the basis of the evaluation of the robusticity ranks scored for ECs, it is possible to assert that the most utilized muscles were the *deltoideus*, the *trapezoid*, the *pectoralis major*, the *teres major*, the *biceps brachii,* and the *supinator* for the upper limb; and the *gluteus maximus* for the lower limb. The development of the upper and lower limb entheses was bilaterally expressed: in favour of the right side in the case of the upper limb, and in favour of the left side in the case of the lower limb. Considering the great disparity in representation between males and females, sex comparison was based on the mere observation of the severity ranks distribution in each category. Thus, the males displayed the most severe modifications in all the examined comparable entheses; in particular, they stood out in virtue of the development of *pectoralis major* (humerus) and *gluteus maximus*. Females exhibited high ranks on *trapezoid* and *conoid ligaments, pectoralis major, brachioradialis, deltoideus*, *teres major, biceps brachii,* and *supinator*. For which concerns the OLs and the EFs, these two markers seem to draw different trends. The formers affected a very low percentage of entheses (4/90, 4.4%); the only moderate degree was observed on a mature adult male. The last was recorded in higher percentage (26/90, 28.9%), and predominantly on elbow and shoulder. Females provided the highest rates of EFs; it must be taken into account, however, that they were overall better represented than the males. Neither OA evidence nor extra-masticatory dental defect was recorded.

3.2.2 Kissonerga *Mosphilia*

3.2.2.1 Paleodemography

The biological sex and mortality profile of adults from the M-LChal site of *Mosphilia* is presented in table 3.2. Sex estimation was possible for 18 of the 20 individuals. The proportion of female individuals (12/20, 60.0%) greatly exceeds males (6/20, 30.0%). Age estimation was possible for all the skeletons included in the study. Three of the four age categories are represented: the young (20-24 years), the middle (25-34 years), and the mature (35-44 years) adults. No old adults (45+) were identified. The majority of adults fell within the range of young adults (20-24 years) and the middle adults (25-34 years).

Table 3.2. Mosphilia: Age and sex composition of the sample. ND: not determined. %: within the sex.

	Young adult 20-24		Middle adult 25-34		Mature adult 35-44		Old adult 45+		Total	
	N	%	N	%	N	%	N	%	N	%
Male	0	0.0	6	100.0	0	0.0	0	0.0	6	30.0
Female	4	33.3	4	33.3	4	33.3	0	0.0	12	60.0
ND	0	0.0	2	100.0	0	0.0	0	0.0	2	10.0
Total	4	54.5	3	27.3	2	18.2	0	9.1	20	100.0

The bar chart in figure 3.31 illustrates the age distribution of the sample by sex. Overall, the female age distribution reflects all age categories represented, while the male age distribution reflects only the middle adult range.

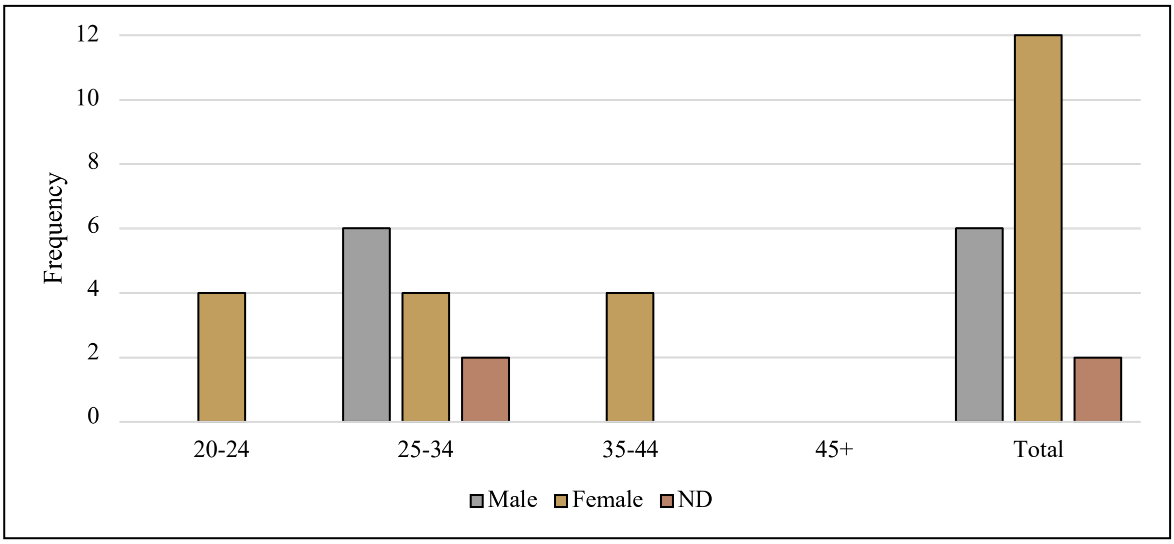


Figure 3.31. Mosphilia: Age distribution of the sample by sex. ND: not determined. N:20.

3.2.2.2 Entheseal Changes

3.2.2.2.1 <u>Robusticity: relationship between score development and enthesis</u>

The evaluation of the ECs of this sample was carried out on a total of 98 entheses belonging to 12 individuals. Figure 3.32 shows the pattern of the distribution of the observed entheses within the whole sample. All the entheses were found to be poorly represented since their index is above 50.0%.

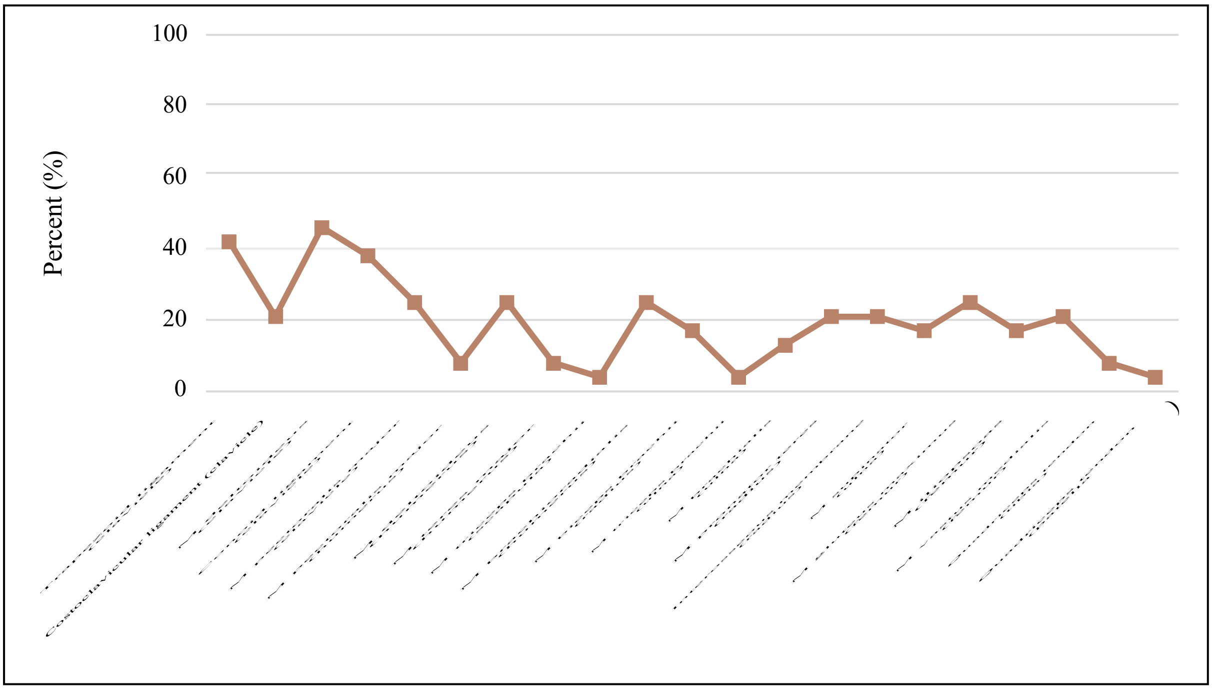


Figure 3.32. Mosphilia: Entheses representation (%) within the whole sample. N:98.

The *deltoideus* (clavicle), the *conoid,* and the *trapezoid* were the most frequently assessed (11/98, 11.2% the former, and 10/98, 10.2% the last). In contrast, the *triceps brachii* (scapula and ulna) and the *quadriceps tendon* (patella) were the least represented (1/98, 1.0%) (Figure 3.33). Thus, it can be inferred from this first assessment that there was a bias between the most and the least represented entheses of the order of 1:10.

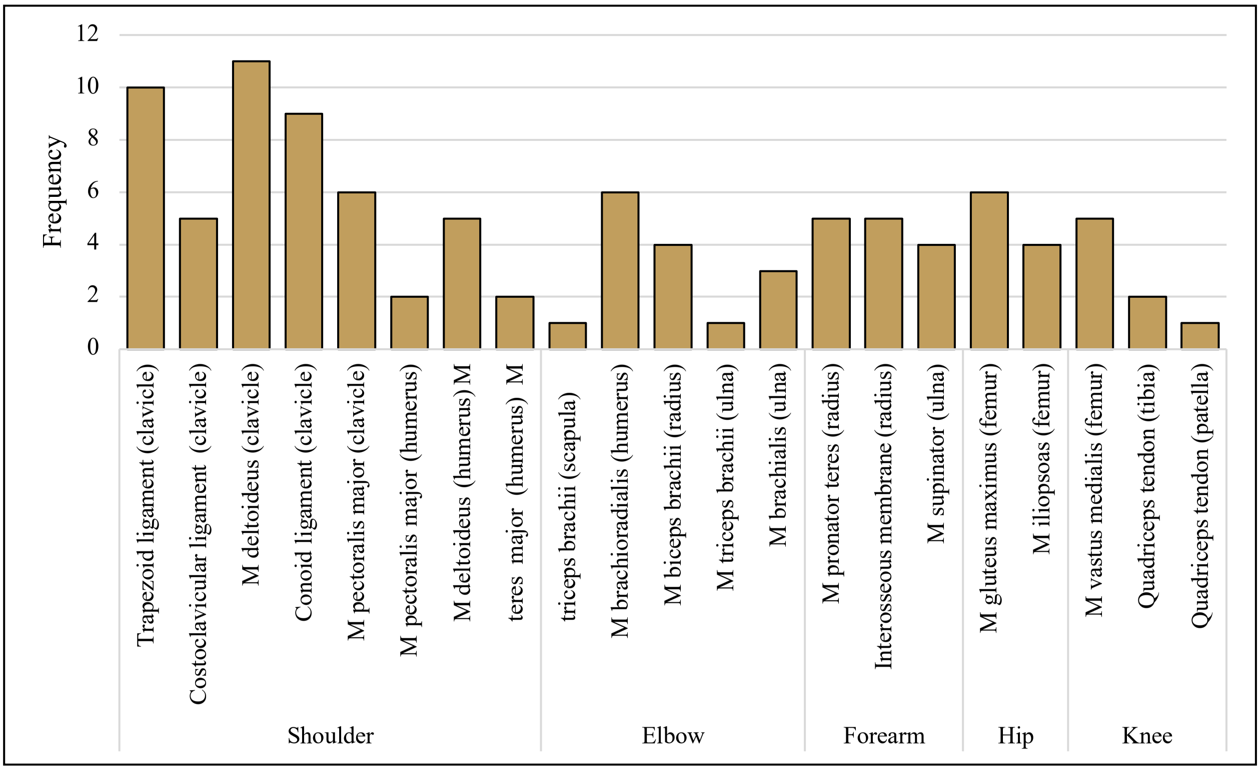


Figure 3.33. Mosphilia: Frequency distribution of observed entheses by muscle. N:98.

Concerning the distribution of the robusticity ranks by enthesis, the mild forms (=84) prevailed over the moderate (=13) and severe (=1); the moderate + severe were detected to a greater extent on the *pectoralis major* (humerus) (½, 50.0%), the *supinator* (2/4, 50.0%), the *conoid* (4/9, 44.4%) and the *costoclavicular* (2/5, 40.0%) (Figure 3.34). Only one severe degree was assigned, in the whole sample, to a *brachioradialis*.

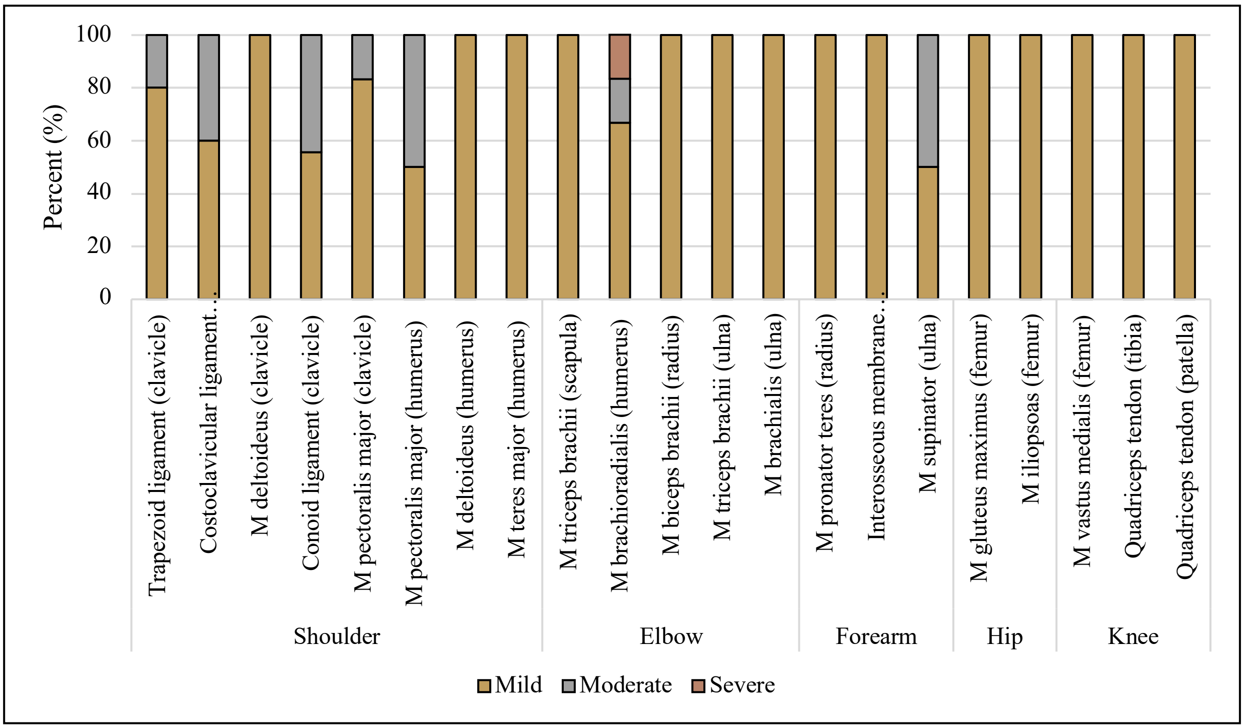


Figure 3.34. Mosphilia: Frequency distribution of mild, moderate, and severe robusticity ranks by muscle. N:98.

3.2.2.2.2 Robusticity: relationship between score development, side, sex, and age

Concerning the bilateral asymmetry, only a few entheses were equally represented by side such as the *pectoralis major* and the *teres major*. Overall, the left entheses (=51) prevailed over the right (=47). The *triceps brachii* (ulna and scapula) and the *quadriceps tendon* (patella and tibia) were not compared as, in the first case, scores were available only for the left side while, in the second case, scores were available for the left side (Figure 3.35).

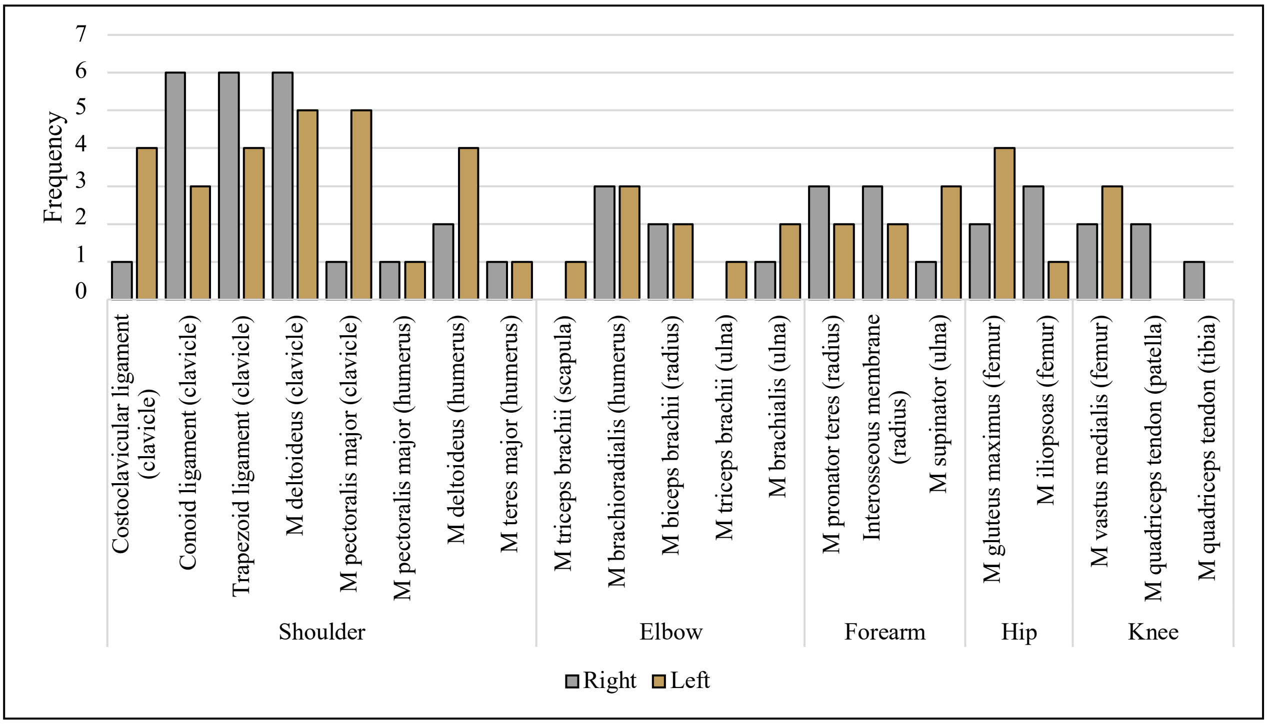


Figure 3.35. Mosphilia: Frequency distribution of the observed entheses by side. N:98.

Thus, as shown in figure 3.36, the *conoid*, the *brachioradialis*, and the *pectoralis major* (humerus) had pronounced development on the right side, while the *pectoralis major* (clavicle), the *trapezoid*, the *costoclavicular*, and the *supinator* displayed more pronounced expressions on the left side. Apart from the cases in which the observed entheses were equally distributed by side (e.g., *pectoralis major*), in the other cases, the disparities in representation prevented the assessment of the bilateral asymmetry. Indeed, the most severe scores were noted in correspondence of the better-represented side.

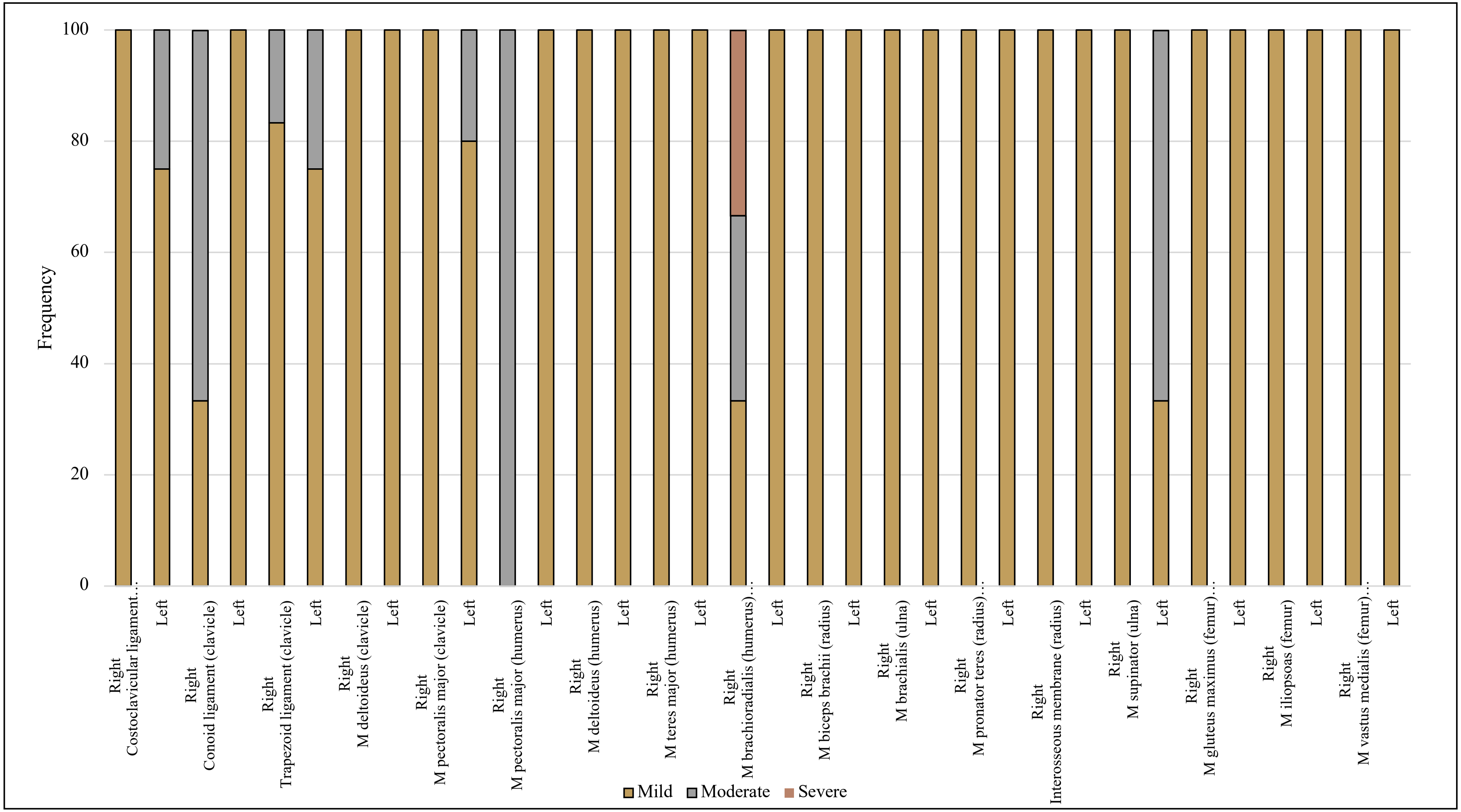


Figure 3.36. Mosphilia: Frequency distribution of mild, moderate, and severe robusticity by side. N:93.

Looking at the pooled functional complexes, only two functional complexes were equally represented: the hip and the forearm. The left entheses prevailed over the right in the shoulder (26/50, 52.0%) and the elbow (10/16, 62.5%); while the right entheses prevailed over the left in the knee (5/8, 62.5%) (Figure 3.37).

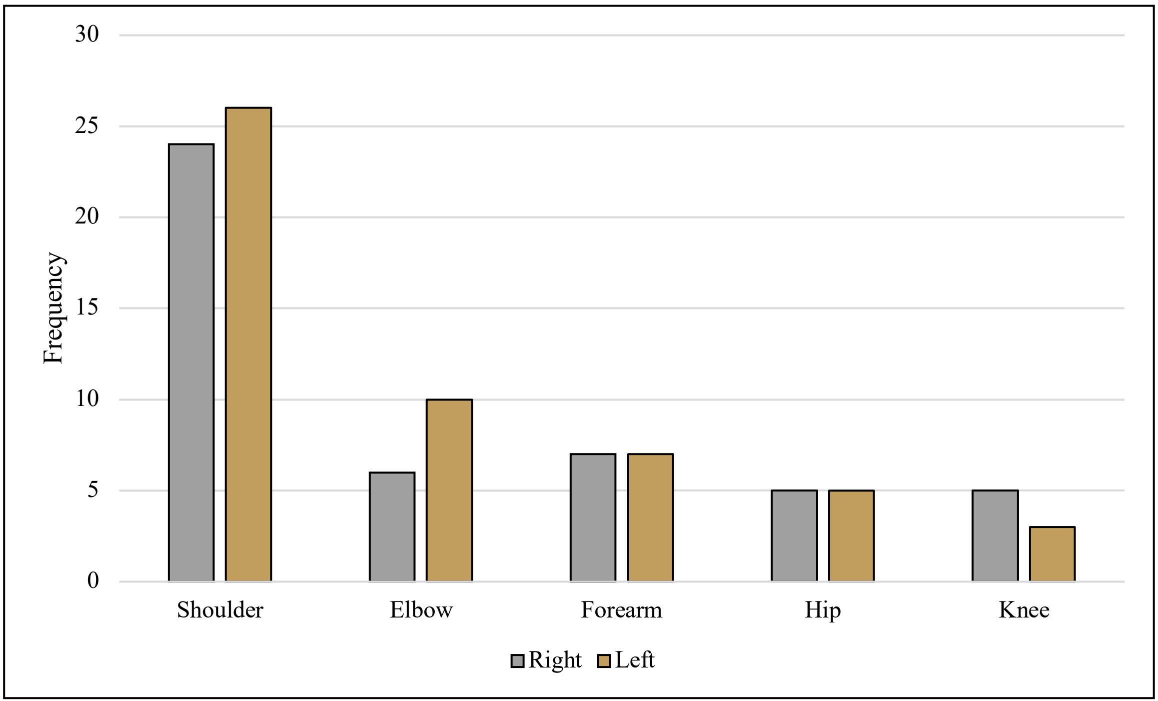


Figure 3.37. Mosphilia: Frequency distribution of the observed entheses by side (pooled functional complexes). N:98.

Despite being underrepresented, both in the case of the shoulder and the elbow, the right side yielded the highest rates of moderate robusticity. In the shoulder, the percentage of moderate ranks found on the right side (7/24, 29.2%) prevailed over the rate observed on the left (3/26, 11.5%); in the elbow, only the right side exhibited moderate (1/6, 16.7%) and severe robusticity ranks (1/6, 16.7%). The forearm, on the contrary, exhibited more severe robusticity ranks on the left side (2/7, 28.6%). These differences were however not statistically significant (shoulder p-value=0.123, elbow p-value=0.313, forearm p-value=0.383, hip p-value=1.000, knee p-value=1.000).

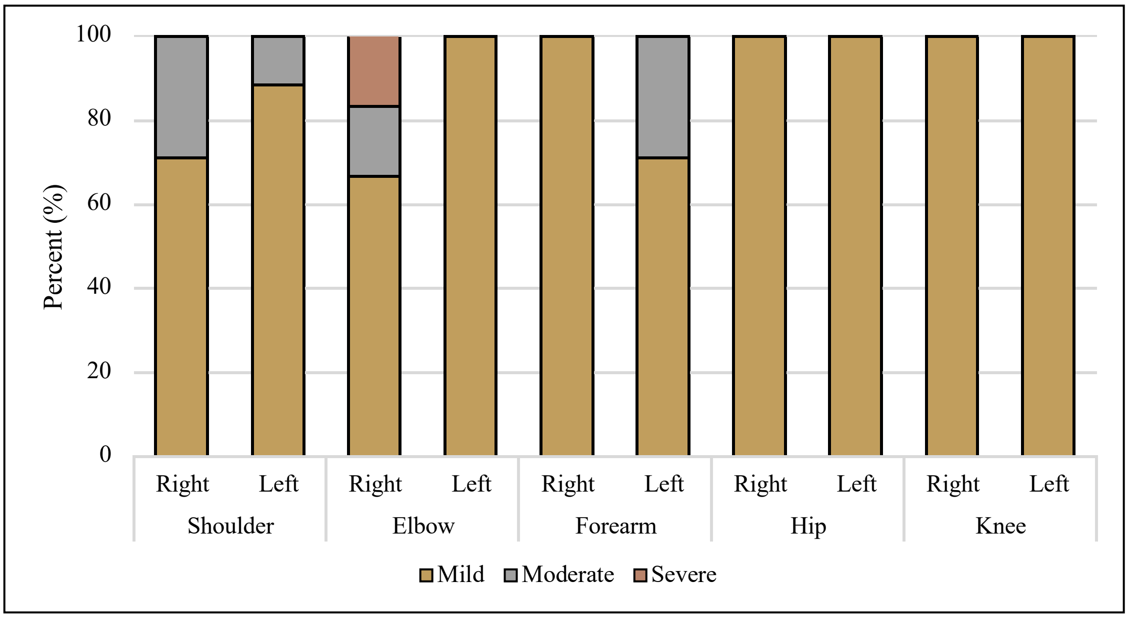


Figure 3.38. Mosphilia: Frequency distribution of mild, moderate, and severe robusticity ranks by side (pooled functional complexes). N:98.

Concerning the comparisons between sexes, as expected, given the bias in representation between females (=12) and males (=6), the number of the entheses belonging to the females (=64) greatly exceeded the number of those pertaining the males (=34) (Figure 3.39). A number of entheses were not represented by both the sexes including the *pectoralis major* and the *teres major*. The greatest bias in representation was observed on the *pectoralis major* (clavicle): 1:5 in favour of the females.

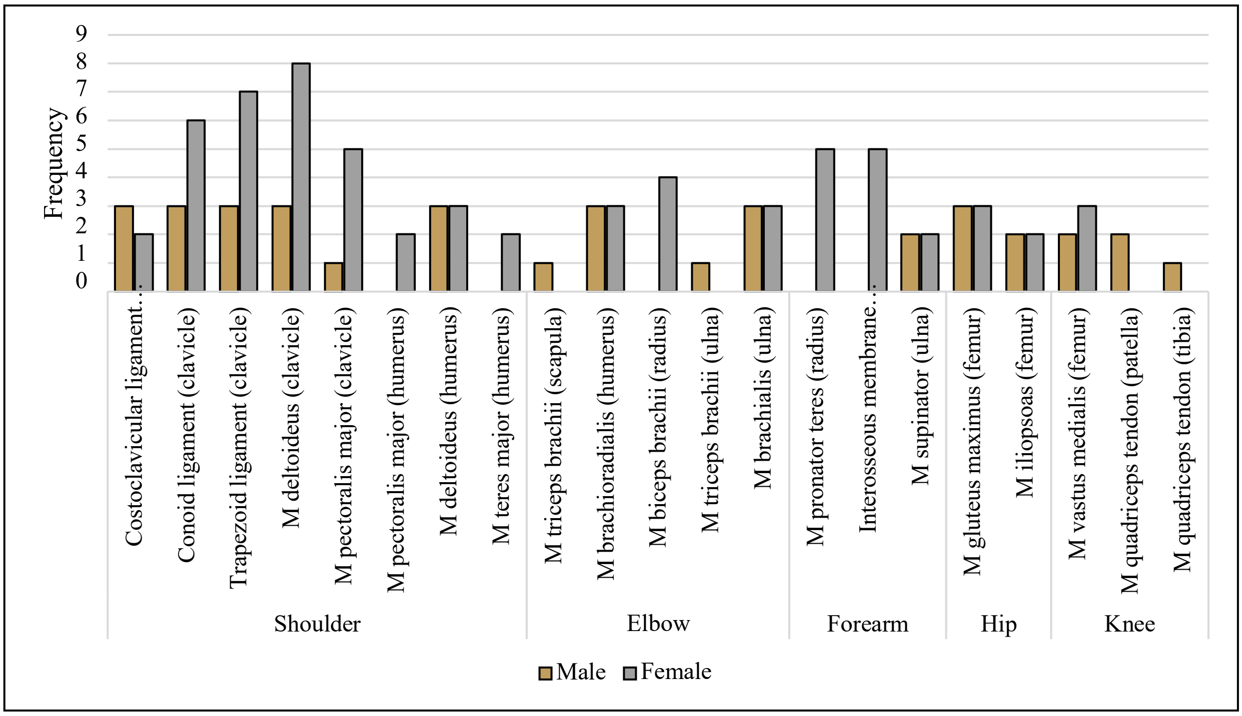


Figure 3.39. Mosphilia: Frequency distribution of the observed entheses by sex. N:98.

Figure 3.40 and figure 3.41 show that sexually dimorphic patterns occurred in this group. More specifically, the males displayed more severe ranks on the *conoid*, the *costoclavicular* and the *brachioradialis*; while the females exhibited more severe forms on the *trapezoid ligament*, the *pectoralis major* (clavicle), and *supinator*.

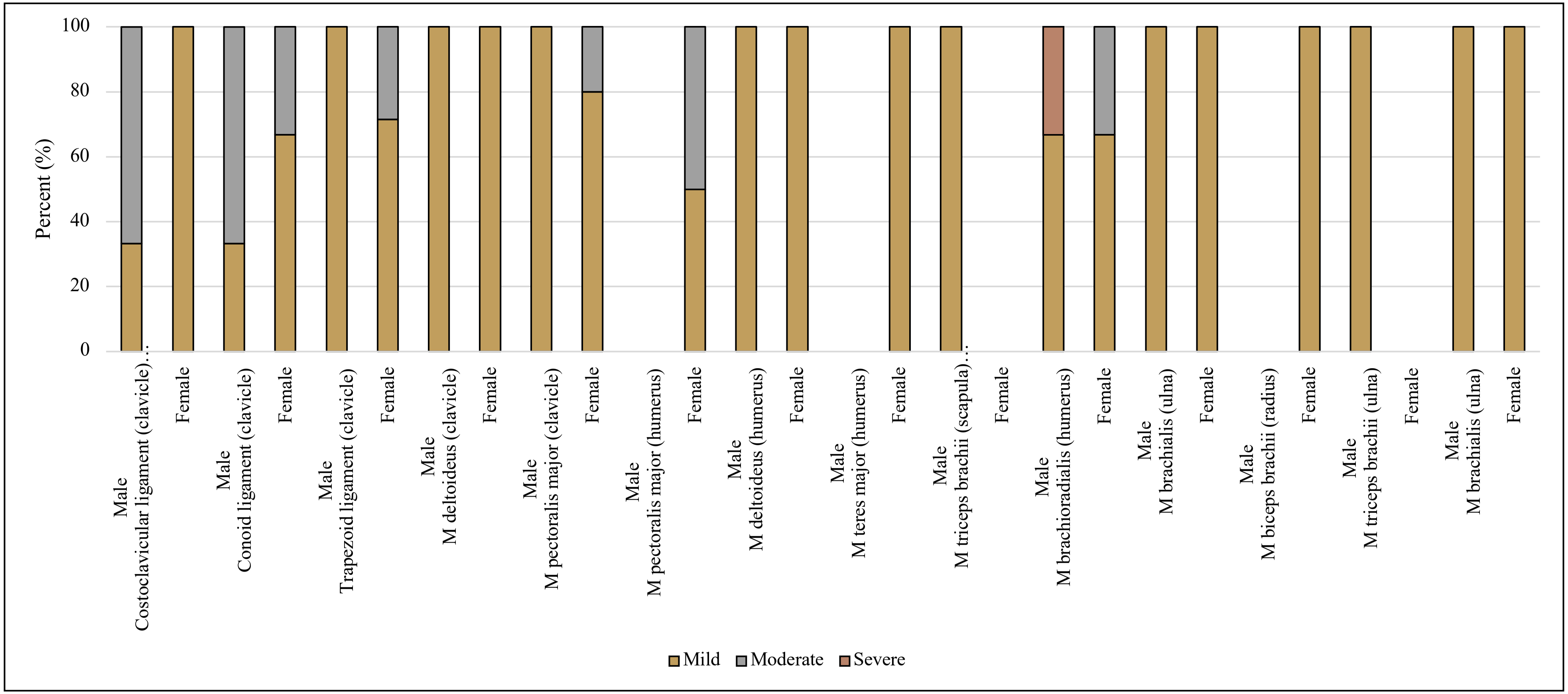


Figure 3.40. Mosphilia: Frequency distribution of mild, moderate, and severe robusticity by sex (shoulder and elbow). N:66.

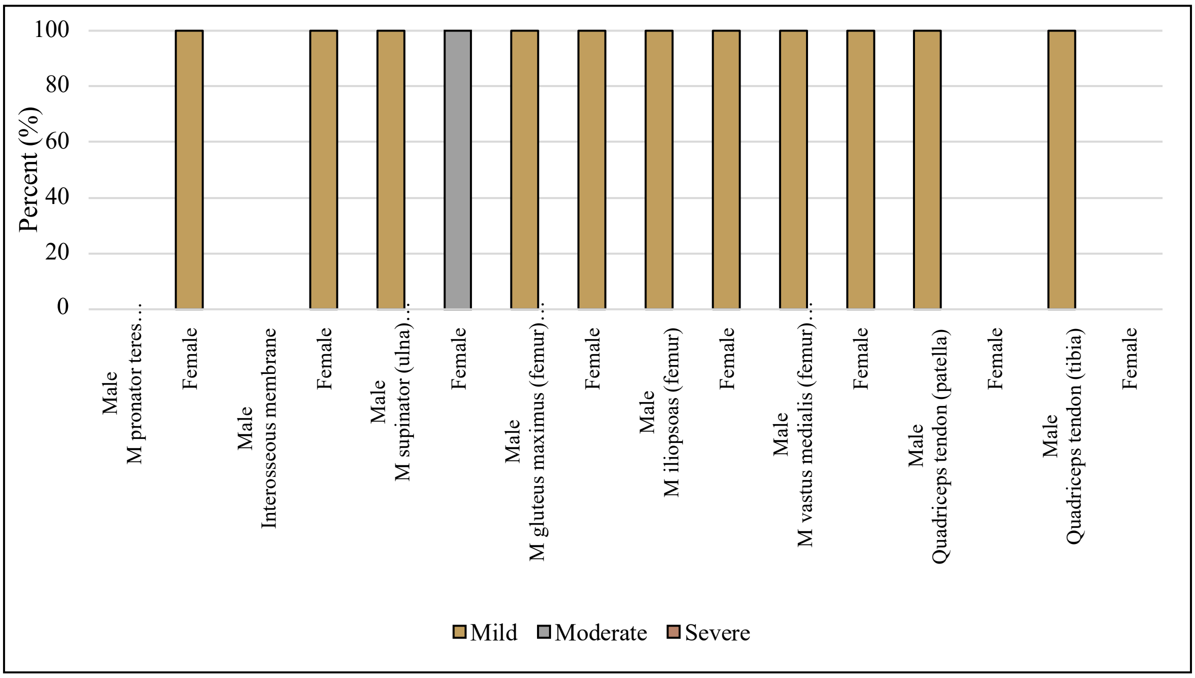


Figure 3.41. Mosphilia: Frequency distribution of mild, moderate, and severe robusticity by sex (forearm, hip, and knee). N:32

Looking at the comparisons between the sexes, the female category was better represented than the male sub-sample in the shoulder, elbow, and forearm; the hip was equally represented. Finally, the knee was slightly better represented by male entheses (5/8, 62.5%) than female entheses (3/8, 37.5%).

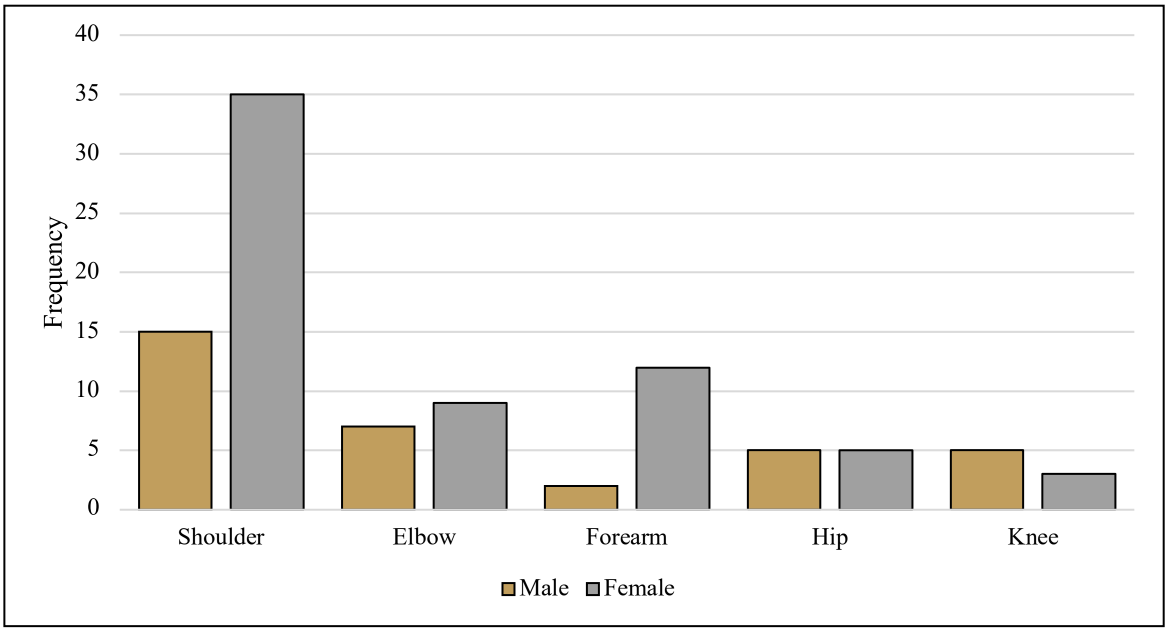


Figure 3.42. Mosphilia: Frequency distribution of the observed entheses by sex (pooled functional complexes). N:98.

In terms of severity distribution, males exhibited the most severe robusticity ranks in all the functional complexes belonging to the upper limb except in the forearm, where females yielded 16.7% (2/12) moderate degrees compared with 0.0% (0/2) moderate forms recorded on the males. It must be noted, in this case, that the very low representativity of the male entheses prevented any proper comparisons. The lower limb entheses, instead, provided only mild degrees in both sexes (Figure 3.43).

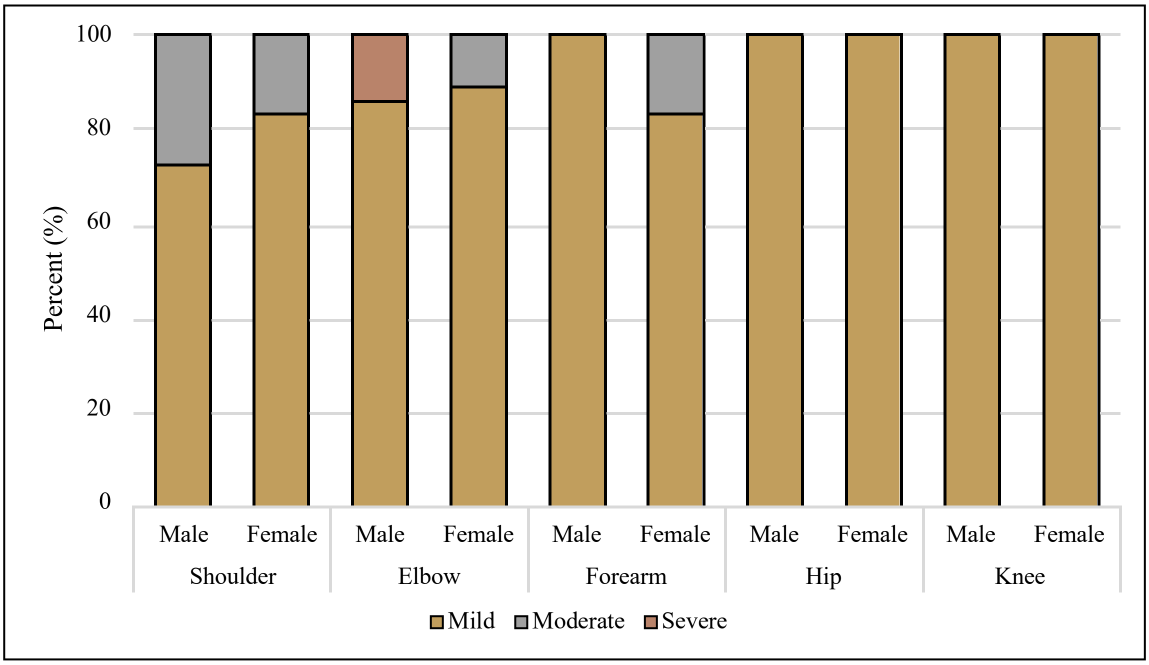


Figure 3.43. Mosphilia: Frequency distribution of mild, moderate, and severe robusticity ranks by sex (pooled functional complexes). N:98.

Despite these differences, the Mann-Whitney *U*-test did not reveal any significant difference in the distribution of the robusticity ranks between the sexes (shoulder p-value= 0.445, elbow p-value=0.918, forearm p-value=0.791, hip p-value=1.000, knee p-value=1.000).

Concerning the comparisons between the age groups, by combining the observed entheses in functional complexes, it is evident that all three age groups were represented, however not equally, in all five functional complexes. With regards to the shoulder, the younger adults yielded the greatest number of entheses (18/98, 62.1%), followed by the middle (17/98, 41.5%) and the mature adults (15/98, 53.6%). As for the forearm, the hip, and the knee, the middle adults were the best-represented category, followed by the mature and the young adults. Finally, concerning the elbow, the middle adult entheses prevailed over the young and the mature adult ones.

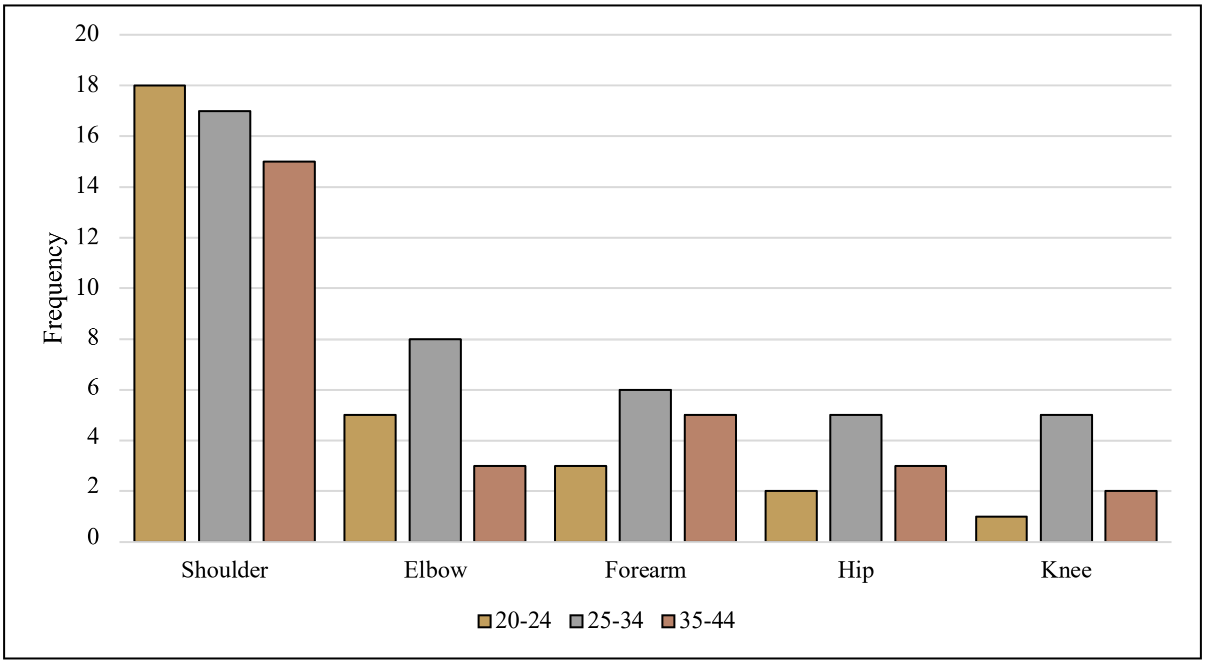


Figure 3.44. Mosphilia: Frequency distribution of the observed entheses by age category (pooled functional complexes). N:98.

The frequency assessment in figure 3.45 shows that, overall, the severity of this marker increases with age. The only exception is represented by the forearm where the younger adults, despite being underrepresented, yielded 33.3% (1/3) moderate degrees compared with 20.0% (1/5) from the mature adults.

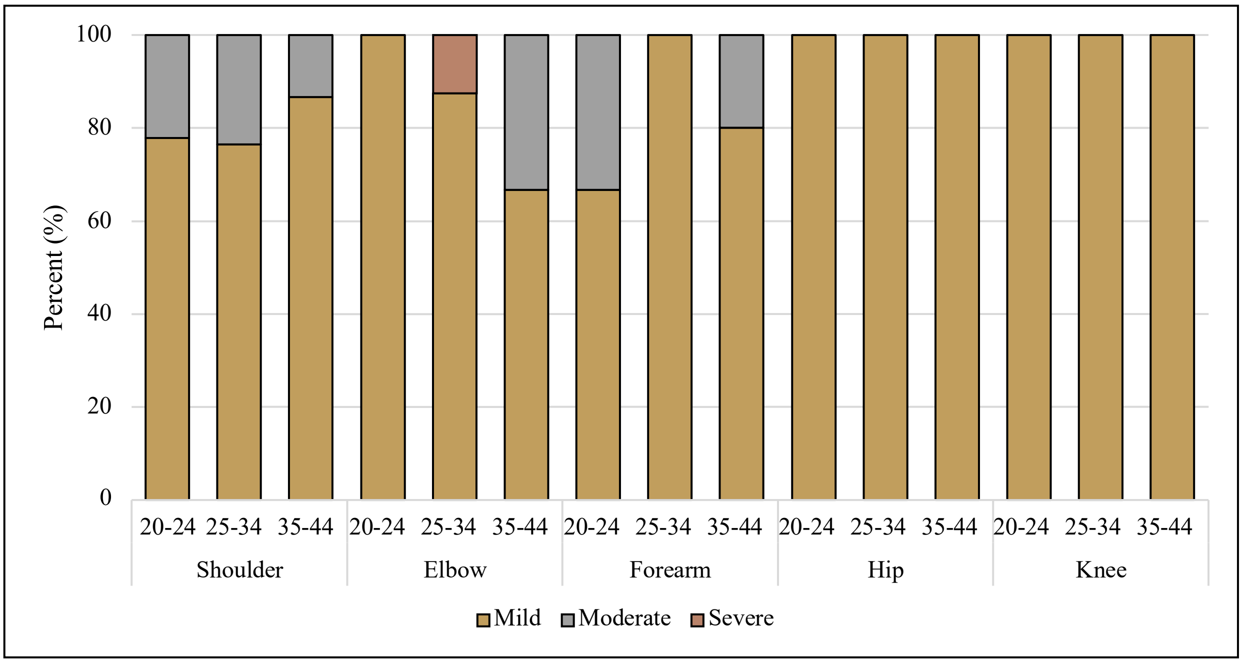


Figure 3.45. Mosphilia: Frequency distribution of mild, moderate, and severe robusticity ranks by age category (pooled functional complexes). N:98.

However, these differences in the distribution of the robusticity ranks between the age categories were not statistically significant (shoulder p-value= 0.774, elbow p-value=0.456, forearm p-value=0.391, hip p-value=1.000, knee p-value=1.000).

3.2.2.2.3 Osteolytic and Enthesophytic formations: relationship between score development and enthesis

OLs and EFs were not present on all the observed entheses. More specifically, the OLs were rarely found, affecting only 18.4% (18/98) of the entheses under study; while the EFs were more frequent and were detected on 21.4% (21/98) of the observed surfaces.

For which concern the OLs, the *biceps brachii* was the most affected (3/4, 75.0%) followed by the *brachioradialis* (3/6, 50.0%) and the *iliopsoas* (2/4, 50.0%) (Figure 3.46). The *quadriceps tendon* (patella) displayed 100.0% of affections but they refer to a single enthesis.

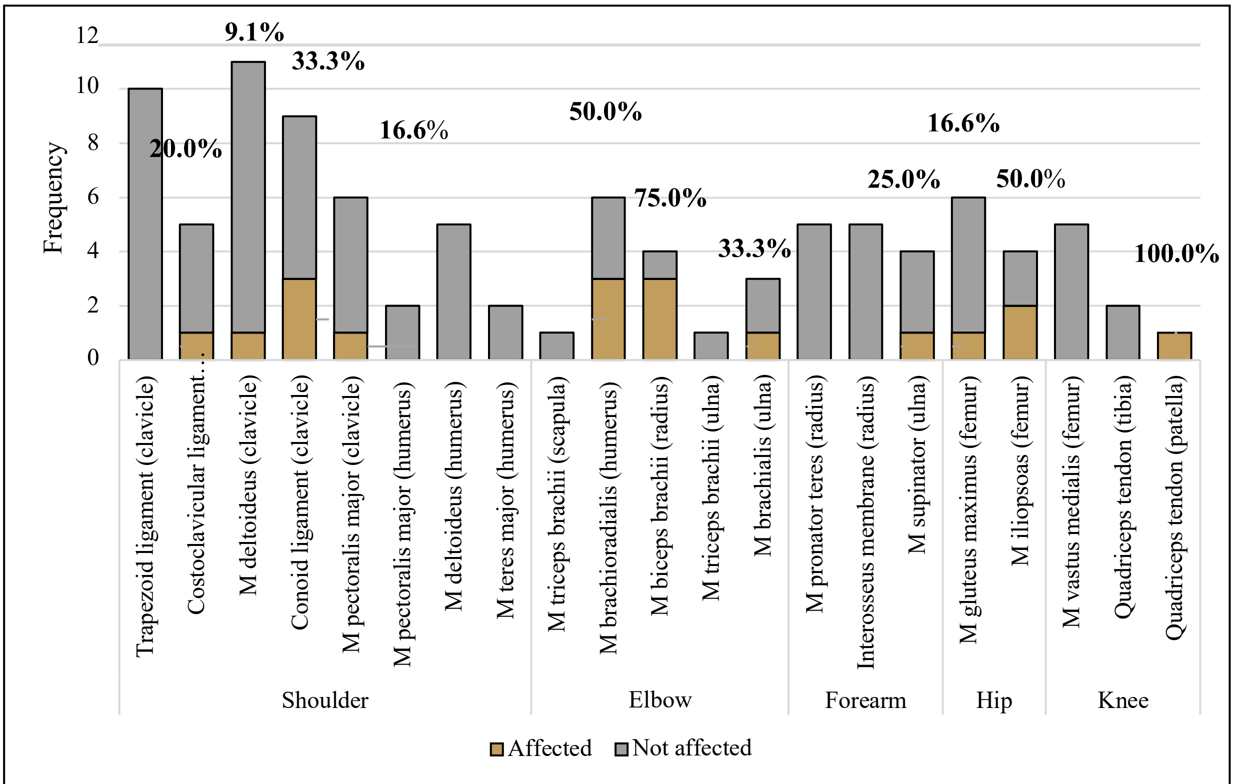


Figure 3.46. Mosphilia: Frequency distribution of the entheses affected by OLs by muscle. N:98.

Overall, the mild lesions (=14) prevailed over the moderate (=4); no severe cases were found. As can be appreciated by figure 3.47, four entheses - *costoclavicular ligament* and *conoid ligament*, *deltoideus* (clavicle), *brachialis* and *quadriceps tendon* (patella) - exhibited only moderate evidence. This percentage, however, refers to a single enthesis affected.

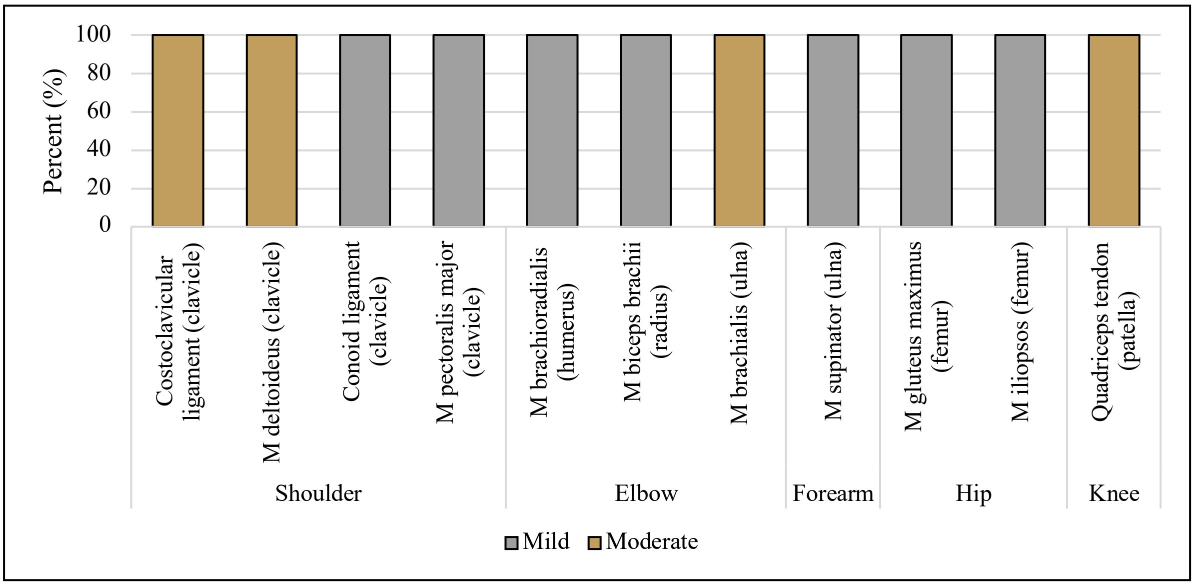


Figure 3.47. Mosphilia: Frequency distribution of mild and moderate OLs ranks by muscle. N:18.

By pooling the entheses in functional complexes, the elbow was the most affected (7/16, 43.8%), followed by the hip (3/10, 30.0%) and the knee (1/8, 12.5%). The forearm is the least affected with only 7.1% (1/14) lesions.

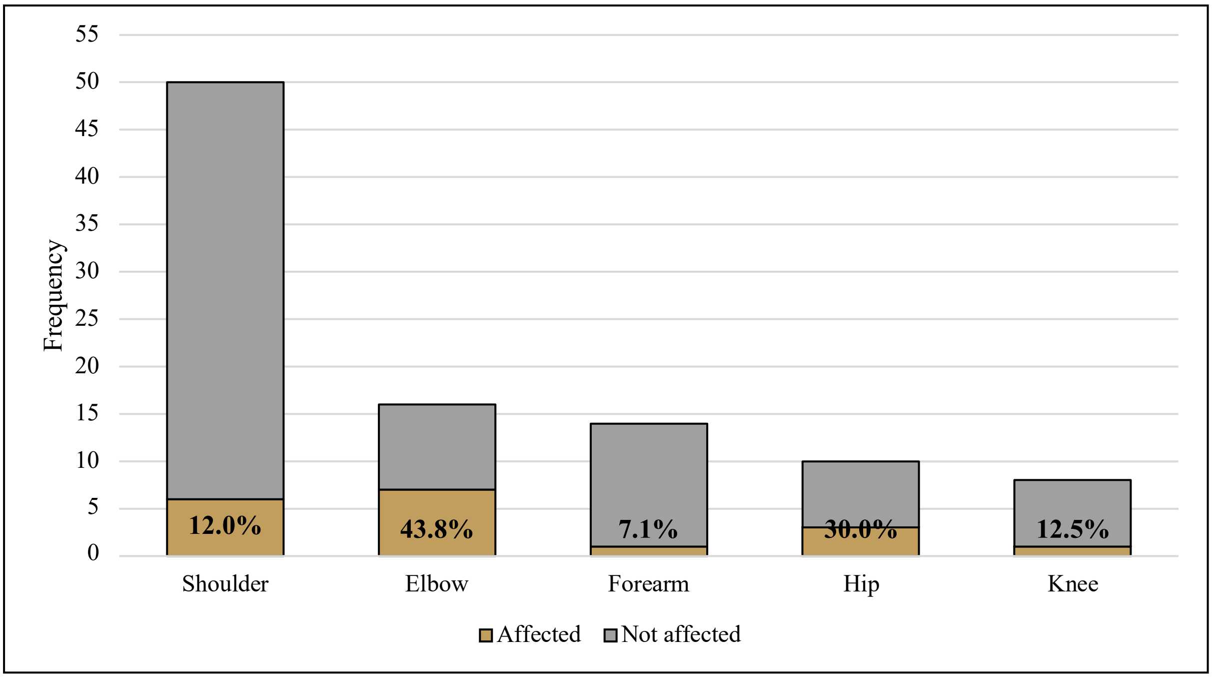


Figure 3.48. Mosphilia: Frequency distribution of the entheses affected by OLs by functional complex. N:98.

For which concerns the severity distribution of this marker, the most severely affected was the shoulder with 33.3% (2/6) moderate degrees, followed by the elbow with 14.3% (1/7) moderate forms. The only affected enthesis was ranked as moderate (Figure 3.49).

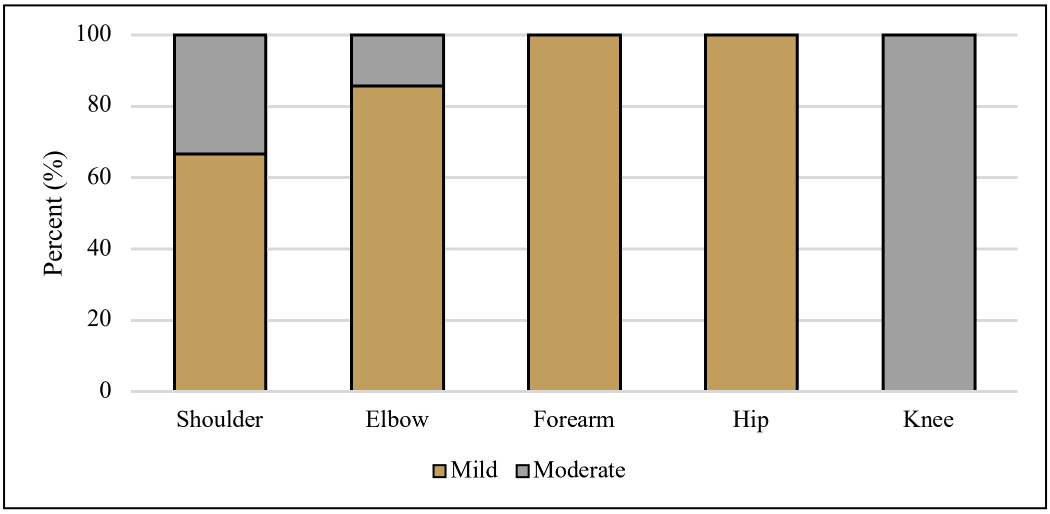


Figure 3.49. Mosphilia: Frequency distribution of mild and moderate OLs ranks by functional complex. N:18.

Moving to the EFs, the most affected entheses were the *gluteus maximus* and the *iliopsoas* (3/6, 50.0% and 2/4, 50.0% respectively), followed by the *conoid ligament* (4/9, 44.4%) (Figure 3.50).

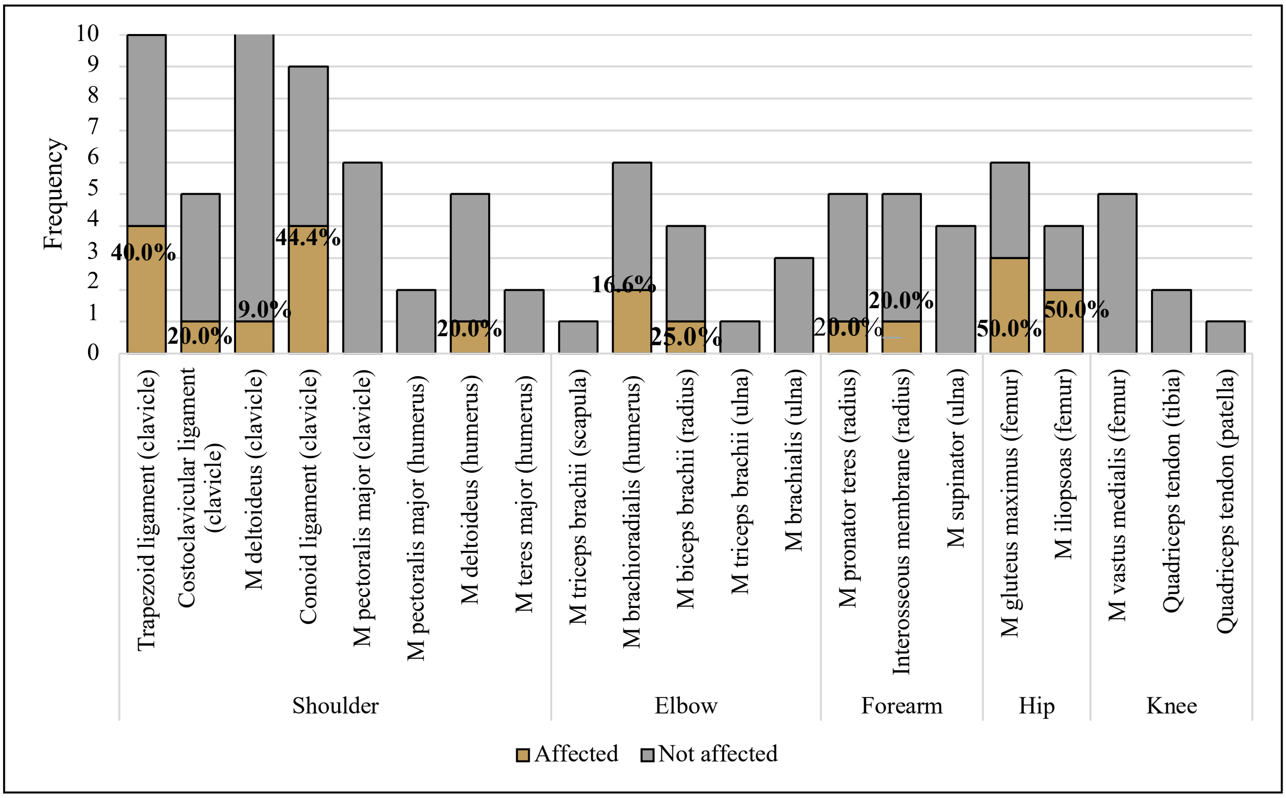


Figure 3.50. Mosphilia: Frequency distribution of the entheses affected by EFs by muscle. N:98.

For which concerns the severity distribution of this marker, all affected surfaces exhibited mild forms except the *conoid ligament* (1/1, 100.0), the *trapezoid ligament* (2/4, 50.0%) and the *deltoideus* (clavicle) (1/4, 25.0%) which displayed moderate degrees (Figure 3.51).

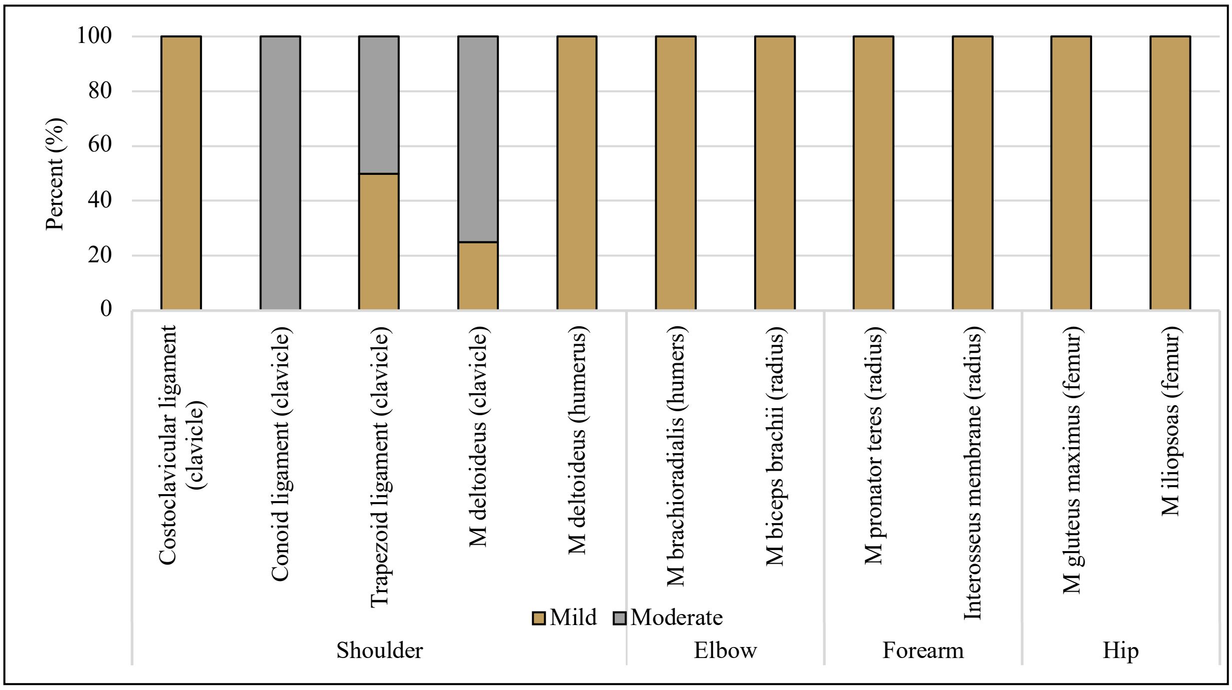


Figure 3.51. Mosphilia: Frequency distribution of mild and moderate EFs ranks by muscle. N:21.

By pooling the entheses in functional complexes, the hip was found to be the most affected (5/10, 50.0%), followed by the shoulder (11/50, 22.0%) and elbow (3/16, 18.8%) (Figure 3.52). No affection was observed on the knee.

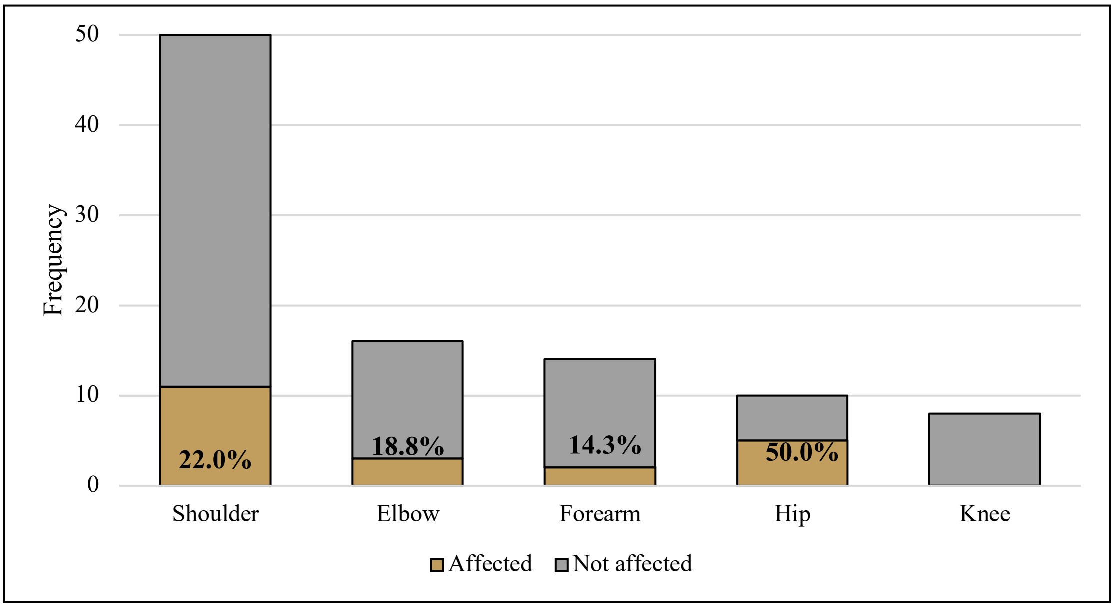


Figure 3.52. Mosphilia: Frequency distribution of the entheses affected by EFs by functional complex. N:98.

In terms of severity distribution, the shoulder was the only functional complex which exhibited moderate forms (6/11, 54.5%) (Figure 3.53).

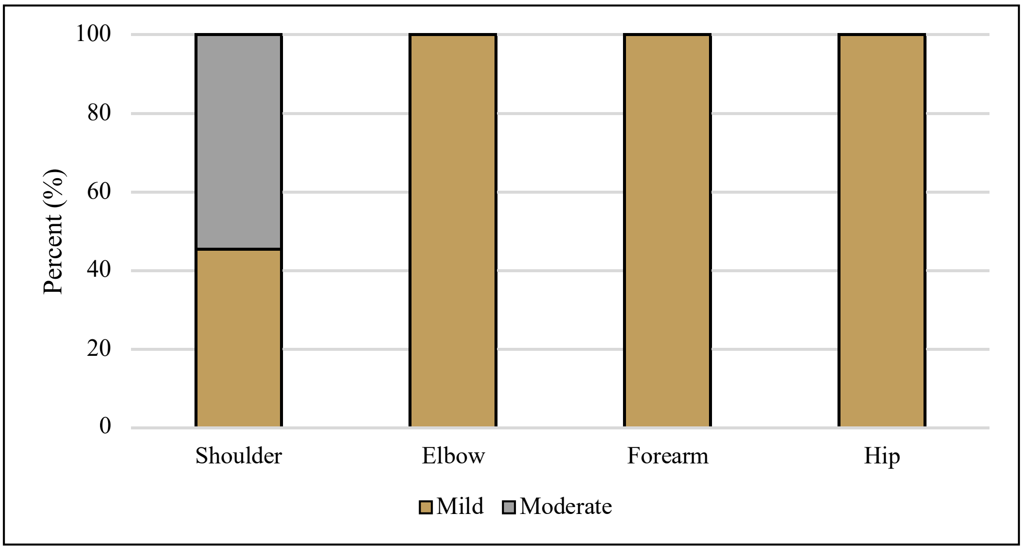


Figure 3.53. Mosphilia: Frequency distribution of mild and moderate EFs ranks by functional complex. N:21.

3.2.2.2.4 Osteolytic and Enthesophytic formations: relationship between score development, side, sex, and age

Looking at the distribution of the OLs by side, the right side was found to be more affected in all the functional complexes except in the hip, where an opposite pattern was noted. The forearm and the knee were excluded from comparisons as, in these two cases, the left side did not provide evidence of affections (Figure 3.54).

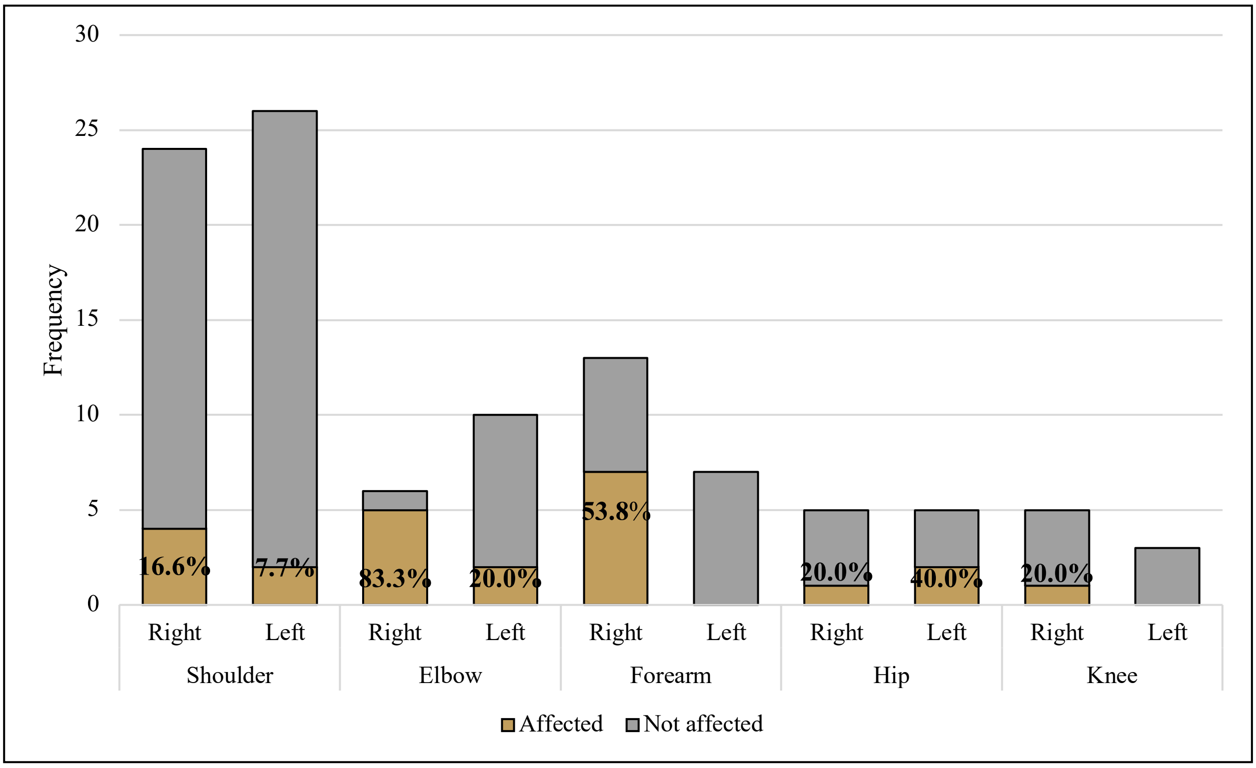


Figure 3.54. Mosphilia: Frequency distribution of entheses affected by OLs by side (pooled functional complexes). N:98.

Thus, considering only the surfaces affected, the left side of the shoulder was more severely affected, providing 50.0% (1/2) moderate degrees, than the right (¼, 25.0%); while the elbow exhibited more severe affections on the right side (1/5, 20.0%) than the left side (0/2, 0.0% of moderate degrees) (Figure 3.55). The hip provided only mild forms of OLs on both sides.

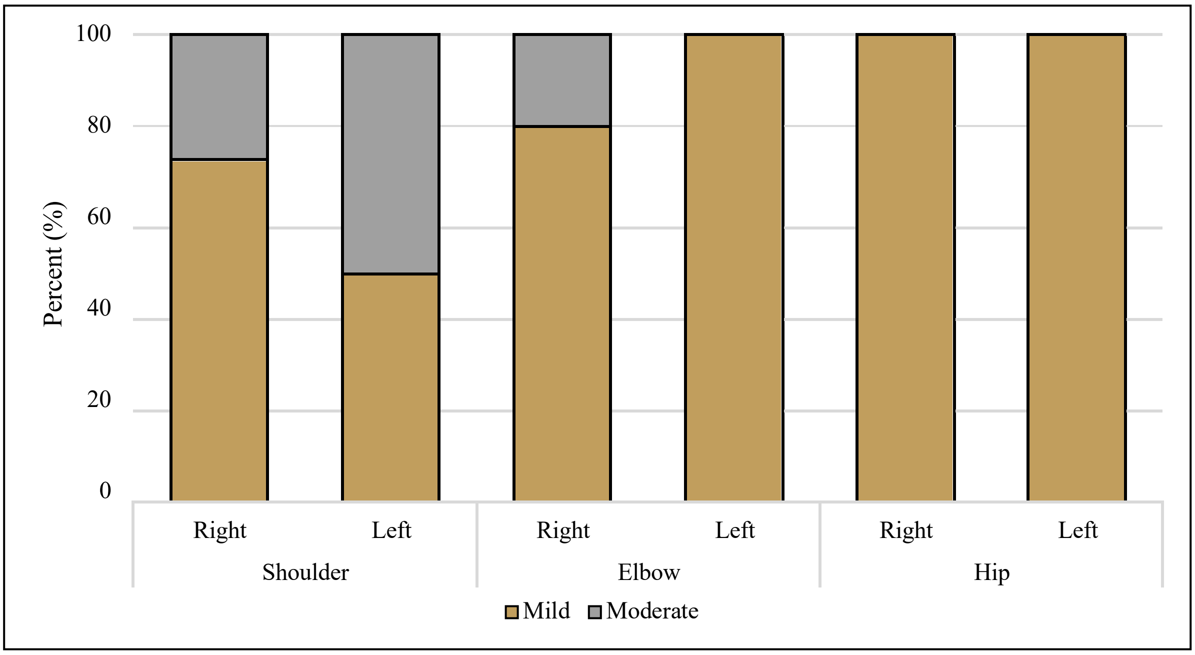


Figure 3.55. Mosphilia: Frequency distribution of mild and moderate OLs ranks by side (pooled functional complexes). N:18.

Despite these results, the Mann-Whitney *U*-test did not reveal any significant difference (shoulder p-value=0.800, elbow p-value=0.857, hip p-value=1.000).

For which concerns the distribution of the EFs between the sides, the elbow, the forearm, and the knee were excluded from comparisons because they did not display EFs on both sides (Figure 3.56). In the other cases, the right side was found to be more affected (shoulder 7/24, 29.2% and hip 3/5, 60.0%) than the left (shoulder 4/26, 15.4% and hip 2/5, 40.0%).

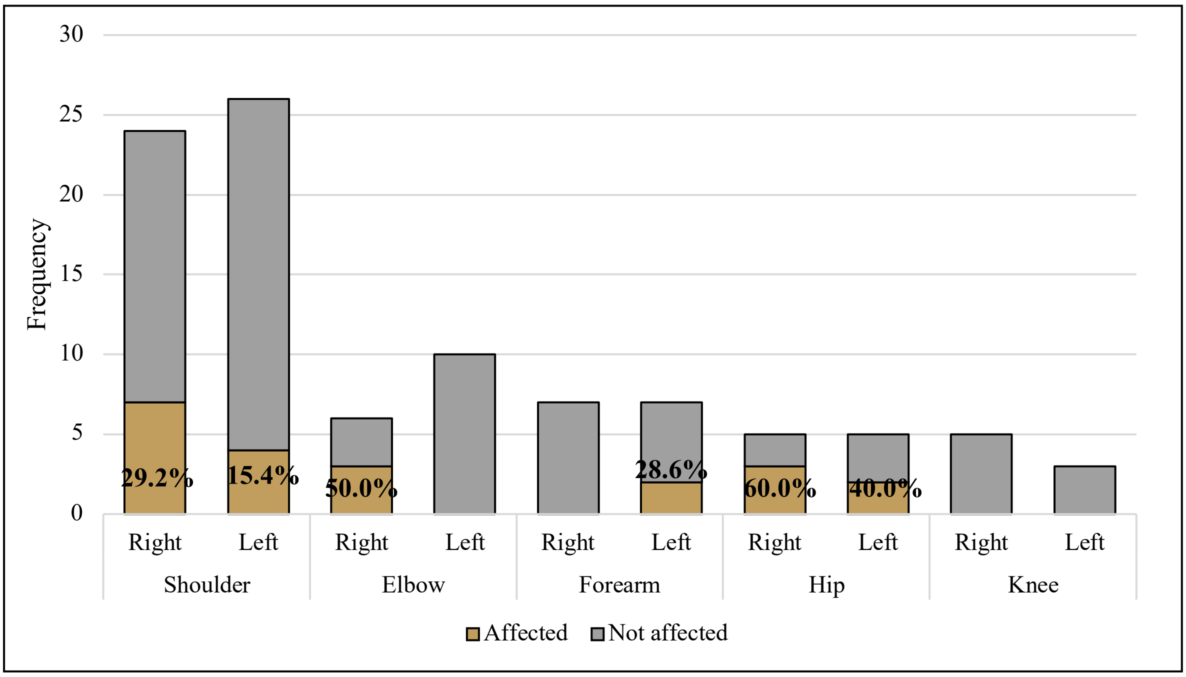


Figure 3.56. Mosphilia: Frequency distribution of entheses affected by EFs by side (pooled functional complexes). N:98.

Thus, focusing on the number of surfaces affected, the right side of the shoulder exhibited a greater proportion of moderate degrees (4/7, 57.1%) compared with the left (2/4, 50.0%). For which concerns the hip, both the sides provided only mild forms (Figure 3.57).

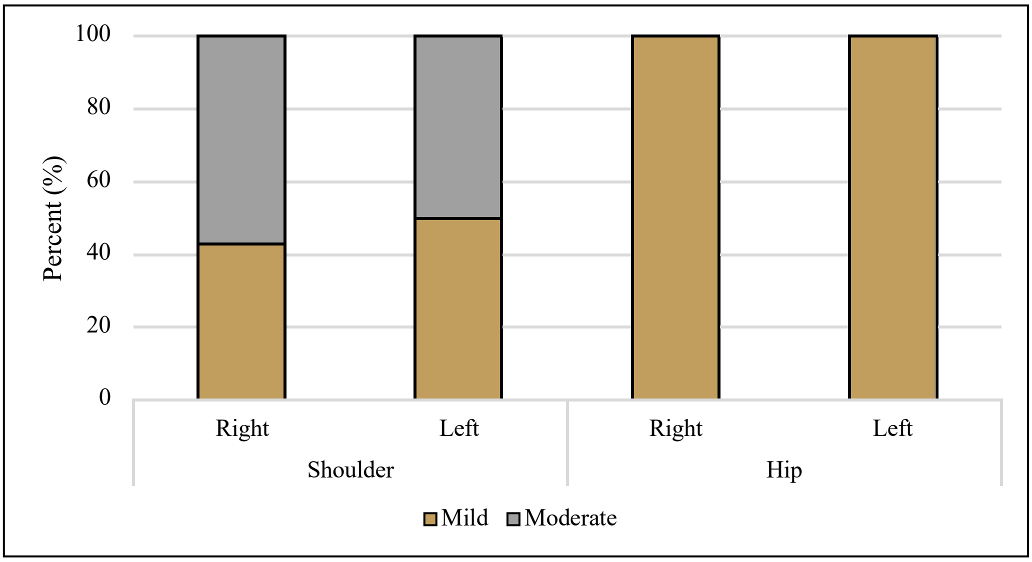


Figure 3.57. Mosphilia. Frequency distribution of mild and moderate EFs ranks by side (pooled functional complexes). N:16.

No significant differences were, however, revealed by the Mann-Whitney *U*-test (shoulder p-value=0.927, hip p-value=1.000).

For which concerns the distribution of the OLs ranks between sexes, this assessment was based on the analysis of four functional complexes, shoulder, forearm, elbow and hip, which were found to be affected (Figure 3.58). Males displayed a greater proportion of OLs on all the functional complexes except in the case of the elbow where the females provided a higher percentage of affections (4/9, 44.4%) compared with the counterpart (3/7, 42.9%).

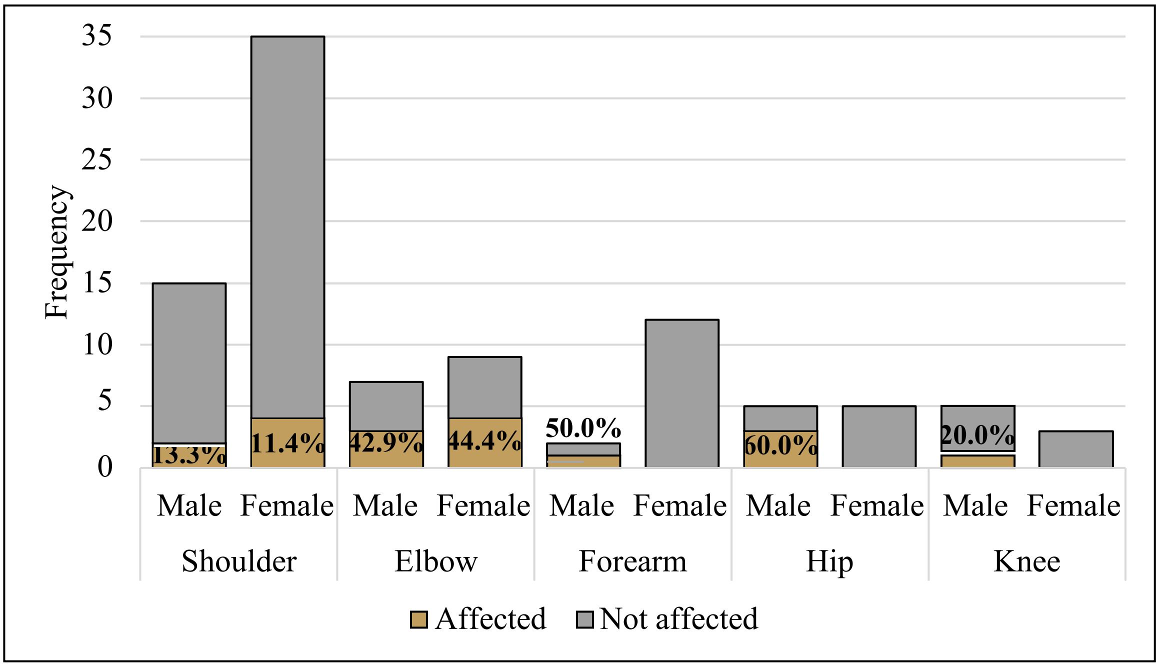


Figure 3.58. Mosphilia: Frequency distribution of entheses affected by OLs by sex (pooled functional complexes). N:98.

Thus, focusing on these complexes, the frequency assessment in figure 3.59 revealed that the males were more severely affected in all the comparable complexes.

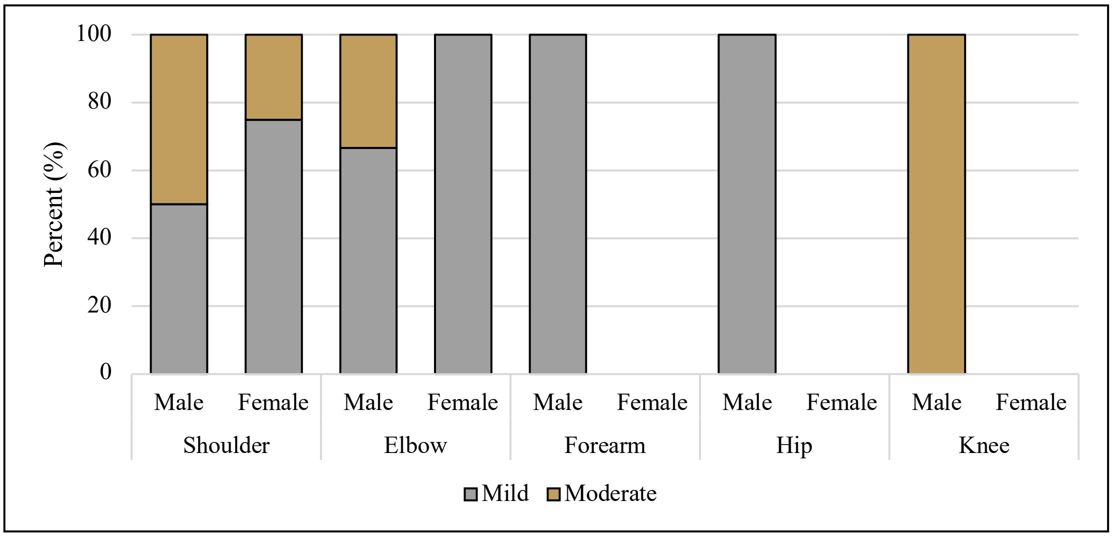


Figure 3.59. Mosphilia: Frequency distribution of mild and moderate OLs ranks by sex (pooled functional complexes). N:13

These differences in the OLs rank distribution between the sexes were not statistically significant (shoulder p=value 0.800, elbow p-value=0.629).

For which regard the EFs, despite being underrepresented, the entheses recorded on the male skeletons displayed greater rates of EFs on the shoulder and elbow: 4/15, 26.7% on the shoulder and 2/7, 28.6% on the elbow, compared with proportions observed on the females, 7/35, 20.0% on the shoulder and 1/9, 11.1% on the elbow. The opposite trend was noted on the hip, where the female entheses displayed a higher percentage of affections (3/5, 60.0%) compared with the males (2/5, 40.0%). As for the forearm, only female entheses exhibited this evidence.

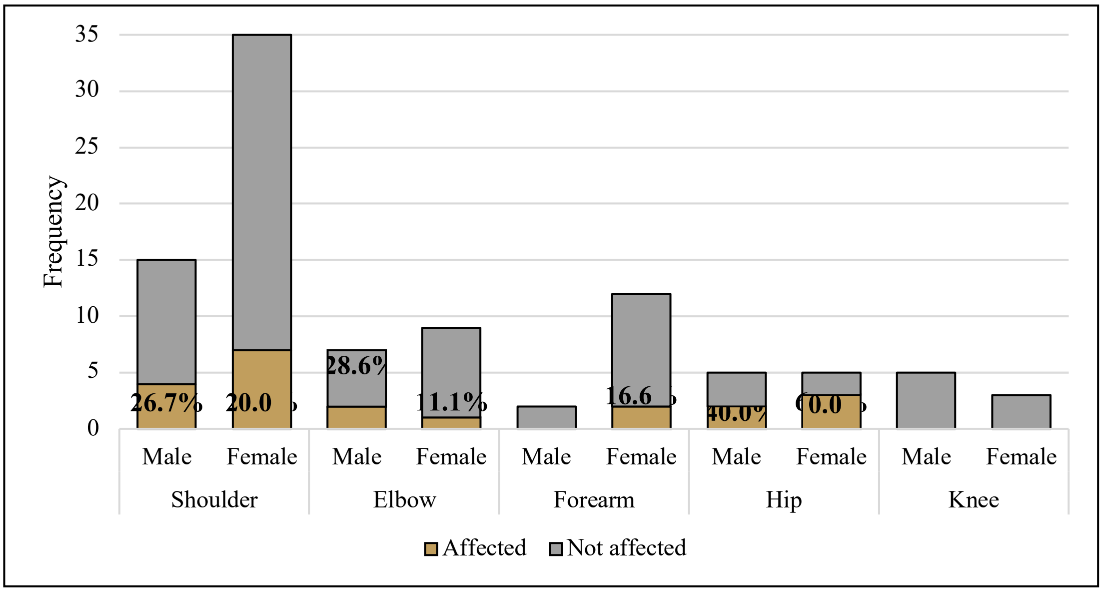


Figure 3.60. Mosphilia: Frequency distribution of entheses affected by EFs by sex (pooled functional complexes). N:98.

Looking at the severity distribution of this marker between the sexes, the only comparable functional complex, for which differences were detected, was the shoulder: indeed, the female entheses exhibited a greater proportion of moderate degrees (5/7, 71.4%) compared with the males (¼, 25.0%). It must be specified, however, that there was a bias in representation between the females and the males of the order of 2:1.

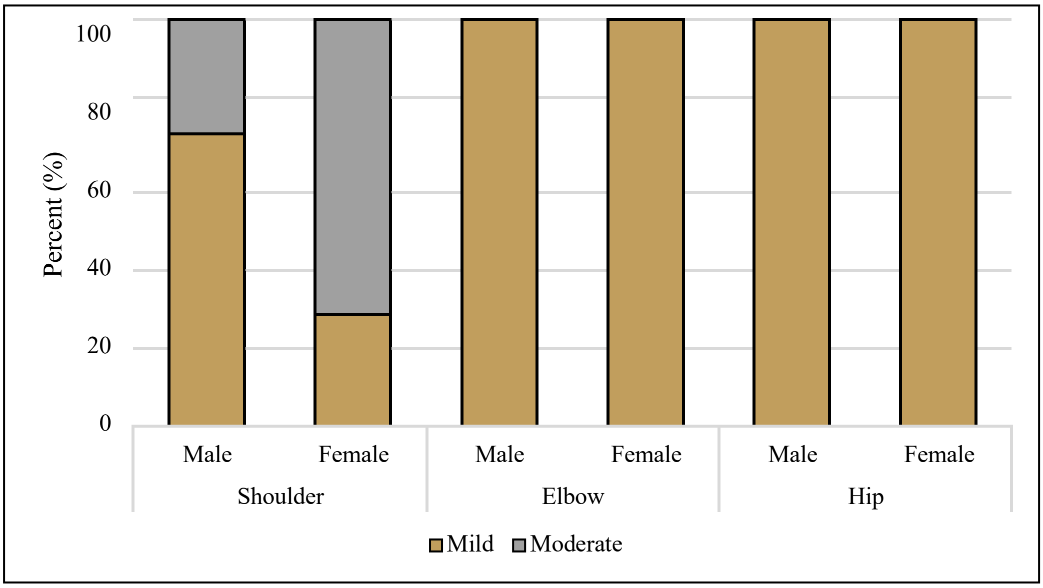


Figure 3.61. Mosphilia: Frequency distribution of mild and moderate EFs ranks by sex (pooled functional complexes). N:19

These differences were however not statistically significant (shoulder p-value=0.230, elbow p-value=1.000, hip p-value=1.000).

Finally, for which concerns the distribution of the two markers between the age categories, in the case of the OLs, the lower limb functional complexes and the forearm were excluded from comparisons as they showed affections only in the category 25-34, the middle adults. However, these few entheses affected by OLs were in mild form except that one observed on the knee, for which was assigned a moderate degree. For which concern the other functional complexes, it can be observed an increase in the number of affections from the young to the mature adult age range (Figure 3.62). The only exception to this general trend was represented by the elbow, where the percentage of affections of the young adults (2/5, 40.0%) slightly exceeded the number of affections of the middle adults (3/8, 37.5%).

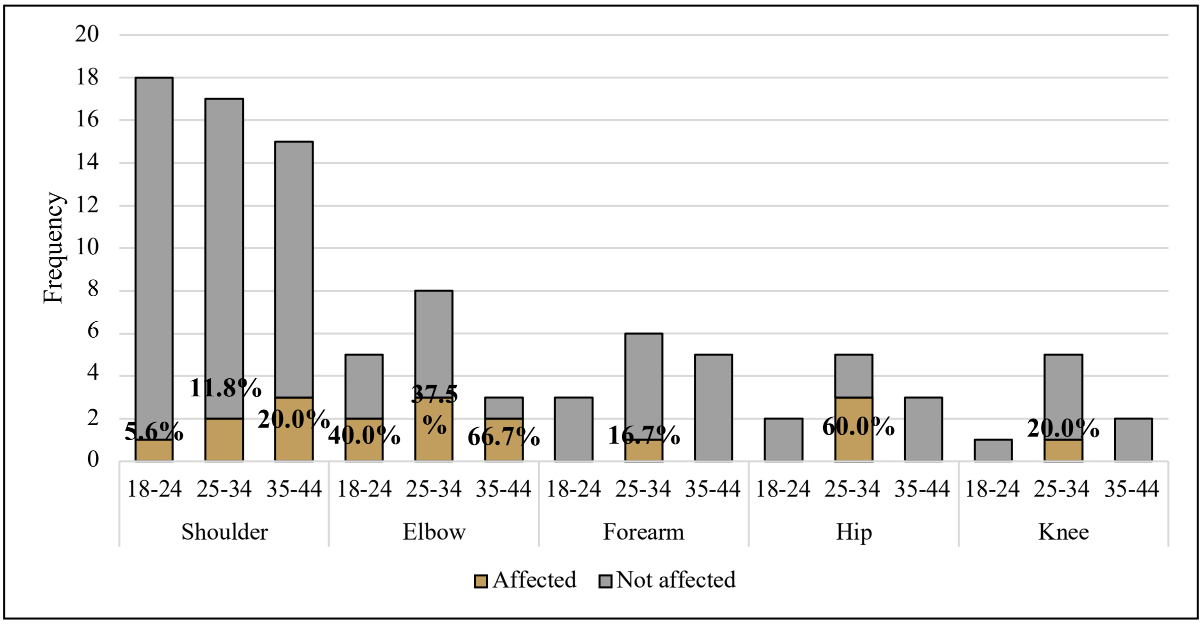


Figure 3.62. Mosphilia: Frequency distribution of entheses affected by OLs by age category (pooled functional complexes). N:98.

Focusing on the only comparable functional complexes, the middle adults displayed higher percentages of moderate OLs (½, 50.0%) compared with the mature adults (1/3, 33.3%) on the shoulder as well as on the elbow (Figure 3.63).

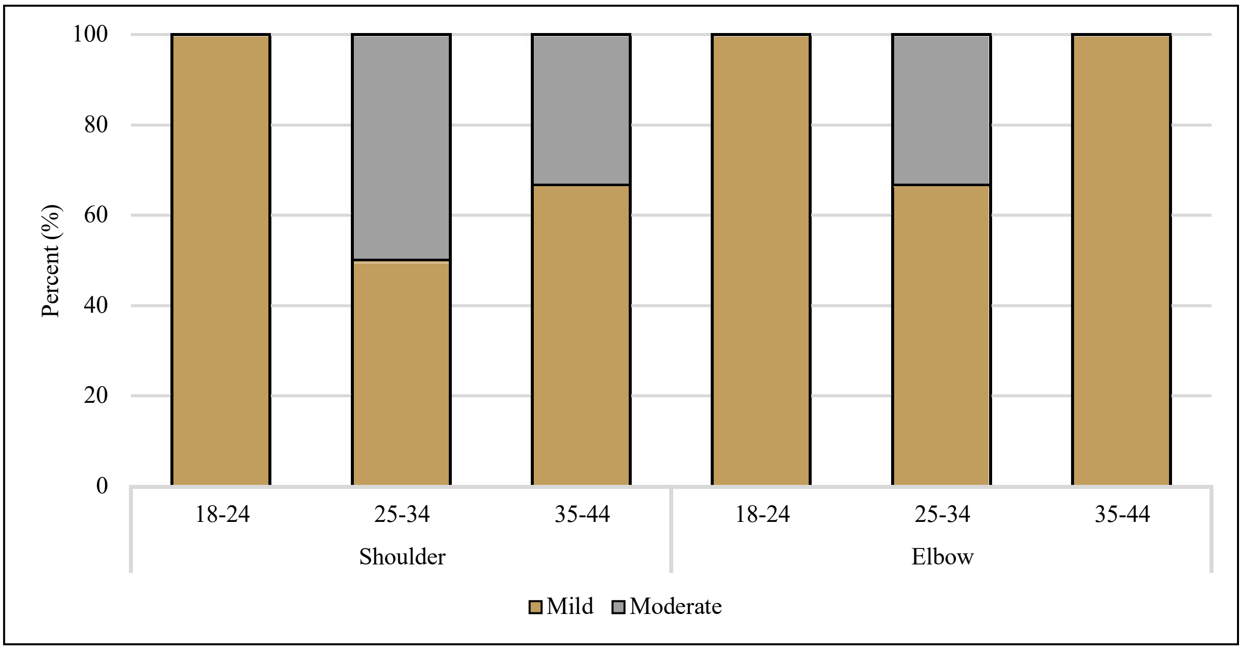


Figure 3.63. Mosphilia: Frequency distribution of mild and moderate OLs ranks by age category (pooled functional complexes). N:13.

No significant difference was revealed by the Kruskal-Wallis on both the complexes (shoulder p-value=0.732, elbow p-value=0.513).

Concerning the EFs, the forearm and the knee were excluded from comparisons as no more than one category exhibited affections. As in the case of the OLs, the upper limb entheses displayed a similar trend: the percentage of affections increased from the younger (4/18, 22.2% on the shoulder and 1/5, 20.0% on the elbow) to the middle age range (4/17, 23.5% on the shoulder and 2/8, 25.0% on the elbow); and decreased from the middle to the mature adult range (3/15, 20.0% on the shoulder and 0/3, 0.0% on the elbow) according to the proportion of entheses belonging to each category. For which concerns the hip, the number of EFs decreased from the younger (½, 50.0%) to the middle adults (2/5, 40.0%); and increased from the middle to the mature adults (2/3, 66.7%).

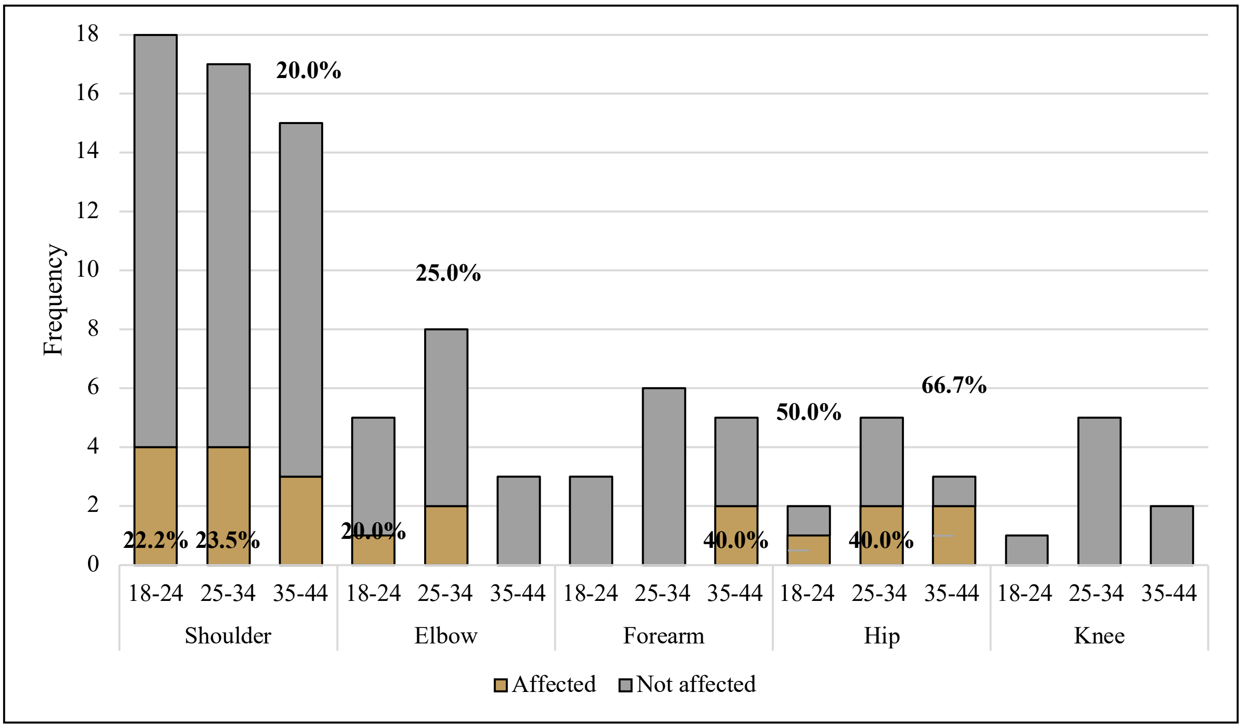


Figure 3.64. Mosphilia: Frequency distribution of entheses affected by EFs by age category (pooled functional complexes). N:98.

As for the severity of the manifestations, on the shoulder, the percentage of moderate degrees decreased from the young (¾, 75.0%) to the middle adults (¼, 25.0%), and increased from the middle to the mature adult range (2/3, 66.7%). No difference, instead, was observed on the elbow and the hip.

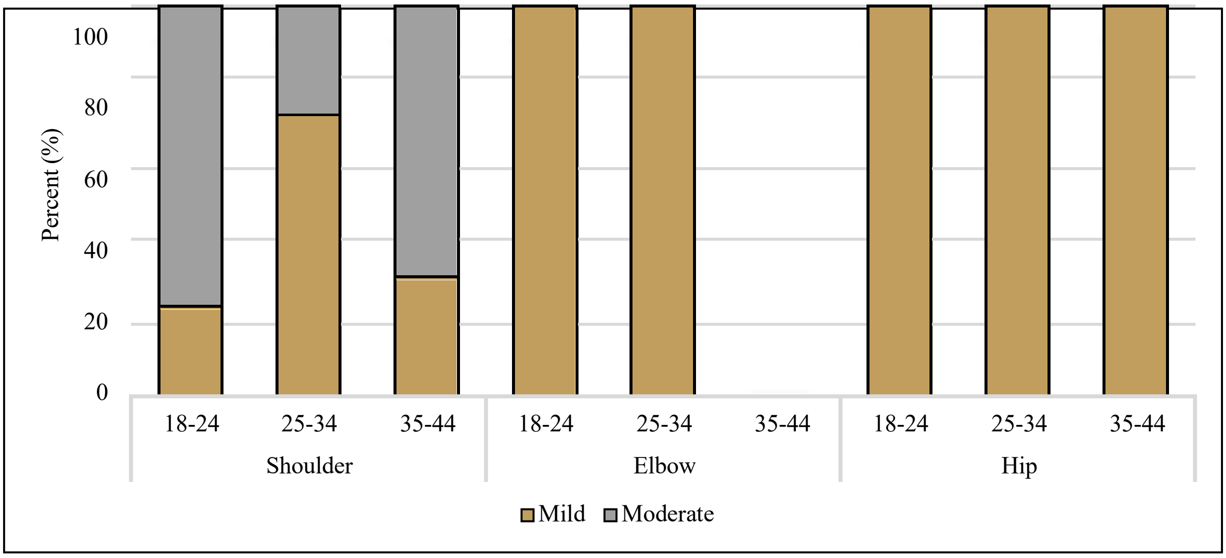


Figure 3.65. Mosphilia: Frequency distribution of mild and moderate EFs ranks by age category (pooled functional complexes). N:19

No significant difference was observed between the three age groups by carrying out the Kruskal-Wallis test (shoulder p-value=0.000, elbow p-value=1.000, hip p-value=1.000).

3.2.2.3 Osteoarthritis

OA evaluation was based on the observation of a total of 20 joint surfaces from eight individuals. As it is evident in figure 3.66, none of the joint surfaces under study rose above 25% of the BRI scale. Thus, they were categorized as very poorly represented. Three were not found at all: the humeral capitulum, the trochlea, and the acetabulum.

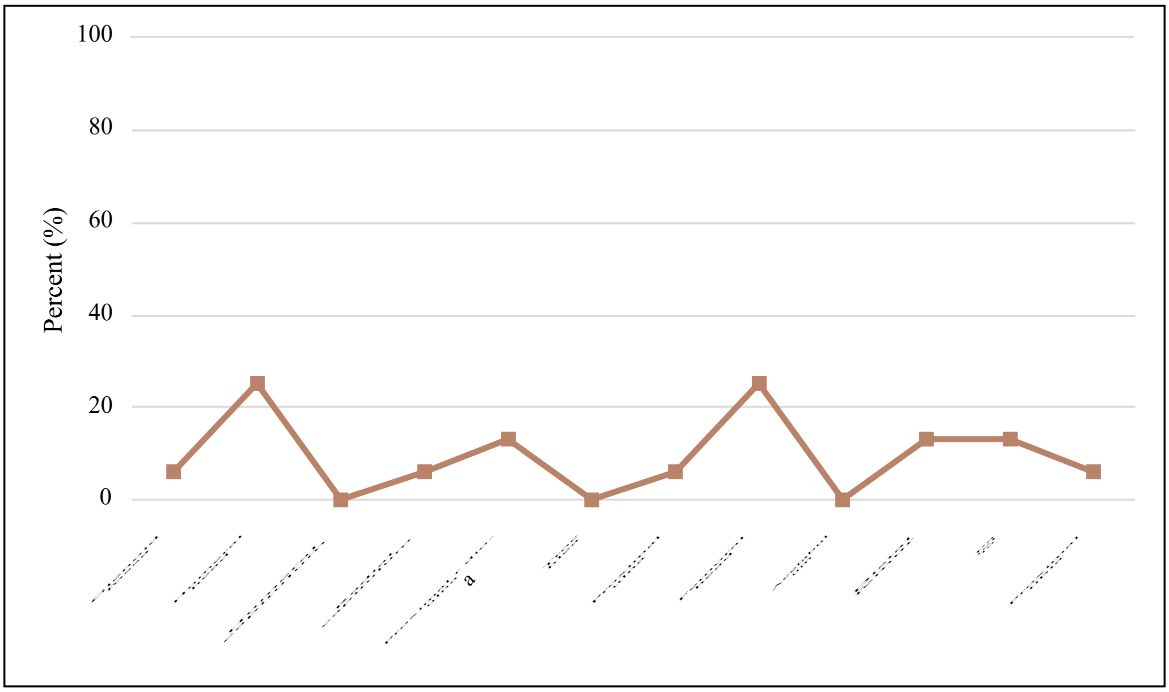


Figure 3.66. Mosphilia: Joint surfaces representation (%) within the sample. N:20.

Among the 20 observed surfaces, only three displayed were affected by OA: one humeral head and two femoral heads. No cases of eburnation and fusion were observed (Figure 3.67). Thus, comparison between sides, sex and age categories was allowed.

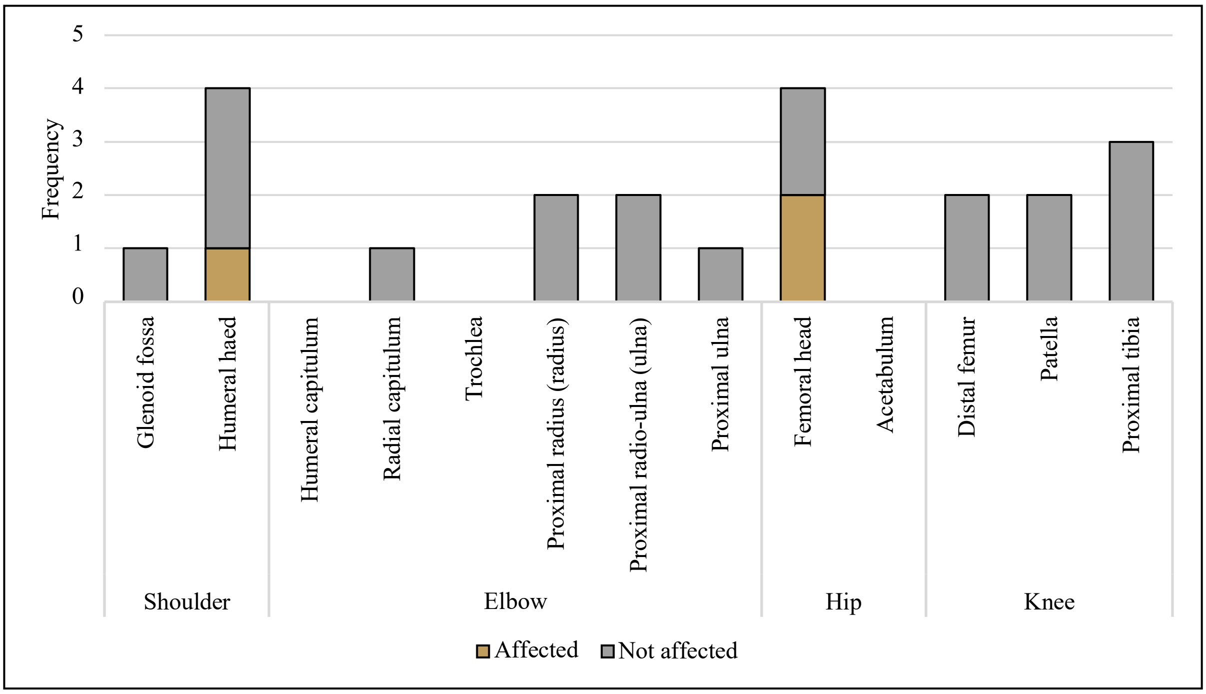


Figure 3.67. Mosphilia: Frequency distribution of affected articular surfaces by joint. N:20.

All three cases were ranked as mild and belonged to two female skeletons: one young (humeral head) and one mature adult (two femoral heads).

3.2.2.4 Extra-masticatory dental wear patterns

A total of 224 maxillary and 224 mandibular teeth from 14 individuals were examined for evidence of extra-masticatory dental wear. Only one defect was noted. It consisted of an occlusal groove on a right maxillary first premolar belonging to a middle adult male deposed in tomb 515. Thus, no comparison between sexes and age groups was allowed (Figure 3.68).

Figure 3.68. Mosphilia, Tomb 515: Evidence of occlusal groove on a first maxillary premolar.

3.2.2.5 Summary

In sum, the population from *Mosphilia* was small and highly biased towards females which fell within all three age categories represented (20-24, 25-34, 35-44); while the males only fell within the middle age range (25-34 years). On the basis of the evaluation of the robusticity ranks scored for ECs, it is possible to assert that the most utilized muscles were the *conoid*, *costoclavicular* and *trapezoid ligaments*, the *pectoralis major*, the *brachioradialis*, and the *supinator*. Despite the underrepresentation of males in the assemblage, the robusticity ranks distribution indicated a marked sexually dimorphic pattern. Female activity profile suggested higher ranking of an array of muscles such as the *trapezoid,* while the males stood out by virtue of the higher development of the *costoclavicular* and the *conoid ligament*, and for the high scores of the *brachioradialis*, which favours the flexion and the supination of the forearm. The development of the upper limb entheses was bilaterally expressed: in favour of the right side, for the shoulder and elbow, and in favour of the left side, for the forearm. While the lower limb entheses did not display any differences between the sides. For which regards the comparison between age groups, interestingly, the young adults exhibited more severe degrees of robusticity compared with the other groups on the forearm; on the remaining complexes, it was observed an increase in the number of severe modifications from the young to the mature adult age range. Concerning the OLs, they predominantly occurred on the elbow, even if the shoulder was the more severely affected functional complex. Concerning the bilateral asymmetry, differences between the sides were observed on the shoulder, most severely affected on the left side, and on the elbow, more severely affected on the right side. Regarding the comparisons between the sexes, the OLs affected to a greater extent the male entheses than the counterpart. Finally, their incidence increased from the young to the mature adult range. Concerning the EFs, they mostly affected the lower limbs entheses with greater involvement of the *gluteus maximus* and the *iliopsoas* than the upper limbs. Despite this, the functional complex more severely affected was the shoulder. This latter was also the only functional complex which allowed a comparison between the sexes and the sides: in this case, the females were found to be the most severely affected; and the right side was the most involved. For which regards the comparison between the age groups, the evaluation of the shoulder revealed that the severity of this affection decreased from the young to the middle adults, and increased from the middle adults to the mature adults. Concerning the OA, only three surfaces (one humeral head and two femoral heads) displayed evidence of OA. All of these belonged to female individuals, one in the young and one in the middle adult range. Concerning the extra-masticatory dental defect, an occlusal groove on a molar of a middle adult male was recorded.

3.3.3 Erimi *Pamboula* (summary) (Appendix 1)

Only two individuals were examined for the collection of Erimi *Pamboula*, both males, one of uncertain age and one in middle adulthood. Thus, no comparison between sexes and age groups was allowed. The evaluation of the robusticity ranks scored for ECs showed that the *brachioradialis*, the *pectoralis major*, the *teres major*, and the *conoid* were the most utilized muscles, but only this latter showed a right-side asymmetry. Concerning the OLs and the EFs, the former occurred on only four entheses (*conoid ligament*, *trapezoid ligament* and *biceps brachii* (2)) in mild forms; the last on the *pectoralis major* (humerus), *brachioradialis* and *quadriceps tendon* (patella) in moderate forms. No evidence of OA or extra-masticatory dental wear was found.

3.3 Philia-Middle Bronze Age II

3.3.1 Sotira *Kaminoudhia*

3.3.1.1 Paleodemography

The biological sex and mortality profile of adults from the E-MBA site of Sotira is presented in table 3.3. Sex estimation was possible for seven of the nine individuals. The proportion of the female individuals (6/9, 66.6%) greatly exceeds the males (1/9, 11.1%). Age estimation was possible for all the skeletons included in the study. Three of the four age categories are represented: the young (20-24 years), the middle (25-34 years), and the mature (35-44 years) adults. No old adults (45+) were identified. Thus, the majority of adults (4/9, 44.4%) fell within the range of middle adults (25-34 years).

	Young adult 20-24		Middle adult 25-34		Mature adult 35-44		Old adult 45+		Total	
	N	%	N	%	N	%	N	%	N	%
Male	0	0.0	0	0.0	1	100.0	0	0.0	1	11.1
Female	2	33.3	3	50.0	1	16.7	0	0.0	6	66.7
ND	0	0.0	1	50.0	1	50.0	0	0.0	2	22.2
Total	2	22.2	4	44.4	3	33.3	0	0.0	9	100.0

Table 3.3. Sotira: Age and sex composition of the sample. ND: not determined. %: within the sex.

The bar chart in figure 3.69 illustrates the age distribution of the sample by sex. Overall, it must be noted that the female age distribution reflects all the three represented age categories, while the male age distribution reflects only the mature adult range.

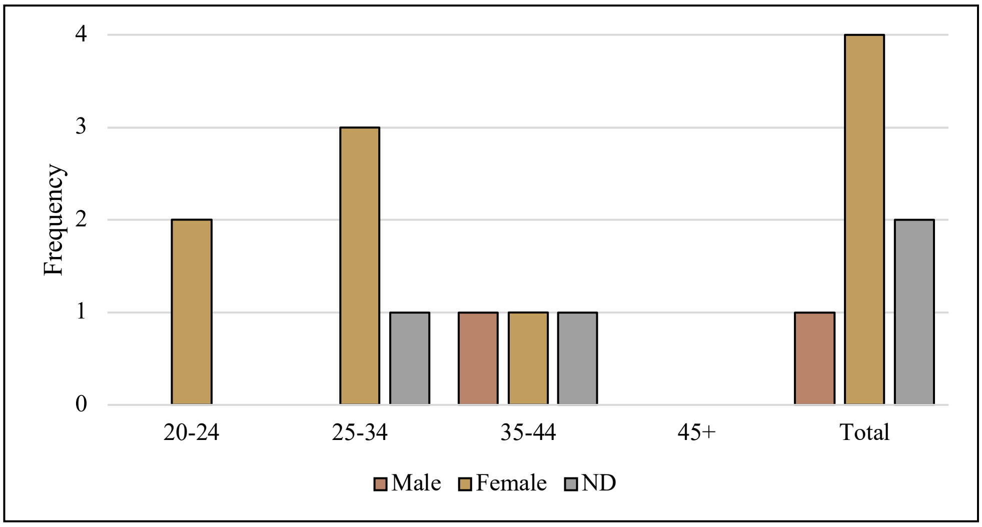


Figure 3.69. Sotira: Age distribution of the sample by sex. ND: Not determined. N:9

3.3.1.2 Entheseal Changes

3.3.1.2.1 Robusticity: relationship between score development, enthesis, and functional complex

The evaluation of the ECs of this sample was carried out on a total of 64 entheses belonging to seven individuals. As can be noted in figure 3.70, the BRI values were very low: none rose above 50.0 %, all the recorded entheses were very poorly represented.

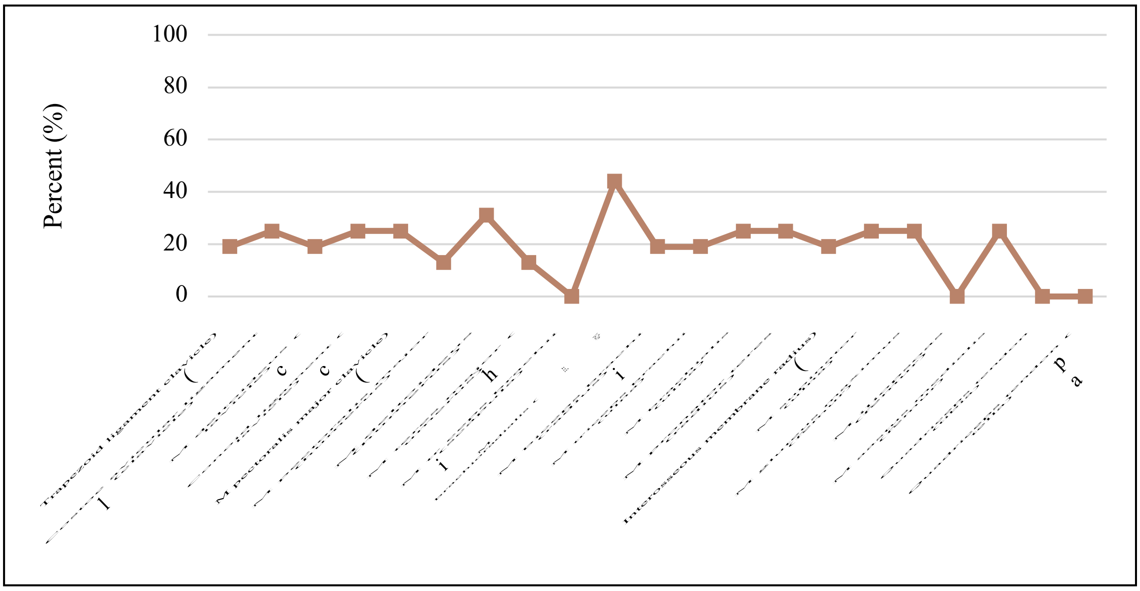


Figure 3.70. Sotira: Entheses representation (%) within the whole sample. N:64.

Looking at the distribution of entheses for which ECs could be recorded, figure 3.71 shows that the *brachioradialis* and the *deltoideus* (humerus) were the most frequently assessed (7/64, 10.9% and 5/64, 7.8% respectively). In contrast, the *quadriceps* tendon (patella) was the less well-preserved enthesis (1/64, 1.6%). Thus, this first assessment highlighted a bias between the most and the least represented entheses of the order of 7:1.

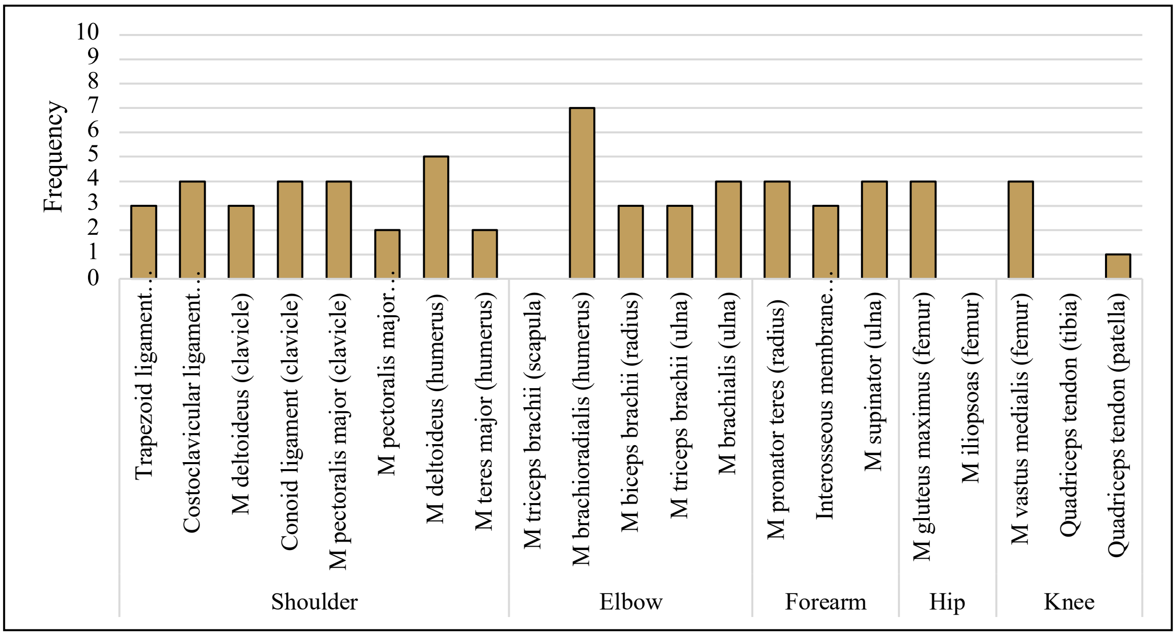


Figure 3.71. Sotira: Frequency distribution of observed entheses by muscle. N:64.

Concerning the robusticity ranks distribution, the majority of the observed entheses were slightly developed. Moderate degrees were scored in greater extent on the *pectoralis major* (humerus) (½, 50.0%), in almost equal percentage on the *costoclavicular* and the *brachialis* (1/4, 25.0%), on the *deltoideus* (humerus) (1/5, 20.0%) and the *brachioradialis* (1/7, 14.3%). The most severe forms were instead observed on the *pectoralis major* (humerus) (½, 50.0%), the *trapezoid* *ligament* and the *triceps brachii* (1/3, 33.3%), the *supinator* (¼, 25.0%) and the *brachioradialis* (1/7, 14.3%) (Figure 3.72).

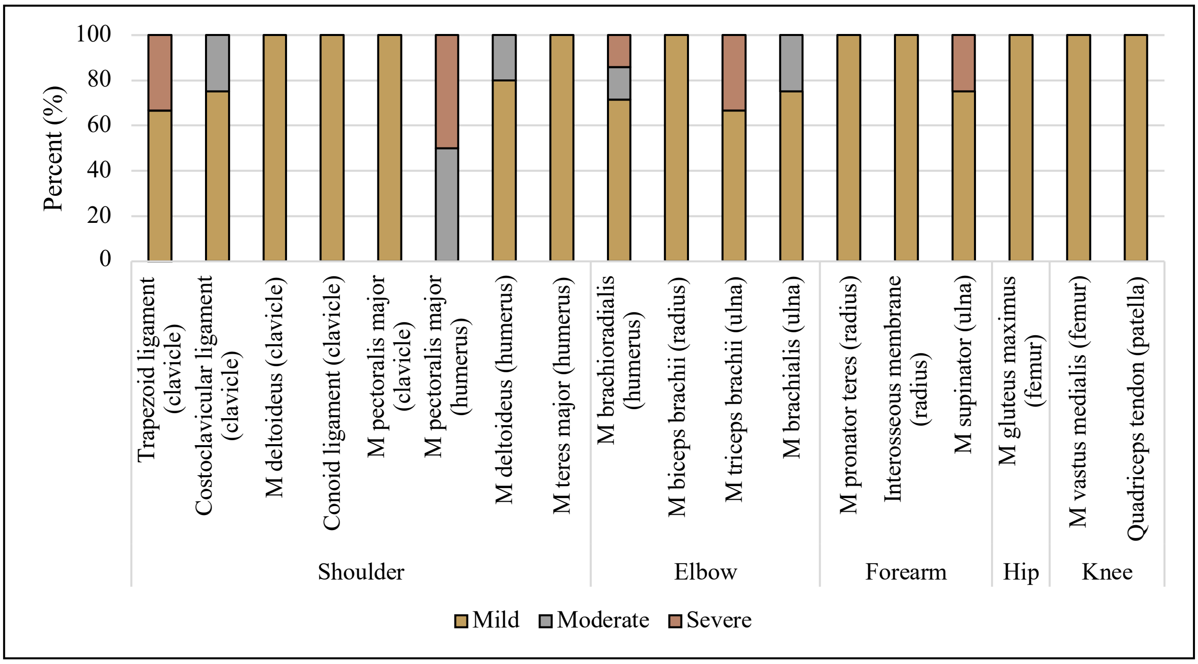


Figure 3.72. Sotira: Frequency distribution of mild, moderate, and severe robusticity ranks by muscle. N:64.

At the functional complex level, the upper limb entheses were the most assessed: their representativity gradually decreased from the shoulder (27/64, 42.2%) to the forearm (11/64, 17.2%). For which concerns the lower limbs, the hip was the least assessed (4/64, 6.3%) (Figure 3.73).

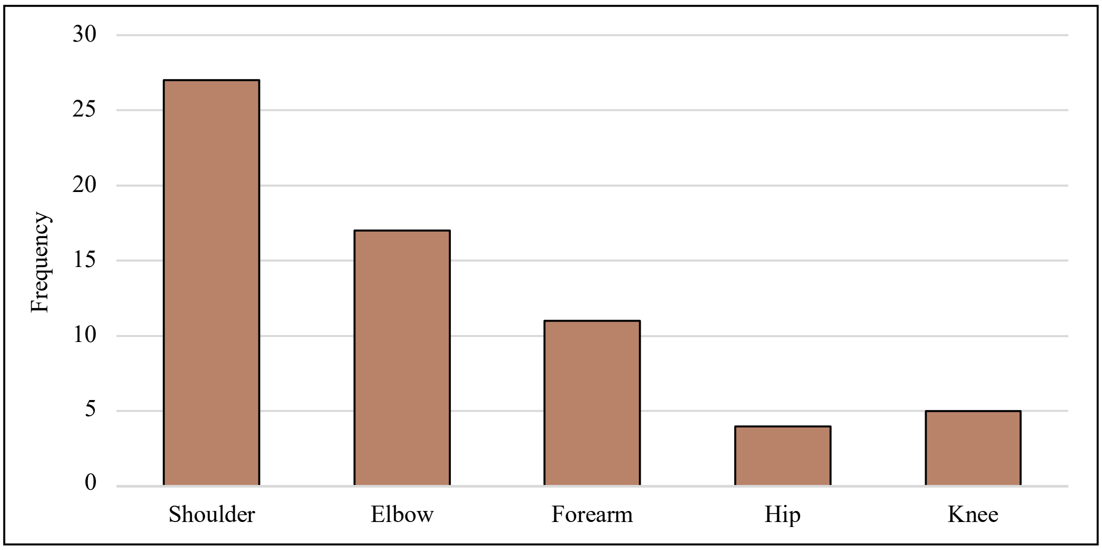


Figure 3.73. Sotira: Frequency distribution of observed entheses by functional complex. N:64.

Only the upper limb entheses exhibited moderate and severe robusticity. The elbow displayed the highest percentage of moderate and severe degrees (2/17, 11.8%), followed by the shoulder with 11.1% (3/27) moderate and 7.4% (2/27) severe degrees; and the forearm with 9.1% (1/11) severe degrees.

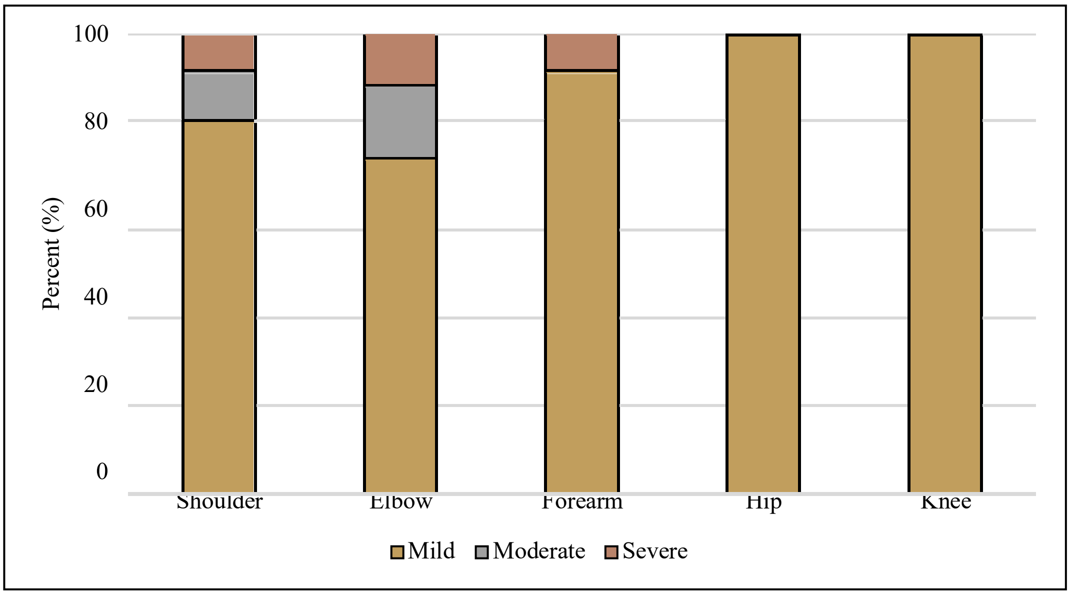


Figure 3.74. Sotira: Frequency distribution of mild, moderate, and severe robusticity ranks by functional complex. N:64.

3.3.1.2.2 Robusticity: relationship between score development, side, sex, and age

Concerning the bilateral asymmetry, only a few entheses were found to be equally represented such as the *costoclavicular* and the *pectoralis major* (humerus). Overall, the right entheses (=35) prevailed over the left (=29): more specifically, on the shoulder, the left entheses were the best represented, while in the other functional complexes the right was overrepresented.

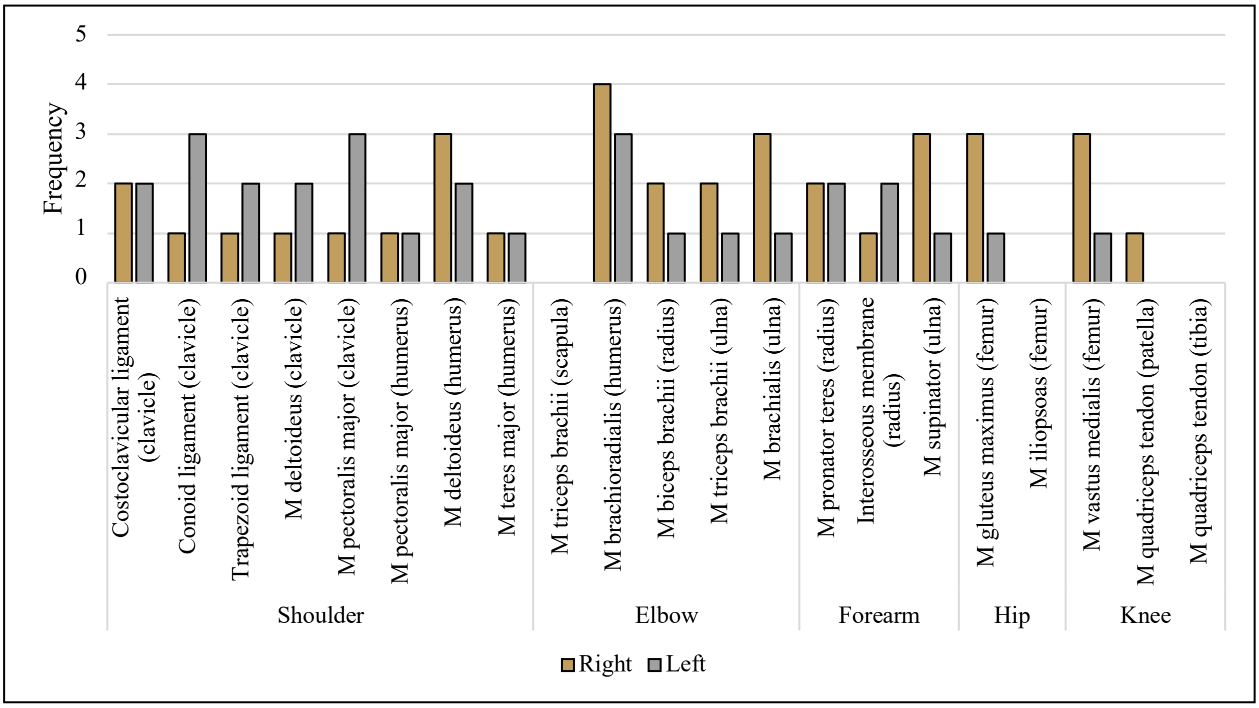


Figure 3.75. Sotira: Frequency distribution of the observed entheses by side. N:64.

Thus, considering the robusticity ranks distribution by side, the *pectoralis major* (humerus), the *deltoideus* (humerus), the *brachioradialis*, and the *triceps brachii* exhibited pronounced development on the right side, while the *trapezoid ligament* displayed more pronounced expressions on the left side (Figure 3.76). It must be specified that, in all these cases, the percentage of moderate and severe degrees increased according to the number of observed entheses. The only exception was represented by the *pectoralis* (humerus), equally represented on both sides.

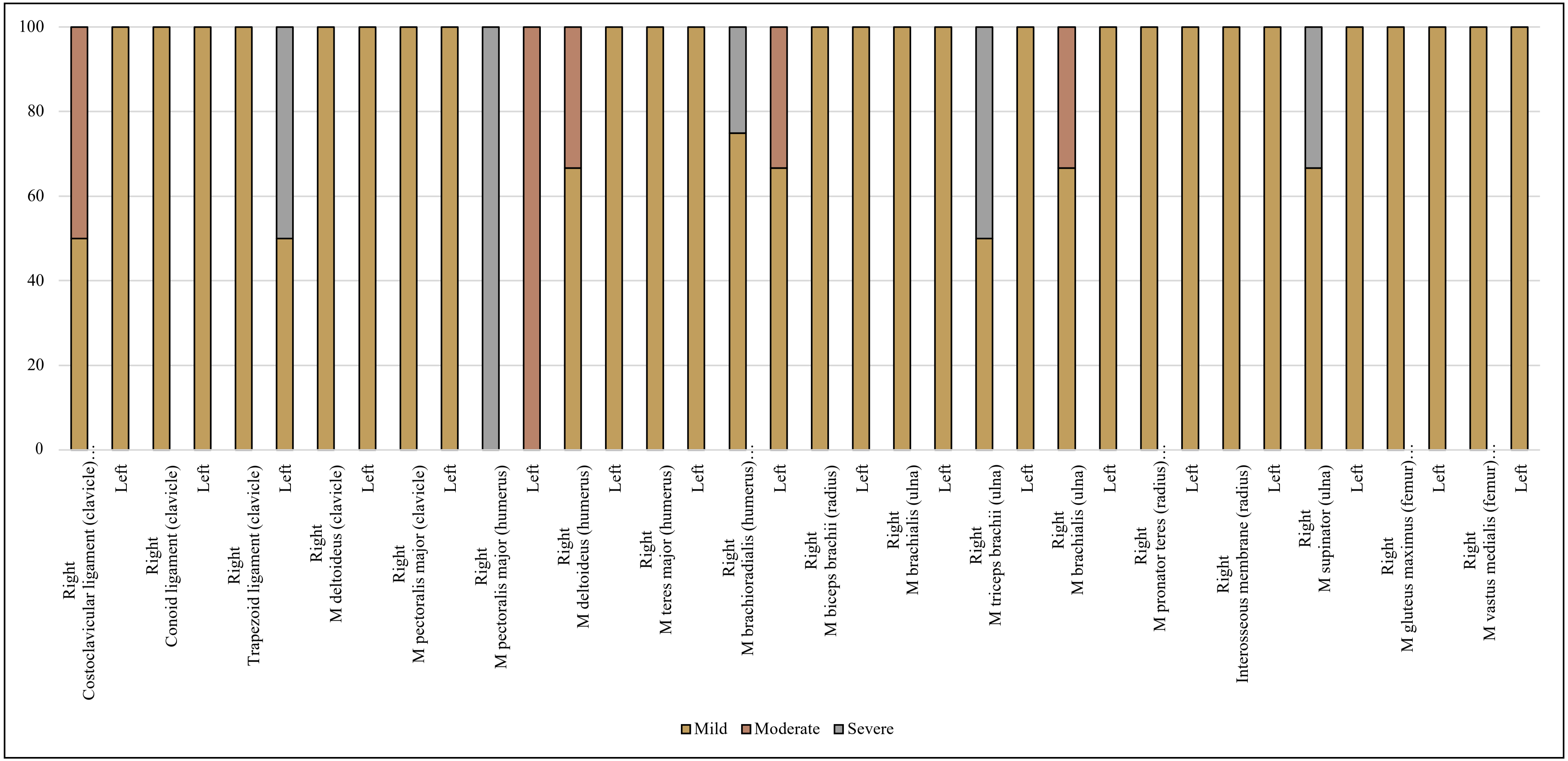


Figure 3.76. Sotira: Frequency distribution of mild, moderate, and severe robusticity ranks by side. N:63.

By combining the entheses in functional complexes, it is evident that the forearm was the only functional complex almost equally represented between the sides. As for the shoulder, the left side entheses were the predominant (16/27, 59.3%), while in the remaining functional complexes, the right side was found to be the most represented. The most consistent bias was noted for the knee (4:1) (Figure 3.77).

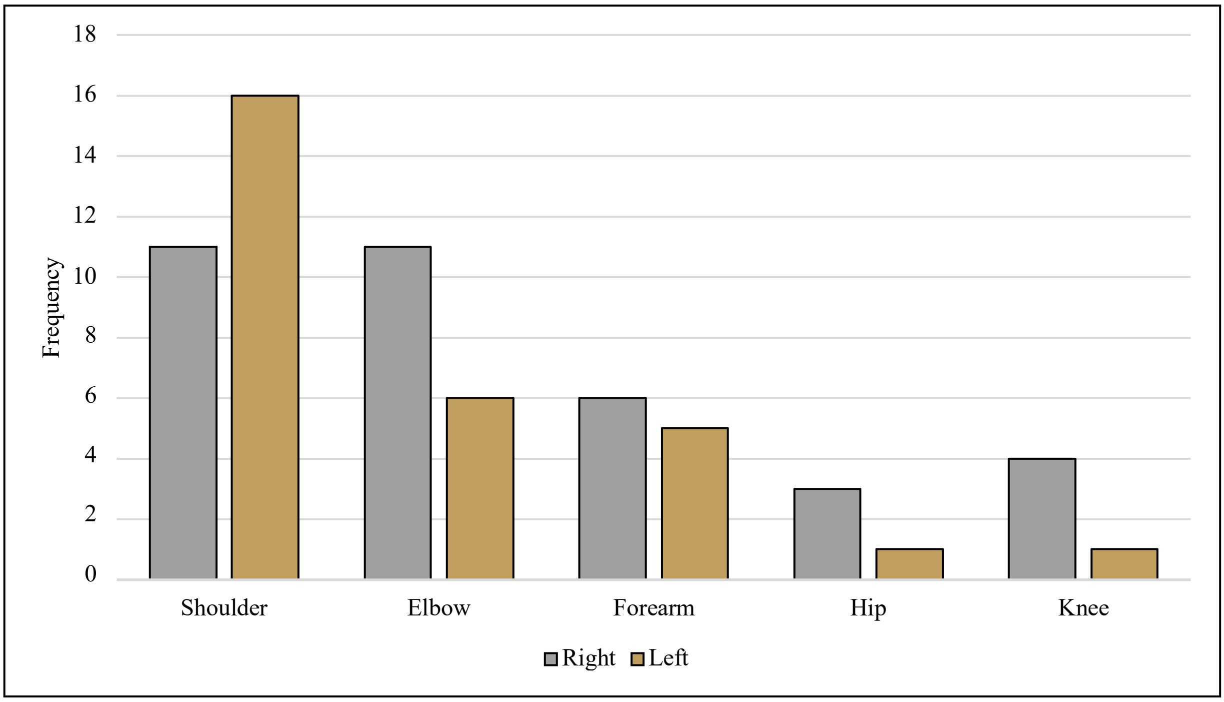


Figure 3.77. Sotira: Frequency distribution of the observed entheses by side (pooled functional complexes). N:64.

Despite being underrepresented, the right shoulder was found to be more developed as it exhibited higher percentages of moderate (2/11, 18.2%) and severe degrees (1/11, 9.1%) compared with the left, which exhibited only 6.3% (1/16) moderate degrees and 6.3% (1/16) severe forms. As for the elbow, only the right side displayed severe degrees (2/11, 18.2%) other than moderate degrees (1/11, 9.1%); while the left side displayed 16.7% (1/6) moderate degrees. Finally, as for the forearm, only the right entheses yielded evidence of severe robusticity (1/6, 16.7%) (Figure 3.78). These differences were however not statistically significant (shoulder p-value=0.544, elbow p-value=0.660, forearm p-value=0.662).

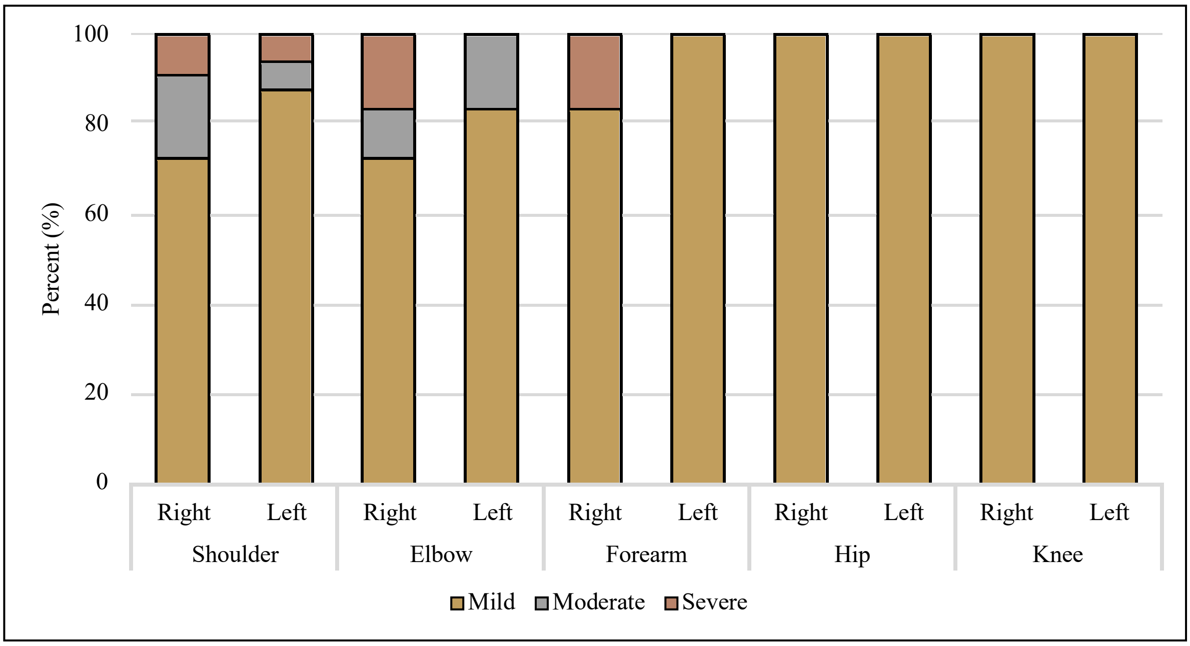


Figure 3.78. Sotira: Frequency distribution of mild, moderate, and severe robusticity ranks by side (pooled functional complexes). N:64.

For which concern the comparisons between sexes, the sample under examination was limited to the number of the entheses (N=56) collected from sex determined individuals. As expected, the bias between females (=6) and males (=1) affected the comparability of the two sub-samples. Only three entheses were recorded on the only male skeleton included in this study; on the contrary, a total of 53 entheses were scored on the females. Only two entheses were found to be represented by both the sexes (*deltoideus* (humerus) and *brachioradialis*); in the case of the *deltoideus*, the bias between the best and least represented sex was of the order of 4:1 (Figure 3.79).

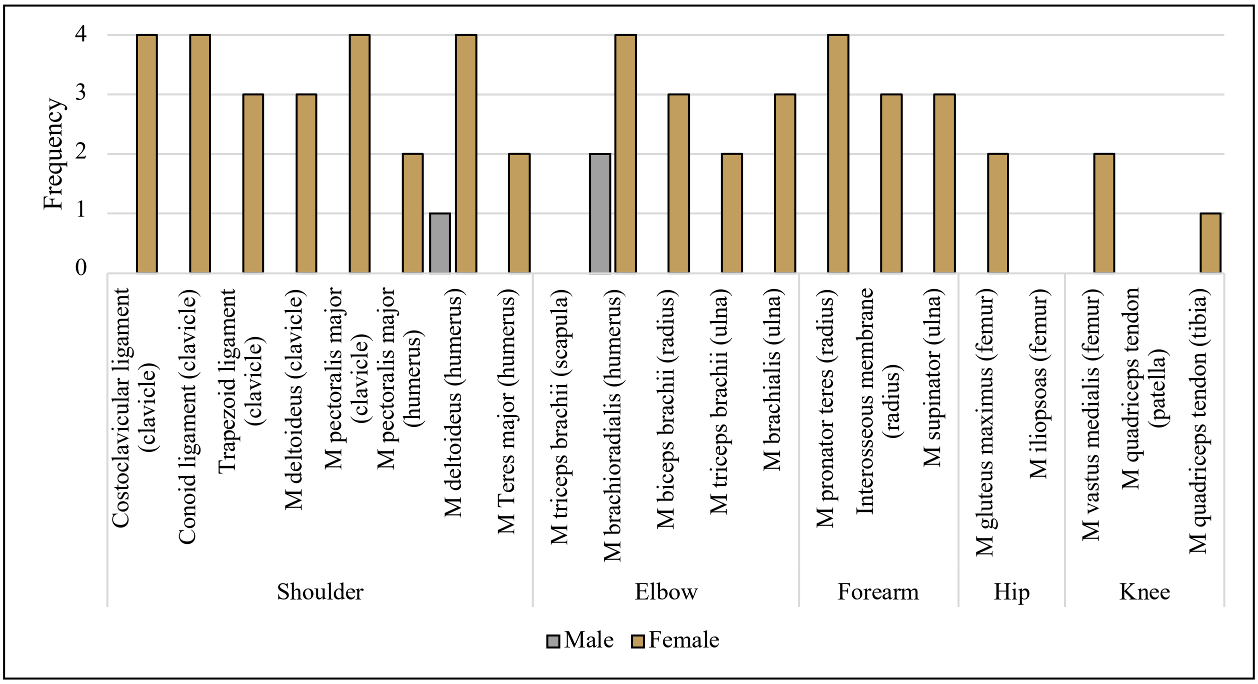


Figure 3.79. Sotira: Frequency distribution of the observed entheses by sex. N:56.

As for the development of the observed entheses, the females exhibited higher ranks on the *costoclavicular* (1/4, 25.0% moderate degree), *trapezoid* (1/3, 33.6% severe degree), and *pectoralis major* (humerus) (1/2, 50.0% moderate and ½, 50.0% severe degree). As for the male, the only assigned moderate degree was on the *deltoideus*. It is evident that by combining the entheses in functional complexes, the resulted bias prevented any comparison (Figure 3.80).

For which concerns the comparison between age categories, figure 3.81 shows that in five functional complexes, there was not an equal distribution of entheses. The most consistent bias (8:1) was observed in the shoulder, between the middle adult (25-34 years) and mature adult (35-44 years) age category, towards the former; and between the young adults (20-24 years) and the mature adults (1:9), towards of these latter, in the elbow.

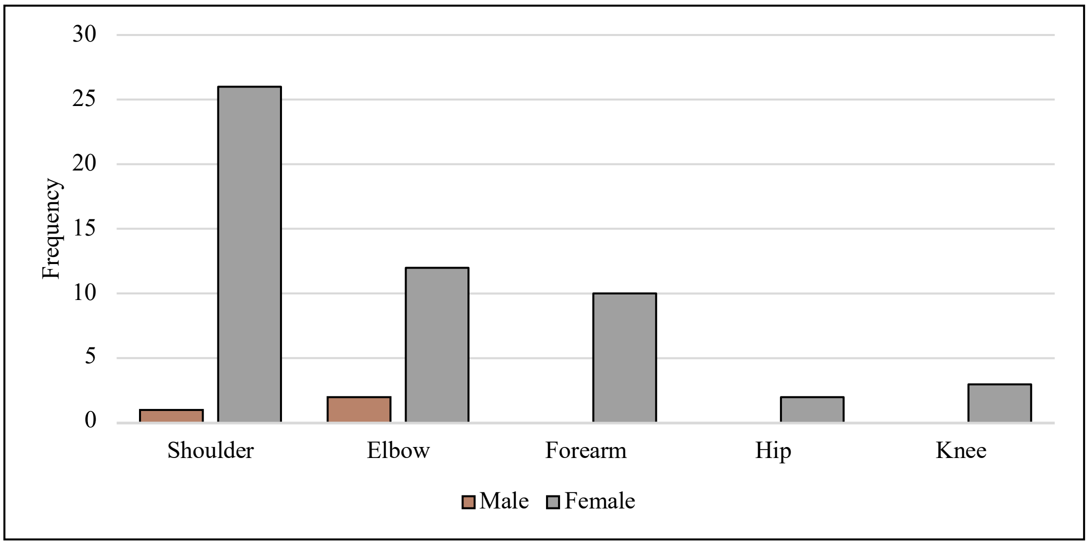


Figure 3.80. Sotira: Frequency distribution of the observed entheses by sex (pooled functional complexes). N:56.

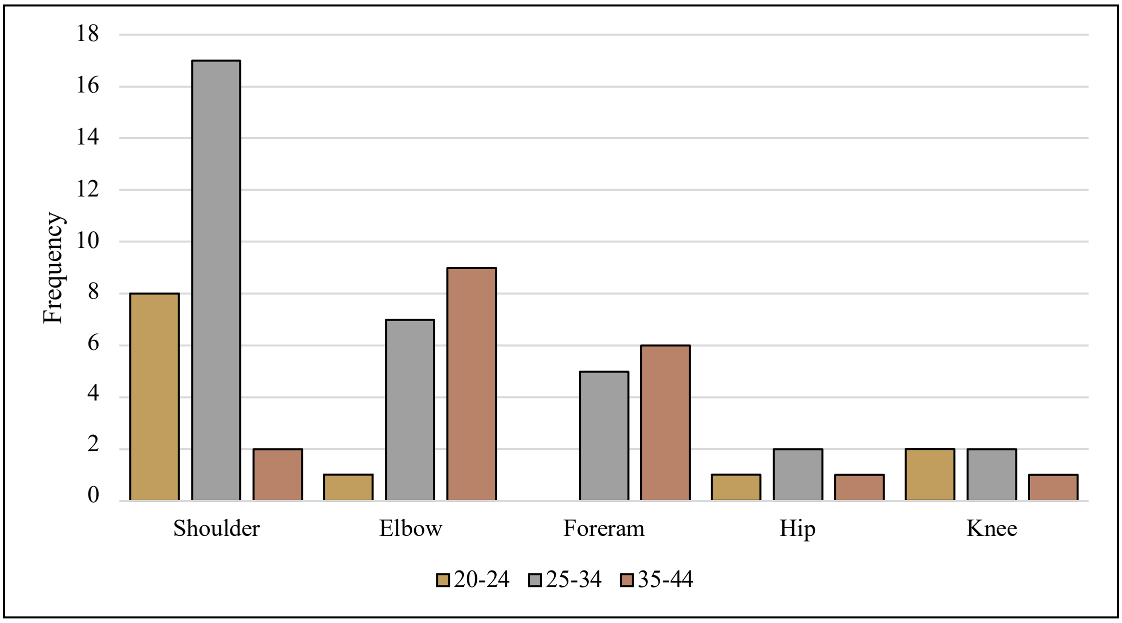


Figure 3.81. Sotira: Frequency distribution of the observed entheses by age category (pooled functional complexes). N:64.

Overall, taking into account the poor representativity of such categories (e.g., young adult entheses in the elbow=1), it was noted an increase in the rate of moderate and severe degrees from the younger to the older age ranges (Figure 3.82). Exceptions to this trend were, however, observed on the elbow, where the young adults provided 100.0% moderate degrees, and on the shoulder, where the same category provided 12.5% moderate degrees and 12.5% severe degrees. It must be specified, however, that the aforementioned rates refer to a single enthesis recorded.

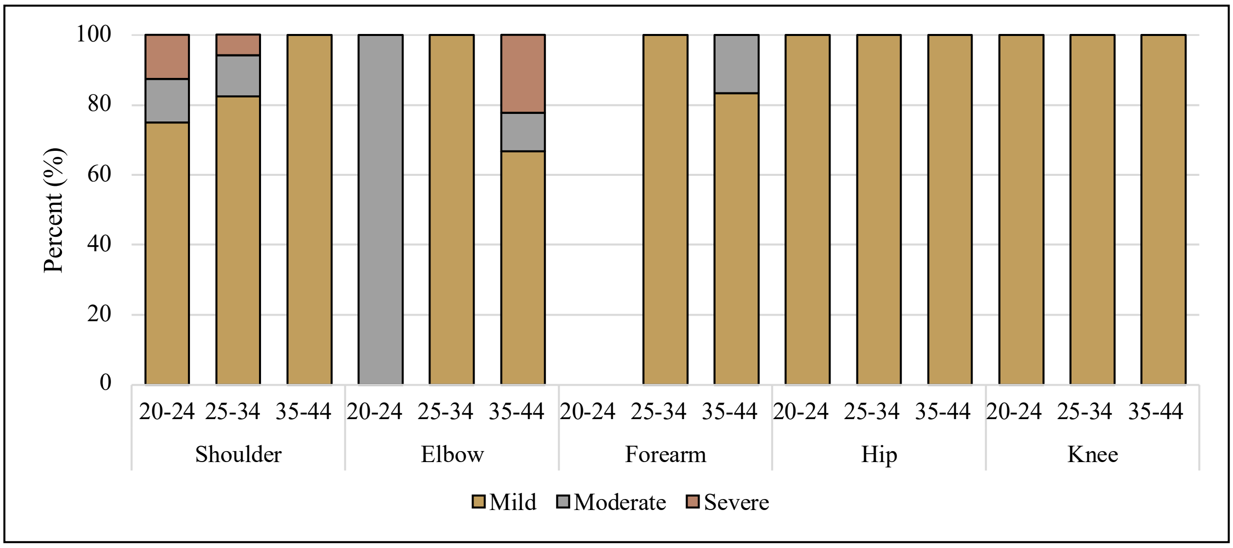


Figure 3.82. Sotira: Frequency distribution of mild, moderate, and severe robusticity ranks by age category (pooled functional complexes). N:64.

The Mann-Whitney *U*-test carried out on the functional complexes separately did not reveal any significant difference (shoulder p-value=0.708, elbow p-value=0.833, forearm-value=0.662, hip p-value=1.000, knee p-value=1.000).

3.3.1.2.3 <u>Osteolytic and Enthesophytic formations: relationship between score development, enthesis, and functional complex</u>

OLs and EFs were not present on all the entheses observed. More specifically, the formers were rare, affecting only 9.4% (6/64) of the total observed entheses; the last were more frequent, affecting 56.3% (36/64) of the total observed.

For which concerns the OLs, the entheses affected were the *costoclavicular ligament* (75.0%, 3/4), the *supinator* (66.6%, 2/4) and the *brachialis* (25.0%, 1/4) (Figure 3.83).

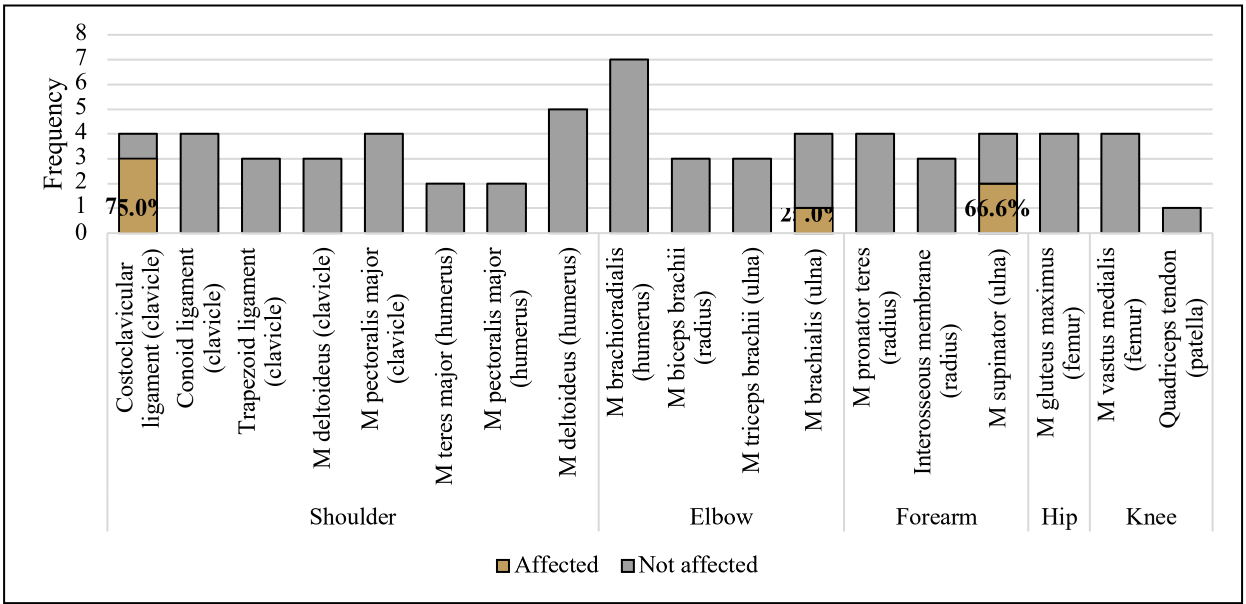


Figure 3.83. Sotira: Frequency distribution of the entheses affected by OLs by muscle. N:64.

Moderate degrees were assigned to two of three *costoclavicular ligaments* and one of the two *supinator* insertions. The remaining surfaces had mild OLs.

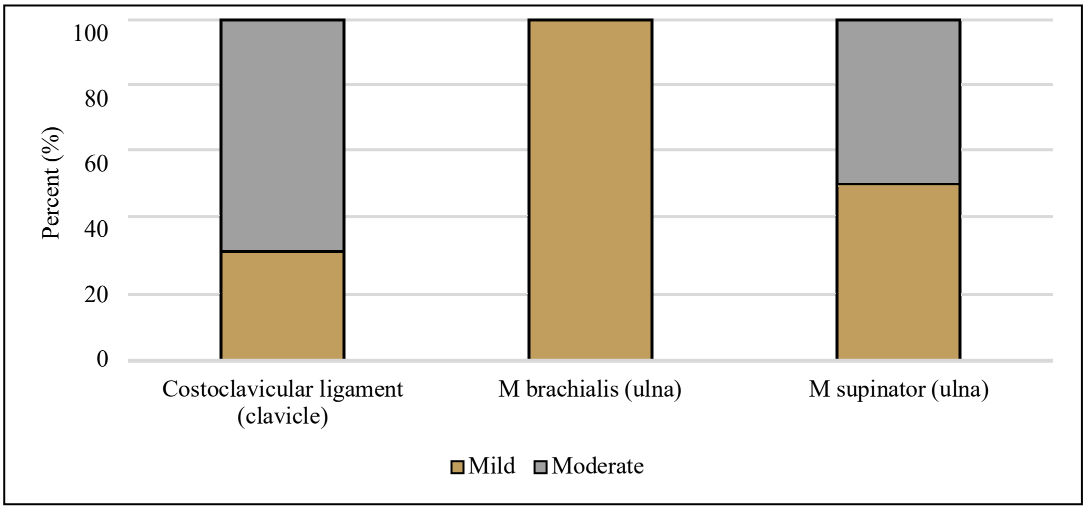


Figure 3.84. Sotira: Frequency distribution of mild and moderate OLs by muscle. N:6.

Concerning the EFs, the most affected entheses were the *pectoralis major* (humerus) (2/2, 100.0%), the *supinator* (4/4, 100.0%), and the *brachioradialis* (6/7, 85.7%) (Figure 3.85). On the contrary, the *conoid ligament*, the *pectoralis major* (clavicle), the *teres major* and, the *quadriceps tendon* (patella) did not yield any evidence of affections.

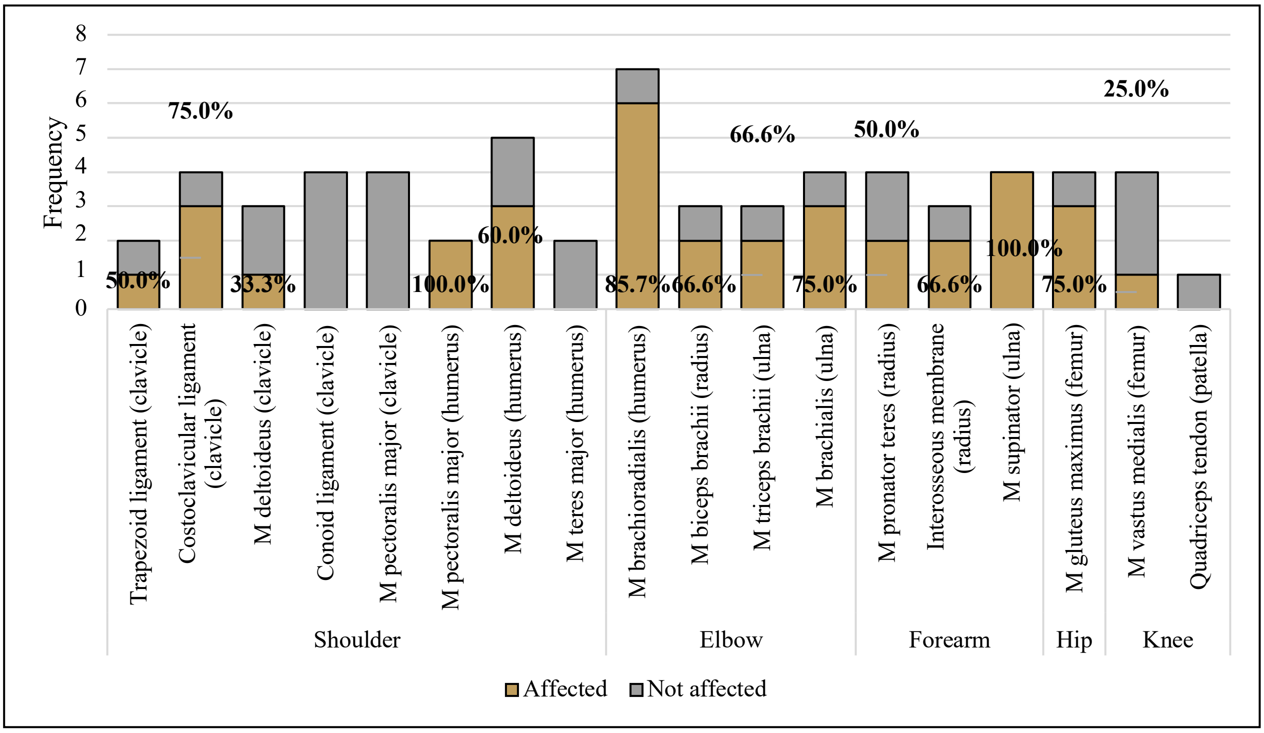


Figure 3.85. Sotira: Frequency distribution of the entheses affected by EFs by muscle. N:64.

In terms of severity distribution, no severe cases were detected. The mild forms (=21) prevailed over the moderate degrees (=9); the most severely affected were the *deltoideus* (clavicle) (1/1, 100.0%) and *pectoralis major* (humerus) (2/2, 100.0%). It must be noted that these high percentages refer to a very low number of entheses affected (Figure 3.86). The most affected entheses, the *brachioradialis* and the *supinator*, displayed 50.0% (3/6) and 50.0% (2/4) moderate expressions respectively.

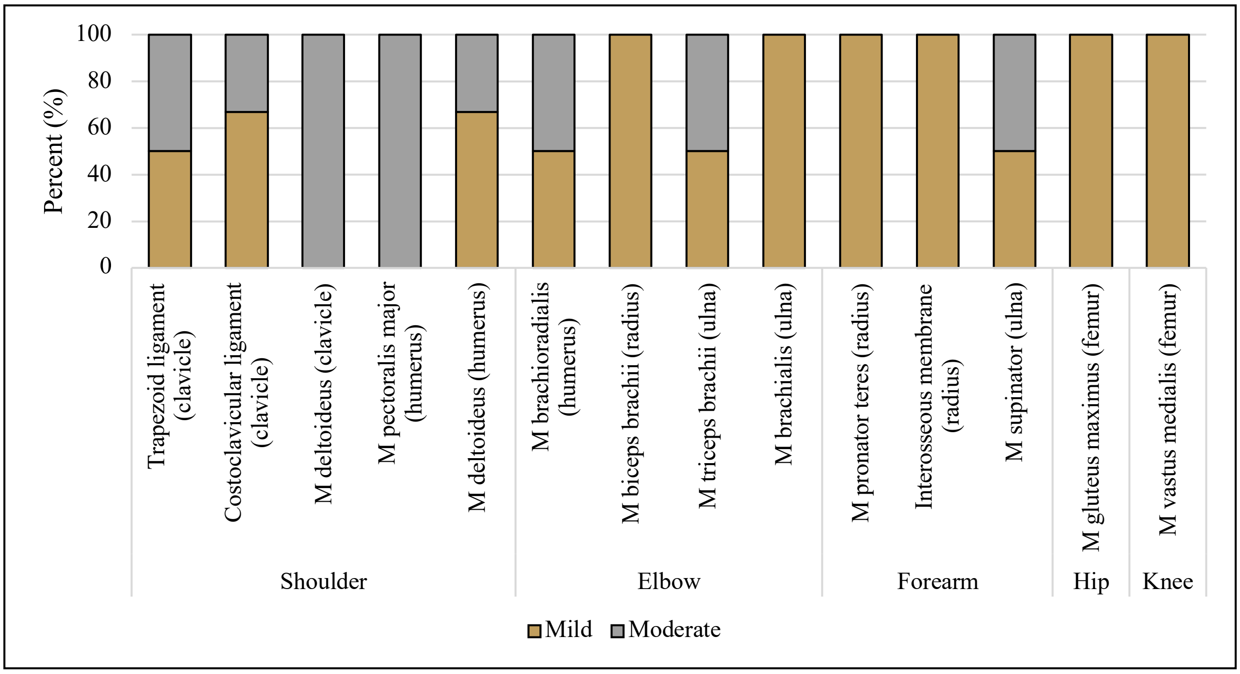


Figure 3.86. Sotira: Frequency distribution of mild and moderate EFs by muscle. N:36.

Since the more consistent number of EFs, figure 3.87 was provided to show the distribution of the affections by functional complex. The shoulder and the knee were the most affected functional complexes (16/27, 59.2% and 4/5, 80.0% respectively). The hip, on the contrary, was the least affected (¼, 20.0%).

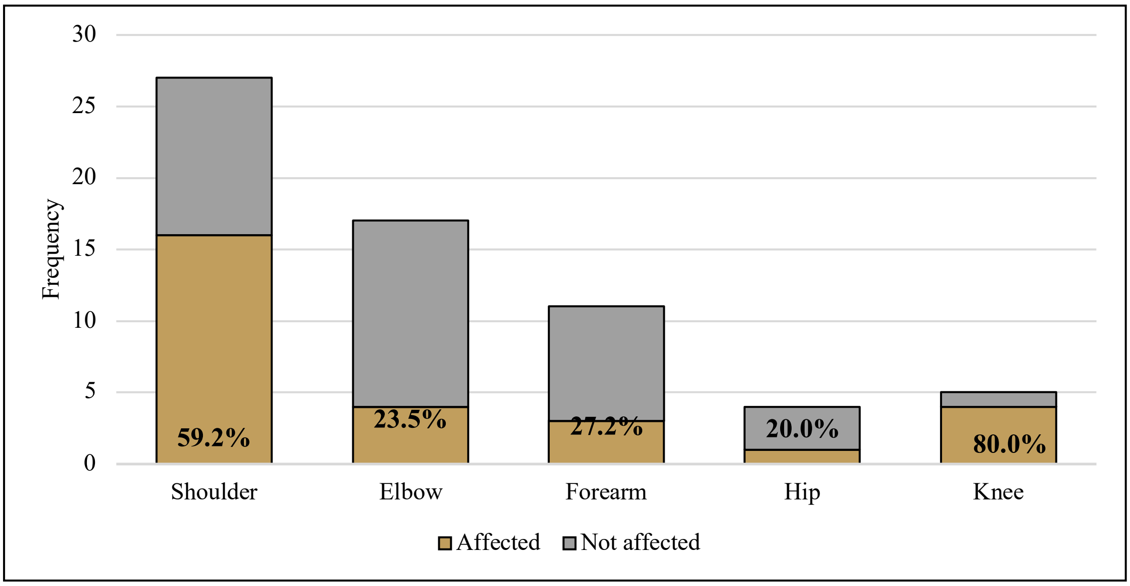


Figure 3.87. Sotira: Frequency distribution of the entheses affected by functional complex. N:64.

In terms of severity distribution, the most severely affected was the shoulder (6/11, 54.5%), followed by the elbow (4/13, 30.8%) and forearm (2/8, 25.0%) (Figure 3.88).

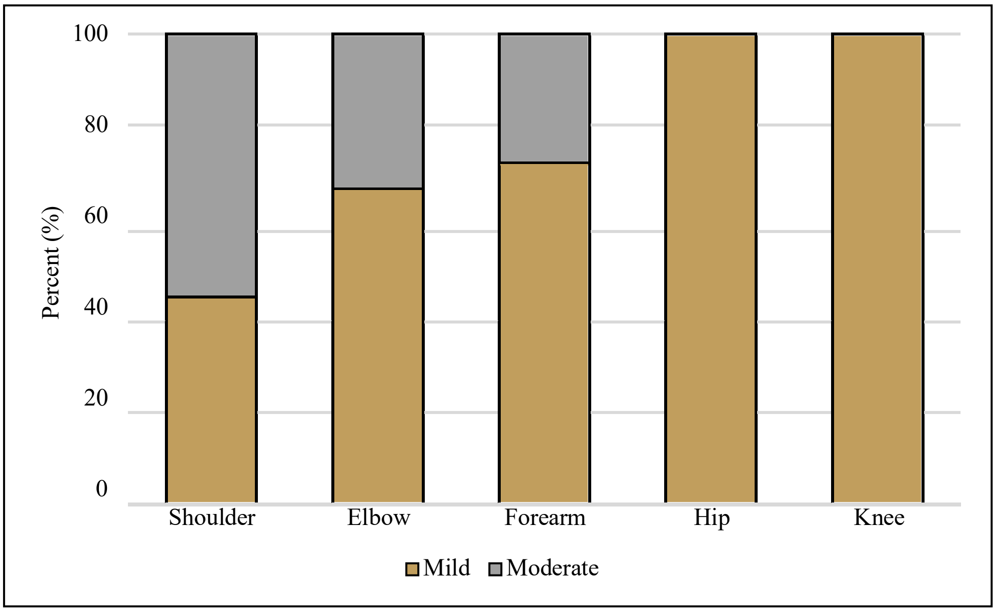


Figure 3.88. Sotira: Frequency distribution of mild and moderate EFs by functional complex. N:64.

3.3.1.2.4 <u>Osteolytic and Enthesophytic formations: relationship between score development, side, sex, and age</u>

The OLs were observed in six cases of 64 entheses observed, thus no comparisons between sides, sex or age categories were possible. It must be specified that the only entheses exhibiting moderate OLs, the *costoclavicular ligament* and the *supinator*, were detected on two female skeletons, one in young adulthood and one in mature adulthood.

Concerning the EFs, comparisons between sides and age groups were carried out. No sex comparison was, instead, performed because of the absence of male entheses in three of five functional complexes and the great bias towards females in the remaining two. It must be noted, however, that of the two affected entheses recorded on the male skeleton, one was ranked as mild and the other as moderate. The affected entheses from female skeletons were predominantly ranked as mild (20/28, 71.4%). Figure 3.89 shows the distribution of the affected entheses, by functional complex, between the sides. No comparison was allowed for the knee because of the absence of affections on the left side. Overall, the right side was more affected than the left side. The only exception was represented by the hip, which, however, was represented by only one enthesis on the left side, and, thus, not useful in terms of comparisons between sides.

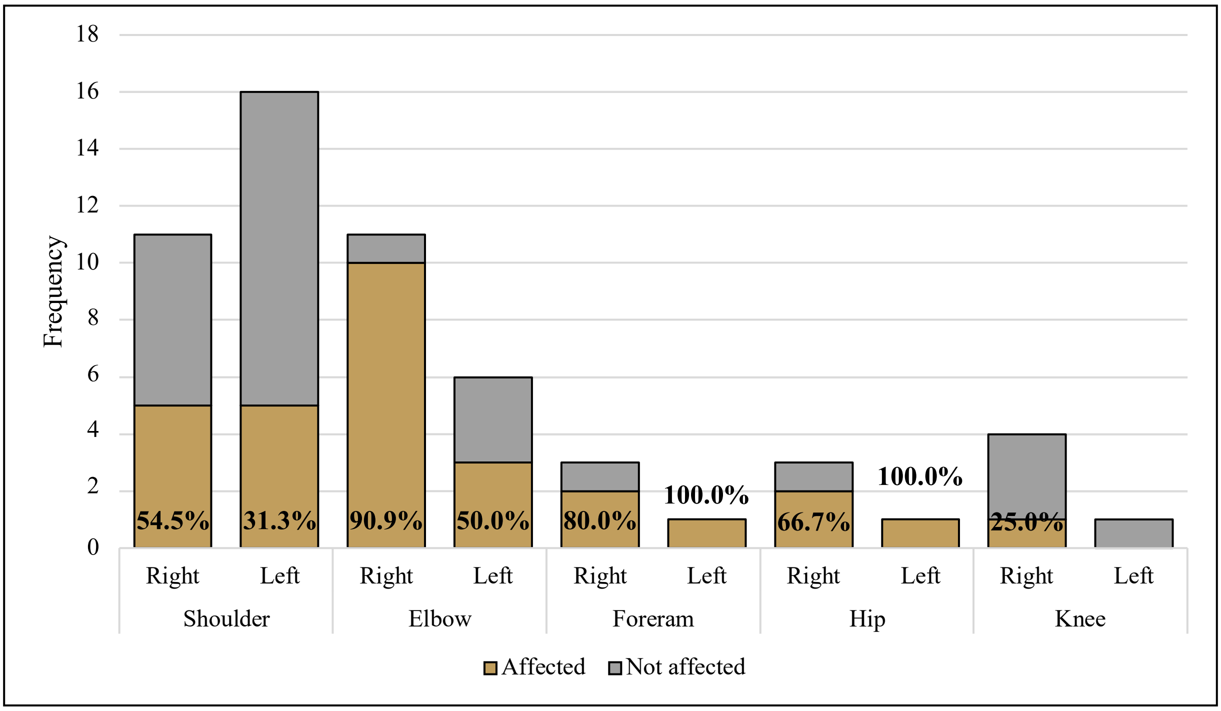


Figure 3.89. Sotira: Frequency distribution of the entheses affected by EFs by side (pooled functional complexes). N:64.

Figure 3.90 shows that the right side of the shoulder was more severely affected (4/6, 66.7%) compared with the left side (2/5, 40.0%); while the elbow and the forearm exhibited more severe manifestations on the left side (1/3, 33.3% and 1/3, 33.3% respectively) compared with the right (3/10, 30.0% and 1/5, 20.0%).

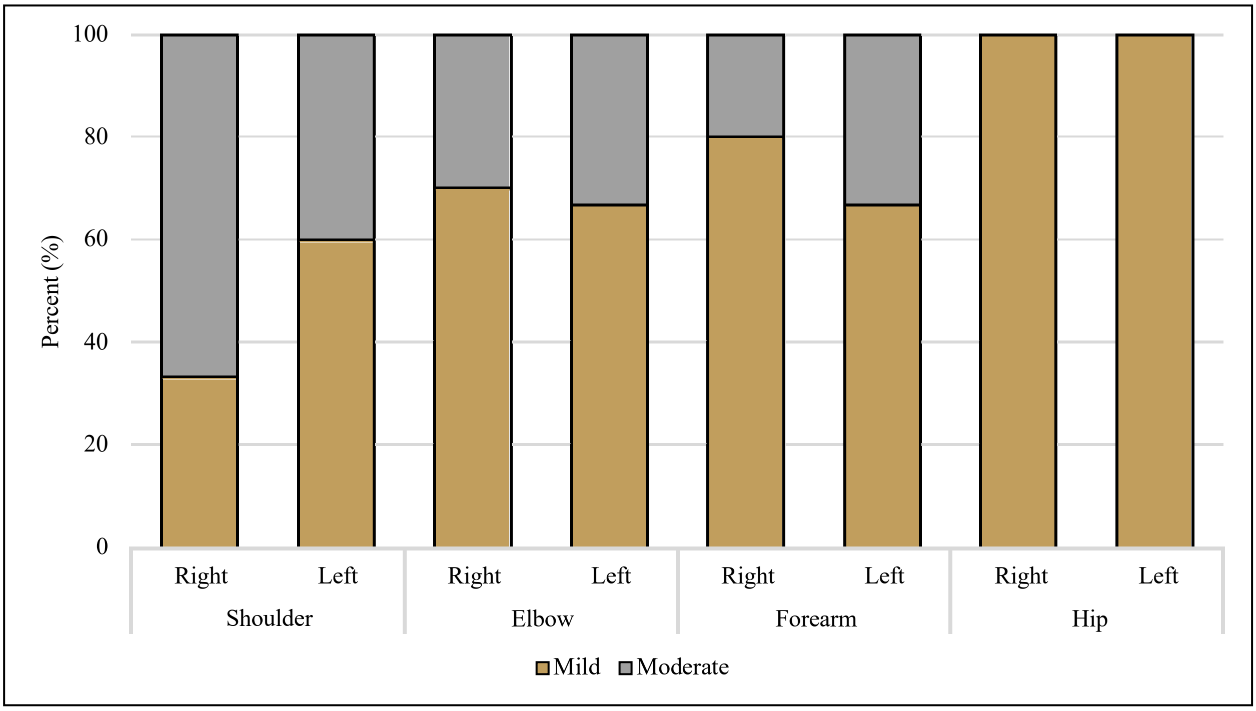


Figure 3.90. Sotira: Frequency distribution of mild and moderate EFs by side (pooled functional complexes). N:36.

The Mann-Whitney *U*-test did not reveal any significant differences between the sides (shoulder p-value=0.537, elbow p-value=0.937, forearm p-value=0.786, hip p-value=1.000).

For which concerns the distribution of the EF ranks between age groups, the knee was excluded from comparisons as only the mature adults exhibited affections. The hip did not provide useful data to sustain an increase with age since the very low number of observations recorded. Considering the other functional complexes, it can be noted a decrease in the number of affections from the young to the middle/mature adults. On the shoulder, for instance, the number of affections decreased from the younger (3/8, 37.5%) to the middle adult range (6/17, 35.3%) as well as in the elbow (1/1, 100.0%, on the young adults' entheses and 5/7, 71.4%, on the middle adults' entheses) may be explained considering the bias in representation of the sub-mentioned categories. In the case of the shoulder, for instance, the number of observed entheses for the category 25-34 (=17) greatly exceeded the number of the entheses observed for the category 20-24 (=8). Thus, this might have affected the availability of the results.

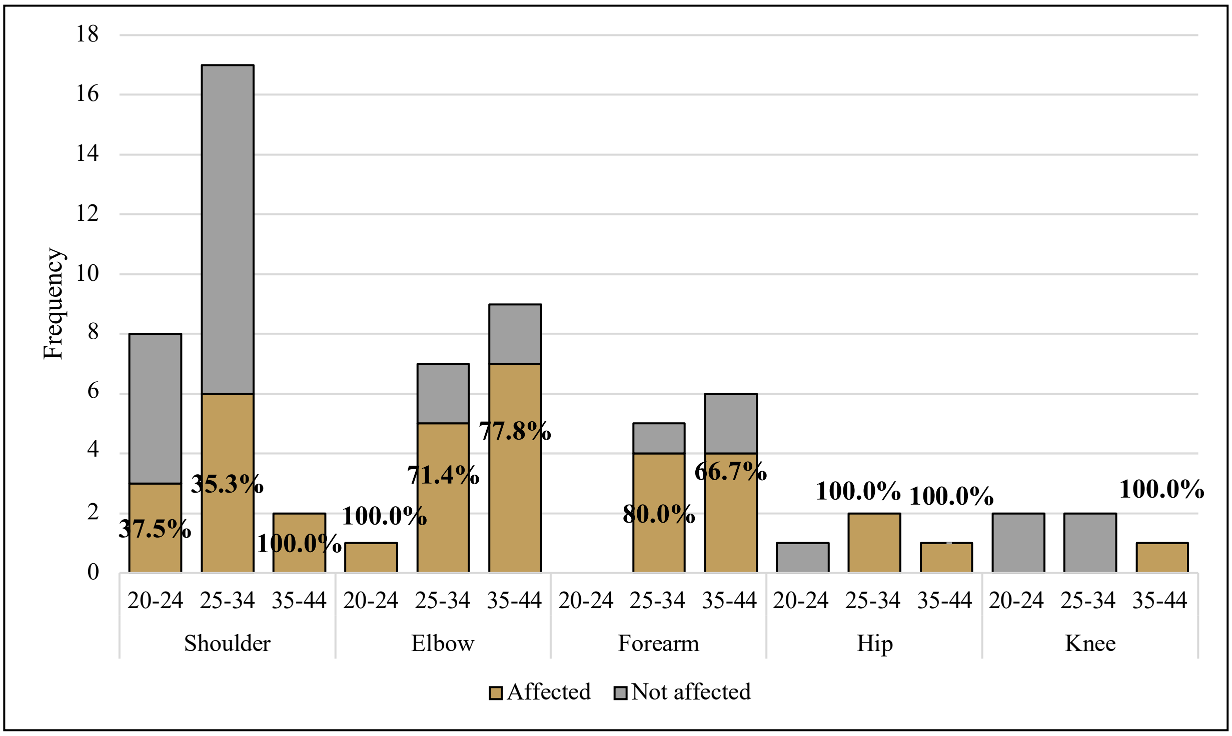


Figure 3.91. Sotira: Frequency distribution of the entheses affected by EFs by age category (pooled functional complexes). N:64.

Similarly, the severity rank distribution seems to be due to the bias in representation of the three categories as, for instance, the younger groups were found to be more severely affected than the mature adults in the shoulder and the elbow (Figure 3.92).

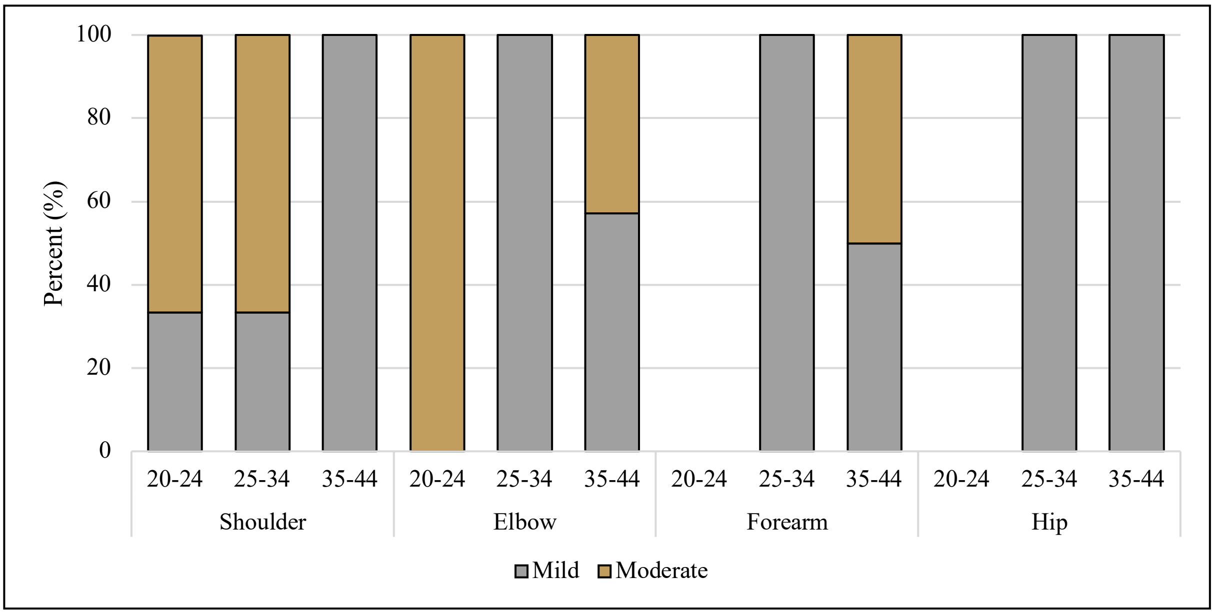


Figure 3.92. Sotira: Frequency distribution of the mild and moderate EFs by age category (pooled functional complexes). N:24.

No significant difference was revealed by the Kruskal-Wallis on both the complexes (shoulder p-value=0.368, elbow p-value=0.150, forearm p-value=0.317, hip p-value=1.000).

3.3.1.3 Osteoarthritis

No joint surface was sufficiently well preserved in this sample to be included in this analysis.

3.3.1.4 Extra-masticatory dental wear

A total of 64 maxillary and 64 mandibular teeth belonging to nine individuals were examined for extra-masticatory dental wear. Two defects, both encompassed in the category of the dental notch, were identified:

- one (degree 1) on the central maxillary incisor of a middle adult female deposed in tomb 11 (Figure 3.93)
- two on the central (degree 3) and lateral (degree 2) maxillary incisors of the young female found in unit 22 (Figure 3.93).

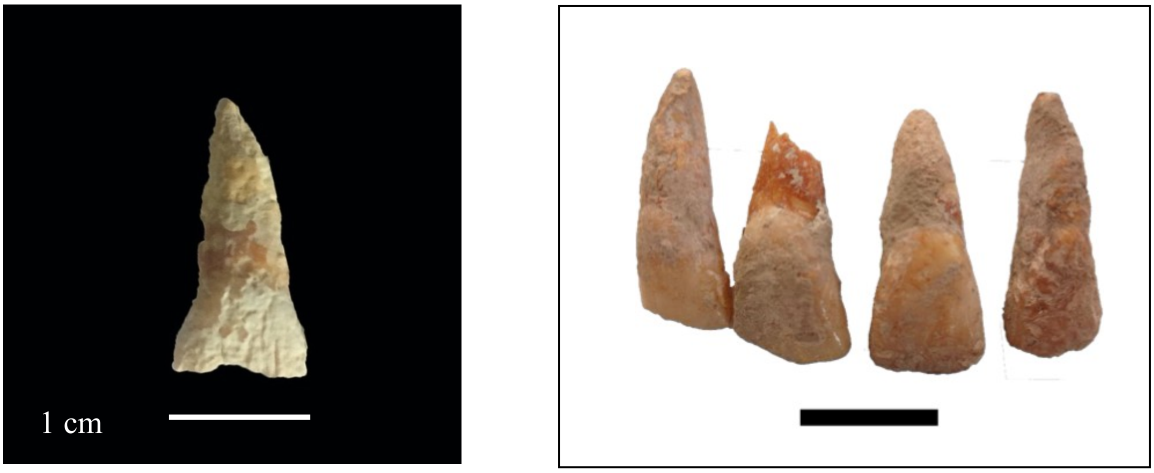


Figure 3.93. Sotira: Evidence of dental notch on a central incisor from tomb 11 of Sotira Kaminoudhia, on the left; central and lateral incisors of the female skeleton found in unit 22, on the right. Photos by courtesy of Anna Osterholtz.

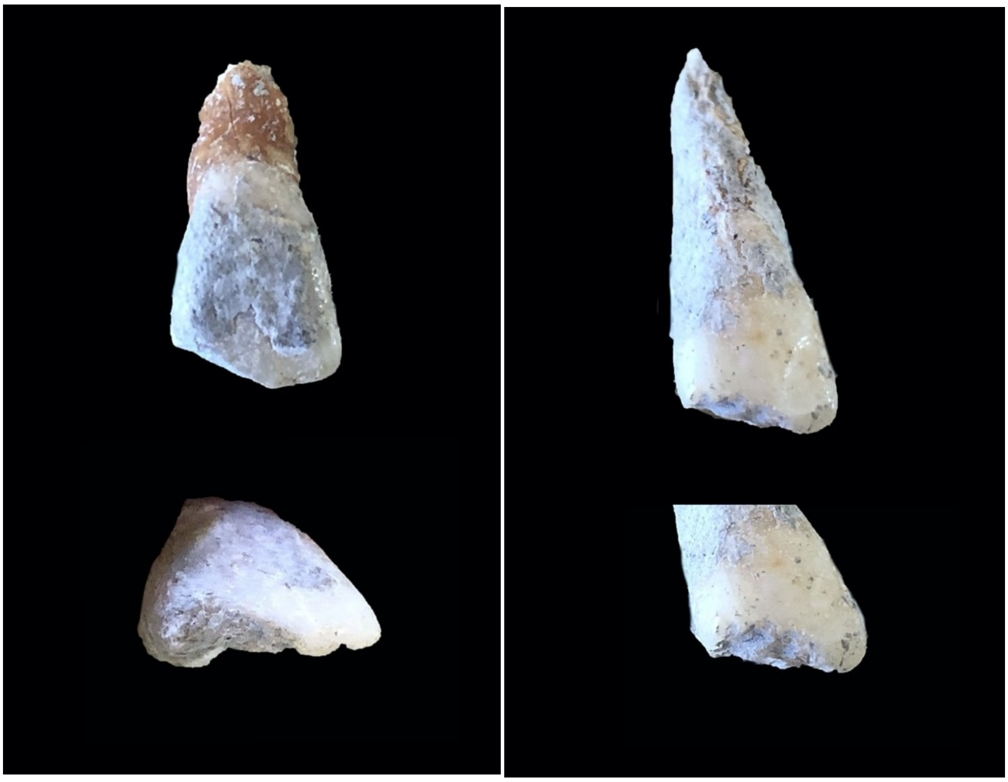


Figure 3.94. Sotira: Focus on the right central (on the left) and lateral incisor (on the right) from unit 22, labial view and occlusal view.

3.3.1.5 Summary

In sum, the population from Sotira was small and highly biased towards females which predominantly fell within the middle age range. The only male examined was a mature adult. On the basis of the evaluation of the robusticity ranks scored for ECs, it is possible to assert that the elbow and the shoulder were the functional complexes which displayed the more severe robusticity. All the functional complexes, except the shoulder, exhibited a right-side asymmetry. The great bias between male and female entheses (three from the male and 53 from the females) prevented additional comparisons between the two groups; however, it was noted that the females exhibited high ranks on the *costoclavicular*, *trapezoid*, and *pectoralis major*. Concerning the comparisons between age groups, the bias in the representativity of the three age groups affected the reliability of the results. Indeed, the more severe forms were found in the best-represented categories. Concerning the OLs, they occurred on six surfaces pertaining to the *costoclavicular ligament*, the *supinator*, and the *brachialis*, all in mild forms. For this reason, no differences between sides, sexes and age categories could be ascertained. Concerning the EFs, they occurred on 36 surfaces, predominantly pertaining to the elbow and hip, even if the shoulder resulted to be the most severely affected. The right side was more affected than the left. The great bias between males and females did not allow any comparison. No joint surface was recorded on this sample. Two extra-masticatory dental defects were noted: both of the type of the notch and both from female skeletons.

3.2.3 Kalavasos Village Tombs

3.3.2.1 Paleodemography

The biological sex and mortality profile of adults from the EBA-MBA site of Kalavasos is presented in table 3.4. Sex estimation was possible for 21 of the 22 individuals. The number of male individuals slightly exceeded the number of females. Age estimation was possible for 21 of the 22 individuals. All four age categories are represented.

Table 3.4. Age and sex composition of the sample. ND: not determined. %: within the sex.

	Young adult 20-24		Middle adult 25-34		Mature adult 35-44		Old adult 45+		ND		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Male	0	0.0	6	50.0	2	16.7	3	25.0	1	8.3	12	54.5
Female	4	44.4	2	22.2	3	33.3	0	0.0	0	0.0	9	40.9
ND	1	100.0	0	0.0	0	0.0	0	0.0	0	0.0	1	4.5
Total	5	0.0	8	25.0	5	50.0	3	0.0	1	25.0	22	100.0

The bar chart in figure 3.95 illustrates the age distribution of the sample by sex. Overall, it must be noted that the female age distribution reflects the young and mature adult range, while the male age distribution reflects the middle, mature and old adult range.

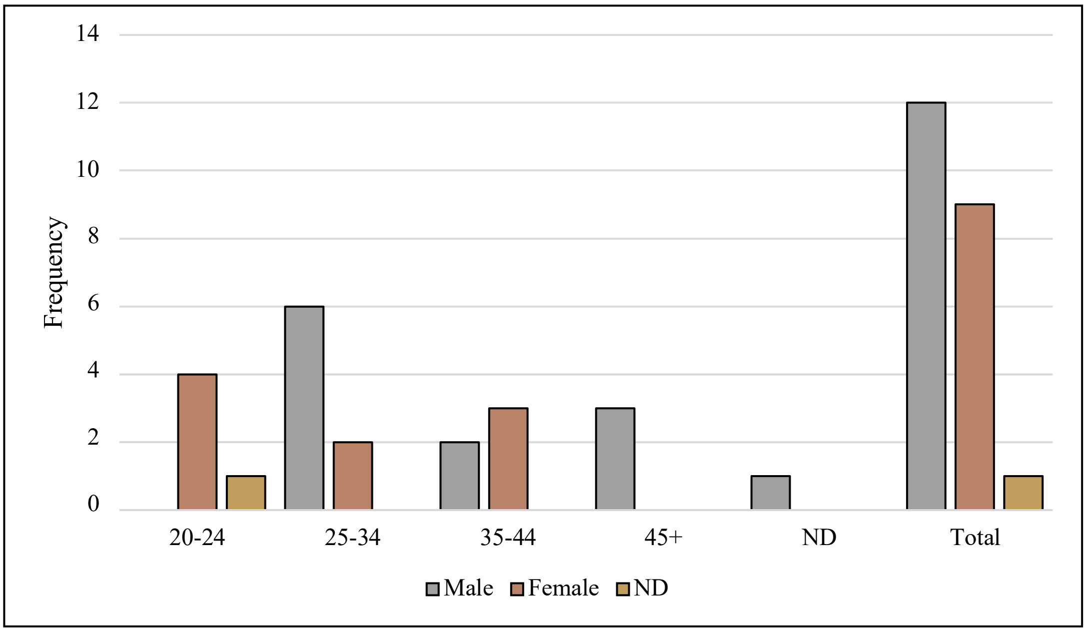


Figure 3.95. Kalavasos: Age distribution of the sample by sex. ND: not determined. N:22.

3.3.2.2 Entheseal Changes

3.3.2.2.1 <u>Robusticity: relationship between score development, enthesis, and functional complex</u>

The evaluation of the ECs of this sample was carried out on a total of 131 entheses belonging to 21 individuals. Figure 3.96, designed to highlight the pattern of the entheses representation within the whole sample, shows that none of the observed entheses was well-represented.

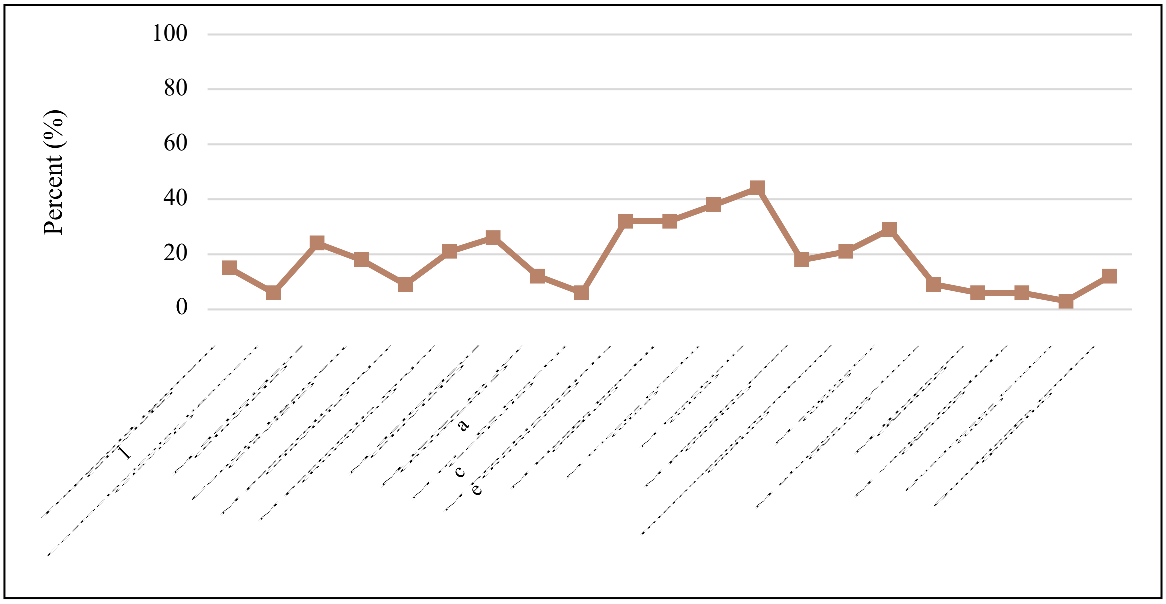


Figure 3.96. Kalavasos: Entheses representation (%) within the whole sample. N:131.

The *brachialis* and the *triceps brachii* (ulna) were the most frequently assessed (15/131, 11.5% and 13/131, 9.9% respectively). In contrast, the *quadriceps tendon* (tibia) was the least assessed (1/131, 0.8%).

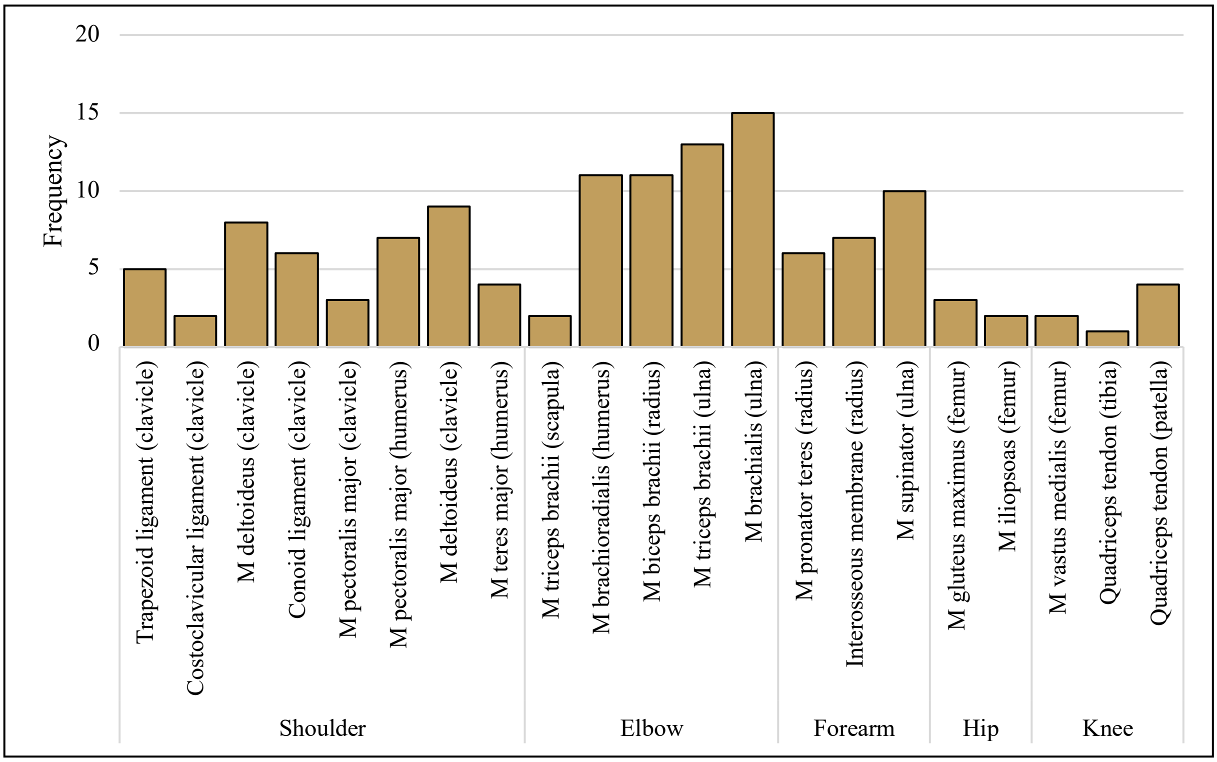


Figure 3.97. Kalavasos: Frequency distribution of the observed entheses by muscle. N:131.

Thus, this assessment highlighted a bias between the best and the least represented entheses (*brachialis* and *quadriceps tendon* (tibia)) of the order of 15:1. Overall, the mild forms were the prevalent (100/131, 76.3%). Moderate degrees prevailed on the *quadriceps tendon* (tibia) (1/1, 100.0%), the *pectoralis major* (humerus) (4/7, 57.1%), the *costoclavicular ligament* (1/2, 50.0%), and the *brachioradialis* (5/11, 45.5%). As it is evident by this graph, most of the discussed percentages refer to a single observation. The same consideration can be done in relation to the great percentage of severe robusticity detected on the *iliopsoas* (50.0%), for instance, which was related to a single observation (Figure 3.98).

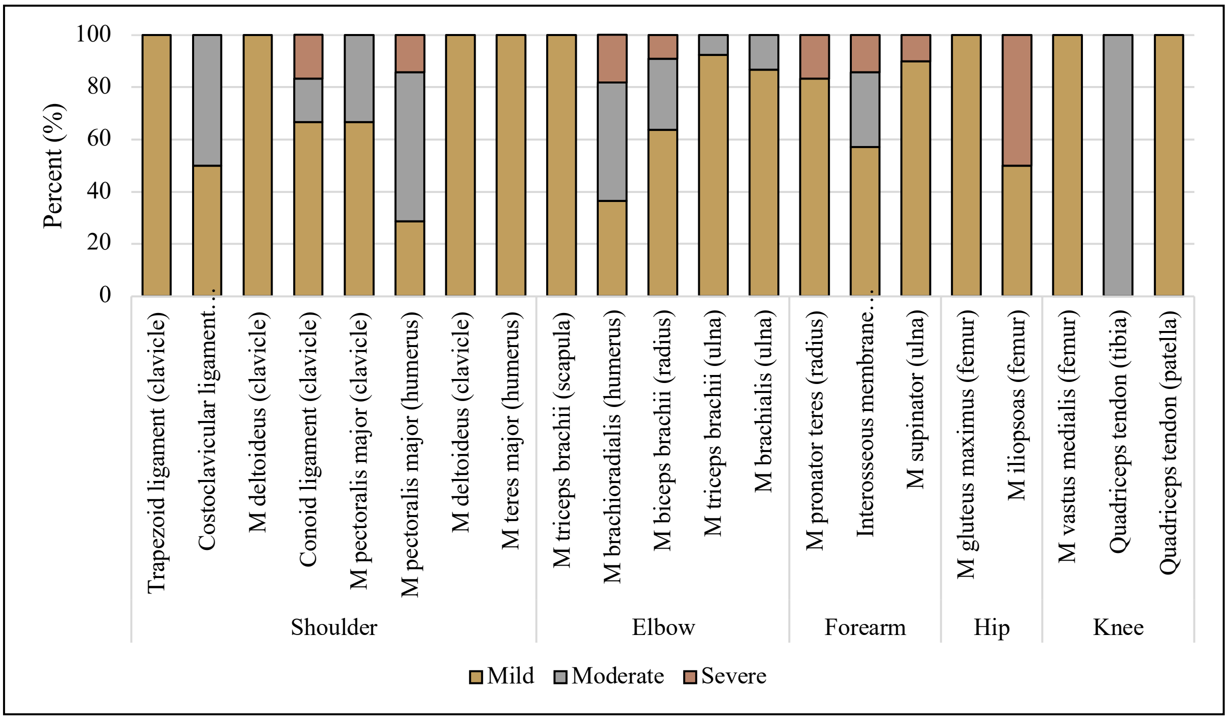


Figure 3.98. Kalavasos: Frequency distribution of mild, moderate, and severe robusticity ranks by muscle. N:131.

By pooling the entheses in functional complexes, it results evident that the best represented functional complex was the elbow (52/131, 39.7%), followed by the shoulder (44/131, 33.6%). In contrast, the less well represented was the hip (5/131, 3.8%) (Figure 3.99).

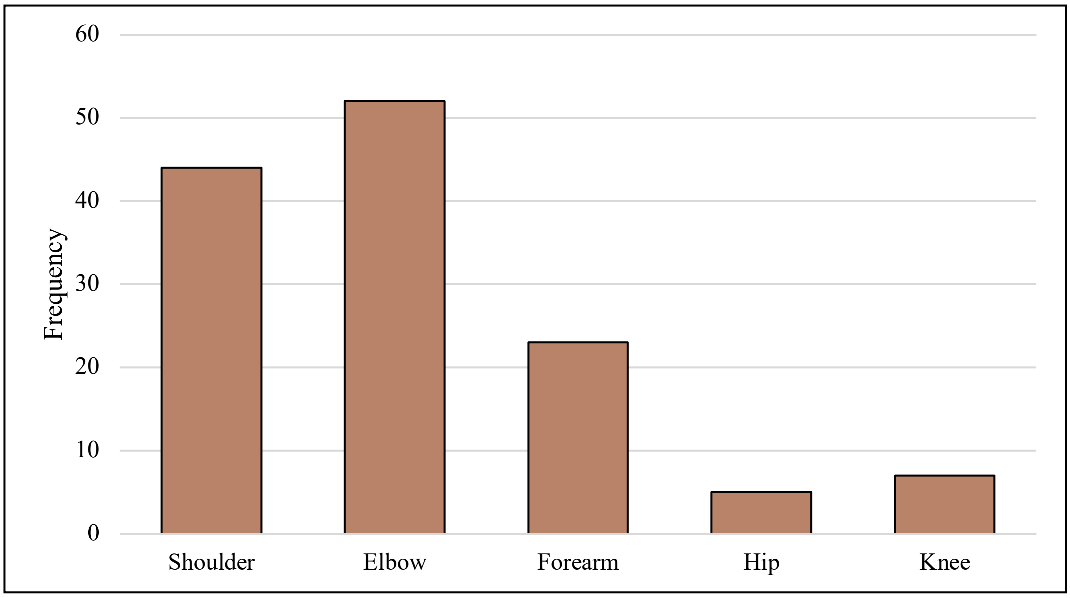


Figure 3.99. Kalavasos: Frequency distribution of the observed entheses by functional complex. N:131.

Looking at robusticity ranks distribution, the greatest percentage of moderate + severe degrees was observed on the elbow (14/52, 26.9%) and the shoulder (9/44, 20.5%), but the greatest number of severe degrees was found on the hip (1/5, 20.0%). As previously stated, the percentages related to the lower limbs were likely to be unreliable since the poor representations of these functional complexes.

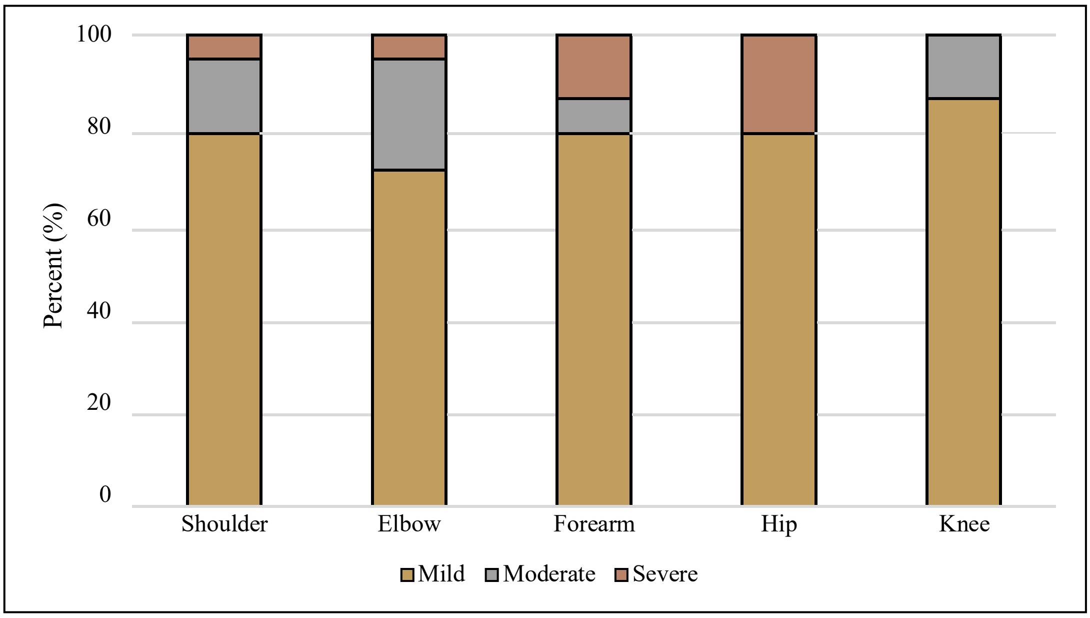


Figure 3.100. Kalavasos: Frequency distribution of mild, moderate, and severe robusticity ranks by functional complex. N:131.

3.3.2.2.2 Robusticity: relationship between score development, side, sex, and age

For which concerns the comparison between sides, figure 3.101 allows us to appreciate that, except for the *triceps brachii* (scapula) and *quadriceps tendon* (patella), the two sides were almost equally represented.

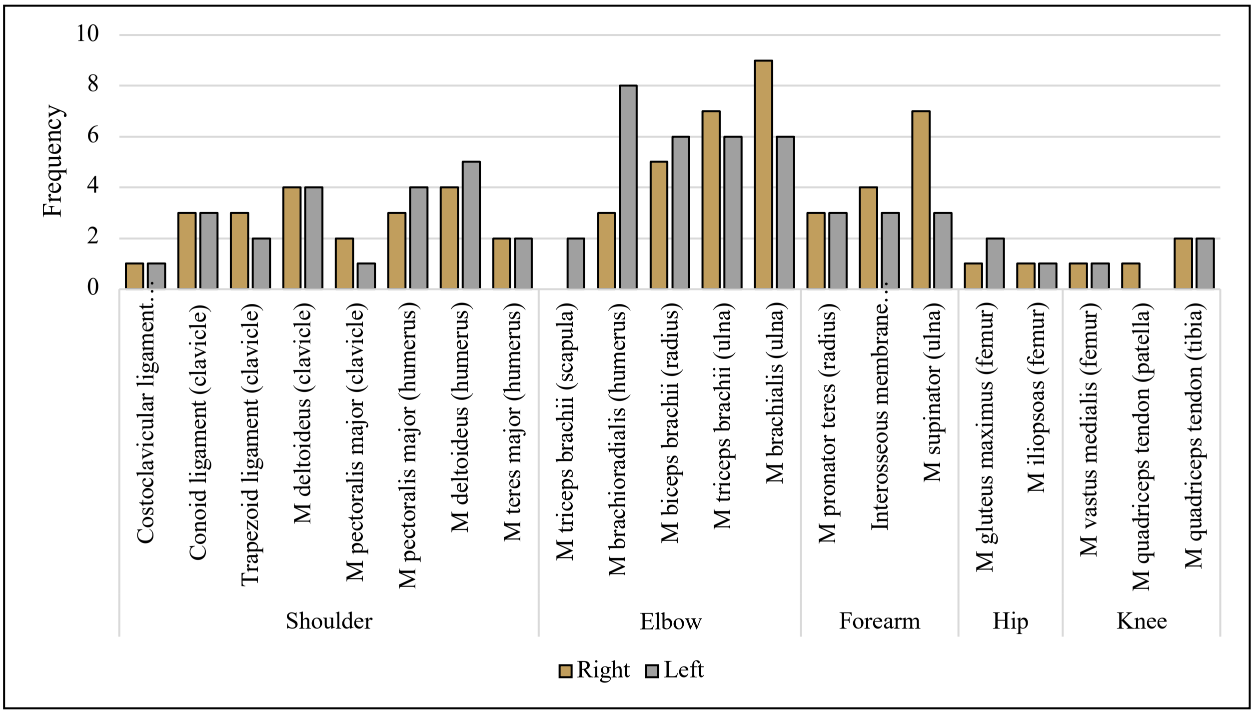


Figure 3.101. Kalavasos: Frequency distribution of the observed entheses by side. N:131.

Thus, considering the severity distribution of this marker, with the only exception of the *biceps brachii* and the *pronator teres*, all compared entheses displayed a left asymmetry.

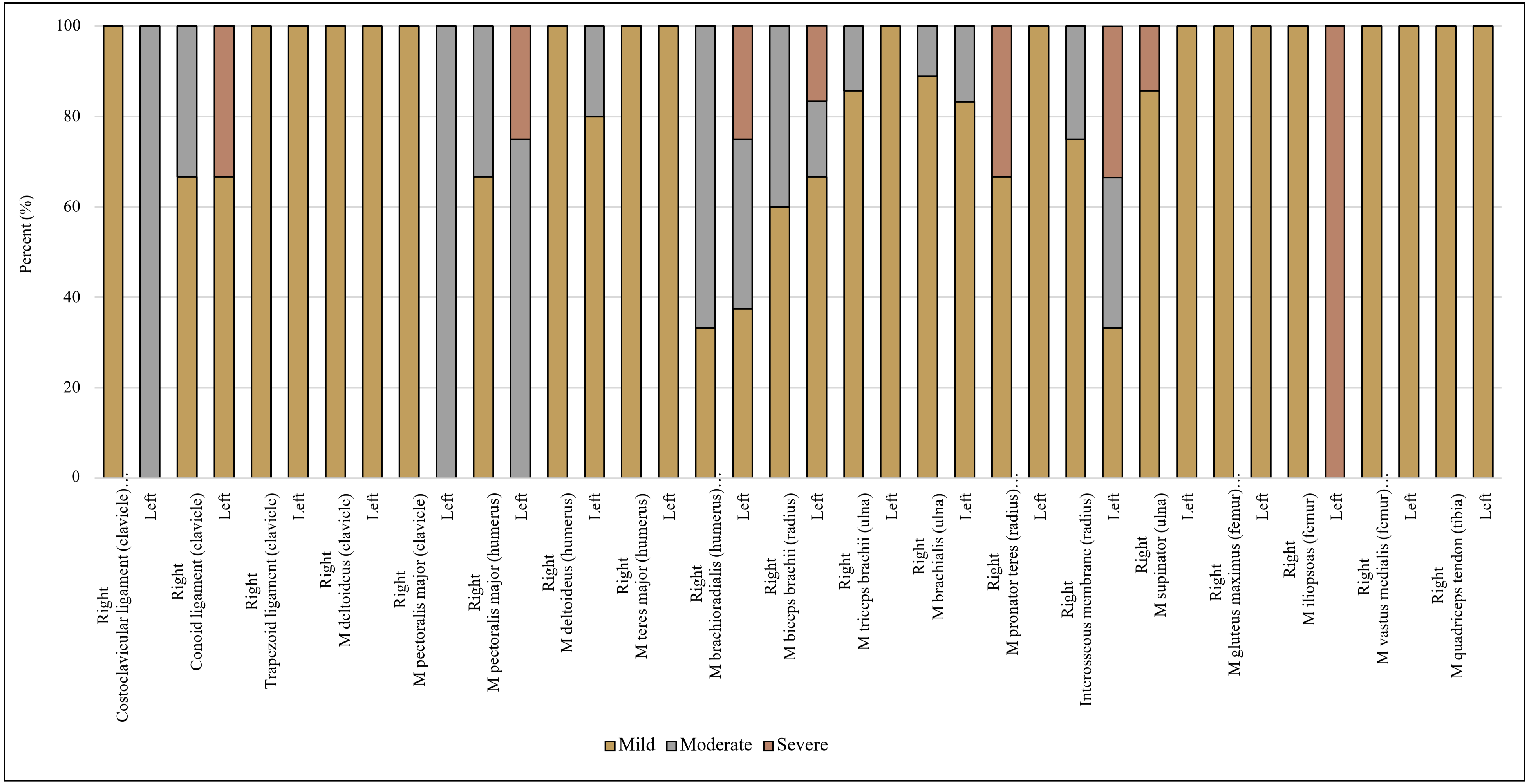


Figure 3.102. Kalavasos: Frequency distribution of mild, moderate, and severe robusticity ranks by side. N:131.

As for the functional complexes, all the five functional complexes were almost equally represented except the elbow, better represented by left entheses, and the forearm which was better represented on the right side (Figure 3.103).

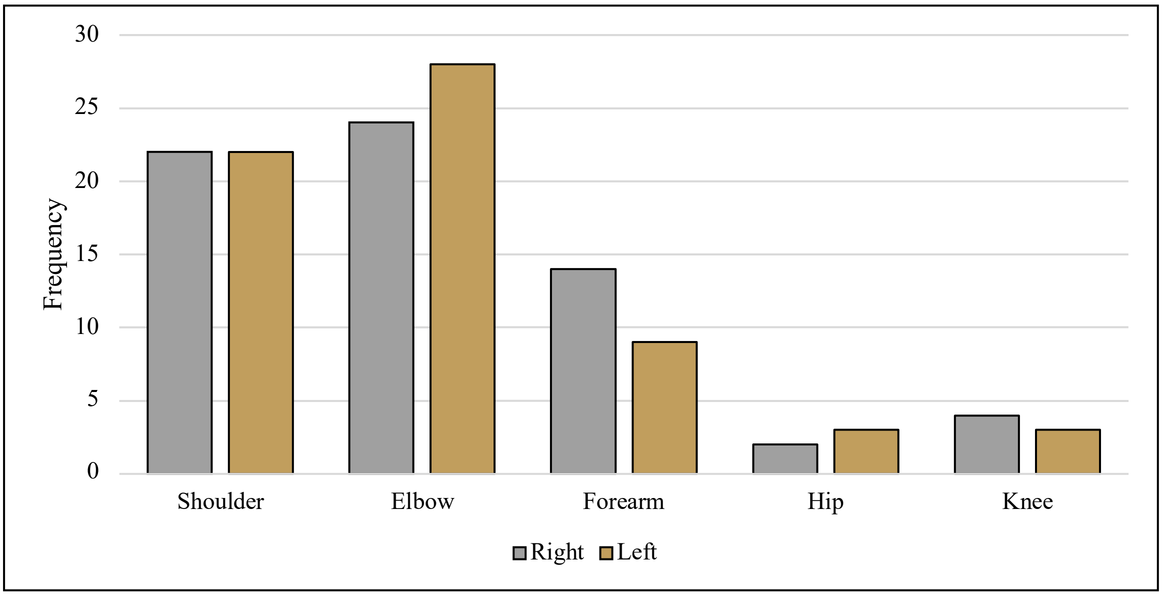


Figure 3.103. Kalavasos: Frequency distribution of the observed entheses by side (pooled functional complexes). N:131.

Looking at the severity distribution of the robusticity ranks by side, all the functional complexes, except the knee, were more developed on the left side compared to the right (Figure 3.104). The entheses belonging to the knee exhibited 25.0% (1/4) moderate degrees on the right side, while the left entheses were found to be only slightly developed.

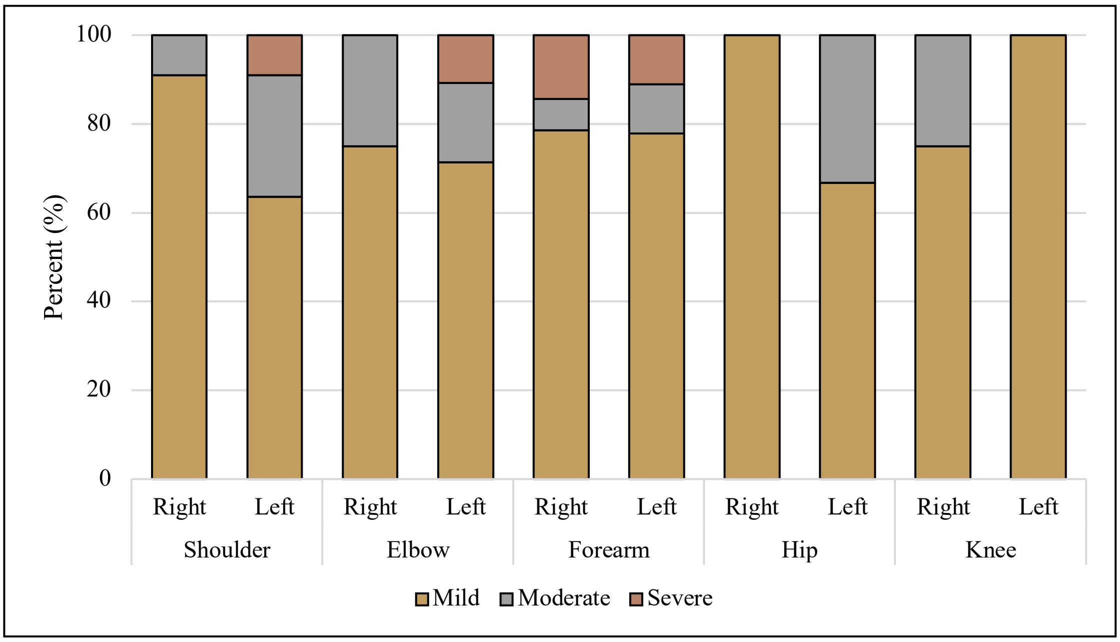


Figure 3.104. Kalavasos: Frequency distribution of mild, moderate, and severe robusticity ranks by side (pooled functional complexes). N:131.

These differences between the sides were statistically significant (p-value=0.029) for the shoulder, not significant for the other functional complexes (elbow p-value=0.619, forearm p-value=1.000, hip p-value=0.800, knee p-value=0.629).

For which concerns the comparison between the sexes, the sample was restricted to 128 entheses derived by the sex-determined individuals. Not all the entheses were found to be comparable: *costoclavicular* and *pectoralis major*, for instance, were not represented on both the sex. Among the comparable, none were equally represented: more especially, the greatest bias was noted on the *interosseous membrane* (1:6, towards the females) (Figure 3.105).

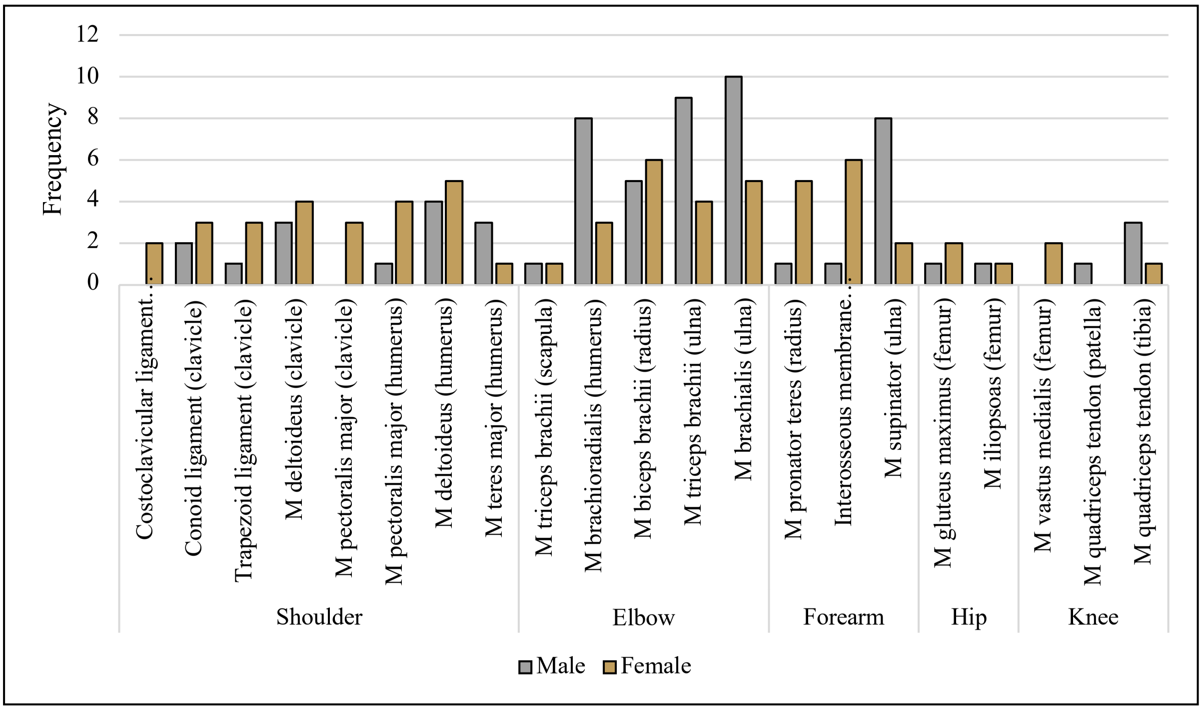


Figure 3.105. Kalavasos: Frequency distribution of the observed entheses by sex. N:128.

Looking at the severity distribution, the males exhibited greater development of the *conoid*, the *biceps brachii*, the *brachialis*, the *pronator*, and the *iliopsoas*; while females had greater development of the *pectoralis major*, the *brachioradialis*, and the *interosseous membrane*.

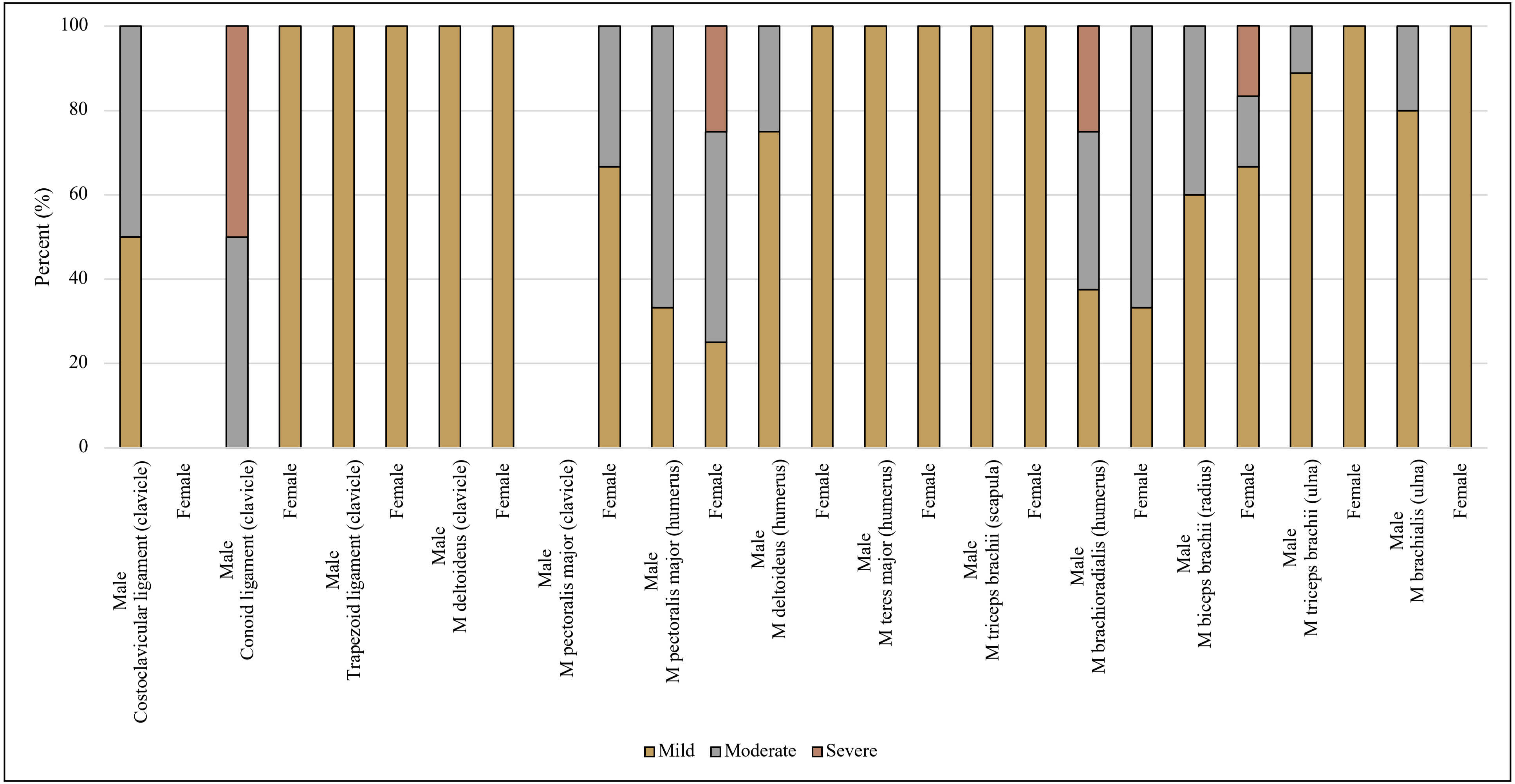


Figure 3.106. Kalavasos: Frequency distribution of mild, moderate, and severe robusticity ranks by sex (shoulder and elbow). N:96.

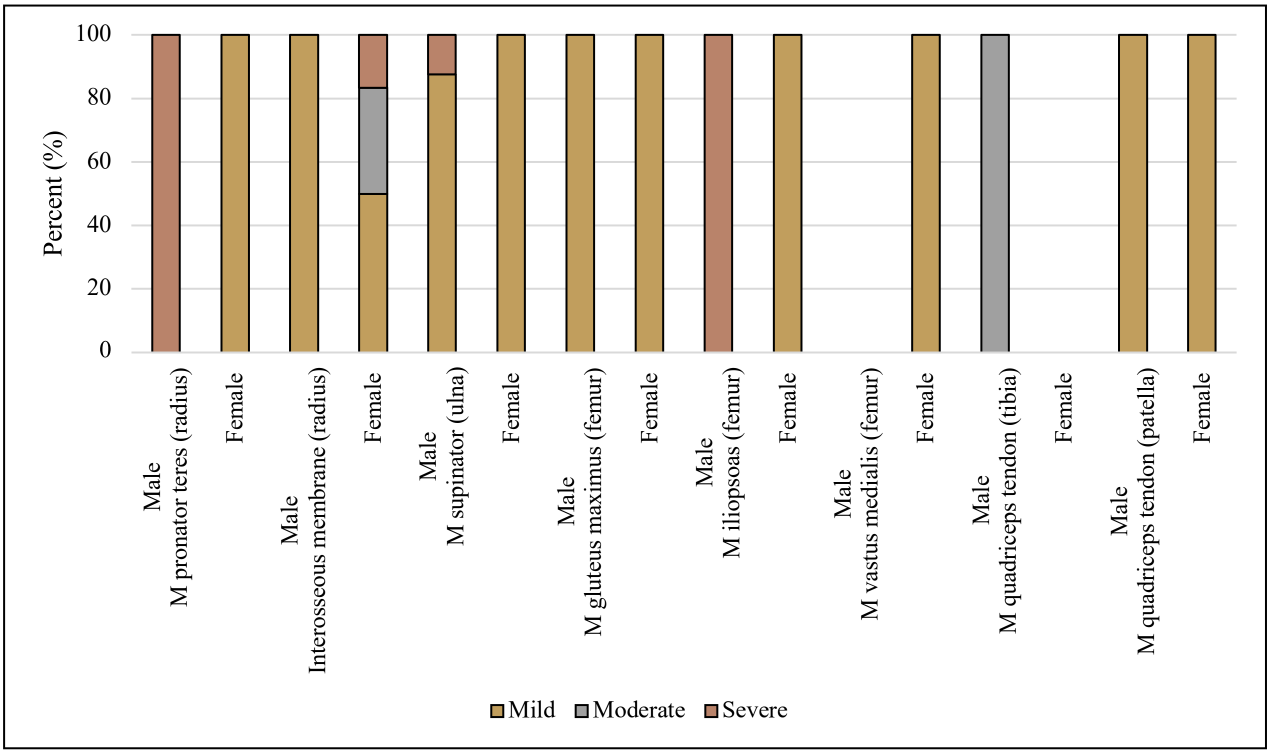


Figure 3.107. Kalavasos: Frequency distribution of mild, moderate, and severe robusticity ranks by sex (forearm, hip and knee). N:35

At the functional complex level, the hip and the knee did not show a great disparity in representation; it must be specified, however, that, since the very low number of observations by sex, they did not be considered for any comparison. The elbow displayed a bias towards males of the order of 2:1. In the other two complexes, the females were, instead, better represented than the males (Figure 3.108).

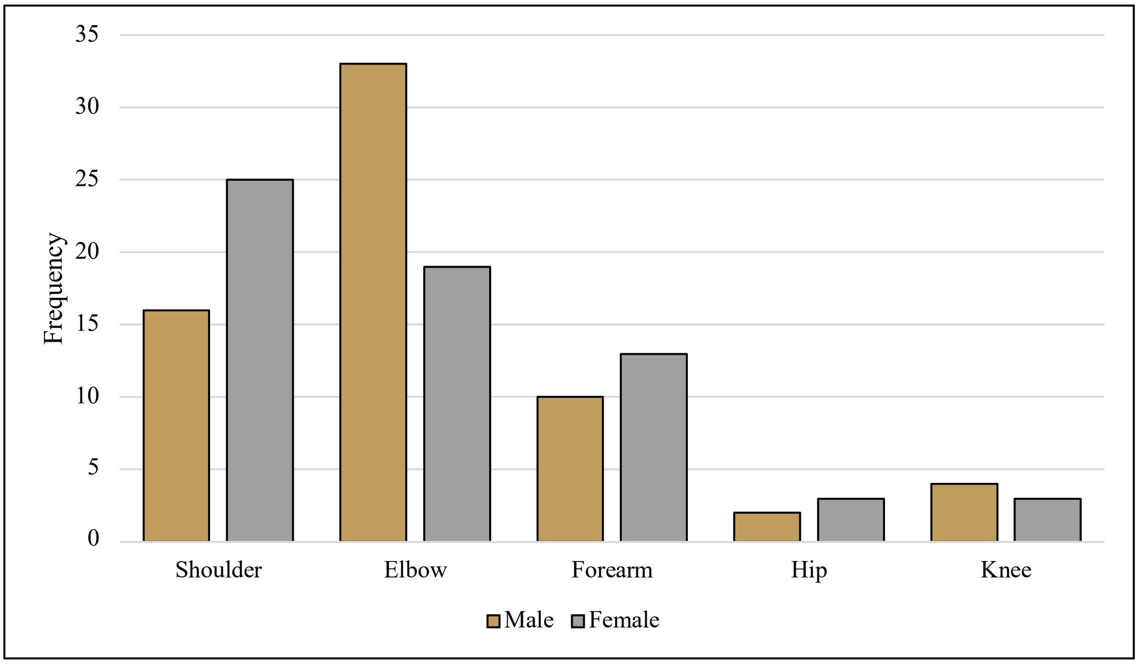


Figure 3.108. Kalavasos: Frequency distribution of the observed entheses by sex (pooled functional complexes). N:128.

Yet, despite being underrepresented, the males exhibited the highest percentages of moderate and severe robusticity ranks in all the functional complexes (Figure 3.109). The greatest proportion of moderate degrees (50.0%) was noted on the hip; it must be specified, however, that this rate refers to a single enthesis.

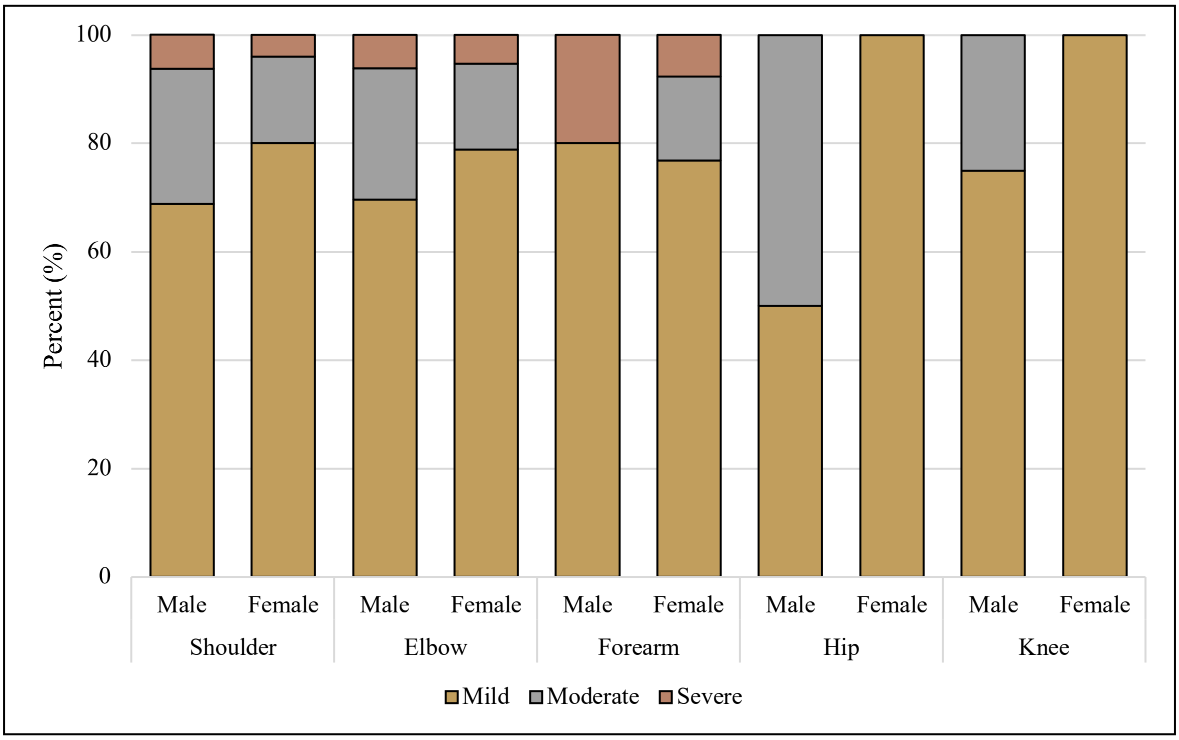


Figure 3.109. Kalavasos: Frequency distribution of mild, moderate, and severe robusticity ranks by sex (pooled functional complexes). N:128.

These differences were however not significant (shoulder p-value=0.552, elbow p-value=0.492, forearm p-value=1.000, hip p-value=0.400, knee p-value=0.629).

For which concerns the robusticity ranks distribution between the age groups, the sample under study was restricted to 128 entheses belonging to the age-assigned individuals. As expected, the four age categories were not equally represented. Overall, the middle adults were the best-represented category, while the old adults was the least well represented (Figure 3.110).

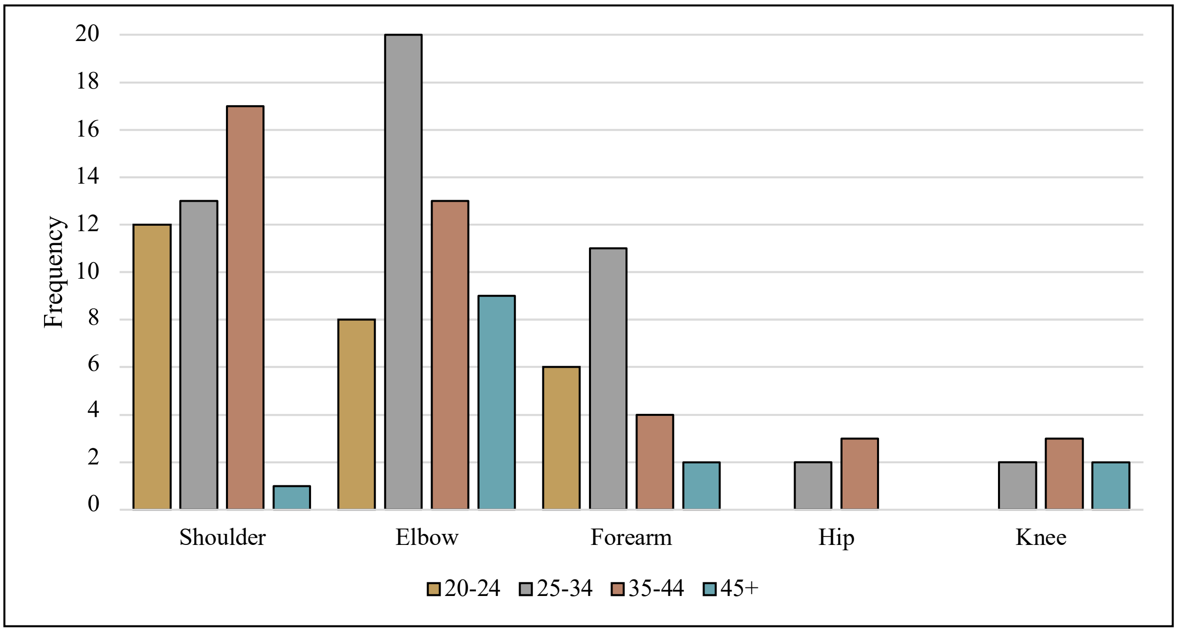


Figure 3.110. Kalavasos: Frequency distribution of the observed entheses by age group (pooled functional complexes). N:128.

Thus, looking at severity ranks distribution by age category, in the upper limb entheses, the percentages of moderate and severe degrees increased from the young (20-24 years) to the middle adult range (25-34 years); and decreased from the middle to the mature adult range (35-44 years). As for the lower limb, the only moderate and severe forms identified were discovered in the mature adults group. This pattern of distribution seems to reflect the pattern of representation of each age category reported in figure 3.110.

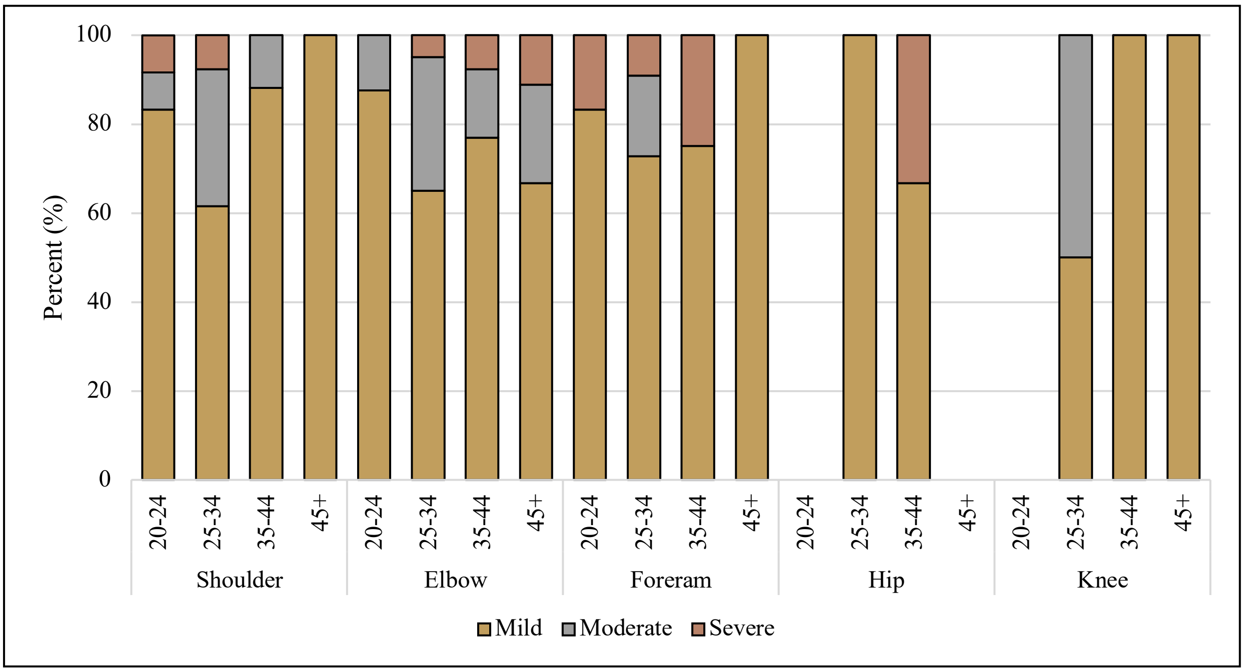


Figure 3.111. Kalavasos: Frequency distribution of mild, moderate and severe robusticity ranks by age category (pooled functional complexes).

These different patterns were however not statistically significant (shoulder p-value=0.198, elbow p-value=0.467, forearm p-value=0.667, hip p-value=0.414, knee p-value=0.221).

3.3.2.2.3 Osteolytic and Enthesophytic formations: relationship between score development and enthesis

OLs and EFs were not present on all the observed entheses. More specifically, the OLs were rare, affecting only 1.5% (2/131) of the total of the entheses; the EFs were frequent, affecting 54.2% (71/131) of the examined surfaces.

Concerning the OLs, the only affected entheses were a *biceps brachii* and a *brachialis*. This did not allow any comparison between sides, sexes and age groups.

Concerning the EFs, the most affected entheses were the *pectoralis major* (humerus) (6/7, 85.7%), the *trapezoid ligament* (4/5, 80.0%), and the *teres major* (3/4, 75.0%). No affection was instead observed on the *vastus medialis* (Figure 3.112).

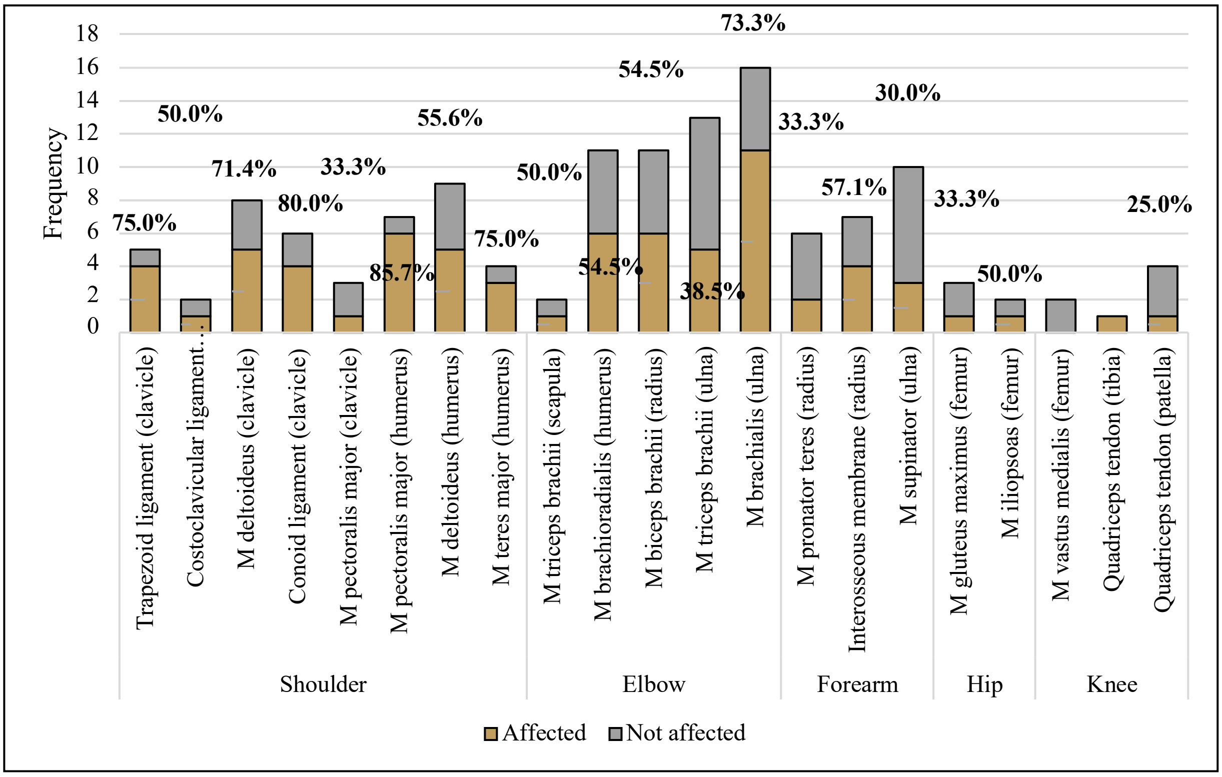


Figure 3.112. Kalavasos: Frequency distribution of the entheses affected by EFs by muscle. N:131.

Thus, focusing on the 71 entheses affected by EFs, the *supinator*, the *iliopsoas*, and the *quadriceps tendon* (tibia) were the most severely affected yielding 100.0% moderate degrees. In all three cases, however, this high percentage was calculated by considering not more than two entheses. Severe EFs were instead found on the *conoid ligament* (1/4, 25.0%), the *brachioradialis* (1/6, 16.7%), and *the biceps brachii* (1/6, 16.7%) (Figure 3.113).

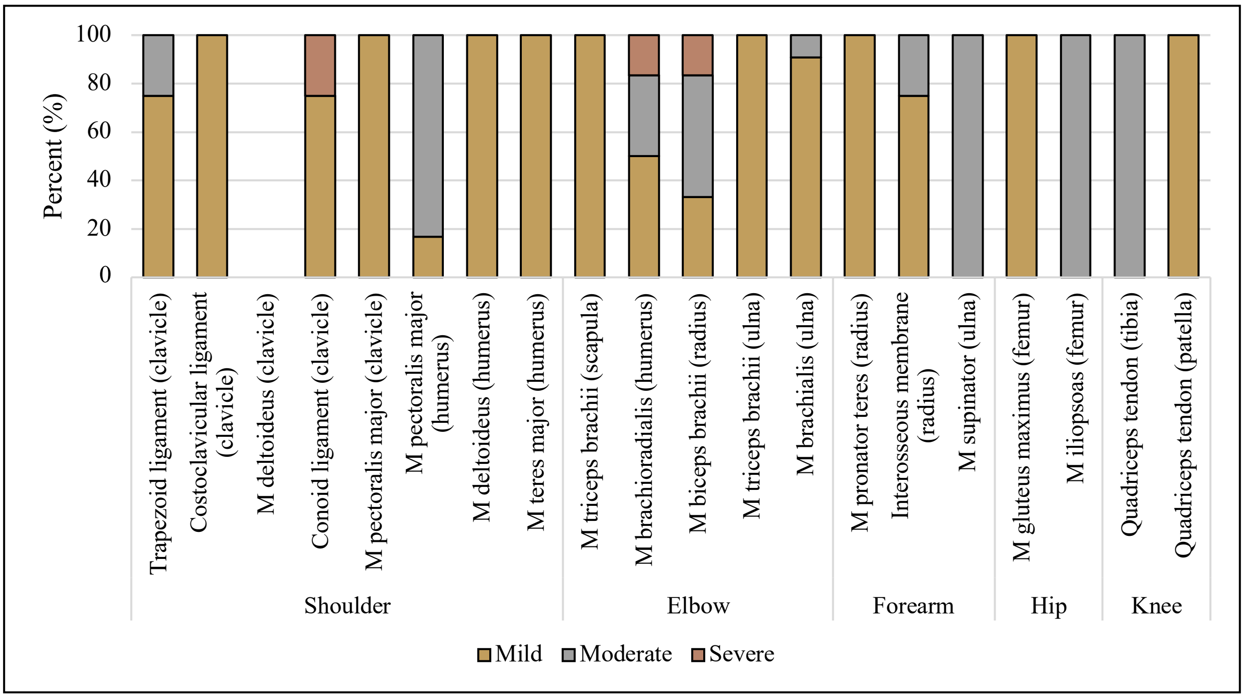


Figure 3.113. Kalavasos: Frequency distribution of mild, moderate, and severe EFs ranks by muscle. N:71.

Turning to the representativity of the affected entheses by functional complex, the shoulder, the elbow, and the hip displayed the highest rates of affections (29/44, 65.9%; 29/52, 55.8% and 2/5, 66.6% respectively). The knee, instead, exhibited the lowest percentage (2/7, 28.6%) (Figure 3.114).

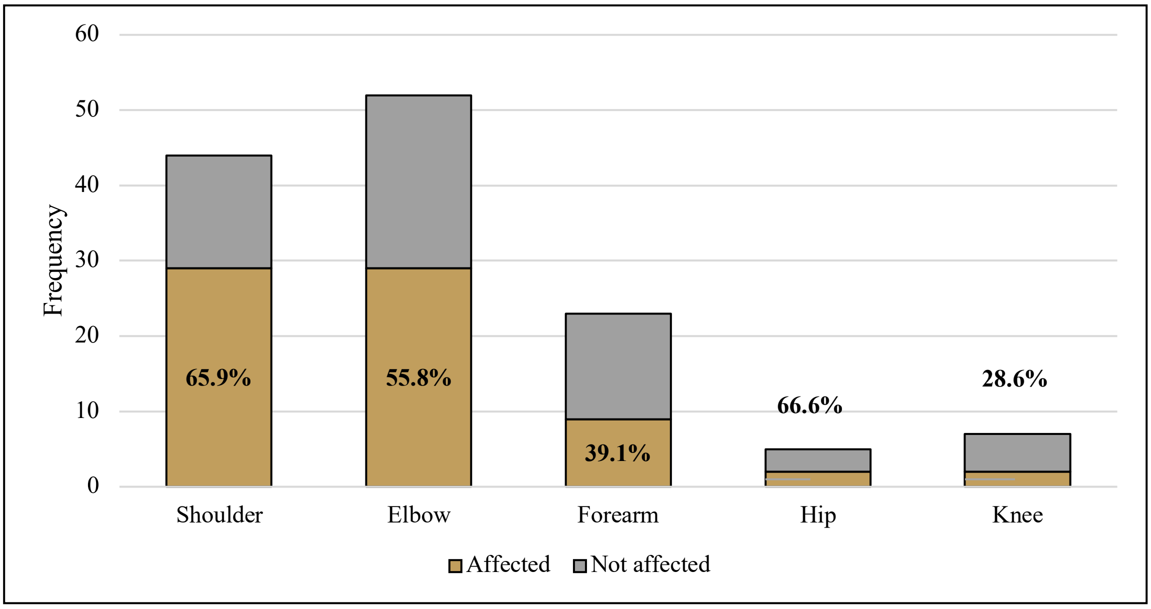


Figure 3.114. Kalavasos: Frequency distribution of entheses affected by EFs by functional complex. N:131.

Looking at the severity distribution, the higher percentages of moderate degrees were assessed on the hip and knee (½, 50.0%), the least represented functional complexes. Among the functional complexes pertaining to the upper limb, the forearm exhibited the greatest number of moderate EFs (4/9, 44.4%), but the elbow displayed the greatest percentage of severe scores (2/29, 6.9%) (Figure 3.115).

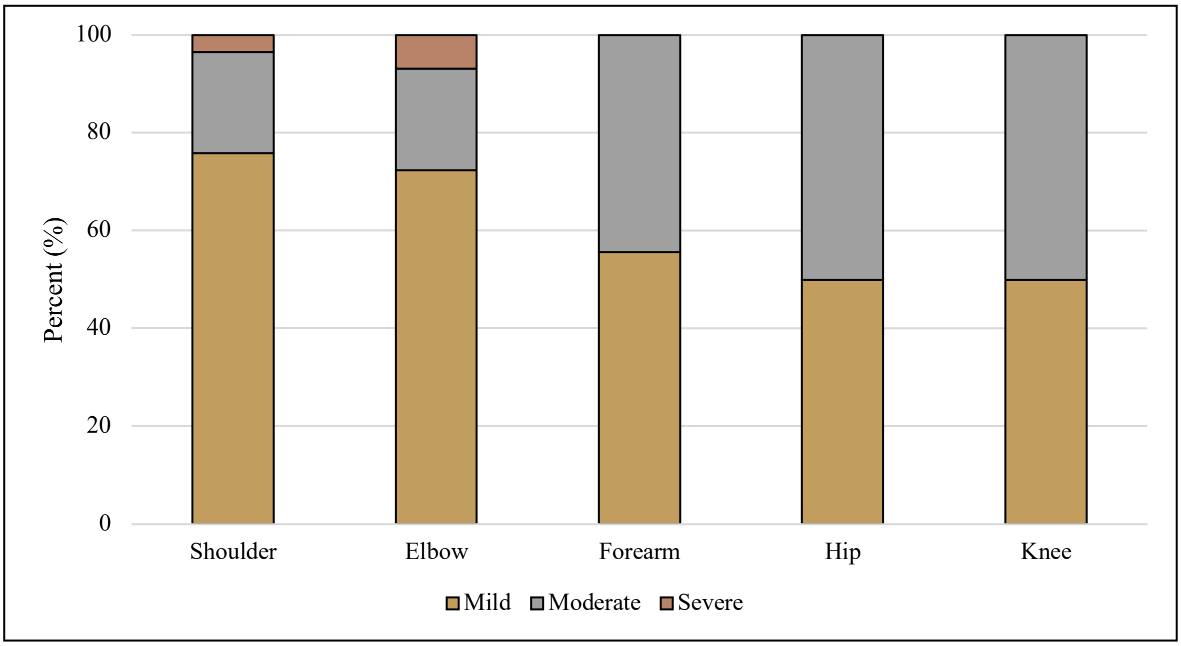


Figure 3.115. Kalavasos: Frequency distribution of mild, moderate, and severe EFs ranks by functional complex. N:71.

3.3.2.2.4 Enthesophytic formations: relationship between score development, side, sex, and age

EFs were observed on 71 entheses of 131; in this case, the comparison between the sides was conducted. The hip was not taken into consideration because it did not display evidence of EFs on the right side (Figure 3.116). In the remaining functional complexes, the left side was found to be more affected than the right. In the shoulder, the percentage of affections of the left side (18/22, 81.8%) greatly exceeded the percentage of affections of the right (11/22, 50.0%); in the elbow the bias was lower, yielding 60.7% (17/28) compared with 12/24, 50.0% of the right side; in the forearm, 44.4% (4/9) of affections was found on the left and 33.7% (5/14) on the right; in the knee, 33.3% (1/3) of affections was detected on the left and 25.0% (1/4) on the right. Thus, overall, the pattern of distribution of the EFs by side reflects the rate of preservation of entheses for each group.

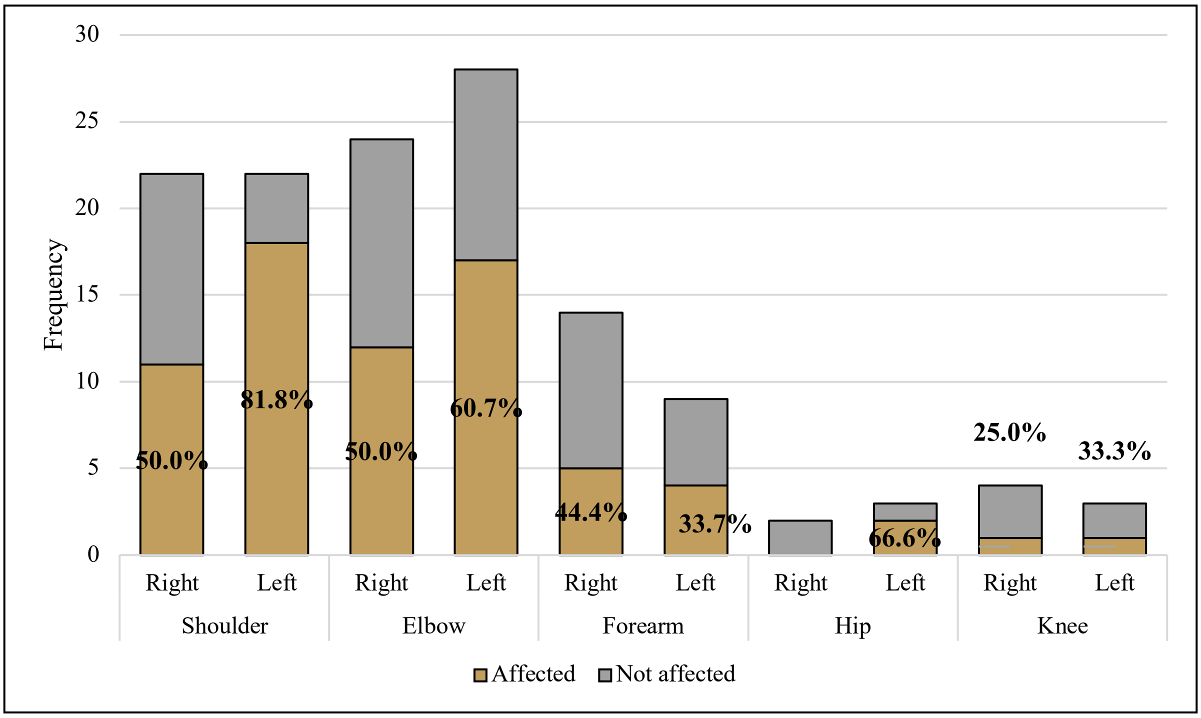


Figure 3.116. Kalavasos: Frequency distribution of entheses affected by EFs by side (pooled functional complexes). N:131.

Similarly, the distribution of the most severe degrees reflects the aforementioned pattern, but an exception was noted and is represented by the shoulder, in which, despite being underrepresented, the right side (4/11, 36.4%) provided the highest rate of moderate + severe forms compared with the left 16.7% (2/12).

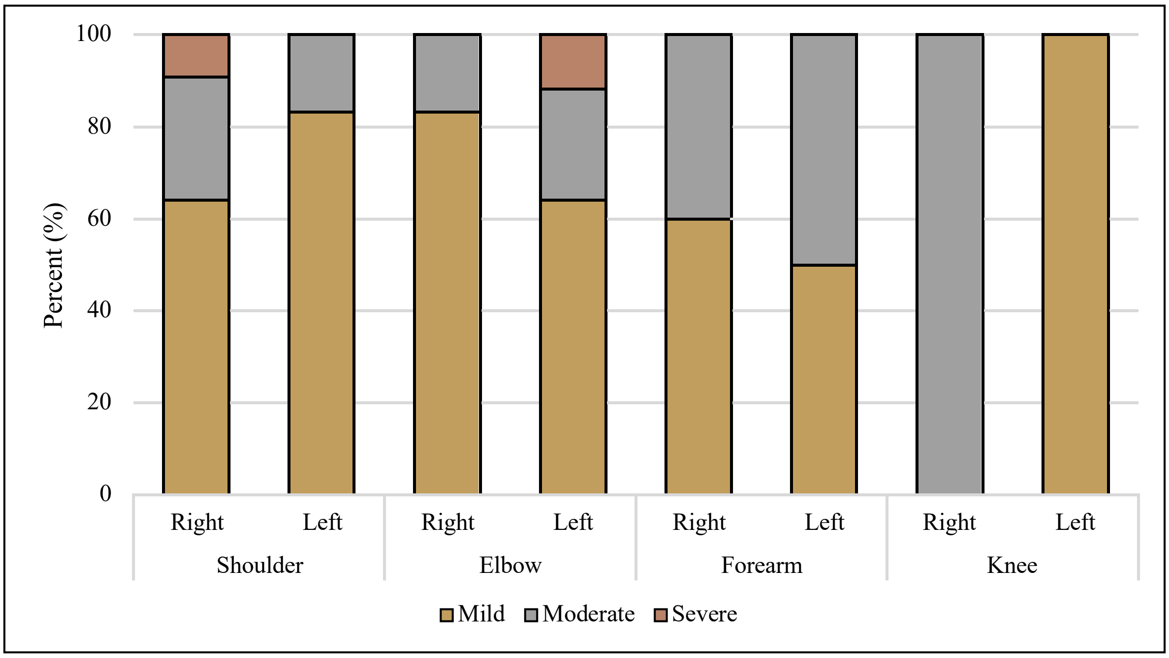


Figure 3.117. Kalavasos: Frequency distribution of mild, moderate, and severe EFs ranks by side (pooled functional complexes). N:71.

These differences were however not statistically significant (shoulder p-value=0.363, elbow p-value=0.370, forearm p-value=0.905, knee p-value=1.000).

For which concerns the distribution of the EFs between sexes, male entheses, despite being underrepresented in the cases of the shoulder, the forearm, and the hip, displayed the highest proportion of affections compared with the females.

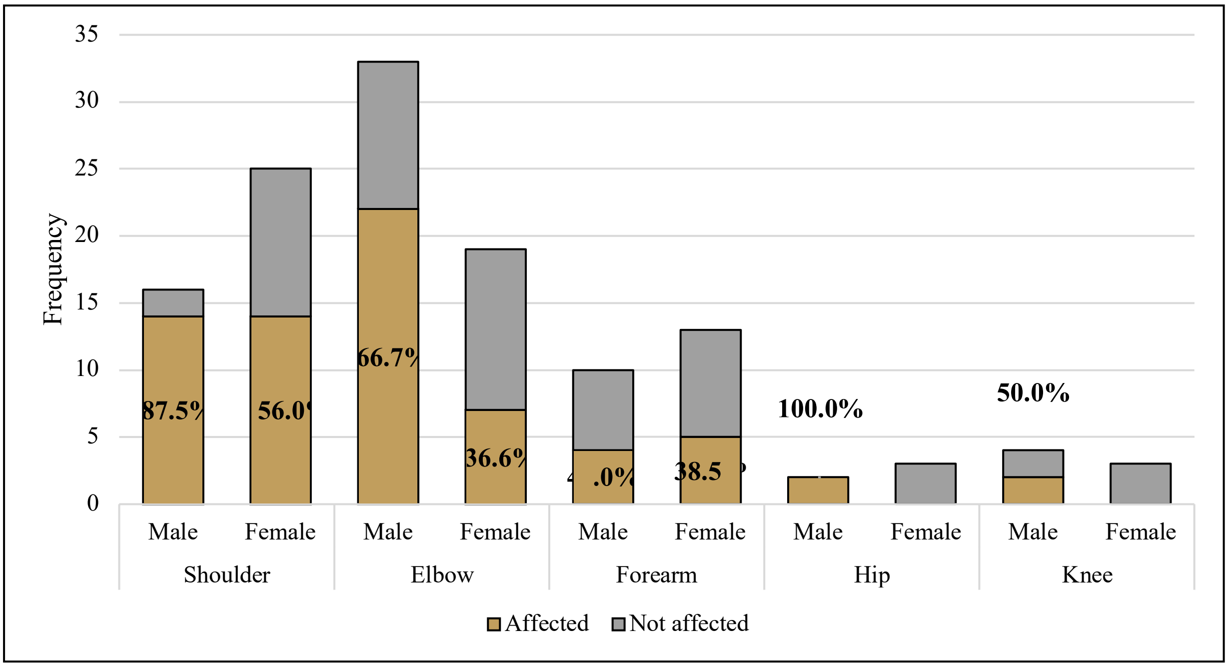


Figure 3.118. Kalavasos: Frequency distribution of entheses affected by EFs by sex (pooled functional complexes). N:128.

Focusing on the three comparable functional complexes, the males were more severely affected on the shoulder, with 28.6% (4/14) moderate and severe EFs compared with 14.3% (1/14) moderate EFs recorded on the females; and on the forearm which showed 75.0% (3/4) moderate formations compared with 20.0% (1/5) of the females. As for the elbow, the females were more severely affected yielding 57.1% (4/7) moderate + severe degrees compared with 18.2% (4/22) moderate and severe EFs recorded on the males (Figure 3.119).

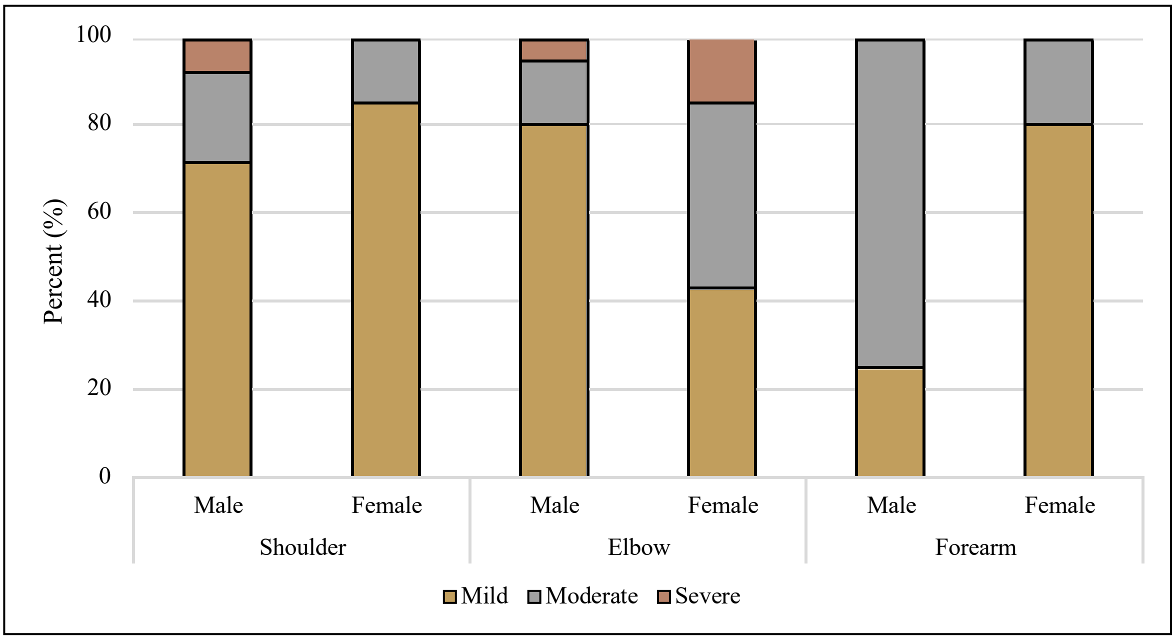


Figure 3.119. Kalavasos: Frequency distribution of mild, moderate, and severe EFs ranks by sex (pooled functional complexes). N:70.

These differences were however not significant (shoulder p-value=0.511, elbow p-value= 0.135, shoulder p-value=0.190).

Concerning the distribution of the EFs between age groups, the lower limb entheses were not considered as the number of affections by age category was not useful for comparisons. As for the shoulder, the elbow, and the forearm, overall, the percentages of affections decreased from the young/middle adults to the mature adults (Figure 3.120).

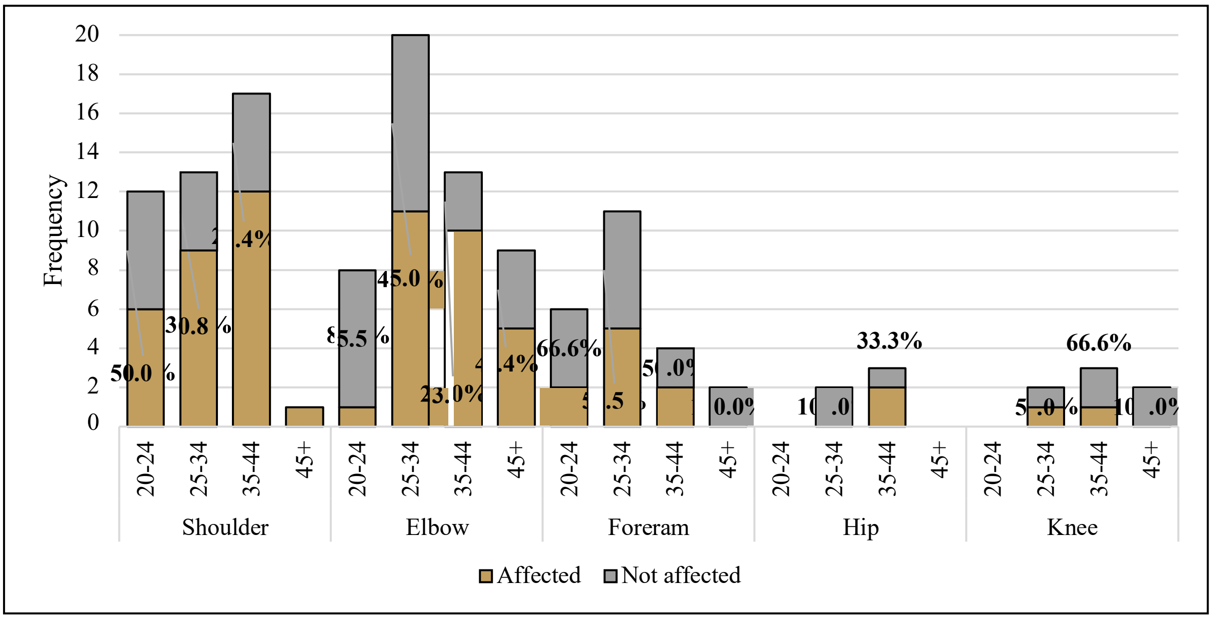


Figure 3.120. Kalavasos: Frequency distribution of entheses affected by EFs by age group (pooled functional complexes). N:128.

Overall, as in the previous cases, the greatest proportions of moderate and severe forms were identified on the sub-samples which provided the highest rates of affections. Thus, also in this case, the EFs rank distribution was determined by the representativity of the age categories (Figure 3.121).

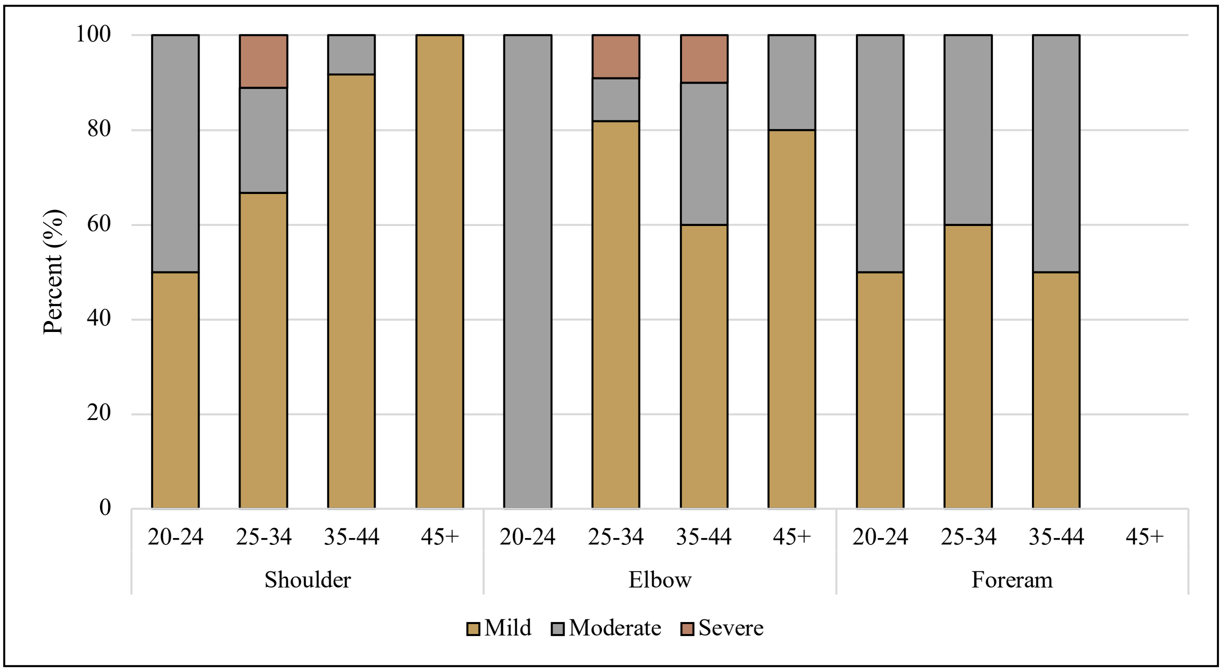


Figure 3.121. Kalavasos: Frequency distribution of mild, moderate, and severe EFs ranks by age category (pooled functional complexes). N:68.

These different patterns were however not significant (shoulder p-value=0.243, elbow p-value=0.383, forearm p-value=0.961).

3.3.2.3 Osteoarthritis

OA evaluation was based on the observation of a total of 30 joint surfaces belonging to 11 skeletons. According to figure 3.122, which shows the BRI value of each joint surface under study, the overall status of preservation of this sample was poor; in fact, only one joint surface, the femoral head, was found to be well-represented.

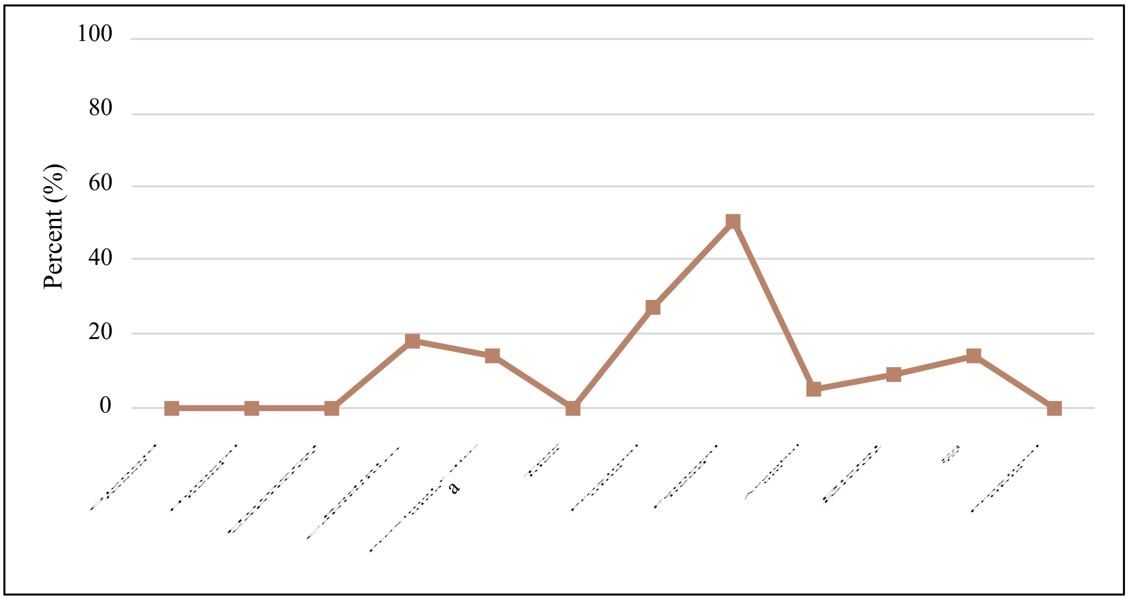


Figure 3.122. Kalavasos: Joint surfaces representation (%) within the whole sample. N:30

The most frequently assessed joint surface was the femoral head (10/30, 33.3%), followed by the proximal ulna (6/30, 20.0%) (Figure 3.123)

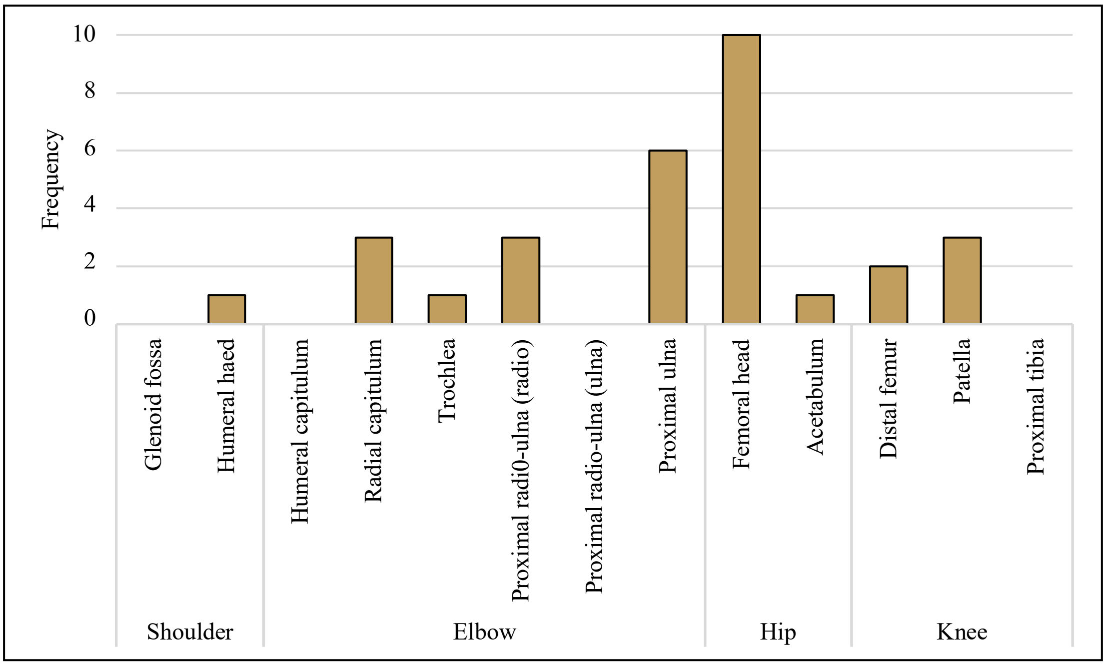


Figure 3.123. Kalavasos: Frequency distribution of the observed surfaces by joint. N:30.

No case of eburnation or fusion was observed. No one of the observed joint surfaces was affected by OA since they did not display more than one of the three considered markers (ML, PO, SO).

3.3.2.4 Extra-masticatory dental wear

A total of 30 maxillary and 26 mandibular teeth belonging to nine individuals were examined for extra-masticatory dental wear. None of the above-mentioned defects was detected on this sample but a case of LSAMAT was found by Anna Osterholtz on two maxillary incisors belonging to one skeleton deposed in tomb 65 (tomb included in this dissertation) and reported in her PhD dissertation (Osterholtz 2015, p. 151). Unfortunately, these teeth have never been allocated in the storage rooms where the collection is presently housed. This prevented the possibility to examine the two defects in person. Nevertheless, Anna Osterholtz has courteously granted me permission to reproduce the figure from her PhD Dissertation (Figure 3.124).

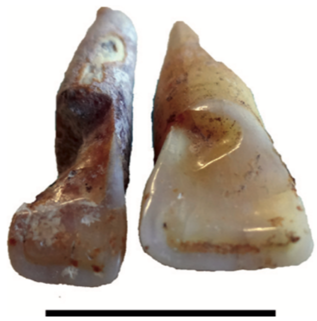


Figure 3.124. Kalavasos: Evidence of LSAMAT observed on two maxillary central incisors from tomb 65. Courtesy Anna Osterholtz.

3.3.2.5 Summary

In sum, the population from Kalavasos was small and highly biased towards males which fell within the middle adult range. On the basis of the evaluation of the robusticity ranks scored for ECs, it is possible to assert that the shoulder and the elbow were the best represented functional complexes; they also displayed the most severe robusticity scores. All the functional complexes with the only exception of the knee displayed a left-side asymmetry. However, this difference was not statistically significant. Despite being underrepresented, the entheses examined on the male skeletons exhibited the more severe robusticity ranks on the *conoid*, the *biceps brachii*, the *brachialis*, the *pronator*, and the *iliopsoas*; while females had greater development of the *pectoralis major*, the *brachioradialis*, and the *interosseous membrane*. Concerning the OLs, they occurred on only one surface pertaining to the *biceps brachii,* and the *brachialis* ranked as mild and belonged to a young adult female and a male of undetermined age. Concerning the EFs, they occurred on 71 surfaces predominantly belonging to the shoulder and elbow; this latter was the most severely affected. The severity distribution of the EF ranks by side suggested a left-side asymmetry for the forearm and elbow; the opposite trend was noted for the shoulder and knee. The males were more affected than the females and displayed more severely forms on the shoulder and forearm, while the females exhibited the more severe degrees on the elbow. The percentages of affections increased from the young to the mature adults but, interestingly, the severity distribution of this marker decreased from the young to the old adult range. Neither OA evidence nor extra-masticatory dental wear was found.

3.3.3 Marki Alonia (Summary) (Appendix 2)

The Marki *Alonia* sample consisted of four individuals: two males and two females which predominantly (=2) fell within the young adult range. The remaining was a middle adult and a mature adult. The evaluation of the robusticity ranks scored for ECs led to ascertain that the males had greater development of the *conoid*; while the females exhibited increasing stress at *costoclavicular*, *trapezoid, deltoideus*, *pectoralis major,* and *brachioradialis.* The development of the upper limb entheses was bilaterally expressed, in favour of the right side, except the *pectoralis major* and the *costoclavicular*, which displayed increasing development of the left side. Concerning the comparisons between age groups, the severity of this marker increased with age. Concerning the OLs, they occurred on four entheses (*costoclavicular, trapezoid*, and *iliopsoas*) predominantly in mild forms. Since the very low number of affections, no differences between sides, sexes and age categories could be ascertained. Concerning the EFs, they occurred on five entheses (*costoclavicular*, *deltoideus* (humerus), *deltoideus* (clavicle) and, *iliopsoas*) predominantly in mild forms. Since the very low number of affections, no differences between sides, sexes and age categories could be ascertained. Concerning the OA, only one of ten joint surfaces displayed evidence of OA. It belonged to a young female. No evidence of extra-masticatory dental wear was identified.

3.3.4 Alambra Mouttes (Summary) (Appendix 2)

The osteological collection from Alambra *Mouttes* which was considered for this dissertation consisted of six individuals, four males and two females. Five of these fell within the middle adult category, the last one in the mature category. The evaluation of the robusticity ranks scored for ECs showed that the males had increasing stress at the *brachialis*, the *membrane interosseous*, and the *gluteus maximus*, while the females provided only mild expressions on all the examined entheses. The comparison of the severity rank distribution between the age categories confirmed that age was a confounding factor as the severity of this marker increased with age. Concerning the OLs, they occurred on the *supinator*, the *gluteus maximus*, the *iliopsoas*, and the *vastus medialis*. Thus, no comparisons between sexes, age groups and sides were conducted. Concerning the EFs, they occurred on 16 surfaces, predominantly included in the forearm and hip; however, the shoulder and hip were the most severely affected. The right side was more affected than the left. The females exhibited more affections, but this finding can be ascribed to the consistent bias in terms of representation of the entheses. Overall, the EF severity ranks increased with age. Concerning the OA, two of ten joint surfaces displayed evidence of OA, both belonging to middle adults, one male and one female. No evidence of extra-masticatory dental wear was noted.

3.3.5 Erimi Laonin tou Porakou (Summary) (Appendix 2)

The sample from Erimi *Laonin tou Porakou* examined for this study included four individuals, two males and two females. Two of these fell within the mature adult range, one was of uncertain age, the fourth was a middle adult. The evaluation of the robusticity ranks distribution scored for ECs led to establishing that the females had high ranking at the *costoclavicular,* the *trapezoid,* the *pectoralis major*, and the *deltoideus*, while the males exhibited greater values at the *conoid* and the *interosseous membrane*. As for the comparison between age groups, the severity of this marker increased with age. Concerning the OLs, they occurred on four entheses pertaining to the *conoid* and the *interosseous membrane*. Thus, no differences between sides, sexes and age categories could be ascertained since the very low number of affected entheses. Concerning the EFs, they occurred on eight surfaces that predominantly belonged to the shoulder: the males displayed the highest percentage of affections, but the females were more severely affected. No comparison between age categories was possible. Neither evidence of OA nor extra-masticatory dental wear were found.

3.3.6 Episkopi Phaneromeni (Summary) (Appendix 2)

A total of 14 individuals, ten females and four males, from the site of Episkopi *Phaneromeni* was considered for this dissertation. For eight of these, the age at death could not be assessed; as for the remaining, three were categorized as young adults, the other three were one middle, one mature, and one old adult. The evaluation of the robusticity ranks distribution indicated that the males utilized the *triceps brachii* (ulna) and the *biceps brachii* more than the females, who, on the contrary, had pronounced *brachialis* and *brachioradialis* compared with the males. In all the cases, the right side was more developed than the left. OLs and EFs seem to draw different trends. The former affected a very low percentage of the observed surfaces (3/51, 5.9%), more specifically, they were noted on the *brachialis* of a female of not determined age and on two *brachioradialis* of a middle adult female. Since the very low number of affections, no comparisons were carried out. The last, recorded in a higher percentage (34/51, 66.7%), mostly affected the lower limbs entheses, especially the *gluteus maximus* and *vastus mediali*s. The shoulder and the hip displayed a left-side asymmetry, while the elbow, the forearm and, the knee were more affected on the right side. Overall, the elbow was more severely affected in the males, shoulder, forearm and, knee in the females. Concerning OA, only two articular surfaces were affected: one belonging to a middle adult female and one to a male of uncertain age at death. The only extra-masticatory dental defect observed in this sample is a case of LSAMAT pertaining to a mature adult male.

3.4 Middle Bronze Age III-Late Bronze Age III

3.4.1 Hala *Sultan Tekke*

3.4.1.1 Paleodemography

The biological sex and mortality profile of adults from the LCI-III site of Hala is presented in table 3.5. Sex estimation was possible for all the observed skeletons (n=9). The proportion of the female individuals (7/9, 77.8%) greatly exceeds the males (2/9, 22.2%). Age estimation was possible in only six of nine cases (66.7%). Three of the four age categories are represented: young (20-24 years), middle (25-34 years) and mature (35-44 years) adults. No old adults (44+ years) were recovered. Given the very small sample size, it would be misleading to draw any detailed conclusions about mortality. It is, however, possible to assert that the majority of adults fell within the range of young adults (20-24 years).

Table 3.5. Hala: Sex and age composition of the sample. ND: not determined. %: within the sex.

	Young adult 20-24		Middle adult 25-34		Mature adult 35-44		Old adult 45+		ND		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Male	0	0.0	0	0.0	1	50.0	0	0.0	1	50.0	2	22.2
Female	3	42.9	1	14.3	1	14.3	0	0.0	2	28.6	7	77.8
Total	3	33.3	1	11.1	2	22.2	0	0.0	3	33.3	9	100.0

The bar chart in figure 3.125 illustrates the age distribution of the sample by sex. Overall, it must be noted that the female age distribution reflected all the three age categories, but mostly the younger, while the only one male assigned age at death was a middle adult.

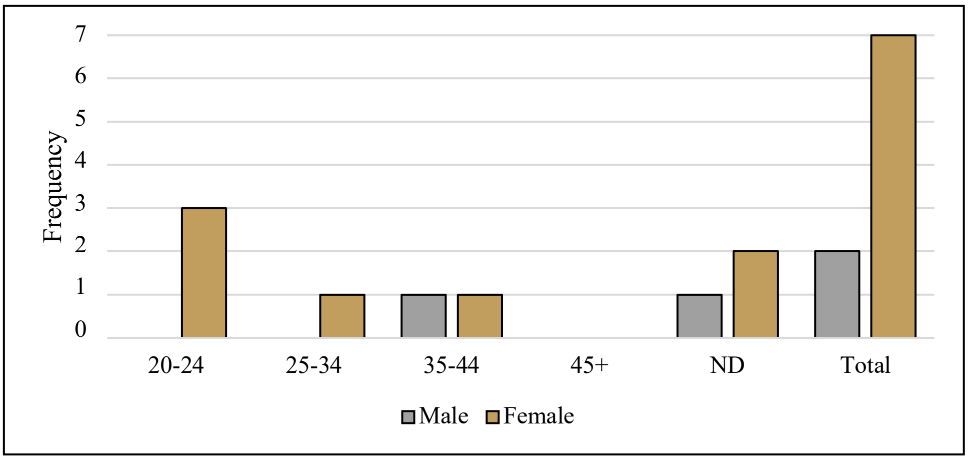


Figure 3.125. Hala: Age distribution of the sample by sex. ND: Not Determined. N:9.

3.4.1.2 Entheseal Changes

3.4.1.2.1 <u>Robusticity: relationship between score development, enthesis, and functional complex</u>

The evaluation of the ECs of this sample was carried out on a total of 147 entheses belonging to nine individuals. As can be noted in figure 3.126, the BRI values were overall high compared with the previous samples: seven entheses in total, including the *costoclavicular* and the *brachialis*, yielded values that rise above 50.0%.

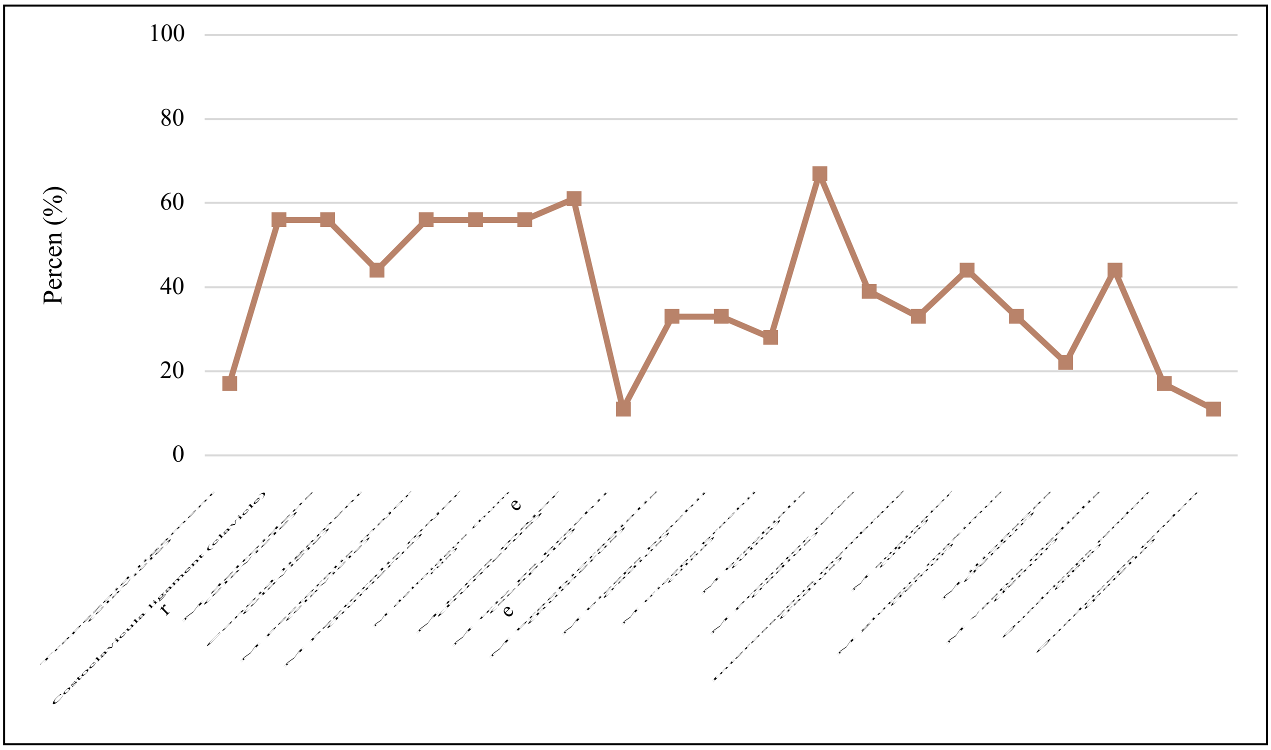


Figure 3.126. Hala: Entheses representation (%) within the sample. N:147.

Thus, focusing on the distribution of entheses for which scores for ECs could be recorded, figure 3.127 shows that the *brachialis* was the most frequently assessed (12/147, 8.2%), followed by the *teres major* (11/147, 7.5%). In contrast, *trapezoid ligament, triceps brachii* (scapula), and *quadriceps tendon* (patella) were the less well-preserved entheses (1/147, 0.7%).

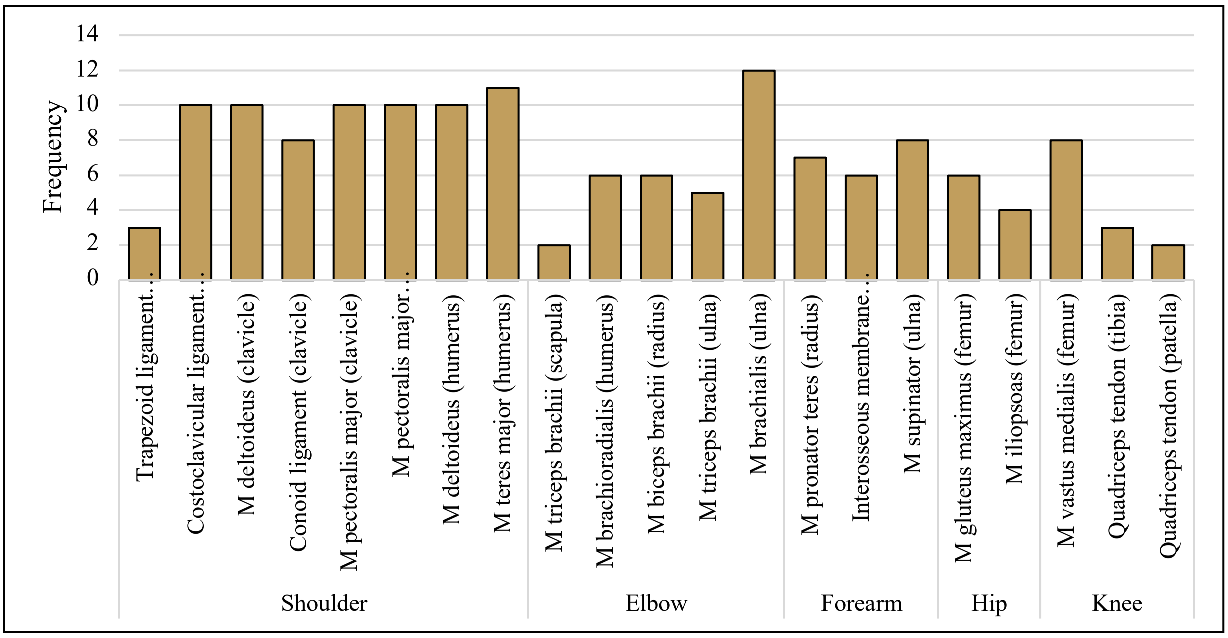


Figure 3.127. Hala: Frequency distribution of observed entheses by muscle. N:147.

Looking at the distribution of the robusticity rank by muscle, the entheses which exhibited the highest percentages of moderate and severe degrees were the *quadriceps tendon* (patella), with 50.0% (1/2) moderate and 50.0% (1/2) severe degrees, the *brachioradialis,* which exhibited 50.0% (3/6) moderate degrees and 16.7% (1/6) severe degrees, and the *biceps brachii*, which provided 66.7% (4/6) moderate degrees.

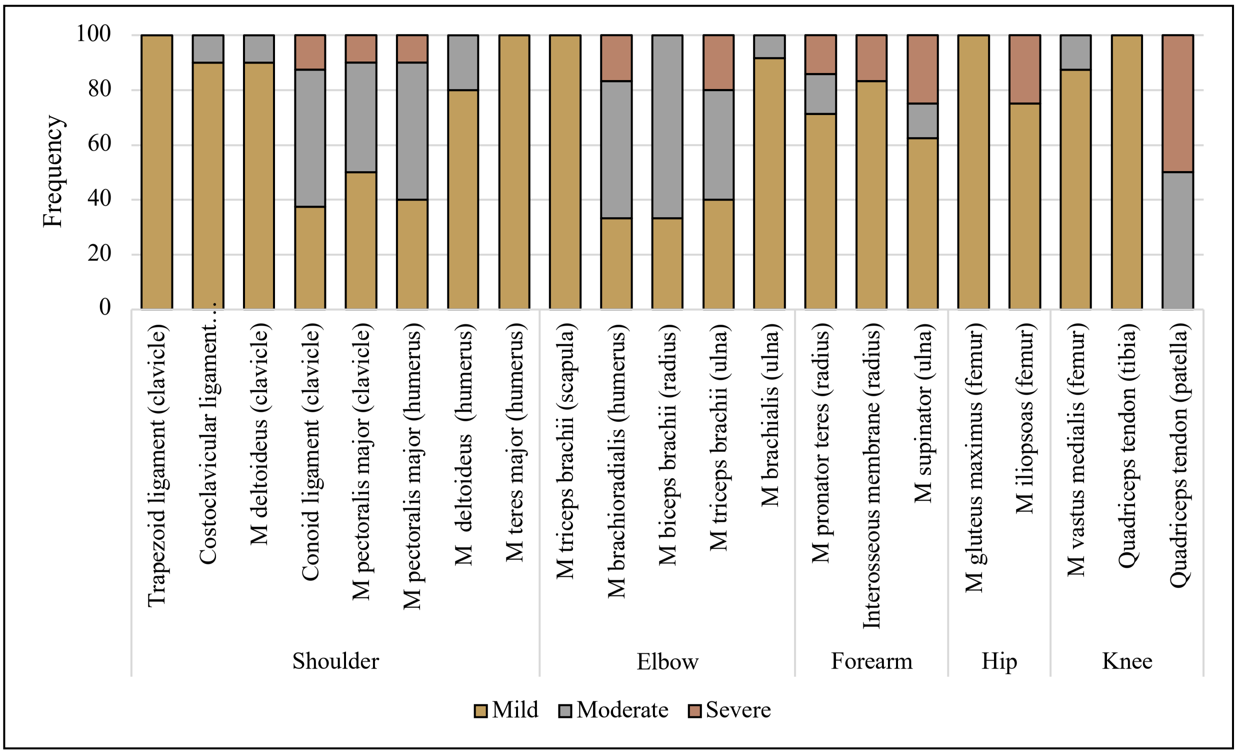


Figure 3.128. Hala: Frequency distribution of mild, moderate, and severe robusticity ranks by muscle. N:147.

Moving to the representativity of the functional complexes, the bar chart in figure 3.129 indicates that the shoulder was the best represented (72/147, 49.0%), followed by the elbow (31/147, 21.1%) and forearm (21/147, 14.3%). The hip was the least well-represented (10/147, 6.8%).

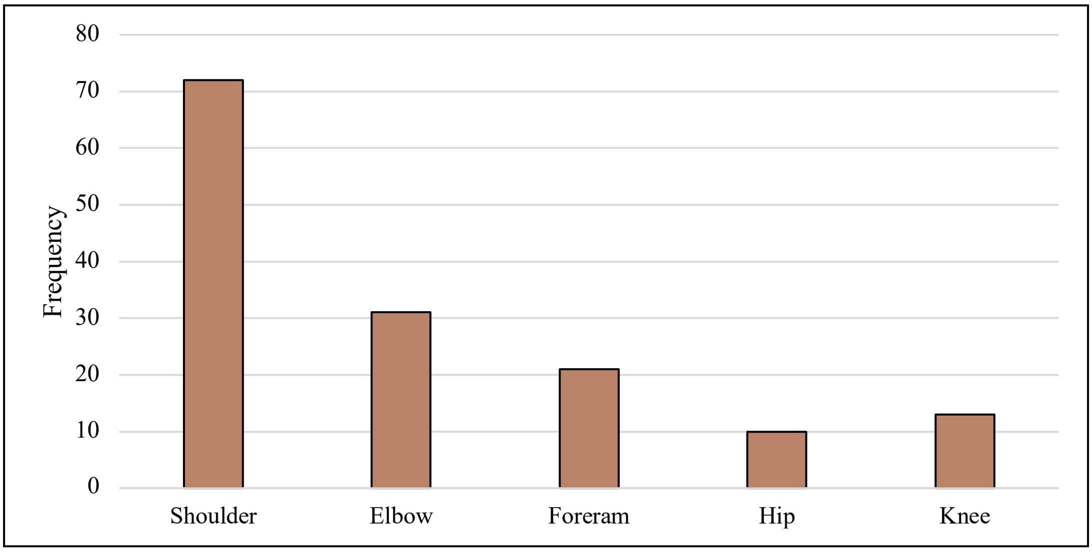


Figure 3.129. Hala: Frequency distribution of the observed entheses by functional complex. N:147.

As for the severity distribution of these modifications, the elbow was the functional complex with the highest percentages of moderate (10/31, 32.3%) and severe robusticity (2/31, 6.5%), followed by the forearm (2/21, 9.5% moderate degrees and 4/21, 19.0% severe forms), and the shoulder (17/72, 23.6% moderate degrees and 3/72, 4.2% severe forms) (Figure 3.130).

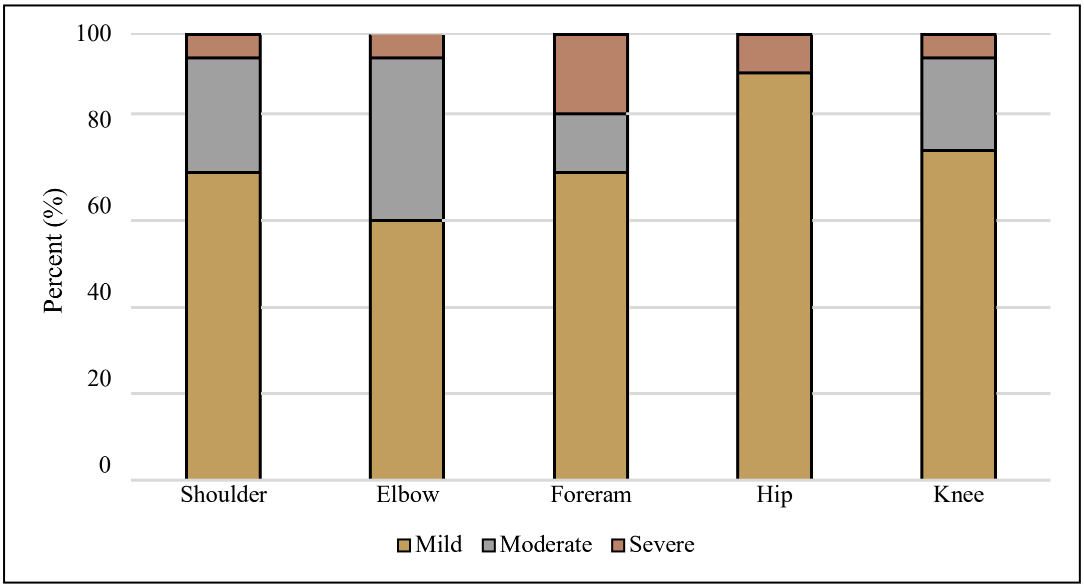


Figure 3.130. Hala: Frequency distribution of mild, moderate, and severe robusticity ranks by functional complex. N:147.

3.4.1.2.2 Robusticity: relationship between score development, side, sex, and age

Concerning the bilateral asymmetry, figure 3.131 shows that most of the observed entheses were equally represented on both sides. In only a few cases, it was noted a bias between the sides of the order of 2:1, as, for instance, on the *teres major* or the *biceps brachii*.

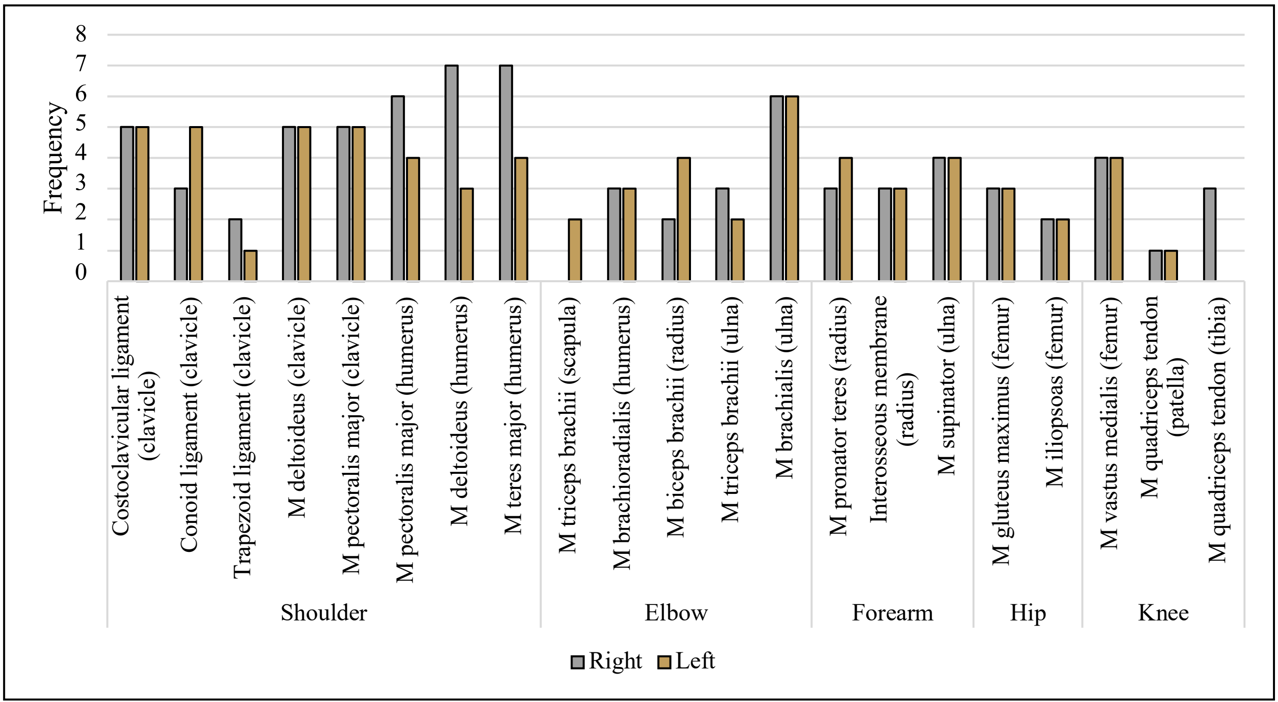


Figure 3.131. Hala: Frequency distribution of the observed entheses by side. N:147.

As for the robusticity distribution, the majority of the compared entheses exhibited a right-side asymmetry. The only exceptions were represented by the *deltoideus* (humerus), the *brachialis* and the *biceps brachii*, but only in this latter case, the left side was found to be the best represented. Thus, in the remaining cases, the disparity in representation might have affected the results (Figure 3.132).

By combining the entheses in functional complexes, the right side appeared to be better represented than the left in two cases, the shoulder and the knee, while the elbow and the forearm were slightly better represented on the left side. The hip was equally represented (Figure 3.133).

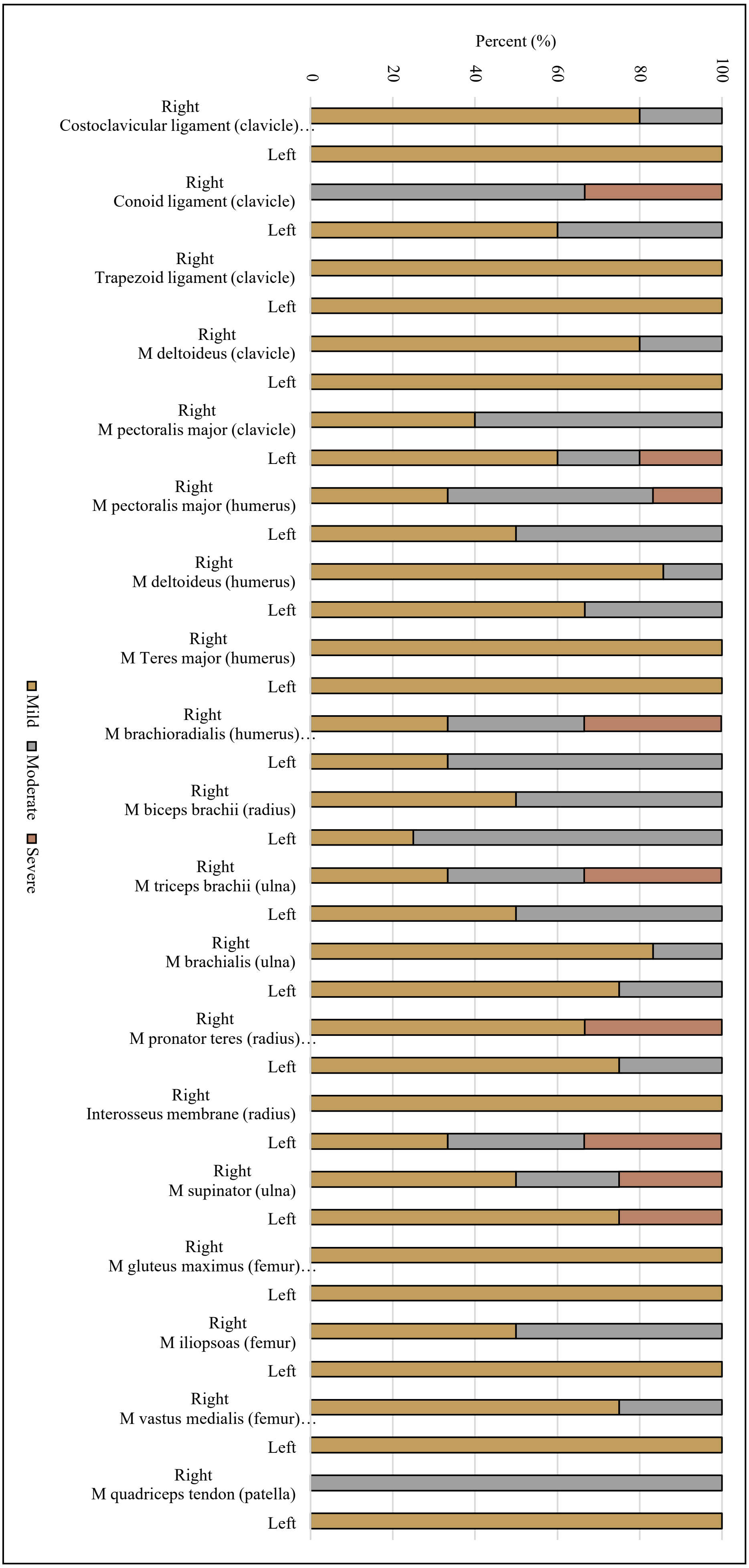


Figure 3.132. Hala: Frequency distribution of mild, moderate, and severe robusticity ranks by side. N:147.

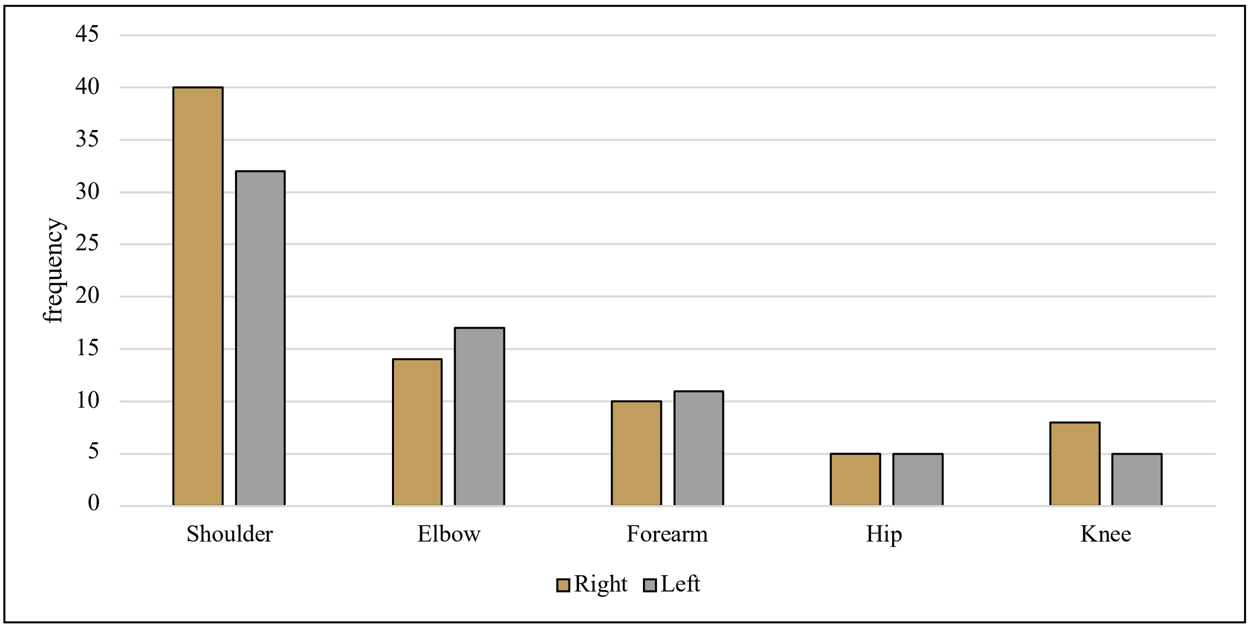


Figure 3.133. Hala: Frequency distribution of the observed entheses by side (pooled functional complexes). N:147

Looking at the severity rank distribution by side, all the functional complexes exhibited a right-side asymmetry (Figure 3.134).

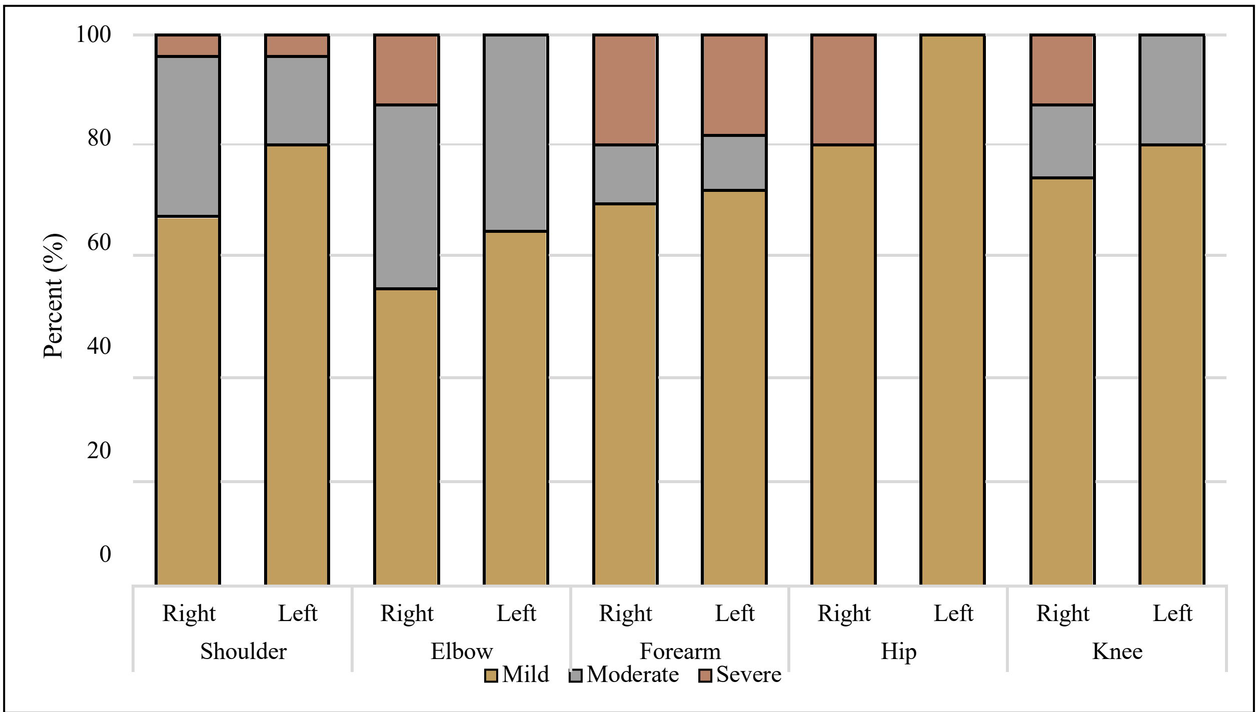


Figure 3.134. Hala: Frequency distribution of mild, moderate, and severe robusticity ranks by side (pooled functional complexes). N:147.

These differences between the sides were not statistically significant (shoulder p-value=0.320, elbow p-value=0.570, forearm p-value=0.918, hip p-value=0.690, knee p-value=0.833).

Concerning the comparisons between sexes, as expected since the greater number of female skeletons (=7) under study compared with the males (=2), the number of entheses belonging to the females (=112) greatly exceeded the number of those pertaining to the males (=35). Almost half of the recorded entheses were not represented in both the sexes (Figure 3.135). In the other cases, the bias in representation reached the order of 1:4, as for the *teres major*. This certainly has affected the reliability of the results.

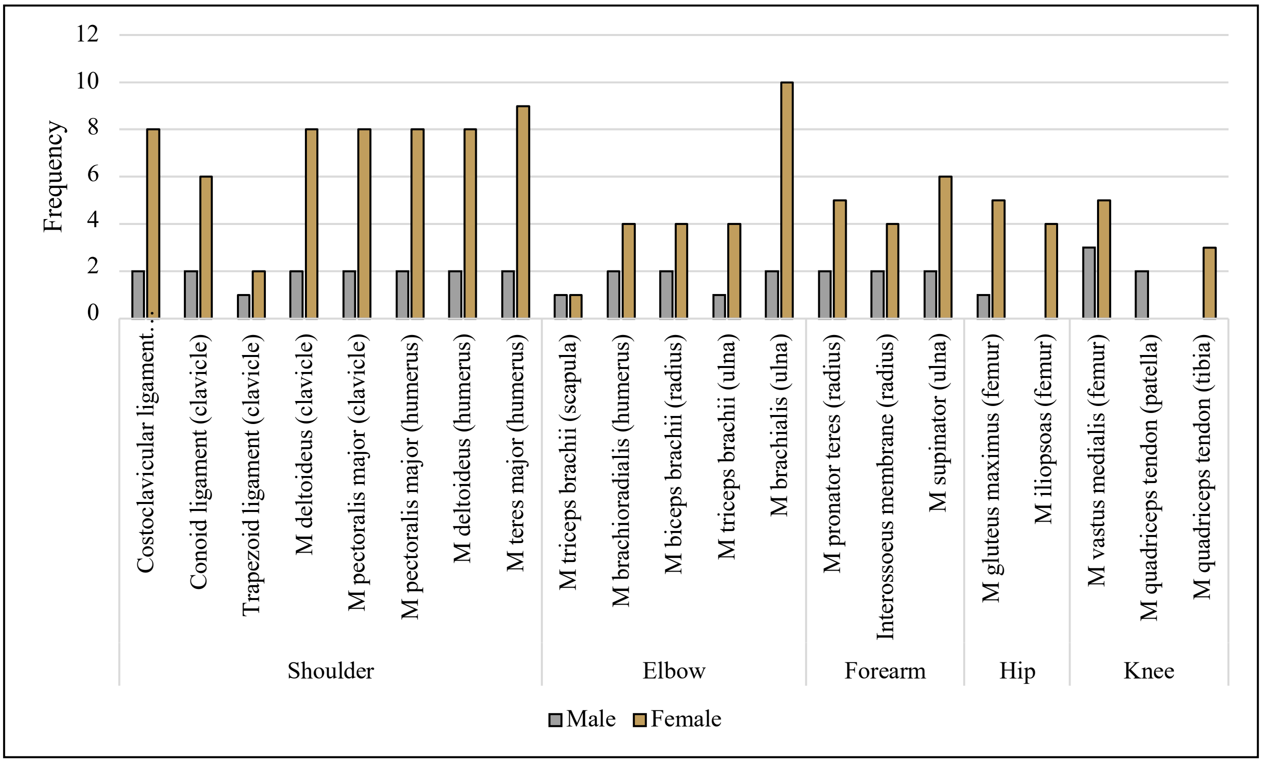


Figure 3.135. Hala: Frequency distribution of the observed entheses by sex. N:147.

Taking into account the great disparities in representation between sexes, it must be noted that males exhibited greater development of all the comparable entheses except on the *costoclavicular* and the *deltoideus* (humerus). Overall, females stood out for increasing ranks at the *deltoideus* (humerus), *interosseous membrane, brachialis* and *costoclavicular*. Conversely, males exhibited more severe expressions at the *conoid, pectoralis major*, *brachioradialis*, *biceps brachii, pronator teres* and *triceps brachii* (Figure 3.136).

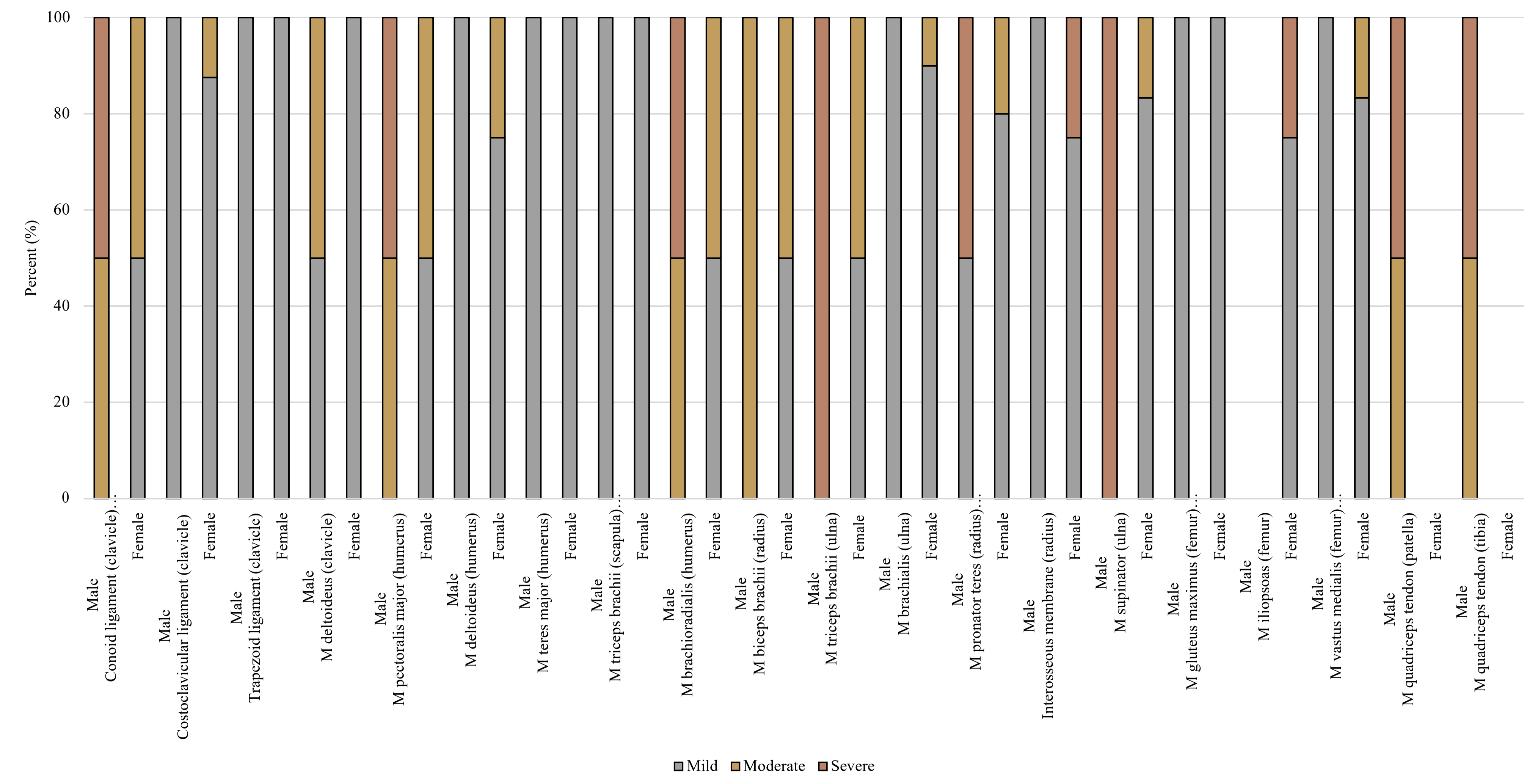


Figure 3.136. Hala: Frequency distribution of mild, moderate, and severe robusticity ranks by sex. N:147.

By combining the entheses in functional complexes, it appears evident how neither the forearm nor the hip could be compared as they were represented only by female entheses. Concerning the other functional complexes, males were greatly underrepresented compared with females.

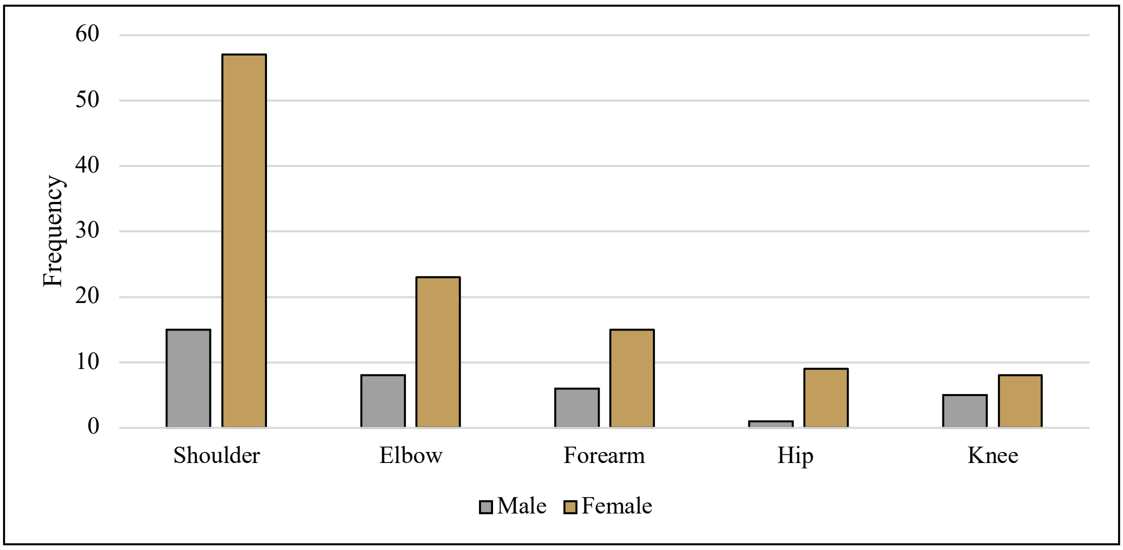


Figure 3.137. Hala: Frequency distribution of the observed entheses by sex (pooled functional complexes). N:147.

However, at the functional complex level, the males displayed the highest percentages of moderate and severe degrees in all the comparable functional complexes except the hip, where 1/9 (11.1%) severe degrees were observed on the females compared with 0.0% moderate degrees of the males. This result can be ascribed to the greater number of female entheses compared with the only one recorded on the male skeletons. Overall, males seem to have utilized the elbow and the shoulder muscles more than the others.

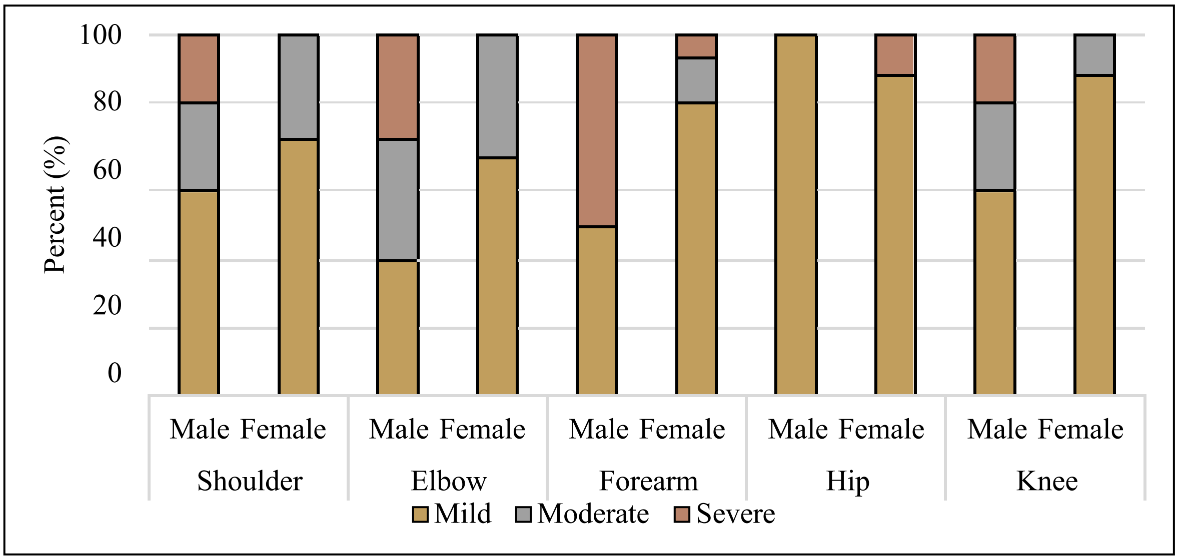


Figure 3.138. Hala: Frequency distribution of mild, moderate, and severe robusticity ranks by sex (pooled functional complexes). N:147.

The Mann-Whitney *U*-test did not reveal significant differences between the sexes (shoulder p-value=0.077, elbow p-value=0.100, knee p-value=0.641).

Finally, concerning the relationship with age, the dataset was restricted to 133 entheses, those belonging to individuals of known age (N=6). Figure 3.139 shows that there was a not equal representativity of the five functional complexes between the age categories. More specifically, the three young skeletons provided the highest numbers of entheses pertaining to the shoulder, the forearm, and the knee. The only one middle adult examined provided the greatest number of entheses pertaining to the hip, while the two mature adults provided the highest percentages of entheses pertaining to the elbow.

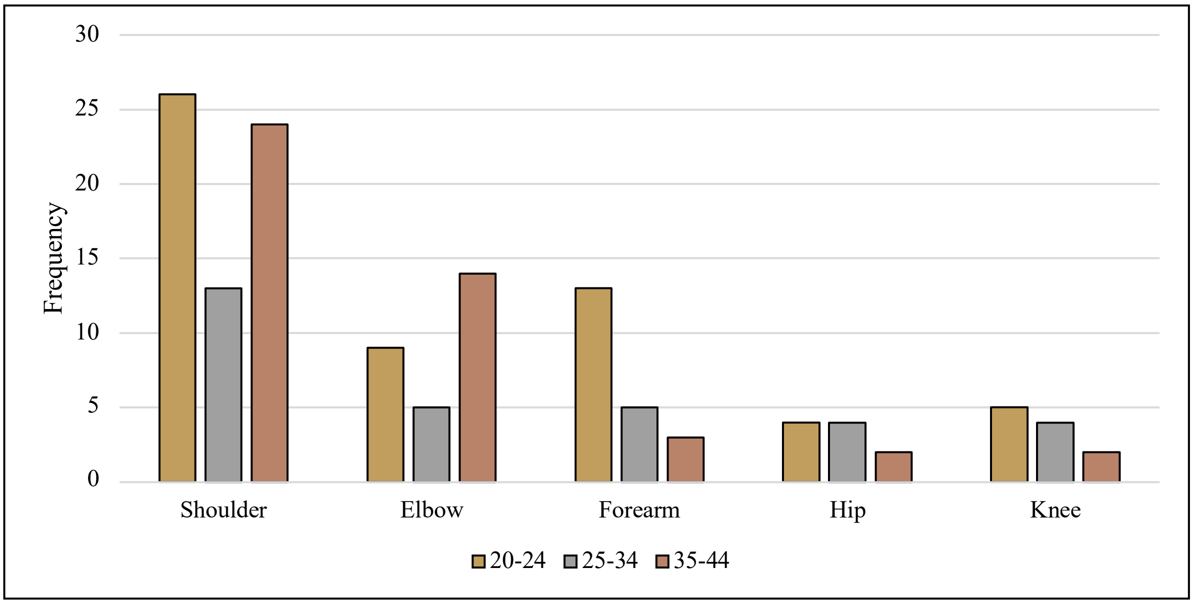


Figure 3.139. Hala: Frequency distribution of the observed entheses by age category (pooled functional complexes). N:133.

Figure 3.140 shows the distribution of the robusticity ranks between the three age categories. Overall, as expected, the mature adults exhibited the highest rates of moderate and severe robusticity scores in all the functional complexes. The younger groups showed on the knee, a higher rate of moderate (1/5, 20.0%) and severe degrees (1/5, 20.0%) than the middle adults. This can be explained considering the better representation of this category.

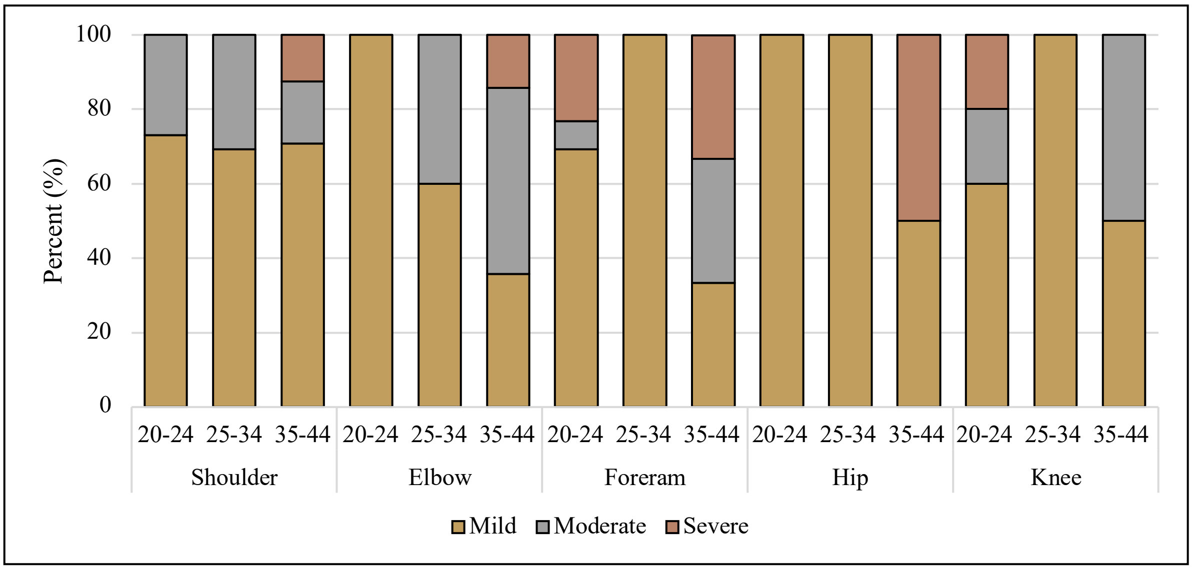


Figure 3.140. Hala: Frequency distribution of mild, moderate, and severe robusticity ranks by age category (pooled functional complexes). N:133.

The only significant difference was however found on the elbow (p-value=0.011), in the other functional complexes no significant differences were revealed (shoulder p-value=0.906, forearm p-value=0.168, hip p-value=0.135, knee p-value=0.349).

3.4.1.2.3 Osteolytic and Enthesophytic formations: relationship between score development and enthesis

OLs and EFs were not found on all the observed entheses. More specifically, the former affected 5.4% (8/147) of the entheses, while the last were detected on 70.1% (103/147) of the surfaces.

As for the OLs, the most affected enthesis was the *biceps brachii* which provided two evidence (Figure 3.141).

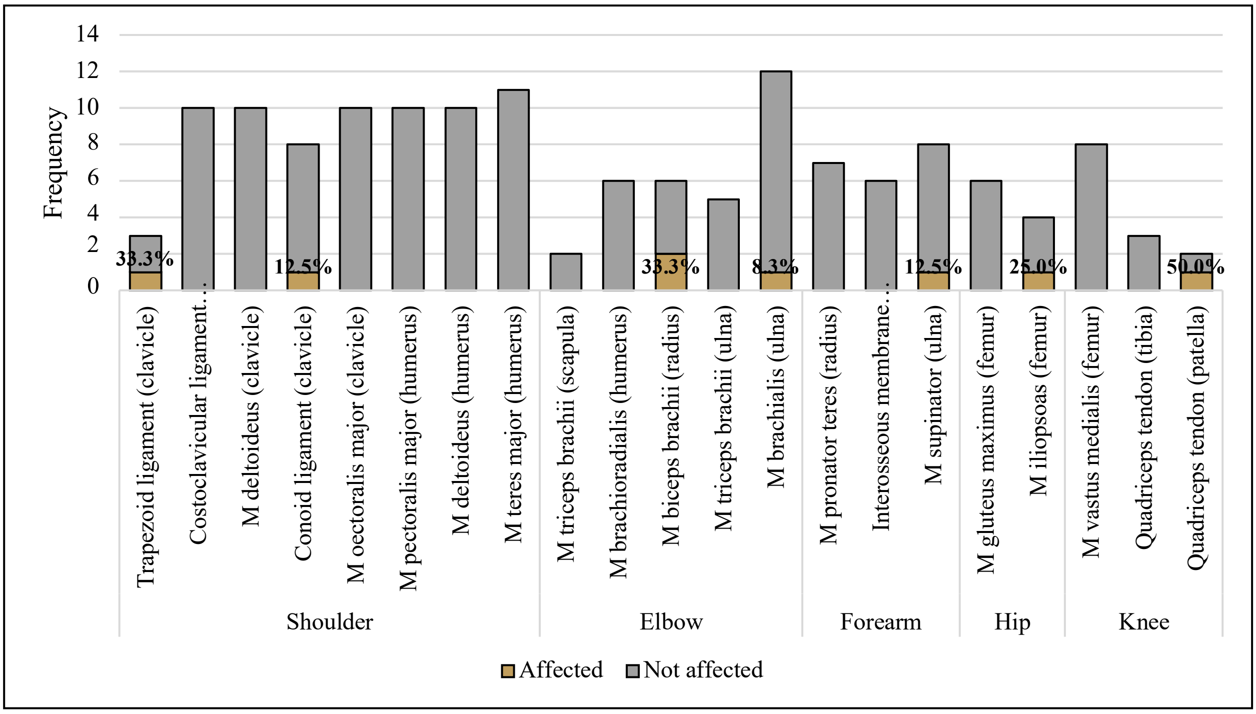


Figure 3.141. Hala: Frequency distribution of the entheses affected by OLs by muscle. N:147.

Thus, focusing on the number of entheses affected (N=8), all detected forms of OLs were ranked as mild with the only exception of the *biceps brachii* which exhibited 50.0 % (1/2) moderate forms (Figure 3.142).

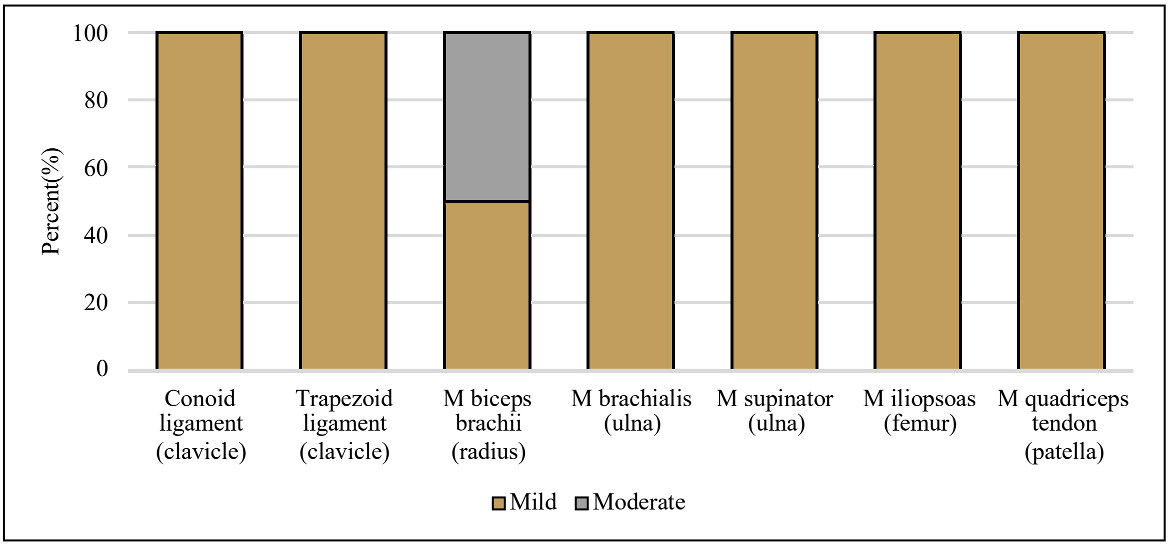


Figure 3.142. Hala: Frequency distribution of the mild, moderate, and severe OLs ranks by muscle. N:8

By combining the entheses in functional complexes, as it is shown in figure 3.143, the hip was the most affected (1/10, 10.0 %), followed by the elbow (3/31, 9.7%), and knee (1/13, 7.7 %); while the shoulder was the least affected (2/72, 2.8%).

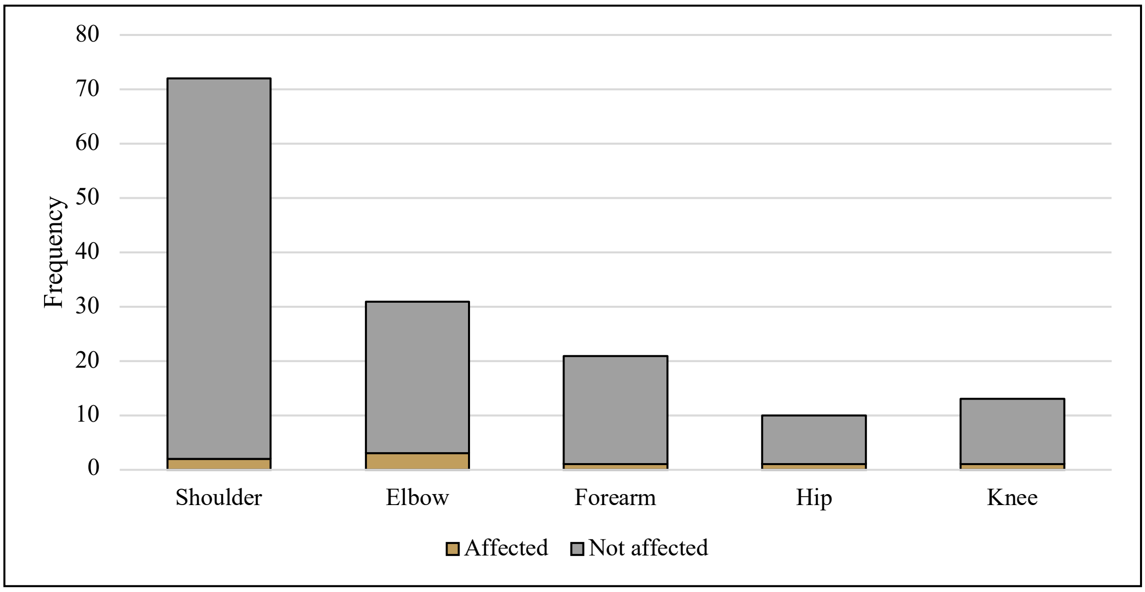


Figure 3.143. Hala: Frequency distribution of the entheses affected by OLs by functional complex. N:147.

With regards to the severity distribution, the elbow was the only functional complex which exhibited moderate OLs (1/3, 33.3%).

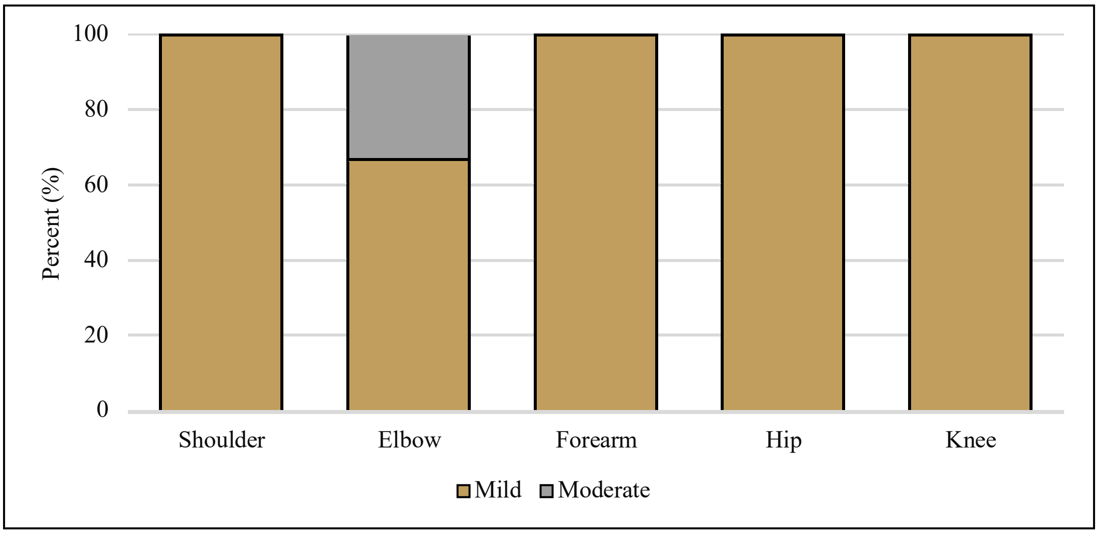


Figure 3.144. Hala: Frequency distribution of mild and moderate OLs ranks by functional complex. N:8.

Concerning the EFs, six entheses in total, including the *conoid ligament* and the *trapezoid,* displayed 100.0% of affections. Conversely, the *triceps brachii* (scapula) did not provide any evidence (Figure 3.145).

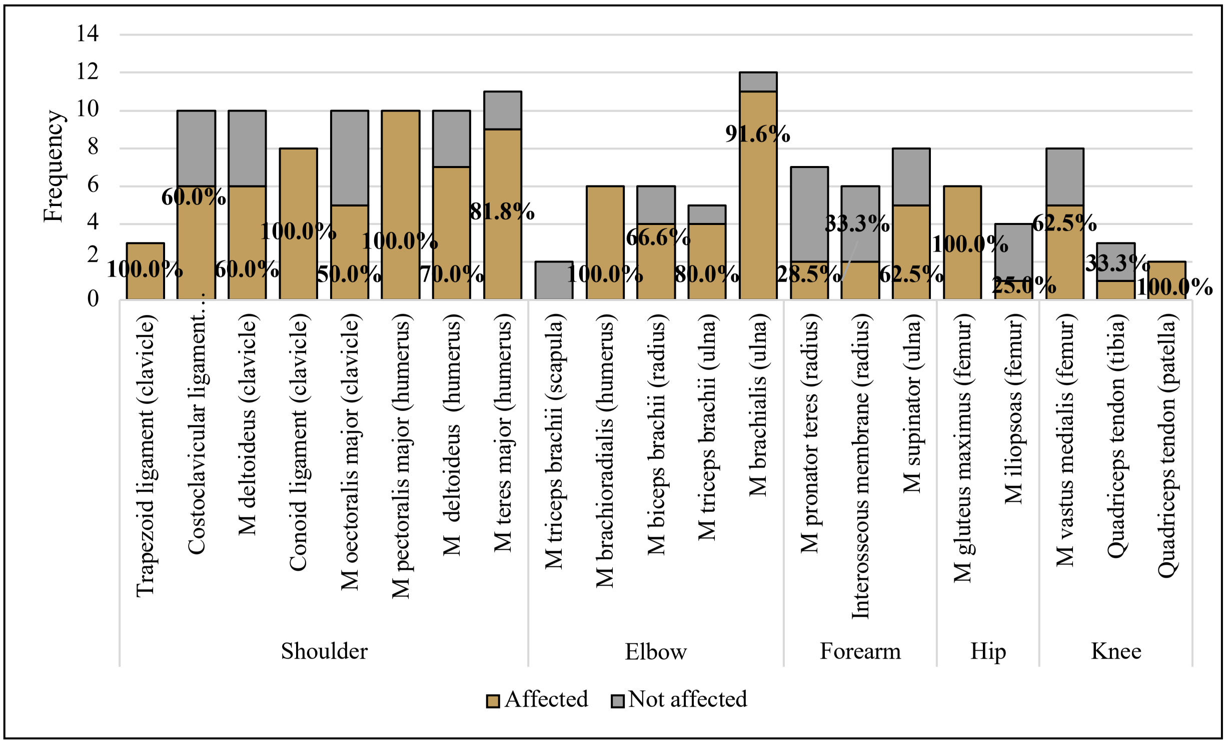


Figure 3.145. Hala: Frequency distribution of the entheses affected by EFs by muscle. N:147.

Focusing on the affected, the *biceps brachii* (4/4, 100.0%) and *quadriceps tendon* (patella) (2/2, 100.0%) provided only evidence of moderate forms, while the *pectoralis major* (humerus) (8/10) and the *supinator* (4/5) yielded 80.0% (Figure 3.146).

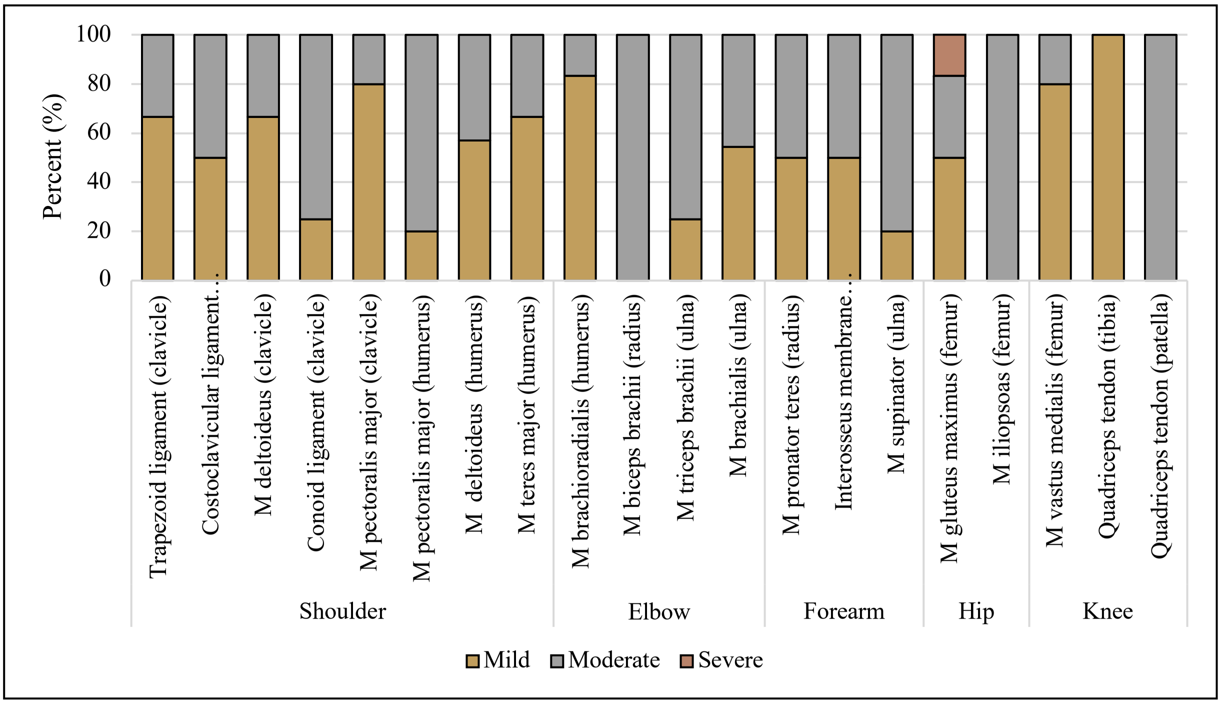


Figure 3.146. Hala: Frequency distribution of the mild, moderate, and severe EFs ranks by muscle. N:103.

By pooling the entheses in functional complexes, it can be noted that the elbow was the most affected (25/31, 80.6 %), followed by the shoulder (54/72, 75.0%). Conversely, the forearm was the least affected (9/21, 42.9 %).

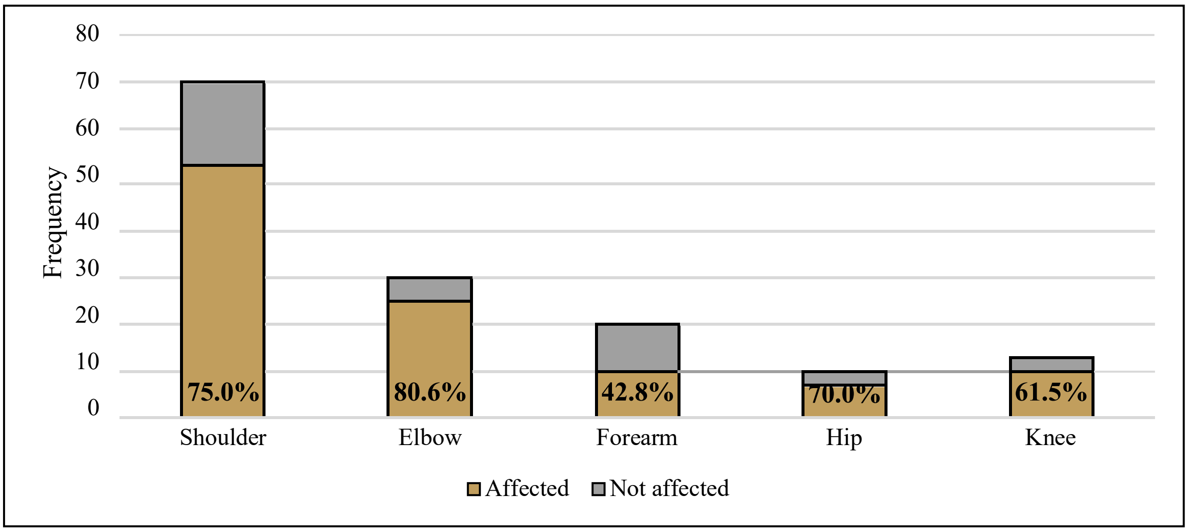


Figure 3.147. Hala: Frequency distribution of the entheses affected by EFs by functional complex. N:147.

With regards to the severity of these manifestations, it can be said that the forearm displayed the greatest percentage of moderate degrees (6/9, 66.7%), even if the only severe EFs was detected on the hip (1/7, 14.3%). On the contrary, the knee provided the lowest rate of moderate degrees (3/8, 37.5%).

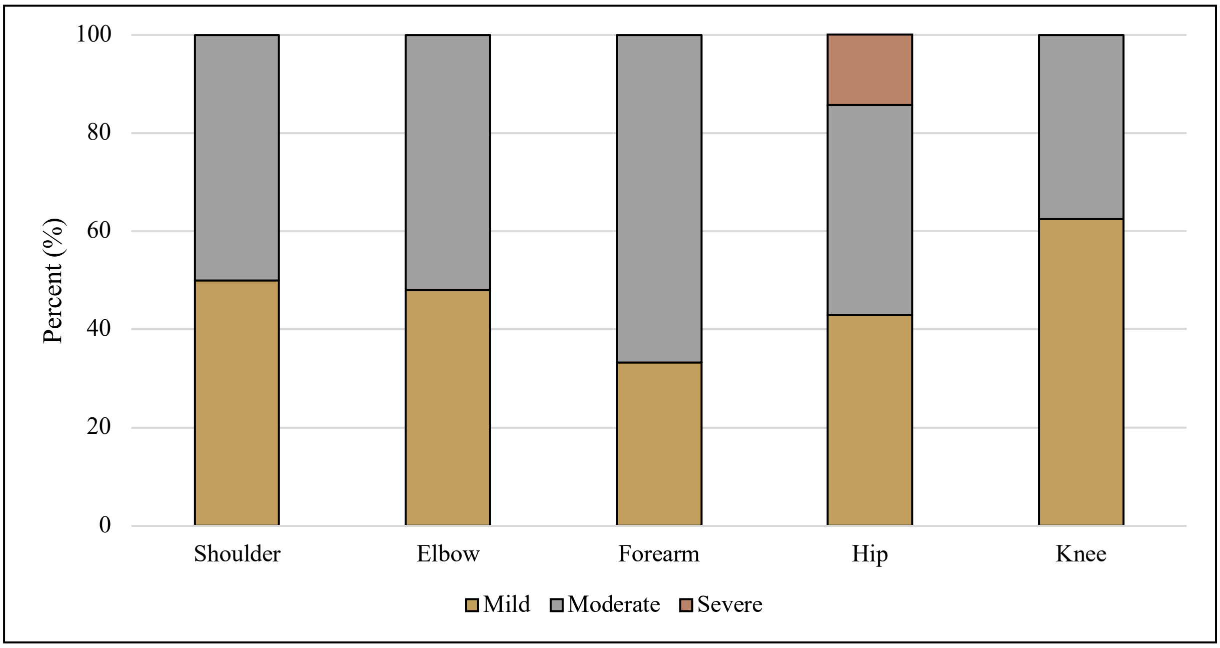


Figure 3.148. Hala: Frequency distribution of mild, moderate, and severe EFs ranks by functional complex. N:103.

3.4.1.2.4 <u>Osteolytic lesions and Enthesophytic formations: relationship between score development, side, and sex</u>

In the light of the results emerging from the previous assessment, only 8 entheses were found to be affected by OLs and, thus, were examined to test for the asymmetrical distribution of this marker by functional complex. As can be appreciated by figure 3.149, the only functional complex providing affections on both sides was the elbow (N=3).

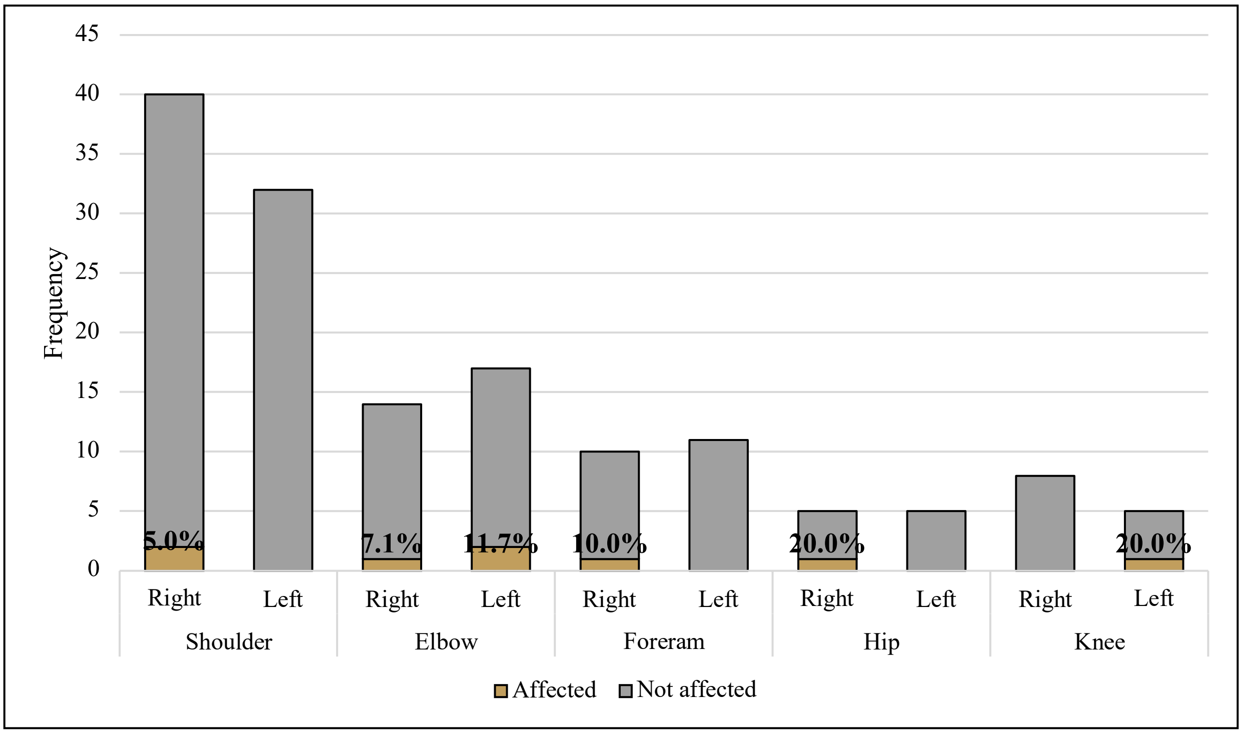


Figure 3.149. Hala: Frequency distribution of the entheses affected by OLs by side (pooled functional complexes). N:147.

Hence, since the very limited number of comparable surfaces, neither statistical tests nor frequency assessments were carried out. It can be said, however, that one of the two entheses belonging to the left elbow was scored as moderate, the other mild; while the only affected right enthesis was ranked as mild. Moving to the EFs, figure 3.150 clearly indicates that on the elbow and the hip there was a slight right-side asymmetry, while the shoulder displayed a greater proportion of EFs on the left side (27/32, 84.4%).

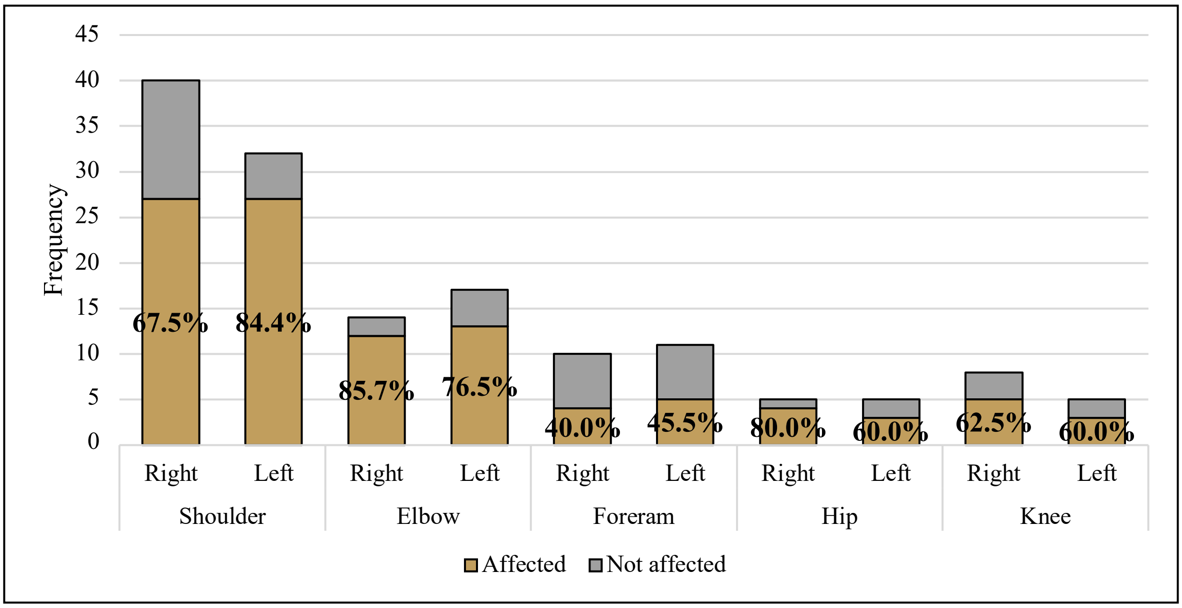


Figure 3.150. Hala: Frequency distribution of the entheses affected by EFs by side (pooled functional complexes). N:147.

The frequency assessment carried out to test for the asymmetrical distribution of the EFs revealed that the right side was slightly more affected than the left in all the functional complexes except the hip, where the moderate plus severe forms (2/3, 66.6%) recorded on the left side prevailed over the mild (2/4, 50.0%) recorded on the right side (Figure 3.151).

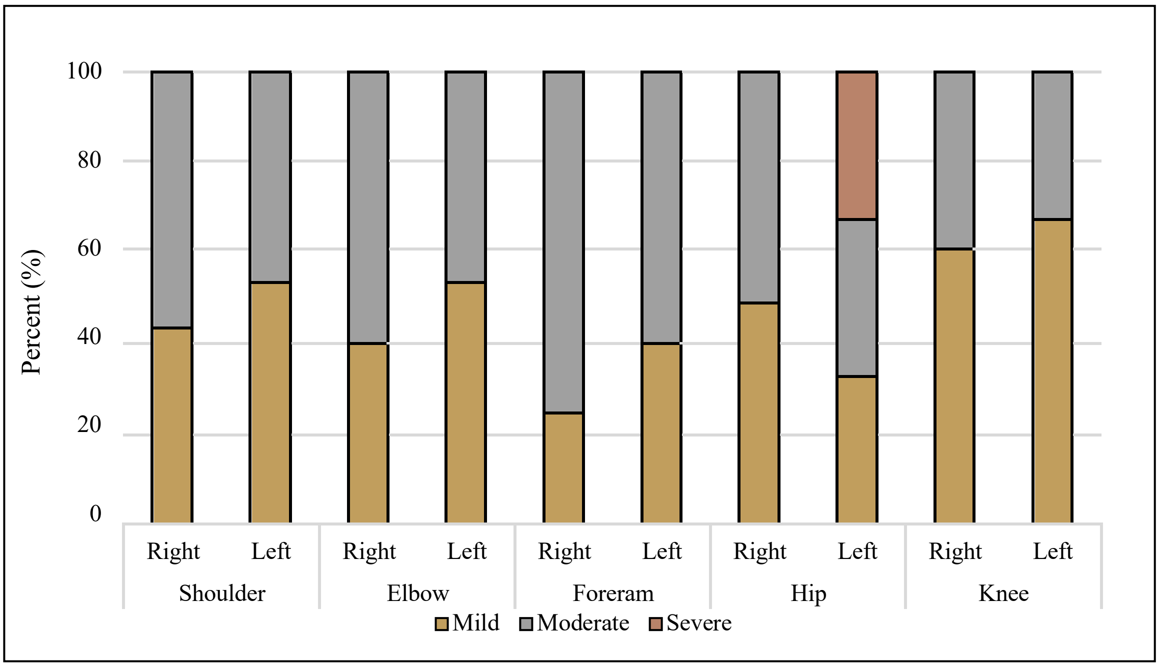


Figure 3.151. Hala: Frequency distribution of mild, moderate, and severe EFs ranks by side (pooled functional complexes). N:103.

These differences were not statistically significant (shoulder p-value = 0.153, elbow p-value = 0.769, forearm p-value = 0.556, hip p-value = 0.629, knee p-value = 1.571).

Turning to the comparison of the OLs between the sexes, figure 3.152 shows that, overall, OLs affected at equal rates the females and the males. More specifically, the females exhibited the greatest proportion on the elbow. The male displayed affections on the shoulder and the knee. In terms of severity distribution, the only moderate degree was assigned to one enthesis pertaining to the elbow of the females.

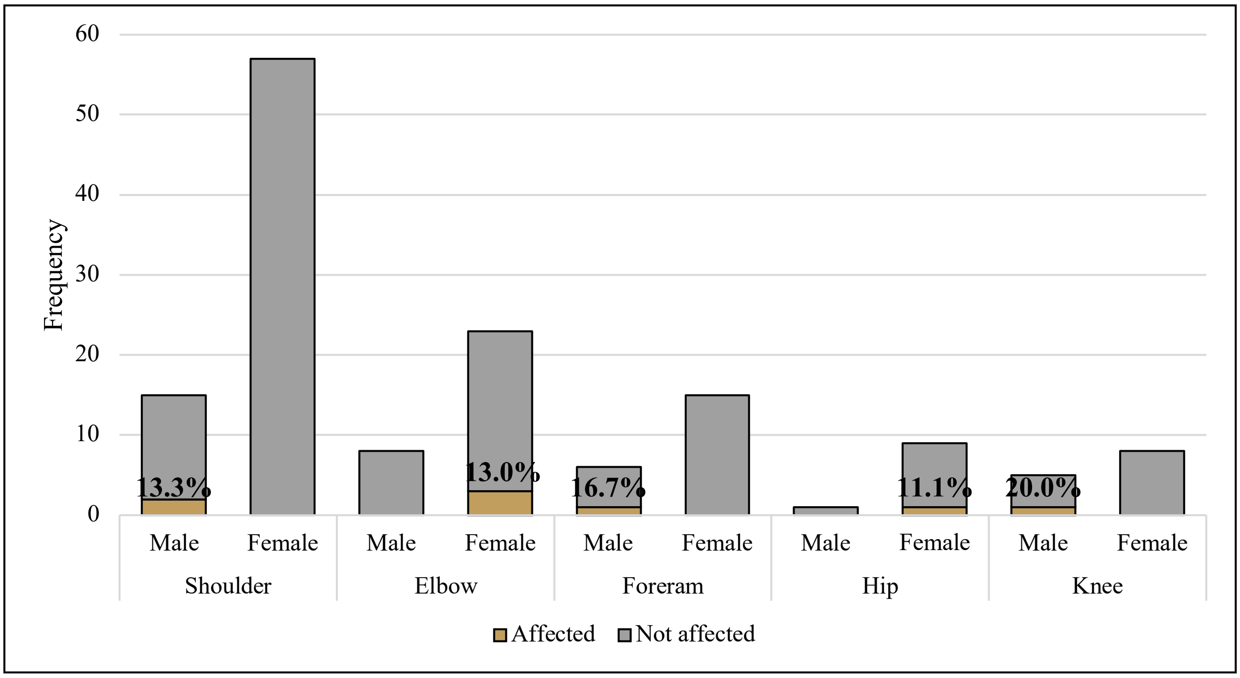


Figure 3.152. Hala: Frequency distribution of entheses affected by OLs by sex (pooled functional complexes). N:147.

For which concerns the distribution of the EFs by sex, two functional complexes of five, the shoulder and the elbow, were comparable as they exhibited affections in both the sexes (Figure 3.153). In both cases, the males displayed the highest number of EFs (shoulder 13/15, 86.7% and elbow 7/8, 87.5%).

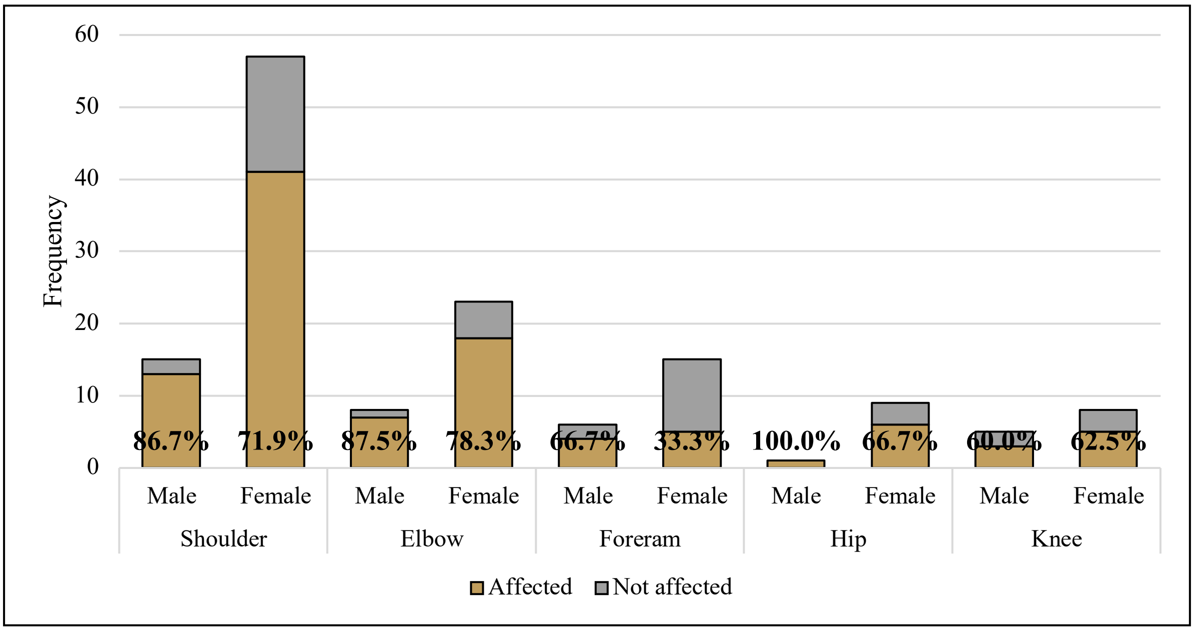


Figure 3.153. Hala: Frequency distribution of entheses affected by EFs by sex (pooled functional complexes). N:147.

Focusing on the two comparable functional complexes, and taking into account the disparities in representation, almost an equal distribution of the mild and moderate forms between the sexes was noted (Figure 3.154). A slight predominance of moderate degrees on the males over the females was, however, observed. These differences were statistically not significant (shoulder p-value=0.000 and elbow p-value=0.790).

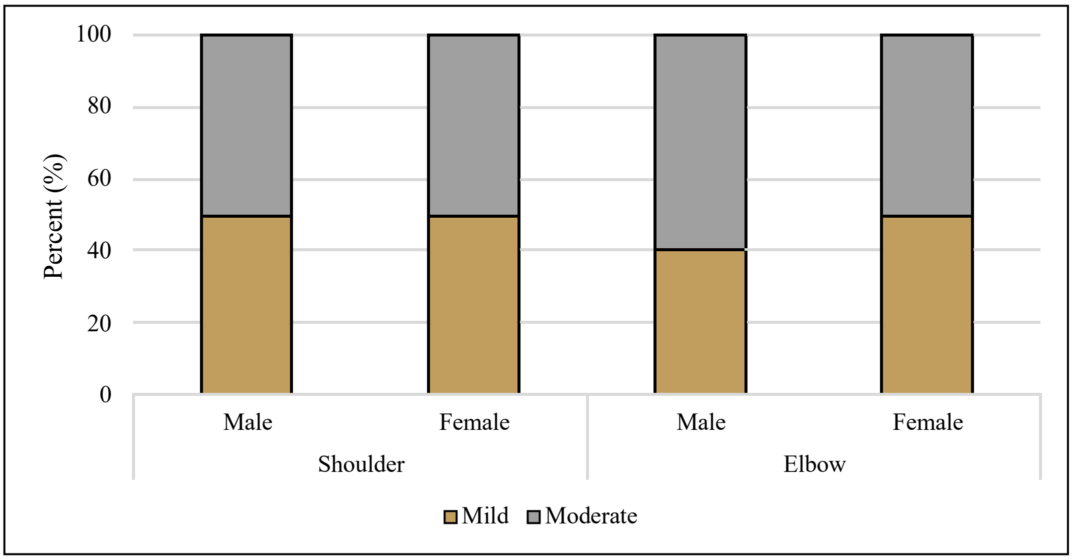


Figure 3.154. Hala: Frequency distribution of mild, moderate, and severe EFs by sex (pooled functional complexes). N:79.

Concerning the distribution of the OLs between the three age categories, the forearm, the hip, and the knee were not considered as only one category, by complex, was found to be affected. In the other cases, the number of affections (=5) was too low and, thus, no trend was highlighted (Figure 3.155).

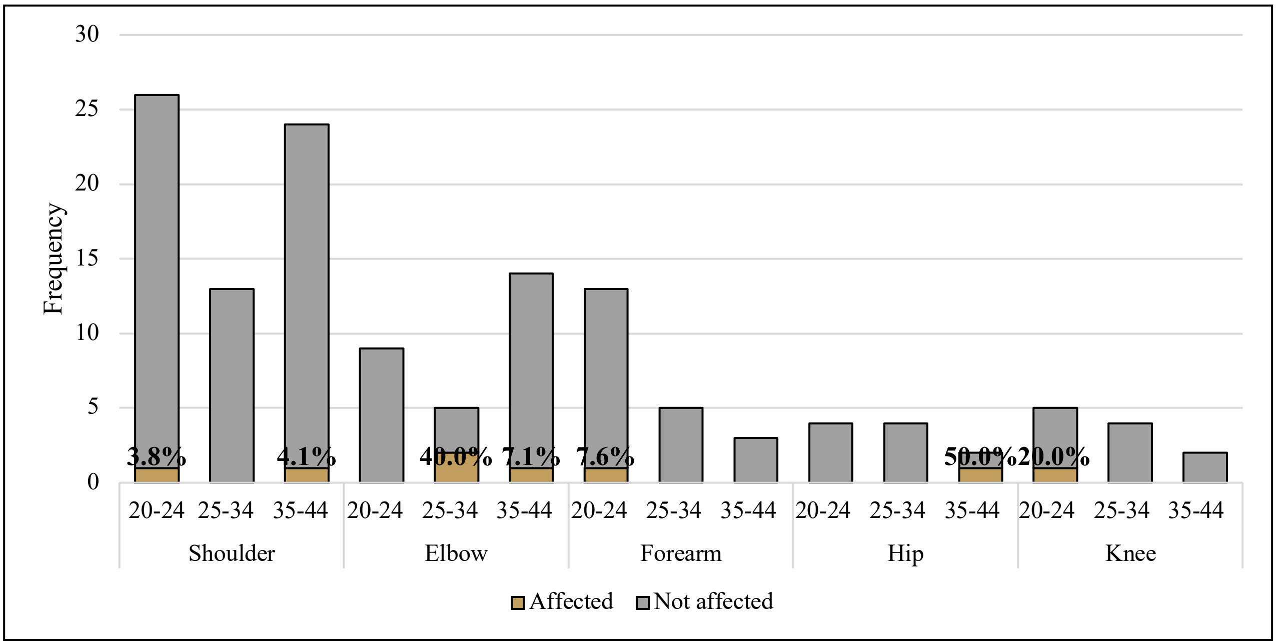


Figure 3.155. Hala: Frequency distribution of entheses affected by OLs by age category (pooled functional complexes). N:147.

However, it must be clarified that the only case of moderate OLs (1/2, 50.0%) came from a middle adult skeleton.

Finally, concerning the EFs, the surfaces affected were not equally distributed between the three age groups (Figure 3.156). On the shoulder and the elbow, it was observed an increase in the number of EFs from the young age category (17/26, 65.4%, on the shoulder, and 4/9, 44.4% on the elbow) to the middle adult age group (12/13, 92.3%, on the shoulder, and 5/5, 100.0%, on the elbow), and a decrease from this latter and the mature adults (18/24, 75.0%, on the shoulder, and 13/14, 92.9%, on the elbow). As for the forearm, it was observed an increase in the number from the young (6/7, 46.2%) to the mature adults (3/3, 100.0%). As for the other two functional complexes, it was noted a decrease in the number of the affections from the young adult range (¾, 75.0%, on the hip, and 4/5, 80.0%, on the knee) and the middle adult range (2/4, 50.0% on both), and an increase from this latter to the mature adult range (2/2, 100.0%, on hip, and 2/2, 100.0%, on knee).

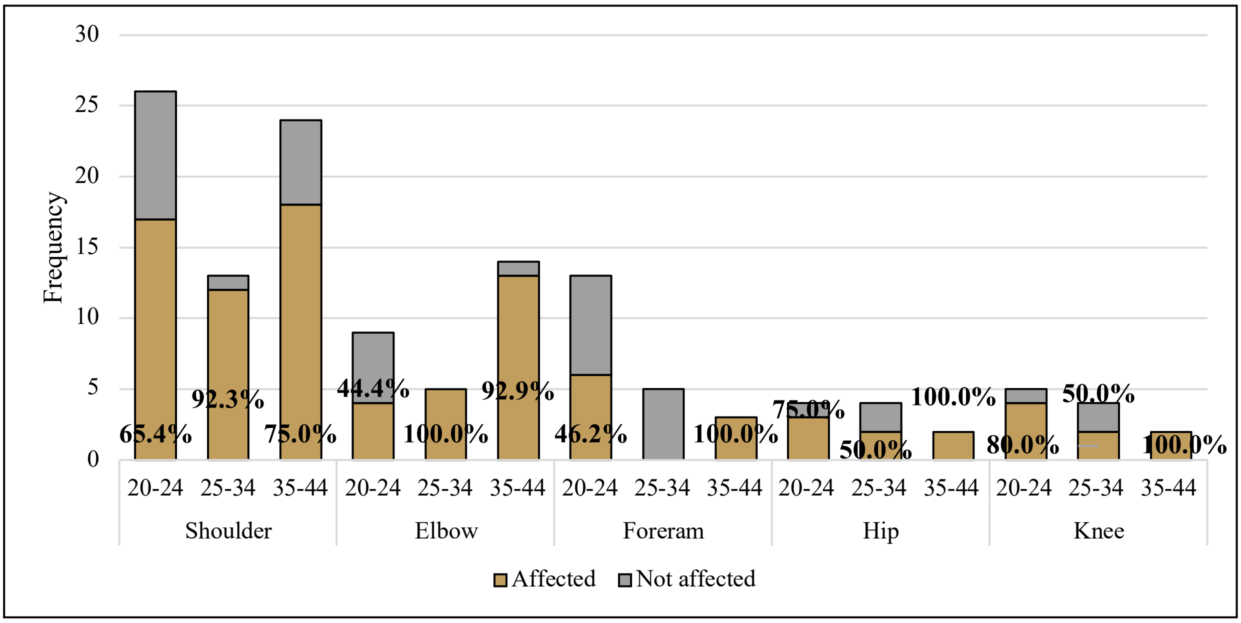


Figure 3.156. Hala: Frequency distribution of entheses affected by EFs by age category (pooled functional complexes). N:133.

Moving to the distribution of the severity ranks by age category, it was noted, overall, that this data was strongly related to the percentage of affections found in each category. On the elbow, for instance, the number of the moderate degrees increased from the young (2/2, 50.0%) to the middle adults (3/5, 60.0%), and a decrease from the middle to the mature adult range (7/13, 53.8%). The middle adult category was represented by only five entheses compared with 14 of the mature adult group.

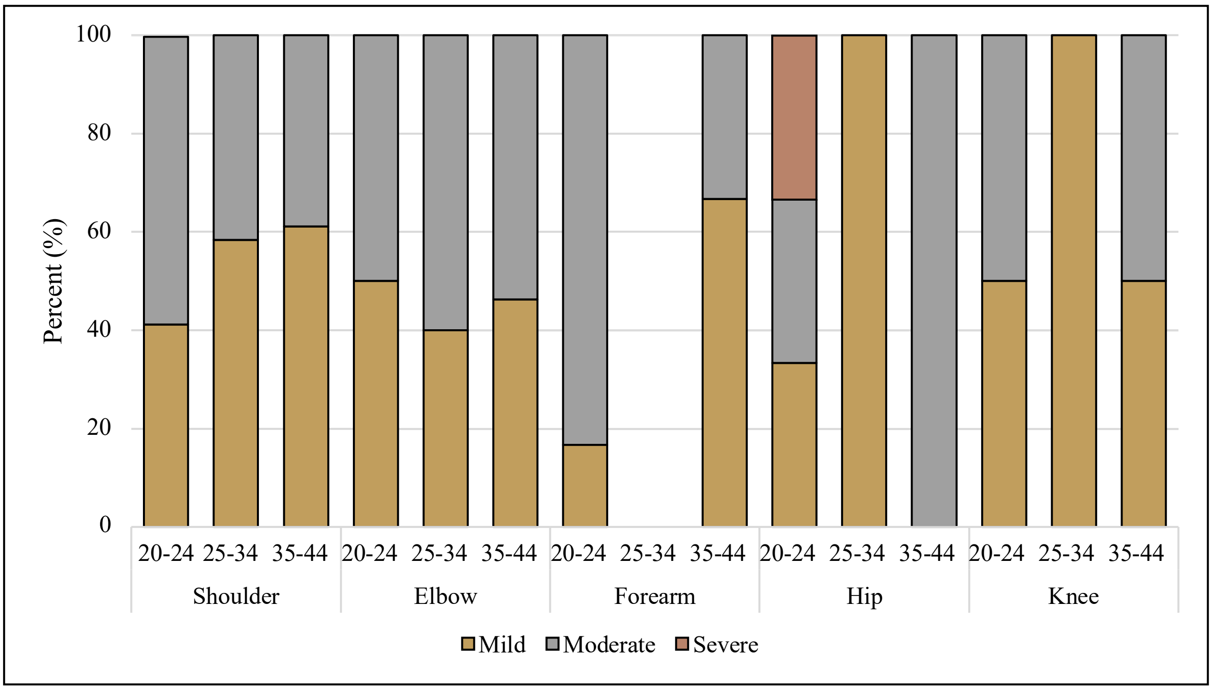


Figure 3.157. Hala: Frequency distribution of mild, moderate, and severe EFs ranks by age category (pooled functional complexes). N:99.

These differences were however not statistically significant (shoulder p-value=0.092, elbow p-value=0.955, forearm p-value=0.157, hip p-value=0.243 and knee p-value=0.497).

3.4.1.3 Osteoarthritis

OA assessment was based on the observation of 27 joint surfaces belonging to four individuals. Figure 3.158 shows that four of 12 joint surfaces observed - humeral head, radial capitulum, proximal ulna and femoral head - yielded an index of 50.0%, thus they were deemed well-preserved. The remaining were all poorly represented.

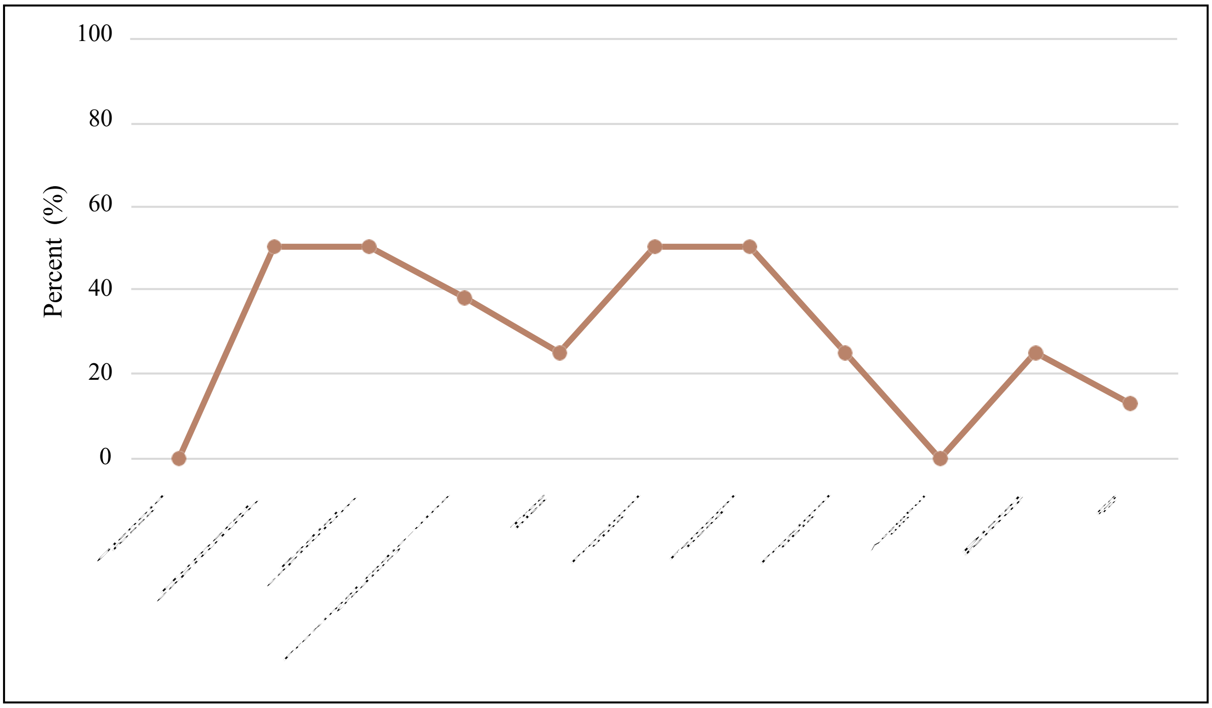


Figure 3.158. Hala: Joint surfaces representation (%) within the sample. N:27.

Among the 27 observed articular surfaces, only three (two proximal radio-ulnar (radius) and one proximal ulna) exhibited slight evidence of OA since they presented at least two of the three markers reported in the literature (ML, PO, and SO) (Figure 3.159). No case of eburnation and/or fusion was detected.

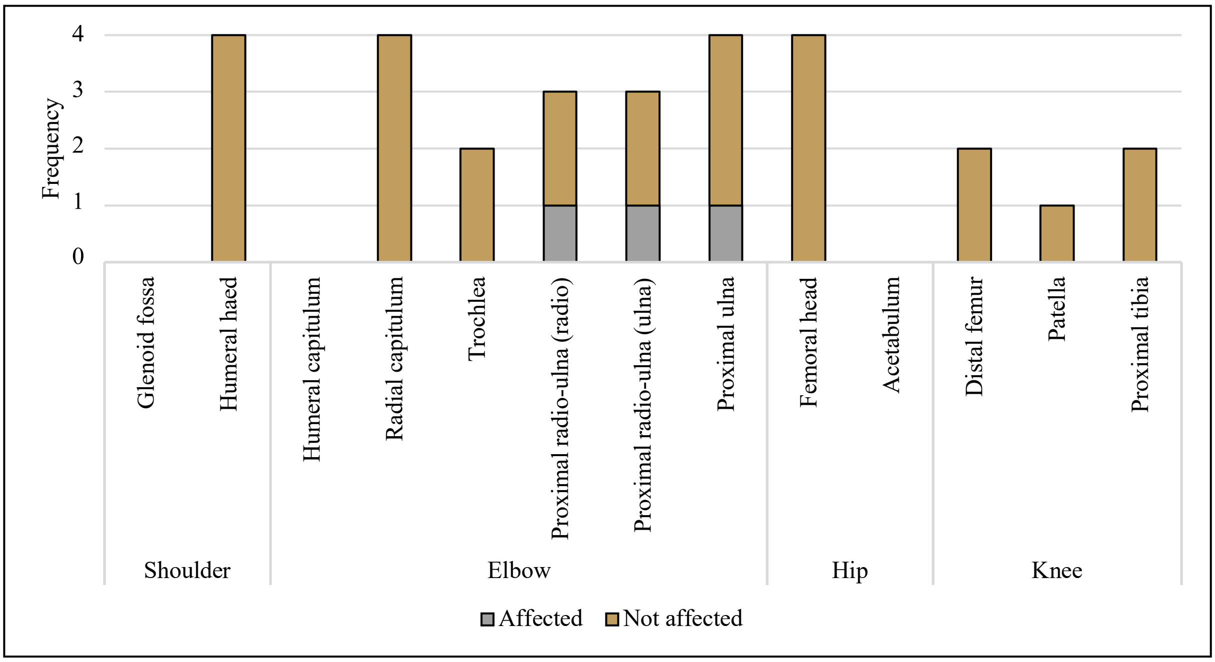


Figure 3.159. Hala: Frequency distribution of the observed joint surfaces. N:27.

In the light of these findings, no comparison between sexes, age groups or sides were allowed. It is possible, however, to say that the two proximal radio-ulnar surfaces belonged to a mature female, while the proximal ulna to a young female.

3.4.1.4 Extra-masticatory dental wear

A total of 22 maxillary and 29 mandibular teeth belonging to three individuals were examined for evidence of extra-masticatory dental defects. No case was noted. Thus, no comparison between sexes and age groups was allowed.

3.4.1.5 Summary

In sum, the population from Hala *Sultan Tekke* was small and highly biased towards females with 2/3 individuals for whom age could be assessed. On the basis of the evaluation of the robusticity ranks scored for ECs, it is possible to assert that males exhibited more severe expressions on the *costoclavicular* and the *deltoideus.* Females stood out for increasing ranks on the *deltoideus* (humerus), the *interosseous membrane,* the *brachialis,* and the *costoclavicular*. Overall, the examined entheses displayed a right-side asymmetry. For which concerns the OLs and the EFs, these two markers seem to draw different trends. The former affected a very low percentage of the surfaces observed (8/147, 5.4%) predominantly belonging to the elbow. No differences were observed in the distribution of the severity ranks between the sexes and the sides. Interesting, the middle adult entheses affected by this evidence were most severely involved than the mature adult entheses. The last, recorded in higher percentage (103/147, 70.1%), and most severely on the hip, predominantly affected the right side. The males were found to be slightly more affected than the females; while, overall, the younger individual entheses were most severely affected than the older.

Concerning the OA, only three articular surfaces were found to be affected: one belonging to a young female and the other two to mature females. No extra-masticatory dental defect was detected on this sample.

3.4.2 Kalavasos *Ayios Dhimitrios*

3.4.2.1 Paleodemography

The biological sex and mortality profile of adults from the LCI-III site of *Ayios Dhimitrios* is presented in table 3.6. Sex estimation was possible for only three of six skeletons, which were all females. Age estimation was possible in all the cases. Two of the four age categories are represented: the young (20-24 years) and the middle (25-34 years) adult ranges. Neither mature (35-44 years) nor old adults (44+ years) were recovered. Given the very small sample size, it would be misleading to draw any detailed conclusions about mortality. It is, however, possible to assert that the majority of adults fell within the range of young adults (20-24 years).

Table 3.6. Ayios Dhimitrios: Sex and age composition of the sample. ND: not determined. %: within the sex.

	Young adult 20-24		Middle adult 25-34		Mature adult 35-44		Old adult 45+		Total	
	N	%	N	%	N	%	N	%	N	%
Male	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Female	2	66.7	1	33.3	0	0.0	0	0.0	3	50.0
ND	3	100.0	0	0.0	0	0.0	0	0.0	3	50.0
Total	5	88.3	1	16.7	0	0.0	0	0.0	6	100.0

The bar chart in figure 3.160 illustrates the age distribution of the sample by sex. Overall, it must be noted that the female age distribution reflects the younger age range.

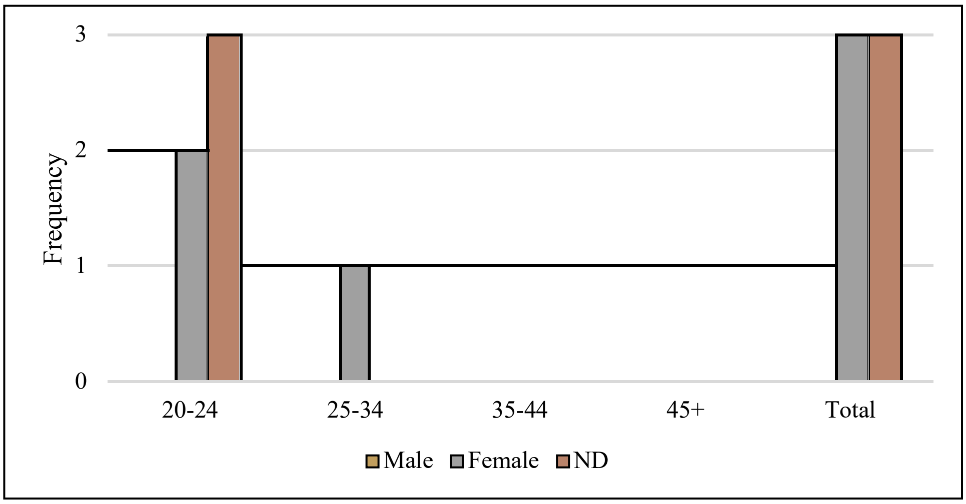


Figure 3.160. Ayios Dhimitrios: Age distribution of the sample by sex. ND: Not Determined. N:6.

3.4.2.2 Entheseal Changes

3.4.2.2.1 <u>Robusticity: relationship between score development, enthesis, and functional complex</u>

The evaluation of the ECs of this sample was carried out on a total of 25 entheses belonging to three individuals. As can be noted in figure 3.161, only four entheses - the *brachioradialis*, the *triceps brachii* (ulna), the *pronator teres*, and the *supinator* - were well-represented as their BRI values rise above 50.0 %. Eight entheses of 21 were not analysed as they were not preserved *(conoid ligament*, *pectoralis major* (humerus), *deltoideus* (humerus), *teres major*, *triceps brachii* (scapula), *brachialis*, *iliopsoas*, *quadriceps tendon* (tibia)). The remaining were poorly represented.

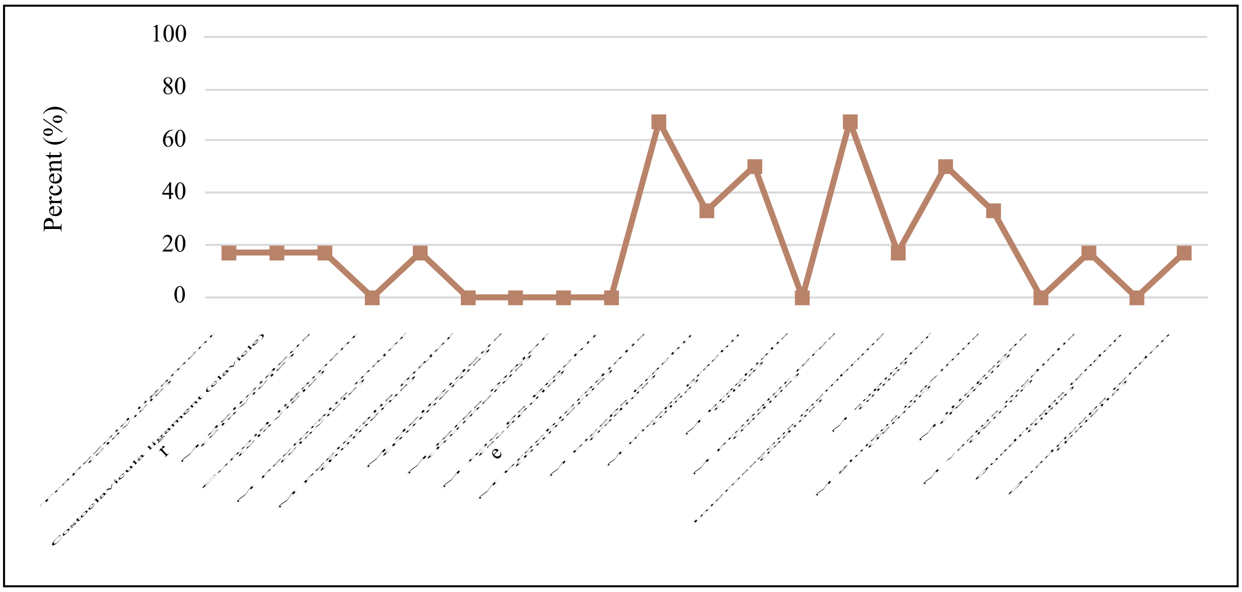


Figure 3.161. Ayios Dhimitrios: Entheses representation (%) within the sample. N:25

Thus, to highlight the distribution of entheses for which scores for ECs could be recorded by muscle, figure 3.162 was produced. The *brachioradialis* and the *pronator teres* were the most frequently assessed (4/25, 16.0%). In contrast, seven entheses including the *costoclavicular* and *trapezoid ligaments* were the less well-preserved entheses (1/25, 4.0%).

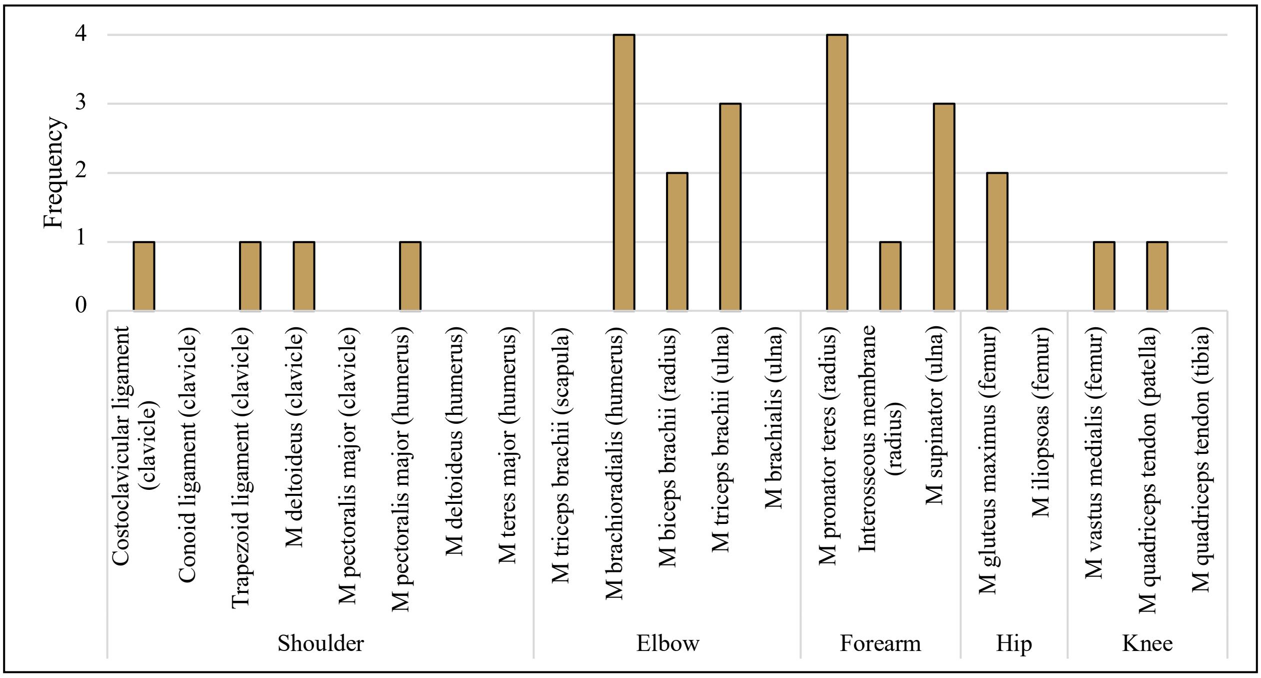


Figure 3.162. Ayios Dhimitrios: Frequency distribution of the observed entheses by muscle. N:25.

This preliminary assessment highlighted the bias between the most and the least represented enthesis that was of the order 4:1. Thus, the very low representativity of the sample certainly affected the reliability of the data related to the most utilized functional muscles. In this context, however, it can be said that the majority of the observed entheses were slightly developed; moderate degrees were detected on the *deltoideus* (100.0%, 1/1), the *pectoralis major* (100.0%, 1/1), and the *supinator* (33.3%, 1/3). Severe forms were found on the *triceps brachii* (1/3, 33.3%), *brachioradialis* (1/4, 25.0%), and *gluteus maximus* (1/2, 50.0%).

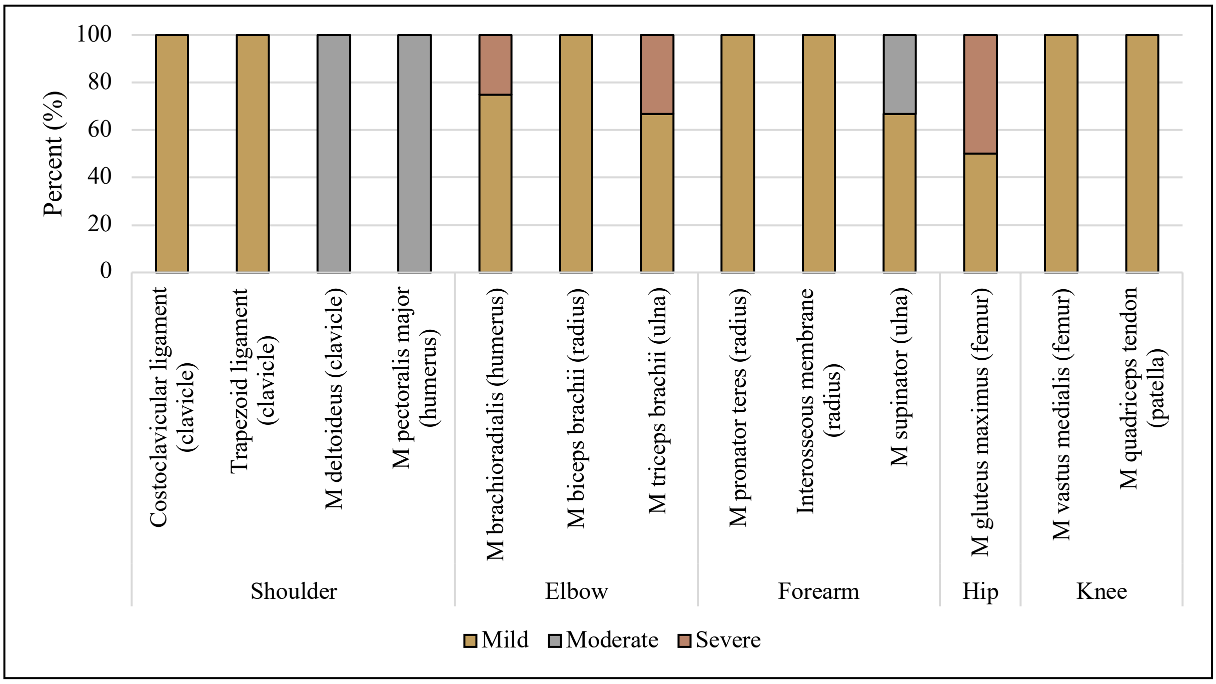


Figure 3.163. Ayios Dhimitrios: Frequency distribution of mild, moderate, and severe robusticity ranks by muscle. N:25.

Looking at the distribution of the observed entheses by functional complex, figure 3.164 shows that the elbow was the best-represented enthesis (9/25, 36.0%), followed by the forearm (8/25, 32.0%). The knee and the hip were, instead, the least-represented (2/25, 8.0%).

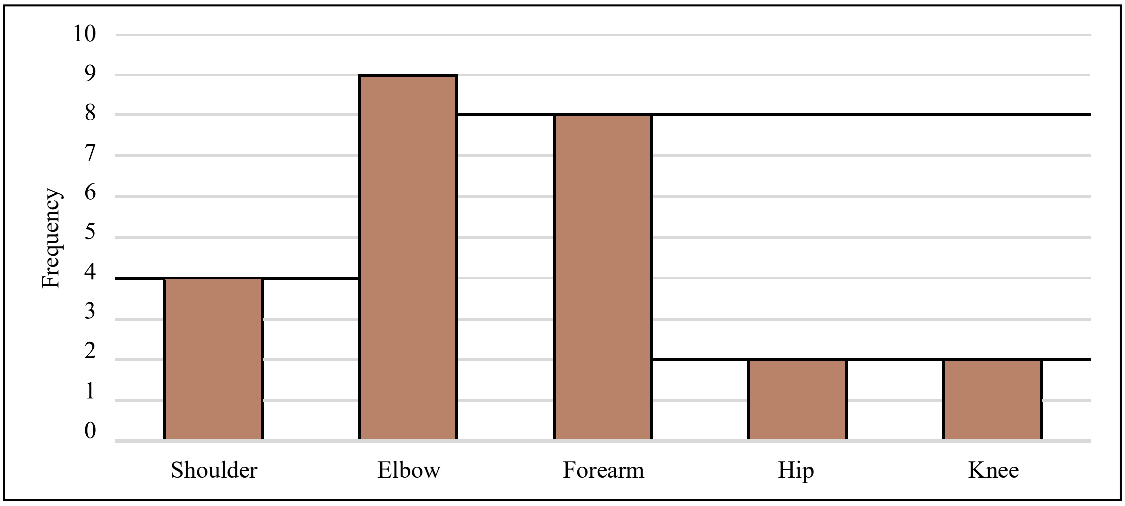


Figure 3.164. Ayios Dhimitrios: Frequency distribution of the observed entheses by functional complex. N:25.

Unfortunately, the inconsistent number of entheses belonging to the hip and knee prevented the possibility to draw a conclusion regarding the use of the lower limb in this sample. It can be only noted that one of the two hip entheses displayed a severe degree of robusticity. In the remaining cases, it was observed a prevalence of mild degrees; 50.0% (2/4) moderate scores were, additionally, observed on the forearm (1/8, 12.5%), and 22.2% (2/9) severe modifications on the elbow.

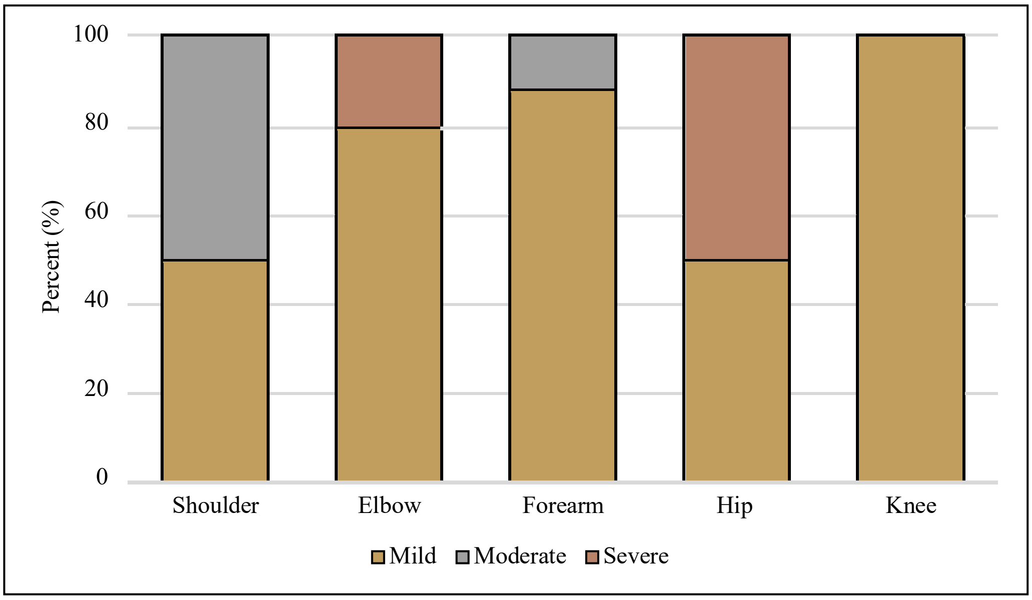


Figure 3.165. Ayios Dhimitrios: Frequency distribution of mild, moderate, and severe robusticity ranks by functional complex. N:25.

3.4.2.2.2 Robusticity: relationship between score development, side, sex, and age

As for the bilateral asymmetry, it is evident that only four entheses were represented on both sides. Among these, only the *brachioradialis* and the *biceps brachii* sample yield an equal number of surfaces.

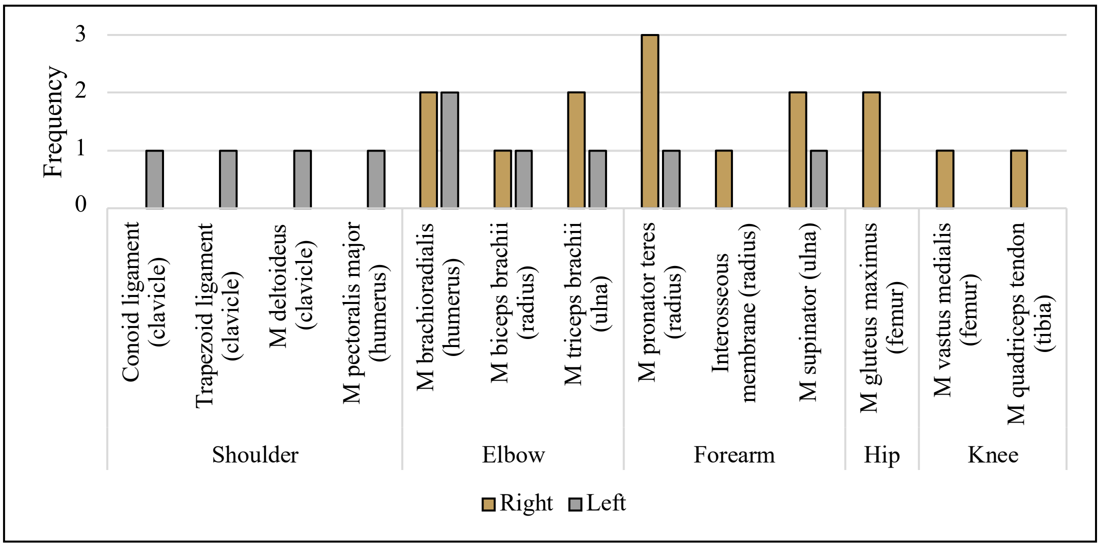


Figure 3.166.Ayios Dhimitrios: Frequency distribution of the entheses by side. N:25.

Thus, looking at the comparable entheses, figure 3.167 shows a left-side asymmetry on the *brachioradialis* and *triceps brachii* and a right-side asymmetry on the *supinator*.

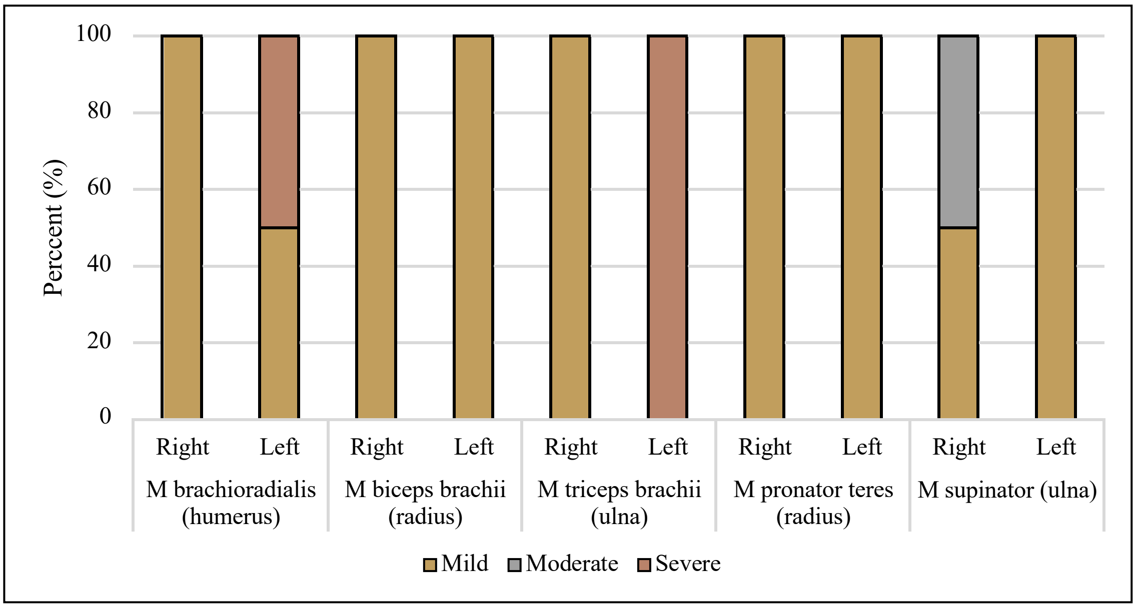


Figure 3.167. Ayios Dhimitrios: Frequency distribution of mild, moderate, and severe robusticity ranks by side. N:14.

By pooling the entheses in functional complexes, it is evident that the only comparable complexes were the elbow and the forearm; in both these cases, the right entheses prevailed over the left (Figure 3.168).

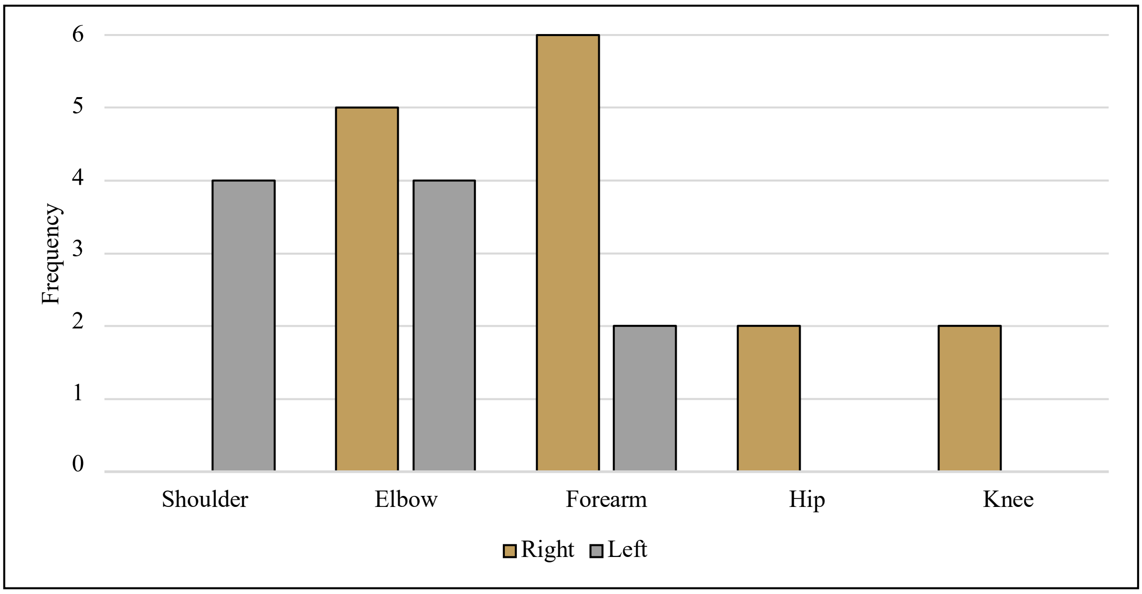


Figure 3.168. Ayios Dhimitrios: Frequency distribution of the entheses by side (pooled functional complexes). N:25.

Focusing on these two functional complexes, figure 3.169 displayed higher ranks on the left side of the elbow (2/4, 50.0%) compared with the right (0.0%, 0/5), and on the right side of the forearm (1/6, 16.7%) compared with the left side (0/2, 0.0%). It must be stressed that, however, in this latter case, the left side included only two entheses.

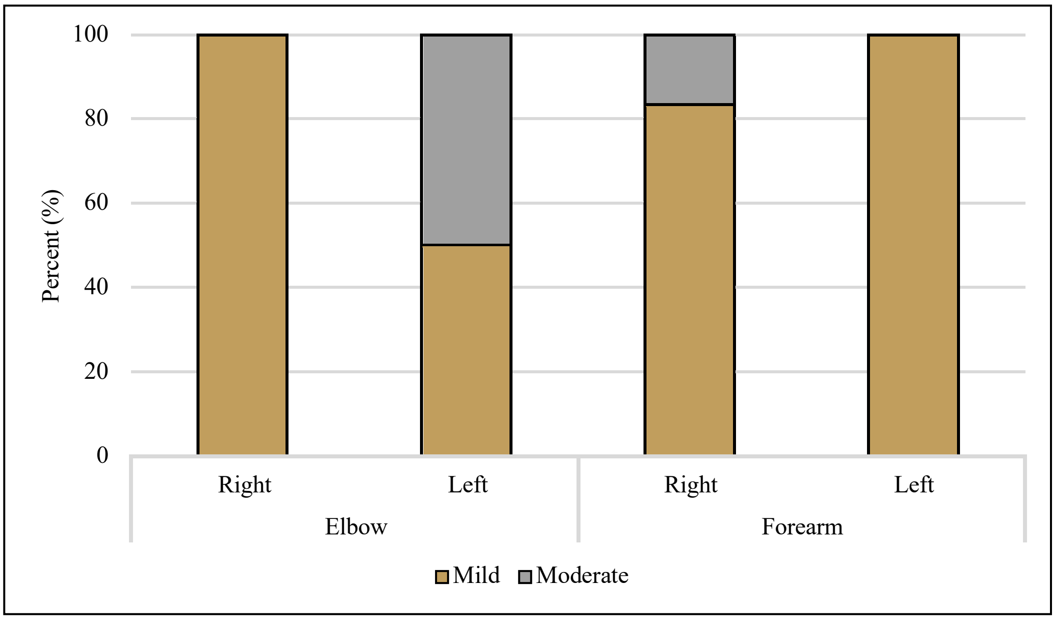


Figure 3.169. Ayios Dhimitrios: Frequency distribution of mild and moderate robusticity ranks by side (pooled functional complexes). N:17.

Despite these findings, the Mann-Whitney *U*-test did not reveal any significant difference (elbow p-value=0.286, forearm p-value=0.857).

No comparisons between sexes were allowed because of the absence of the males in this sample. However, females exhibited increasing stress at the *deltoideus* (clavicle), the *pectoralis major* (humerus), the *biceps brachii*, and the *triceps brachii* (ulna).

For which concerns the comparisons between age categories, the elbow and the forearm were the only functional complexes represented by both the categories (Figure 3.170). The young adults were better represented than the middle adults in both the complexes, yielding a bias, for the forearm, of 3:1, and, for the elbow, of 5:4.

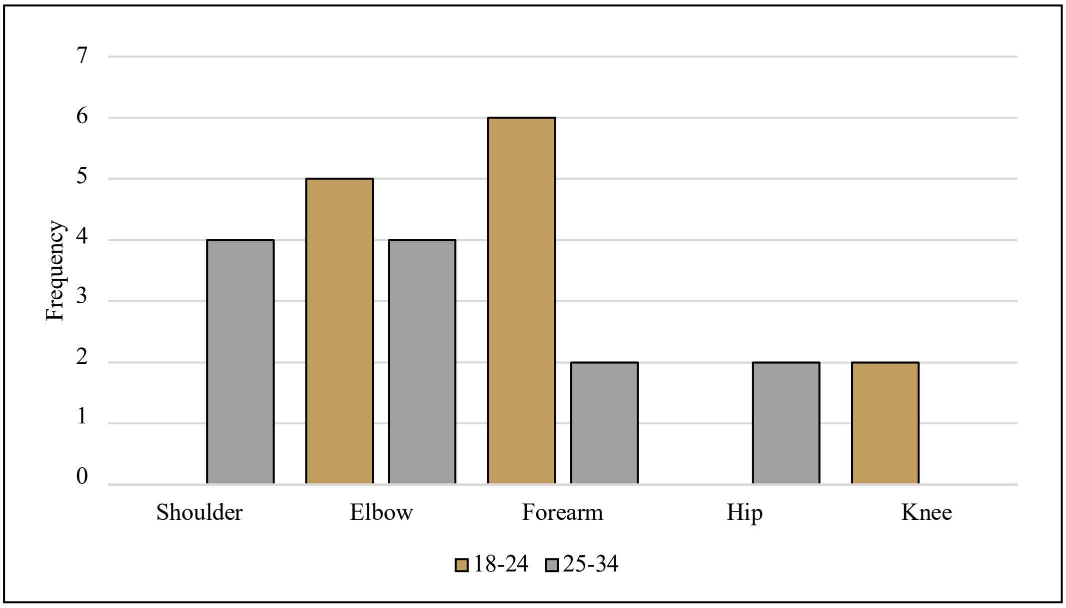


Figure 3.170. Frequency distribution of the observed entheses by age category (pooled functional complexes). N:25.

Looking at the severity rank distribution, despite being underrepresented, the middle adult category showed the most severe forms of robusticity in both the complexes: in the elbow, 50.0% (2/4) compared with 0.0% (0/5) recorded on the young adults and, in the forearm, 50.0% (1/2) compared with the 0.0% (0/6) observed on the younger adults (Figure 3.171).

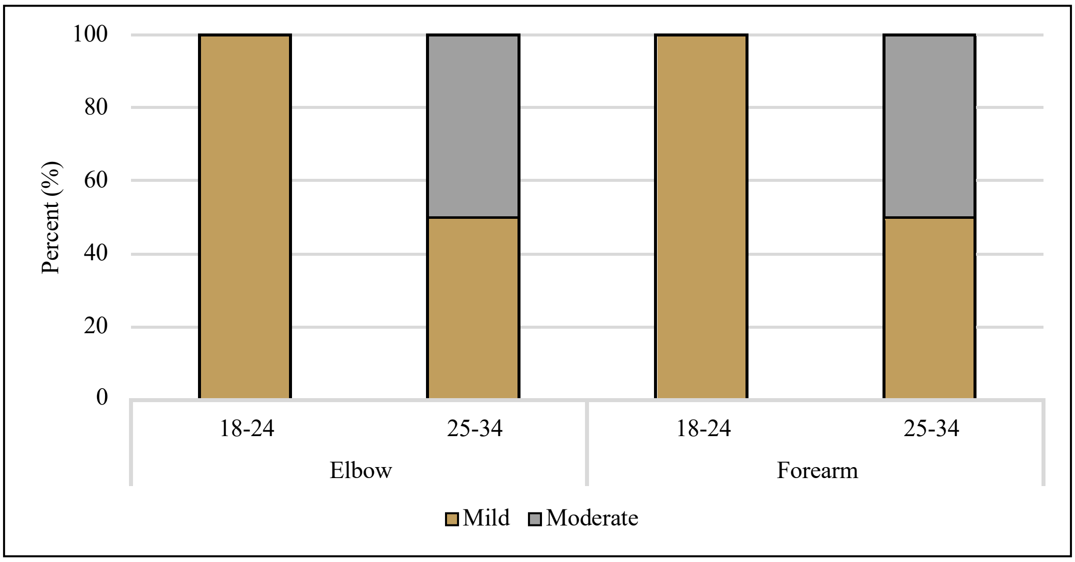


Figure 3.171. Ayios Dhimitrios: Frequency distribution of mild and moderate robusticity ranks by side (pooled functional complexes). N:17.

However, these differences between the sexes were not statistically significant (elbow p-value=0.286 and forearm p-value=0.429)

3.4.2.2.3 Osteolytic and Enthesophytic formations: relationship between score development and enthesis

OLs and EFs were not found on all the observed entheses. More specifically, the OLs affected 8.0% (2/25) of the entheses, while the last were detected on 52.0% (13/25) of the surfaces. Among those affected by OLs, the *gluteus maximus* was ranked as moderate, while the *brachioradialis* was ranked as severe (Figure 3.172).

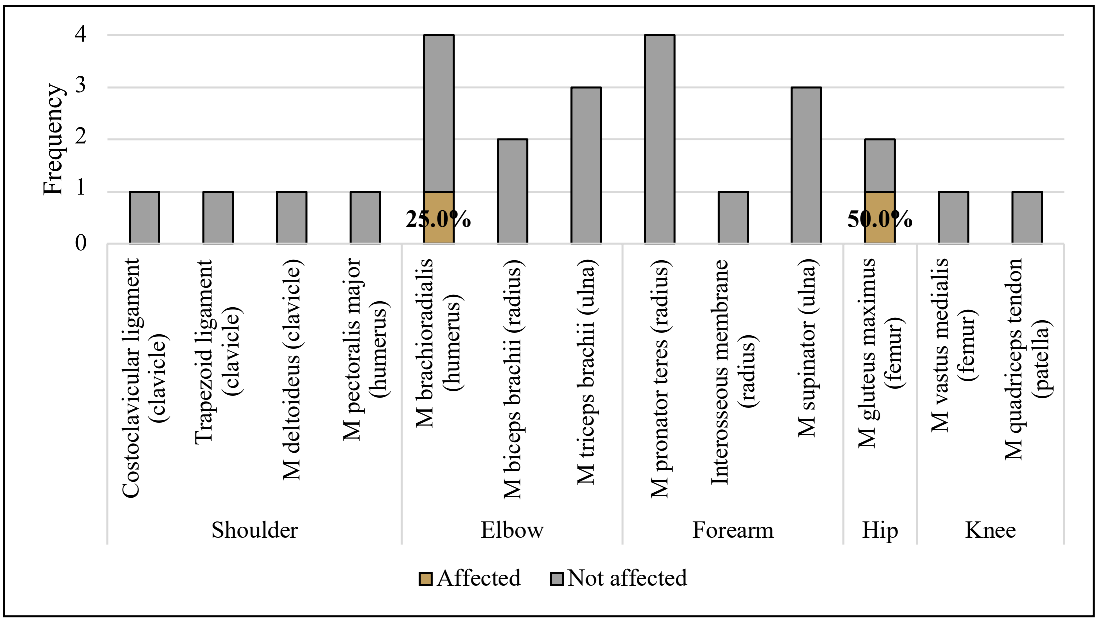


Figure 3.172. Ayios Dhimitrios: Frequency distribution of the entheses affected by OLs by muscle. N:25.

For which concerns the EFs, this marker was detected on the majority of the recorded entheses, except the *trapezoid ligament*, the *pronator teres,* and the *interosseous membrane*. The *brachioradialis*, the *triceps brachii* (ulna), and the *supinator*, which are the best represented, yielded 75.0% (3/4) and 33.3% (1/3) affections, respectively. In the remaining cases, the very low representativity of the samples did not permit to draw any conclusion about the frequency distribution of this marker by enthesis.

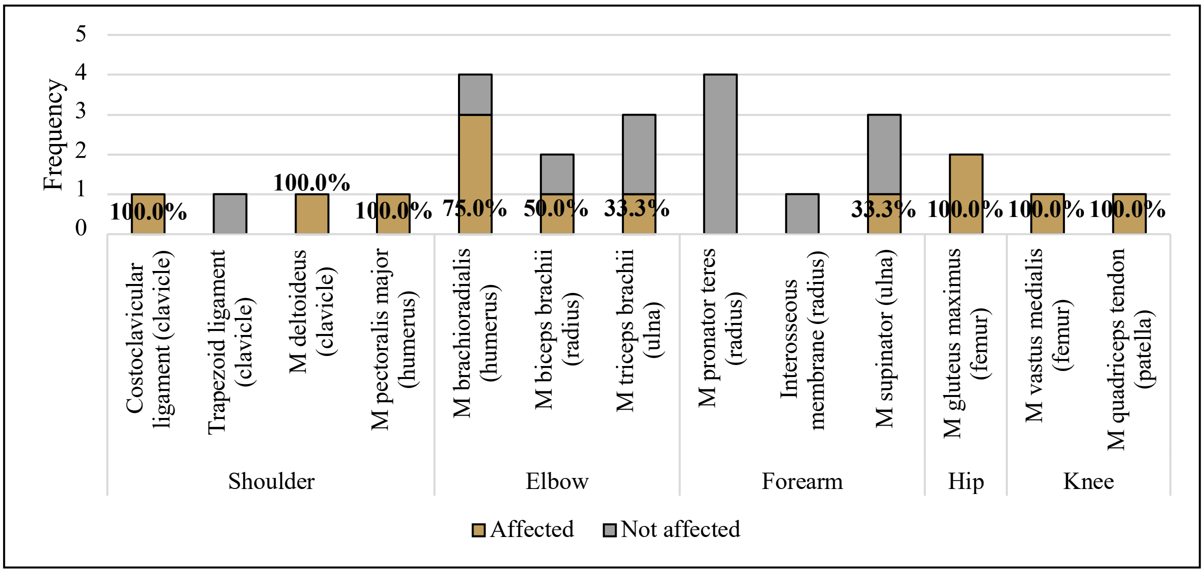


Figure 3.173. Ayios Dhimitrios: Frequency distribution of the entheses affected by EFs by muscle. N:25.

Among the 13 entheses affected, the only *triceps brachii* observed was ranked as severe; moderate degrees were assigned to the *biceps brachii* and the *supinator*. The remaining were in mild forms with a very slight percentage of moderate (1/3, 33.3% on the *brachioradialis*) and severe degrees (½, 50.0% on the *gluteus maximus*) (Figure 3.174).

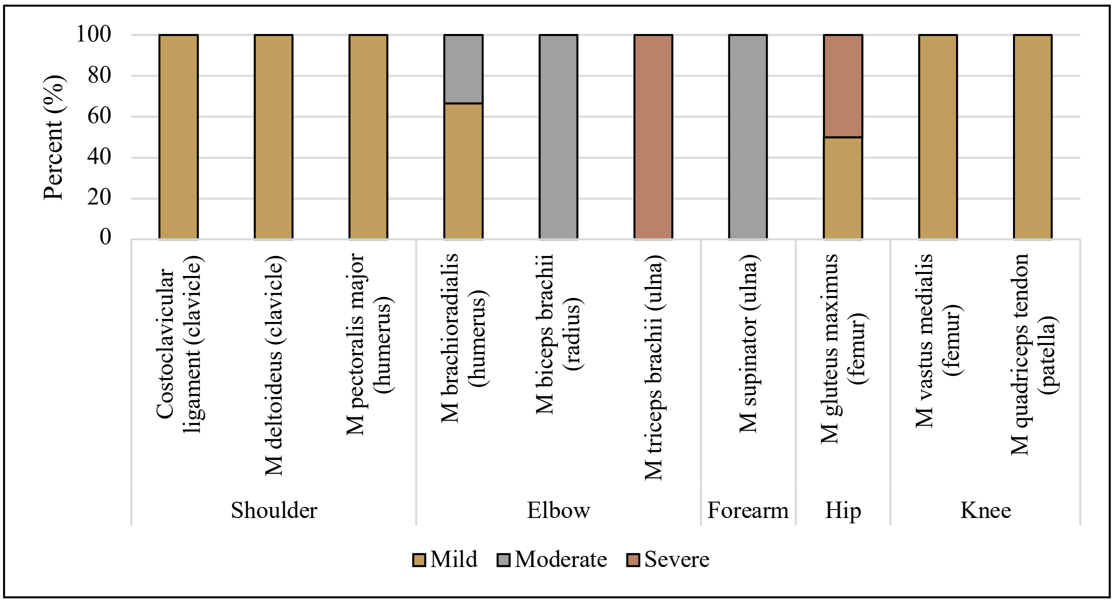


Figure 3.174. Ayios Dhimitrios: Frequency distribution of mild, moderate, and severe EFs ranks by muscle. N:13.

Looking at the frequency distribution of the entheses affected by EFs by functional complex, figure 3.175 shows that the hip and the knee, the least represented districts, yielded the highest percentages of affections (2/2, 100.0%). The shoulder was the most affected (3/4, 75.0%), followed by the elbow (5/9, 55.6%) and the forearm (1/8, 12.5%).

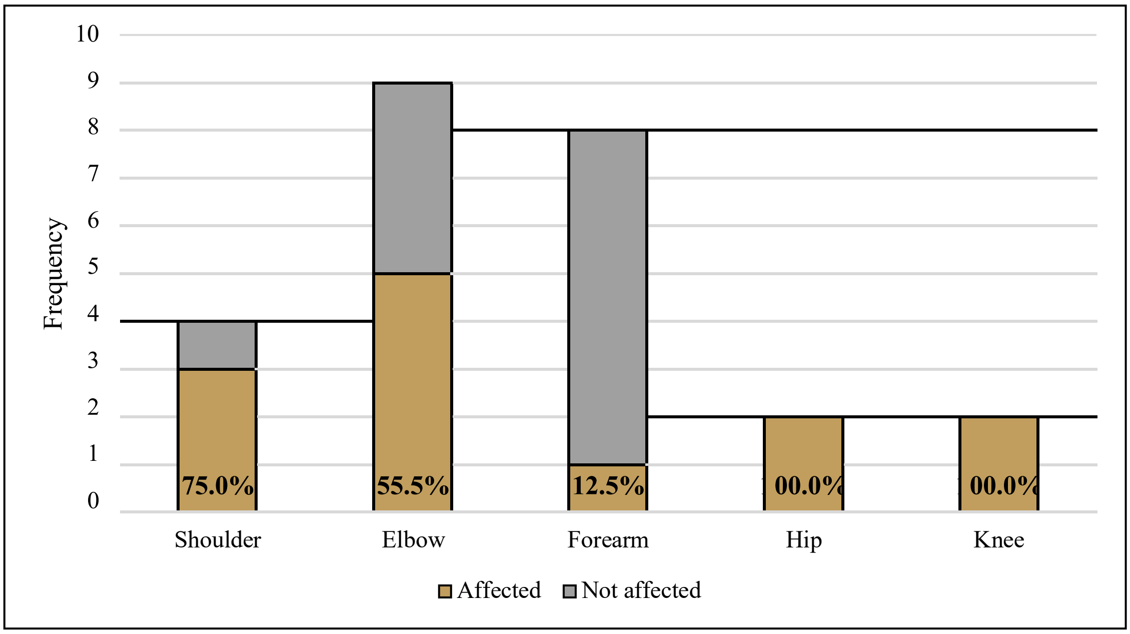


Figure 3.175. Ayios Dhimitrios: Frequency distribution of the entheses affected by EFs by functional complex. N:25.

Focusing on the entheses affected, the severity ranks distribution in figure 3.176 suggests that the most affected functional complex, namely the elbow, displayed 20.0% (1/5) severe and 40.0% (2/5) moderate degrees. The shoulder, despite being more affected than the other, exhibited only mild degrees. The remaining three functional complexes were represented by a very low number of surfaces affected which, in the case of the forearm, was ranked as moderate (1/1, 100.0%), while, in the case of the knee, were both in mild forms, and in the case of the hip, were one mild (½, 50.0%) and the other severe (½, 50.0%).

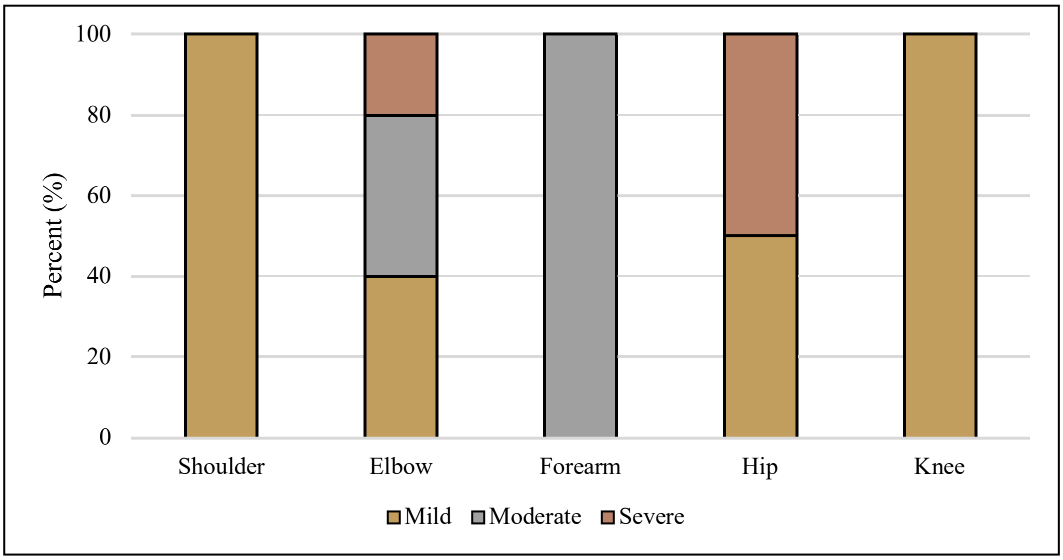


Figure 3.176. Ayios Dhimitrios: Frequency distribution of mild, moderate, and severe ranks by functional complex. N:13.

3.4.2.2.4 Osteolytic and Enthesophytic formations: relationship between score development, side, and sex

Since the very low number of OLs recorded (N=2), no comparisons between sides, sexes and age categories were allowed. For which concerns the EFs distribution by side, figure 3.177 shows that the only comparable functional complex was the elbow. Indeed, the shoulder, the hip, and the knee were represented by only entheses pertaining to one side. The forearm, represented by both sides, displayed affections only on the right side. Thus, focusing on the elbow, the right side (3/5, 60.0%) was slightly more affected than the left (2/4, 50.0%). In terms of severity distribution, that the highest ranks were detected on the left side (½, 50.0% of severe and ½, 50.0% of moderate degrees) compared with the right (1/3, 33.3% of moderate and 2/3, 66.7% of severe degrees). No significant differences were found between the sides (p-value=0.200).

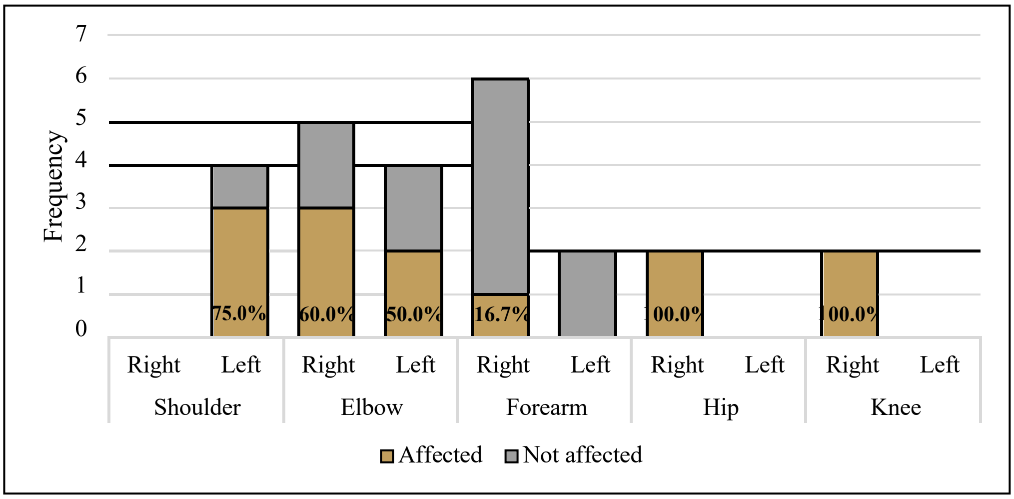


Figure 3.177. Ayios Dhimitrios: Frequency distribution of the entheses affected by EFs by side (pooled functional complexes). N:25.

No comparisons between sexes were allowed because of the absence of entheses from male individuals. Concerning the comparisons between age groups, and specifically in the elbow, namely the only functional complexes represented by entheses recorded on young and middle adult skeletons, it was observed an increase in the number of the affections with age (Figure 3.178). Moreover, the older individuals were affected by the most severe forms (2/3, 66,7%) compared with the younger. No significant differences were however found between the two groups (p-value=0.800).

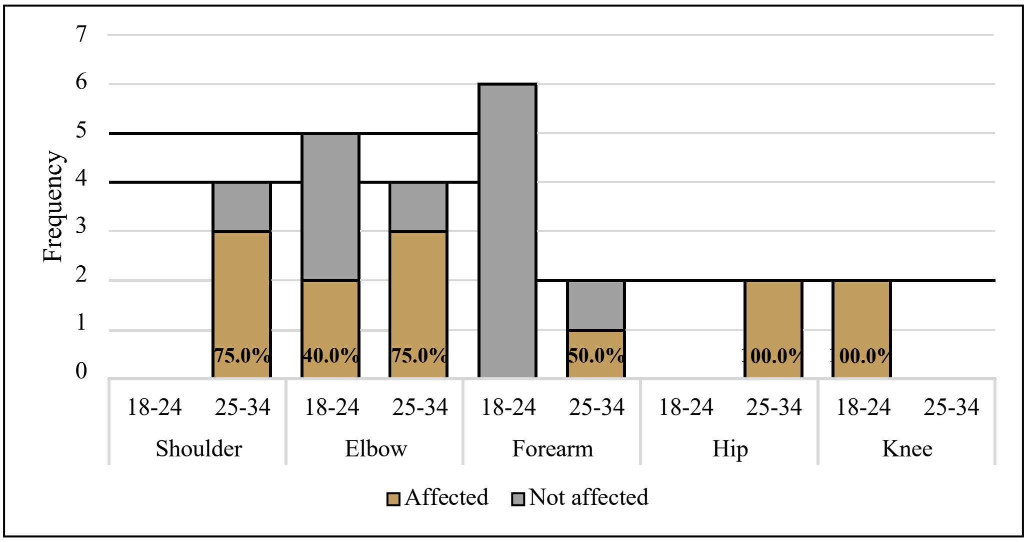


Figure 3.178. Ayios Dhimitrios: Frequency distribution of entheses affected by EFs by age category (pooled functional complexes). N:25.

3.4.2.3 Osteoarthritis

OA assessment was based on the observation of 9 joint surfaces belonging to three individuals. Figure 3.179 was provided to highlight the pattern of the joint surface representation within the whole sample. As can be noted, the BRI values were overall very low: none rise above 25.0%.

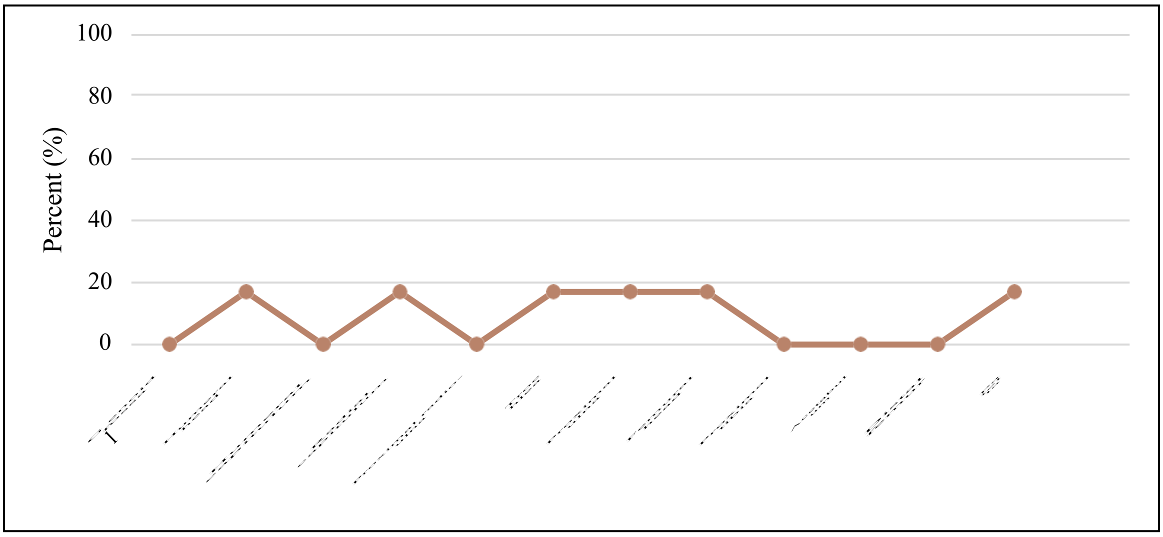


Figure 3.179. Ayios Dhimitrios: Joint surfaces representation (%) within the sample. N:9.

Among the 9 types of joint surfaces represented, the radial capitulum, the trochlea, and the proximal ulna were the best represented (2/9, 22.2%) in the whole sample.

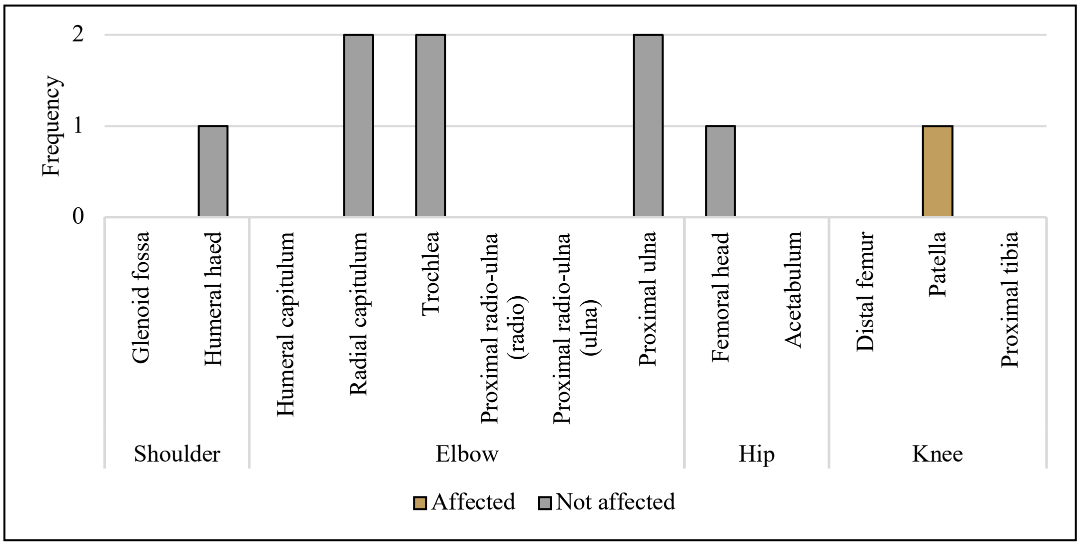


Figure 3.180. Ayios Dhimitrios: Frequency distribution of the observed articular surfaces by joint. N:9.

Only one joint surface displayed evidence of OA. It was a patella belonging to a young female who presented severe PO, mild ML and mild SO.

3.4.2.4 Extra-masticatory dental wear

A total of 8 maxillary and 14 mandibular teeth belonging to four individuals were examined for evidence of extra-masticatory dental wear. No case was noted. Thus, no comparison between sexes and age groups were allowed.

3.4.2.5 Summary

In sum, the sample of Kalavasos *Ayios Dhimitrios* was small and entirely constituted by females, 3/6 of whom were of unknown age. On the basis of the evaluation of the robusticity ranks scored for ECs, it is possible to assert that all the entheses represented on both sides displayed a left-side asymmetry. Unfortunately, no comparison between sexes was carried. As for the relationship between robusticity ranks and age, the severity of this marker increased from the young to the middle adult range. For which concerns the OLs and the EFs, the former affected a very low percentage of the surfaces observed (2/25, 8.0%): a *brachioradialis* and a *gluteus maximus*. No comparisons between sexes, sides and age groups were carried out. The last were recorded in higher percentage (13/25, 52.0%), predominantly on the elbow and shoulder but affected more severely elbow. No comparisons between sexes were allowed; while the comparisons between sides revealed a greater number of affections on the right side compared with the left on the elbow, the only functional complex comparable. Concerning the OA, only one joint surface was affected, and it came from a young female. No extra-masticatory dental defect was detected on this sample.

3.4.3 Enkomi *Ayios Iakovos* (Summary) (Appendix 3)

The Enkomi sample consisted of a selection of femurs belonging to 20 individuals (12 females and 8 males) relocated to the Medelhavsmuseet of Stockholm from the site of origin. The remaining sample was inaccessible for study. No information related to the age at death of these individuals was available. The evaluation of the robusticity ranks scored for ECs allowed us to understand that the *gluteus maximus* was mostly developed in the males compared with the counterpart; the *vastus medialis* and the *iliopsoas* were, instead, more developed in the females. On all three entheses, the right side was more utilized than the left. For which concern the OLs and the EFs, these two markers seem to draw different trends. The former affected a very low percentage of the surfaces observed (11/90, 12.2%). As for the *iliopsoas*, they were equally distributed by sex, but the females were more severely affected; while, considering the *gluteus maximus*, they were mostly detected on the male skeletons which were also the more severely affected. The right side of the *gluteus maximus* was more utilized than the left, but less severely affected; while the left side of the *iliopsoas* was the more affected, but less severely interested. The EFs, recorded in higher percentage (40/90, 44.4%) compared with the OLs, mostly affected the males than the females. The most affected enthesis was the *iliopsoas,* even if, the most severe forms were observed on the *gluteus maximus*. The right side was greatly interested than the left, with the only exception of the i*liopsoas* which displayed a higher number of evidence on the left side. No joint surface was found to be affected by OA.

Chapter 4 Results: Diachronic comparisons

In the first part of the results, skeletal evidence for activity patterns in the osteological collections was investigated separately. This facilitated a greater understanding of the data, and its variation between populations, but has not addressed the main research questions of this thesis, which seek to explore chronological variations in activity. In the present chapter, contemporary collections were pooled in three groups: Chalcolithic (Chal), Philia-Middle Bronze II (Philia-MBAII) and Middle Bronze Age III-Late Bronze Age III (MBAIII-LBAIII), and analysis was undertaken to explore whether muscles, joints and teeth were utilized at the same intensity level or not between these chronological periods.

Table 4.1 shows the biological sex and age composition of the pooled sample by period. The sample was sufficient to consider the two demographic factors, sex and age, separately. However, despite the pooling of data, the two sexes were not equally represented for each age category in all three periods. This inhibited the extent to which it was possible to investigate activity patterns by sex and age in combination.

Table 4.1. Age and sex composition of the sample.

	Chal			Philia-MBAII			MBAIII-LBAIII			
	Male	Female	ND	Male	Female	ND	Male	Female	ND	Total
20-24	0	9	0	2	9	1	0	6	3	30
25-34	7	6	3	8	10	1	1	2	0	38
35-44	1	5	0	7	3	1	1	2	0	20
45+	0	0	0	5	1	0	0	0	0	6
ND	1	0	0	2	4	0	9	16	0	32
Total	9	20	3	24	27	3	11	26	3	126

The bar chart in figure 4.1. suggests that, overall, the Chal males were the least represented in the whole sample, and there were more than twice as many females from this period. The Philia-MBAII group had a relatively equal sex distribution, whereas the MBAIII-LBAIII was also dominated by females (26/40, 65.0%), while the males represented 27.5% (11/40) of the total. Overall, females predominated with 73 (57.9%) individuals compared with 44 (34.9%) males.

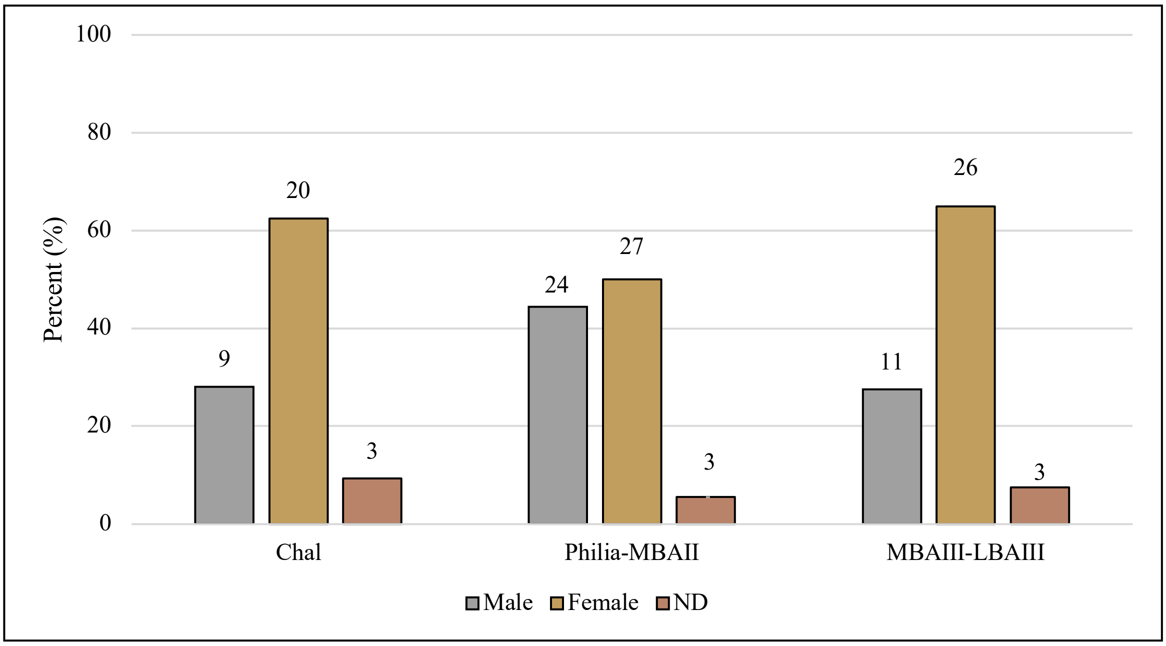


Figure 4.1. Sex composition of the three chronological periods. ND: not determined. N:126.

The large number of MBAIII-LBAIII skeletons for whom age could not be determined (25/40, 62.5%) prevented the possibility to draw any viable conclusions about the demographic profile for the period. Overall, it must be noted an increase in the number of mature individuals (35-44 years) from Chal to Philia-MBAII (6/32, 18.8% in the Chal, 11/54, 20.4% in the Philia-MBAII).

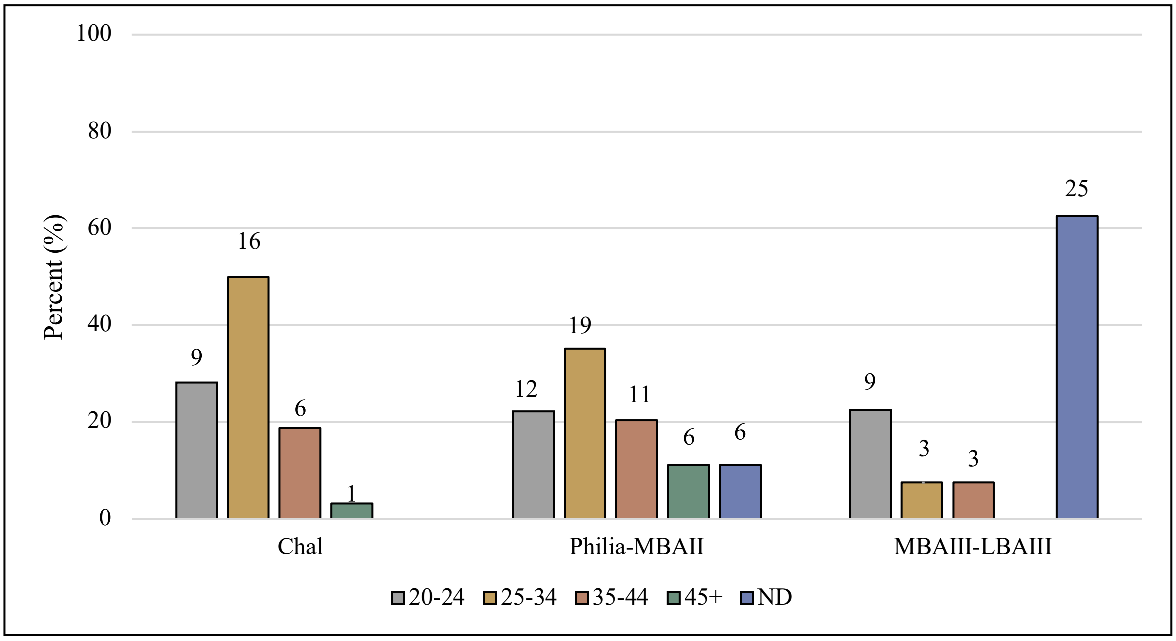


Figure 4.2. Age composition of the three chronological periods. ND: not determined. ND:126.

4.1 Entheseal Changes

4.1.1 Index of representativity of the entheses

A variety of factors including the depositional conditions of the skeletons and the geographical location of the cemeteries affect the preservation of the skeletons. In order to evaluate the enthesis/ joint surface preservation of the collections, pooled per period, figure 4.3 was provided.

As can be noted, the BRI values related to the entheseal representation were overall very low. The only exception was represented by the frequencies of the *gluteus maximus*, the *iliopsoas,* and the *vastus medialis* from LBA: in this case, the ratio between the actual number of entheses observed and the theoretical number of entheses that should have been present on the basis of the number of the individuals was comprised between 43.8% and 52.5%. The over-representation of these elements derives from the examination of the selection of femurs from the site of Enkomi relocated in the Stockholm Museum. Indeed, the status of preservation of this skeletal collection was significantly better than the other osteological samples included in this research both in terms of bone completeness and in terms of surface preservation. Concerning the other entheses, the pattern of representativity was similar in all groups with a higher frequency of the *conoid*, the *deltoideus,* the *brachioradialis,* and the *brachialis.* Conversely, the entheses belonging to the scapula, patella and tibia were the least represented.

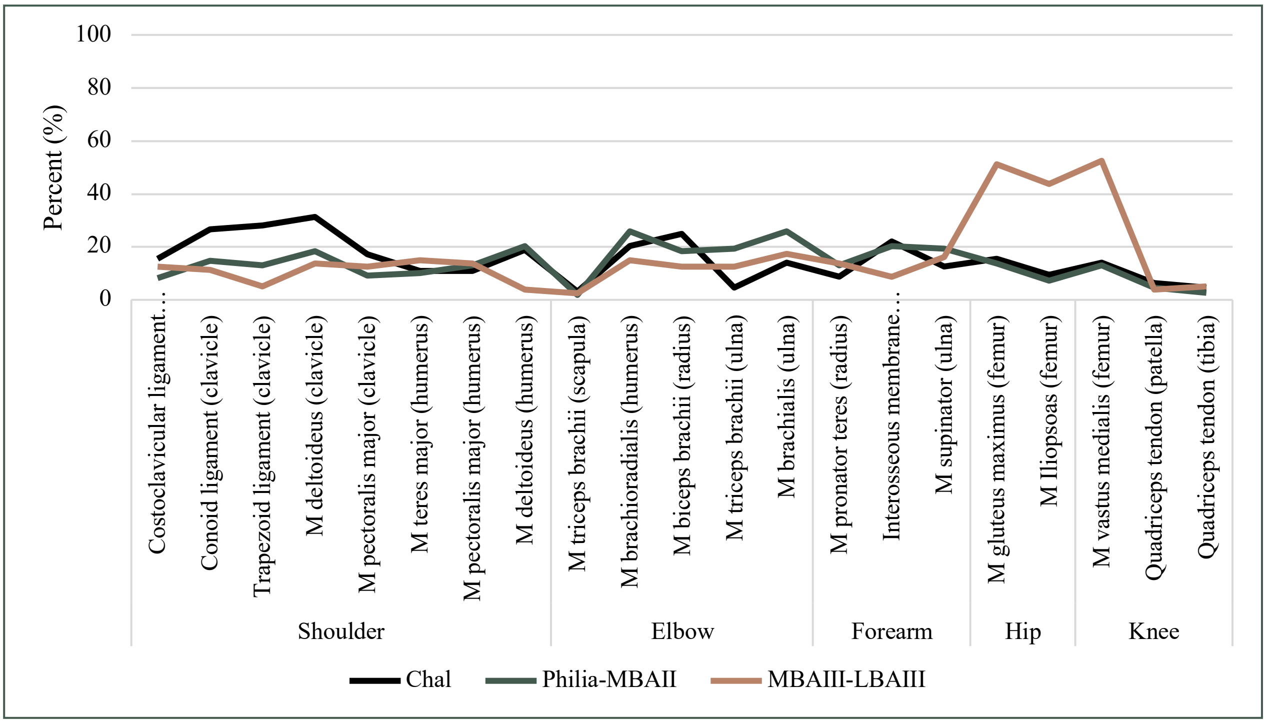


Figure 4.3. Entheses representation (%) within the whole sample. N:810.

4.1.2 <u>Robusticity: comparisons of the functional complex development between the three periods</u>

Before assessing changes in muscle utilization across the times, it was deemed appropriate to highlight potential disparities in the representation of each enthesis. Overall, the collections examined for LBA provided the lowest number of entheses per type, except, as already stated, the *gluteus maximus*, the *iliopsoas*, the *vastus medialis* to which add the *teres major* and, the *quadriceps tendon* (tibia). The most consistent group, the Philia-MBAII sample, provided the highest percentages of entheses; in very few cases their proportion was similar to the Chal proportions such as for the *costoclavicular*, the *conoid*, and the *deltoideus*.

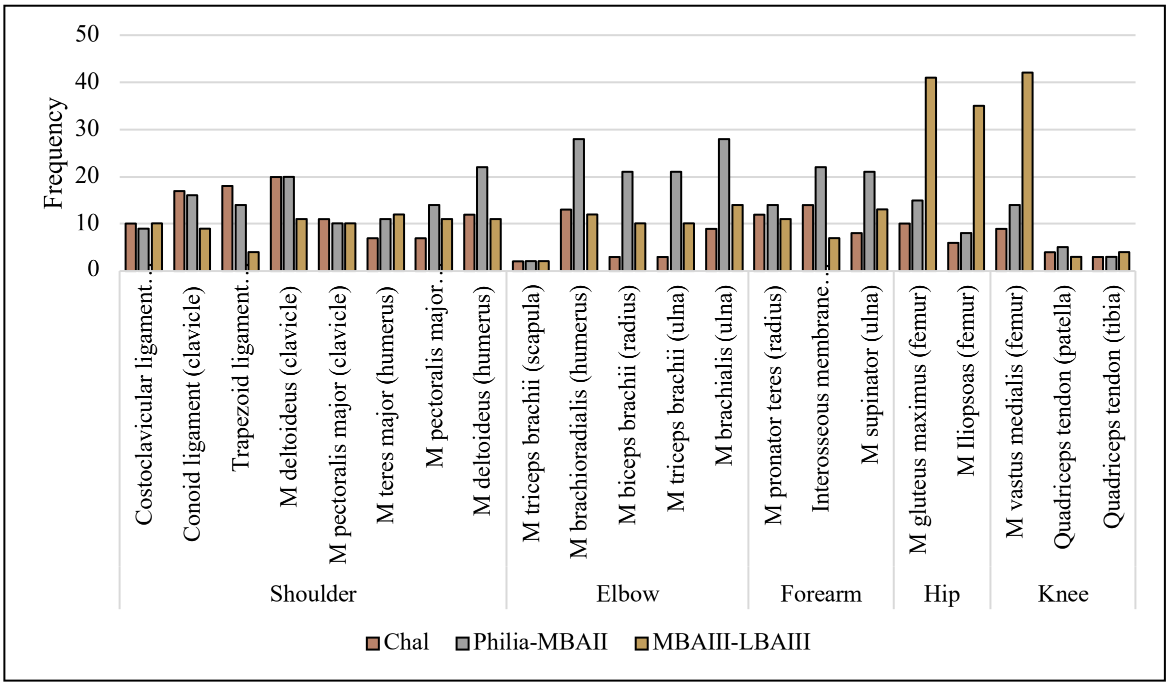


Figure 4.4. Frequency distribution of the observed entheses by chronological period. N:810.

Hence, to evaluate the distribution of the most severe robusticity expressions (moderate + severe) across the periods, figure 4.5 was produced. Interestingly, the disparities in representations seem to have not strongly affected the reliability of the data, which, overall, hint less utilization, from Chal to Philia-MBAII, of some types of muscles such as for the *costoclavicular*, the *trapezoid*, the deltoideus, the *pectoralis major* (humerus), and the *supinator*; and higher ranks of the same types, from Philia-MBAII to LBA. In other cases, it was observed an exponential increase in the level of severity of the manifestations from Chal to LBA: this occurs, for example, at the level of the *conoid*, the *brachioradialis*, and the *pronator teres.* Finally, there were a few cases in which it was observed a gradual decrease in terms of muscle development such as, for example, the *trapezoid*, the *interosseous membrane*, the *gluteus maximus,* and the *iliopsoas*.

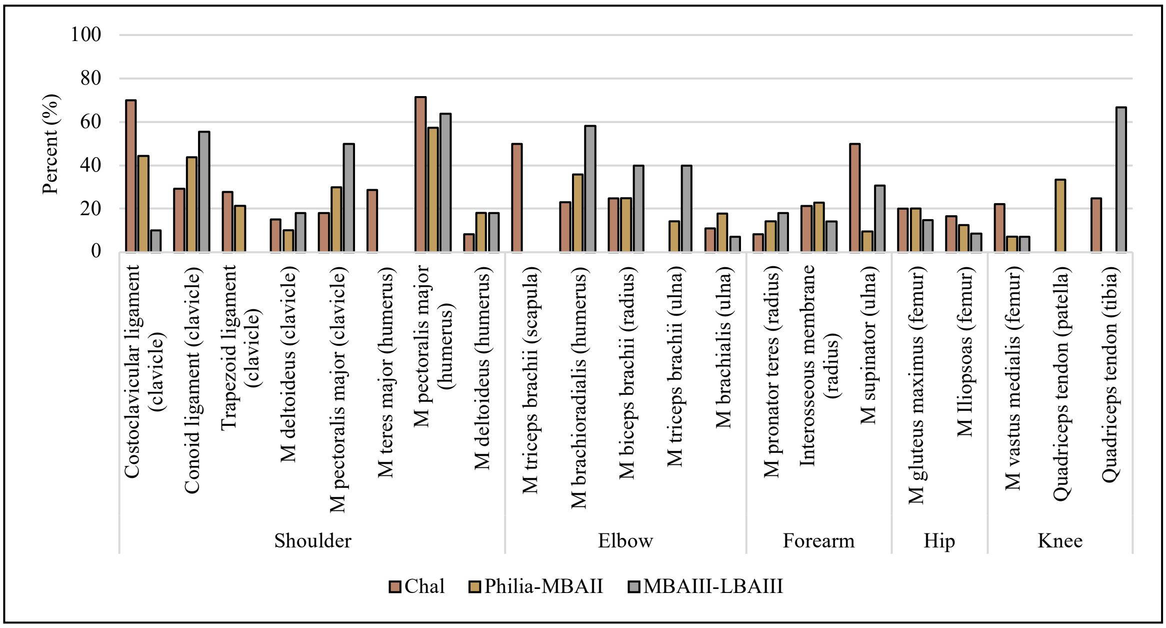


Figure 4.5. Frequency distribution of moderate + severe robusticity ranks across the periods (pooled sexes, sides and age categories). N:810.

Looking at the functional complex level, it appears more evident how the samples dated to the first and second period yielded the higher rates of entheses pertaining to the shoulder, the elbow, and forearm; while the samples dated to LBA yielded a greater representation of hip and knee entheses.

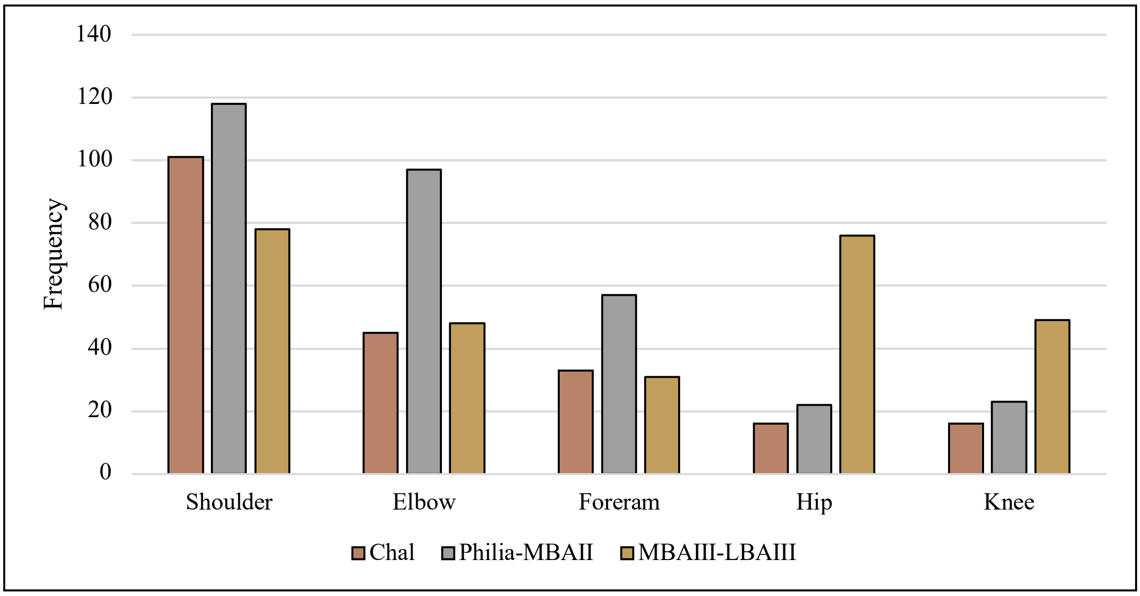


Figure 4.6. Frequency distribution of the observed entheses by chronological period (pooled functional complexes).

Thus, looking at the distribution of the combined moderate and severe expressions by functional complex, it was overall observed a gradual decrease of the percentage of these degrees from Chal to Philia-MBAII, and an increase from Philia-MBAII to LBAIII.

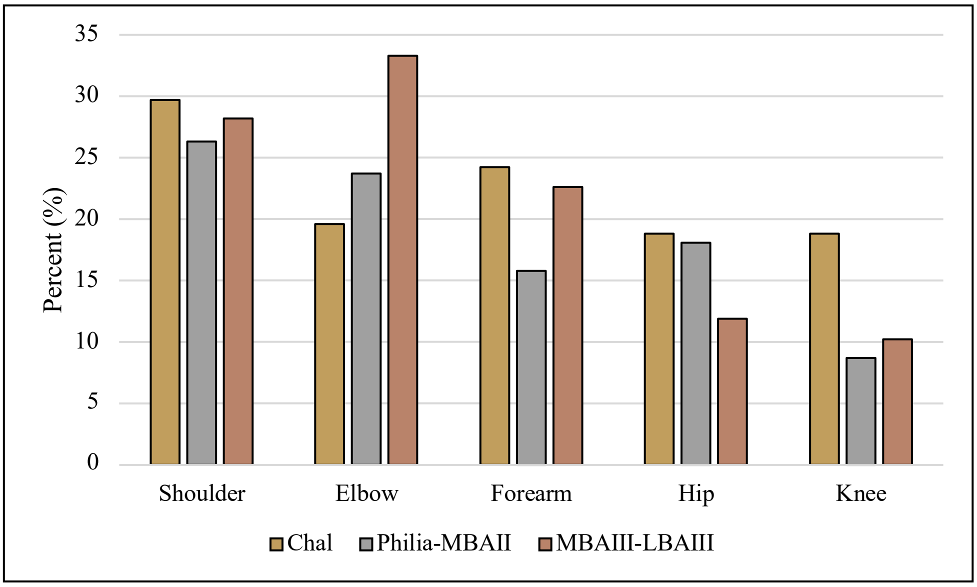


Figure 4.7. Frequency distribution of moderate + severe robusticity ranks by period (pooled sexes, sides and age categories). N:810.

4.1.3 Robusticity: relationship between the level of development of each functional complex, side, sex and age

To create a foundation on which to explore the bilateral asymmetry across the periods, proportions of observed entheses were examined to highlight the potential disparity in the representation of each side by period. Overall, it was noted an almost equal distribution of the observed entheses by side: slight disproportions, towards the right side, were observed on the shoulder and the forearm; towards the left side, on the elbow and the hip.

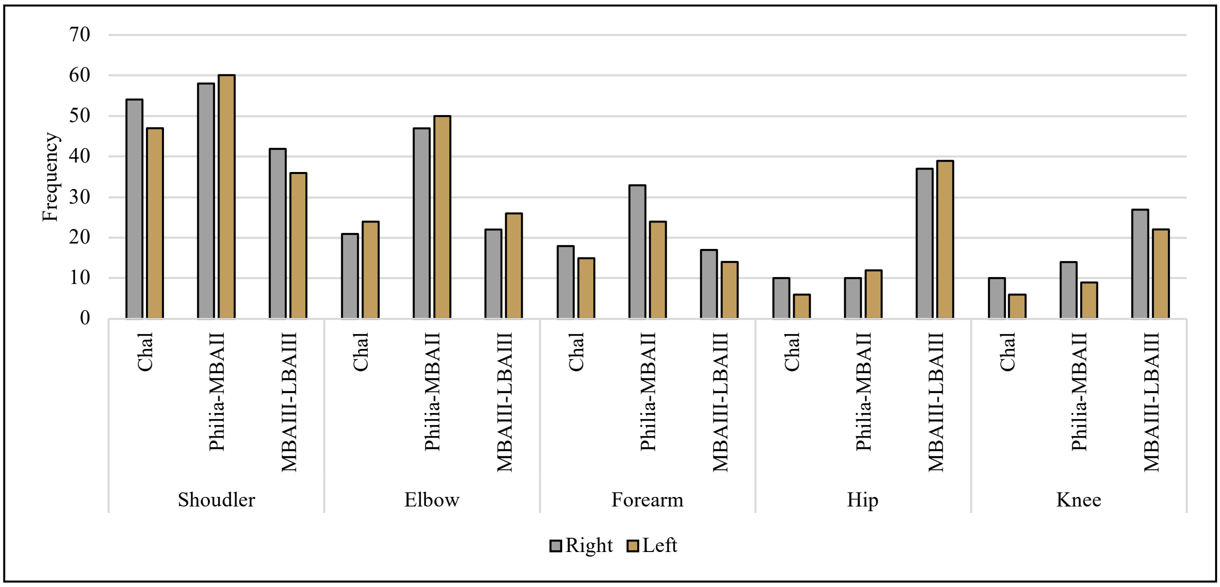


Figure 4.8. Frequency distribution of the observed entheses, by side, across the chronological periods (pooled functional complexes). N:810.

The evaluation of the distribution of the moderate + severe robusticity degrees, by side, revealed a right-side asymmetry in almost all the functional complexes (Figure 4.9, Figure 4.10). A left-side asymmetry was noted at the level of the shoulder, within the Philia-MBAII sample, and at the level of the elbow, within the MBAIII-LBAIII sample, at the level of the forearm, within the Chal sample, at the level of the hip, within the Chal and the MBAIII-LBAIII sample.

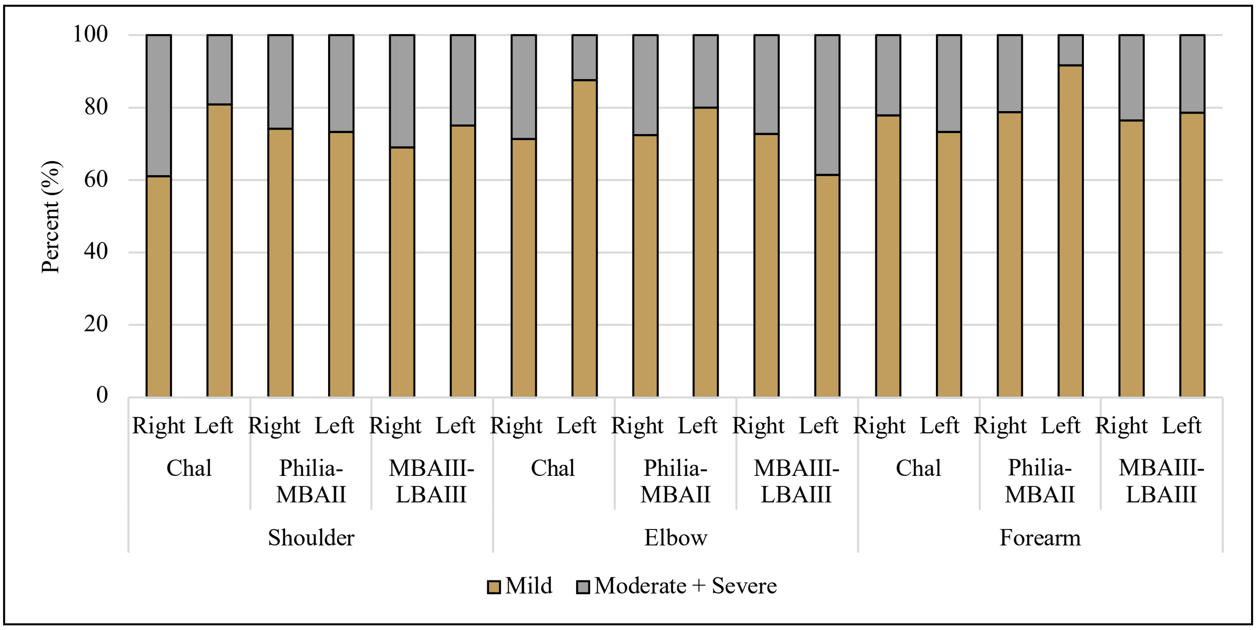


Figure 4.9. Frequency distribution of mild and moderate + severe robusticity ranks, by side, across the periods (upper limbs). N:608.

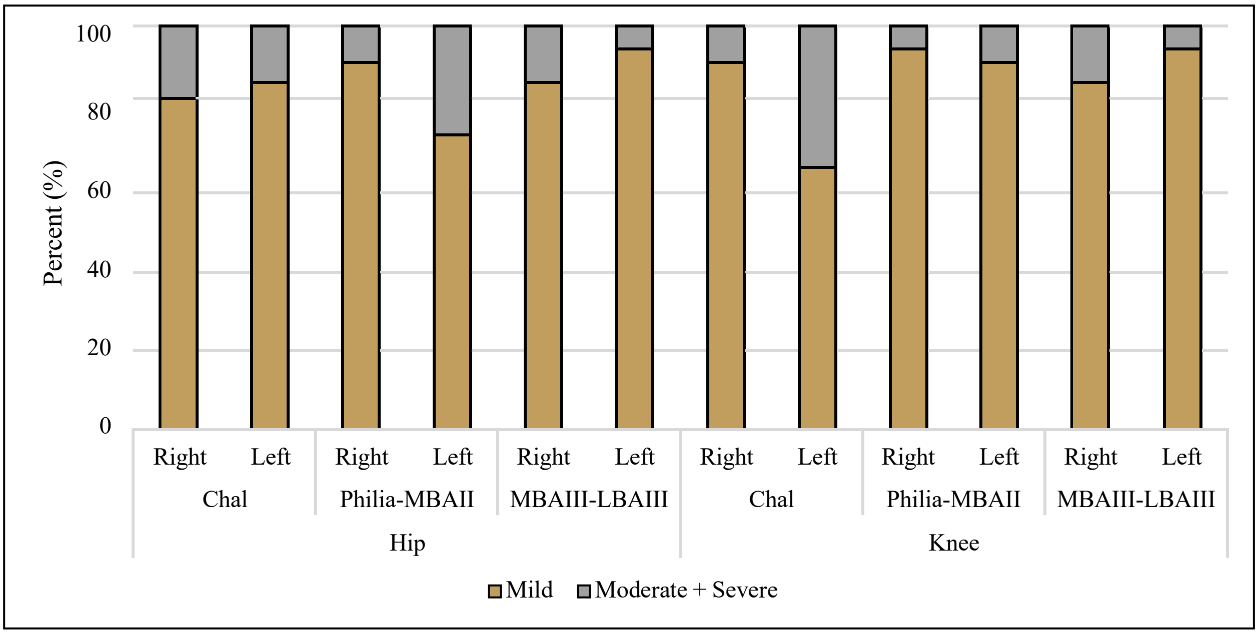


Figure 4.10. Frequency distribution of mild and moderate + severe robusticity ranks, by side, across the periods (lower limbs). N:202.

The Mann-Whitney *U*-test, carried out on the functional complexes separately, revealed no significant difference between the sides in the shoulder (Chal p-value=0.127, Philia-MBAII p-value=0.917, MBAIII-LBAIII p-value=0.779), the elbow (Chal p-value=0.285, Philia-MBAII p-value=0.777, MBAIII-LBAIII p-value=0.893), in the forearm (Chal p-value=1.000, Philia-MBAII p-value=0.866, MBAIII-LBAIII p-value=0.683), in the hip (Chal p-value=0.157, Philia-MBAII p-value=0.564, MBAIII-LBAIII p-value=0.655), in the knee (Chal p-value=1.000, Philia-MBAII p-value=1.000, MBAIII-LBAIII p-value=0.414).

As for differences in the utilization of the five functional complexes between the sexes, as expected, the proportion of female entheses greatly prevailed over the male ones in all the functional complexes (Figure 4.11).

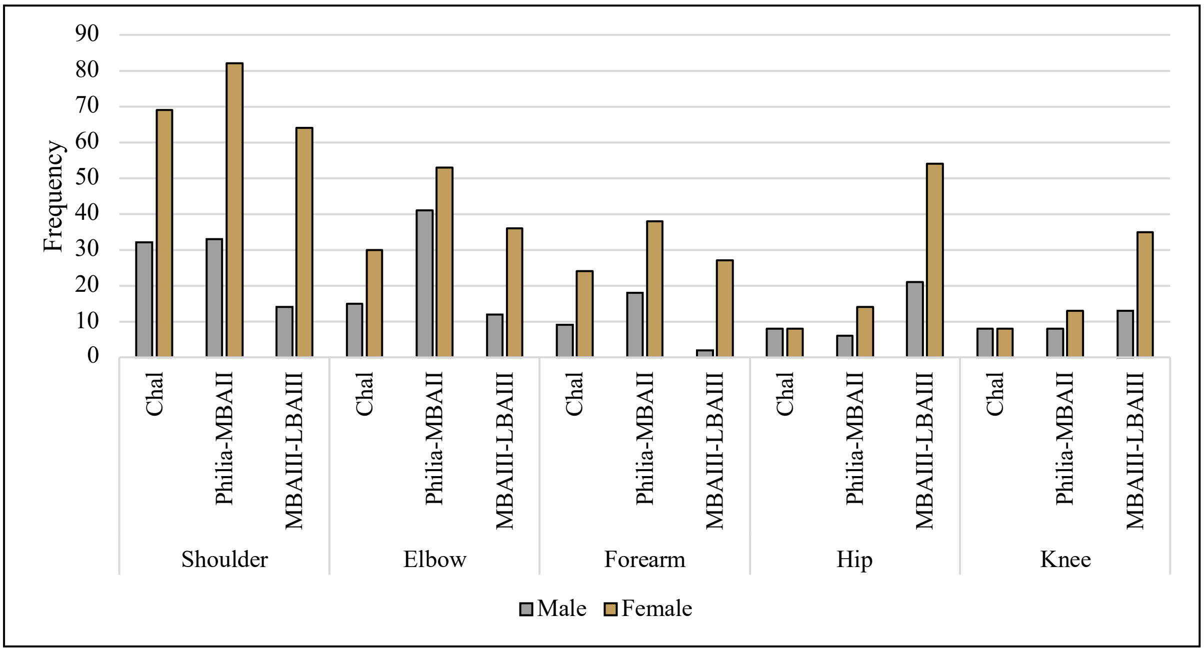


Figure 4.11. Frequency distribution of the observed entheses, by sex, across the chronological periods (pooled functional complexes). N:795.

In terms of severity distribution, despite being underrepresented, the males displayed higher ranks in all the functional complexes (Figure 4.12; Figure 4.13). Overall, the males showed an increasing development of the shoulder and the elbow across the periods; a decrease in the development of the forearm and hip from the Chal to the MBAII period; an equal utilization of the knee across the periods. The females displayed a decrease in the number of moderate and severe modifications from the Chal to the MBA period, and an increase from the MBAIII to the LBAIII period in all the functional complexes belonging to the upper limbs; as for the lower limb, no comparison between the periods was allowed.

The Mann-Whitney *U*-test, carried out on the functional complexes separately, revealed no significant difference between the sexes in the shoulder (Chal p-value=0.747, Philia-MBAII p-value=0.268, MBAIII-LBAIII p-value=0.133), the elbow (Chal p-value=0.341, Philia-MBAII p-value=0.103, MBAIII-LBAIII p-value=0.103), in the forearm (Chal p-value=0.462, Philia-MBAII p-value=0.225, MBAIII-LBAIII p-value=0.192), in the hip (Chal p-value=0.064, MBAIII-LBAIII p-value=0.804), in the knee (Chal p-value=0.535, Philia-MBAII p-value=0.064, MBAIII-LBAIII p-value=0.726). The only significant difference was found in the hip for the Philia-MBAII sample (p-value<0.001).

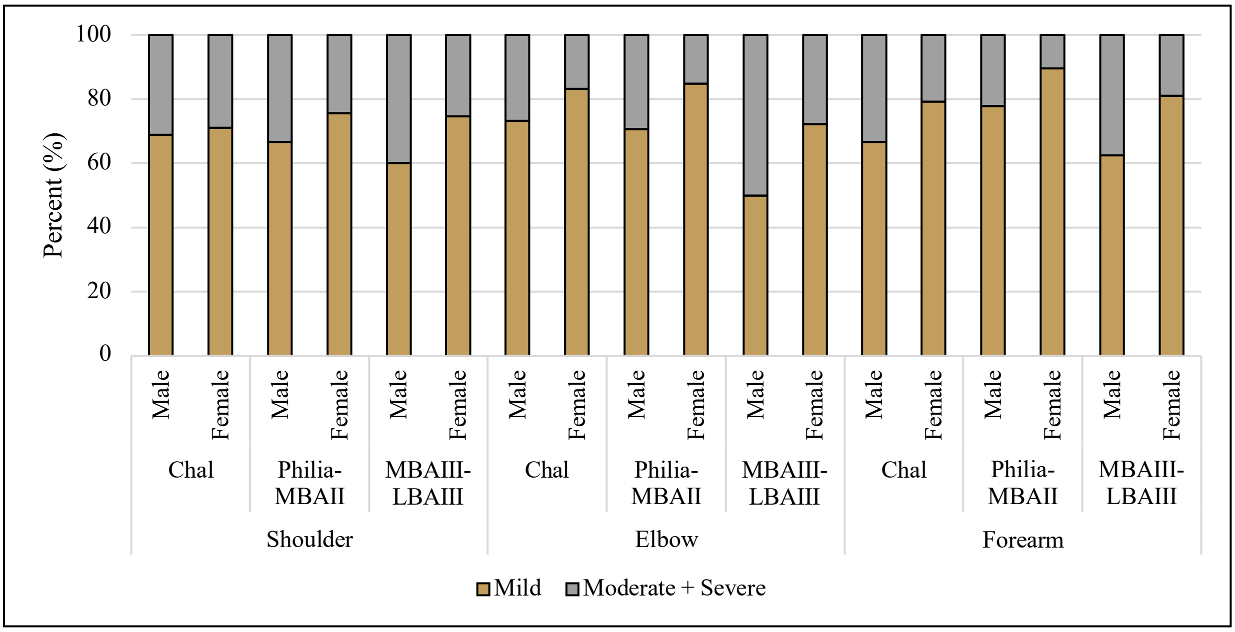


Figure 4.12. Frequency distribution of mild and moderate + severe robusticity ranks, by sex, across the periods (upper limb). N:599.

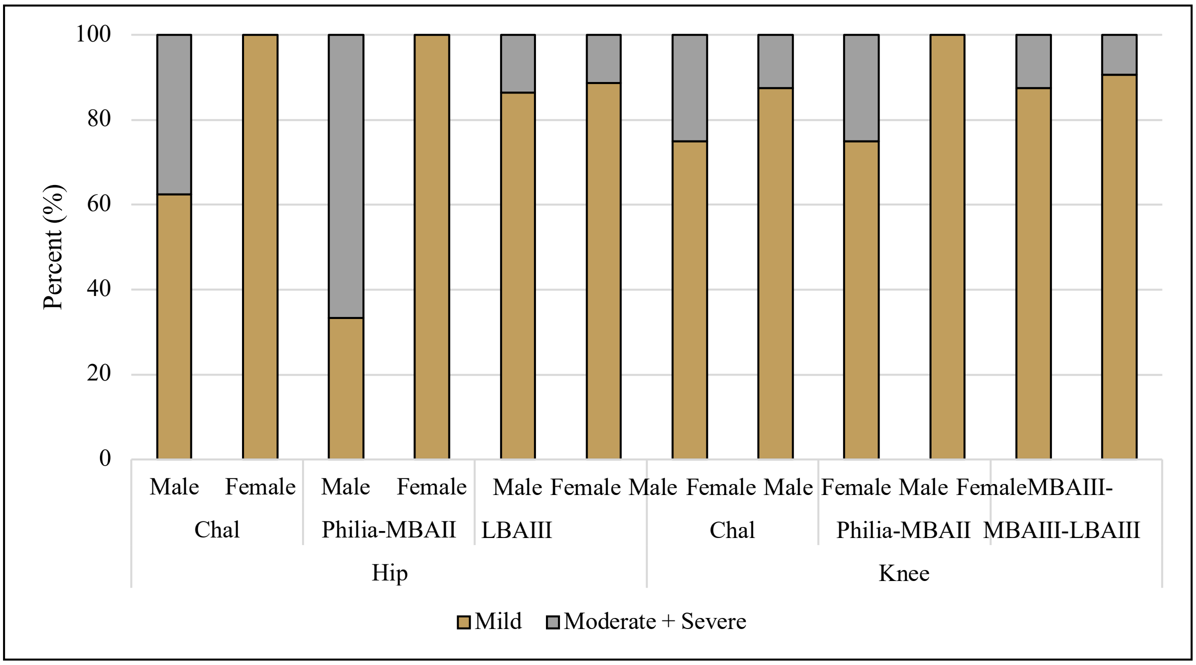


Figure 4.13. Frequency distribution of mild and moderate + severe robusticity ranks, by sex, across the periods (lower limb). N:196.

Concerning the relationship between the robusticity rank distribution and the age, the entheses belonging to the five functional complexes were pooled in two groups, upper limb and lower limb in order to avoid additional loss and dispersal of data, already caused by the large number of individuals whom age could not be determined (see figure 4.1).

Looking at the upper limb, as expected, the younger age categories were better represented than the older: these last (45+) comprised only 12 entheses, and thus, could not be compared. The number of the observed entheses for each age range was not equally distributed by period. For the younger individuals, for instance, the number of the Chal entheses (=80) was twice as the number of the Philia-MBAII entheses (=42); for the middle adults, the Philia-MBAII skeletons yielded four times the number of the MBAIII-LBAIII entheses. The mature adults were almost equally represented in the Chal and the MBAIII-LBAIII samples, but these two samples were less represented than the Philia-MBAII sample.

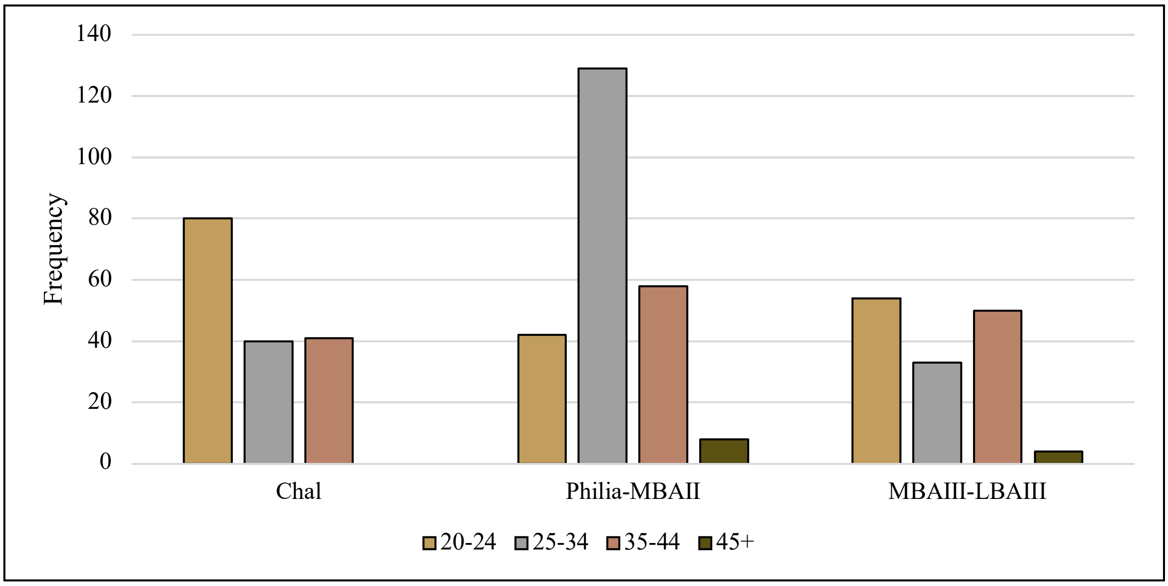


Figure 4.14. Frequency distribution of the entheses pertaining to the upper limb, by age category, across the periods. N:527

On the basis of the bar chart in figure 4.15, it can be inferred that, overall, the number of moderate + severe robusticity increased with age across the periods. The only deviations from this trend were represented by the categories 20-24 and 35-44 in the Chal period: according to the collected data, the young individuals from the Chal utilized the upper limbs in greater proportion compared with the populations of the subsequent periods. This finding, however, could be ascribed to the bias in representation between the considered categories.

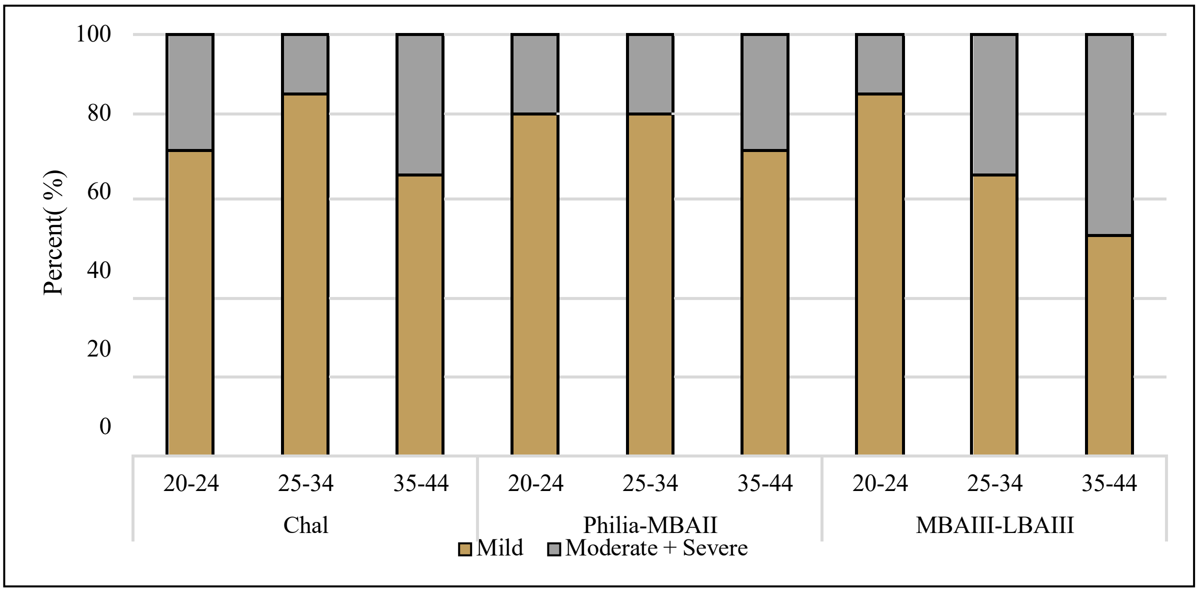


Figure 4.15. Frequency distribution of mild and moderate + severe robusticity ranks, by age category, across the periods (pooled upper limbs). N:527.

Considering the lower limbs, the distribution of the entheses by age category across the periods was not equal (Figure 4.16). As for the young adults, the ratio between the best and least represented sample (Philia-MBAII and MBAIII-LBAIII) was of the order of almost 3:1. The opposite trend was found for the middle adults: here, the entheses from the Philia-MBAII collection were twice the number of the entheses from the MBAIII-LBAIII sample. For the mature adults, the first and third sub-sample provided an almost equal number of entheses, while the second period was represented by only six entheses.

As in the previous case, it was noted, overall, an increase in the number of severe degrees from the younger to the older age ranges (Figure 4.17). It must be noted however that the middle adults displayed a lower proportion of affections compared with the other groups despite being overrepresented at least two periods of three. This figure cannot be deemed sufficient to support any difference in the activity patterns. The Kruskal Wallis test carried out on the upper and lower limbs separately revealed a significant difference between the three age categories in the upper limb of the LBA sample (p-value=0.002), no difference was found in the other samples (Chal p-value=0.149, Philia-MBAII p-value=0.294). Concerning the lower limbs, no difference was revealed (Chal p-value=0.102, Philia-MBAII p-value=0.375, MBAIII-LBAIII p-value=0.131).

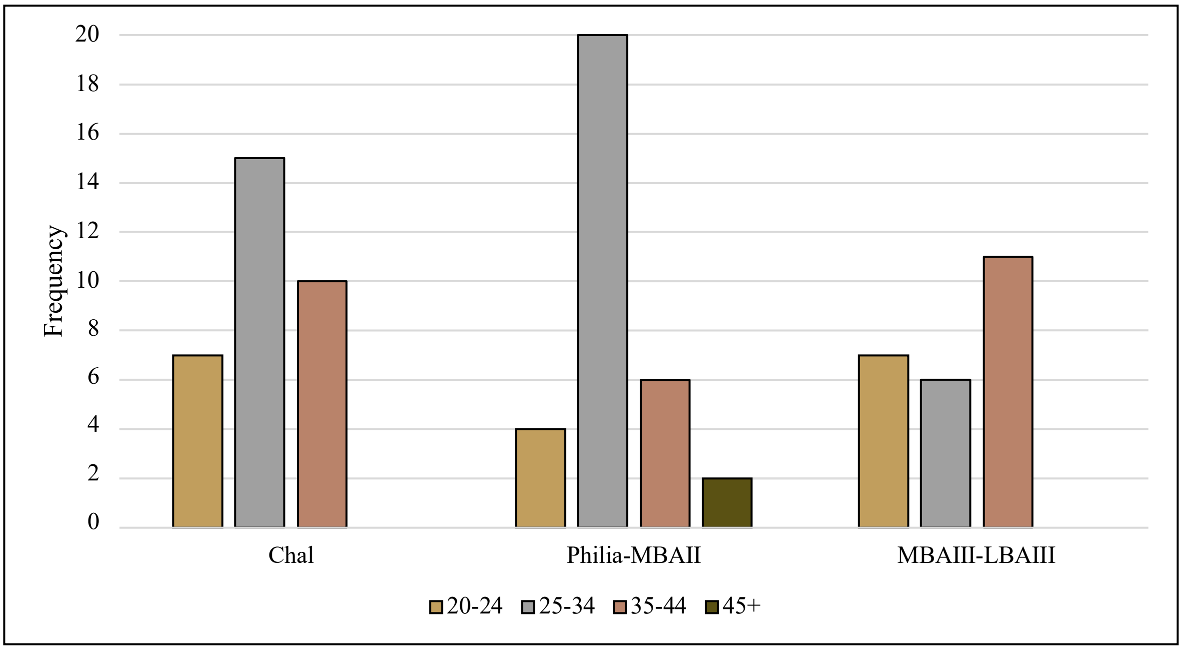


Figure 4.16. Frequency distribution of the entheses pertaining to the lower limb, by age category, across the periods. N:90.

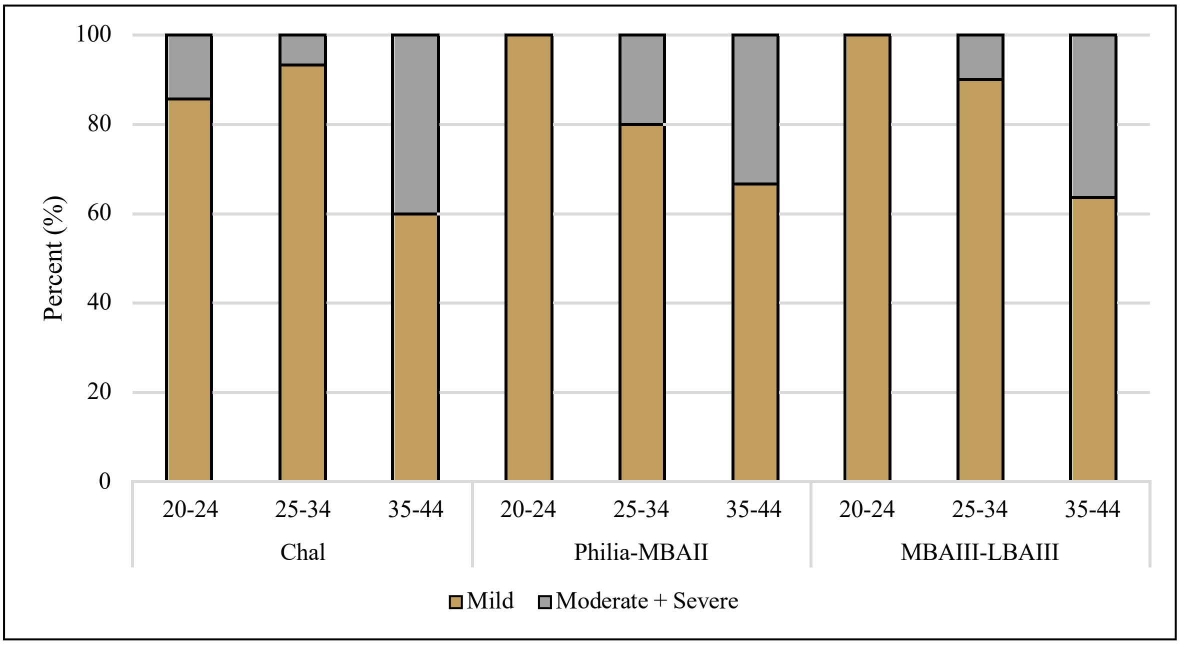


Figure 4.17. Frequency distribution of mild and moderate + severe robusticity ranks, by age category, across the periods (pooled lower limbs). N:90.

In sum, the evaluation of the robusticity ranks distribution in the five functional complexes showed a homogeneous development of the aforementioned complexes across the periods. Mild ranks prevailed over the moderate and severe expressions, however, there were some variations in the data that hints towards chronological differences, albeit ones that cannot be confirmed statistically as a result of small sample sizes. Considering the differences in terms of representation of each complex, the Chal populations utilized the muscles pertaining to the shoulder, forearm and knee more frequently than the other samples; the Philia-MBAII samples seem to have utilized the hip muscles more frequently compared with the other groups, while the MBAIII-LBAIII utilized the elbow more frequently than the other samples. The evaluation of bilateral asymmetry across the chronological periods showed that the right side was overall more utilized than the left side, with some exceptions such as the entheses included in the hip of the Chal sample. Concerning the differences in the use of the five functional complexes, the males displayed higher ranks in all the comparable cases, despite being under-represented compared with the counterpart. The evaluation of the robusticity ranks distribution by age category allowed us to identify a common trend across the periods: the older individuals had a greater muscle development than the younger people.

4.1.4 Osteolytic lesions and enthesophytic formations: prevalence and severity distribution of the two markers rank by enthesis and functional complex across the periods

As emerged by the intra-population analysis, the OLs affected a very small percentage of entheses. Table 4.2 clearly shows that the presence of this marker did not exceed 13.0% in each chronological period.

Table 4.2. Prevalence rate of OLs across the periods. N: number of entheses affected; %: percentage of affections within the period.

	Presence		Absence	
	N	%	N	%
Chal	26	12.3	185	87.7
Phila-MBAII	23	7.3	294	92.7
MBAIII-LBAIII	21	7.4	261	92.6
Total	70	8.6	740	91.4

Furthermore, a correlation between this marker and the type of enthesis was demonstrated. Indeed, some of these entheses such as the *conoid ligament,* the *brachialis,* the *supinator,* the *gluteus maximus,* and the *iliopsoas* were affected in all three periods regardless of their rate of representation (Table 4.3). Conversely, entheses represented in high proportion in all the periods did not display any evidence of lesion (e.g., *brachioradialis, deltoideus* (humerus)). Overall, in the Chal sample, the *quadriceps tendon* (tibia) (2/4, 50.0%) and the *biceps brachii* (6/16, 37.5%) were the most affected. In the Philia-MBAII materials, the *costoclavicular ligament* (5/9, 55.6%) and the *iliopsoas* (2/8, 25.0%) were the most affected. Finally, in the pooled MBAIII-LBAIII collections, the *quadriceps tendon* (patella) (1/3, 33.3%) was the most affected.

Table 4.3. Frequency distribution of the OLs, by muscle, across the periods. n: number of affections; N: number of entheses observed; %: percentage of entheses affected. The entheses written in bold were the only ones affected in all three periods regardless of their rate of representation.

	Chal		Philia-MBAII		MBAIII-LBAIII	
	n/N	%	n/N	%	n/N	%
Costoclavicular ligament (clavicle)	1/10	10.0	5/9	55.6	0/10	0
Conoid ligament (clavicle)	**5/17**	**29.4**	**1/16**	**6.3**	**1/9**	**11.1**
Trapezoid ligament (clavicle)	2/18	11.1	1/14	7.1	1/4	25.0
M deltoideus (clavicle)	1/20	5.0	2/20	10.0	0/11	0.0
M pectoralis major (clavicle)	1/11	9.1	0/10	0.0	0/10	0.0
M teres major (humerus)	0/7	0.0	0/11	0.0	0/12	0.0
M pectoralis major (humerus)	0/7	0.0	0/14	0.0	0/11	0.0
M deltoideus (humerus)	0/12	0.0	0/22	0.0	0/11	8.3
M triceps brachii (scapula)	0/2	0.0	0/2	0.0	0/2	0.0

M brachioradialis (humerus)	3/13	23.1	2/28	7.1	1/12	8.3
M biceps brachii (radius)	6/16	37,5	1/20	5.0	2/10	20.0
M triceps brachii (ulna)	0/3	0.0	0/21	0.0	0/10	0.0
M brachialis (ulna)	**1/9**	**11.1**	**3/28**	**10.7**	**1/14**	**7.1**
M pronator teres (radius)	0/12	0.0	0/14	0.0	0/11	0.0
Interosseous membrane (radius)	0/14	0.0	1/22	4.5	0/7	0
M supinator (ulna)	**1/8**	**12.5**	**3/21**	**14.3**	**1/13**	**7.7**
M gluteus maximus (femur)	**1/10**	**10.0**	**1/15**	**6.7**	**6/41**	**14.6**
M Iliopsoas (femur)	**2/6**	**33.3**	**2/8**	**25.0**	**7/35**	**20.0**
M vastus medialis (femur)	0/9	0.0	1/14	7.1	0/42	0.0
M quadriceps tendon (patella)	0/3	0.0	0/5	0.0	1/3	33.3
Quadriceps Tendon (tibia)	2/4	50.0	0/3	0.0	0/4	0.0

Considering the OLs distribution by functional complex, of the 26 entheses affected from the Chal sample, the highest proportion (13/26, 50.0%) were observed on the elbow and hip. The highest percentage of OLs from Philia-MBAII was scored on the hip (3/22, 13.6%), while in the LBA sample, the highest percentage was observed on the hip (13/76, 17.1%) (Figure 4.18).

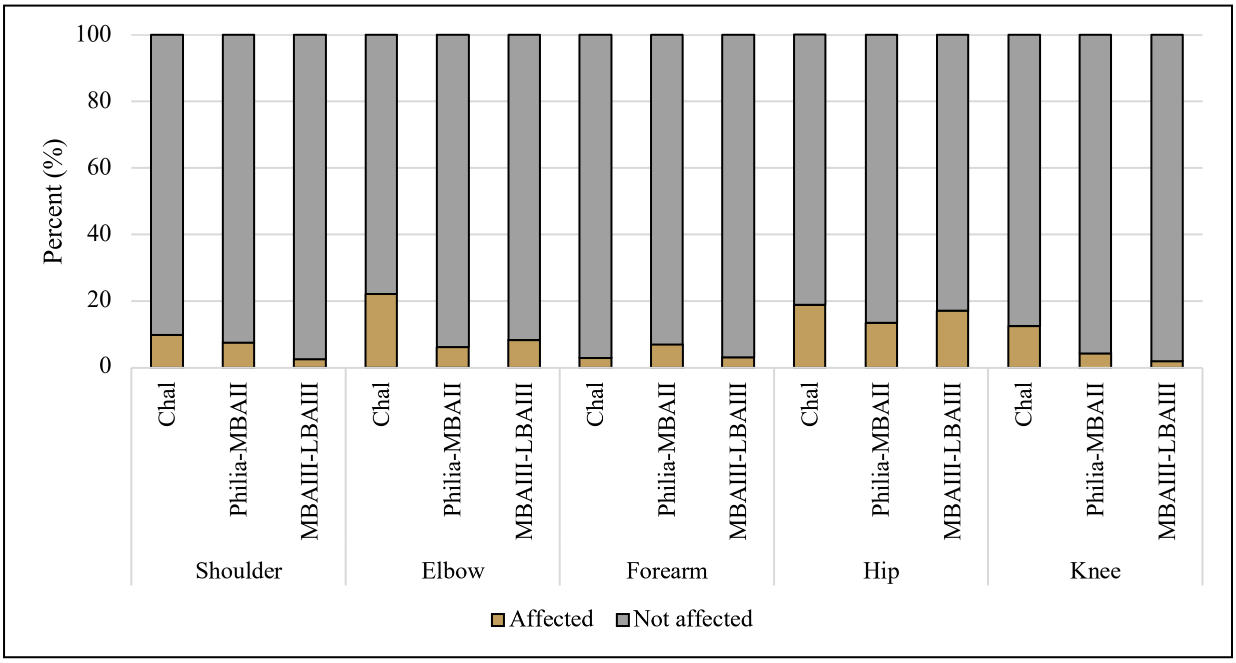


Figure 4.18. Frequency distribution of OLs, by the functional complex, across the periods. N:810.

For which concerns the EFs, they affected a higher number of entheses (376/810, 46.4%) compared with the OLs (Table 4.4).

Table 4.4. Prevalence rate of the EFs across the periods. N: number of entheses affected; %: percentage of affections within the period.

	Presence		Absence	
	N	%	N	%
Chal	50	23.7	161	76.3
Phila-MBAII	162	51.1	155	48.2
MBAIII-LBAIII	164	58.2	118	41.8
Total	376	46.4	434	53.6

As opposite to the OLs, the EFs did not affect a certain type of enthesis, but they were observed on all the 21 entheses under study. The *costoclavicular* and the *iliopsoas* were the most affected in the Chal sample; the *conoid* and the *iliopsoas* were the most affected in the Philia-MBAII sample, while the *conoid* and the *brachioradialis* were the most affected in the MBAIII-LBAIII.

Table 4.5. Frequency distribution of the EFs by enthesis across the periods. n: number of affections; N: number of entheses observed; %: percentage of entheses affected.

	Chal		Philia-MBAII		MBAIII-LBAIII	
	n/N	%	n/N	%	n/N	%
Costoclavicular ligament (clavicle)	6/16	37.5	7/9	43.8	6/10	60.0
Conoid ligament (clavicle)	6/17	35.3	7/16	77.8	9/9	100.0
Trapezoid ligament (clavicle)	6/18	33.3	8/14	57.1	3/4	75.0
M deltoideus (clavicle)	3/20	15.0	11/20	55.0	7/11	63.6
M pectoralis major (clavicle)	0/11	0.0	1/10	10.0	5/10	50.0
M teres major (humerus)	0/7	0.0	3/11	27.3	9/12	75.0
M pectoralis major (humerus)	1/7	14.3	9/14	64.3	11/11	100.0
M deltoideus (humerus)	1/12	8.3	10/22	45.5	7/11	63.6
M triceps brachii (scapula)	0/2	0.0	1/2	50.0	0/2	0.0
M brachioradialis (humerus)	3/13	23.1	15/28	53.6	11/12	91.7
M biceps brachii (radius)	8/16	50.0	10/20	50.0	7/10	70.0
M triceps brachii (ulna)	1/3	33.3	9/21	42.9	6/10	60.0
M brachialis (ulna)	2/9	22.2	18/28	64.3	12/14	85.7
M pronator teres (radius)	4/12	33.3	6/14	42.9	2/11	18.2
Interosseous membrane (radius)	1/14	7.1	9/22	40.9	2/7	28.6
M supinator (ulna)	1/8	12.5	11/21	52.4	6/13	46.2

M gluteus maximus (femur)	3/10	30.0	10/15	66.7	24/41	58.5
M Iliopsoas (femur)	3/6	50.0	7/8	87.5	14/35	40.0
M vastus medialis (femur)	0/9	0.0	7/14	50.0	19/42	45.2
M quadriceps tendon (patella)	1/4	25.0	1/5	20.0	2/3	66.7
Quadriceps Tendon (tibia)	0/3	0.0	2/3	66.7	2/4	50.0

Considering the EFs distribution by functional complex, it can be noted that in the first two periods, a large proportion of observed EFs were concentrated on the hip (6/10, 37.5% in the Chal and 16/22, 72.7% in the Philia-MBAII). In the third period, the shoulder (57/78, 73.1%) and the elbow (36/48, 75.0%) were the most affected (Figure 4.17).

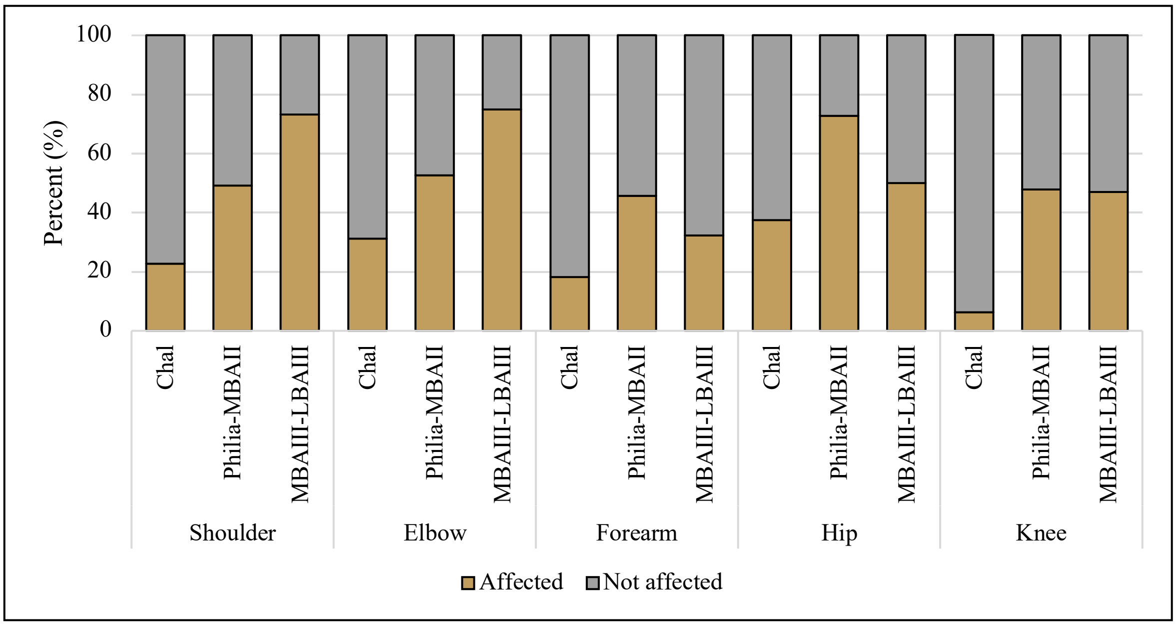


Figure 4.19. Frequency distribution of EFs, by functional complex, across the periods. N:810.

4.1.5 Osteolytic lesions and enthesophytic formations: prevalence and severity distribution of the two markers by side, sex, and age across the three periods

Considering the consistent bias between the five functional complexes and the very low number of manifestations in the case of the OLs, to create a foundation for the statistical analysis, the entheses were pooled in the upper and lower limbs. Looking at the upper limbs, a very slight bilateral asymmetry towards the right side was noted in all the pooled samples (Figure 4.20).

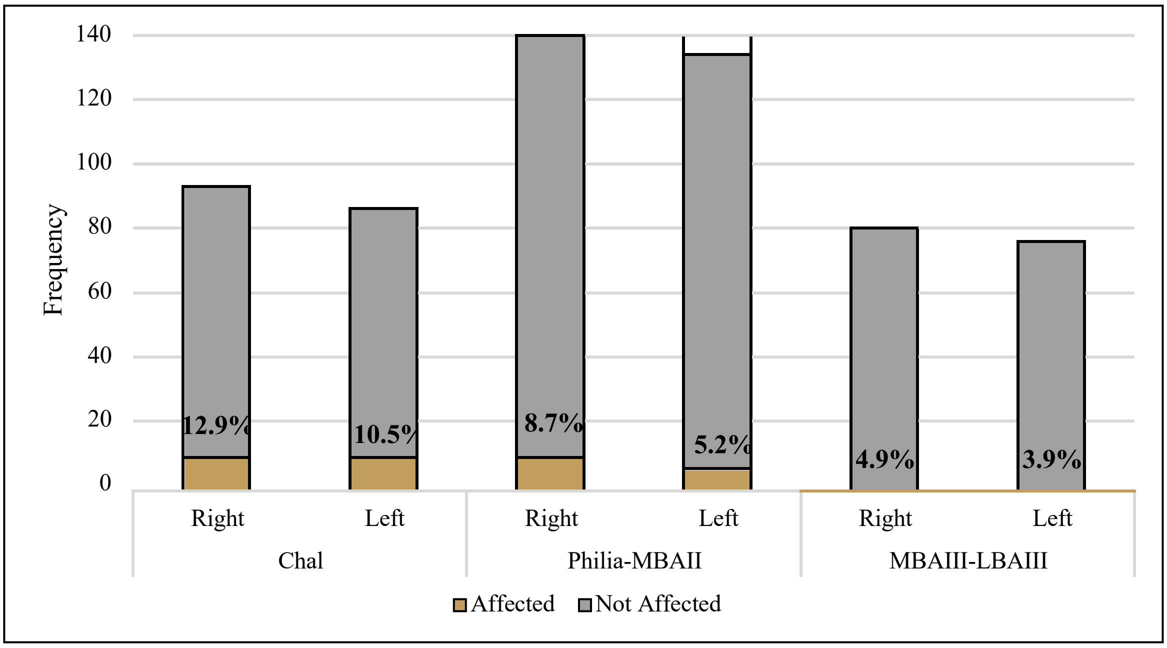


Figure 4.20. Frequency distribution of OLs, by side, across the periods (upper limb). N:608.

Thus, concerning the OLs ranks distribution, the large majority of the affections (34/47, 72.3%) was in mild forms. In the Chal sample, the number of moderate + severe degrees was almost equal between the sides; in the second and third sample, the left side (5/7, 71.4% and 2/3, 66.7% respectively) was most severely affected than the right compared (2/12, 16.7% and 0/4, 0.0%, respectively) (Figure 4.21). However, it must be specified that in both these last cases, the right side was underrepresented, thus, this bias in representation could be the reason for this pattern of distribution. The Mann-Whitney *U*-test did not reveal any significant difference in the distribution of mild, moderate, and severe ranks between the sides in the Chal sample (p-value=0.754) and the MBAIII-LBAIII sample (p-value=0.078), but it showed a significant difference in the Philia-MBAII sample (p-value=0.020).

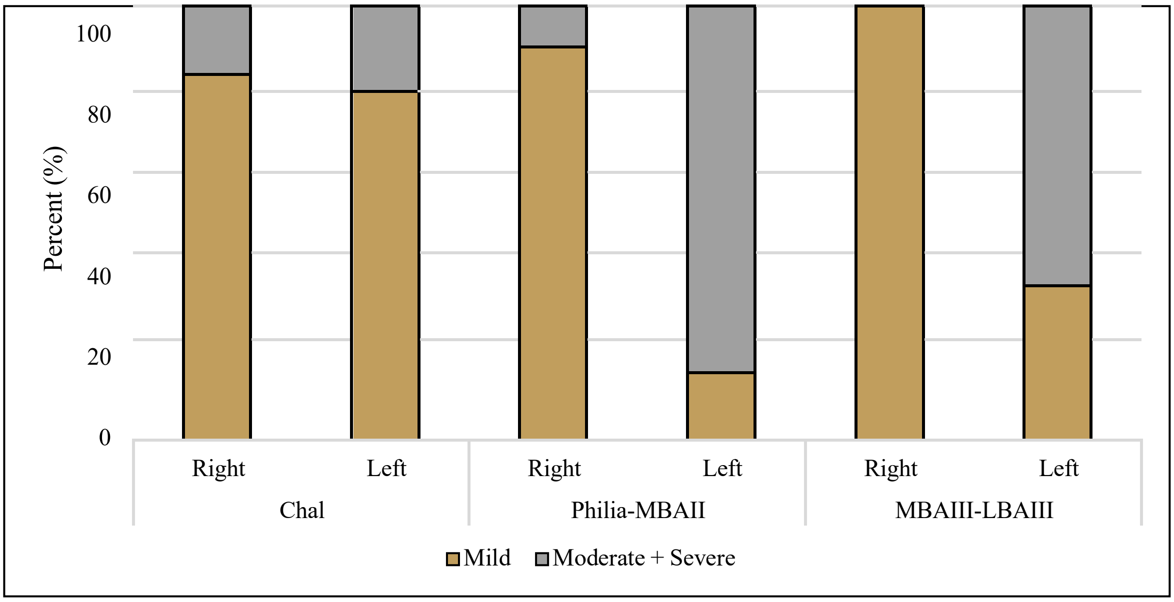


Figure 4.21. Frequency distribution of the mild and the moderate + severe OLs, by side, across the periods (upper limb). N:47.

As for the lower limbs, the bilateral asymmetry was, overall, slight and in favour of the left side (Figure 4.20). In the Philia-MBAII sample, this difference was more consistent (3/21, 14.3% on the left side compared with only 1/24, 4.2% of the right entheses).

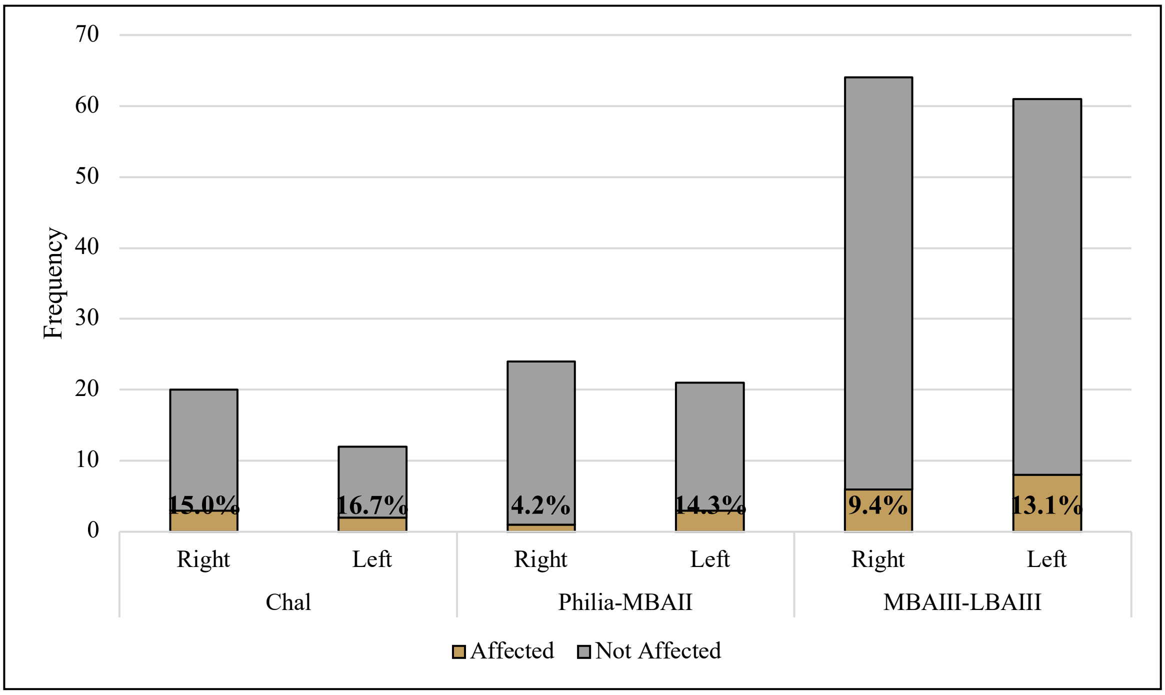


Figure 4.22. Frequency distribution of the OLs, by side, across the periods (lower limb). N:202.

For which concerns the severity distribution of the lesions on the lower limb, in Chal sample the right side provided the only moderate evidence recorded; in the Philia-MBAII all the entheses affected from both the sides were in mild forms. Finally, from the MBAIII-LBAIII, it was observed a higher proportion of moderate lesions on the left side (3/8, 37.5%) compared with the right side (2/6, 33.3). The Mann-Whitney *U*-test, however, did not reveal any significant difference between the sides in all the periods considered (Chal p-value=0.414, Philia-MBAII p-value=1.000, MBAIII-LBAIII p-value=0.939).

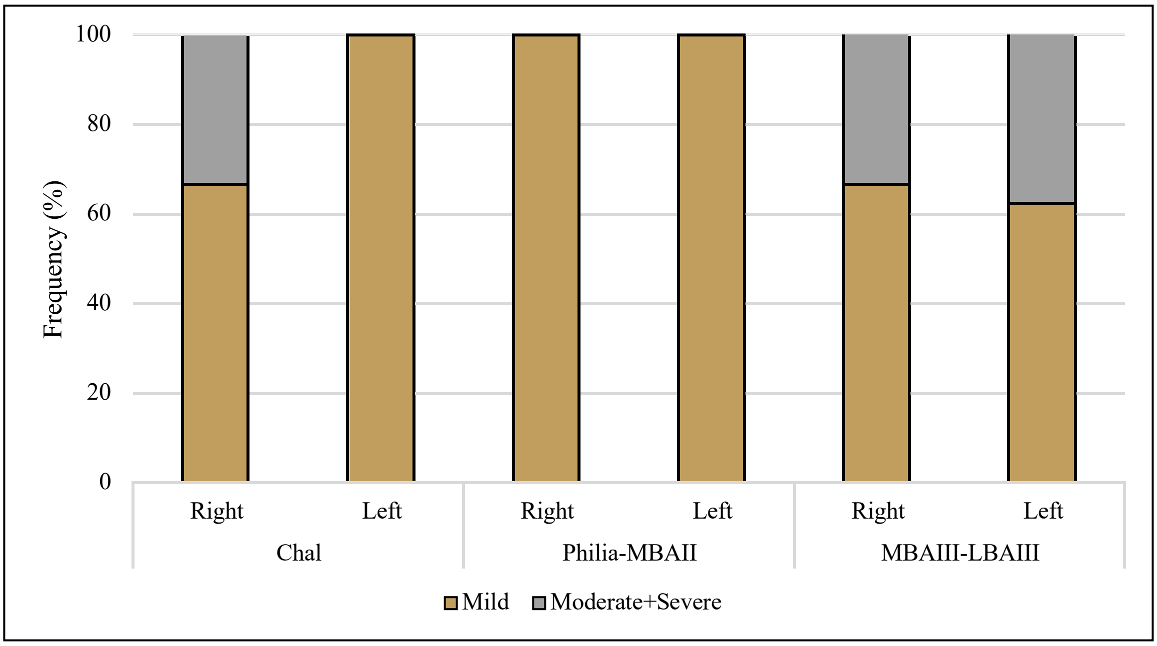


Figure 4.23. Frequency distribution of the mild and moderate + severe OLs, by side, across the periods (lower limb). N:23.

Focusing on the distribution of the EFs by side, in the first two periods, the right side was more affected (30/93, 32.3% in the Chal and 69/138, 51.1% in the Philia-MBAII) compared with the left (13/86, 15.1% for the Chal and 66/134, 49.3% for the Philia-MBAII). As for the MBAIII-LBAIII, the percentage of EFs recorded on the left entheses (54/76, 71.1%) slightly exceeded the number of formations observed on the right side (49/76, 60.5%).

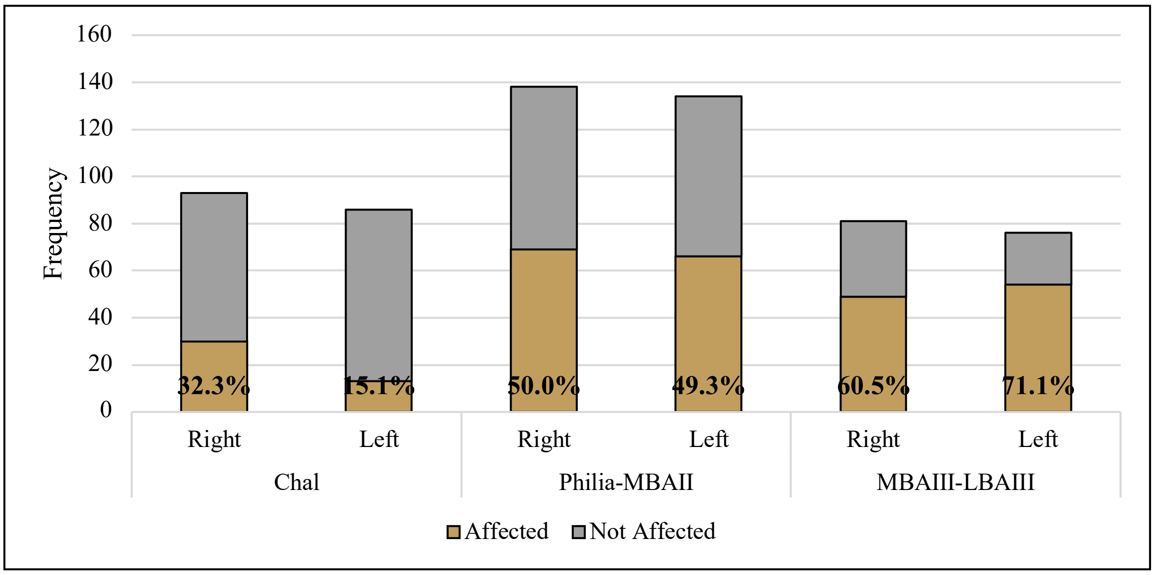


Figure 4.24. Frequency distribution of EFs, by side, across the periods (upper limb). N:608.

For which concerns the EFs ranks distribution by side, figure 4.25 shows that in the first two periods, there was no bilateral asymmetry in the distribution of the most severe forms; in the third period, the right side displayed the higher proportion of moderate degrees (27/49, 55.1%). No significant difference between the sides was revealed by the Mann-Whitney *U*-test in the Chal (p-value=0.960), the Philia-MBAII (p-value=0.680), and the MBAIII-LBAIII sample (p-value=0.434).

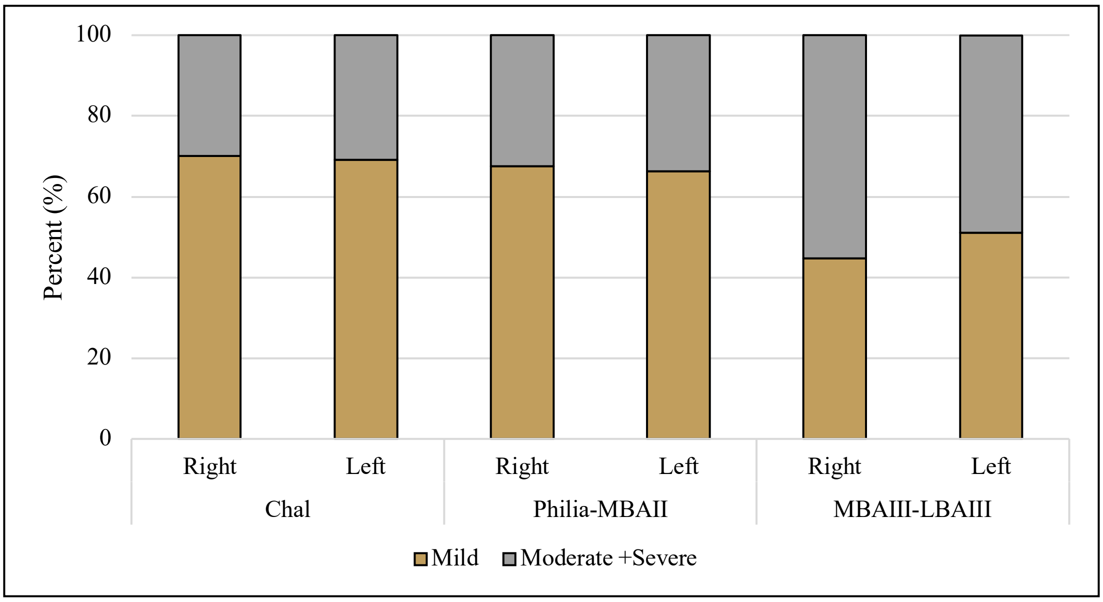


Figure 4.25. Frequency distribution of the mild and moderate + severe EFs, by side, across the periods (upper limb). N:281.

Considering the distribution of EFs on the lower limbs, in the first two periods, the greater proportions of affections were observed on the left side (3/12, 42.9% in the Chal and 14/21, 66.7% in the Philia-MBAII). Conversely, in the MBAIII-LBAIII sample, the right side was the most affected (35/64, 54.7%) (Figure 4.26).

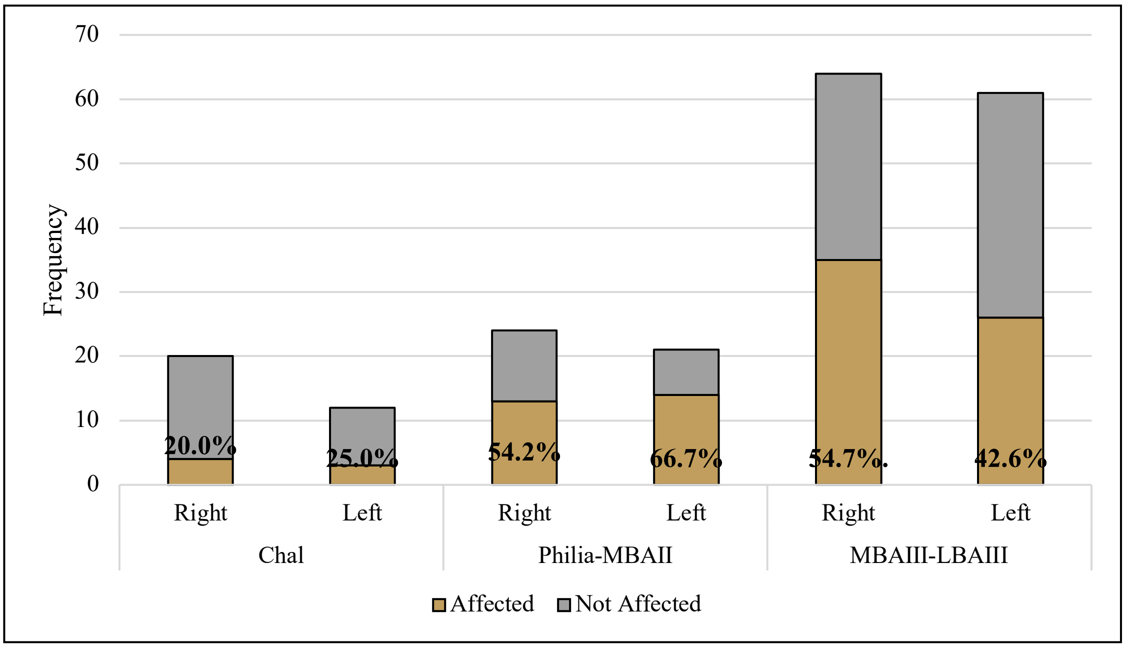


Figure 4.26. Frequency distribution of EFs, by side. across the periods (lower limb). N:202.

Focusing on the only affected entheses, it was observed a very slight asymmetry in the distribution of the moderate + severe EFs in the Philia-MBAII and MBAIII-LBAIII collections: towards the right side, in the first case; towards the left side, in the second. In the Chal remains the right lower limb entheses were only in mild forms and the left entheses displayed 33.3% (1/3) of moderate bone formations. No significant difference was revealed by the Mann-Whitney *U*-test in each sample (Chal p-value=0.248, Philia-MBAII p-value=0.920 and the MBAIII-LBAIII p-value=0.921).

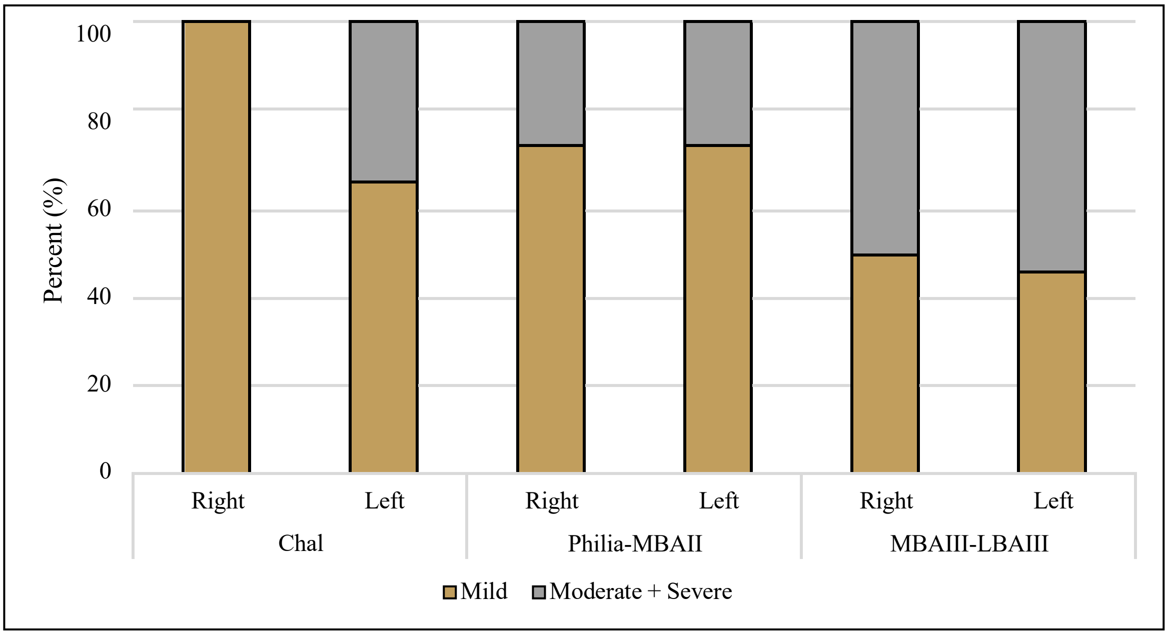


Figure 4.27. Frequency distribution of the mild and moderate + severe EFs, by side, across the periods (lower limb). N:95.

As in the previous case, since the low number of OLs and EFs, the prevalence of the female individuals in the whole sample, and so, to avoid additional dispersal of data, the evaluation of the distribution of the two markers by sex was carried out by combining the entheses in upper and lower limbs.

Looking at the upper limbs, figure 4.28 shows that in the Chal and MBAIII-LBAIII samples, the males displayed a slightly higher percentage of OLs (11/56, 19.6% and 3/35, 8.6%, respectively) compared with the females (10/123, 8.1% and 4/120, 3.3%, respectively). This finding is particularly significant since the consistent underrepresentation of the male entheses. As for the Philia-MBAII, the female entheses displayed the highest proportion of lesions (13/173, 7.5%) compared with the males (4/92, 4.3%).

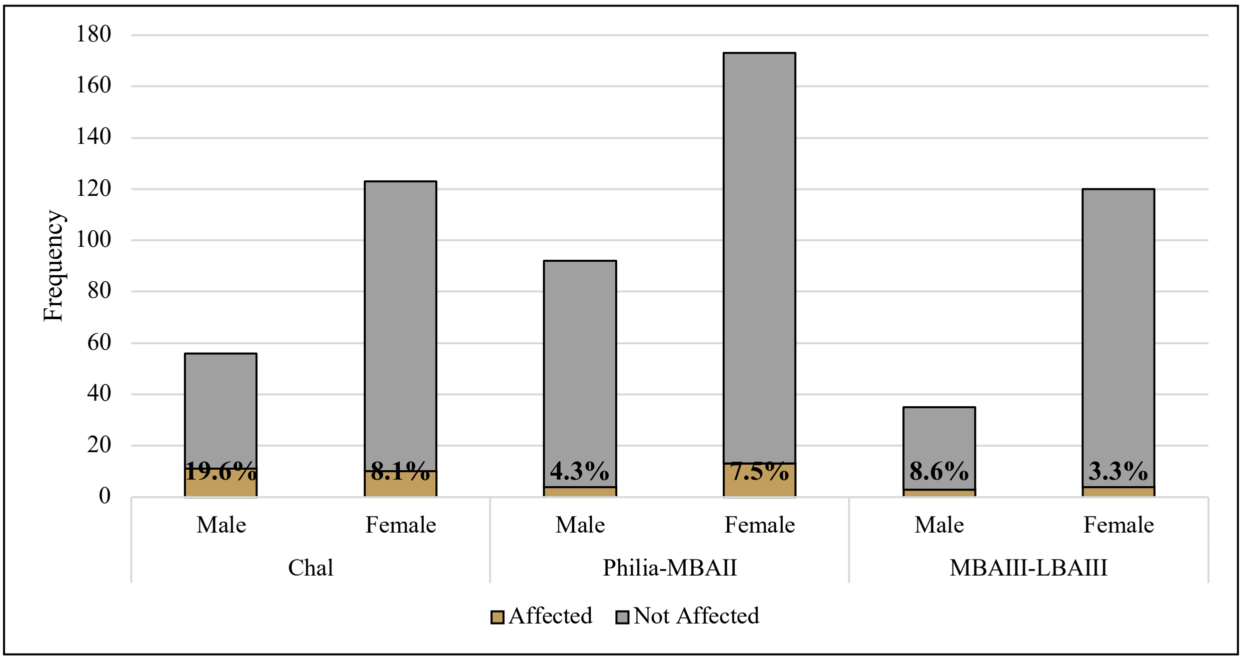


Figure 4.28. Frequency distribution of OLs, by sex, across the periods (upper limb). N:599.

Looking at the OLs severity distribution, in the Chal sample, the males which were the most affected, yielded the highest proportion of moderate lesions (3/11, 27.3%) compared with the counterpart (1/10, 10.0%); in the Philia-MBAII sample, the proportion of moderate lesions recorded on the female entheses (6/13, 46.2%) exceeded the moderate affections found on the males (1/4, 25.0%); finally, in the MBAIII-LBAIII sample, moderate and severe lesions (2/4, 50.0%) were exclusively detected on the females (Figure 4.29). The Mann-Whitney *U*-test did not reveal any significant difference in the distribution of the mild, moderate, and severe forms between the sexes (Chal p-value=0.326, Philia-MBAII p-value=0.466, MBAIII-LBAIII p-value=0.186).

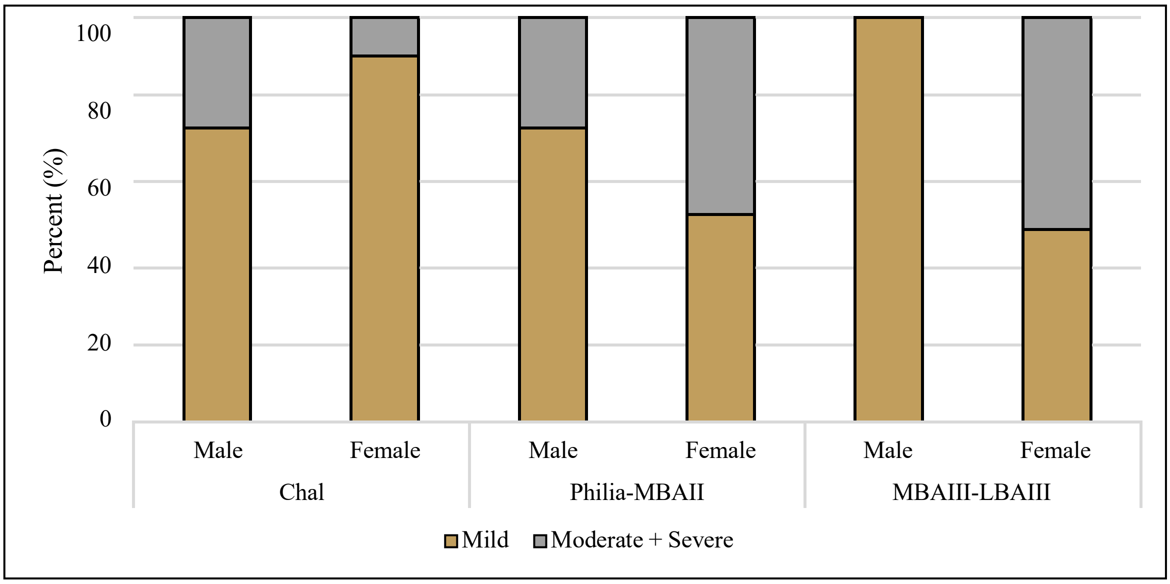


Figure 4.29. Frequency distribution of the mild and moderate + severe OLs, by sex, across the periods (upper limb). N:45.

Looking at the lower limb entheses, in all the examined samples the male entheses were found to be more affected than the female entheses which prevailed in number over the male entheses in at least two samples, Philia-MBAII and MBAIII-LBAIII (Figure 4.30).

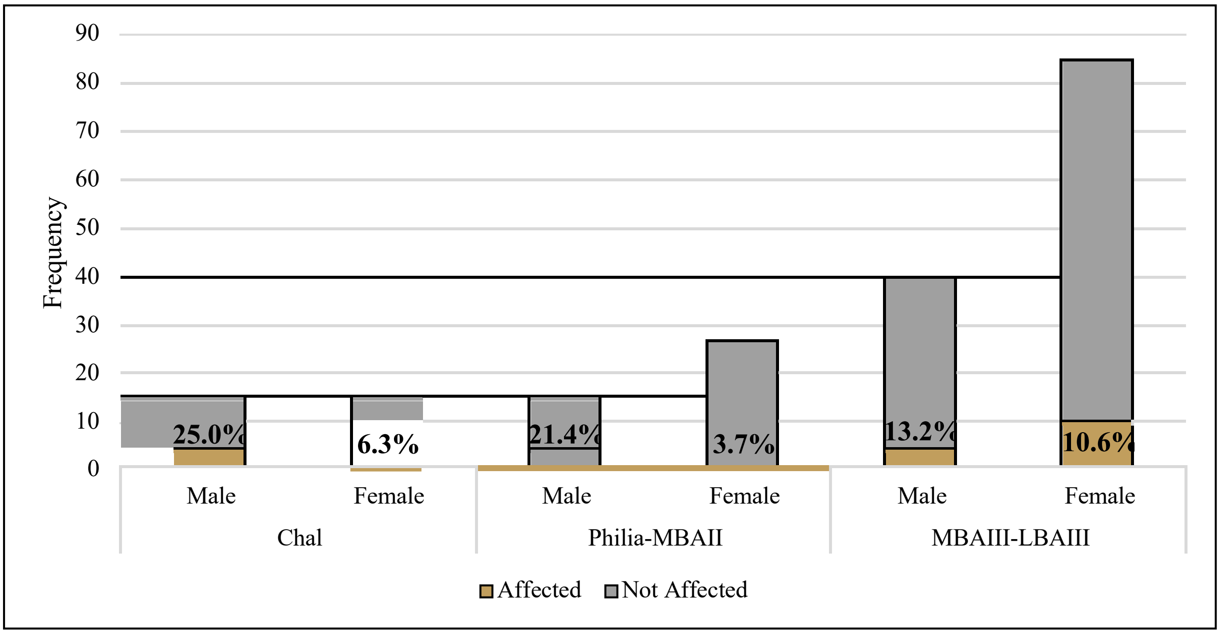


Figure 4.30. Frequency distribution of OLs, by sex, across the periods (lower limb). N:196.

Figure 4.31 shows the severity distribution of the OLs by sex across the periods. In the Chal sample, the only cases of moderate OLs were found on the males (¼, 25.0%), in the Philia-

MBAII, only mild degrees were assigned to the identified lesions, finally, in the LBA sample, the highest proportion of moderate lesions was found on the males (2/5, 40.0%). No significant differences between the sexes in the three samples were revealed by the Mann-Whitney *U*-test (Chal p-value=0.617, Philia-MBAII p-value=1.000, MBAIII-LBAIII p-value=0.937).

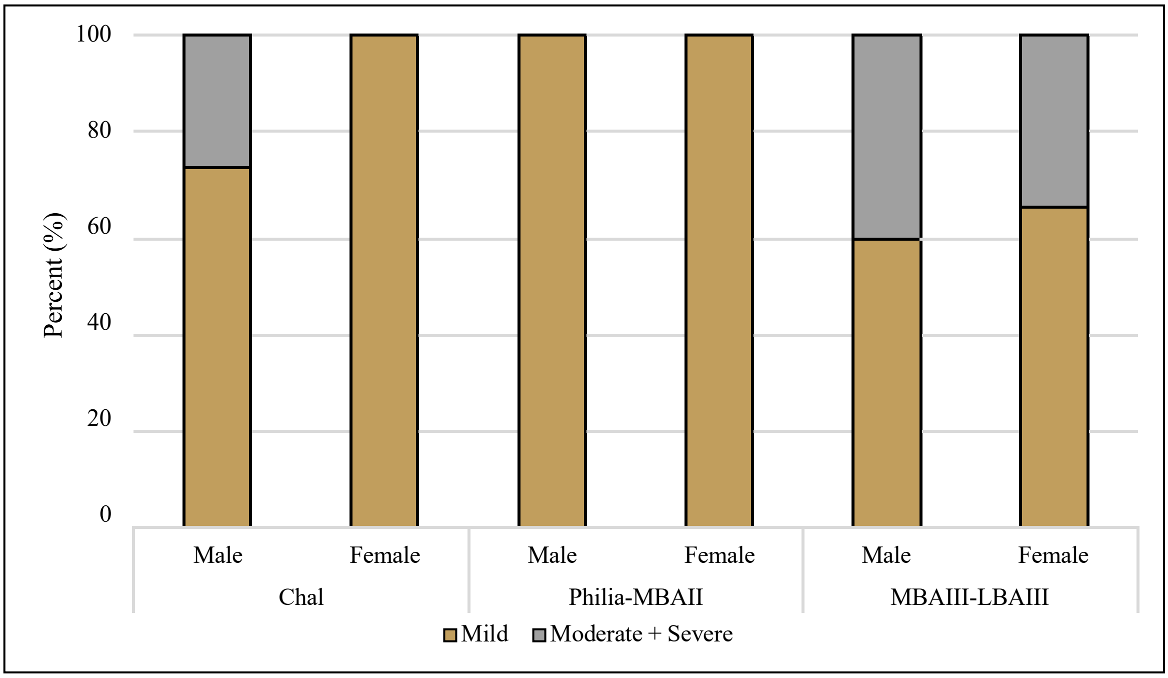


Figure 4.31. Frequency distribution of the mild and moderate + severe OLs, by sex, across the periods (lower limb). N:23.

For which concern the EFs, the bar chart in figure 4.32 shows that in the Chal sample, the females exhibited a greater proportion of EFs (32/123, 26.0%) compared with the males (11/56, 19.6%). As for the subsequent periods, the males displayed the greatest number of EF (56/92, 60.9% and 26/35, 74.3% respectively) compared with their counterpart (74/173, 42.8% and 77/120, 64.2% respectively).

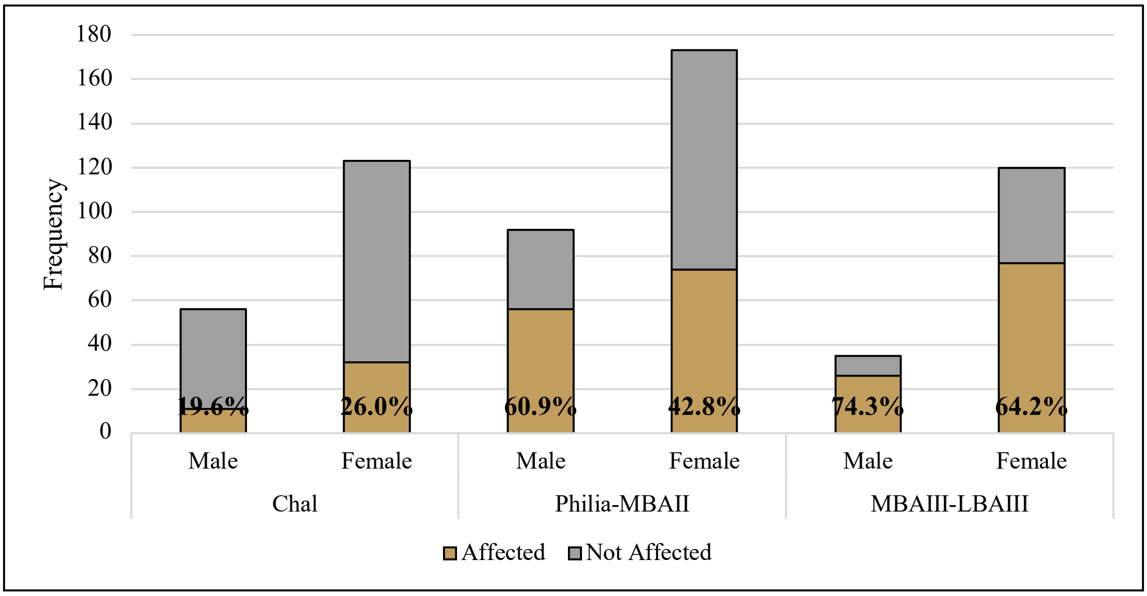


Figure 4.32. Frequency distribution of EFs, by sex, across the periods (upper limb). N:599.

Considering the severity distribution of this feature by sex, very slight differences were found in the Philia-MBAII and MBAIII-LBAIII materials. In the Chal sample, instead, the males provided the highest number of moderate forms (5/11, 45.5%) compared with the females (8/32, 25.0%) (Figure 4.31). No significant difference between the sexes was revealed by Mann-Whitney *U*-test (Chal p-value=0.208, Philia-MBAII p-value=0.596, MBAIII-LBAIII p-value=0.910).

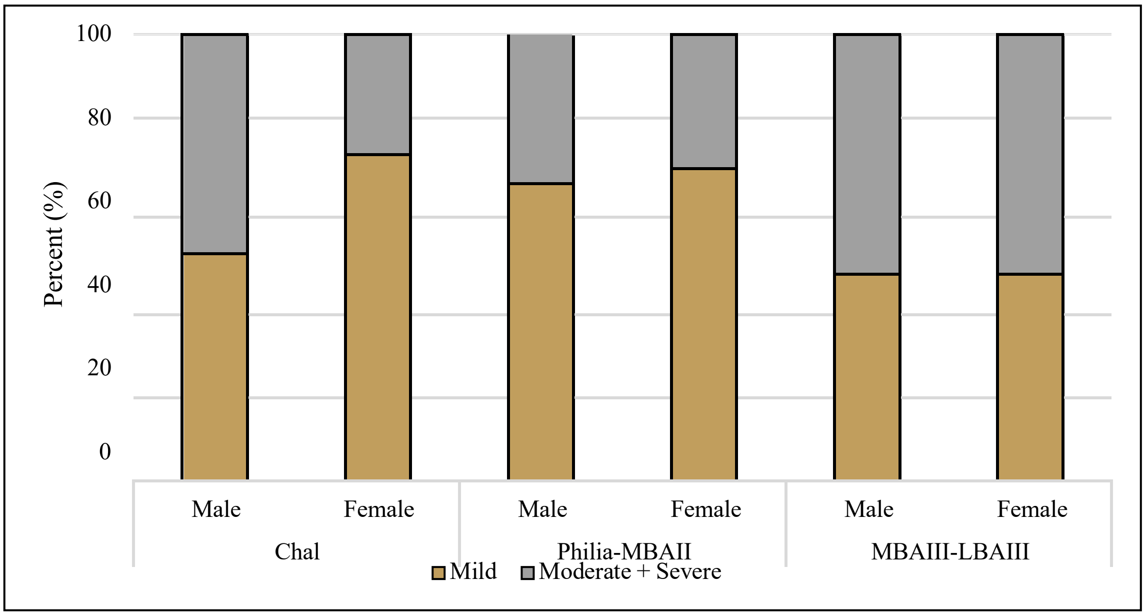


Figure 4.33. Frequency distribution of the mild and moderate + severe EFs, by sex, across the periods (upper limb). N:276.

Moving to the lower limbs, the bar chart in figure 4.34 shows that the percentage of EFs in all three periods were higher in the males (4/16, 25.0% in Chal, 10/14, 71.4% in Philia-MBAII and 23/38, 60.5% in LBA) compared with the counterpart.

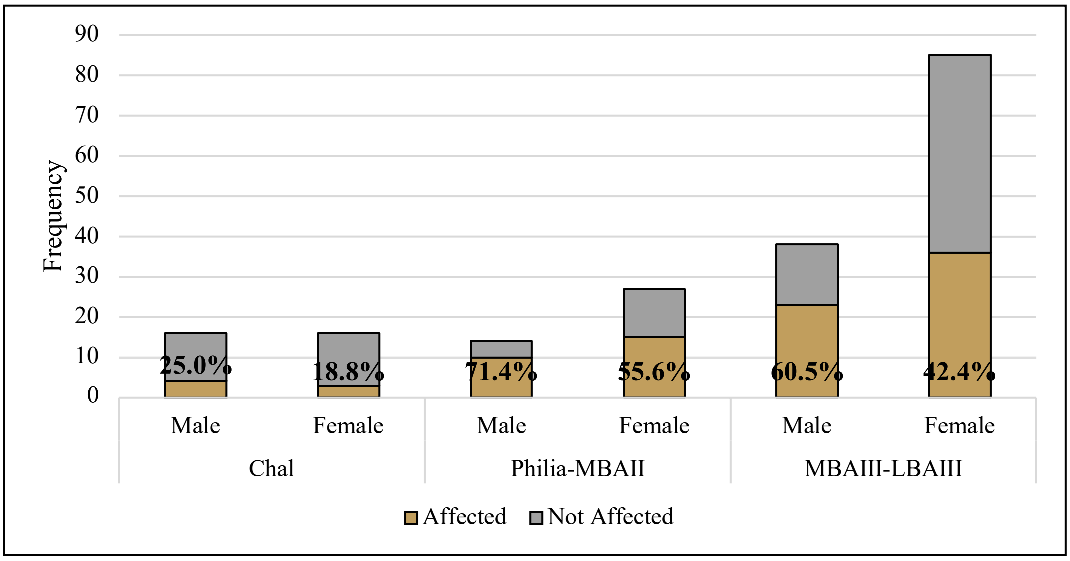


Figure 4.34. Frequency distribution of EFs, by sex, across the periods (lower limb). N:196.

Thus, focusing on the entheses affected, in all the three periods, the males displayed higher proportions of moderate degrees compared with the females. Mann-Whitney *U*-test revealed a significant difference in the Philia-MBAII sample (p-vale=0.015), no significant difference in the other two samples (Chal p-value=0.386, MBAIII-LBAIII p-value=0.833).

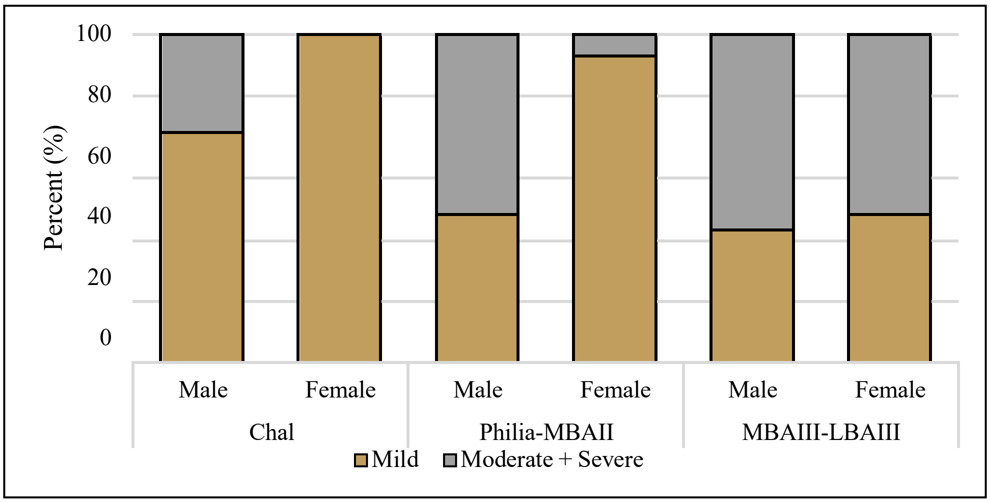


Figure 4.35. Frequency distribution of the mild and moderate + severe EFs, by sex, across the periods

(lower limb). N:91.

In order to investigate the prevalence and the severity distribution of the two markers, by age category, across the periods, all the entheses from individuals of determined age (=118) were combined in upper and lower limbs. Since the absence of old individuals (45+) in the Chal as well as in the MBAIII-LBAIII, this category was excluded by comparisons. Figure 4.36 shows the distribution of the OLs, by age category, on the upper limb. As expected, the younger adults were the least affected in each period. In the cases of the Chal and MBAIII-LBAIII, the mature adults, despite being underrepresented, provided a greater proportion of affections compared with the middle adults.

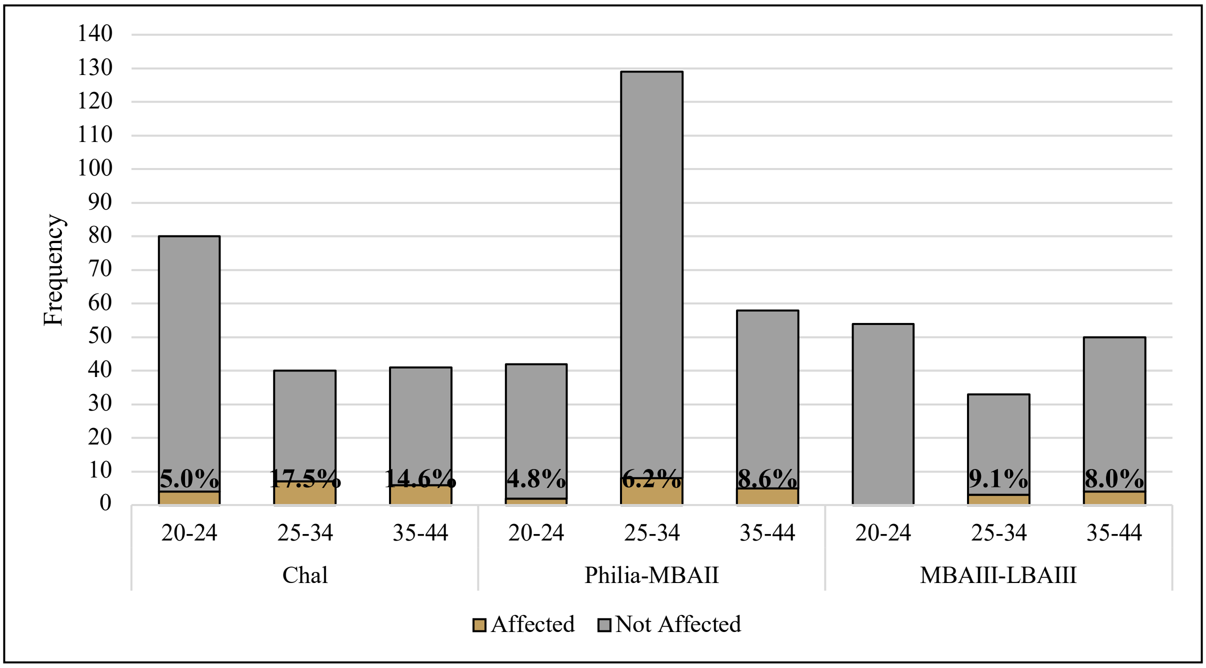


Figure 4.36. Frequency distribution of OLs, by age category, across the periods (upper limb). N:527.

For which concerns the OLs ranks distribution by age category, in the Chal sample the number of moderate degrees increased from the young to the mature adults. In the Philia-MBAII, the young adult category provided only two affections, both ranked as moderate, the middle adult provided a higher rate of moderate degree (2/8, 25.0%) compared with the mature adults (1/5, 20.0%). As for the third period, the only moderate and severe degrees (2/3, 66.7%) were in the middle adult category. The Mann-Whitney *U*-test revealed no significant difference in the distribution of the OLs ranks between the age categories (Chal p-value=0.460, Philia-MBAII p-value=0.114, MBAIII-LBAIII p-value=0.078).

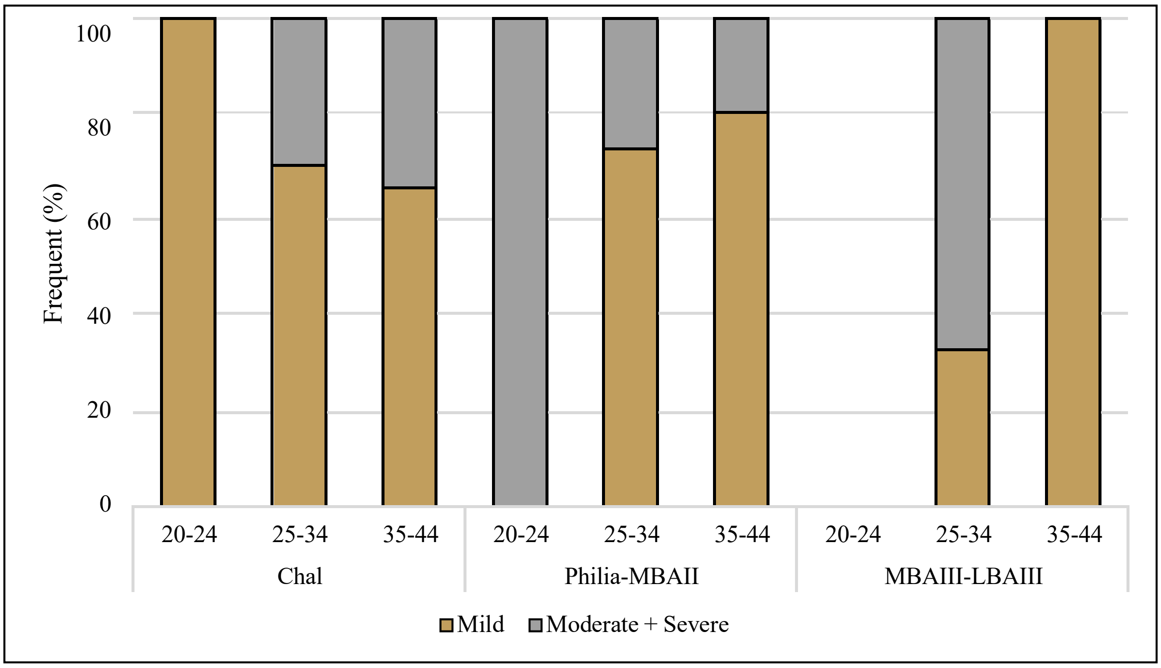


Figure 4.37. Frequency distribution of the mild and moderate + severe OLs, by age category, across the periods (upper limb). N:39.

Looking at the lower limb entheses, in the first two periods, only the middle adult category provided evidence of OLs (5/15, 33.3% and 4/20, 20.0% respectively). It must be taken into account that the middle adults were the best-represented category in both cases. Thus, this bias in representation could be the reason for this pattern of distribution. In the MBAIII-LBAIII sample, the percentages of OLs increased from the middle (1/10, 10.0%) to the mature adult range (2/11, 18.2%). In the light of this evidence and considering the very low number of observations for both the categories, no additional graph was produced. However, no difference in the OLs ranks distribution was observed between the middle and the mature adults.

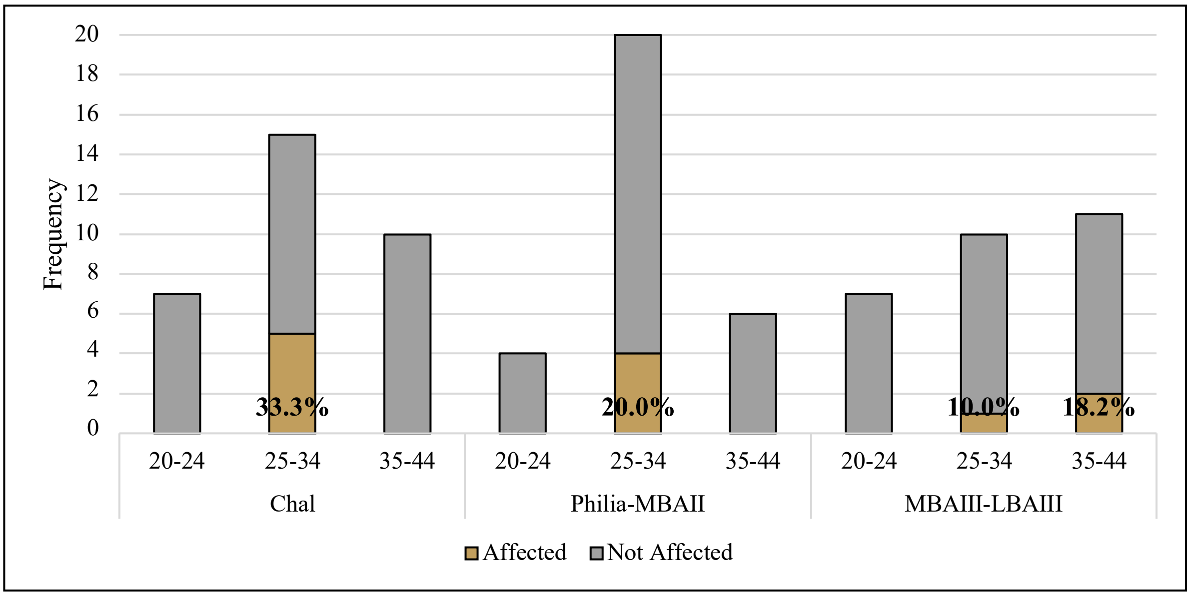


Figure 4.38. Frequency distribution of OLs, by age category, across the periods (upper limb). N:80.

Looking at the EFs distribution on the upper limbs, two different patterns were highlighted: in the Chal sample, the highest proportion (24/80, 30.0%) was detected on the young adult category, the best represented among the three. In Philia-MBAII and MBAIII-LBAIII, on the contrary, the proportion of EFs increased from the young to the mature adults.

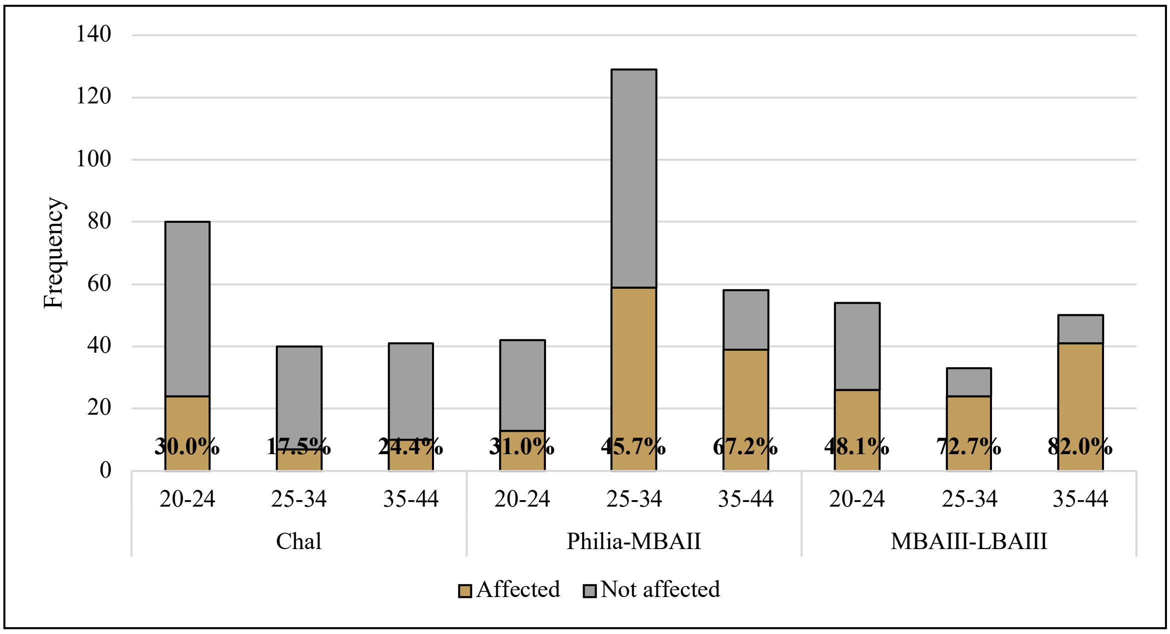


Figure 4.39. Frequency distribution of EFs, by age category, across the periods (upper limb). N:527.

Interestingly, the distribution of the most severe forms seems to depend on the representativity of the age categories in the Chal and the LBA sample. The opposite pattern was instead observed in the second period where the highest proportion of moderate degrees was found on the young adults (8/13, 61.5%) despite although they were not the best represented.

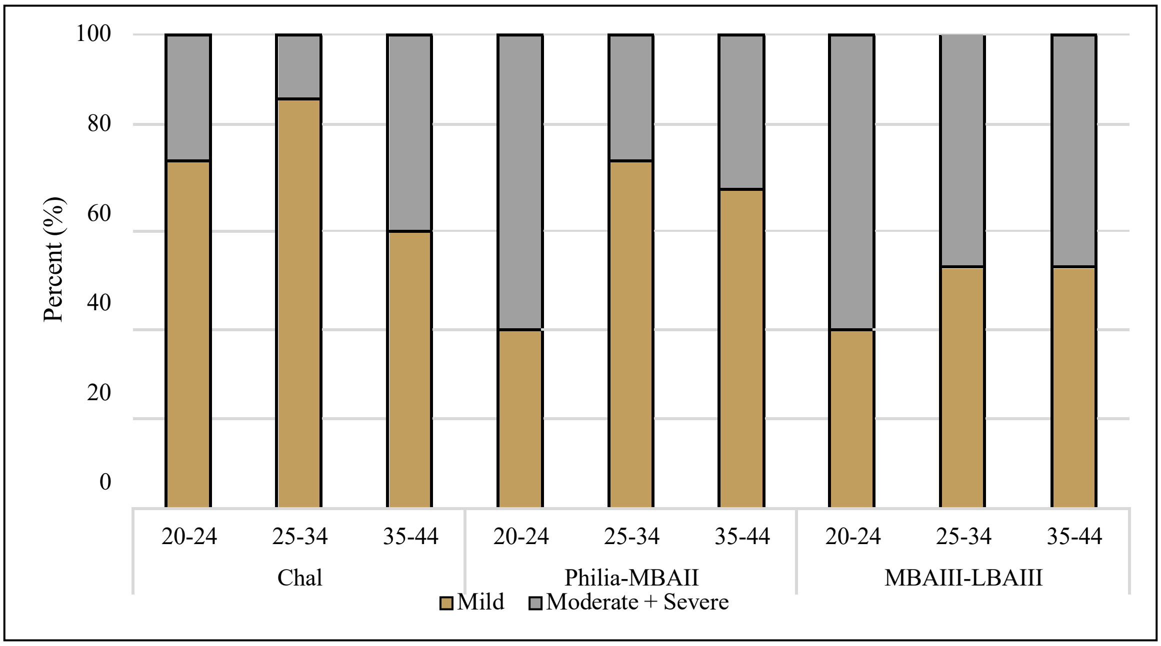


Figure 4.40. Frequency distribution of the mild and moderate + severe EFs, by age category, across the periods (upper limb). N:243.

The Kruskal Wallis test revealed a significant difference in the EFs ranks distribution between the three age categories in the Philia-MBAII (p-value=0.043), no difference was found in the Chal (p-value=0.484) and in the MBAIII-LBAIII (p-value=0.465).

Looking at the lower limb, the percentages of distribution of the EFs, overall, increased from the young to the mature adult range except in the MBAIII-LBAIII sample where the young adults displayed a higher proportion of affections (9/11, 81.8%) compared with the mature adults (4/7, 57.1%) (Figure 4.39).

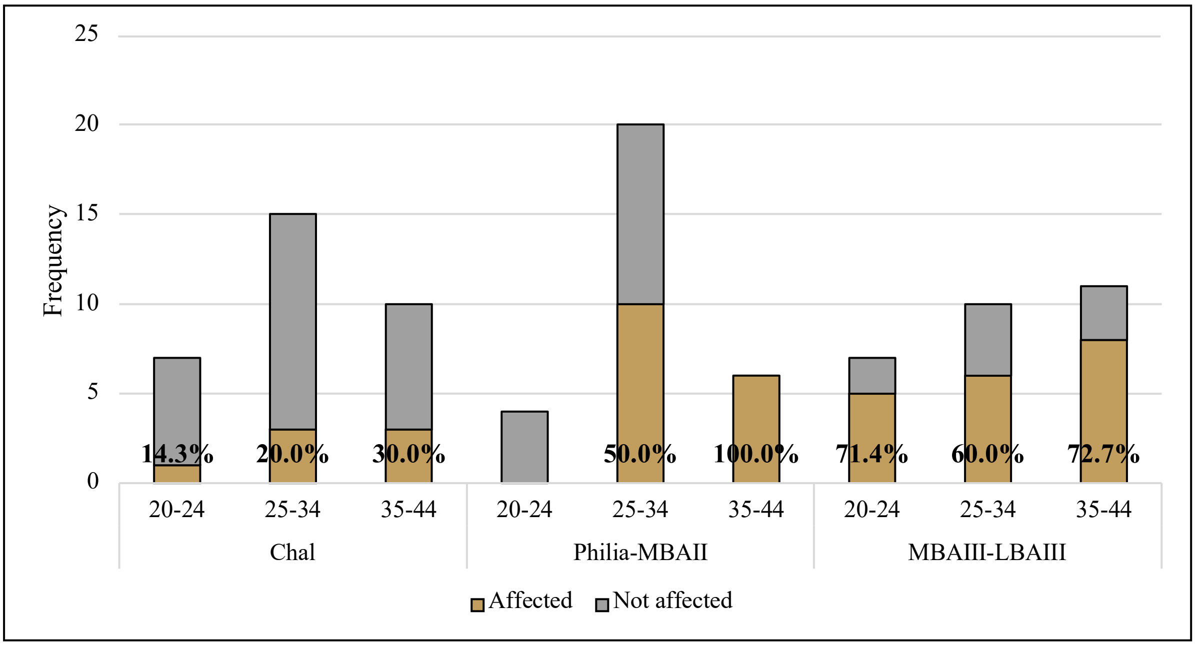


Figure 4.41. Frequency distribution of EFs, by age category, across the periods (lower limb). N:90.

The low number of EFs recorded on the lower limb did not allow to identify any pattern in the distribution of the mild, moderate, and severe EFs by age category. In the Chal sample, only the middle adult category provided OLs (1/3, 33.3%), and this was ranked as moderate. In the Philia-MBAII, the middle adult entheses had a higher rate of moderate degrees (4/10, 40.0%) compared with mature adults (2/6, 33.3%), which, however, was better represented. As for the MBAIII-LBAIII, the highest proportion of moderate + severe forms was observed on mature adults (6/8, 75.0%). These differences were however not significant (Chal p-value=0.513, Philia-MBAII p-value=0.796, MBAIII-LBAIII p-value=0.203).

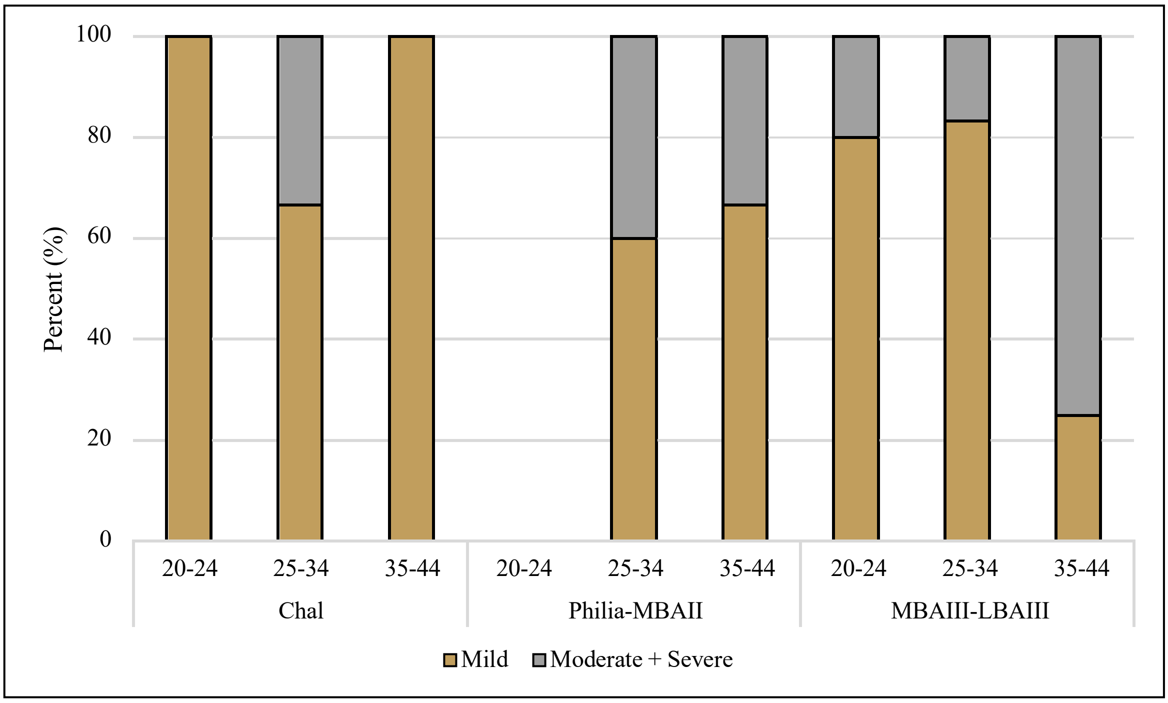


Figure 4.42. Frequency distribution of the mild and moderate + severe EFs, by age category, across the periods (lower limb). N:42

In sum, the evaluation of the distribution of the OLs and EFs ranks by side showed that, overall, the right side was more severely affected than the left side in the upper limb. The opposite pattern was noted in the lower limbs. Concerning the distribution of the OLs in the upper limbs by sex, two different patterns were highlighted: in the Chal sample, the males were more severely affected than the females, while in the Philia-MBAII and in the MBAIII-LBAIII, the females were more severely affected than the males. As for the lower limbs, the highest proportion of affections and the most severe forms were scored on the males in all the considered periods. Concerning the distribution of the EFs in the upper limbs by sex, two different patterns were highlighted: the females were found to be more affected, but the most severe degrees were scored on the males. In the other two periods, the male entheses were more affected but only in the second period, Philia-MBAII, they were also more severely affected. As for the lower limbs, the entheses belonging to the Chal and the MBAIII-LBAIII male skeletons were more affected and more severely affected; instead, in the second period, the females were more affected but less severely affected. Concerning the distribution of OLs and EFs ranks by age category, the large number of individuals of unknown age within the whole sample led to significant reductions in the number of entheses included in the comparison. For which concerns the OLs, their distribution reflected the bias in representation between the age categories. As for the EFs, overall, was observed an increase in the number of affections from the young to the mature adults. The only exception was noted, for the upper limbs, in the Chal sample: here, the young adults were more affected than the other categories. This finding, however, could be ascribed to the better representativity of this category compared with the others. As for the lower limb, the frequency distribution of this marker increased with age; the only exception was represented by the MBAIII-LBAIII sample, in which the younger adults resulted to be more affected compared with the mature adults.

4.2 Osteoarthritis

Figure 4.43 was provided to highlight the representation of the observed articular surfaces between the three periods. As can be noted, the BRI values are overall very low. The only exception was represented by the values of two entheses (femoral head and distal femur): in this case, the ratio between the actual number of joint surfaces observed and the theoretical number of joint surfaces that should have been present on the basis of the number of the individuals was comprised between 39.2% and 65.2%. The over-representation of these elements in the LBA sample, as already explained, was due to the inclusion in this research of a selection of femurs from the site of Enkomi, relocated in the Stockholm Museum. Indeed, the status of preservation of this skeletal collection was significantly better than the other osteological samples considered, both in terms of bone completeness and in terms of surface preservation.

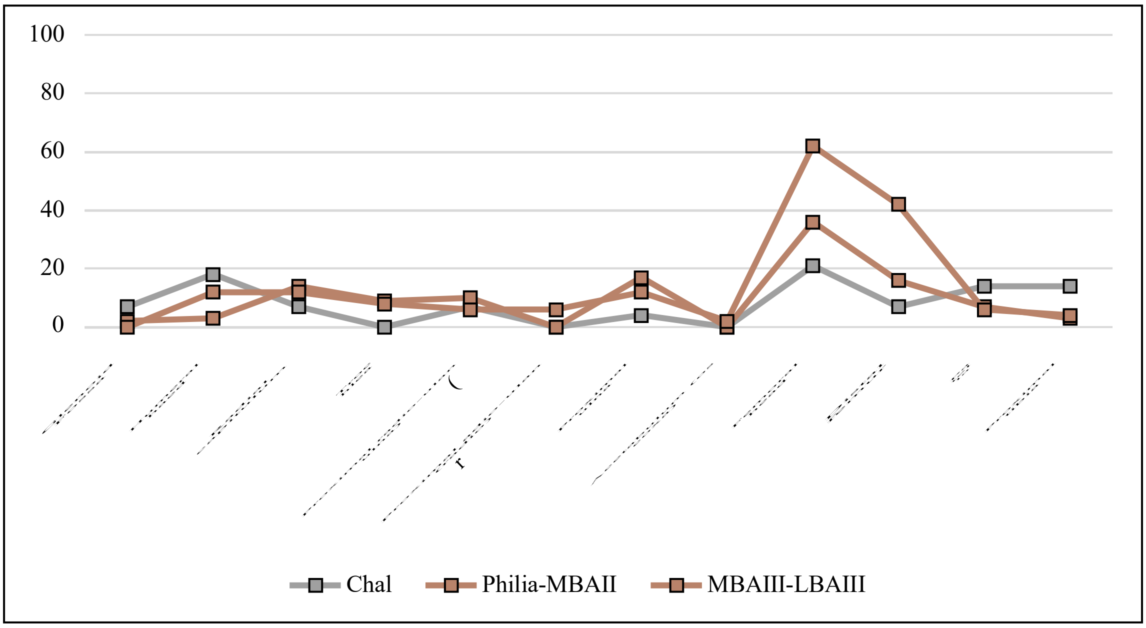


Figure 4.43. Joint surfaces representation (%) within the sample. N:184.

4.2.2 <u>Prevalence of the osteoarthritis by functional complex across the three periods</u>

In order to evaluate the frequency distribution of the OA in the examined skeletal collections, it was deemed crucial to highlight the potential disparities in representation which may affect the availability of the results. Overall, only 184 joint surfaces met the criteria for inclusion described in Section 2.3.4: 28 from the Chal sample, 68 from the Philia-MBAII sample, and 88 from the MBAIII-LBAIII. They were scored on a total of 60 individuals: 14 from the Chal, 29 from the Philia-MBAII, and 26 from the MBAIII-LBAIII. As stated in the methodological section, at least two of the three considered markers (ML, PO and SO) must be present to support that a joint surface is affected. Consequently, all the articular faces which presented only one of these markers were excluded from comparisons.

Thus, in order to avoid additional dispersal of data, all the observed joint surfaces were pooled in the four functional complexes: shoulder, elbow, hip and knee. Figure 4.44 shows that in the Chal samples, the best-represented complexes were the knee and the shoulder; in the Philia-MBAII the best-represented complexes were the elbow and the hip; while in the MBAIII-LBAIII sample hip and knee were the best represented.

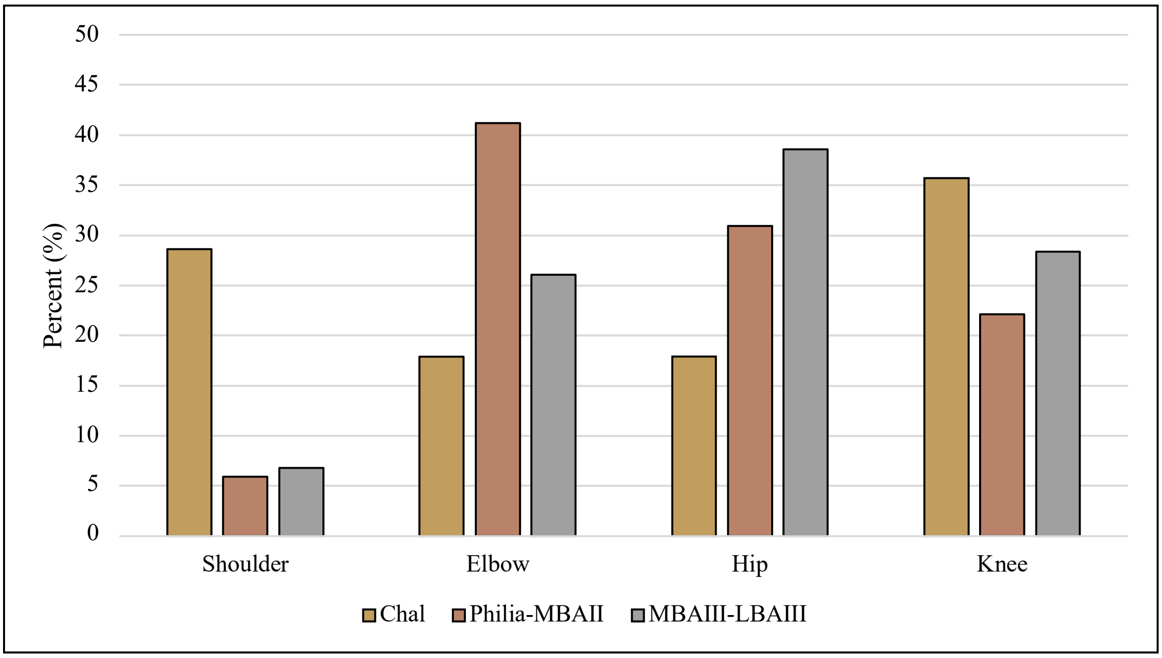


Figure 4.44. Frequency distribution of the observed joint surfaces, pooled in functional complexes, by chronological period. N:184.

Looking at the distribution of the OA across the periods, the bar chart in figure 4.45 shows that in the case of the shoulder only the Chal sample displayed OA (1/8, 12.5%). As for the elbow, the MBAIII-LBAIII displayed the greatest percentage of evidence (3/23, 13.0%) despite being less well represented than the Philia-MBAII which provided 28 observable joint surfaces and only two affections (7.1%). As for the hip, the Chal sample provided a very low number of observable joint surfaces (=5) and affections (2/5, 40.0%), not enough to make any comparison with the Philia-MBAII sample, which was better represented and displayed 9.5% (2/21) of affections. Finally, for which concerns the knee, the only two affections were found on the Philia-MBAII (6.7%) and on the MBAIII-LBAIII (4.0%). In the light of this finding, no differences in the OA distribution across the periods were identified.

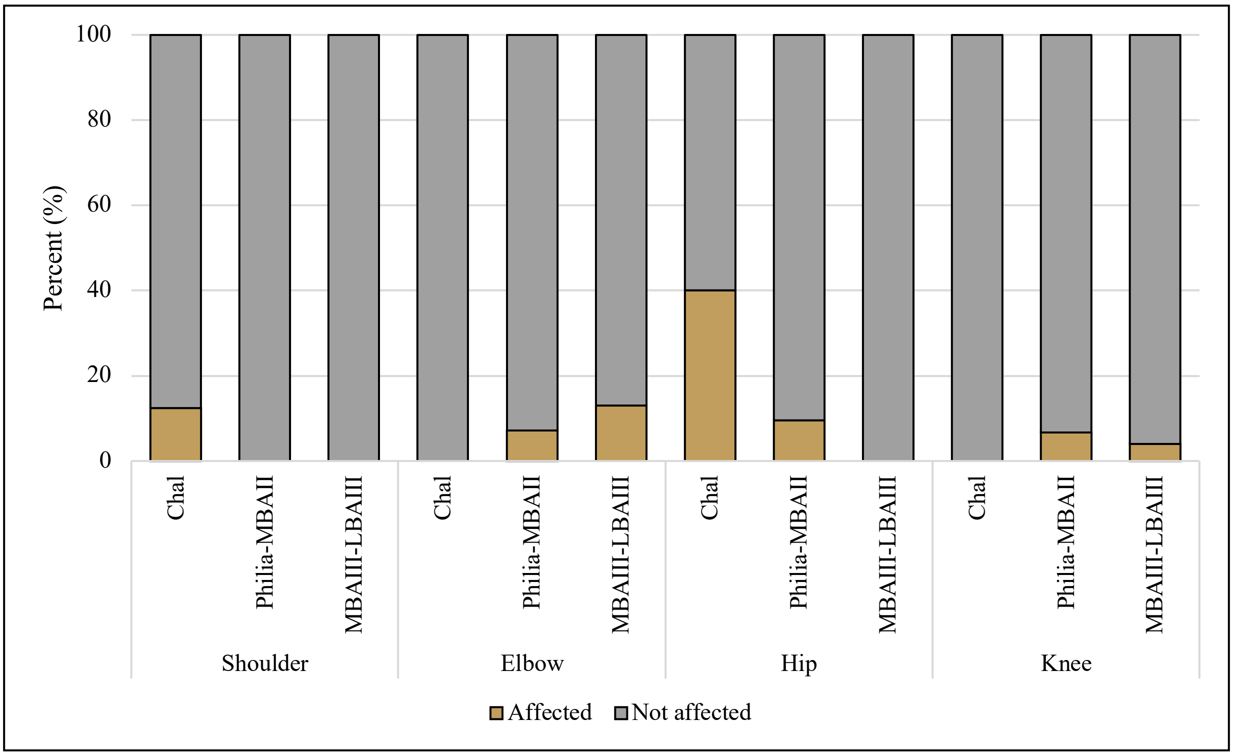


Figure 4.45. Frequency distribution of the OA, by functional complex, across the periods. N:184.

For which concerns the severity distribution of these markers, only four cases of 12 exhibited moderate or severe degenerations: three from the Philia-MBAII and one from the MBAIII-LBAIII. The formers pertained to two males (one middle adult and one of not ascertained age) and one female (middle adult). The last was identified on a middle adult female.

In sum, a total of 184 joint surfaces from 60 skeletons were examined. Of these, only 12 resulted to be affected by OA: 3/25 (10.7%) from the Chal sample, 5/68 (7.4%) from the Philia-MBAII and 4/88 (4.5%) from the MBAIII-LBAIII. Since the very low number of joint surfaces examined and the disparity in representation of the four functional complexes by periods, no trend can be inferred.

4.2.3 Prevalence of the osteoarthritis by side, sex, and age across the three periods

The very low number of joint surfaces observed forced us to evaluate the distribution of the OA, by side, by pooling the examined articular faces in upper and lower limbs.

Focusing on the upper limbs, only the Chal sample was almost equally represented by side; in the other two cases, the number of right joint surfaces greatly prevailed over the left ones: for the Philia-MBAII, this disparity was of the order of 2:1, while for the MBAIII-LBAIII, the ratio was of the order 4:1. It must be noted that, while in the case of the left side, the greatest disparity in terms of representation was observed between the Philia-MBAII and MBAIII-LBAIII and was of the order of 2:1; in the case of the right side, the disparity was more consistent reaching the order of 3:1 between the MBAIII-LBAIII and the Chal sub-sample.

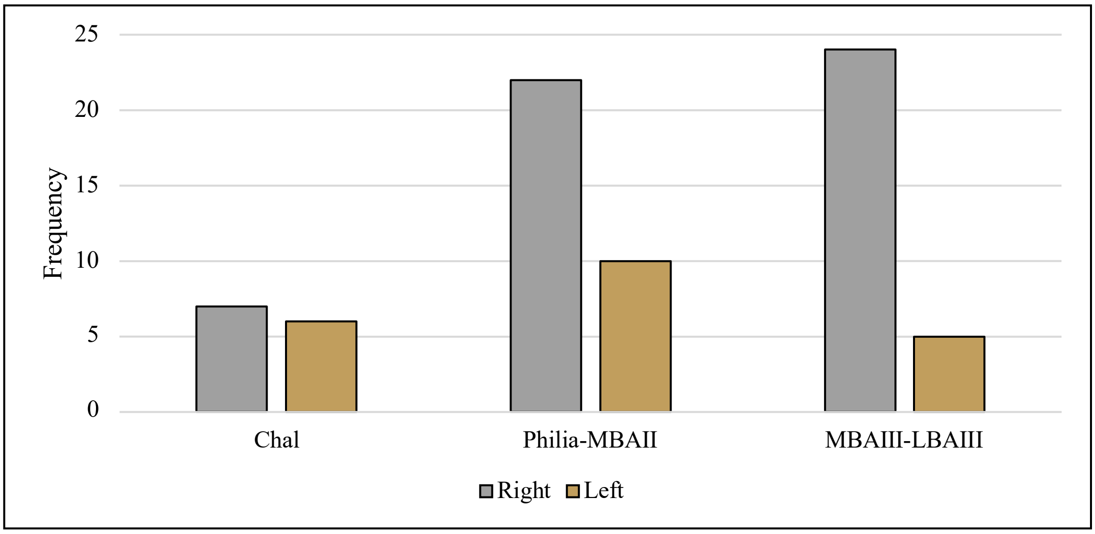


Figure 4.46. Frequency distribution of the observed joint surfaces, by side, across the periods (upper limb). N:74.

This bias in representation must be taken into account in the evaluation of the distribution of OA by side. Indeed, the only cases of OA recorded in the first (1/7, 14.3%) and third sample (3/24. 12.5%) were on the right side (Figure 4.45). In the Philia-MBAII, on the contrary, the left side provided the highest proportion of evidence (1/10, 10.0%), despite being underrepresented. Since the frequencies were very low, no statistical test was conducted.

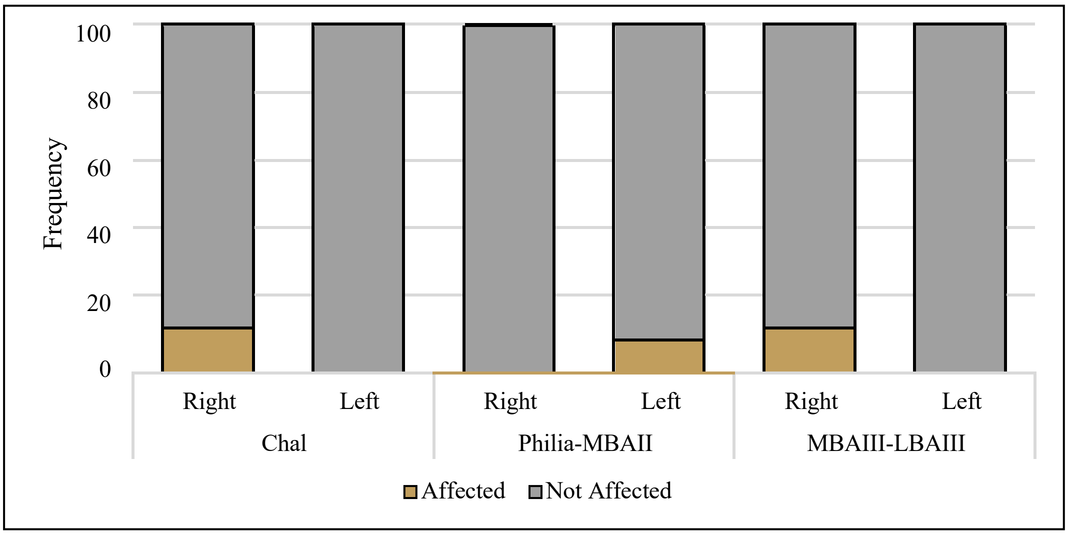


Figure 4.47. Frequency distribution of OA, by side, across the periods (upper limb). N:74.

As for the lower limb, the right side was more represented than the left (Figure 4.48).

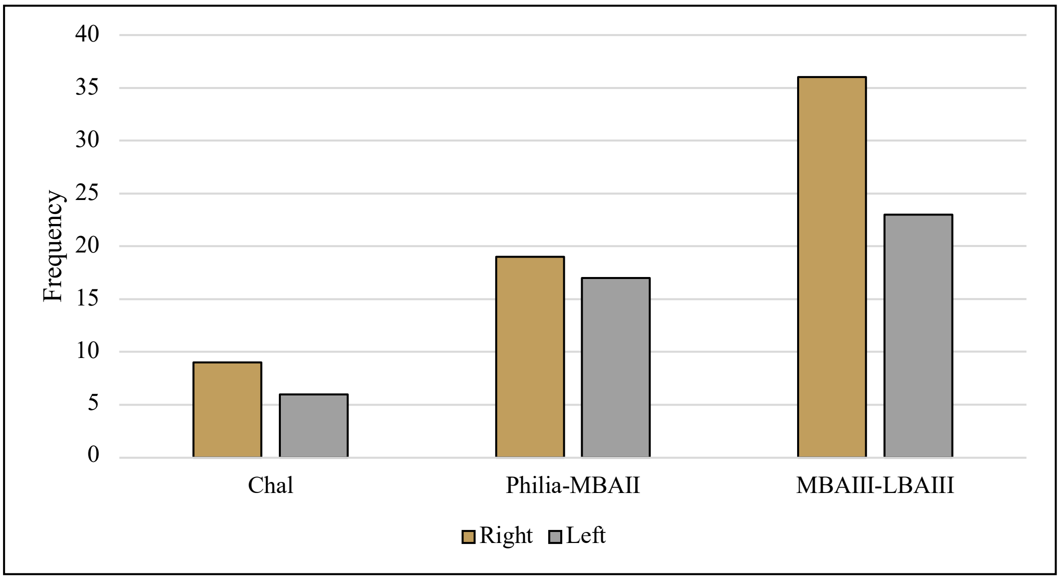


Figure 4.48. Frequency distribution of the observed joint surfaces, by side, across the periods (lower limb). N:110.

However, despite being better represented, the right side (1/9, 11.1%) of the Chal sample was less affected than the left. The Philia-MBAII and the MBAIII-LBAIII sample displayed more affections on the right side.

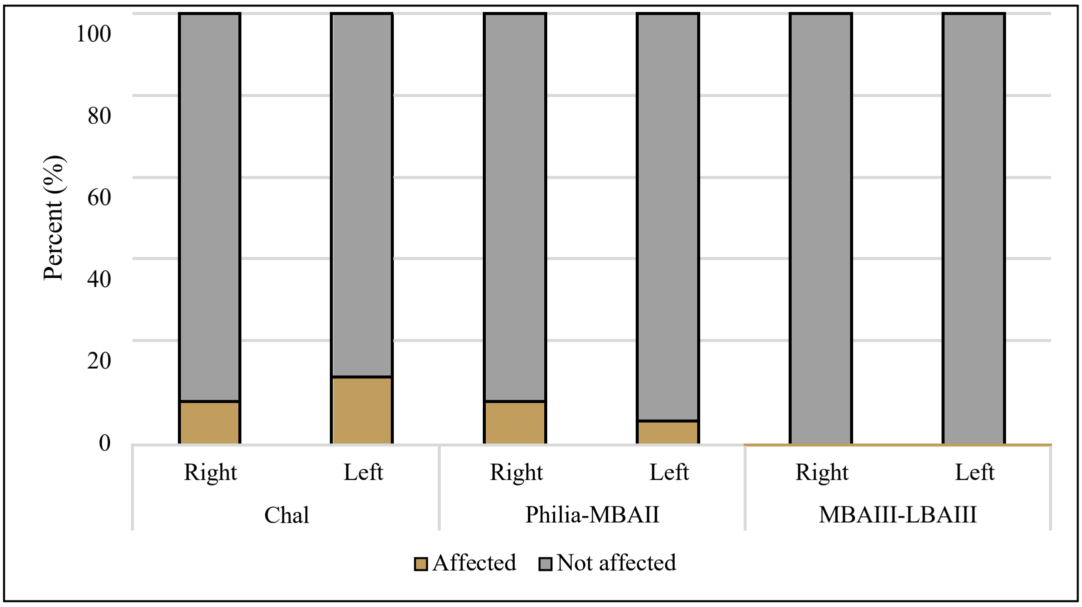


Figure 4.49. Frequency distribution of OA, by side, across the periods (lower limb). N:110.

As for the distribution of the OA by sex, the joint surfaces were pooled in two groups: the upper and the lower limb. Hence, a total of 183 surfaces were recorded and examined on 59 individuals. Concerning the upper limb, the bar chart in figure 4.50 shows that both the sexes were not equally represented in the three samples. More specifically, in the first two periods, the number of the observed joint surfaces between the sexes were almost equal, with a slight prevalence of the female joint surfaces. In the third period, instead, this disparity was greater with only eight surfaces from the males and 21 from the female skeletons. The number of the joint surfaces from female skeletons of the third period was three times as the number of the joint surfaces from the Chal period. For which concern the joint surfaces from male skeletons, it was noted a bias in representation between the Chal and the Philia-MBAII of the order of 1:3.

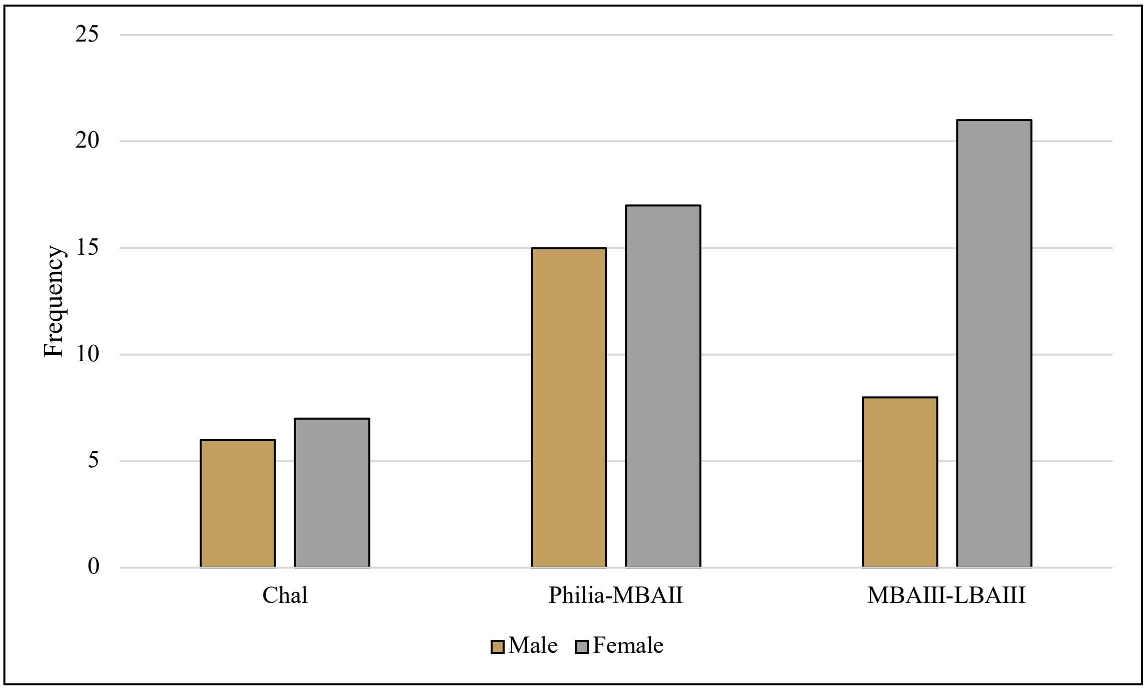


Figure 4.50. Frequency distribution of the observed joint surfaces, by sex, across the periods (upper limb). N:109.

Figure 4.51 shows that only the female skeletons were affected by OA, but it is plausible since the significant predominance of females in the whole sample. No additional test was performed.

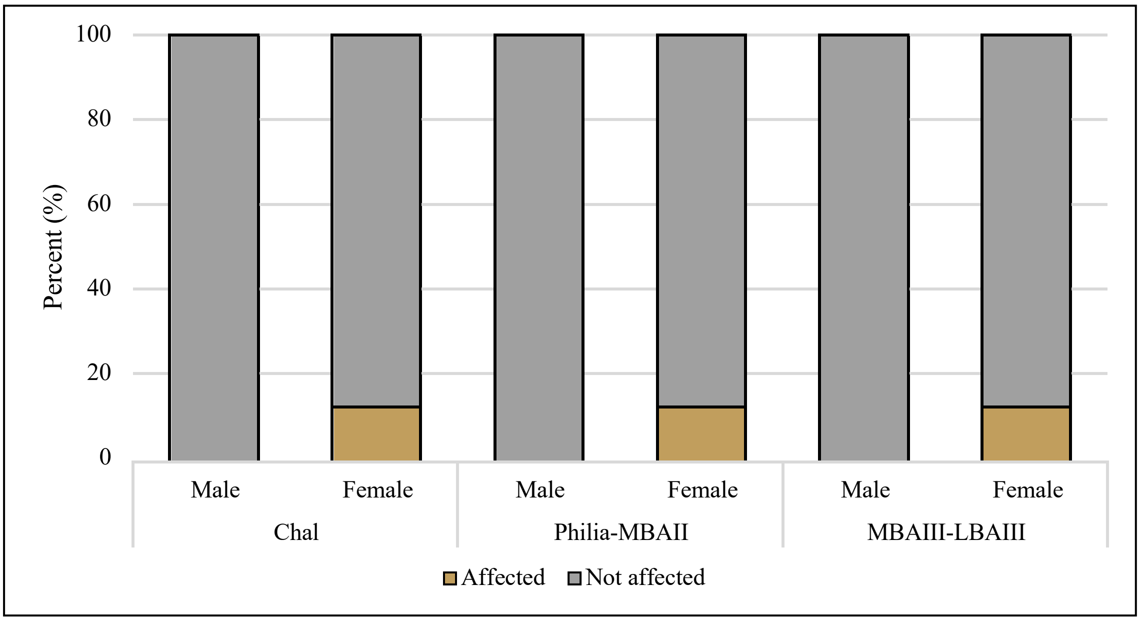


Figure 4.51. Frequency distribution of OA, by sex, across the periods (upper limb). N:109.

Concerning the lower limbs, the number of surfaces pertained to the female skeletons prevailed over the counterpart, and the ratio between the best and least represented sample (Chal and MBAIII-LBAIII) was of the order of 4:1 for the females, and 3:1 for the males (Figure 4.52).

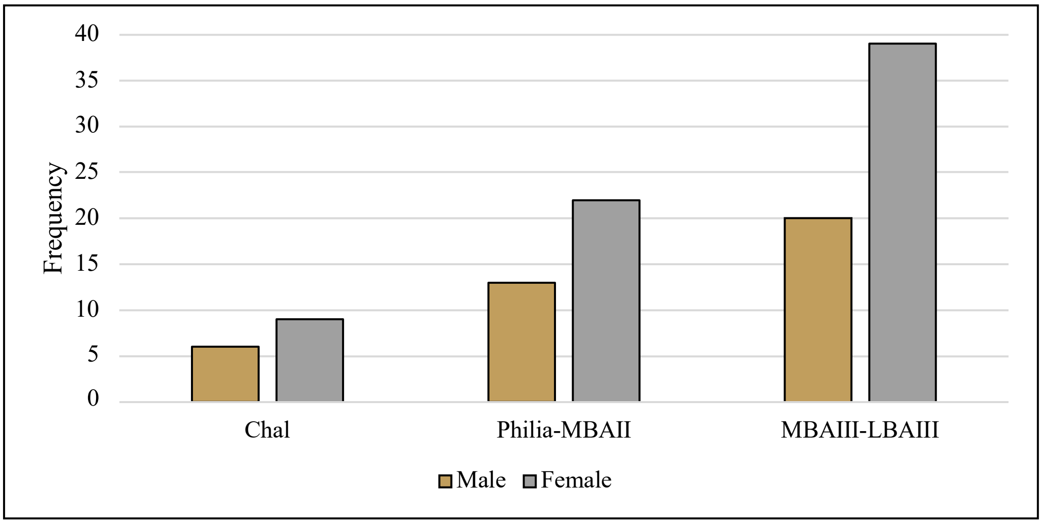


Figure 4.52. Frequency distribution of the observed joint surfaces, by sex, across the periods (lower limb). N:74

Looking at the distribution of the OA on the lower limb by sex, in the first and third sample, as expected, OA was exclusively detected on the females. Instead, in the second period, the males, despite being underrepresented, displayed the highest percentage of affections (Figure 4.53). No additional statistical evaluation was performed since the very low number of affections.

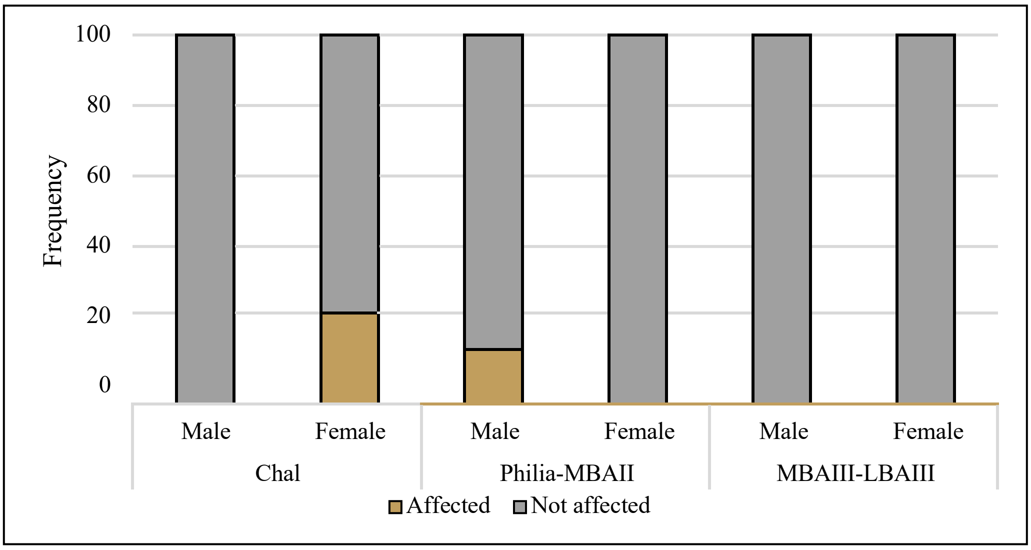


Figure 4.53. Frequency distribution of the OA on the lower limb, by sex, across the periods. N:74

Concerning the relationship between OA and age, as in the previous cases, since the very low number of joint surfaces observed (=118) on the individuals of certain age at death (=36), the comparisons were based on the pooled upper and lower limbs. The individuals categorized as old adults (+45) were excluded from comparisons as represented only in the Philia-MBAII. Thus, a total of 108 joint surfaces distributed in two groups, upper (=59) and lower (=49) limb, from 34 individuals were examined.

Looking at the upper limbs, figure 4.54 shows that no age category provided a comparable number of surfaces across the periods. As for the young adults, the sample which provided the highest number of surfaces was the MBAIII-LBAIII (=11): between this group and the least represented sample, namely the Chal (=4), there was a bias of the order of 3:1. The middle adults were predominantly represented by the Philia-MBAII sample (=9), while the least represented was the MBAIII-LBAIII sample with only 3 surfaces examined. Finally, the mature adults were largely represented by the MBAIII-LBAIII sample (=14) and very poorly by the Philia-MBAII (=3). The Chal resulted to be the only period in which the three categories were almost equally represented; in the Philia-MBAII collections, the middle adults were the best-represented category (=9) while the mature adults provided only 3 upper limb joint surfaces; finally, the MBAIII-LBAIII was predominantly represented by the joint surfaces from mature adults (=14) and joint surfaces from the young adults (=11).

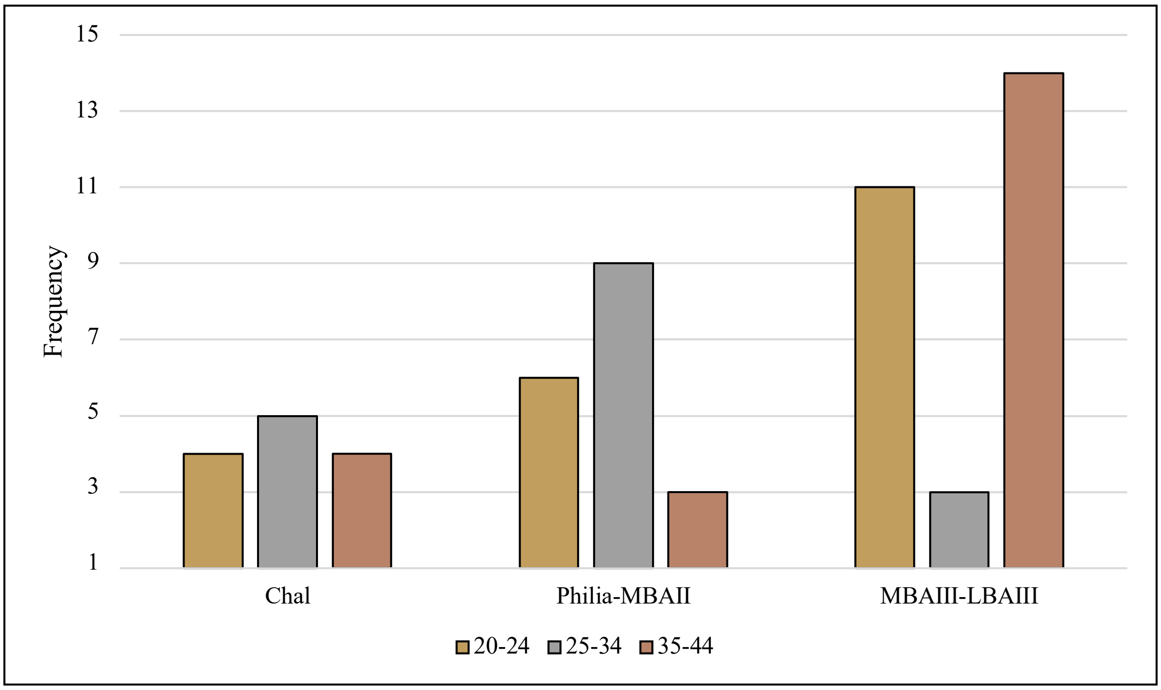


Figure 4.54. Frequency distribution of the observed joint surfaces, by age category, across the periods (upper limb). N:59.

Figure 4.55 shows that the number of affections recorded was not sufficient to infer any pattern. Overall, the distribution of the affections reflects the pattern of distribution of the observed joint surfaces.

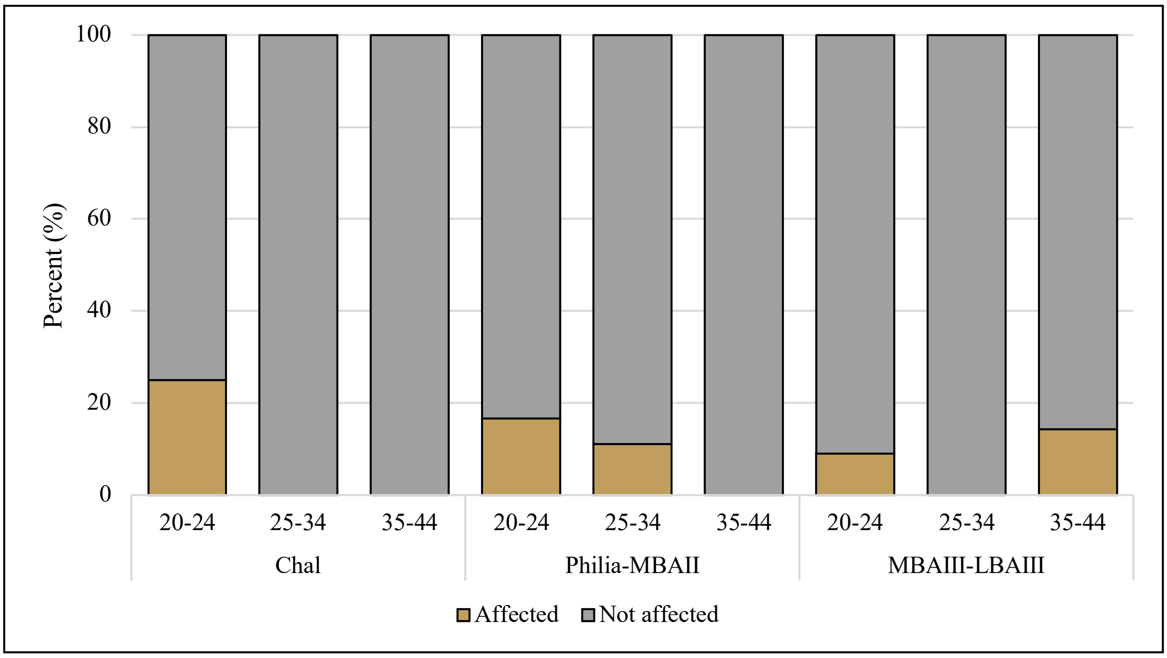


Figure 4.55. Frequency distribution of OA, by age category, across the periods (upper limb). N:59.

Looking at the lower limb, the age categories were not equally represented in the three periods (Figure 4.56). The largest disparity in representation was found in the middle adults, where the ratio between the best, Philia-MBAII (=7), and the least represented sample, the MBAIII-LBAIII (=1), was of the order of 6:1. For which concerns the young adults, the Philia-MBAII yielded almost double as the number of the joint surfaces from the other two periods; as for the mature adults, the number of the observed joint surfaces gradually increased from the Chal to the LBA. No additional test was performed.

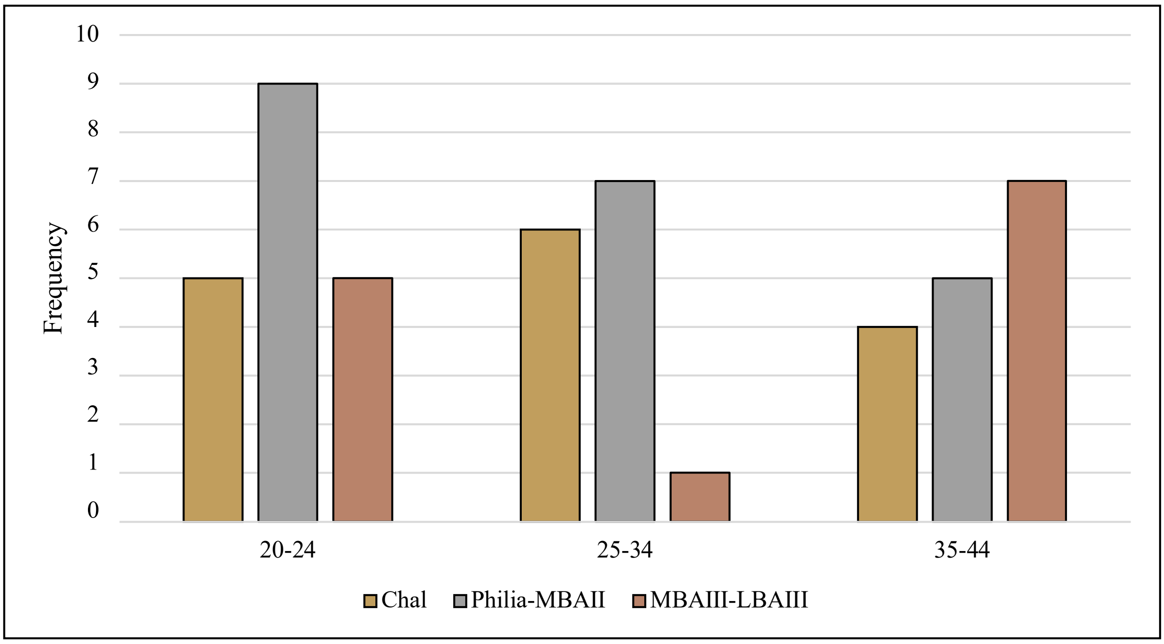


Figure 4.56. Frequency distribution of the observed joint surfaces, by age category, across the periods (lower limb). N:50.

As for the distribution of the OA on the upper limb, the number of the observed joint surfaces was insufficient to infer a trend for each period. However, it is possible to say that, despite being underrepresented, the category of the Chal mature adults, represented by only four surfaces, exhibited the only two cases of affections as well as the category of the middle adults from the Philia-MBAII. For which concerns the third period, the only observed evidence was found in the category of the young adults, represented, however, by only four joint surfaces. No additional test was carried out.

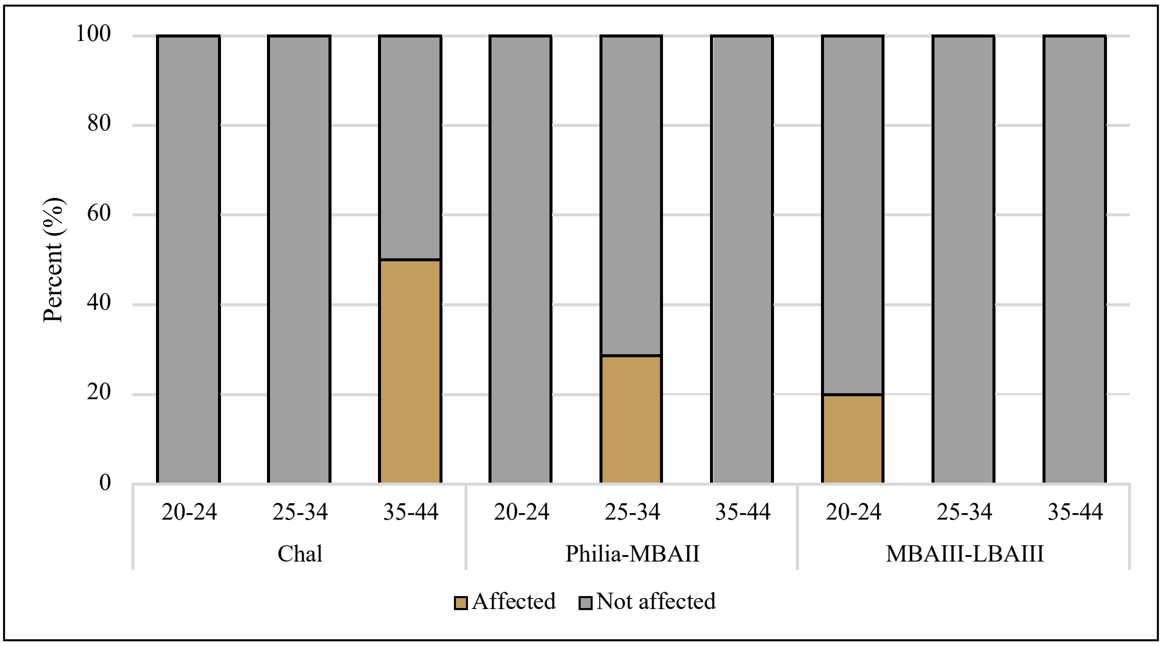


Figure 4.57. Frequency distribution of the OA, by age category, across the periods (lower limb). N:50.

In sum, the evaluation of the OA distribution by side revealed that the number of right articular surfaces prevailed over the number of the left. Despite this, the left upper limb joint surfaces of the Philia-MBAII were slightly more affected than the right; in the same way, the left lower limb surfaces from the Chal collections were slightly more affected than the right. As for the differences between the sexes, since the predominance in the whole sample of the female individuals, both in the upper and the lower limbs, the largest proportions of articular surfaces were represented by the females. As a consequence of this, concerning the upper limbs, the only affections were observed on the females. No consistent differences were noted between the three periods. Concerning the lower limbs, in the Chal and in the MBAIII-LBAIII sample, the only affections were recorded on the females: 22.2% (2/9) in the former, and 2.6% (1/39) in the last period. In the Philia-MBAII sample, despite being underrepresented, the joint surfaces examined in the male skeletons were slightly more affected (2/13, 15.4%) compared with joint surfaces from females (1/22, 4.0%). As for the distribution of the OA by age category, the number of joint surfaces observed on the three samples was not sufficient to infer any specific pattern. Only six affected surfaces were detected on the upper limb of the pooled sample; five were found on the lower limb.

4.3 Extra-masticatory dental wear

A total of 332 maxillary and 316 mandibular teeth from 69 individuals (Table 4.6) were examined to assess the presence and the distribution of extra-masticatory dental wear patterns on the selected Chal-LBAIII Cypriot populations.

Table 4.6. Sex and age distribution of the individuals examined for extra-masticatory dental wear by period. N: number of individuals observed; %: percentage of individuals observed.

	Sex						Age								
	Male		Female		ND		Young adult		Middle adult		Mature adult		Old adult		Total
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N
Chal	6	28.6	14	66.7	1	4.8	6	28.6	13	61.9	2	9.5	0	0.0	21
Philia-MBAII	19	46.3	18	43.9	4	9.8	9	22.0	17	41.5	10	24.4	5	12.2	41
MBAIII-LBAIII	0	0.0	6	75.0	2	25.0	7	12.5	1	12.5	0	0.0	0	0.0	8

As expected, since the disparity in representation of each period in the whole sample, it was observed a bias of the order 2:1 between the number of individuals examined for the Philia-MBAII period and those examined for the Chal period. Overall, however, the least represented period was the MBAIII-LBAIII for which only eight individuals providing dentitions were considered. As a result of this, table 4.7 shows that the bias in terms of representativity between the teeth recovered and examined for the Philia-MBAII and those observed in the MBAIII-LBAIII collections was of the order of 6:1 for the maxilla and 5:1 for the mandible.

Table 4.7. Frequency distribution of the observed teeth by arch across the periods. N: number of teeth by period; %: percentage of teeth by period.

	Maxilla							Mandible						
	Chal		Philia-MBAII		MBAIII-LBAIII		Total	Chal		Philia-MBAII		MBAIII-LBAIII		Total
	N	%	N	%	N	%	N	N	%	N	%	N	%	N
I1	16	12.0	20	11.6	1	3.8	37	16	12.0	23	13.2	3	9.7	42
I2	13	9.8	16	9.2	2	7.7	31	13	9.8	13	7.5	2	6.5	28

C	17	12.8	25	14.5	5	19.2	47	16	15.0	26	14.9	3	9.7	45
P1	20	15.0	28	16.2	2	7.7	50	12	11.2	21	12.1	5	16.1	38
P2	20	15.0	25	14.5	3	11.5	48	11	10.3	19	10.9	4	12.9	34
M1	16	12.0	19	11.0	5	19.2	40	16	15.0	25	14.4	3	9.7	44
M2	19	14.3	26	15.0	6	23.1	51	20	18.7	32	18.4	8	25.8	60
M3	12	9.0	14	8.1	2	7.7	28	7	6.5	15	8.6	3	9.7	25
Total	133	100.0	173	100.0	26	100.0	332	107	100.0	174	100.0	31	100.0	316

4.3.1 Prevalence of the extra-masticatory dental wear by sex and age category across the three periods

Table 4.8 was designed to compare the distribution of each dental defect in the three samples. Thus, starting with the grooving, it was detected only on the Chal dentition in a very low percentage: it affected one tooth of a middle adult male. The second defect, the LSAMAT, was detected only on the Philia-MBAII sample and, more specifically, on two individuals: a middle adult female and a mature adult male. The notching was observed in the Chal sample and in the Philia-MBAII sample: the former on a middle adult male, the last on two females, one young age adult and the other middle adult.

Table 4.8. Frequency distribution of grooving, LSAMAT and notching on the examined individuals, by sex and age category, across the periods. n: number of individuals affected; N: number of individuals observed; %: percentage of individuals affected.

		Sex				Age							
		Males		Females		Young adult		Middle Adult		Mature adult		Old adult	
		n/N	%	n/N	%	n/N	%	n/N	%	n/N	%	n/N	%
Chal	Grooving	1/6	16.7	0/14	0.0	0/6	0.0	1/13	7.7	0/2	0.0	0/0	0.0
	LSAMAT	0/6	0.0	0/14	0.0	0/6	0.0	0/13	0.0	0/2	0.0	0/0	0.0
	Notching	0/6	0.0	1/14	7.1	0/6	0.0	1/13	7.7	0/2	0.0	0/0	0.0
Philia-MBAII	Grooving	0/141	0.0	0/180	0.0	0/84	0.0	0/127	0.0	0/95	0.0	0/41	0.0

	LSAMAT	1/141	0.7	2/180	1.1	2/84	2.4	0/127	0.0	1/95	1.1	0/41	0.0
	Notching	0/141	0.0	3/180	1.7	2/84	2.4	1/127	0.8	0/95	0.0	0/41	0.0
MBAIII-LBAIII	Grooving			0/42	0.0	0/54	0.0	0/3	0.0				
	LSAMAT			0/42	0.0	0/54	0.0	0/3	0.0				
	Notching			0/42	0.0	0/54	0.0	0/3	0.0				

In sum, the extra-masticatory dental wear distribution on the three samples revealed that these dental defects were very uncommon. Indeed, on a total of 648 teeth examined only eight exhibited evidence of grooving (=1), LSAMAT (=3) and notching (=4). Since these very little data, it was not possible to identify specific patterns for each period. However, it was noted that the only case of grooving identified was related to a male, the LSAMAT evidence were predominantly observed on the females, and the notching affected only the females (Figure 4.58).

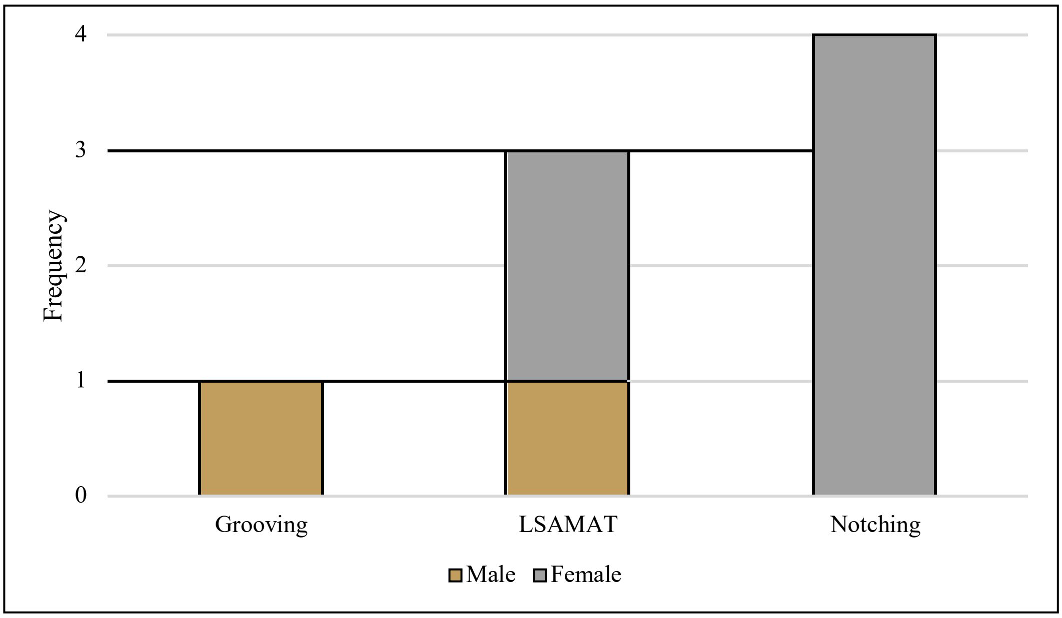


Figure 4.58. Frequency distribution of the grooving, LSAMAT and notching by sex (pooled sample).

Chapter 5 Discussion

This chapter offers, in an initial section (section 5.1), a critical discussion of the mortality profiles and the sex composition of the populations included in this research. Archaeological, genetic and anthropological data are integrated to explain the skewed sex distribution towards females detected in all three periods. A second section (section 5.2) focuses on the status of preservation of the osteological assemblages under study, considering the geographical settings from which they come, excavation procedures and restoration interventions. More specifically, differential representations of the bone specimens are emphasized in order to evaluate the reliability of the data obtained by the examination of activity patterns. The last section (5.3) discusses the evidence for activity patterns based on the examination of the activity-related stress markers in light of the archaeological data available in the literature. Potential differences in the use of muscles, joints and teeth are highlighted to explore gendered division of tasks in Chal-LBA Cyprus. In all the three sections, thus, a qualitative approach was preferred to the quantitate one as the statistical analyses performed on small sample sizes can be provided only speculative considerations. In the specific case of the Cypriot osteological collections, the integration of frequency analyses with different, multiple strands of data (e.g., archaeological, botanical, zooarchaeological, climatic, genetic) was regarded as the most appropriate approach to produce reliable data.

5.1 Paleodemography

The most recurrent shortcomings in reconstructing prehistoric labour patterns derive from the stereotyped assumption that a "uniform, developmental trajectory for sexual labour division" marked the history of every ancient human population (Peterson 2002, p. 3). Instead, divisions in labour originate from an unrepeatable set of biological, environmental, economic and social conditions (Peterson 2002, p. 3). Understanding the sex composition and the mortality pattern of a population in a specific chronological period is, thus, crucial to mitigate the risks of misinterpretation of data inherent to its social structure.

5.1.1 Sex ratio

The sex ratio, or the number of males relative to females in a specific society, is not a fixed parameter: it is calculated by the formula sex ratio (RS) = 100*male/female. Sex ratios are typically male-biased at birth both in groups of hunter/gatherers and in agricultural communities (Cintas-Pena & Herrero-Corral 2020, p. 262), but tend to vary during the lifecycle of a population as a consequence of biological (e.g., high mortality in females due to the risks of the childbirth), cultural (e.g., female neglect), and social forces (e.g., increasing inter-personal violence or sex-based migrations) (Cintas-Pena & Herrero-Corral 2020; Hobbs 2004; Page *et al*. 2019, Sieff *et al*. 1990). The predominance of males at birth has been extensively interpreted as a result of a concomitance of cultural practices including selective abortion or infanticide led by a marked preference for male offspring (Hewlett 1991; Page *at al*. 2019). As known, the sex composition of a skeletal series may not exactly represent the real composition of the population which occupied that site (Eshed *et al*. 2004, p. 327). There are three most important factors underlying this issue: i) the fragmentary nature of the archaeological skeletal remains which often makes sex estimations only speculative; ii) the methods employed for sex estimation which are mostly tailored to modern populations and thus may not be calibrated correctly for prehistoric collections; iii) the burials customs which may entail differential treatments of the dead according to sex, age and social position (Eshed *et al*. 2004, pp. 324-7). Yet, despite being aware of the limitations of the paleodemographic analysis, "this is our only means of developing some understanding of the vital statistics of prehistoric populations" (Hassan 1981, p. 96).

Results of the analysis of the adult skeletal remains from the selected MChal-LBA sites have indicated an RS of 54.5 for the Chal, 85.2 for the Philia-MBAII and 48 for the MBAIII-LBAIII.[11] In other words, in all the three periods, women substantially outnumber men: in the Chal and LBA sample, in particular, the number of females was more than twice as high as the number of the adult males. The very skewed pattern observed for the Chal sample may be explained by supposing two scenarios: i) differential burial treatments reserved for the two sexes; ii) male-biased migrations of the groups; iii) both.

[11] The RS was not calculated for each collection separately but by pooling data per period as in many cases these collections consisted of only a few individuals (e.g., Erimi *Pamboula*, Erimi *Laonin tou Porakou*, Marki *Alonia*).

Hitherto, with rare exceptions, mortuary studies addressing sex-based differential treatments in prehistory focused on the difference in grave goods (e.g., jewellery for females, weapons for males) recovered in association with sexable corpses (Burchell 2006). Yet, one of the most stimulating issues, in this sense, concerns the use of space for the selective burial of males and females. Females, for instance, in some prehistoric contexts, were recovered under the floors of the houses (Molleson 1994). This custom was historically interpreted as a social expression of the women's role within the community by emphasizing their association with those activities characteristic of the domestic sphere (Molleson 1994, p. 75). Alternative suggestions stress that the first farmers of the Near East did not reserve specific areas for funerary practices; thus, according to this opinion, burying their death underneath their dwellings was the way to "re-confirm their right to use their land" (Turek 2014, p. 3). According to Turek (2014, p. 5), after the abandonment of the house by the living, digging a grave was a symbolic act that aimed to protect the "outer surrounding of the house of the dead". In Cyprus, and specifically in the Chal-MBA contexts considered, a greater occurrence of female skeletons was observed under the floors of domestic areas. In some of these, among those dated to the later phases, there were identified specific categories of materials relevant to activities such as textile production (loom weights or spindle whorls). This led to speculation, as in other archaeological contexts, about the labour spheres of males and females and the potential allocation of these working activities (Peterson 2002, p. 3). Beyond any stereotyped reconstruction, the greater distribution of female burials under the floor of specific, domestic areas discovered in a number of Cypriot archaeological sites such as Lemba, *Mosphilia*, Marki, Sotira etc., and the recovery in some of these working tools may suggest a potential association of the deceased with activities within that domestic context. Nevertheless, by linking archaeological records and theoretical models reproducing a defined set of activities with their skeletal manifestations more evidence-based interpretations can be generated (Larsen 2015). Data summarized up to here hint that: i) females were deposited to a greater extent within or in association with domestic places; ii) they were segregated from males (Bolger & Serwint 2002, pp. 72-77). It is reasonable that the remaining component of these communities was interred elsewhere (Bolger & Serwint 2002, p. 73; Peltenburg *et al*. 1998). Thus, it is evident how, in these contexts, burial customs entailing the use of domestic space for the selective burial of females combined with the location of the excavated areas may have significantly impacted the sex ratios of the sample. As specified in the first chapters, the investigations of the Chal archaeological sites included in this research, for instance, have resulted in the sole exposure of the settlement.

However, there are other factors whose influence must be considered: in particular, the migrations of certain groups. This suggestion is in effect supported by archaeological and genetic studies, which have demonstrated that the major migrations that occurred at the beginning of the Bronze Age from Anatolia to Europe were characterized by a disproportionate movement of males (Goldberg *et al*. 2016). Analysis of Y-chromosomal data from six samples from Late Neolithic/Bronze Age Anatolia has in fact suggested that, for every female, between four and five males migrated (Goldberg *et al*. 2016). Despite being aware that the afore-mentioned sample is very small to base any solid argumentation, this finding is certainly suggestive as it provides a first genetic dataset to further explore the issue of the migrations that occurred in this crucial period.

Alongside the great migrations from Anatolia, as stressed by Knapp, the technological innovations (e.g., copper industry) promoted within the Cypriot communities since the LChal made necessary a more complex communication network which developed to ensure access to and control of the most important resources of the Island of Cyprus (Knapp 1990;1993). There is no doubt, in fact, that copper exploitation and consumption strongly impacted the geographical distribution of the settlements of the subsequent period, the Philia-EBA. In this phase, new sites such as Marki or Alambra occupied strategic locations, at the interface between the Mesaoria plain and the mineral sources located in the foothills of the Troodos Massif (Knapp 1990, p. 159). The potential for a highly mobile workforce, potentially dominated by men, raises the question of whether the dead were returned to be buried within the boundaries of their original villages, or elsewhere. Particularly relevant to this discussion is the theory reported by Peltenburg and co-authors (2019) to explain the unexpected discrepancy between the number of burials identified in the Chal cemetery complexes (*Vathyrkakkas* 1-3 and *Laona*) which served the settlement of Souskiou *Laona* (around 1200 individuals) and the estimated number of inhabitants of the settlement itself (100-600 people). Peltenburg supposed that some of the burials were reserved for groups of people coming from the surrounding villages, including Kissonerga *Mosphilia* and Lemba *Lakkous*. It must be noted that Souskiou was the principal centre for the production of cruciform figurines which were perceived not only as symbols of fertility but also as the expression of a new social identity (Lorentz 2014). Turning to the sex ratio of the combined Chal samples, they indicated that a part of the community consisting predominantly of males was interred elsewhere, outside the boundaries of the settlement. Given the central role of the *Laona* settlement, it cannot be ruled out that the members of nearby communities moved there for the above-mentioned reasons.

As for the sex composition of the Philia-MBA, archaeological contexts selected for this dissertation, which rely on the evaluation of the human remains recovered both in the domestic and the funerary contexts, this indicates a different trend from the female-dominated assemblages of the earlier Chal period, namely an increase in the inclusion of adult males. Interestingly, focusing on the burials in domestic contexts, 16 intra-mural burials were identified in Sotira and Marki: six of these were occupied by females (37.5%), only two (12.5%) by males and the remainder by an infant, children and adolescents. Thus, even in this phase, the highest number of intra-mural burials were reserved for females and children/infants. In contrast, among the individuals interred in extra-mural tombs, there was an almost equal number of males and females (27 males and 28 females). It is evident, thus, that the overrepresentation of the females in the dataset is created by the inclusion of the female-dominated group of burials in domestic contexts, and that the data derived from the cemeteries have a balanced sex ratio. Furthermore, it is evident how these statistical variations in demographic patterns of the skeletal assemblages from prehistoric Cyprus were strongly impacted by a combination of factors including the number of excavated/preserved burials and the extension of the excavated domestic quarters. The sex composition of the communities examined for MBAIII-LBAIII presents a return to the female-dominated pattern seen in the Chal sites. However, the very skewed pattern towards females must be treated with caution since the sample size of the available skeletal material is tiny compared to the estimated population, which archaeological evidence for the extension of settlement sites suggests was growing. Moreover, the three osteological series considered, Enkomi, *Ayios Dhimitrios* and Hala, derive from not more than 16.0% of the total number of tombs identified in the three sites in question; the remainder are represented by looted, disturbed, or, alternatively, by incompletely documented contexts (section 2.2.4). The most emblematic example is represented by the case of Enkomi. The site, as has been explained in section 2.2.4.1, was one of the most extensively excavated from the LBA. More than 185 chambers covering the period between MBAIII and LBAIII were excavated (Crewe 2004). From the detailed descriptions of the contents of the chambers provided by the excavators, it was possible to infer that a mean of 10-11 individuals was deposited in each tomb (Courtois, Lagarce & Lagarce 1986; Dikaios 1969-71; Gjerstad *et al.* 1934; Schaeffer 1952). Yet, the only available information relating to the sex composition of this sample concerns 28 individuals (17 females and 11 males), namely 1.1% of the estimated number of dead (around 2500) which were potentially interred in the 185 tombs excavated. It is evident that the contribution provided by the site of Enkomi in establishing a demographic pattern for the population is limited. Similarly, the excavation of the burials which served the ancient site of Hala which commenced at the end of the nineteenth century, at least in its initial stage, was inadequately conducted and has resulted in very scant documentation (Bailey 1976). Subsequently, the efforts of the Swedish Expedition which resumed the project in the 1970s led to proficient recovery[12] and a more adequate treatment of the osteological materials (Fischer & Bürge 2017). From 2013 to 2017, a total of 17 skeletons were excavated from two tombs, all located to the west of the Mosque of Hala: Tomb X and Tomb A (Fisher & Bürge 2016;2017). It is clear that the small number of skeletons available, deriving from only two tombs, cannot be considered representative of the whole population (Eshed *et al*. 2004).

5.1.2 Mortality profile

Increasing longevity (based on the number of individuals surviving to older adulthood), and fertility (based on the number of live births to women during their reproductive period) has been observed in mortality patterns during the transition from hunter/gathering to an agricultural economy (Bentley, Goldberg & Jasieńska 1993, p. 778; Eshed *et al*. 2004; Larsen 2015; Lewis & Gowland 2007). Research into human life histories has demonstrated that both these variables are positively correlated with technological and cultural innovations, changes in subsistence activities and diet experienced by past populations, as they generated an improvement in general health conditions (Caspari & Lee 2004, p. 10899; Chamberlain 2009, p. 278). Since the focus of this research was on the adult members of the examined communities, data with which to reconstruct infant mortality rates were not generated, and any assessment was only briefly mentioned. Small sample size and the overrepresentation of females hindered any discussion of male and female mortality patterns separately. Thus, the data were pooled. The mortality curve

[12] The recently recovered skeletons are very well preserved compared to the materials exhumed from tomb 1 excavated by Karageorghis in 1968.

of the examined Cypriot populations reported in figure 4.2 (chapter 4) highlighted for the Chal a peak of mortality in the middle-age cohort with a percentage of mature adults of 18.8%; a potential increase in longevity during the MBA, with a peak of mortality in the middle-age cohort but with an increasing percentage of mature adults of 22.2% and of old adults of 7.4%; and a decrease during the LBA, with a peak in the younger age cohort, and only 7.5% of individuals in the mature range. Thus, while taking into account potential bias due to the issue of preservation of the materials, the differences in the peak of mortality from the Chal to the MBA populations would corroborate findings revealed by a number of studies, namely that the greater availability of food surplus due to agricultural intensification contributed to the general improvement of life conditions (Chamberlain 2009, p. 282).

5.2 Representativity of the selected skeletal specimens

Anthropological literature abounds with examples of important osteological collections systematically excluded from studies and publications as they were perceived as undeserving of attention because of their fragmentation and poor cortical preservation (Knüsel & Robb 2016, p. 656). Yet information concerning the nature and extent of taphonomic changes present in bone material may provide varied and useful insights into the burial environment, and therefore illuminate social aspects of funerary programs (Knüsel & Robb 2016, p. 656). Where post-excavation alterations have negatively impacted the ability to analyze remains these must be documented both to offer an accurate report on the current and future potential of the remains and to offer a context for the interpretation of data obtained from their analysis. Moreover, through the use of carefully selected methods and nuanced modes of interpretation, the impact of poor preservation can be ameliorated.

While the percentage of preservation of the cortical bone was not reported in this dissertation, one of the *criteria* of inclusion entailed the presence and thus the visibility of at least 50% of the examined surface (enthesis, joint surface). Consequently, in this section, alterations concerning bone surface preservation were mentioned for the sole purpose of discussing potential incompatibility between the level of completeness of the skeleton reported in archival documentation and the rate of representativity of each considered surface (enthesis and joint surface) which may be affected by taphonomic events.

5.2.1 Enthesis and joint surface representation index

Despite the variety of the geographical settings considered in this dissertation and the differences in burial customs (e.g., multiple or single deposition, position of the deceased) or in the typology of tombs, the curve of representativity[13] of the observed entheses for the selected Cypriot collections (pooled per chronological period) showed a very similar trend per period with comparable values in the majority of the cases (Figure 3.298). Concerning the clavicle, *conoid ligament* and *deltoideus* were the most frequently assessed and, thus, the best-preserved; for the humerus *brachioradialis* and *deltoideus*; for the radius *biceps brachii* and *interosseous membrane*; for the ulna the *brachialis*; for the femur *gluteus maximus*. Tibial and patellar entheses were very poorly represented. Similarly, the curve of representativity of the observed joint surfaces for the collections included in this research pooled per period yielded comparable values in most of the surfaces examined. Overall, the femoral head and the distal femur were the most frequently assessed, followed by the articular faces belonging to elbow joints.

Hence, the bone specimens of the Cypriot prehistoric communities under study, selected to infer the level of muscle development and the articular involvement, were almost equally well preserved across the periods. The taphonomic factors implicated appear to be consistent across time, and therefore not directly attributable to the differing forms of funerary rite employed. Rather intrinsic factors are implicated, in particular the location of the examined surfaces on the bone can be regarded as a determinant of a better or worst preservation. The majority of the aforementioned entheses extend for almost half the length of the diaphysis (e.g., *deltoideus* of the humerus) or occupy carved regions of the bone (e.g., *biceps brachii*). Conversely, muscle sites located in proximity to the epiphyseal regions appear less well preserved; this is undoubtedly due to the high proportion of cancellous bones which characterized these regions (Willey, Galloway & Snyder 1997). Thus, the low representativity of some entheses is presumably due to: i) a higher level of fragmentation of some anatomical districts (tibia in particular) registered during the laboratory analysis; ii) cortical erosion and/or the presence of mineral concretions which hinder the observation of the bone surface.

[13] The curve of representation is due by the indices of representation of specific bone elements/bone surfaces occurring in a specific sample. This is a valuable tool to explore the different representation of bone segment between different collections (Lorentz 2016).

Although the extent of preservation observed across the sites belonging to the three periods of interest to this study was similar, the forms of cortical erosion encountered did vary substantially between sites. Cortical erosion is a phenomenon that can be caused by a variety of factors including contact with growing plants, animal activity or hazardous cleaning attempts (Gordon & Buikstra 1981). As for the effect of the plants, reticular patterns of grooves with circular cross-sections caused by the branching downwards into the terrain of roots were extensively identified in all the samples included in this dissertation, but to a greater extent in the *Mosphilia* and Erimi collections. The example provided in figure 5.1 shows a humerus exhumed from a shallow pit of c. 0.60 m cut in the bedrock within the settlement area of Kissonerga (Niklasson 1991). The tracks appear discoloured because of the dissolution of the mineral component of the bone tissue. Indeed, the plant roots produce hydrogen ions which react with the salts present in the deposits by forming acid secretions (Schultz 1997, p. 206). It must be borne in mind that plants may also cause the displacement and fragmentation of the bones (Knüsel & Robb 2016; Manifold 2012).

Figure 5.1. Evidence of taphonomic damage caused by root action. Fragmentary humerus from pit 562 of Kissonerga Mosphilia.

As for Erimi, the collapse of the covering structures has certainly favoured the penetration of plant roots (olives in particular) which in fact have left a very peculiar pattern of erosion (Figure 5.2). The archaeological site of Erimi is covered by vegetation consisting of carobs (*Ceratonia Siliqua*), wild olives (*Oleaeuropea*), and thorny brooms (*Calycotome infesta*) (Bombardieri, Chelazzi & Amadio 2015, p. 135).

Figure 5.2. Evidence of taphonomic damage caused by root action. Fragmentary humerus from chamber tomb 230 of Erimi Laonin tou Porakou.

It should be pointed out that in addition to the chemical erosion caused by the acid secretions of these species, the presence of groundwater at shallow depth favours the exchange of minerals (essentially calcium) between the bone matrix and the surrounding soil by accelerating the collagen dissolution (Bombardieri, Chelazzi & Amadio 2015, figure 27; Stodder 2007, p. 81). As it is evident in figure 4.2, in the most severe cases the morphology of the bone is completely masked by the erosion (Brickley & McKinley 2004, p. 16).

Concerning the pH level of the soil, the majority of the osteological materials examined for this dissertation were recovered from deposits of calcareous matrix and with an alkaline pH (Camera *et al*. 2017, fig 7). As is known, chalk soils contribute to the dissolution of the organic component of the bones (collagen), causing simultaneously the flaking of the cortex as a consequence of the force exercised by the crystallization of the salts Na_2CO_3, NaCl (Baxter 2004, p. 43; Behrensmeyer 1978, p. 154; Collins *et al*. 2002, p. 385). This flaking appears at an initial stage as superficial striations, parallel to the bone fibres (Buikstra & Ubelaker 1994, p. 98): this level of damage was the most frequently observed on the external surfaces of Lemba, *Pamboula*, Sotira, Episkopi and Kalavasos skeletons. In the later stages of the degradation process, the osseous texture becomes fibrous and rough with open cracks (Buikstra & Ubelaker 1994, p. 98). Interestingly, despite the geographical proximity to the site of Lemba, some skeletal remains exhumed in Kissonerga displayed more severe cortical damages (Figure 5.3).

Figure 5.3. Fragmentary clavicle displaying fibrous texture from tomb 505 of Kissonerga Mosphilia.

The recently - excavated human remains from Hala represent an exception in this sense, as despite being interred in a calcareous deposit, the level of cortical preservation as well as completeness is excellent. In very few cases, cortical alterations due to the secretion of the plant roots or disarrangement of the bones as a consequence of successive interments were observed.

Figure 5.4. Evidence of extensive erosion caused by root action on a fragmentary humerus from tomb RR L 104 of Hala Sultan Tekke.

Severe erosional wear was also exhibited by the materials excavated at Marki: in this case, on the contrary, the erosion was attributed to long-term internment in acid soils (ochric rendzinas, pH values of which oscillate between 5 and 8) (Lorentz 2006a, p. 293) (Figure 5.5). Acid soils are, in fact, responsible for hydroxyapatite degradation (Child 1995, p. 21; Trueman & Martill 2002,

p. 372). Additionally, Lorentz suggests as potential causes of the mechanical abrasions observed on the Marki bone materials the flooding of the burial features (Lorentz 2006a, p. 293).

Figure 5.5. Evidence of cortical erosion observed on a radial shaft from burial XIII of Marki.

A coherent pattern emerges from the analysis of fragmentation. There is a differential level of fragmentation of the skeletons according to tomb typology which is much stronger than any pattern associated with the geological characteristics of the terrain. This aspect is particularly evident in the materials examined for the second chronological macrophase which derived in part from extra-mural chamber tombs and in part from graves carved within the settlements. According to Krogman and Işcan (1986), the bodies deposed at more than 1m depth were usually more protected from the activity of carnivorous animals. Moreover, the maintenance of cooler temperatures is favoured by greater depths which reduces the rates of decomposition of the soft tissues (Rodriguez 1997, p. 459). Conversely, the bodies deposited in shallow graves (or in the more superficial layers), which is the case with the Chal depositions, were more exposed to biological activity, since the decompositional odours reach more easily above the ground and attract insects and carnivores (Galloway, Willey & Snyder 1997; Rodriguez 1997).

In the specific case of the Cypriot remains, however, there is another factor which may have determined high levels of fragmentations of skeletal remains deposited in the chamber tombs, namely that the chambers (more often than the pits) were disturbed both in antiquity and in modern times (Bombardieri 2017; Coleman *et al.* 1996; Duryea 1965; Todd 2007). The implications of post-burial disturbance, particularly from looting, on the differential survival of human remains are significant, and therefore warrant further exploration here. For instance, the evidence of plundering which occurred in various Cypriot contexts, including at Erimi, Episkopi, and Alambra, suggests that the looters entered the chamber through shafts dug through the roof (Bombardieri 2017; Duryea 1965; Moyer 1989, p. 58; Todd 2007). It can be assumed that the intensity of trampling together with the destructive effect of the collapse of the covering structure on the bones within was extremely significant, especially for segments with thin cortical bone such as the epiphyses (Andrew & Cook 1995; Olsen & Shipman 1988). As stated in the introduction of this section, in fact, the bone segments with higher bone mineral density tend to survive in greater percentages (Blau 2017, p. 204; Waldron 1987; Willey 2016; Willey, Galloway & Snyder 1997). Thus, despite specific taphonomic factors, which vary according to the different archaeological contexts considered, this study observed that bone segments with higher bone mineral density tend to survive in greater percentages, which would be consistent with this assumption (Blau 2017, p. 204, Willey 2016, Waldron 1987; Willey, Galloway & Snyder 1997). Diaphyseal sites, especially in proximity to the midshaft, have a higher bone density, which decreases towards the most proximal and distal parts (Willey, Galloway & Snyder 1997, p. 300). Indeed, the location of the muscle insertions more frequently observed in the Cypriot materials is the diaphysis; while, overall, the number of joint surfaces was considerably low. Moreover, looting will have exposed skeletal elements, for an uncertain period, to sunlight which can explain the discolouration of tissues (e.g., Figure 5.2) as well as facilitate the incursion of animals which caused disarticulation, dispersal and fragmentation of the skeletons (Andrew & Cook 1995, p. 679).

As for the completeness of the skeletons, two cases merit specific consideration. The *Pamboula* collection which included only two individuals yielded the highest number of entheses because one of the excavated burials was transported in its entirety to the Cyprus Museum (see Figure 2.13), ensuring a more proficient recording of ECs evidence. Conversely, the inclusion of the selection of bones consisting of femurs from the archaeological site of Enkomi skewed the pattern of representation of those muscle insertions and joint surfaces not located on this anatomical district. Indeed, if we do not consider the data related to Enkomi, the remaining LBA samples which derived from *Ayios Dhimitrios* and Hala would, on the whole, be the best represented. More than one insertion was observed on both the collections of *Ayios Dhimitrios* and Hala which, in fact, yielded values of representation exceeding 67% (e.g., *pronator teres*, *brachioradialis* and *brachialis*). In both these cases, the intentional relocation of the materials determined the better or worse conservation of the skeleton. Moreover, looking at the last chronological period (EBAIII-LBAIII), all the tombs included in this sub-sample accommodated more than one individual. The re-use of the same funerary settings by members of a kin group certainly introduced an additional element of disturbance of the burial strata. In this sense, the lower representativity of some anatomical districts can be ascribed to attempts at "making room for newcomers", or to the intentional rearrangement of the previously interred bodies as part of an extended ritual program (Keswani 2004, p. 24).

In sum, what the osteological materials examined for this dissertation have shown is that taphonomic factors such as plundering, for instance, affected the integrity of the skeletons and consequently hampered the exploration of the past activities performed by ancient Cypriot communities. Nevertheless, the archive generated by this research may significantly contribute to future research in this field. While the damage caused by improper recovery, especially in the past, cannot be quantified, the effect of uncorrected restorations practices is visible (Figure 2.1). Additionally, it is worth noting that in most of the cases the bones are even today stored in the original boxes, often lacking labels. This makes it difficult, even impossible, to identify the bone specimens as they are reported in the publications.

5.3 Interpretation of the activity patterns in relation to the archaeological data

In the previous two sections, factors which are traditionally used to question the accuracy of activity reconstructions based on skeletal markers, such as the fragmentary state of the remains or the representativity of the considered categories considered, were explored and discussed.

In this chapter, a first section (section 5.3.1) is designed to explore the activity patterns revealed by the evaluation of evidence for skeletal robusticity across the periods by integrating these data with archaeological, botanical and zooarchaeological records. Where available, studies conducted on contemporary populations are mentioned in order to corroborate or reject the proposed argumentations.

A second section (section 5.3.2) is intended to discuss the data provided by the evaluation of the distribution of enthesopathies (OLs and EFs) distribution across the periods. First, relationships with the robusticity data are examined and, then, suggestions are made regarding potential factors which might have been determined the distribution of severity ranks.

The third and fourth section are focused on OA and extra-masticatory dental wear. Both of these strands of data are more problematic to interpret than those based on robusticity and enthesopathies. Evidence of OA did not turn out to be so valuable in reconstructing the level of joint utilization of the examined populations and evidence of dental wear was limited in its potential to assess the potential use of teeth as tools. Reasons behind their scarce presence and the problems related to their evaluation in prehistoric Cypriot bone materials are explored.

5.3.1 Robusticity expressions in the examined Middle Chalcolithic-Late Bronze Age collections

The Middle-Late Chalcolithic contexts

During the MChal and LChal, there were two major practices upon which the economy of the Cypriot populations was based: animal husbandry/hunting with consequent butchering and agriculture (Frankel, Webb & Pike-Tay 2013, p. 95; Peltenburg *et al.* 1985, p. 322). It must be taken into account that the limited view provided by the archaeological exploration of a small number of sites fails to capture the complexity of the economic strategy of the Chalcolithic inhabitants of the island (Frankel, Webb & Pike-Tay 2013; Webb & Frankel 2007). However, we do know that the practice of agriculture encompassed a sequence of tasks including the preparation of the soil for planting (smoothing out the surface of the terrain with hoe, stick or adze), planting and covering (Peterson 2002, p. 110). When the population increased, it can be assumed that demand for land and wood for cooking or producing building materials (e.g., lime plaster) made timbering - land clearance - a central activity too (Peterson 2002, p. 110). Concerning hunting/husbandry/butchering and the species of animals present on the three sites of Lemba, *Mosphilia* and *Pamboula*, according to Croft (1991) deer represents one of the primary contributors to meat supply, at least until the beginning of the LChal when its exploitation declined in combination with the spread of pig across the island. Indeed, in the transition between MChal and LChal, the percentage of identified deer remains from Lemba and *Mosphilia* decreased from 47.6% to 35.9% at Lemba (period 2-3) and from 51.3% to 44.4% at *Mosphilia* (period 3-4) (Croft 1991, p. 71). During the same period, the proportion of pig remains at both sites increased from one quarter to around one half of the total faunal assemblage. This evidence suggests that the importance of pork in the human diet increased, alongside a decline of hunting at the end of the Chalcolithic (Croft 1991, p 73). In contrast, ovicaprids, consisting predominantly of goats, contributed in minimal part to the meat supply of the communities discussed here (Croft 1991). According to Croft (2012, p. 123), a deer might have offered more meat than a caprine or a pig. Nevertheless, the patterns strongly suggest changes in animal husbandry and diet and therefore the activities that would be associated with these practices among the communities.

As anticipated in the first chapter of this thesis, picrolite, terracotta and pottery production were also attested at all the sites considered for the period (Knapp 2013, p. 227). The decorative styles typical of the earlier phase of the Chal period (linear motifs alternating with large parts left unpainted) declined in favour of more complex designs; but, what is more important, a greater variety of forms began to circulate in these villages (e.g., flasks, pithoi etc.) bearing witness to the increasing importance acquired, in this period, by communal experiences of feasting in addition to the availability of food surplus (Bolger 1991; Knapp 2013, p. 228). Several scholars such as Frankel, Webb and Bombardieri argue that the production of food and artefacts in this chronological period was intended to satisfy local consumption (Bombardieri 2017, p. 356; Frankel & Webb 2012, p. 489). Among the evidence in support of household production, Frankel and Webb (2012, p. 489) mention, for instance, the recovery "of stone burnishing tools and non-professionally made vessels". This would lead us to suppose that no specialist in this type of activity existed, but rather that this occupation was shared by a large part of the community.

Data generated in the present study for robusticity ranks recorded on the three selected MChal-LChal samples would seem to corroborate reconstructions based on archaeological data which indicate that farming activities (agriculture/ husbandry) had a central role in the subsistence of the three sites considered for this period. Furthermore, from the examination of the *Mosphilia* collection, it has emerged that some specific tasks were accomplished by a restricted number of individuals and that these divisions of roles were sex-based. More specifically, **males** stood out by virtue of the higher development of the *costoclavicular* and *conoid* ligaments, both sternoclavicular and acromioclavicular joints stabilizers and for the high scores of the *brachioradialis*. The ***costoclavicular ligament***, extending between the clavicle and the first rib, limits the clavicle in the abduction of the arms (Peterson 2002, p. 109). ***Brachioradialis*** originates from the supracondylar crest of the humerus and attaches to the styloid process of the radius. In its active function, it favours the flexion and the supination of the forearm (Kahle, Leonhardt & Platzer 1992, p. 162). Interestingly, this latter expressed a right-side asymmetry. The ***conoid ligament*** acts by limiting the scapula rotation (Peterson 2002, p. 117). Stress at these two combined muscles was regarded as the result of hoeing, digging and chopping tasks in a number of prehistoric populations, including the skeletal remains from Early Bronze Age I Bab edh-Dhra (Jordan) (Paterson 2002, p. 109); which, indeed, involved flexion, extension, rotation of the sternoclavicular joint and the drawing forward and back of the shoulder (Dutour 1986; Hawkey & Merbs 1995; Munson-Chapman 1997; Paterson 2002, p. 118). Despite being aware of the fact that the available literature relates to subsequent periods, it is appropriate to specify that the physical effort behind this motion was presumably the same, regardless of the geographical or historical setting.

That part of the population was engaged in physical tasks associated with farming activities is supported by the archaeological materials recovered in the strata related to the occupational phase 3A-B of the *Mosphilia* settlement, to which correspond the burials investigated in this thesis. This phase was characterized by an evident increase in cereal cultivation suggested by the large variety of tools utilized for the processing of these products (lentils, cereals and peas in particular) which included rubbing stones, grinders, querns in addition to more than 200 axes - some of which had rough faces and thick, worn blades - and chisels with substantial use wear and adzes (Peltenburg *et al.* 1998, p. 181). These last were interpreted by the excavators as instruments employed for digging (Peltenburg *et al*. 1998, pp. 169, 171, 182). Thus, first, the anthropological data generated by the present study support the hypothesis promoted by the excavators on a solely archaeological basis, namely that part of the community was devoted throughout the third period of occupation of the *Mosphilia* site to "wider land clearance" (Peltenburg *et al.* 1998, p. 181). Second, the present study adds new insight to the division of labour for these tasks, which appears to have involved males more frequently than females in this case.

As for the **females,** they stood out by virtue of the higher development of muscles active in lifting such as the ***trapezoid***, whose function is to stabilize the scapula by permitting the elevation and the upward rotation of the arms and the ***pectoralis major***, which contributes to drawing the arm across the chest and to pulling the raised arm down (Kahle, Leonhardt & Platzer 1992, p. 144; Hawkey & Merbs 1995, p. 303; Peterson 2002, p. 101). It is impossible to establish the nature of the loads in question; but it is undoubtedly suggestive to notice that the same activity pattern was observed on the female component of other agricultural communities such as those of Pecos Pueblo, New Mexico, (USA) (1200-1838 AD) (Munson-Chapman 1997) or Hudson Bay, Canada (ca. 1205 AD) (Hawkey & Merbs 1995).

In the case of Lemba, higher robusticity ranks among the **females** were observed at the *trapezoid and conoid ligaments, pectoralis major, brachioradialis, deltoideus*, *teres major, biceps brachii* and *supinator*. The functions of the first four muscles have been already clarified. Concerning the ***deltoideus***, their clavicular fibres are active in the flexion of the humerus. They are also responsible for the internal rotation of the forearm on the transverse plane (Kahle, Leonhardt & Platzer 1992, p. 137). The ***biceps brachii*** is the principal flexor of the elbow; by contracting, it determines the supination of the forearm, namely the external rotational movement which, with a bent elbow, turns the palm of the hand upwards (Dutour 1986; Kahle, Leonhardt & Platzer 1992, p. 152). In this function, it is assisted by the ***supinator*** which is also responsible for the external rotation of the forearm (Kahle, Leonhardt & Platzer 1992, p. 166). The *biceps brachii* also participates, in tandem with the *deltoid*, in the abduction of the arm, namely in the movement of the arms away from the sagittal plane (Kahle, Leonhardt & Platzer 1992, p. 152; White & Folkens 2005, p. 72). ***Teres major*** and *pectoralis major* are active, in tandem, in humeral adduction, in addition to its flexion and internal rotation (Capasso, Kennedy & Wilczak 1999, p. 65-66; Hawkey & Merbs 1995; Peterson 2002, p. 104). Several activities might have required flexion, internal rotation, abduction and supination of the upper limbs. Among these, the pounding of grain carried out with a pestle and mortar was hypothesized by a number of scholars including Molleson (1994, p. 72) for the Pleistocene-Holocene collection of Abu Hureyra (Syria), Dutour (1986, p. 222-3) for the Neolithic series of Hassi el Abiod (Mali) and Chin-Tafidet (Niger), and Bridges (1989) for the Archaic collection of Pickwick Basin of the Tennessee River. The sequence of movements required to accomplish this operation - rotational movements of the shoulder with arms flexed - involved the synergic employment of the *deltoideus*, *trapezoid ligament*, *biceps brachii and supinator* which in effect were found to be the most utilized muscles in the Lemba sample (Figure 5.6).

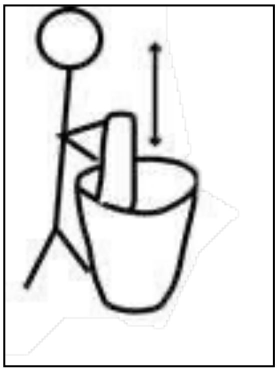


Figure 5.6. Graphical reproduction of the pounding in perpendicular direction. After Dubreuil 2001, p.74.

This reconstruction is plausible in the case of Lemba which yielded a large amount of archaeological evidence (pestles and grinders) which attested this practice (Peltenburg *et al*. 1985). Traces of red ochre identified on a calcarenite pestle and a hammerstone/grinder suggested that these tools were additionally used to crush red ochre other than to vegetable matter (Peltenburg 1983 *et al.,* p. 320). It cannot be ruled out, however, that increasing stress observed on the *teres major* and *pectoralis major* was degenerated by the pushing forward and then pulling back to the starting position of the grinding stones related to the grinding process (Figure 5.7) (Molleson 1994).

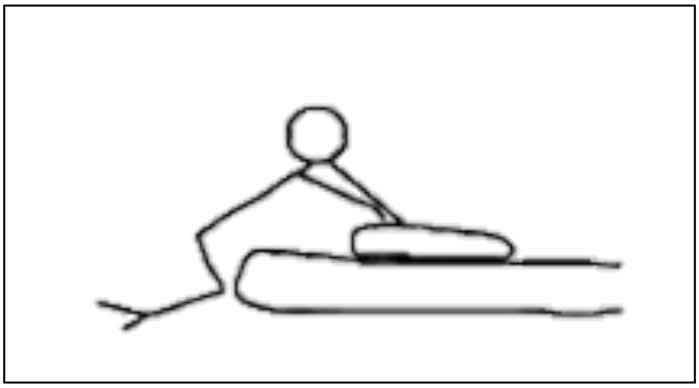


Figure 5.7. Graphic reproduction of the grinding with querns. After Dubreuil 2001, p.74.

Indeed, a large number of rubbers associated with fragmentary saddle querns found in pits beside hearths (e.g., Building 10) from the first period of occupation of the site was recovered at Lemba (Peltenburg *et al*. 1985, pp. 321-22). Traces of carbonized grains identified in the Store Area (a sort of granary destined to store a supply for 20 people per annum) lead to the assumption that vegetable matter was gathered and then stored in specific spaces within the settlement, ground with rubbing stones and querns, and finally cooked (Peltenburg *et al*. 1985, pp. 321-22).

A very low number of the relevant entheses belonging to **male** skeletons were included and considered for the Lemba collection. This prevented the possibility of investigating the level of muscle involvement of the entire skeleton. Consequently, any reconstruction should be only speculative. However, it seems that they have experienced the same kind of stress as the females. It should be possible, thus, to hypothesize that the males examined participated in the same type of task as carried out by the females.

A very similar pattern - severe expressions at the *brachioradialis, pectoralis major* and *conoid* - was also noted on the two **male** skeletons composing the sample of *Pamboula*. Under the circumstances, it is important to stress that the muscle development of such a small number of individuals cannot be deemed representative of the habitual activity patterns of an entire community; rather they must be interpreted as insights into individual lifeways. Unfortunately, no grinder/pestle or rubber stone was recovered by the archaeologists on the site (Dikaios 1936). This clearly does not imply that this activity was not carried out. Indeed, the area covered by the excavation measured around 150 sq.m. (Dikaios 1936, p. 2), so it is possible that a large part of the settlement and its material culture remained unexplored. It must be noted, however, that other tasks might have been required the synergic employment of these muscles. Hawkey and Merbs (1995), for instance, associated high scores of robusticity recorded on the *pectoralis major* and *teres major* in two prehistoric skeletal series from Northwest Hudson Bay with the scraping of animal hides. This task involved repetitive flexion and extension of the elbow, actions in which the humerus was adducted toward the chest (Hawkey & Merbs 1995, p. 332). Concerning the tools utilized for this practice, experimental data as well as ethnographic evidence suggested that they predominantly consisted of scrapers, with curved wear surfaces (Campana 1989, p. 50). These types of objects are widely attested in contemporary (M-LChal *strata*) southern-western Cypriot sites such as *Mosphilia* and *Mylouthkia* (Peltenburg 2003, p. 196) but are not attested at Lemba. Thus, while it is not possible to rule out activities associated with scraping, in the case of Lemba the first hypothesis seems to be the most reliable. On the contrary, reconstructions of scraping actions appear more plausible for the skeletons of Erimi, where the abundance of tools traditionally associated with butchery, including scrapers, hints at the importance of this activity within the range of subsistence activities conducted (Dikaios 1936, p. 53; Frankel, Webb & Pike-Tay 2013). Indeed, faunal remains recovered at *Pamboula* were predominantly represented by deers that accounted for 71.9% of the identified fragments (Croft 1991, p. 71). Concerning hide working, as with the grinding, different tools of different materials were used to accomplish different phases of the process (Christidou & Legrand-Pineau 2005). More specifically, scrapers with convex edges were employed in "fleshing and softening" hide through pulling (Christidou & Legrand-Pineau 2005), a motion which in effect involved repetitive, habitual adduction of the arms (Figure 5.8).

Figure 5.8. Reproduction of pulling motion executed with a scraper. After Christidou & Legrand-Pineau 2005, figure 6.

Moving on from the upper limb entheses to consider the lower limbs, the skeletal remains from Lemba, which were predominantly male, displayed increasing stress at the *gluteus maximus* which is one of the major flexors of the thigh. Repetitive flexion of the thigh on the pelvis is required in movement around rough, elevated terrain. It is also associated with raising the trunk when it is in recumbent position (Sanchis-Moysi *et al*. 2011, p. 1). High levels of robusticity in the *gluteus maximus* may, therefore, be indicative of movement on steep or hilly areas. Alternatively, a wide range of tasks might be carried out in recumbent position, none of which can be identified specifically using the available data here.

In terms of comparison between subjects of different ages at death, as expected, it was noted that there was an increase in the number of severe expressions from younger to older groups.
In sum, the activity patterns identified through the examination of the selected Chalcolithic groups was consistent with a range of archaeological findings. First, that agriculture, hunting and

husbandry (and derived occupations such as food preparation) were the activities which were predominantly practised by the inhabitants of these sites; second, that a certain division of working activities existed that was essentially sex-based; and third, that individuals built up increasing robusticity over time, and therefore age can be considered a confounding factor for the EC evaluation. Overall, males seem to have been predominantly involved in tasks which required repetitive flexion and supination of the forearm such as digging or hoeing or, as most convincingly evidenced at *Pamboula*, hide working. Females exhibited increasing stress at muscles involved in lifting, or, as in the case of Lemba, in flexion, internal rotation, abduction and supination of the upper limbs. Among the various prehistoric activities traditionally connected with the evidence arising from the examination of the Lemba female skeletons, pounding and grinding were deemed as the most plausible occupations, considering the archaeological data retrieved on the sites. In other words, the anthropological data have corroborated the activity models previously provided by the excavators on the basis of the archaeobotanical, zooarchaeological, and archaeological records, by clarifying the manner in which these elements (e.g., stone instruments) were used by the members of the communities and the related activities reflected in the musculoskeletal apparatus.

5.3.2 Robusticity expressions in the examined Philia-Middle Bronze Age II Cypriot collections

There is almost unanimous consensus in the literature in defining the EBA - MBA Cypriot societies as “egalitarian, agropastoral communities”, culturally and economically isolated from nearby Mediterranean regions such as Crete or Levant (Webb & Knapp 2021). Archaeological, botanical and zooarchaeological records suggested that animal husbandry and agriculture were the primary activities practised on most of the sites of the period including those examined in this dissertation: Sotira, Marki, Episkopi, Alambra and Erimi (Bombardieri 2017, p. 355; Carpenter 1981; Webb & Frankel 2007; Swiny, Rapp & Herscher 2003). No information concerning the working activities carried out by the occupants of the EBAII-MBAII tombs of Kalavasos, which represent one of the major osteological collections of the period, was reported in the literature since the only evidence of their hypothesized-related settlement consists of a “stretch of wall” identified in the area of the Panayia Church (Todd 2007, p. 325). One of the greatest innovations of the period, and certainly one of the most important of the Philia “package”, was the adoption of the plough. The spread of settlements into areas where it is unlikely a hoe could be productively used and the recovery of a clay model from *Vounous* reproducing single-handled sole-ard plough dated to the EBA offer evidential support of the transition from a hoe-based to a plough-based agriculture (Dikaios 1940, pp. 127-9; Frankel & Webb 2007). Indeed, the spread of new settlements is extensive and the location of sites on more difficult terrain impacted the social organization of labour, as clearing these lands certainly required more time and more physical effort and a larger number of inhabitants must have been involved (Boserup 1970). Some of the literature rejects the idea that females might have contributed significantly to intensive agriculture because of their lower muscular strength (Murdock & Provost 1973). This argument derives from ill-supported assumptions: indeed, plough carried out by using animal traction was not necessarily a highly physically demanding task, especially compared with the manual preparation of soil with a hoe (Ember 1983). Thus, prior to this study, the absence of evidence for gendered involvement makes this more generalized observation more valid. In sum, a new, more articulated organization of labour was necessary for the survival of these communities.

Zooarchaeological remains retrieved on the examined sites hint that caprovids were the most recurrent species, followed by fallow deer and pigs (Croft 2003;2006, p. 263; Reese 1996, p. 439; Scirè Calabrisotto 2017, p. 303). Croft (2003), comparing the animal remains recovered at *Kaminoudhia* and Marki to those collected at *Mosphilia*, found that caprovids at the former sites were very similar to each other in sizes but different from those from *Mosphilia*: more specifically, male caprines from the first two sites were smaller compared with the Chalcolithic ones. This led to the conclusion that new breeds of sheep and goats were introduced at the beginning of the period (Croft 2003, p. 443; Reese 1996). Additionally, the two EBA sites yielded a preponderance of females compared with the Chalcolithic site where the number of male and female caprines was almost the same. Finally, the kill pattern of the animal assemblage from Marki and Alambra indicated that 50-60% of these were killed after reaching full maturity.[14]This figure led to the inference that EBA cattle were exploited for meat as well as for secondary products and traction; whereas in the Chal period, they mainly served for meat (Croft 2003, p. 443; Reese 1996; Spigelman 2006, p. 122). Indeed, Webb and Frankel (1999, p. 23) argue that among the innovations introduced within the Philia culture, new utensils such as

[14] Sheep and goats are both species which are demonstrated to provide the maximus of meat when reaching 3 years of age. When kept beyond this age, they were likely use for secondary products (Spigelman 2006, p. 122)

baking pans, fire-boiling vessels and furniture such as above-ground ovens certainly facilitated widespread adoption of different processes such as cheesemaking.

In addition to the changes in subsistence activities upon which the economy of these communities was based, intensified production of copper, textiles and pottery has been highlighted in a number of Cypriot archaeological contexts. These innovations might have resulted in changes in workload (Bombardieri 2017; Frankel & Webb 2006; Webb & Knapp 2021). It must be clarified, however, that not all the sites taken into consideration for this phase provided archaeological evidence that craft activities were carried out beyond the level of the household (Webb & Knapp 2021). In the case of Marki and Alambra, for instance, subsistence was based on agropastoral activity. Pottery, stone tools and copper artefacts were, according to the excavators, manufactured locally, for local consumption (Coleman *et al*. 1996; Frankel & Webb 2006; Sneddon 2019; Webb & Frankel 2001). Archaeological evidence consisting of chalk casting moulds and a variety of finished artefacts, including axes, daggers and earrings retrieved both in funerary and in domestic contexts, bear witness that extraction, smelting and casting were carried out at Marki, Episkopi, Alambra and Sotira, although probably for local consumption (Coleman *et al*. 1996; Knapp 2012; Swiny 1986; Swiny, Rapp & Herscher 2003; Swiny & Mavromatis 2000). In the case of Marki, this activity was probably prompted by the presence of the ore sourced in the proximity of the site (Mathiatis, Kampia) (Frankel & Webb 2006, pp. 216-7; Knapp 2012, p. 15; Webb & Frankel 2007, p. 196).

As for textile production, archaeological data indicate that since the middle of the third millennium B.C. the inhabitants of the Island had already acquired the technological knowledge related to low whorl spinning (Crewe 1998; Frankel & Webb 2006, p. 169; Webb 2002; Webb & Frankel 2007). This does not mean that textiles were not manufactured before this chronological horizon. Textiles embrace a variety of finished products destined for multiple functions: other than for clothing, animal and vegetable fibres were processed to obtain nets, baskets etc. (Andersson Strand 2012, p. 22; Gillis & Nosch 2007; Muti 2020, p. 17; Rösel-Mautendorfer 2016). A recent re-examination of the archaeological materials retrieved at *Mosphilia* shed new light on the antiquity of this practice (Muti 2020, p. 230). Use-wear analysis carried out on thick oblate, globular and truncated biconical beads found on the site, in fact, have revealed a potential, alternative use to their traditionally accepted function as ornaments: according to Muti (2020, p. 118), they could have served to spin short to medium fibres. However, turning to the

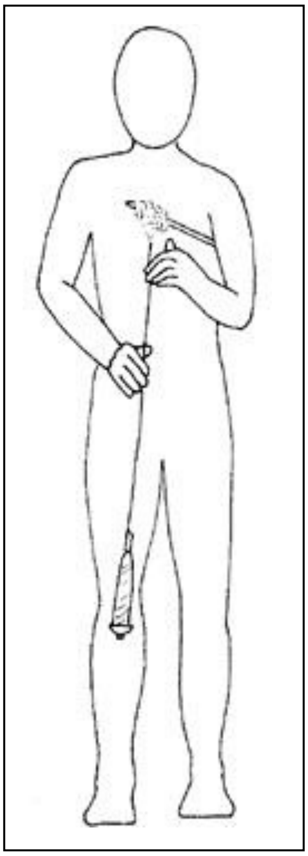


Figure 5.9. Graphic reproduction of suspended spinning with a low-whorl spindle. After Andersson Strand 2012, p. 32, fig. 8.

Philia-EBA horizon, in all archaeological contexts as mentioned before, a consistent number of spindle whorls, loom weights and needles, utilized for spinning, weaving and sewing, were retrieved both in the domestic and in funerary areas (Bombardieri 2017; Frankel & Webb 2006; Muti 2020, pp. 179, 187; Todd 2007; Swiny, Rapp & Herscher 2003). Marki is the site which provided the largest assemblage of tools for textile production (more specifically for weaving and sewing) for the EBA-MBA period: this included 128 spindle whorls, 76 loom weights and 34 needles (Frankel & Webb 2006; Muti 2020, p. 143). In addition to this evidence for spinning, weaving and sewing, Erimi *Laonin* yielded strong evidence that dyeing was practised by the inhabitants of the site in the course of the MBA (Bombardieri & Muti 2017; Scirè Calabrisotto *et al*. 2017, pp. 282-92). Here, specific vessels like bowls and jugs were recovered in association with installations (e.g., containers, liquid processing structures, hammer) which were thought for pouring and refilling liquids (Bombardieri 2017, p. 34). Furthermore, on the bottom of these installations were identified archaeobotanical remains belonging to the species of *Echium* and *Lithospermum*, plants which may have been used to produce red or purple pigments (Bombardieri & Muti 2017).

Moving to the activity patterns, the examination of the muscle development of Philia-MBA samples yielded very similar activity patterns for the females, while some variations were observed among the males between the communities. Starting with the patterns which were consistent between the sites, **females** stood out for high levels of stress at the extensor and flexor sites (*biceps brachii*, *brachioradialis*, *pronator* and *brachialis)* rather than at the muscles recruited in lifting (*trapezoid* and *pectoralis major*). Among these, the ***brachialis*** insertion site, namely of the most important flexor of the elbow, seems to have been significantly more utilized than in the Chalcolithic communities. This finding can be explained by supposing an increase in activities involving flexion of the arms or an intensification of one/more of these tasks. Differences between the assemblages were noted in the *deltoideus*: in the Sotira assemblage, this enthesis displayed sexually dimorphic differences, with males surpassing females in robusticity ranking, but in the Marki and Erimi assemblages *deltoideus* was more developed in the females.

A variety of tasks might have required the synergic employment of the above-mentioned muscles (Dutour 1986; Hawkey 1988). Peterson (2002, p. 118) notes how milking and processing milk may have entailed significant stress at the flexors and extensors sites. Thus, the activity patterns resulting from the observation of the female skeletons should be compatible with this reconstruction. Furthermore, Croft (2003, p. 446) does not rule out the hypothesis that sheep were exploited for wool processing. Unfortunately, this craft activity has not been investigated from a bioarchaeological perspective. Functional analyses of the related tools as well as their decorative schema were preferred to the examination of the human gestures behind each operation. In 2012, Andersson Strand published a paper with the intent of exploring the textile *chaîne opératoire* of the ancient Near Eastern populations on the basis of textual, archaeological and botanical sources. This provides some basis for a reconstruction of the physical activities involved. It must be specified that tools and, consequently, spinning /weaving techniques had evolved in Cyprus since their initial appearance (Muti 2020, p. 233). However, it is possible to hypothesize that some gestures were perpetuated across the periods and are common to other contemporary communities, such as those for cutting and teasing; while others were dictated by the set of tools employed and the skills required: these are less likely predictable. The very initial stages of the process entailed shearing, most probably by using knives. This occurred once a year when the sheep were moulting, namely in the early summer (Andersson Strand 2012; Barber 1991). It is impossible to determine the number of individuals that were involved in this operation; thus, it would be hazardous to speculate about the workload associated with it. As for spinning, according to Webb and colleagues (2007), it was carried out by using a low-whorl spindle namely by pulling out and twisting the fibres in a thread by hand (Andersson Strand 2012, p. 32; Muti 2020, p. 81) (Figure 5.9). Hence, it can be assumed that this operation entailed repetitive extra and intra rotations in addition to flexion of the arms. This specific step would be compatible with the activity profile described above. Weaving, the process that created the fabric, was accomplished through the use of a warp-weighted loom (Andersson Strand 2012, p. 35; Frankel & Webb 1996) (Figure 5.10). This specific technique was thought to be the most common in Europe and Anatolia in

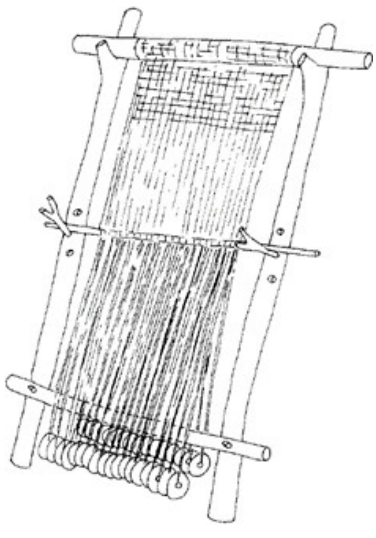


Figure 5.10. Graphic reproduction of a warp-weighted loom. After Andersson Strand 2012, p. 35, fig. 13b.

prehistory (Mårtensson, Nosch & Andersson Strand 2009). As the spinning, the gestures behind this operation presumably consisted of repetitive, intra/extra- rotations and flexion of the forearm. Thus, also this reconstruction would fit the muscle involvement of the female skeletons examined from Marki, Sotira, Erimi, Kalavasos, and Episkopi. As for dyeing, this operation has received less attention from scholars compared with spinning and weaving (Alberti 2007). This is probably because the most infallible indicators (e.g., botanical remains) are perishable and thus often not available; while other categories of materials or facilities associated with this practice could be utilized for other purposes (cooking pots, basins, *pithoi* etc.) (Alberti 2007). It is absolutely plausible that, also in this case, repetitive flexion and extension of the arms were the typical gestures behind this task.

Looking at the **male** activity profile, elevated *conoid*, *pronator teres*, *interosseous membrane* scores are scored in all of the samples considered. In addition to this, males deposited into the Kalavasos tombs exhibited a high level of stress at the *biceps brachii*, *brachialis and brachioradialis*; those from Erimi stood out for high ranking at the *deltoideus*; from Alambra, the *brachialis* was found to be among the most utilized muscle. The function of the *conoid*, *biceps brachii* and *brachialis*, has already been discussed above. The ***interosseous membrane*** stretches between the radius and ulna, acting to absorb the stress pressure transmitted between the two bones (Kahle, Leonhardt & Platzer 1992, p. 121) and ***Pronator teres*** flexes the elbow joint (Kahle, Leonhardt & Platzer 1992, p. 158). Stress at the *conoid* has been interpreted in the literature as evidence of the use of the arm above 90° in flexion or abduction (Munson-Chapman 1997, p. 503). It is evident that this alone cannot be indicative of any specific occupational behaviour. Yet, in association with high ranks of *biceps brachii*, among the most utilized muscles of the Kalavasos males, it may be indicative of the carrying loads by holding them in front of the chest (Munson-Chapman 1997, p. 504). As for the high ranking recorded for the other flexors such as the *pronator teres*, but also the *brachialis*, the *biceps brachii* and the *brachioradialis* in the case of Kalavasos, a plausible explanation is that these individuals were regularly involved in activities which required flexions and abduction of the arms such as grinding or digging. The adoption of the plough can be associated with a change in workload with a reduction of stress at extensors, like the *triceps brachii*, and flexors, like the *teres major*, which act to make downward strikes or blows (Dutour 1986; Hawkey 1988; Peterson 2002, p. 110). Indeed, neither *triceps brachii* nor *teres major* were found to be among the most developed muscles in the Philia-MBA collections. Conversely, muscles associated with digging or chopping wood (*conoid ligament* and *brachioradialis*) and grinding (*deltoideus*, *biceps brachii*, *supinator*, *pectoralis major*) were pronounced. An alternative explanation of this pattern could be related to metalworking. Indeed, as anticipated at the beginning of this paragraph, both smelting and casting were activities performed by the occupants of the Philia-EBA centres included in this research. Among the operations which had to be accomplished for the production of metal objects was roasting. This entailed the mechanical separation (crushing) of the minerals (Rostoker 1975) and was the most physically demanding task. The subsequent phase entailed the reheating of the mixture of the roasted components (smelting) and the transferring of the molten metal into a clay mould (casting) (Rostoker 1975). It can be reasonably assumed that the crushing motions involved in metalworking required the same muscle/joint involvement as grinding foods, although for the last the physical efforts were considerably lower. Unfortunately, in the absence of data from the related settlement in the case of Kalavasos, it would be hazardous to hypothesize further any specific activities which could be responsible for these skeletal expressions.

Concerning the lower limbs, only Kalavasos males exhibited increasing stress at the *gluteus maximus*. For the Chalcolithic collection, stress at this type of entheses was associated with repetitive trips of the inhabitants to hilly areas, among other activities. Indeed, at Kalavasos the site extended across two high peaks, the upper eastern of which accommodated small farming allotments (al-Oumaoui, Jiménez-Brobeil & du Souich 2004, p. 343; Sneddon 2015, p. 143).

In sum, the Philia-MBA robusticity patterns were consistent with changes in subsistence practices previously established on the basis of archaeological and zooarchaeological remains. The most significant innovations were with regard to the use of the plough in combination with traction animals to make productive areas which could not be farmed effectively using the hoe. In addition to this, improvements in craft activities such as textile and metal production impacted the social organization of labour by generating, consequently, new activity patterns. In contrast to the previous period, females from all the considered sites displayed, almost homogenously, stress at the extensors and flexors sites other than at the muscles recruited in lifting. Among the most plausible explanations, it has been hypothesized that they could be continuously involved in some tasks such as spinning and weaving, or alternatively milking and processing milk. All these suggestions are based on the archaeological artefacts recovered within the settlement or in association with burials. Males, on the contrary, displayed increasing stress at *conoid, pronator, interosseous membrane*; but those from Kalavasos stood out in virtue of the increasing stress at the *biceps brachii*, *brachialis* and *brachioradialis;* those from Erimi stood out for high ranking at the *deltoideus*; and those from Alambra, for high scores observed on the *brachialis*. The *conoid ligament* and *brachioradialis*, as already stated, are muscles associated with digging or chopping wood, while *deltoideus*, *biceps brachii*, *supinator*, *pectoralis major* are muscles associated with the grinding process. For the specific muscle development of the Kalavasos group, another suggestion was offered: one of the primary steps in metalworking entailed the mechanical separation of the minerals, which were subsequently roasted (smelting) and transferred, as liquid, into the clay (casting). This kind of process presumably consisted of the same motion performed for grinding.

5.3.3 Robusticity expressions of the examined Middle Bronze Age III-Late Bronze Age III Cypriot collections

Archaeological records from LBA Cypriot contexts bear witness to an increasing social complexity and instability. In a multi-faceted scenario, sites with a clear productive specialism established along rivers, coast or in proximity to mineral resources, served a dense network of processing and administrative centres (Keswani 1993; Knapp 2013). In the agropastoral villages, both the traditional practices of agriculture and husbandry were carried out on the same level as the previous phase (Knapp 2013, p. 308). Sheep and goat remained the most exploited species with 74.1% of identified osteological animal remains at Hala and 75.0% at *Ayios Dhimitrios* belonging to these species. These animals provided milk, meat, wool and hair (Reese 1996, pp. 476-7, 481). Horses and donkeys were used as animals for traction and transport (Reese 1996, p. 479, 481). The introduction of the plough during the Philia period was crucial to later developments, as it favoured the intensification of farming accompanied by an increase in human/materials/products mobility products (Sherratt 1981, p.159). Palaeobotanical remains retrieved from LBA contexts suggest that agricultural production, in this period, was mainly oriented towards the cultivation of cereals and olives (South 1992; South, Russell & Keswani 1989, pp. 92-3). In Buildings X and XI at *Ayios Dhimitrios* (in proximity to which the burials included in this dissertation were located), for instance, were identified areas equipped with storage facilities designed to contain a great amount of oil (ca. 50.000 kg) and a stone tank used to process olives (Keswani 1992, p. 141; South 1992, pp. 135-9 South, Russell & Keswani 1989, pp. 92-3).

It has been widely accepted that the adoption of wheel-made technology together with improvements in knowledge of firing processes (control of reducing and oxidizing phenomena) at the beginning of the LBA (ca 1600 BC) favoured the mass production of pottery and the creation of full-time craft specialists in this technology (Crewe 2007, p. 209; Crewe & Knappett 2012; Rice 1981). It must be clarified, however, that the introduction of these technological innovations did not necessarily mean their uniform adoption by all the communities of the period. The LBA site of Morphou *Toumba tou Skourou,* for instance*,* is known for the presence of workshops specializing in pottery production, but no evidence of the employment of the wheel was recovered (Crewe 2007, p. 216; Vermeule & Wolsky 1990). In some archaeological contexts, specific wheel-made forms (e.g., Plain White or Red/Black Slip wares) circulated together with the same typologies produced in handmade versions (Crewe 2007, p. 210). This could be due, according to Rice (1981), to the fact that acquiring the necessary skills to produce a vessel was a long-term process which began during childhood. Thus, some potters, at least in the very initial phases, might have been resistant to the technological innovations related to mass production (Rice 1981). Indeed, as Crewe (2007, p. 230) argues, these changes in motor habits required "a considerable investment on behalf of the artisans and implies a ready market for their goods". In light of this, apart from the initial step consisting of the preparation of the paste which continued to be carried out manually, the subsequent stages of creating forms and decorating surfaces could be accomplished in different ways. According to the strategies adopted the muscle/joint involvement changed significantly. Furthermore, in the absence of textual sources, it is impossible to establish whether a skilled practitioner in LBA Cyprus worked full-time or part-time. All these unpredictable variables contribute to confounding attempts to identify one or more activity patterns associated with this particular craft activity, which, in effect, in the literature has never been explored from a bioarchaeological/physiological perspective. Increasing demand for Cypriot copper led to the rise of villages specializing in the accomplishment of one or more of the stages associated with metalworking (e.g., Politiko *Phorades* for smelting), but also to the spread of specialist workspaces and equipment inside the buildings of administrative centres as in the case of Enkomi. Here, the earliest archaeological evidence attesting to the smelting process (crucibles, charcoal, tuyere etc.) is dated to LBAI strata (Dikaios 1969-71;

Kassianidou 2012; Kassianidou & Knapp 2005; Muhly 1989, pp. 299-301). In addition to Enkomi and Hala, at *Ayios Dhimitrios* it has been archaeologically documented that the refinement of the ores was carried out locally (Åström 1986; Muhly 1989, p. 229).

Looking at the activity patterns revealed by the evaluation of robusticity ranks at the MBA/LBA sites in the present study, differences in the utilization of the observed muscles between sexes were noted particularly in the Hala collection. In this case, **males** stood out for increasing stress at three categories of muscles - extensors (e.g., *triceps brachii*), flexors (e.g., *brachioradialis*) and adductors (e.g., *pectoralis major, deltoideus*); while **females** experienced increasing stress at the *triceps brachii*, *pronator teres* and *supinator*. No comparisons between sexes could be carried out for the *Ayios Dhimitrios* sample because of the absence of observable male skeletons. Thus, given the low number of skeletons used to discuss the activity patterns of this third period, the social complexity which characterized this chronological phase, and the absence of examined males for *Ayios Dhimitrios*, the interpretation of the results was conducted separately, by site.

Looking at the case of Hala, three females in particular displayed severe stress at the afore-mentioned muscles. One of these, was exhumed from a pit (Z9) discovered in area CQI, and specifically, in a sector where storage, food and textile processing spaces were located (Fischer & Bürge 2018, p. 33). The skeleton in question displayed evidence of poor dental health and porotic hyperostosis which led the anthropologist to assume that the individual suffered from malnutrition or anaemia (Fischer & Bürge 2018, p. 64). Around 511 ceramic sherds including white-painted wheel-made bowls, white painted wheel-made jugs or loom weights were discovered within the pit. Some of these forms were locally produced while others were imported. The majority were recovered in the upper fill of the pit. Given their distribution in the strata and their high grade of fragmentation, they were not grave goods, but rather a later addition to the pit (Fischer & Bürge 2018, p. 63). The other two skeletons were excavated from Area A (Tomb A), in a pit reused for six inhumations. The burial assemblage associated with these individuals consisted of precious items including silver jewellery, faience beads and bronze finger rings (Fischer & Bürge 2016, p. 47). No skeletal evidence indicating poor health status was visible on the skeletons in this case. The combined evaluation of the skeletal evidence and the typology of burial goods lead to the assumption that the three individuals belonged to different social ranks: the former was probably of lower social class; the last were members of the elite of the town. Despite this, the robusticity ranks distribution was relatively uniform. Thus, it is plausible to think that similar activities were conducted both by members of the elite and by persons of low status. Among these, processing/cooking food and textile manufacturing appear to be consistent with the patterns observed.

As for the musculature of the only two males included in the Hala sample, no specific archaeological records included in the burial assemblage or discovered in the proximity of the pit were particularly useful to infer a specific task which may require repetitive supination, extra rotation and flexion. However, the male buried in Pit Z9, who exhibited the most severe expressions, was positioned with the torso and the skull facing down, near the female skeleton described before who was holding three children (two of these presumably twins): thus, it consists in a collective deposition of five individuals buried in a single event according to the excavators (Fischer & Bürge 2018, p. 65). Pit burials were not common during the Late Bronze Age, and, when identified, they have been traditionally interpreted as low-status burials, considering that this tomb type, in terms of construction, required less time and physical efforts (Fischer & Bürge 2018, p. 65). The preliminary anthropological analysis has revealed, as for the female individual, that he suffered from malnutrition, inferred from the observation of enamel hypoplasia, since childhood (Fischer & Bürge 2018, p. 63). Furthermore, two perimortem lesions were noted on the frontal bone: they were associated by the anthropologist with a pointed weapon (Fischer & Bürge 2018, p. 63). Apart from a bronze pin and a wall bracket identified near the body, no other artefact recovered may suggest the occupational role of the individual (Fischer & Bürge 2018, p. 63).

As for the Kalavasos *Ayios Dhimitrios* sample, the female skeletal remains examined for ECs were exhumed from two tombs, tomb 13 and 18, both located in proximity to Building X, a monumental structure interpreted as a residence of the elite of the community (South 2000, p. 361). Indeed, in tomb 18 gold and silver earrings, ivory spindle whorls and a variety of luxury items were discovered as part of the burial goods (South 2000, p. 357). Among the occupants of the two tombs, only females deposed in tomb 18 exhibited high levels of stress at the *triceps brachii* and the *brachioradialis*. Unfortunately, a high ranking on only two muscles is insufficient to infer a specific motion; even though both the muscles have been associated with the practices of textile processing. Indeed, the recovery of ivory whorls as part of the personal belongings of the buried provides a second strand of evidence that associates them with textile production (South 2000, p. 357).

Concerning the evaluation of the robusticity ranks distribution in the lower limb, the sample taken into consideration in this case includes the skeletal remains from Enkomi, which consisted only of a selection of femurs. Overall, in the combined LBA sample, the lower limb entheses appeared to be scarcely developed. The best-represented collection, Enkomi, displayed 13.0% moderate degrees on the *gluteus maximus*, while no more than 1.3% of severe robusticity were scored on the *vastus medialis* and *iliopsoas*. In the Hala collection, the results for *gluteus maximus*, which appeared to be the best represented lower limb enthesis, were overall less developed: only one enthesis of four (25.0%) was ranked as severe. As for *Ayios Dhimitrios*, of the two entheses examined for the evaluation of *gluteus maximus*, only one was ranked as severe.

In sum, the evaluation of the robusticity ranks distribution recorded on the LBA samples showed that, as in the previous phases, males and females experienced different levels of physical stress. Starting with the information provided by the upper limb entheses, females exhibited increasing stress at the *triceps brachii*, *pronator teres* and *supinator*, a set of muscles which were, as already stated, recruited for spinning and weaving among other tasks including processing/cooking of food. Interestingly, artefacts associated with textile production were recovered both in burials of high-status members and in those of lower status individuals. This leads to the assumption that some occupational activities were carried out independently of the social position of the subject. As for the males, in this case the sample considered included only the individuals from Hala; thus, all the resulting considerations must be seen as speculative. However, the highest ranks of robusticity were observed on an individual who had poor health status and exhibited evidence of a peri-mortem fracture caused by a pointed weapon. It is notable that the mechanical gesture behind the throwing of a spear, for instance, could produce the kind of activity pattern observed in this individual. The lower limb entheses suggested that, overall, the examined individuals for LBA did not use the muscles of the thigh as intensively as those from previous periods.

5.3.4 Osteolytic lesions and enthesophytic formations in the combined Chalcolithic-Late Bronze Age examined sample

The evaluation of the distribution of OLs in the examined collections revealed that this type of marker does not fully reflect the pattern of representation of the robusticity ranks. The frequency distribution of this evidence by side, sex and age was extensively discussed in the previous chapter. In this section, in order to identify potential causative factors behind the patterns observed, it was considered appropriate to focus attention on three specific observations:

- In the Chalcolithic sample, *biceps brachii* (37.5%, 6/16), *iliopsoas* (33.3%, 2/6) and the *conoid ligament* (29.4%, 5/17) appeared to be the most affected entheses; but only two entheses, *biceps brachii* and the *conoid ligament*, simultaneously exhibited high ranks of robusticity.
- In the Philia-MBAII sample, the *costoclavicular ligament* (55.6%, 5/9), *iliopsoas* (25.0%, 2/8) and *supinator* (14.3%, 3/21) were the most affected; but only three of these, two *costoclavicular* and one *supinator*, displayed high ranks of robusticity.
- In the MBAIII-LBAIII sample, *quadriceps tendon* (patella) (33.0%, 1/3), *trapezoid ligament* (25.0%, ¼) and *biceps brachii* (20.0%, 2/10) were the most affected; but of these only three, one *quadriceps tendon* and two *biceps brachii*, simultaneously displayed evidence of high robusticity ranks.

Thus, some entheses, regardless of their representativity, tend to exhibit greater rates of evidence of OLs (e.g., *biceps brachii* or *iliopsoas*). This finding corroborates the assumption that the morphology of the enthesis plays a central role in the occurrence of this marker (Henderson *et al*. 2013, p. 159). Indeed, several works have demonstrated that one of the most probable causes for OLs are the remodelling bone processes connected to the growth of the subjects (see for instance Benjamin *et al*. 2007; Dörfl 1980; Mariotti, Facchini & Belcastro 2004; Villotte *et al*. 2010). According to this hypothesis, some entheses are more subject to the force exercised by muscles in their development process (Dörfl 1980, p. 189). The intensity of this force is positively related to the distance covered by an enthesis in its migration to reach the final location (Dörfl 1980) and result in bone destroying processes. Thus, according to this assumption those insertions which covered the longest distance to reach the final location in their migration will exhibit a greater extent of erosive evidence compared with the others. An alternative causative process reported in the literature regards the bone response to excessive stimuli at muscle insertions (Fulton, Albright & El-Khoury 1979). Unfortunately, these stimuli which occur in the form of trauma in the course of the life of the individual are hard to predict or associate with specific motion. In addition to all these arguments, this research has brought to light other significant correlations. Despite being underrepresented, male entheses were predominantly subject to this marker compared with the female in all the three periods. This specific aspect, namely the relationship of this marker with the sex of the individuals, has not been adequately explored in the literature to date. Thus, in the absence of genetic studies which may elucidate this factor, any further consideration could be only speculative. As for the distribution by age groups, while for the Chalcolithic sample the rate of affection increased with age, for the subsequent periods it decreased from the younger to middle adults. This is further evidence of the fact that this osteological manifestation may be independent of the activity.

In sum, the patterns arising from the evaluation of the OLs cannot be unambiguously associated with activity patterns of the communities under study since they might be in part due to the physiological response of bone tissue to skeletal growth. When association with muscle development (robusticity) is not determined, the information they provide is, however, useful and they must be evaluated in broader terms, namely considering that physical stress may produce predictable and measurable responses or unpredictable effects.

Concerning the EFs, the distribution of the most severe expressions (moderate and severe) of this skeletal manifestation reflects the pattern of representativity of the robusticity ranks. Indeed, in all the cases where high robusticity ranks were ascertained, moderate or severe enthesophytes were identified. This further validates the idea that these exostoses were due to specific movements which involved excessive workload (Mariotti, Facchini & Belcastro 2004; Robb 1998; Rogers, Shepstone & Dieppe 1997).

5.3.5 Osteoarthritis

OA was recorded in very few cases on the pooled joint surfaces. Of a total of 184 joint surfaces examined only 12 were affected by OA, 3/25 (10.7%) from the Chal, 5/68 (7.4%) from the Philia-MBAII and 4/88 (4.5%) from the MBAIII-LBAIII sample. The absence of evidence can be explained considering, firstly, the very low percentage of middle and mature adults within the samples and, secondly, the very scarce number of joints preserved and thus observable. Factors which affected the preservation of the joint surfaces have been extensively discussed in the previous section. As for the age of examined subjects, this pathological degeneration of the joints rarely occurs before the fourth decade (see section 3.1.6) (Loeser 2013; Ortner 2003, p. 547; Sofaer-Derevenski 2000). Thus, this led to the conclusion that the age distribution of the subjects as well as the poor status of preservation of the examined materials hampered the assessment of OA distribution within the considered samples.

5.3.6 The extra-masticatory dental wear

The percentages of extra-masticatory dental wear in the examined osteological collections were low: only one case of grooving was detected in the combined samples, specifically on the dentition a Chalcolithic middle adult male; LSAMAT was detected only on the Philia-MBAII sample and, more specifically, on two individuals, a middle adult female and a mature adult male; notching was observed in the Chal sample and in the Philia-MBAII sample: the former on a middle adult male, the last in two females, one of young age and the other of middle age.

This scarce evidence may be attributed to three reasons: i) the activities performed by the individuals not including the use of teeth; ii) the activities carried out were partially accomplished with the use of teeth, but because of the nature of the materials processed, potentially very soft and certainly perishable (e.g., vegetable fibers), and the younger age of the individuals under study, they had not sufficient time to develop any dental defects; iii) they were carried out by more than one person, spreading the impact of this practice across members of the community and thereby diminishing its impact on a single individual.

Chapter 6 Conclusions

Activity related stress markers are tangible traces of general stress accumulated by the muscular-skeletal apparatus throughout life that remain visible on the skeleton after death. An increasing number of studies, prompted by methodological improvements, have contributed to a better knowledge of the physical activities and the lifestyle in the past (Foster, Buckley & Tayles 2014). Yet, academics agree that no specific task can be inferred from the observation of a single insertion or of joint surface expression (al-Oumaoui, Jiménez-Brobeil & du Souich 2004). Indeed, a minimal motion can require the synergic employment of a number of muscles, tendons and joints. Thus, in cases of complex sets of movements the reconstruction of the impact on the soft and hard tissues is hard to realize. In the case of activity reconstructions based on archaeological evidence, the range of sources of knowledge regarding the materials used to carry out certain tasks, the distribution of the work over the course of the day/lifetime, the human resources allocated and the technologies employed are limited, therefore any attempt to explore this issue can only ever produce speculative considerations.

Indeed, in addition to these variables, the interpretation of activity depends also on a detailed understanding of the level and the quality of bone response. Recently, physiological review has emphasized the importance of reassessing the use of activity related stress markers as indicators of activity by providing a new set of data obtained through the scoring of dental and osseous alterations on modern populations whose occupation, age and sex was known (see for instance Mariotti, Facchini & Belcastro 2004). Through an in-depth understanding of the musculo-skeletal response to specific mechanical solicitations it has become increasingly possible to interpret historical phenomena which led to the rise of more complex, human society. On the other hand, the specialized literature admits the importance of the integration of data of different natures (e.g., botanical, zooarchaeological, ethnographic) to capture the complexity of certain productive processes which varied according to geographical, cultural and historical factors (Peterson 2002).

This research was intended to fill a gap in knowledge. It aimed to document the modifications of selected muscles, tendons, ligaments, joint surfaces and teeth in response to the mechanical stimuli deriving from a series of work activities among those assumed to be carried out by selected prehistoric Cypriot communities between the Middle Chalcolithic and the Late Bronze Age on the basis of archaeological reconstructions. In doing this, three skeletal indicators were selected as they have traditionally produced the most reliable information regarding the physical stress accumulated by an individual over a lifetime (section 2.1). The data concerning activity were integrated with multiple strands of archaeological data to offer a comparative context for the economic, social and cultural practices that underpinned the lifeways of the populations under study. Thus, this represents the first multidisciplinary study to integrate activity models generated from anthropological data with archaeological, archaeobotanical and zooarchaeological records. More ambitiously, this study endeavored to grasp potential variations in the use of the upper and lower limbs and teeth in relation to changes in subsistence practices and technological innovations occurring during the prehistoric period in Cyprus. Moreover, the multiscalar approach adopted in the presentation of the results - at intra and inter-population level - enabled an in-depth understanding of the organization of labour within and between the examined communities.

The chronological horizons considered in this dissertation embrace the two final stages of the Chalcolithic (Middle and Late Chalcolithic) (3400 - 2790 BC ca), the entire course of the Early and the Middle Bronze Age (2400 - 1680/1650 BC ca), to the end of the Late Bronze Age (1200-1125/1100 BC ca). This long chronological period was marked by significant social, cultural and economic changes, which led village-based communities, whose subsistence was essentially based on agriculture, husbandry and hunting, to develop into international polities, integrated in a wider trade system (Knapp 2013). The choice to focus on this chronological period offered a framework within which to understand how changing activity patterns might accompany significant social and economic transitions. In an apparently closed setting, as represented by the island of Cyprus, the identification of the social processes which ensured changes in productive activities could be more effective.

Twelve osteological collections, among the most important, best documented and best preserved available for study, were selected in order to generate a substantial dataset with which to reconstruct activity patterns from visible markers on the skeleton; they were firstly examined separately, through a site-by site approach, and then combined by period, for a diachronic evaluation. The identified collections were distributed in three macro-phases for analysis:

Kissonerga *Mosphilia,* Lemba *Lakkous* and Erimi *Pamboula* for the Chalcolithic; Sotira *Kaminoudhia*, Marki *Alonia*, Alambra *Mouttes*, Erimi *Laonin tou Porakou*, Kalavasos Village tombs, Episkopi *Phaneromeni* from the Philia-Middle Bronze Age II; and Kalavasos *Ayios Dhimitrios*, Hala *Sultan Tekke* and Enkomi for the Late Bronze Age (see section 2.2).

The first set of observations made about the collected data was the predominance of female individuals in all the three macro-phases (see sub-section 4.1.1). Concerning the Chalcolithic period, the funerary contexts which yielded evidence of human remains were identified within the settlements. As analysis of these assemblages results in a substantial over-representation of females, and it has been argued that sex dictated the choice of different burial locations. Burials of female individuals under the floors of the houses have been documented in other prehistoric contexts and this practice has been interpreted as the social expression of the women's role within the community by emphasizing their association with those activities inherent to the domestic sphere (Molleson 1994, p. 75). The absence of men from these archaeological assemblages reflects the fact that the locations of their burials remain unknown; however, the hypothesis that new social ties between settlements prompted some to move to other villages for working reasons, and then be buried there, cannot be ruled out. Concerning the Philia-Middle Bronze Age, the percentage of males and females within the examined sample was almost the same, although females still slightly prevail in number over the males. As in the previous cases, the burials excavated within the settlements represented predominantly female depositions; this figure was balanced by the recovery of male individuals in the extra-mural funerary contexts. It is evident, thus, that the choice of location and scale of the investigated areas impacted significantly on the sex ratio of the osteological remains. It must be questioned whether a more extensive excavation regime at Chalcolithic sites would find a similar pattern of male-dominated extra-mural cemeteries and thus extend the antiquity of this practice back in time. Concerning the Late Bronze Age, the small sample-size in this case prevented discussion of the sex distribution. Thus, any consideration could be only speculative. As for the mortality of the considered samples, there was observed an increase in longevity from the Chalcolithic to the Middle Bronze Age; this figure corroborates data revealed by a number of studies which have demonstrated that the greater availability of food surplus due to agriculture intensification contributed to the general improvement of living conditions (Chamberlain 2009, p. 282). Conversely, the high rate of mortality in the younger age cohort observed for the Late Bronze

Age sample was explained by the sampling problems which led to an underrepresentation of individuals assigned an age (62.5%) for this period.

The second set of findings resulted from a detailed observation of the condition of the bone materials, which revealed their almost homogenous status of preservation regardless of their geographical background (see sub-section 4.2.1). Two aspects in particular were considered and discussed in this dissertation: the cortical preservation and the fragmentation/completeness of the skeletons. Concerning the first aspect, the majority of the sites included in this thesis are located on the south coast of Cyprus; thus, the related osteological remains were recovered from similar deposits, consisting of a calcareous matrix with an alkaline pH (Camera *et al*. 2017, fig 7). As it has been extensively explained, chalk soils, in association with other agents such as the plant roots, causes the dissolution of the organic component of the bones (collagen) and the consequent flaking of the cortex (Collins et al. 2002, p. 385; Baxter 2004, p. 43; Behrensmeyer 1978, p. 154). Superficial striations, open cracks and, in the most severe cases, large cortical erosions were observed on a number of bone segments including those from Lemba *Lakkous*, Kissonerga and Erimi *Laonin tou Porakou.* Severe erosion was also observed on the bone materials from Marki *Alonia*, which unlike the above-mentioned archaeological sites, was characterized by the presence of acid soils (ochric rendzinas, pH values which oscillate between 5 and 8) (Lorentz 2006a, p. 293). Acid soils are thought to be responsible for hydroxyapatite degradation (Child 1995, p. 21; Trueman & Martill 2002, p. 372). However, Lorentz, who first examined the materials, suggested an additional explanation, namely that this superficial abrasion was due to the flooding of the burial features (Lorentz 2006a, p. 293). Concerning the second aspect, namely the completeness and the integrity of the skeletons, almost the totality of the examined collections was evaluated as fragmentary and incomplete. This is mostly due a combination of factors, which, overall, were categorized as physical agents and include trampling, temperature, sediment pressure. A number of Middle and Late Bronze Age Cypriot chamber tombs, including some reported in this dissertation, were disturbed both in antiquity and in modern periods (Bombardieri 2017; Coleman *et al*. 1996; Duryea 1965; Todd 2007). Evidence of post-burial disturbance, particularly from plundering, was noted for instance at Erimi *Laonin tou Porakou*, Episkopi *Phaneromeni* and Alambra *Mouttes*, and suggests that the looters entered the chamber through shafts dug into the roof (Bombardieri 2017; Duryea 1965; Moyer 1989, p. 58; Todd 2007). The collapse of the covering structures together with the trampling appeared to be detrimental to the integrity of the skeletons and more specifically of the bone segments. Indeed, it has been demonstrated that the parts of the bones with thin cortex such as the epiphyses tend to survive in smaller percentages than sections with higher bone mineral density, such as the diaphysis (Andrews & Cook 1995; Olsen & Shipman 1988). This impacted the present study. The location of muscle insertions more frequently observed in the Cypriot materials was on the diaphysis, a more durable section of the bone; while, overall, the number of joint surfaces was considerably low. The two best preserved samples were those from Erimi *Pamboula* and Enkomi. In both cases, a selection of bones was curated for future study, as in the case of Enkomi currently located in the Stockholm Museum, or for display, as in the case of the tomb 1 of Erimi currently located in the Cypriot Museum of Nicosia. This ensured a better preservation of the materials and thus a more proficient collection of data.

A thorough exploration of demographic and taphonomic evidence provided important context for the next stage of the study - the examination of activity patterns through the evaluation of the robusticity ranks distribution by site and period. This analysis has revealed differences in the use of the upper and lower limbs by sex and age. Despite being not equally distributed by site, Chalcolithic males and females displayed distinct patterns. In the case of *Mosphilia,* males stood out by virtue of the higher development of the *costoclavicular* and *conoid ligaments* and *brachioradialis*. The combined utilization of these muscles has been traditionally associated with hoeing, digging and chopping tasks (Paterson 2002, p. 109). This hypothesis was certainly plausible for this archaeological context, where, in effect, the excavators recovered a variety of instruments such as chisels or adzes used for digging (Peltenburg *et al*. 1998, p. 181). Females, in contrast, displayed higher scores of muscles active in lifting such as *trapezoid* or *pectoralis major*. In the case of Lemba, females, which represent the large majority of the examined skeletons, displayed elevated stress at the *trapezoid* and *conoid ligaments, pectoralis major, brachioradialis, deltoideus*, *teres major, biceps brachii* and *supinator,* namely a set of muscles involved in the flexion, internal rotation, abduction and supination of the upper limbs. Among the number of prehistoric activities which might have entailed these motions, pounding and grinding grain were deemed the most plausible. Indeed, on site, the excavators recorded a number of pestles, grinders and hammerstones which suggested that this practice was being carried out. Males were represented by a very low number of entheses which significantly impacted the reconstructions but displayed a similar pattern. It is possible to assume that both the sexes undertook the same level of work intensity (Peterson 2002, p. 101). As for Erimi

Pamboula, only two males were examined; and they displayed stress at the *pectoralis major* and *teres major.* Considering the abundance of instruments associated with butchery like the scrapers and faunal remains, consisting predominantly in deer recovered on the site, hide working was suggested as a very plausible explanation. As for the lower limbs, only the collection from Lemba displayed increasing stress at the *gluteus maximus,* a flexor of the thigh, and this is indicative of the fact that the considered individuals used to move on steep or hilly areas or, alternatively, that they used to maintain a recumbent position for an extended time during the day.

Concerning the Philia-Middle Bronze Age, the comparison of distribution of robusticity ranks between the considered samples showed a homogeneous pattern for the females, while some variations were observed among the males between the examined communities. Females stood out for increasing stress at the extensors and flexors sites (*biceps brachii*, *brachioradialis*, *pronator* and *brachialis)* in addition at the muscles recruited in lifting (*trapezoid* and *pectoralis major*). The archaeological and zooarchaeological data suggest significant changes in subsistence activities from the previous period which have been hypothesized to reflect milking and processing of milk and/or textile processing. Both activities might result in the activity patterns observed in the skeletal data. As for the males, they stood out by virtue of the elevated *conoid ligament*, *pronator*, *interosseous membrane* scores in all the considered sample. The *conoid ligament* and *brachioradialis* are muscles associated to digging or chopping, while *deltoideus*, *biceps brachii*, *supinator*, *pectoralis major* are muscles associated with grinding processes. Thus, both these practices might have been responsible for these patterns. In addition to this, there were site-specific patterns among males. The males buried in the Kalavasos Village Tombs exhibited elevated stress at the *biceps brachii*, *brachialis and brachioradialis*; those from Erimi *Laonin tou Porakou* stood out for high ranking at the *deltoideus*; from Alambra *Mouttes*, the *brachialis* was found to be among the most utilized muscle. The robusticity of the Kalavasos remains has been interpreted in the context of increasing development of metal working activity on the island. It has been hypothesized that crushing, the mechanical separation of the minerals used subsequently for metal objects production (Rostoker 1975), could generate a similar pattern of muscle involvement to that required for grinding foods, although for the last the physical efforts were considerably lower. Concerning the lower limbs, only Kalavasos males exhibited increasing stress at the *gluteus maximus*, which, as has been previously clarified, is indicative of repetitive moving in hilly areas (al-Oumaoui, Jiménez-Brobeil & du Souich 2004, p. 343; Sneddon 2015, p. 143), or of long-time maintenance of a recumbent position in such activities as, for instance, grinding or pounding (Sanchis-Moysi *et al*. 2011, p. 1). As there is an absence of additional data from the settlement, which has not yet been identified, the interpretation of these data was not taken further.

Concerning the Late Bronze Age, because of the absence of male individuals for Kalavasos *Ayios Dhimitrios* and of upper limb entheses for the sample from Enkomi, the discussion of the activity patters was carried out site by site. At Hala *Sultan Tekke*, the robusticity ranks distribution suggested a different use of extensor, flexors and adductors by sex. Males displayed higher scores of these entheses compared with females, who, instead, experienced greater stress at the *triceps brachii*, *pronator teres* and *supinator*. For the males, nothing from the archaeological record was deemed useful to clarify the activities of these individuals. However, the most severe expressions were noted in a skeleton which exhibited evidence of poor health status and peri-mortem trauma on the skull. It was suggested in this case that the revealed activity pattern could be compatible with the gesture of the throwing a spear, already documented in other prehistoric contexts (Peterson 2002). As for the females, the resulting patterns may indicate a repetitive set of movements which were typical of spinning and weaving. It is undoubtedly interesting that the female skeletons which exhibited the highest ranks seem to have belonged to a different social status: this is suggested by the types of the burials goods which accompanied the buried (including valuable items in one case and nothing in the other) and by a preliminary assessment of the health status of the occupants of the tombs by the anthropologists (indicating malnutrition in one case and a generally good health status in the other). Concerning the sample from Kalavasos *Ayios Dhimitrios*, individuals were excavated in proximity to the residential Building X and, thus, were supposed to be part of the elite of the town. This hypothesis was in effect confirmed by the rich burial assemblage retrieved in the two funerary contexts considered. The data resulting from their examination suggested stress only at the *triceps brachii* and *brachioradialis*; these data are insufficient to confidently identify a possible explanation for this evidence, but it must be stated that both the muscles are among those involved in fiber manipulation for textile production, while among the personal belongings associated with the buried the archaeologists recovered an ivory spindle whorl (South 2000, p. 3). Finally, although at least one or two lower limb entheses per sample exhibited severe robusticity, a general comparison of the data from the three samples suggested an overall low development of these muscles.

For all the periods considered, the severity distribution of this marker increased from the young to the mature adults, and this confirms the assumption that age must be regarded as one of the most important confounding factors in entheseal development. In other words, the entheses accumulated changes in appearance during the lifecourse; and this process is independent of the activities performed by the individual.

Concerning the evaluation of the enthesopathies, the two markers displayed different patterns of distribution. The osteolytic lesions did not reflect the severity distribution of the robusticity ranks. Some entheses were more affected than others regardless of their representation within the sample. This finding, in effect, corroborated the results of other studies which have demonstrated that the morphology of the enthesis plays a central role in the occurrence of this marker (Henderson *et al*. 2013, p. 159). More specifically, the more severe forms of these lesions were observed on entheses which had covered the longest distance in their migration to reach the final location (Dörfl 1980). Additionally, it has been observed that males, who were represented by a lower number of entheses displayed the highest rate of the marker. Concerning the enthesophytic formations, their distribution reflected the distribution of the robusticity ranks. Thus, while the osteolytic lesions cannot be unambiguously associated with specific tasks carried out by the communities under study since they might be in part due to physiological response of the bone tissue to the skeletal growth or to a traumatic event, the enthesophytic formations contribute to the identification of the activity patterns of the examined skeletons. The combined evaluation of robusticity, osteolytic lesions and enthesophytic formations have demonstrated how physical stress, in a broader sense, may produce predictable and measurable responses in bone.

The evaluation of the osteoarthritic evidence recorded on the examined skeletons did not significantly contribute to the identification of activity patterns of the communities under consideration. Only 12 articular surfaces in total, of 184 observed, were affected by osteoarthrosis. The rates of prevalence of this skeletal indicator did not overall exceed 10%. This finding was undoubtedly due to a combination of factors including the age of subjects which predominantly fall in the young-middle adult categories - indeed, this pathological degeneration of the joints rarely occurs before the fourth decade (Loeser 2013; Ortner 2003, p. 547; Sofaer-Derevenski 2000) - and the very low number of joints included for study, due to the general poor status of preservation of the Cypriot skeletal materials.

The evaluation of the extra-masticatory dental wear recorded on the examined osteological collections suggested that tasks undertaken did not result in visible impact to the teeth. The low prevalence of grooving (one case for the Chalcolithic period), LSAMAT (two cases for the Philia-Middle Bronze Age) and notching (three cases, one for the Chalcolithic and two for the Philia-Middle Bronze Age) did not permit any hypotheses regarding specific activity patterns to be made. Three reasons were suggested to explain the scarcity of this evidence: i) the working activities carried out by the examined individuals did not involve the teeth; ii) the activities carried out were partially accomplished with the use of teeth, but because of the younger age of the individuals under study, and the potentially very soft and certainly perishable (e.g., vegetable fibers) nature of the processed materials, they had not sufficient time to develop any dental defects; iii) the materials were treated by more than one person, spreading the impact of this practice across members of the community and thereby diminishing its impact on a single individual.

To recap, all the osteological collections included in this research have been treated as samples from which to infer the life conditions and the activity profiles of those communities who lived in Cyprus between the MChal and LBA. They do not reflect the entire composition of the original populations as i) none of the considered sites was extensively excavated, ii) recovery and documentation of the burials were often conducted inadequately. Certainly, the fragmentary status of preservation of the considered collections prevented a deep understanding of the level of muscle and joint development. However, despite being aware of these limitations, mainly determined by the geographical and historical context, the present research has successfully contributed to new evidence for inherent behaviors and subsistence activities of Chalcolithic-Late Bronze Age Cypriot populations. This corroborates and advances the archaeological, zooarchaeological and archaeobotanical data by providing additional information concerning the distribution of the most-demanding tasks among the members of these communities. It has revealed how these distinctions were essentially sex-based during the whole of Cypriot prehistory; and that, even with the rise of a social elite, the same tasks may still have been carried out independently of the social status of the individual. This study has also offered new evidence for reconstructing how technological innovations (e.g., plough), which accompanied the lifecycle of the sites, led to an overall improvement of the health status of the occupants, who tended to live longer in the most recent periods compared with the Chalcolithic and experienced a gradual reduction of their musculo-skeletal load. It has suggested that certain methods of working and producing were perpetuated across the time (e.g., cooking, food processing or textile production). This study has demonstrated that even among poorly preserved or commingled osteological collections, anthropological methods, accurately selected, may generate precious sets of data that can be integrated into interpretations that reveal a past population's lifeways. Furthermore, as already stated, this dissertation covered a crucial chronological framework, as a long transitional phase which will lead to the rise of the town. Understanding the social, economic and cultural dynamics which accompanied this historical process in Cyprus may certainly elucidate on contemporary phenomena and events which occurred in the entire Near East in the same period. Thus, a reconsideration of the importance of these osteological collections, which, for a long time, have been neglected because of their status of preservation, is vital. The effects of the social and economic interactions of contemporary near eastern populations have manifested in several, different ways: transfer of technological skills, exchange of material products, adoption of rites and habits. The human remains represents the most direct source of knowledge of all these social changes. Finally, this research advocated for the argument that the archaeological study of material production of any kind deserves to be deepened not just by discussing technological developments, typological classifications or decorative styles, but also by investigating the human component, namely the activities that were undertaken in the production and use of technology and material culture.

However, this research has also raised other questions related to the identification of specific movements or gestures associated with the number of steps included in craft activities such as the textile manufacturing or pottery production. In this sense, the exploration of this issue from a biomechanical, clinical perspective appears essential. The assessment of muscles or joints developments from osteological collections in which sex, age and occupations are known is fundamental for creating a reference for studies of past communities. Future research in this field could include the reconstruction of 3D models in order to recreate the biomechanical involvement which was supposed to be the origin of specific categories of gestures and/or tasks. In this sense, it would be advisable a greater inclusion of skeletal materials from other geographical areas in the Near East, in order to assess potential differences in carrying out certain activities within contemporary communities. To date there are no studies or research groups which have utilized this multi-scalar approach to gain a better understanding of the strategies of division and organization of labour in prehistoric Near East. Thus, it would be helpful the creation of research groups composed of model-makers, specialist physicians, archaeologists, physical and cultural anthropologists in order to explore this issue from a variety of perspectives. For all the above reasons, it can be concluded that the osteological collections considered in this research are the key to elucidate on a number of historical questions which still need to be answered and thus should be re-examined in future to explore additional aspects related to the lifestyle of these communities.

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Appendix I

Chalcolithic collection

Since the impressive amount of data resulted by the site-by-site analysis, which allowed to record all the permutations of data and catch each valuable evidence, it was deemed appropriate to present the largest and most impacting assemblages in the main text of thesis and the smaller ones as Appendices.

Erimi Pamboula

Paleodemography

The biological sex and mortality profile of adults from the M-LChal site of *Pamboula* is presented in table I-1. Sex estimation was possible for both the individuals, categorized as males. Age estimation was possible in only one case of two: it was a middle adult (25-34 years). Neither young adults (20-24 years), mature adults (35-44 years) nor old adults (45+) were found.

Since the very small sample size, it is impossible to draw any detailed conclusions about the mortality profile of the site in this period.

Table I-1. Pamboula: Age and sex composition of the sample. ND: not determined. %: within the sex

	Young adult 20-24		Middle adult 25-34		Mature adult 35-44		Old adult 45+		ND		Total	
	N	%	N	%	N	%	N	%	N	%	N	100.0
Male	0	0.0	1	50.0	0	0.0	0	0.0	1	50.0	2	0.0
Female	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
ND	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	100.0
Total	0	0.0	1	50.0	0	0.0	0	0.0	1	50.0	2	100.0

Entheseal Changes

Robusticity: relationship between score development, enthesis, and functional complex

The evaluation of the ECs of this sample was carried out on a total of 23 entheses belonging to the two individuals. As can be noted in figure I-2, nine entheses of 21 were well represented as their BRI value exceeded 50.0%. Five entheses were poorly represented: the *pectoralis major* (clavicle), the *brachioradialis*, the *interosseous membrane,* the *supinator,* and the *quadriceps tendon* (patella). The remaining were not examined as they were not preserved.

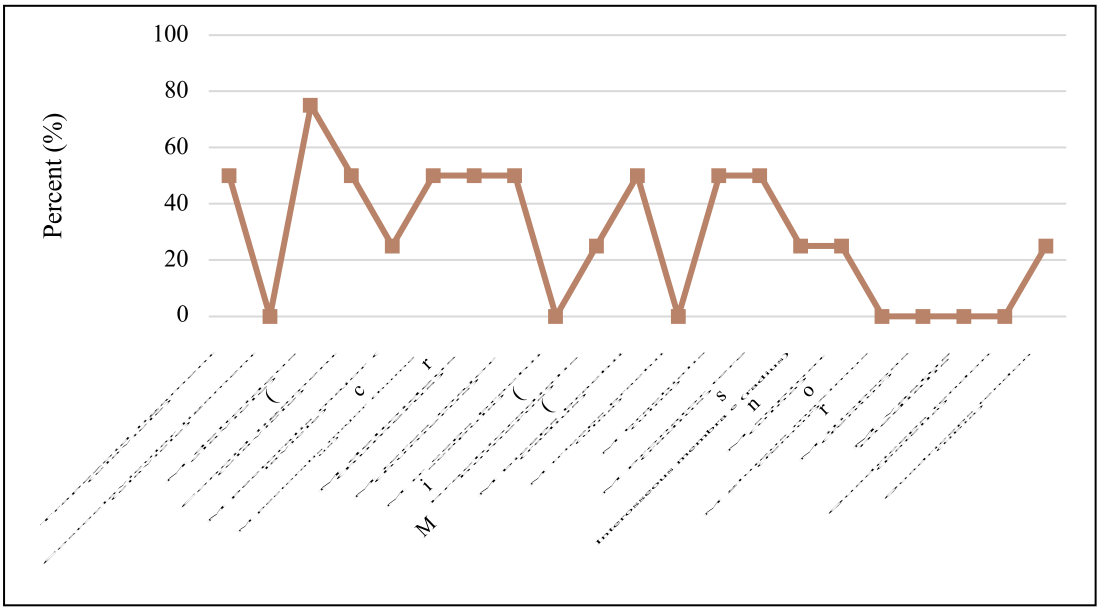

Figure I-2. Pamboula: Entheses representation (%) within the whole sample. N:23.

The *deltoideus* (clavicle) was the most frequently assessed (2/23, 13.0%). In contrast, the *pectoralis major* (clavicle), the *brachioradialis*, the *pronator teres*, the *interosseous membrane*, the *supinator*, and the *quadriceps tendon* (patella) were the least preserved (1/23, 4.3%).

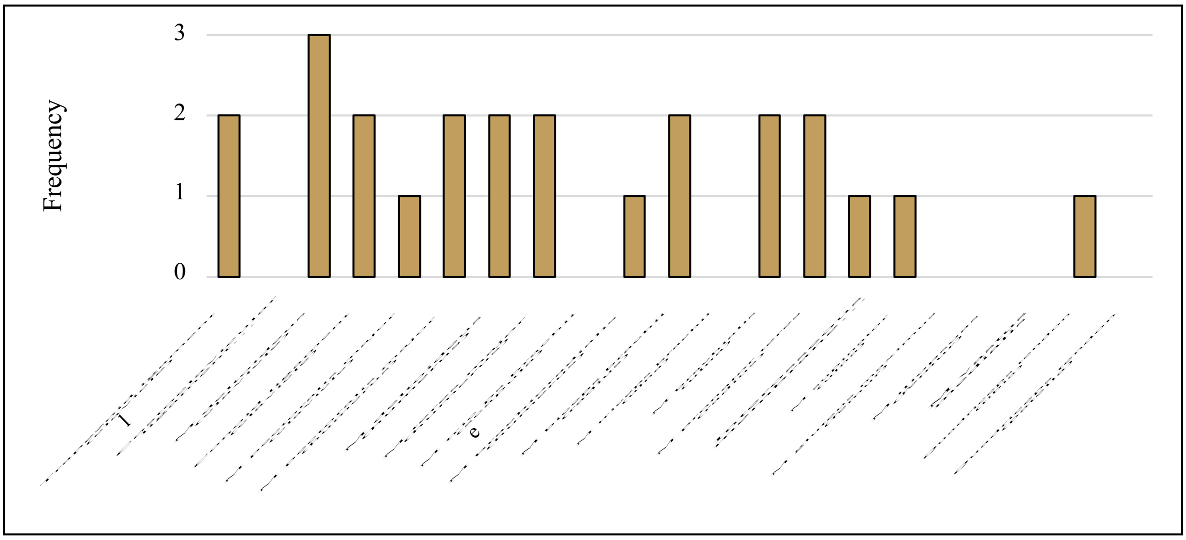

Figure I-3. Pamboula: Frequency distribution of the observed entheses by muscle. N:23.

It is evident by this first assessment that there was a bias between the best (*deltoideus*) and the least (e.g., *brachioradialis*) represented enthesis of the order of 1:3. This finding combined to the very small sample size (23 entheses from two individuals) did not allow a proper evaluation of the level of physical stress experienced by the two individuals. However, it was noted a prevalence of mild forms on the majority of entheses examined (Figure I-4). The most severe forms were recorded on the *pectoralis major* (humerus) and *quadriceps tendon* (patella), both exhibiting 100.0% of moderate degrees, and on the *brachioradialis*, this latter exhibiting one severe robusticity degree.

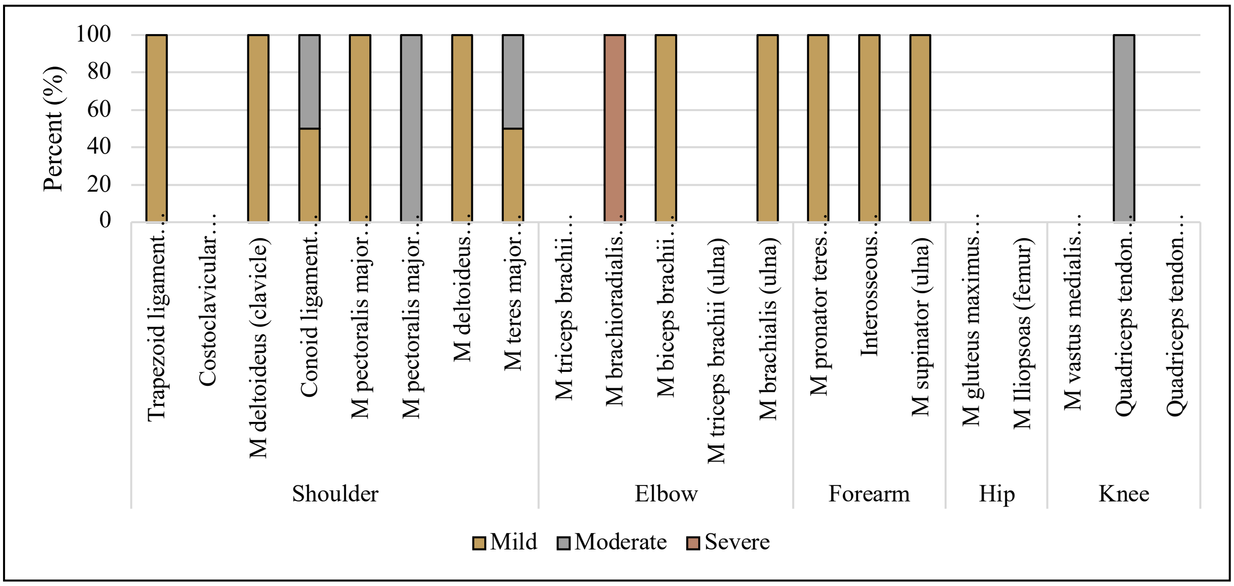

Figure I-4. Pamboula: Frequency distribution of mild and moderate robusticity ranks by enthesis. N:23.

By pooling the entheses in functional complexes, it is more evident that the majority of the recorded entheses were pertained to the shoulder (14/23, 60.9%) and the elbow (6/23, 26.1%); while only one enthesis was observed for the knee (4.3%), and so, was not useful to infer the level of development of the entire functional complex. (Figure I-5).

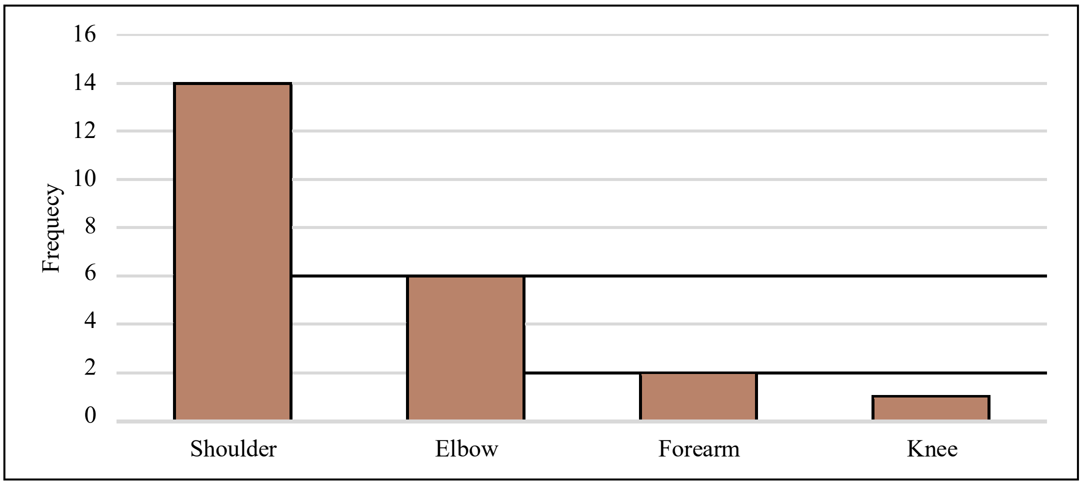

Figure I-5. Pamboula: Frequency distribution of the observed entheses by functional complex. N:23.

As for the shoulder and the elbow, a prevalence of mild forms was noted: a low percentage of moderate degrees (4/14, 28.6%) was, additionally, found on the shoulder, and a very low percentage of severe forms (1/6, 16.7%), on the elbow.

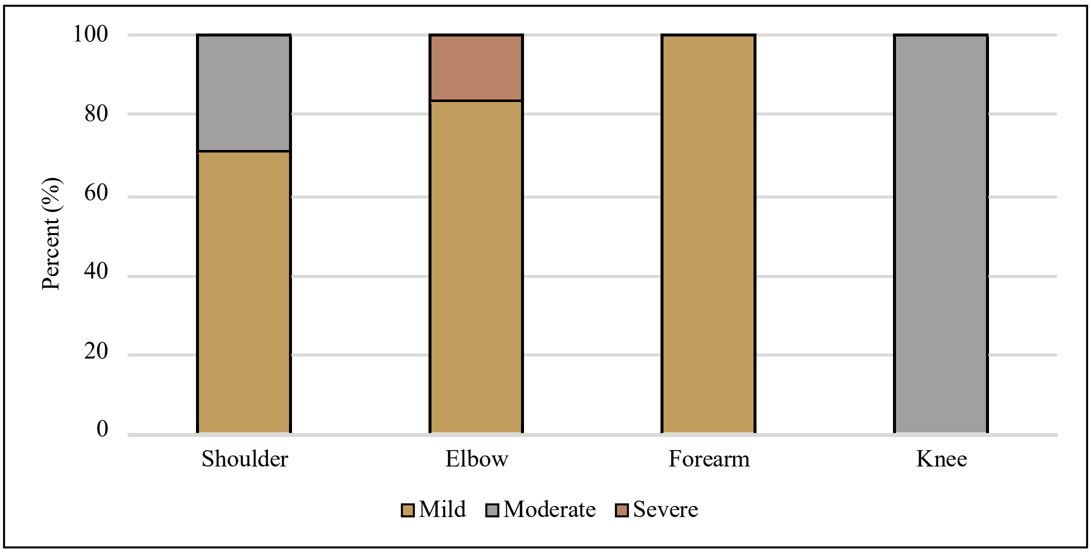

Figure I-6. Pamboula: Frequency distribution of mild, moderate, and severe robusticity ranks by functional complex. N:23.

Robusticity: relationship between score development and side

Concerning the bilateral asymmetry, figure I-7 shows that the majority of the examined entheses were equally represented by side, and displayed an equal distribution of mild and moderate ranks *(Figure I-8)*. In a very few cases was observed a prevalence of moderate degrees on the right side compared to the left: this occurred on the *conoid ligament* and the *teres major (Figure I-8)*.

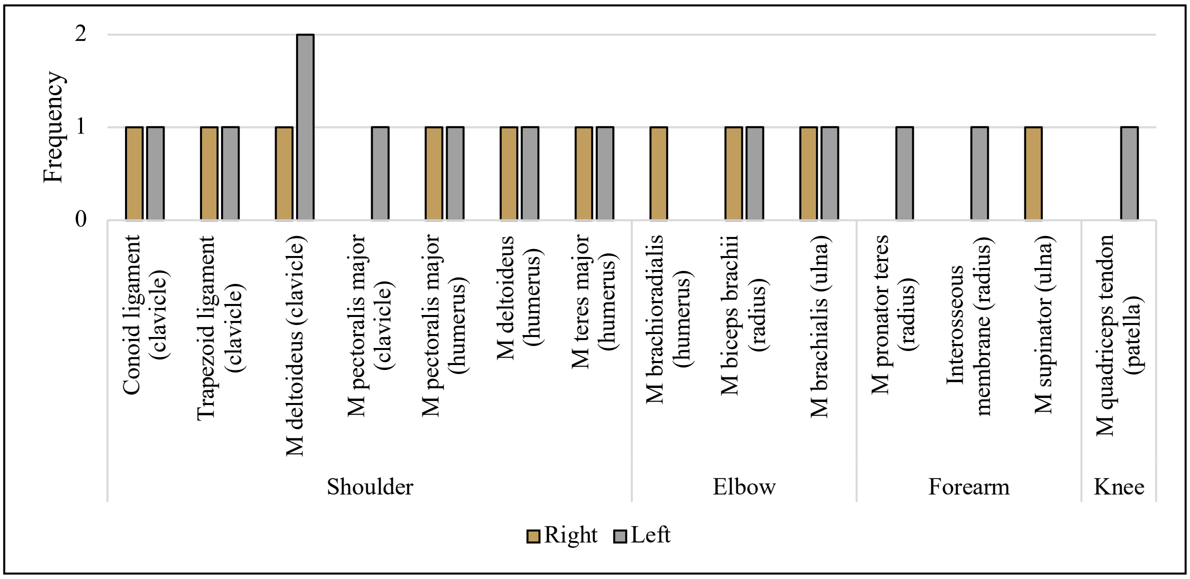

Figure I-7. Pamboula: Frequency distribution of the observed entheses by side. N:23.

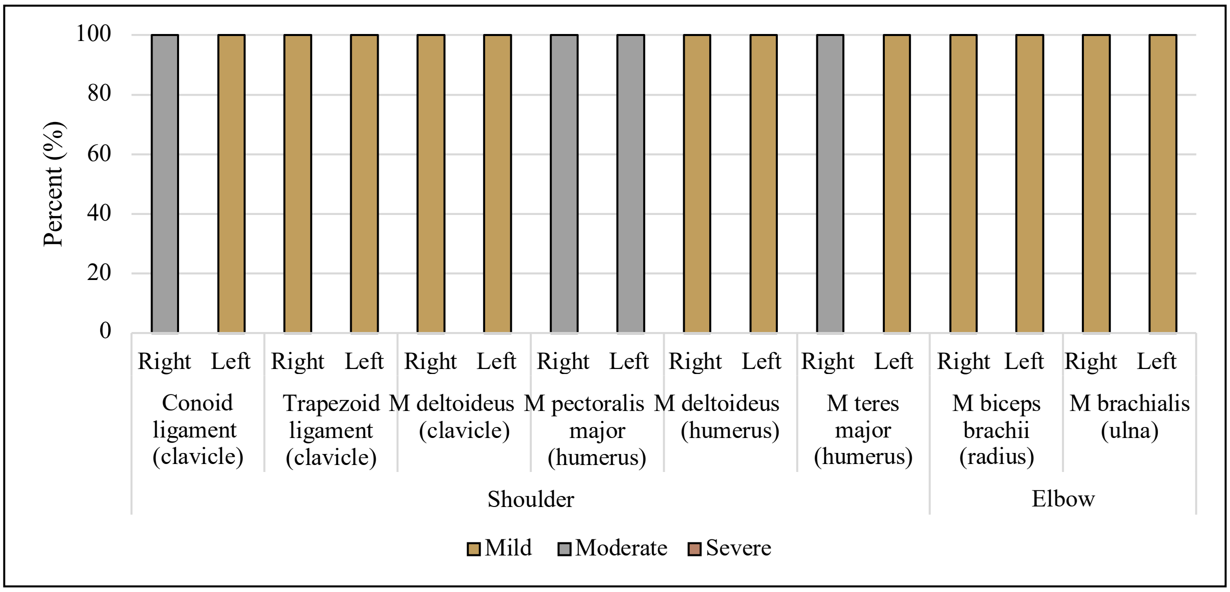

Figure I-8. Pamboula: Frequency distribution of mild, moderate, and severe robusticity scores between sides. N:23.

By pooling the entheses in functional complexes, the knee was the only functional complex excluded from comparisons as it did not provide entheses on the right side. The elbow and the forearm were equally represented by side. For which concerns the shoulder, the number of entheses recorded for the left side slightly exceeded (8/14, 61.5%) the number of entheses recorded for the right side (6/14, 60.0%).

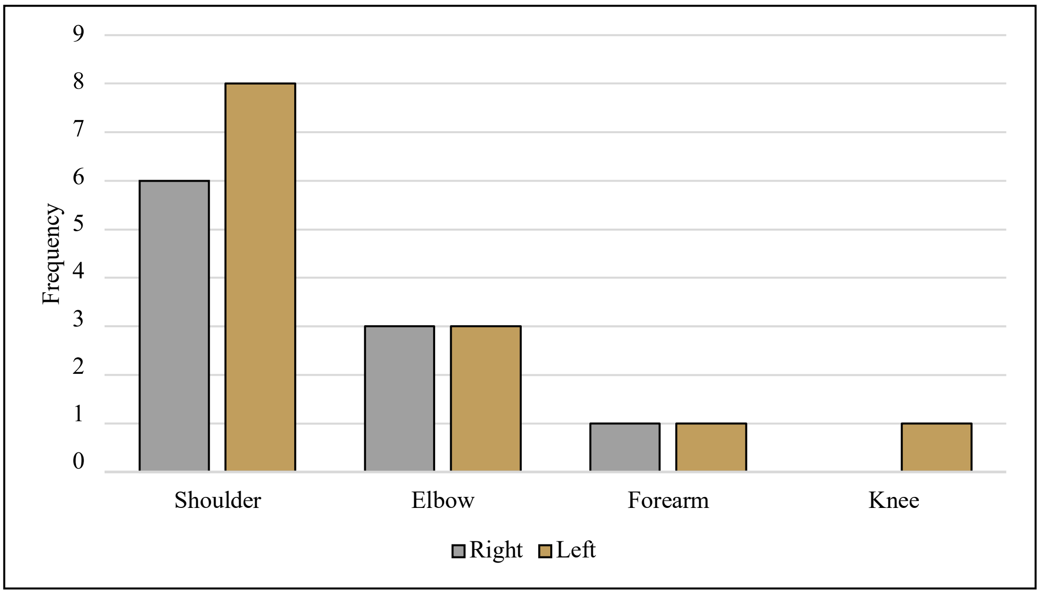

Figure I-9. Pamboula: Frequency distribution of the observed entheses by side (pooled functional complexes). N:23.

The robusticity ranks distribution reported in figure I.10 suggests a greater utilization of the right side of the shoulder and the elbow. More specifically, the former exhibited 50.0% (3/6) moderate degrees compared with 12.5% of the left side; while the last, 33.3% (1/3) severe forms compared with 0.0% of the left. No difference between the sides were, instead, observed on the forearm. The differences were however not statistically significant (shoulder p-value=0.282, elbow p-value=0.700, forearm p-value=1.000).

Since the presence of only two males one of which of unknown age within this sample, no comparisons between sexes and age categories were carried out.

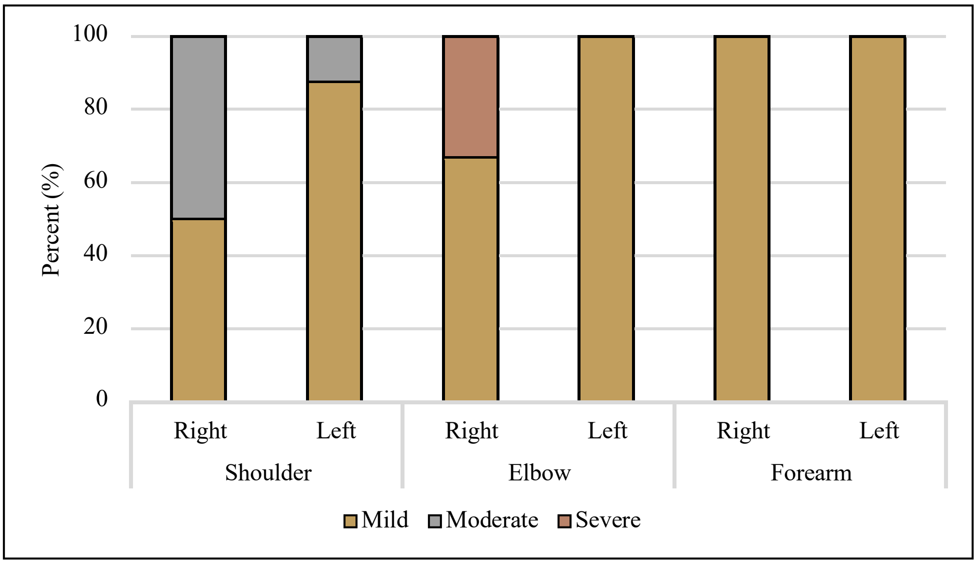

Figure I-10. Pamboula: Frequency distribution of mild, moderate, and severe robusticity ranks by side (pooled functional complexes). N:22.

Osteolytic and Enthesophytic formations: relationship between score development, enthesis, and functional complex

OLs and EFs were not present on all the entheses observed. More specifically, the formers affected 17.4% (4/23) of the total observed entheses, all ranked as mild: a *conoid ligament*, a *trapezoid ligament* and two *biceps brachii* (Figure I-11).

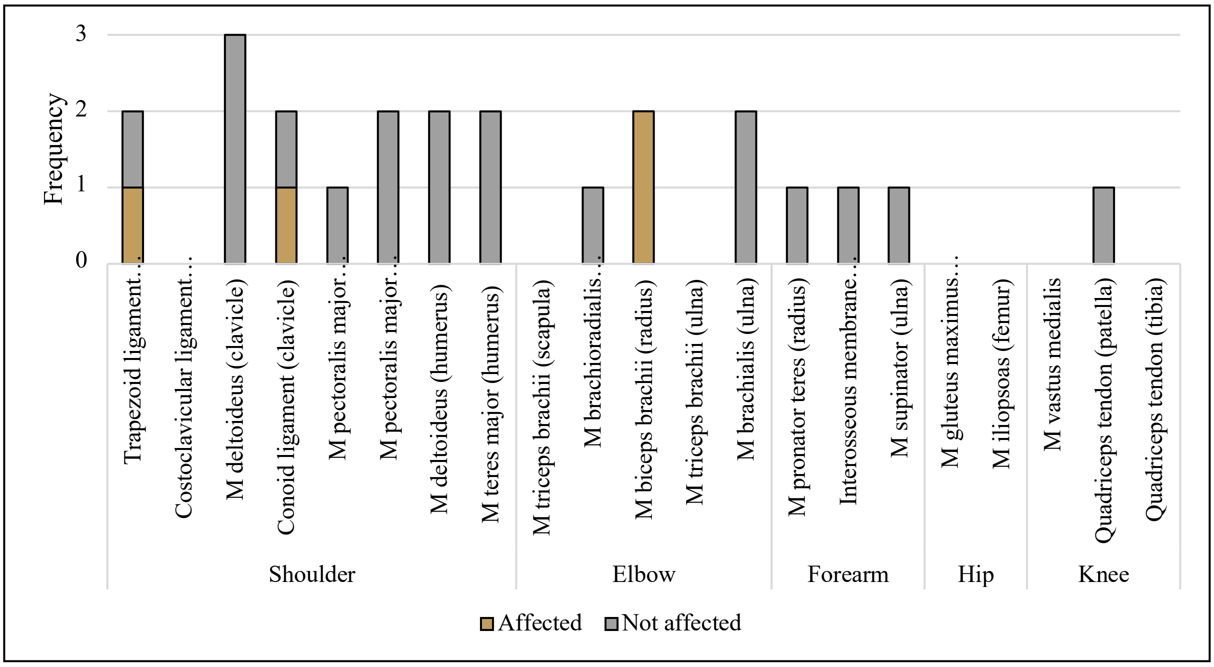

Figure I-11. Pamboula: Frequency distribution of the entheses affected by OLs. N:23.

As for the EFs, this marker affected 13.0% (3/23) of the observed surfaces, all ranked as moderate: a *pectoralis major* (humerus), a *brachioradialis*, and a *quadriceps tendon* (patella) (Figure I-12).

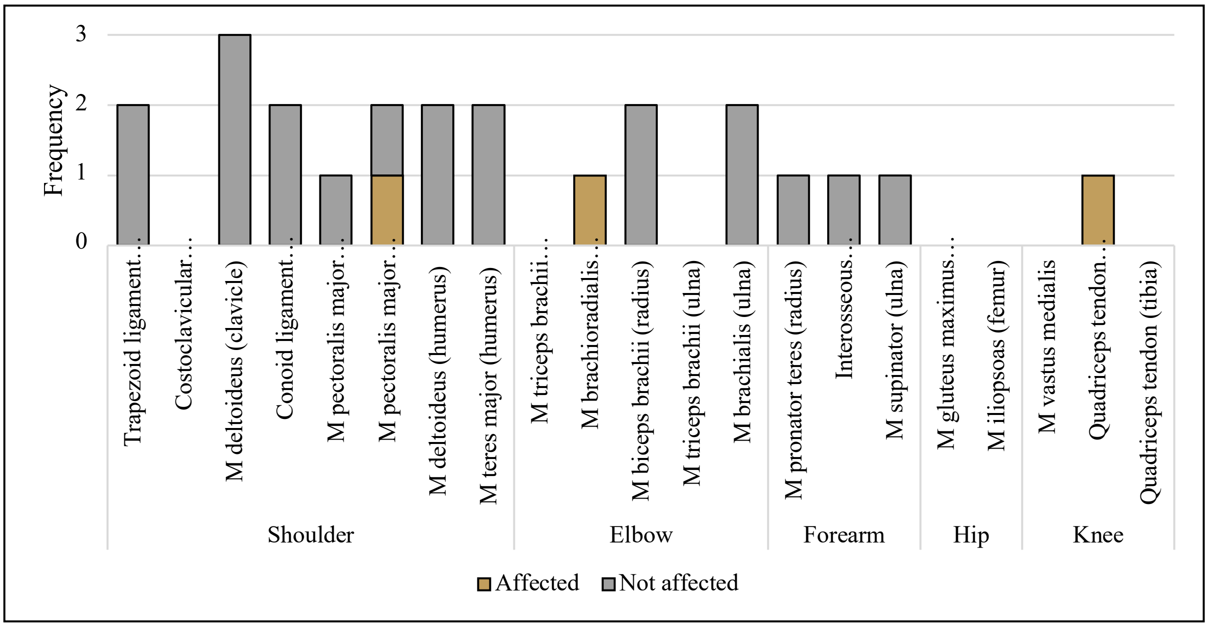

Figure I-12. Pamboula: Frequency distribution of the entheses affected by EFs. N:23.

<u>Osteolytic and Enthesophytic formations: relationship between score development, side, sex, and age</u>

Since the number of surfaces affected and the mere presence of mild forms, in the case of the OLs, and of moderate degrees, in the case of the EFs, no comparison between sides was carried out. Moreover, the presence of two males, one of which of unknown age, did not allow any comparison between sexes and age categories.

Osteoarthritis

Only a joint surface was detected on the two skeletons: a right radial capitulum of the individual deposed in tomb 2. It did not appear affected by OA.

Extra-masticatory dental wear

A total of 6 maxillary and 7 mandibular teeth belonging to the individual deposed in tomb 2 were examined for evidence of extra-masticatory dental wear. No case was noted. Thus, no comparison between sexes and age groups were allowed.

Summary

In sum, only two individuals from the site of Erimi *Pamboula* were included in this dissertation: both males, one of uncertain age and one middle adult. Thus, no comparison between sexes and age groups was allowed. On the basis of the evaluation of the robusticity ranks scored for ECs, it is possible to assert that the *brachioradialis*, the *pectoralis major*, the *teres major*, and the *conoid* were the muscles mostly recruited for habitual tasks, but only the last showed a right-side asymmetry. For which concerns the OLs, they occurred on four entheses (a *conoid ligament*, a *trapezoid ligament*, and two *biceps brachii*) in mild forms. For which concerns the EFs, they occurred on three entheses (a *pectoralis major* (humerus), a *brachioradialis*, and a *quadriceps tendon* (patella)) in moderate forms. No evidence of OA or extra-masticatory dental wear were found.

Appendix II

Philia-Middle Bronze Age II collections

Marki Alonia

Paleodemography

The biological sex and mortality profile of adults from the Philia-MBA site of Marki is presented in table II.1. Sex estimation was possible for all the individuals. The two sexes were equally represented. Age estimation was possible for all the skeletons included in the study. Three of the four age categories are represented: the young (20-24 years), the middle (25-34 years), and the mature (35-44 years) adults. No old adults (45+) were identified. The majority of adults fell within the range of young adults (20-24 years).

Table II.1. Marki: Age and sex composition of the sample. ND: not determined. %: within the sex.

	Young adult 20-24		Middle adult 25-34		Mature adult 35-44		Old adult 45+		Total	
	N	%	N	%	N	%	N	%	N	%
Male	2	100.0	0	0.0	0	0.0	0	0.0	2	50.0
Female	0	0.0	1	50.0	1	50.0	0	0.0	2	50.0
Total	2	50.0	1	25.0	1	25.0	0	0.0	4	100.0

The bar chart in figure II.2 illustrates the age distribution of the sample by sex. Overall, the males age distribution reflects the young group, while the two females were a middle and a mature adult.

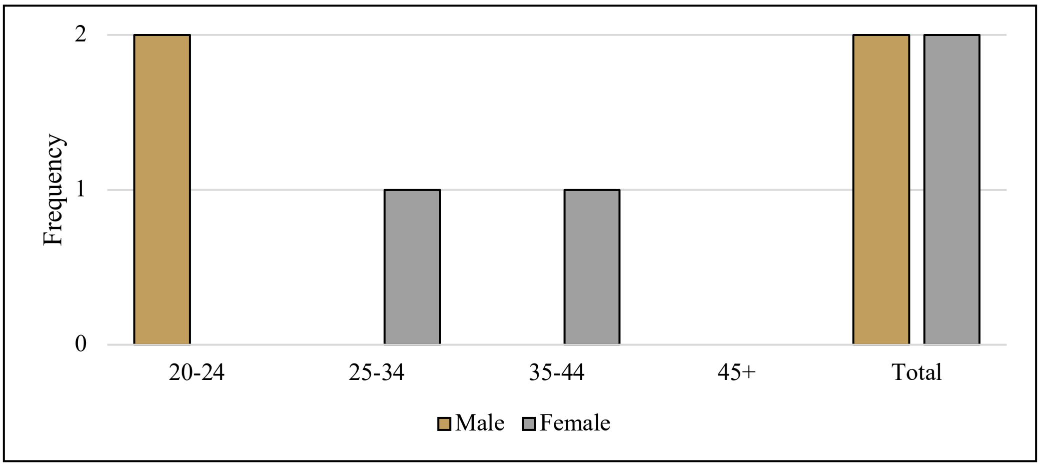

Figure II.2. Marki: Age distribution of the sample by sex. N:4.

Entheseal Changes

<u>Robusticity: relationship between score development, enthesis, and functional complex</u>

The evaluation of the ECs of this sample was carried out on a total of 39 entheses belonging to four individuals.

As can be noted in figure II-3, the BRI values were overall low: only two entheses were found to be well represented (*trapezoid ligament*, *deltoideus* (clavicle)), yielding 4/39, 10.3% of all the recorded entheses. While two were not represented at all (*triceps brachii* (scapula) and quadriceps tendon (tibia)).

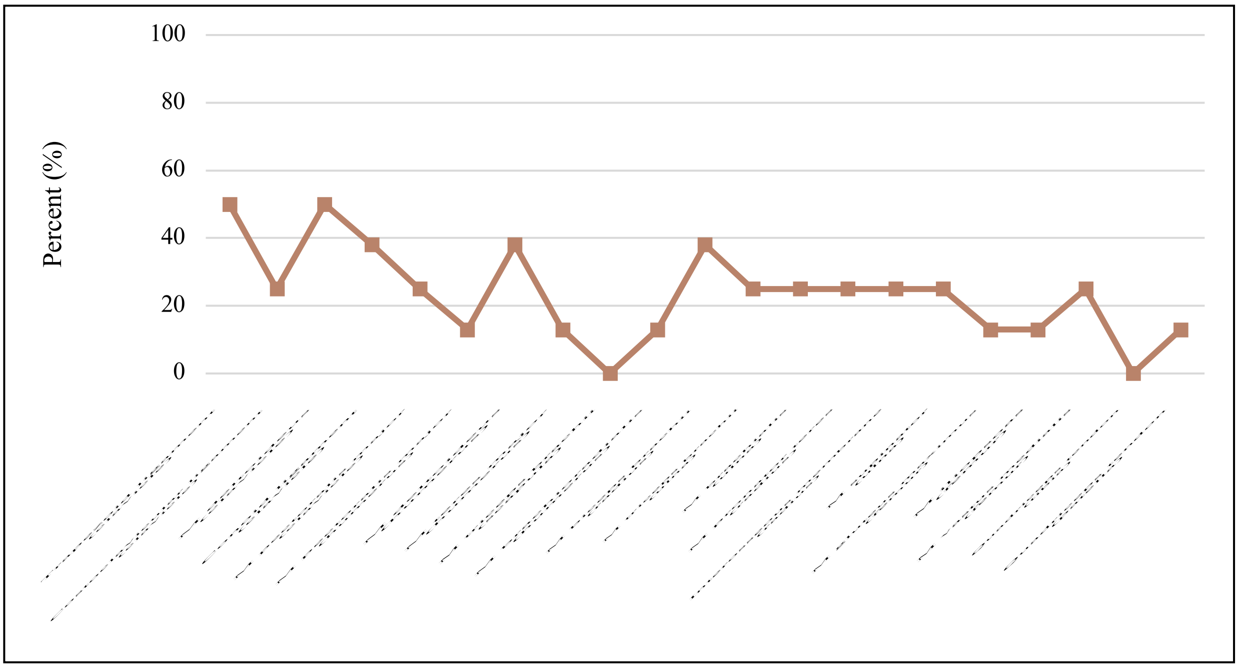

Figure II-3. Marki: Entheses representation (%) within the whole sample. N:39.

Six entheses in total, including the *teres major* (humerus) and *quadriceps tendon* (patella), were recorded in only one case (2.6%) (Figure II-4). This assessment led to ensure that the bias between the most and the least represented entheses was of the order of 1:4.

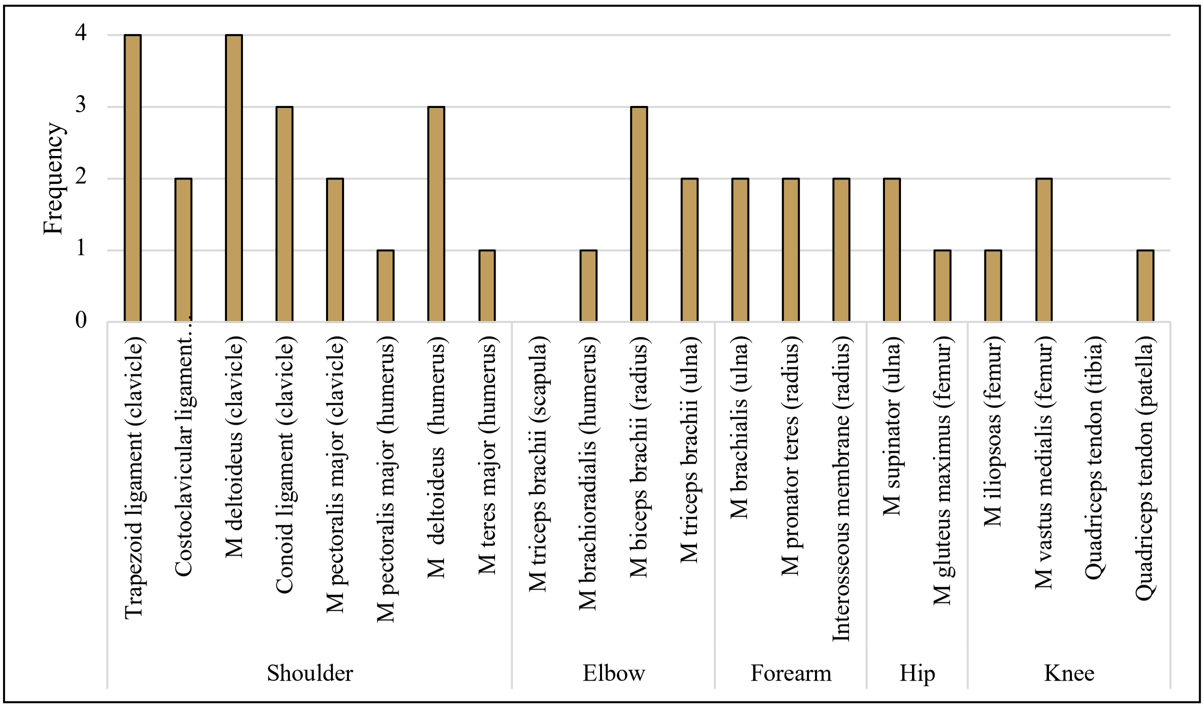

Figure II-4. Marki: Frequency distribution of observed entheses by muscle. N:39.

No evidence of severe robusticity was found. Overall, the entheses were slightly developed (31/39, 79.5%). Moderate degrees were assigned to a total of eight entheses, in greater extent (100.0%) on the *pectoralis major* (humerus) and the *brachioradialis*. The highest ranking, however, refer to a single enthesis observed, so they were inconsistent to draw a pattern of development of such muscles. The best represented *trapezoid* and *deltoideus* (clavicle) were slightly developed with only a low percentage of moderate degree (25.0%, ¼).

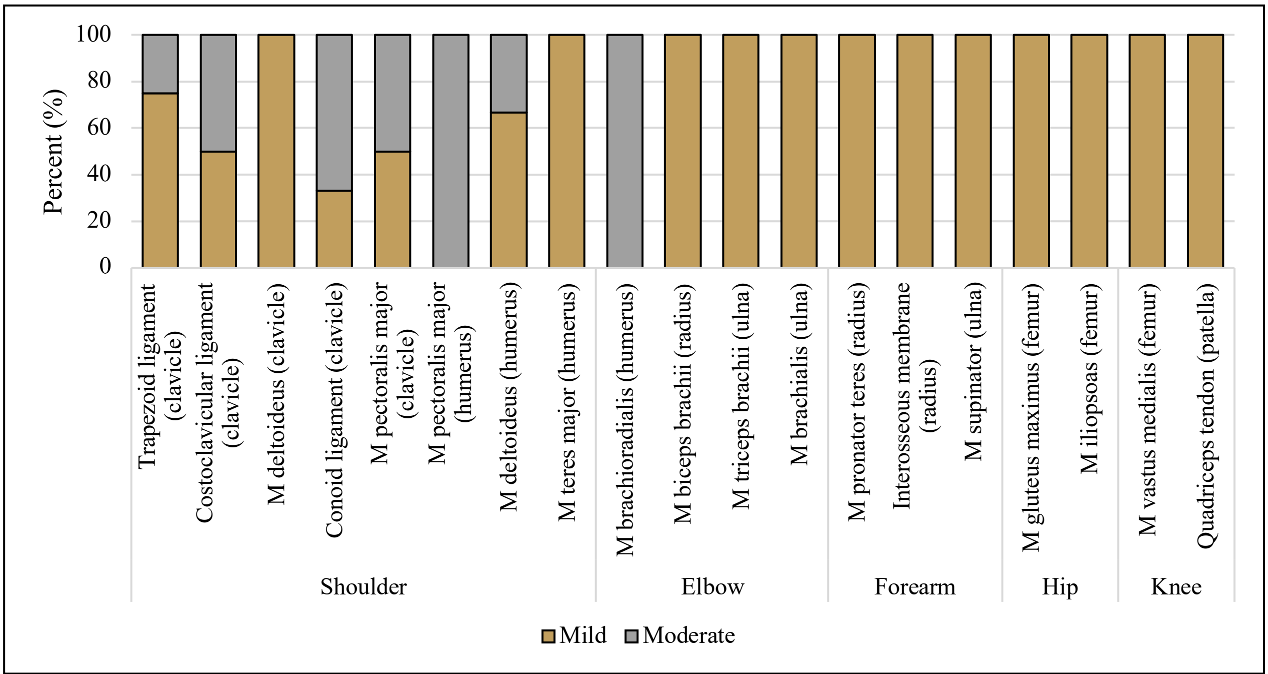

Figure II-5. Marki: Frequency distribution of mild, moderate, and severe robusticity ranks by muscle. N:39.

<u>Robusticity: relationship between score development, side, sex, and age</u>

Concerning the comparison between sides, all the entheses except the *deltoideus* (humerus), the *biceps brachii* and, the *conoid*, were equally represented by side. Eight entheses in total, including the *pectoralis major* (humerus) and *teres major*, were excluded from comparison as they were represented by only one side (Figure II-6).

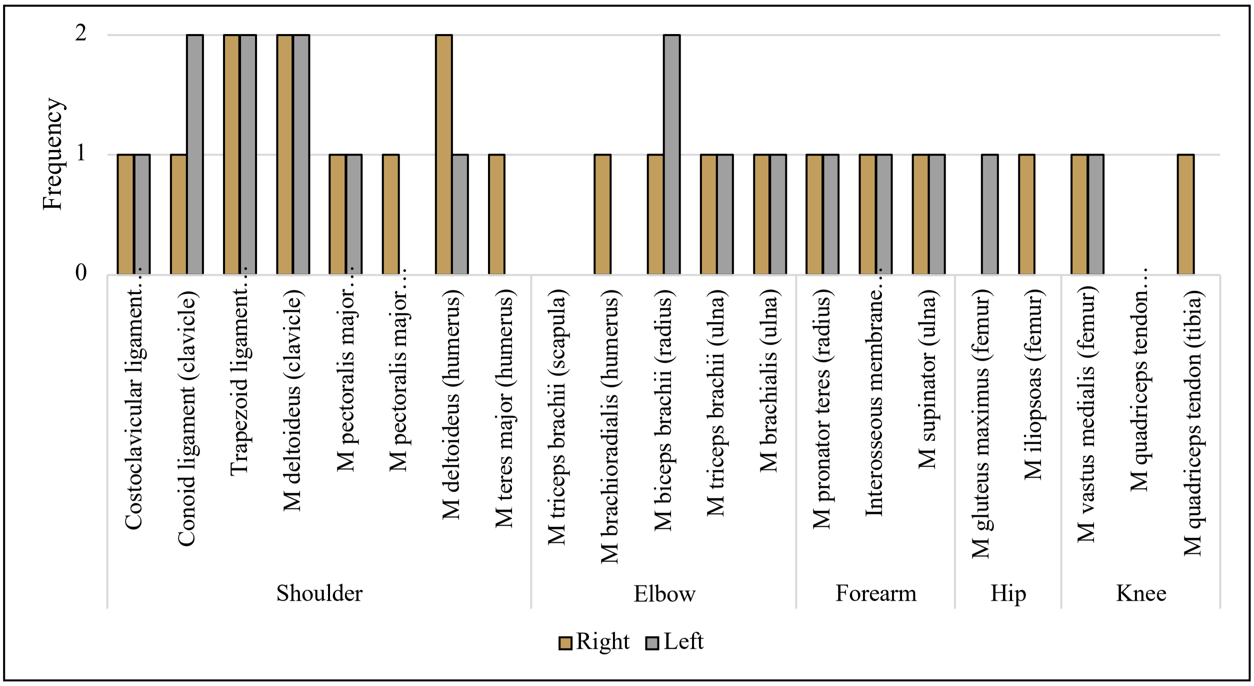

Figure II-6. Marki: Frequency distribution of observed entheses by side. N:39.

Figure II-7 shows that a right-side asymmetry was observed on the majority of the comparable muscles belonging to the upper limb, except the *costoclavicular*. No differences between the sides were noted on the lower limb entheses.

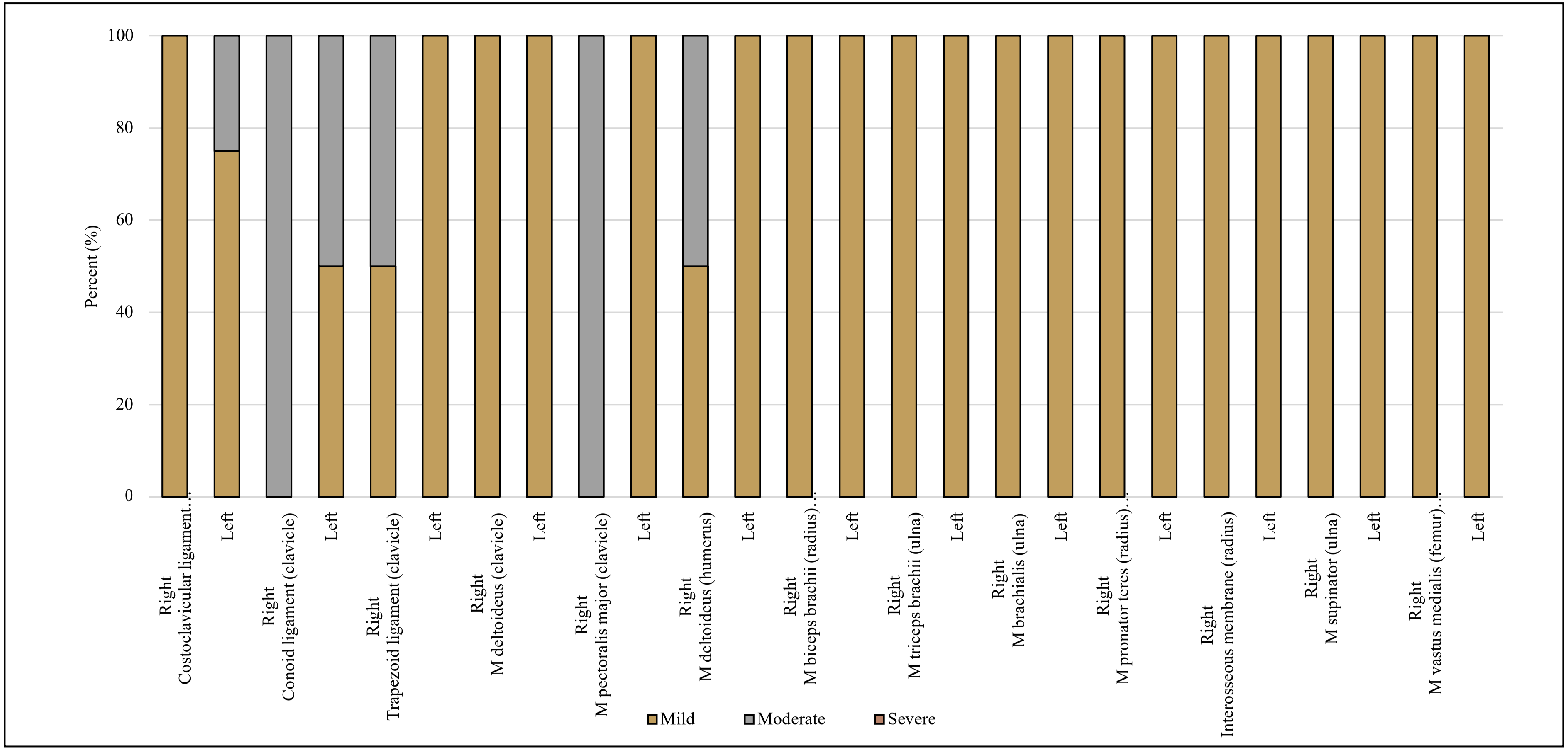

Figure II-7. Marki: Frequency distribution of mild and moderate robusticity ranks by side. N:12.

Looking at the functional complexes, except the shoulder and the knee, which were better represented by the right-side entheses, the other complexes were equally represented by side (Figure II-8).

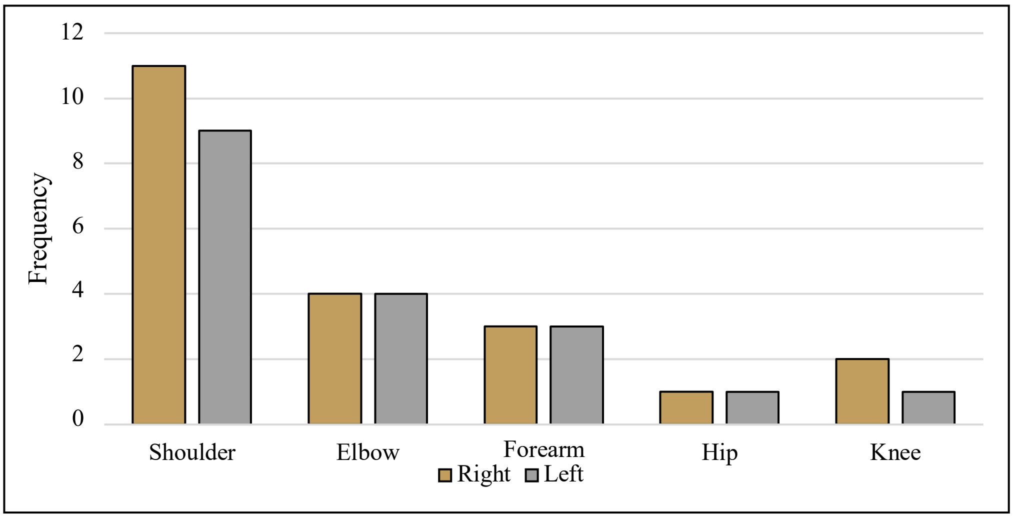

Figure II-8. Marki: Frequency distribution of observed entheses by side (pooled functional complexes). N:39.

Thus, whereas in the forearm, the hip, and knee, no difference between the sides was observed, in the case of the shoulder and the elbow the right side was more severely affected than the left (Figure II-9). On the shoulder, the percentage of moderate degrees observed on the right side (5/11, 45.5%) exceeded the percentage of the same rank recorded on the left side (2/9, 22.2%); as for the elbow, moderate degrees were observed only on the right side (¼, 25.0%). These differences were however not significant (shoulder p-value=0.412, elbow p-value=0.686, forearm p-value=1000, hip p-value=1.000, knee p-value=1.000).

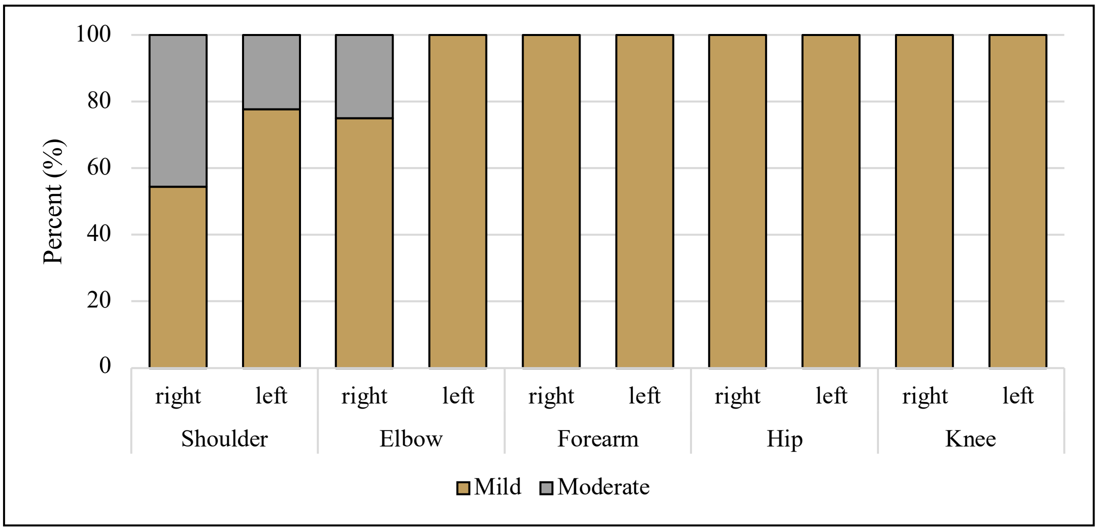

Figure II-9. Marki: Frequency distribution of mild and moderate robusticity ranks by side. N:39.

Concerning the comparison between sexes, females yielded the greatest number of entheses (=31) compared with the males (=8). Only three entheses were equally represented: the *trapezoid*, the *deltoideus* (clavicle), and the *vastus medialis*. As for the *conoid*, the *pectoralis major*, and the *biceps brachii*, the ratio between the best and least represented sex was of the order of 2:1 towards the females. The remaining entheses were merely detected on females (Figure II-10).

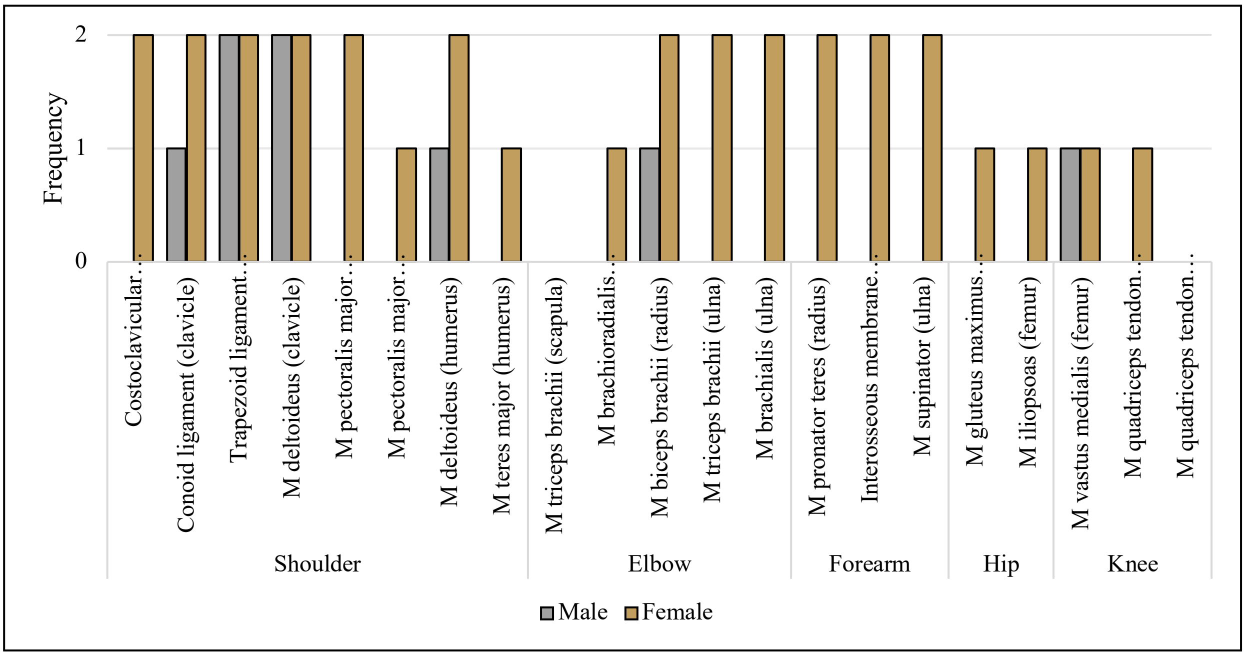

Figure II-10. Marki: Frequency distribution of the observed entheses by sex. N:39.

Hence, concerning the six sub-mentioned comparable entheses, differences in ranking were noted only on the *conoid*, the *trapezoid,* and the *deltoideus*. In the former case, the only male enthesis observed was ranked as moderate; while for the *trapezoid* and the *deltoideus*, the females exhibited the more severe degrees. It must be borne in mind, however, that this finding might be dependent on the disparities in representation. Except for these muscles, the females exhibited increasing stress at the *costoclavicular*, the *pectoralis major*, and the *brachioradialis* (Figure I-11).

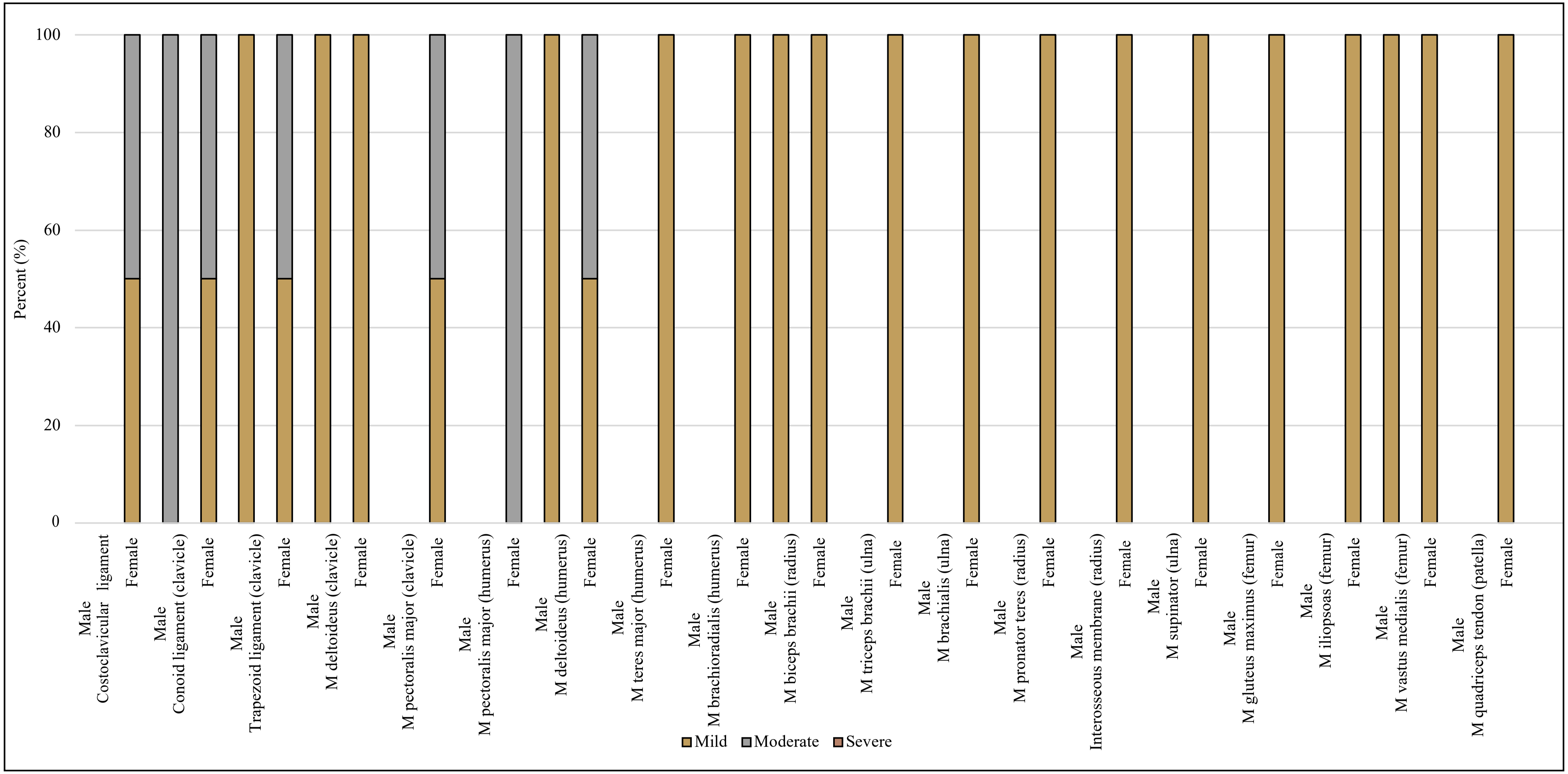

Figure II-11. Marki: Frequency distribution of mild and moderate robusticity ranks by sex. N:39.

By pooling the entheses in functional complexes, the forearm and the hip were excluded from comparisons as they were only represented by females. The shoulder and the knee were better represented by females and the ratio between these latter and the males was of the order of 2:1.

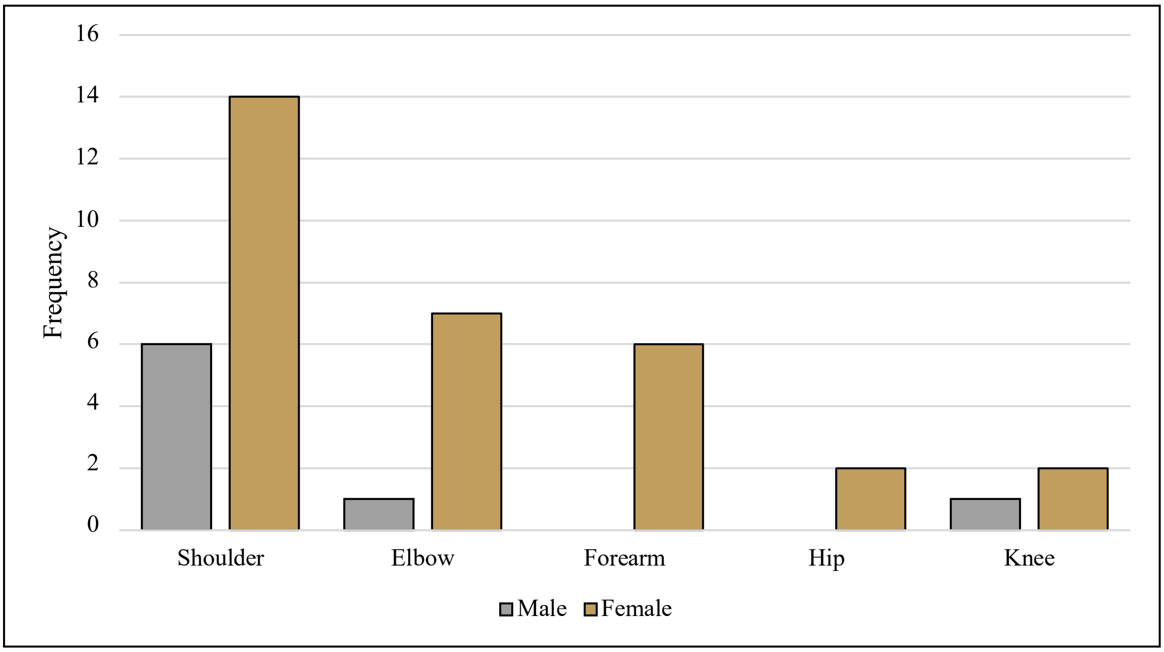

Figure II-12. Marki: Frequency distribution of the observed entheses by sex (pooled functional complexes). N:39.

More specifically, in the shoulder the females displayed 42.9% (6/14) moderate degrees while the males exhibited only 16.7% (1/6) moderate degrees. In the elbow, females displayed 14.3% (1/7) moderate degrees while the males exhibited only mild forms (Figure II-13). The Mann-Whitney *U*-test did not reveal any differences (shoulder p-value=0.397, elbow p-value=1.000, knee p-value=1.000).

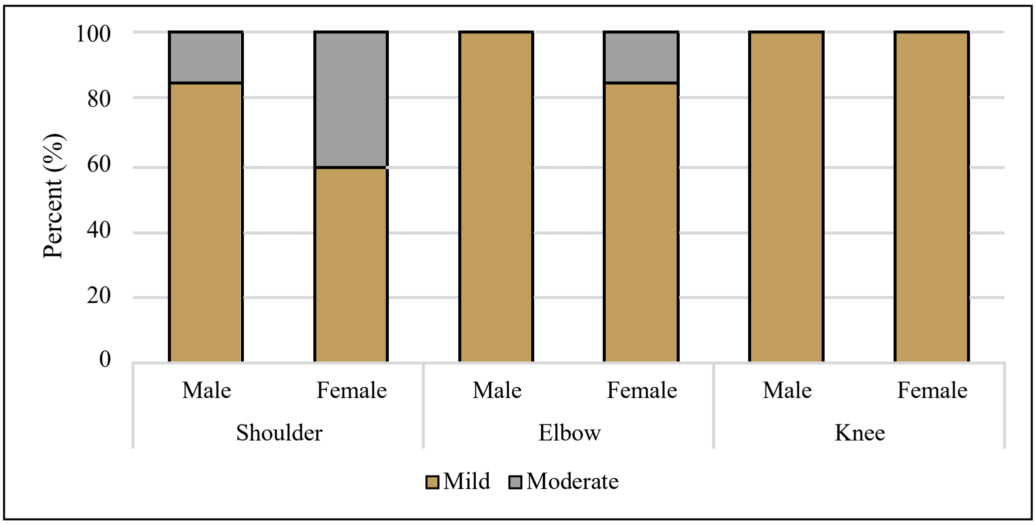

Figure II-13. Marki: Frequency distribution of mild and moderate robusticity ranks by sex (pooled functional complexes). N:31.

Finally, looking at the distribution of the observed entheses by age category, the shoulder was the only functional complex represented by all the three groups; the elbow and the knee were merely represented by two categories, the young and the middle adults. The forearm and the hip were represented only by middle adults. Overall, the number of entheses recorded on the middle adult skeleton included in this study (=28) greatly exceeded the number of the entheses recorded on the two young and the only mature adult examined (=11).

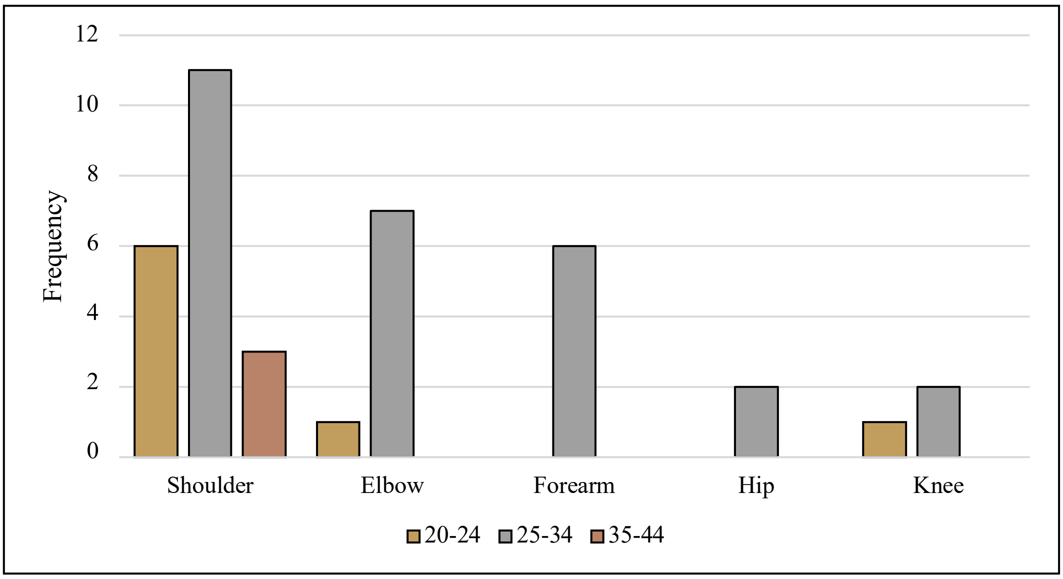

Figure II-14. Marki: Frequency distribution of observed entheses by age group (pooled functional complexes). N:39.

As expected, the severity of the marker increased from the young to the mature adults (Figure II-15). It must be specified, however, that the greater representativity of the middle adult category might have been affected the reliability of the results.

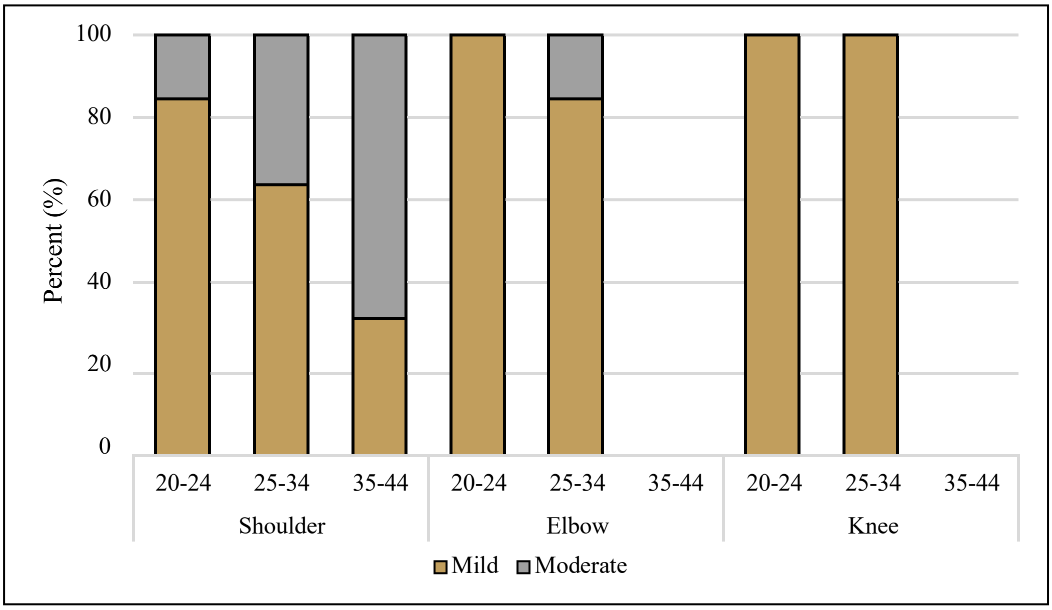

Figure II-15. Marki: Frequency distribution of mild and moderate robusticity ranks by sex (pooled functional complexes). N:21.

These differences were however not significant (shoulder p-value=0.349, elbow p-value=0.705, knee p-value=1.000).

<u>Osteolytic and Enthesophytic formations: relationship between score development and enthesis</u>

OLs and EFs were not present on all the observed entheses. More specifically, the formers were rare, affecting only 10.3% (4/39) of the total number of entheses; the last, a little more frequent, affecting 12.8% (5/39) of the surfaces observed.

For which concerns the OLs, the three types of entheses affected were the *costoclavicular*, the *trapezoid,* and the *iliopsoas* (Figure II-16). Mild forms were detected in all cases, except in the case of the *costoclavicular ligament*, which yielded evidence of moderate OLs.

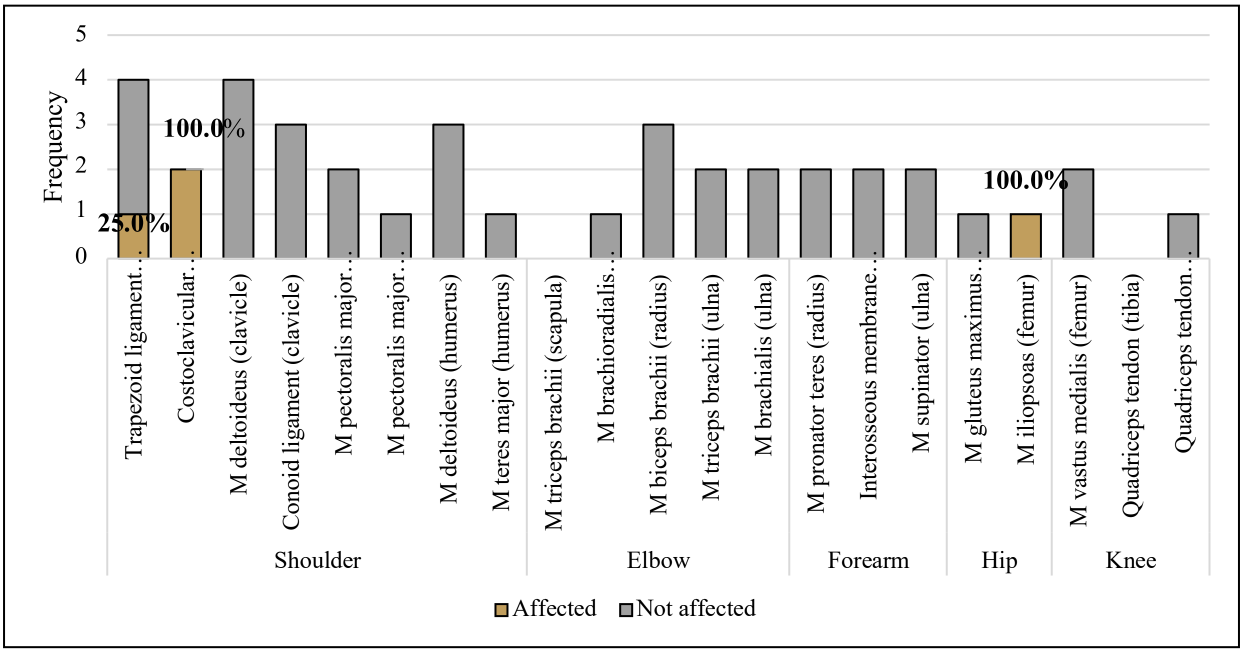

Figure II-16. Marki: Frequency distribution of entheses affected by OLs by muscle. N:39.

For which concerns the EFs, the five entheses affected were two *costoclavicular ligaments*, one *deltoideus* (clavicle), one *deltoideus* (humerus) and one *iliopsoas* (Figure II-17). Mild forms were detected in all cases, except in the case of the *costoclavicular*, which yielded evidence of moderate EFs (Figure II-17).

Since the very low number of affections, no additional graph related to the distribution of these markers by functional complex was produced.

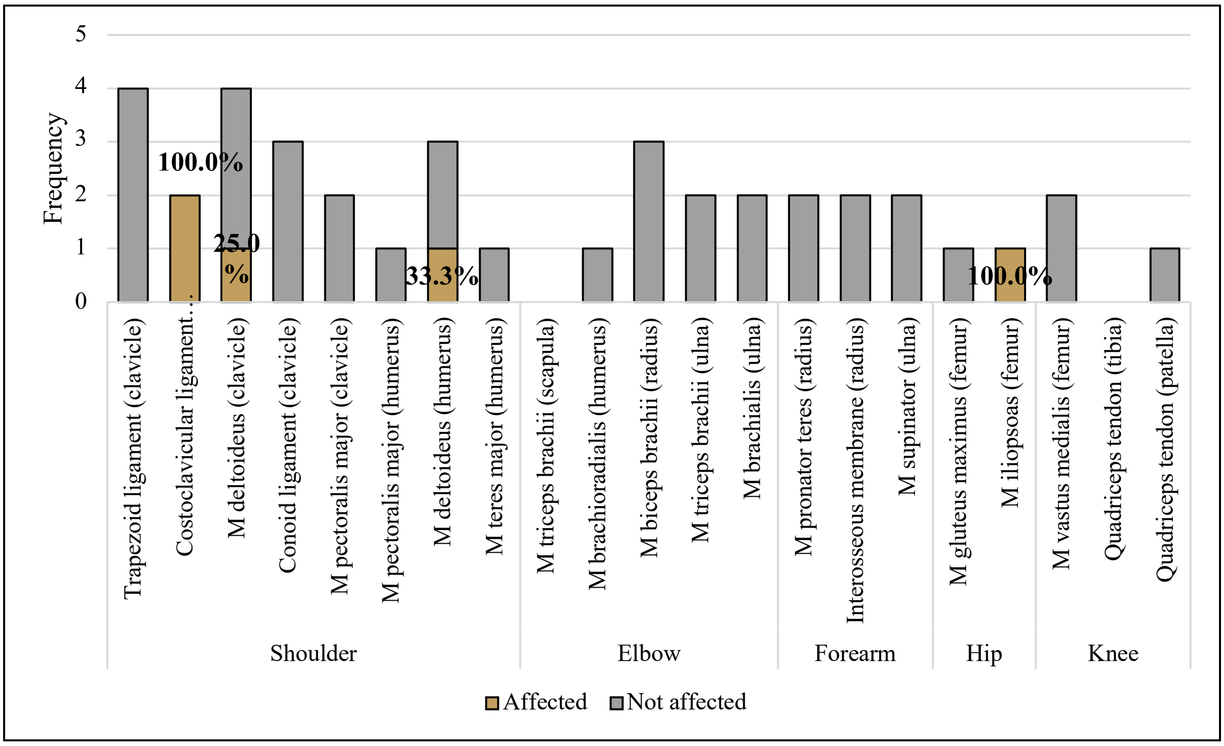

Figure II-17. Marki: Frequency distribution of entheses affected by EFs by muscle. N:39.

<u>Osteolytic and Enthesophytic formations: relationship between score development, side, sex, and age</u>

The OLs were observed on four cases of 39 entheses, thus no comparisons between sides, sexes or age categories were possible. It must be noted, however, that all these affected entheses belonged to a middle adult female.

The EFs were observed on five cases of 39 entheses, thus no comparisons between sides, sexes or age categories were possible. It must be noted, however, that all affected entheses belonged to the same middle adult female mentioned for the OLs.

Osteoarthritis

OA evaluation was based on the observation of a total of 10 joint surfaces recorded on the skeleton of the middle adult female above mentioned which yielded at least one joint surface per type of joint, with the only exception of the glenoid fossa, humeral head, acetabulum and proximal tibia, not preserved at all (Figure II-18).

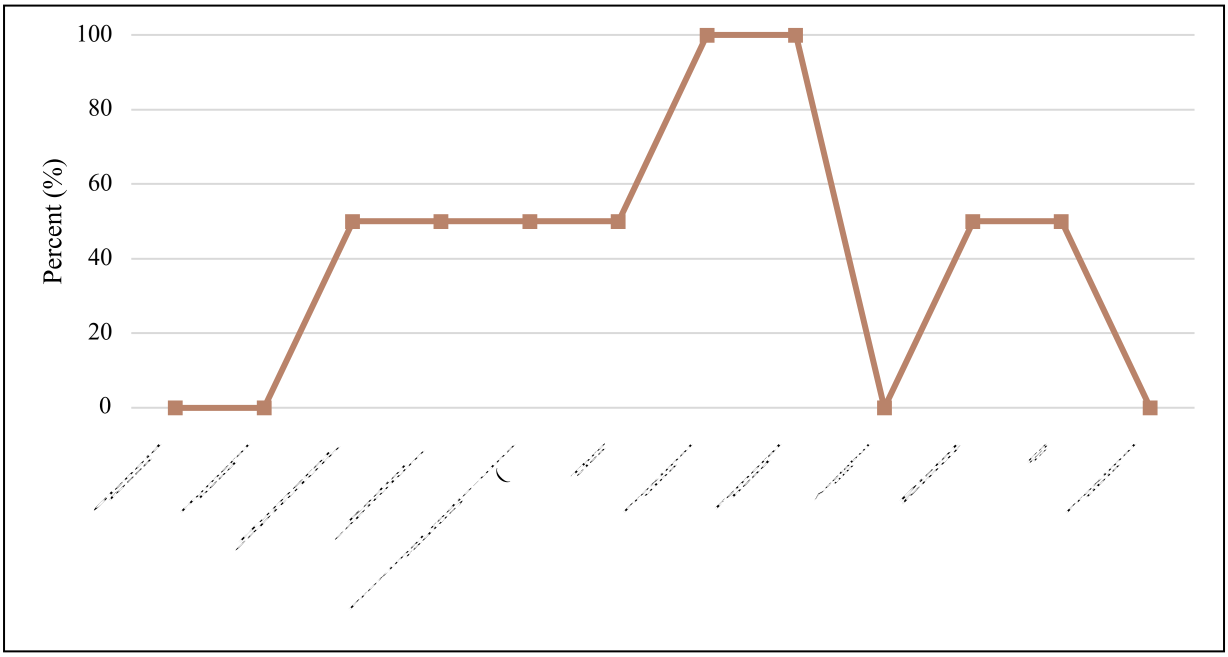

Figure II-18. Marki: Joint surfaces representation (%) within the sample. N:10.

No cases of eburnation and fusion was observed. Only one joint surface, a proximal ulna (1/2), was affected by OA.

Extra-masticatory dental wear

A total of 23 maxillary and 18 mandibular teeth belonging to three individuals were examined for evidence of extra-masticatory dental wear; no case was found.

Summary

In sum, the population from Marki was small and represented by an equal number of females and males. The last predominantly fell within the young adult range. On the basis of the evaluation of the robusticity ranks scored for ECs, it is possible to assert that males exhibited greater development of the *conoid*; while females exhibited increasing stress at the *costoclavicular*, the *trapezoid,* the *deltoideus*, the *pectoralis major*, and the *brachioradialis*. Concerning the bilateral asymmetry, it was noted higher ranking on the right side of the upper limb entheses, except on the *pectoralis major* and the *costoclavicular*, which displayed increasing development of the left side. Concerning the OLs, they occurred on four entheses (*costoclavicular ligament, trapezoid ligament*, *iliopsoas*) predominantly in mild forms. Since the very low number of affections, no differences between sides, sexes and age categories could be ascertained. Concerning the EFs, they occurred on five entheses (*costoclavicular ligaments*, *deltoideus* (humerus), *deltoideus* (clavicle) and *iliopsoas*) predominantly in mild forms. Since the very low number of affections, no differences between sides, sexes and age categories could be ascertained. Concerning the OA, only one of ten joint surfaces displayed evidence of OA. It belonged to a young female. Concerning the extra-masticatory dental wear, no evidence was noted.

Alambra Mouttes

Paleodemography

The biological sex and mortality profile of adults from the MBAII site of Alambra is presented in table III-1. Sex estimation was possible for all the individuals. The proportion of male individuals (4/6, 66.7%) exceeded the females (2/6, 33.3%, 2/6). Age estimation was possible for all the skeletons included in the study. Two of the four age categories are represented: the middle (25-34 years) and the mature (35-44 years) adults. Neither young (20-24 years) nor old adults (45+) were identified. The majority of adults fell within the range of middle adults.

Table III-1. *Alambra: Age and sex composition of the sample. ND: not determined. %: within the sex.*

	Young adult 20-24		Middle adult 25-34		Mature adult 35-44		Old adult 45+		Total	
	N	%	N	%	N	%	N	%	N	%
Male	0	0.0	3	75.0	1	25.0	0	0.0	4	66.7
Female	0	0.0	2	100.0	0	0.0	0	0.0	2	33.3
Total	0	0.0	5	83.3	1	16.7	0	0.0	6	100.0

The bar chart in figure III-2 illustrates the age distribution of the sample by sex. Overall, the males age distribution reflects the middle-mature adult range, while the two females were a middle and a mature adult.

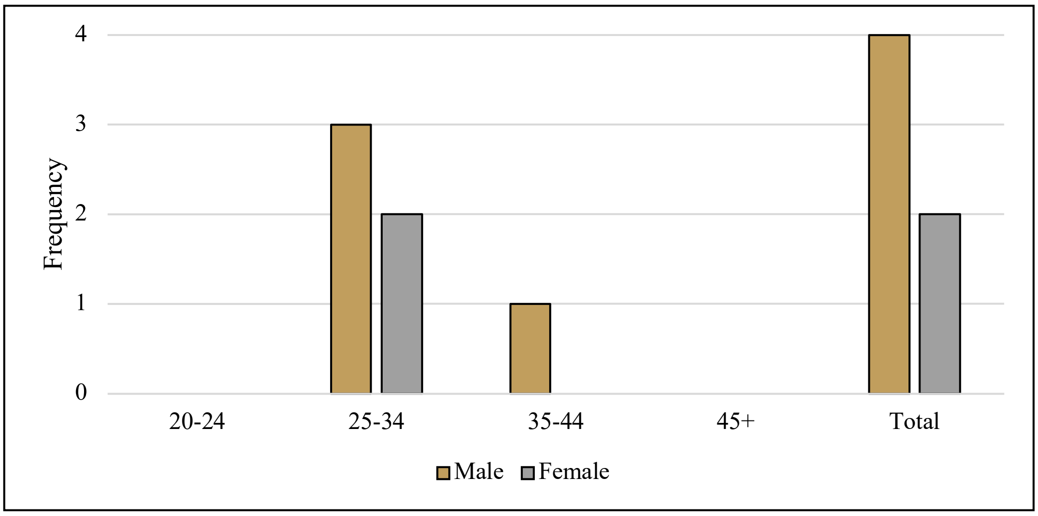

Figure III-2. Alambra: Age distribution of the sample by sex. N:6.

Robusticity: relationship between score development, enthesis, and functional complex

The evaluation of the ECs of this sample was carried out on a total of 32 entheses belonging to five individuals. Figure III-3 shows that none of the examined entheses was well-represented, as their index of representation varies between 1.0% and 40.0%.

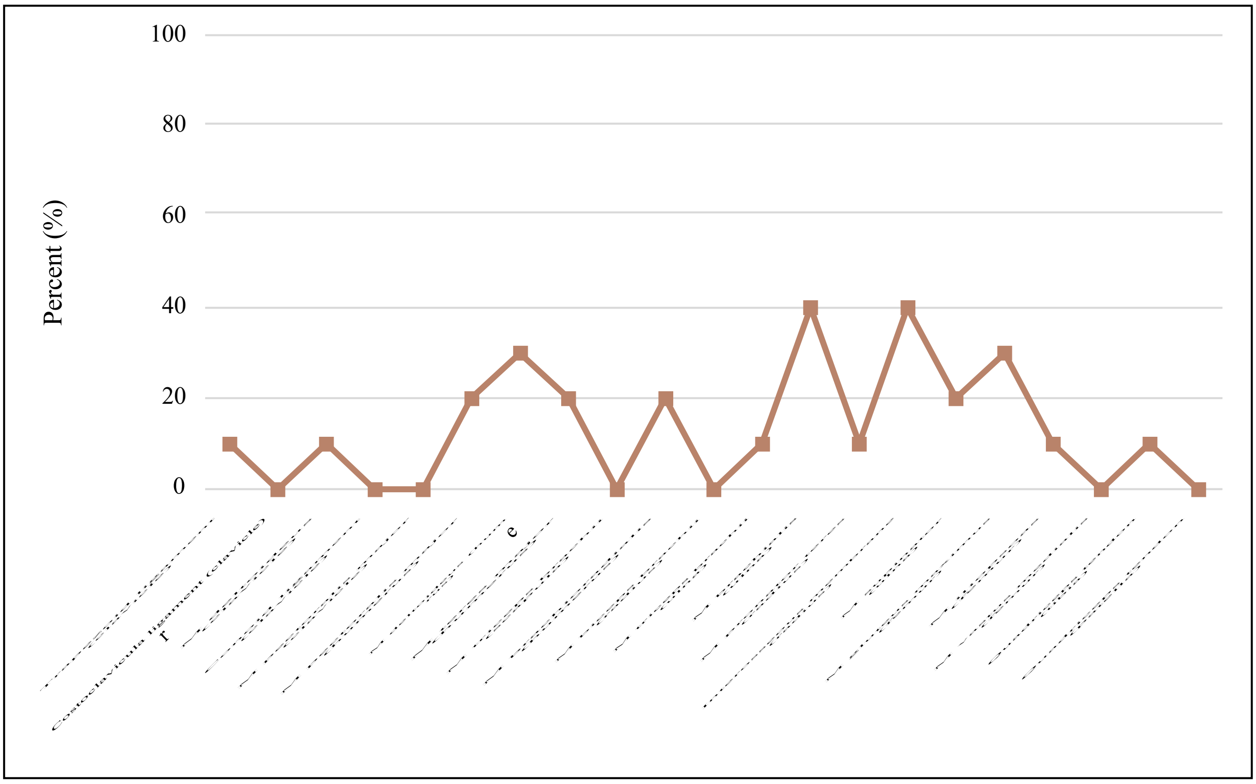

Figure III-3. Alambra: Entheses representation (%) within the whole sample. N:32.

The *brachialis* and the *interosseous membrane* were the most frequently assessed (4/29, 13.8% both). In contrast, seven entheses, including the *trapezoid ligament* and the *quadriceps tendon*, were recorded in only one case (3.4%).

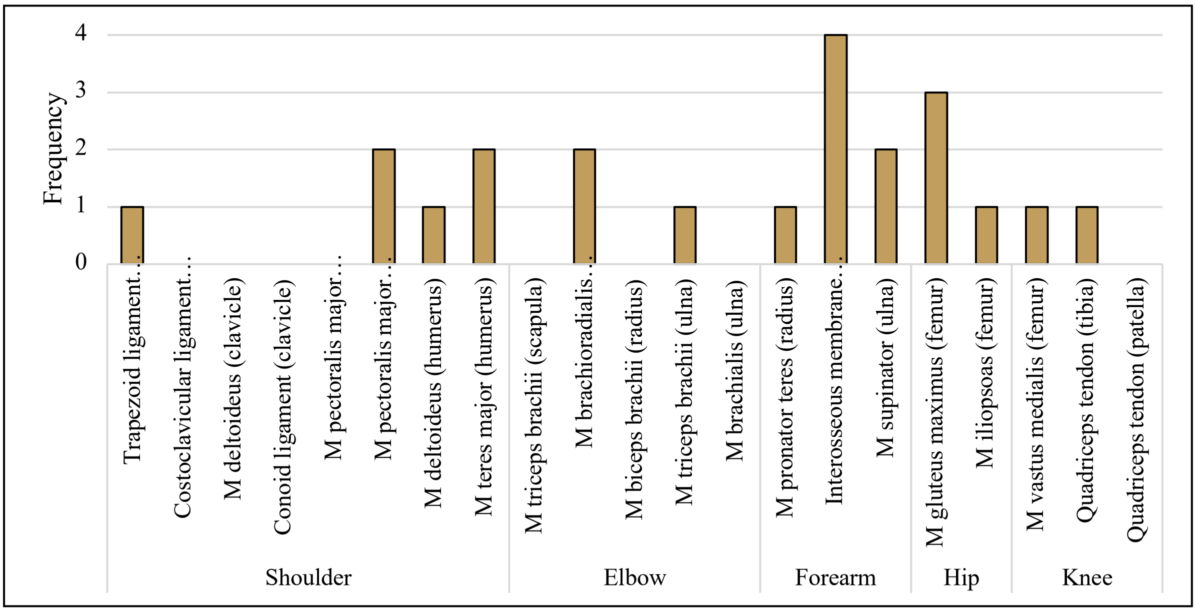

Figure III-4. Alambra: Frequency distribution of the observed entheses by muscle. N:29.

Looking at the severity distribution of this marker, the mild expressions prevailed on the majority of the observed entheses. Moderate robusticity was observed in low percentages on the *brachialis* (1/4, 25.0%), the *interosseous membrane* (1/4, 25.0%); in greater extent on the *vastus medialis* (1/1, 100.0%). The gluteus maximus was the most developed: 33.3% (1/3) moderate degrees and 66.7% (2/3) severe degrees (Figure III-5).

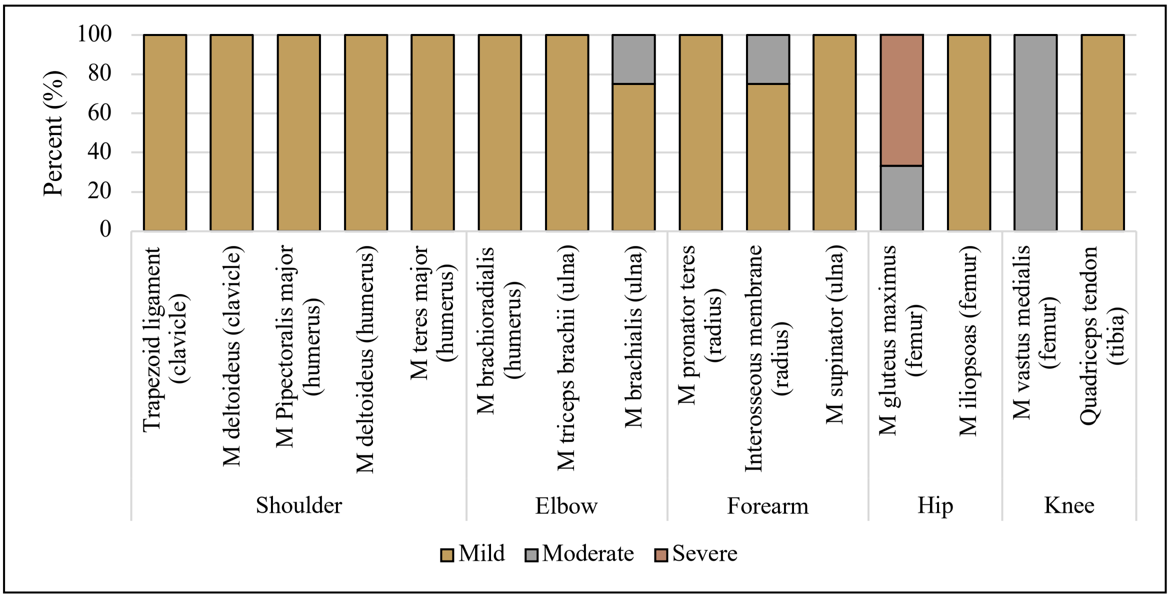

Figure III-5. Alambra: Frequency distribution of mild, moderate, and severe robusticity ranks by muscle. N:29.

By pooling the entheses in functional complexes, the shoulder appears as the best represented district (9/29, 31.0%), followed by the elbow and the forearm (7/29, 24.1%). In contrast, the knee was the less well preserved (2/29, 6.9%) (Figure III-6).

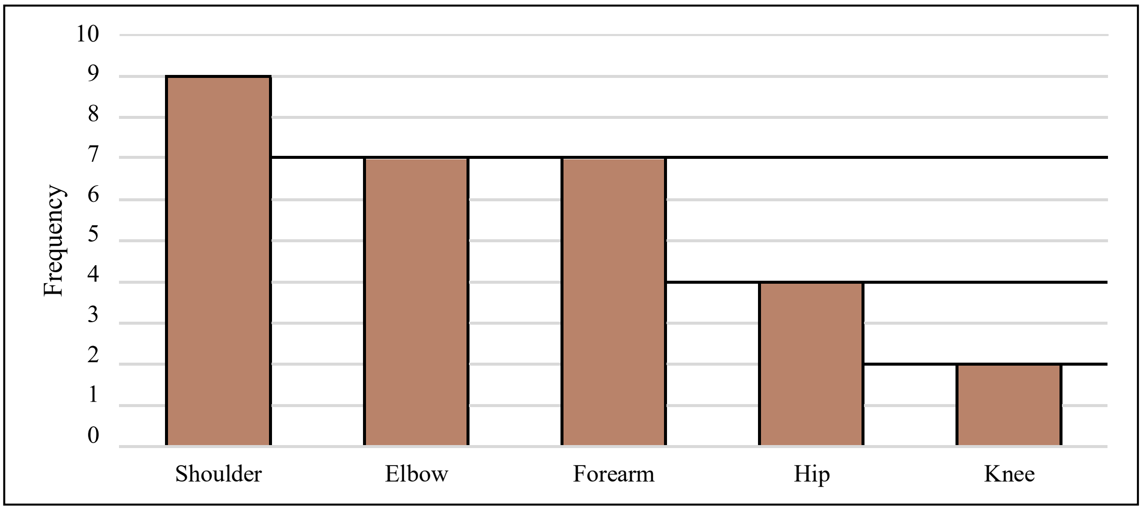

Figure III-6. Alambra: Frequency distribution of the observed entheses by functional complex. N:29

In terms of severity rank distribution, the shoulder was the only complex which exhibited only mild forms. As for the lower limb functional complexes, the hip in particular, displayed the highest percentages of moderate (1/4, 25.0%) and severe ranks (2/4, 50.0%) (Figure III-7).

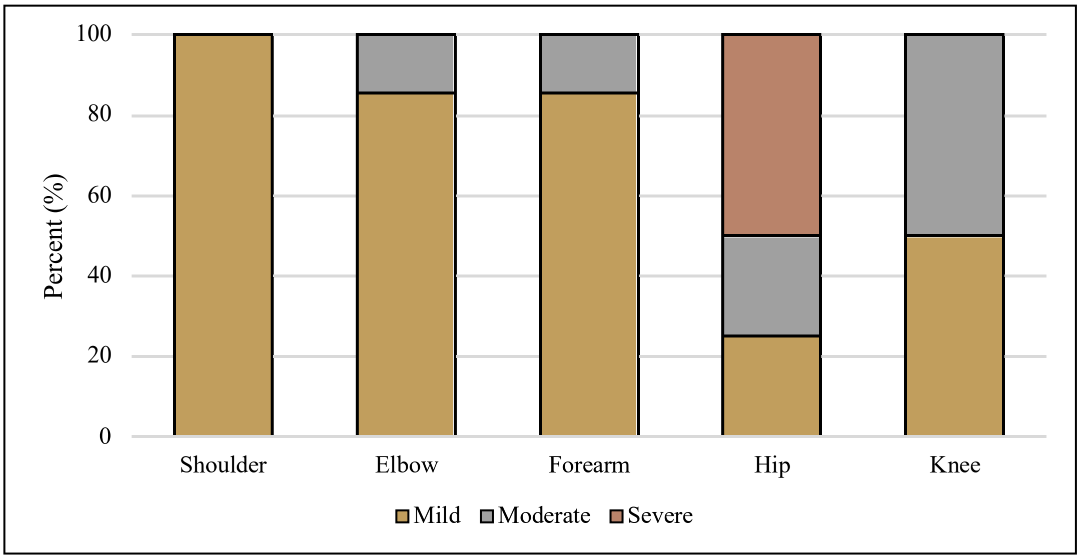

Figure III-7. Alambra: Frequency distribution of mild, moderate, and severe robusticity ranks by functional complex. N:29.

Robusticity: relationship between score development, side, sex, and age

Concerning the comparisons between sides, only seven entheses were represented on both the sides (Figure III-8). Four of seven were equally represented, while the remaining exhibited bias in representation of the order of 1:2, towards the left side, in the case of the *deltoideus* and the *gluteus maximus*, and of the order of 1:3, towards of the right side, in the case of the *interosseous membrane*.

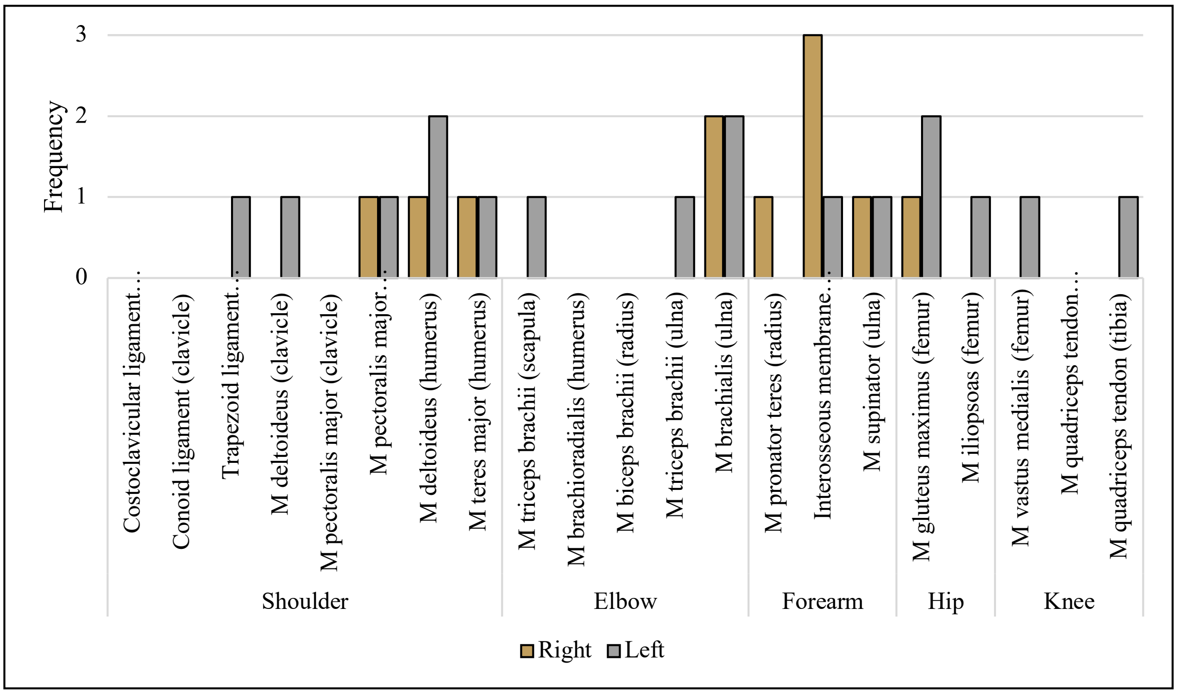

Figure III-8. Alambra: Frequency distribution of the observed entheses by side. N:29.

The evaluation of the robusticity ranks distribution, by side, in figure III-9, indicates that among the comparable entheses, only the *brachialis*, the *interosseous membrane*, and the *gluteus maximus* had pronounced development on the right side.

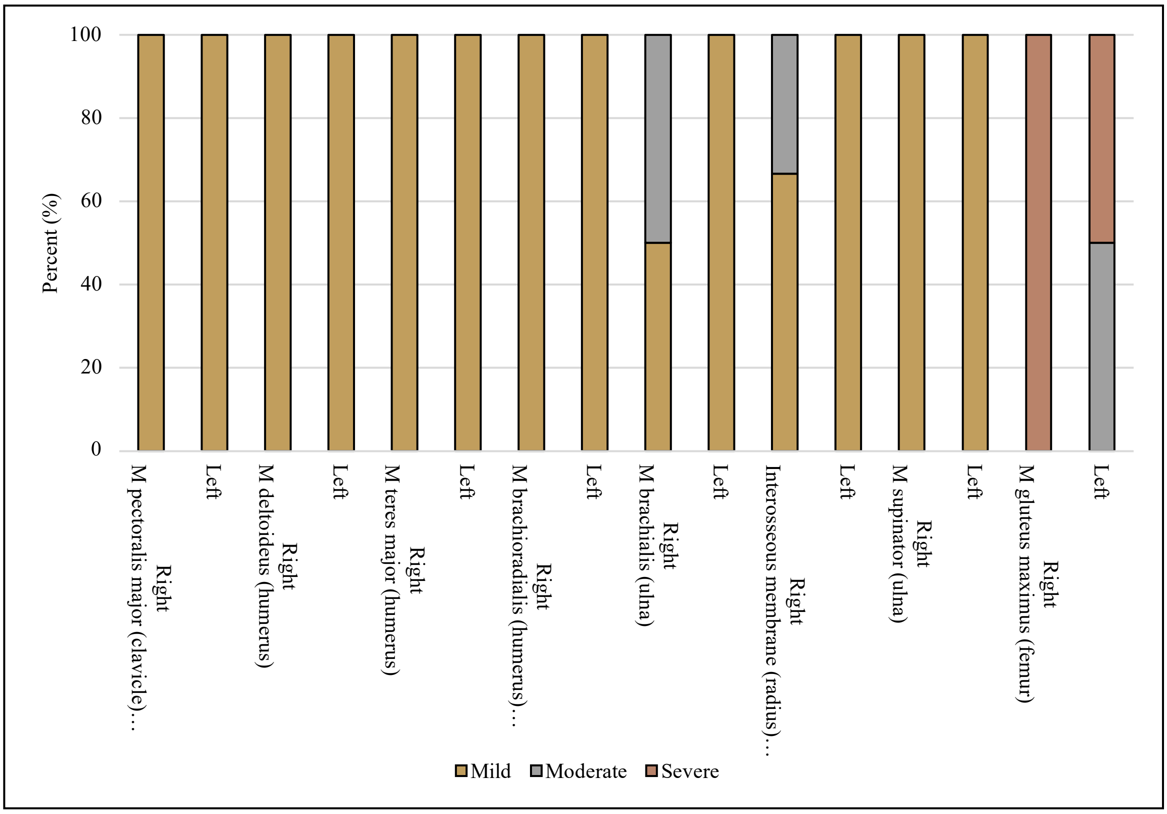

Figure III-9. Alambra: Frequency distribution of mild, moderate, and severe robusticity ranks by side. N:29.

Looking at the functional complexes, the knee was excluded from comparisons because of the absence of the right entheses. The shoulder, the elbow and the hip were better represented on the left side, while the forearm was better represented on the right side (Figure III-10).

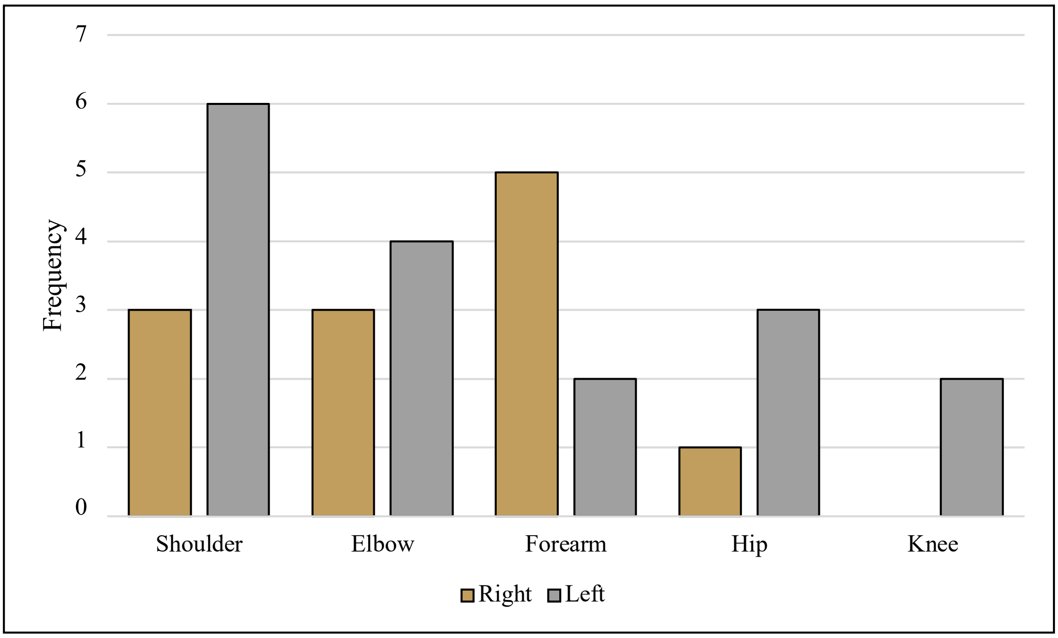

Figure III-10. Alambra: Frequency distribution of the observed entheses by side (pooled functional complexes). N:29.

Thus, looking at the severity rank distribution by side, overall, the right side was found to be more severely affected: the most severe forms were observed on the right hip (100.0%) which, however, was represented by a single enthesis and thus it cannot be considered to discuss the level of development of this functional complex. The left hip, conversely, displayed an equal number (1/3, 33.3%) of mild, moderate and severe expressions.

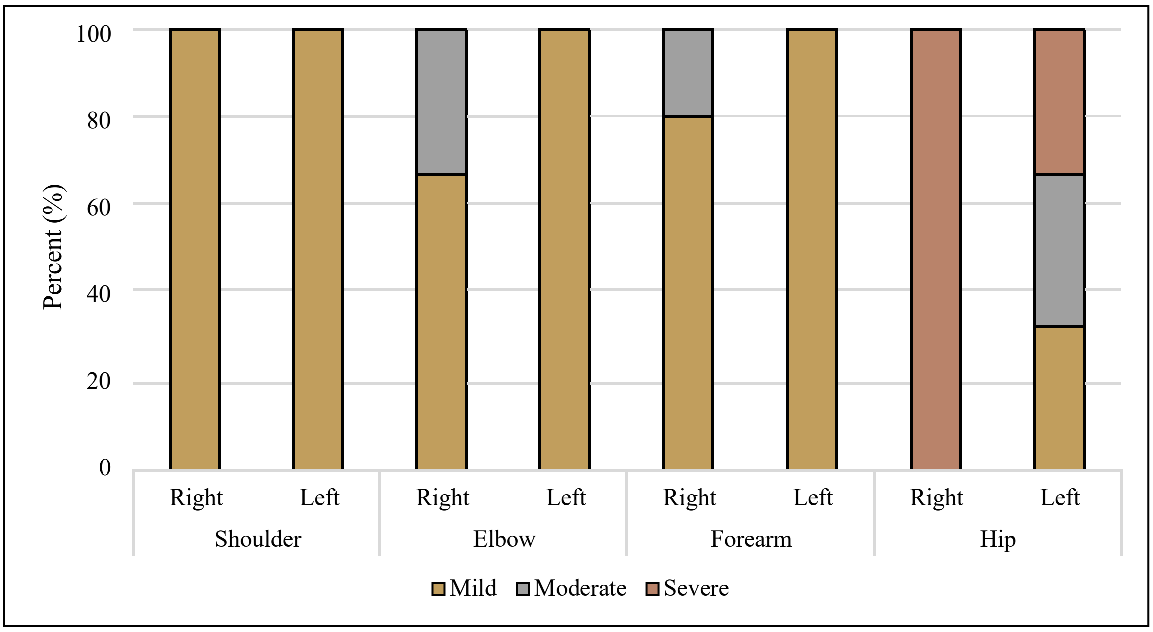

Figure III-11. Alambra: Frequency distribution of mild, moderate, and severe robusticity ranks by side (pooled functional complexes). N:27

These differences were, however, not significant (shoulder p-value=1.000, elbow p-value=0.629, forearm p-value=0.857, hip p-value=0.500).

For which concerns the representativity of the observed entheses between the sexes, in a very few cases both the sexes were equally represented, and specifically, on the *pectoralis major* (humerus), the *teres major,* and the *supinator*. In the cases of the *deltoideus* and the *brachialis*, the males provided the double as the number of the entheses provided by the females (Figure III-12).

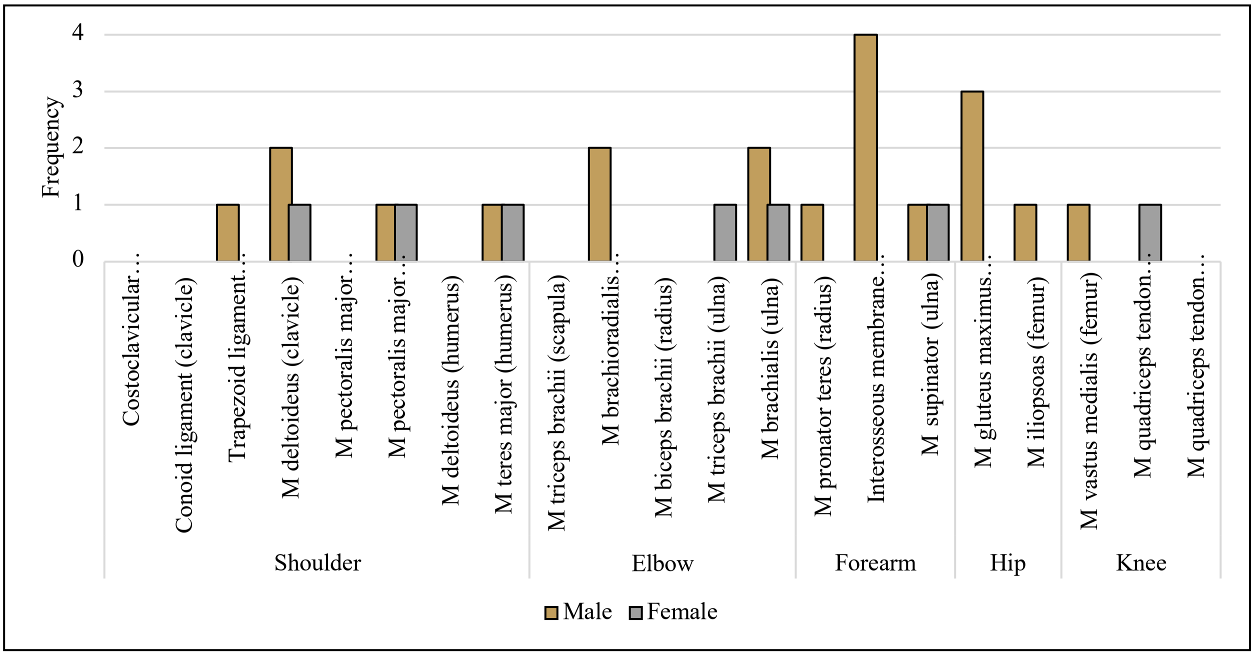

Figure III-12. Alambra: Frequency distribution of the observed entheses by sex (pooled functional complexes). N:29.

Thus, taking into account these disparities and the very low number of entheses observed per type, figure III-13 shows that males exhibited increasing stress at the *brachialis*, the *membrane interosseous,* and the *gluteus maximus*. Females instead provided only mild expressions on all the recorded entheses.

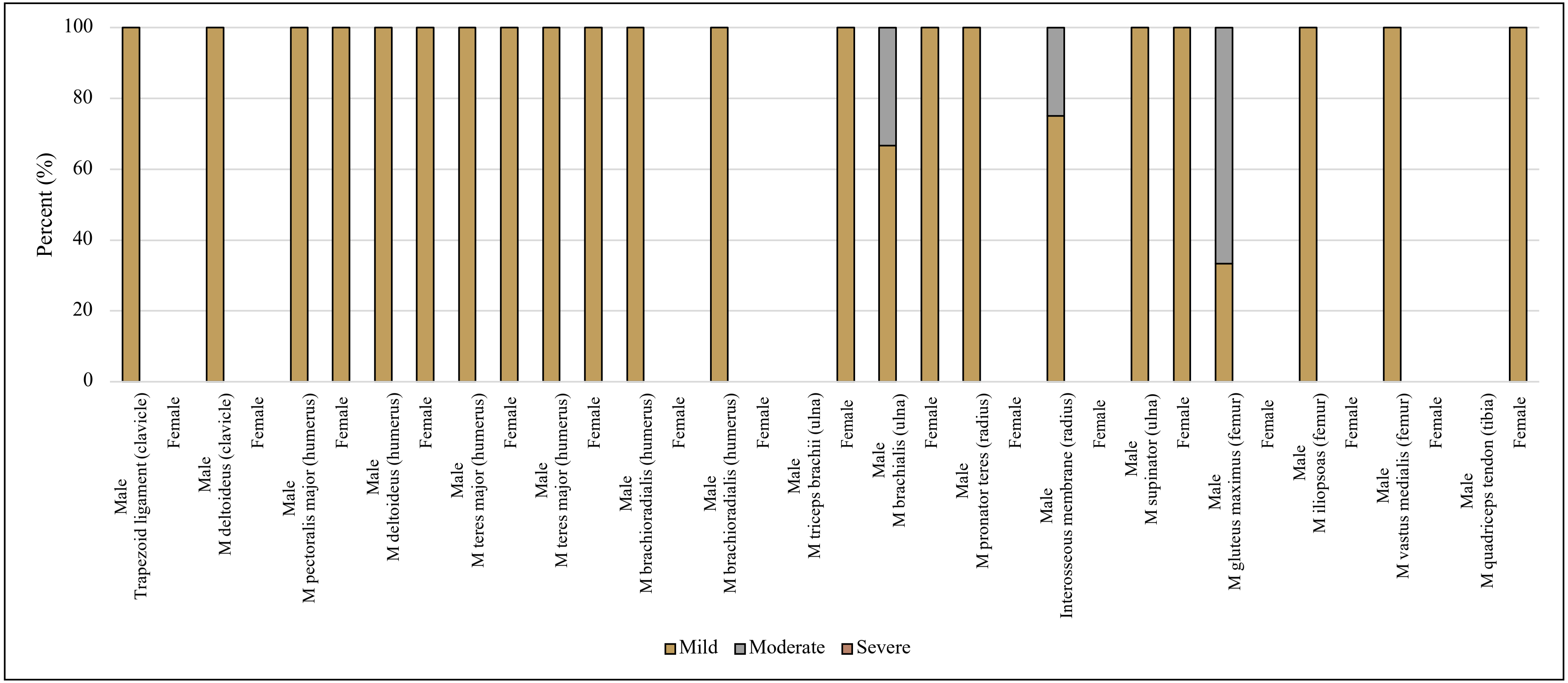

Figure III-13. Alambra: Frequency distribution of mild, moderate, and severe robusticity ranks by sex. N:29.

Looking at the functional complexes, the knee was equally represented by male and female entheses; as for the shoulder, the elbow, and the forearm, the number of the entheses belonging to the males greatly exceeded the number of the those belonging to females. In the first two cases, the ratio between the male and female entheses was of the order of 2:1, in the third case of the order of 6:1.

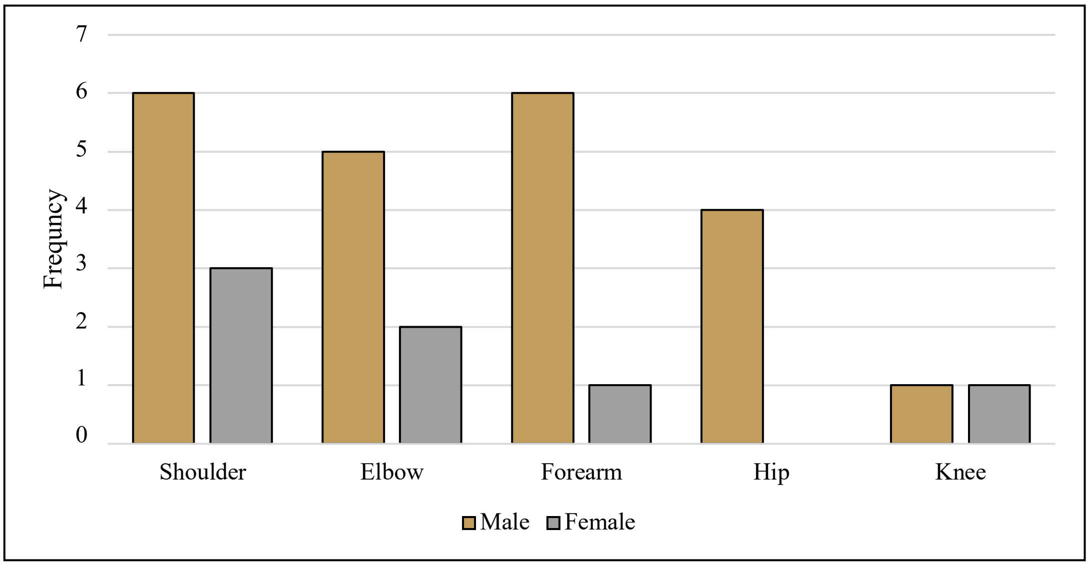

Figure III-14. Alambra: Frequency distribution of the observed entheses by sex (pooled functional complexes). N:29.

Thus, while taking into account this consistent disparity, the males, overall, displayed the most severe modifications in all the comparable districts (Figure III-15). Concerning the knee, for instance, the males provided the highest percentages of moderate degrees (100.0%); it must be specified, however, that they were represented by only one enthesis. In the same way, only one case of moderate robusticity was scored on the elbow and the forearm of the male sub-sample.

These differences were however not significant (shoulder p-value=1.000, elbow p-value=0.857, forearm p-value=0.857, knee p-value=1.000).

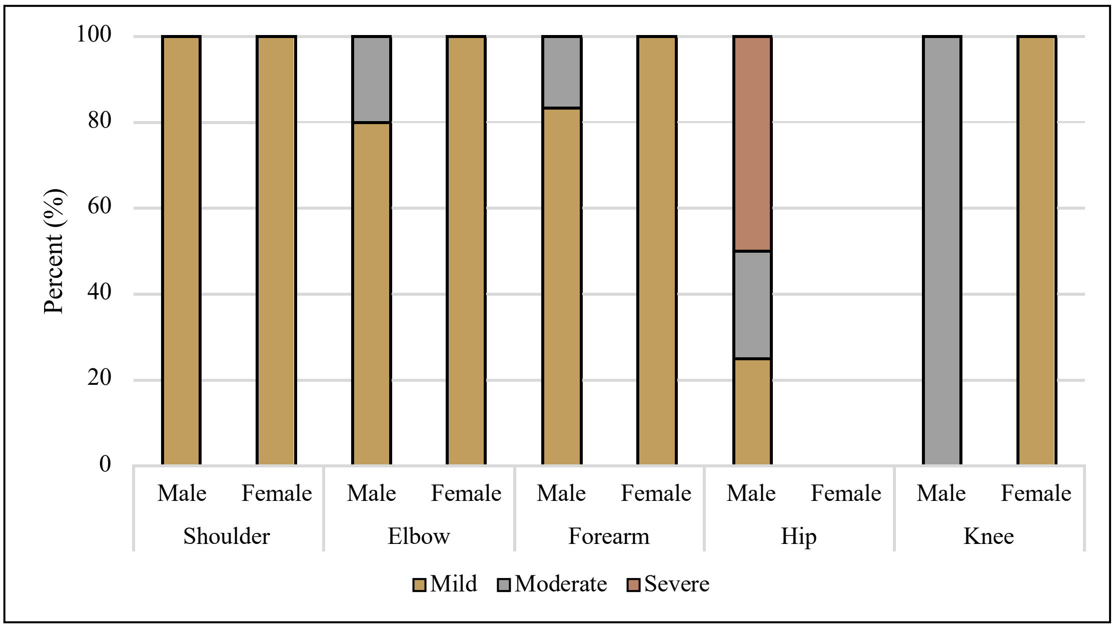

Figure III-15. Alambra: Frequency distribution of mild, moderate, and severe robusticity ranks by sex. N:28.

Finally, concerning the distribution of the robusticity ranks between the age groups, the elbow was the only functional complex represented by both the groups, which, however, were not equally represented (Figure III-16).

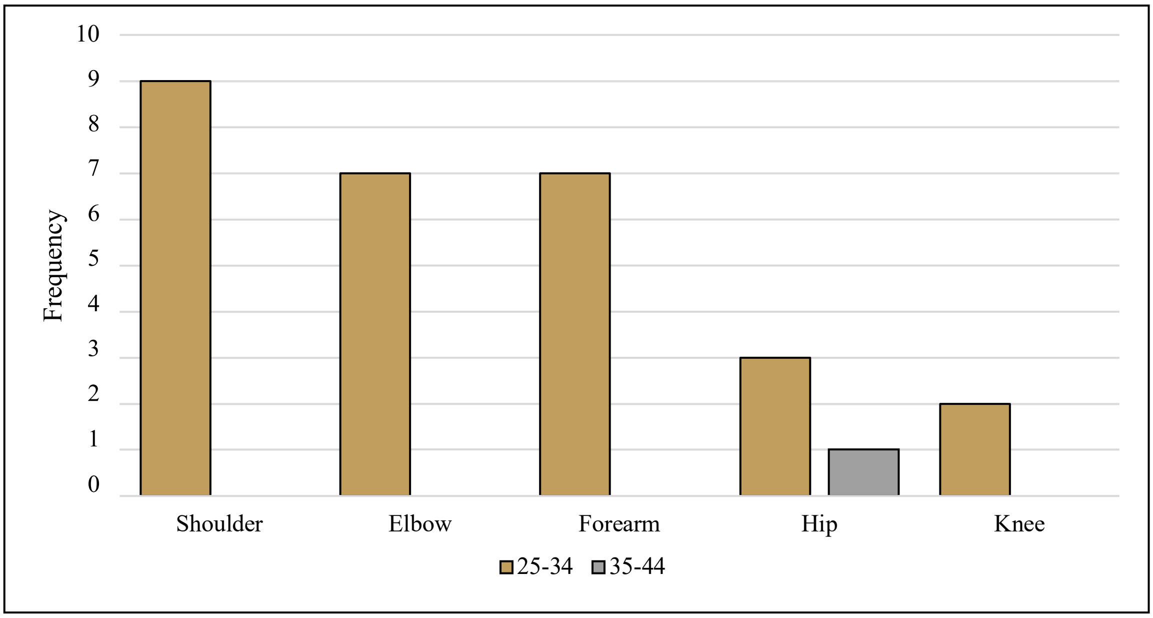

Figure III-16. Alambra: Frequency distribution of the observed entheses by age category (pooled functional complexes). N:29.

Neither a frequency assessment nor statistical tests were carried out in this case. It must be stated, however, that the only enthesis belonging to the mature adult was ranked as severe, while the three entheses pertaining to the elbow of the middle adults predominantly displayed an equal distribution of mild, moderate, and severe expressions (1/3, 33.3%).

<u>Osteolytic and Enthesophytic formations: relationship between score development and enthesis</u>

OLs and EFs were not present on all the observed entheses. The formers were rare, affecting only 13.8% (4/29) of the total observed entheses; the last were more frequent, affecting 55.2% (16/29) of the surfaces observed.

For which concerns the OLs, the four surfaces affected consisted of a *supinator*, a *gluteus maximus*, an *iliopsoas* and a *vastus medialis* (Figure III-17). All OLs observed were ranked as mild.

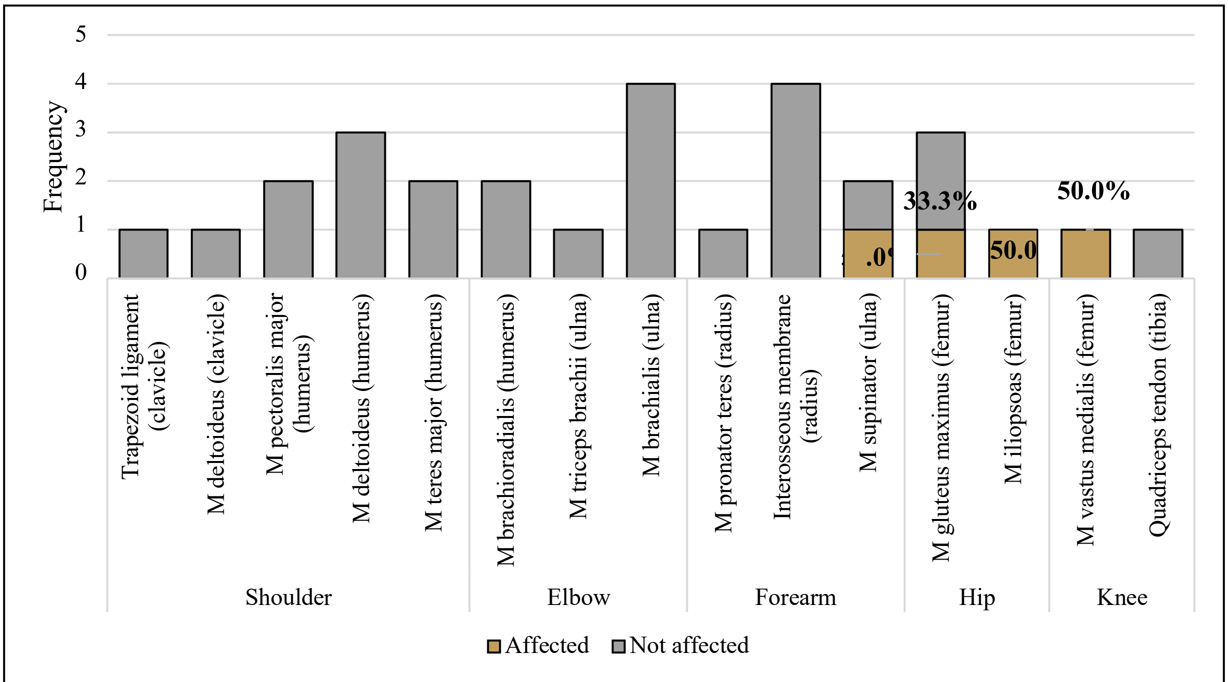

Figure III-17. Alambra: Frequency distribution of entheses affected by OLs by muscle. N:29.

No additional graph was produced to highlight the distribution of the affected entheses by functional complex, since the scant number of affections.

For which concerns the EFs, the most affected were the *gluteus maximus* (2/3, 66.7%), the *interosseous membrane* (2/4, 50.0%), and the *brachialis* (2/4, 50.0%), namely the entheses that exhibited the greatest ranks of robusticity (Figure III-18). It must be noted that 100.0% of affections was observed on six entheses including the *trapezoid ligament* and *triceps brachii*. This percentage however refer to not more than two entheses.

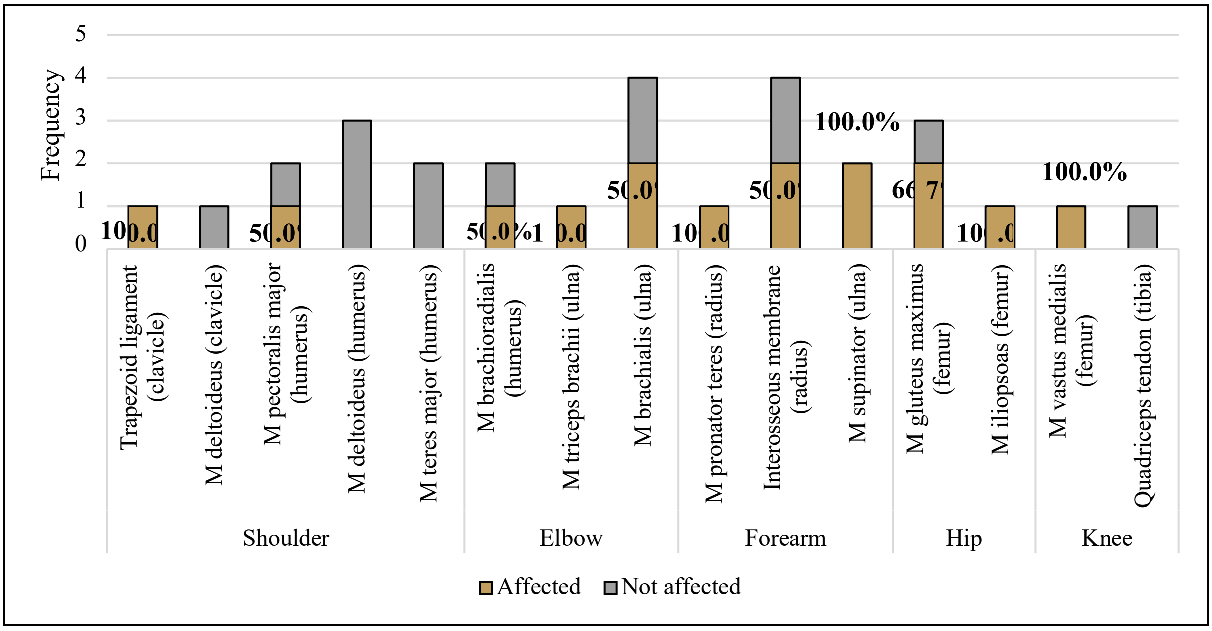

Figure III-18. Alambra: Frequency distribution of entheses affected by EFs by muscle. N:29.

Looking at the severity distribution of this marker, no severe forms were assessed. The mild forms were prevalent, but moderate ranks were assigned to the *trapezoid*, the *deltoideus* (clavicle), the *vastus medialis*, and the two *gluteus maximus* (Figure III-19).

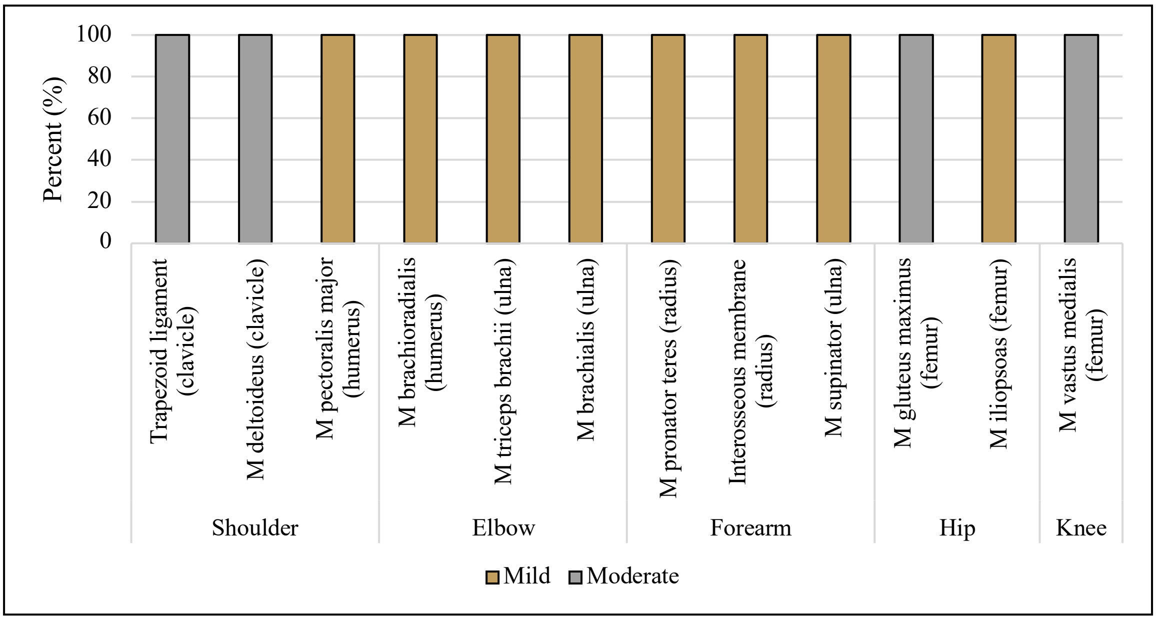

Figure III-19. Alambra: Frequency distribution of the mild and moderate EFs ranks by muscle. N:18.

<u>Osteolytic and Enthesophytic formations: relationship between score development, side, sex, and age</u>

Since the OLs were observed in four cases of 29 entheses, no comparisons between sides, sexes or age categories were possible. It is worthy to say that all affected entheses belonged to a middle adult male.

EFs were observed on 16 surfaces of 29; this allowed comparisons between sides, sexes and age groups. Thus, concerning the bilateral asymmetry, the knee was excluded from comparisons because of the absence of right enthesis as well as the shoulder which did not exhibit any affection on the right side. As for the remaining functional complexes, the right side was predominantly affected than the left. More specifically, the right elbow exhibited 66.7% (2/3) of affections compared with 50.0% (2/4) of the left side; the right forearm displayed 80.0% (4/5) of affections compared with the left side (50.0%, ½); the right hip exhibited 100.0% (1/1) of affections compared with 66.7% (2/3) of the left side.

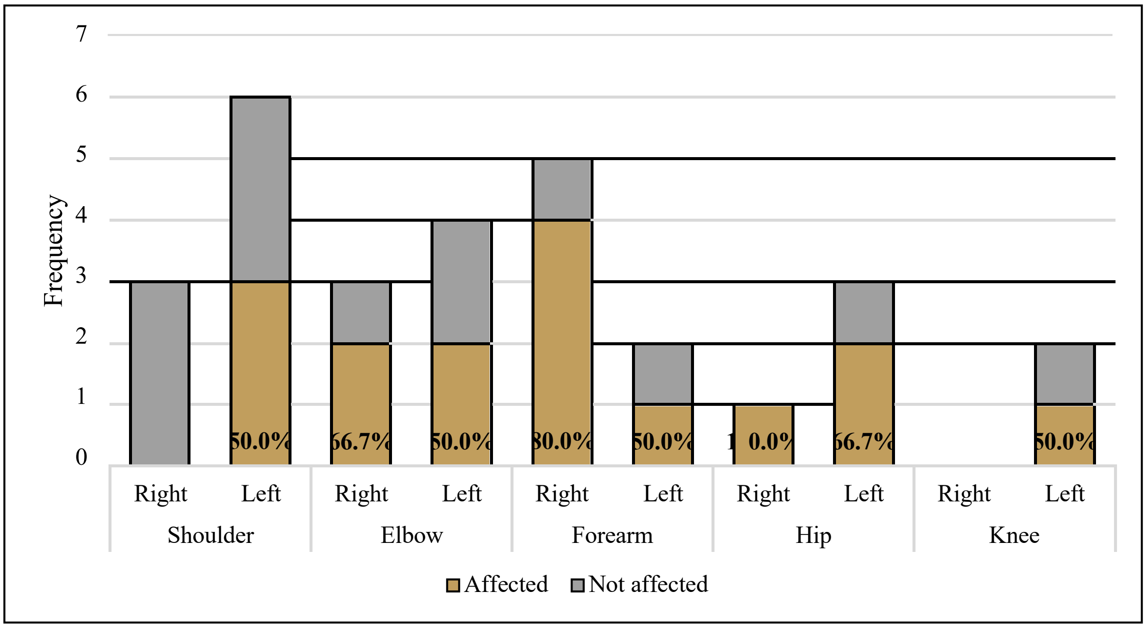

Figure III-20. Alambra: Frequency distribution of the entheses affected by EFs by side (pooled functional complexes). N:29.

In terms of severity distribution, the only functional complex which provided differences between the sides was the hip with 100.0% (1/1) moderate degrees on the right side compared with the 50.0% (1/2) of the same degree on the left. It must be noted however that left side was represented by two entheses compared with the only enthesis of the right side.

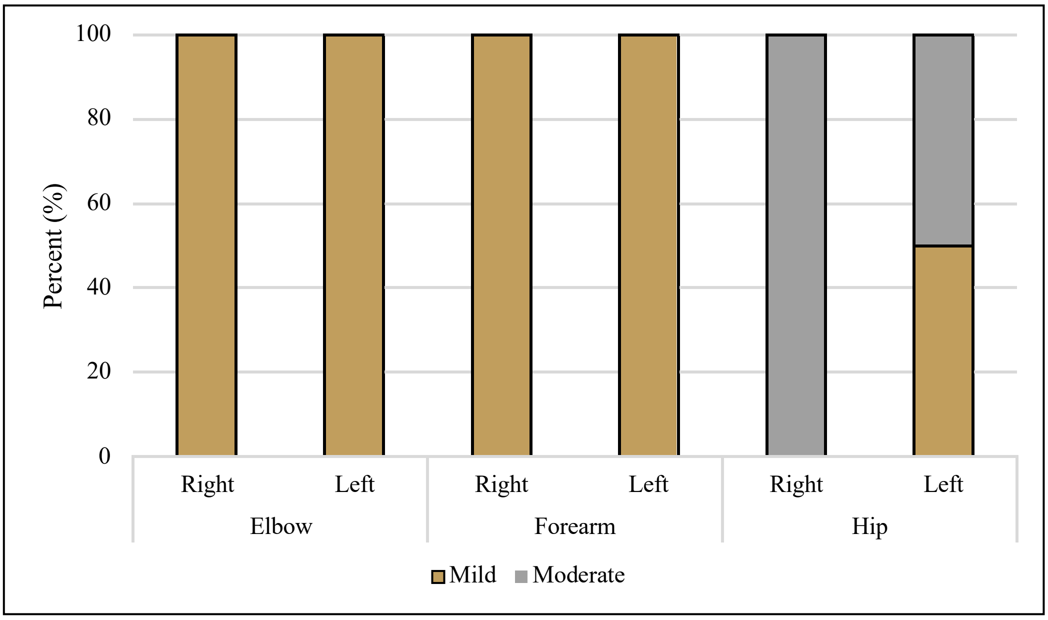

Figure III-21. Frequency distribution of the mild and moderate EFs by side (pooled functional complexes). N:12.

The Mann-Whitney *U*-test confirmed the absence of significant difference for the elbow (p-value=1.000) and the forearm, (p-value=1.000); no significant difference was observed for the hip (p-value=0.667).

For which concerns the distribution of the EF ranks between sexes, only the elbow and the forearm were considered as presented affections on both the sides. In all the three comparable complexes, the female entheses displayed the greatest percentages of affections (100.0% in both the cases) (Figure III-22). It must be stressed, however, that the consistent bias between the male and the female entheses, of the order of 6:1 on the forearm, and of the order of 2:1 on the elbow, might have affected the reliability of the results.

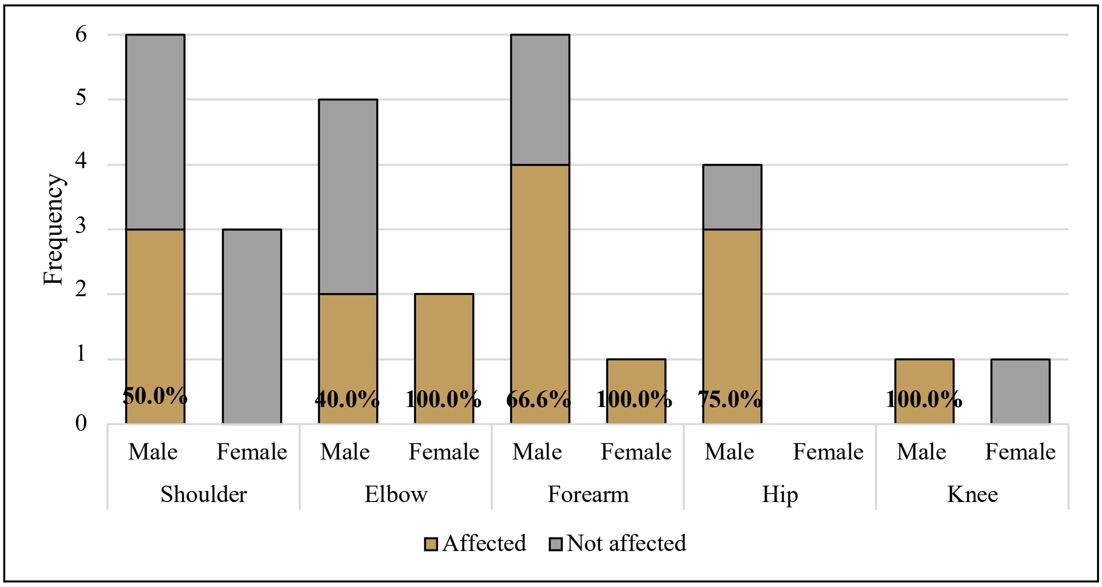

Figure III-22. Alambra: Frequency distribution of the entheses affected by EFs by sex (pooled functional complexes). N:29.

Both in the case of the elbow and in the case of the forearm, all the affections were ranked as mild. Thus, no difference in terms of severity distribution was detected between the sexes.

Finally, concerning the distribution of the EF between age groups, the only comparable group was the hip for which, however, a bias of the order of 3:1 towards middle adults was assessed (Figure III-23).

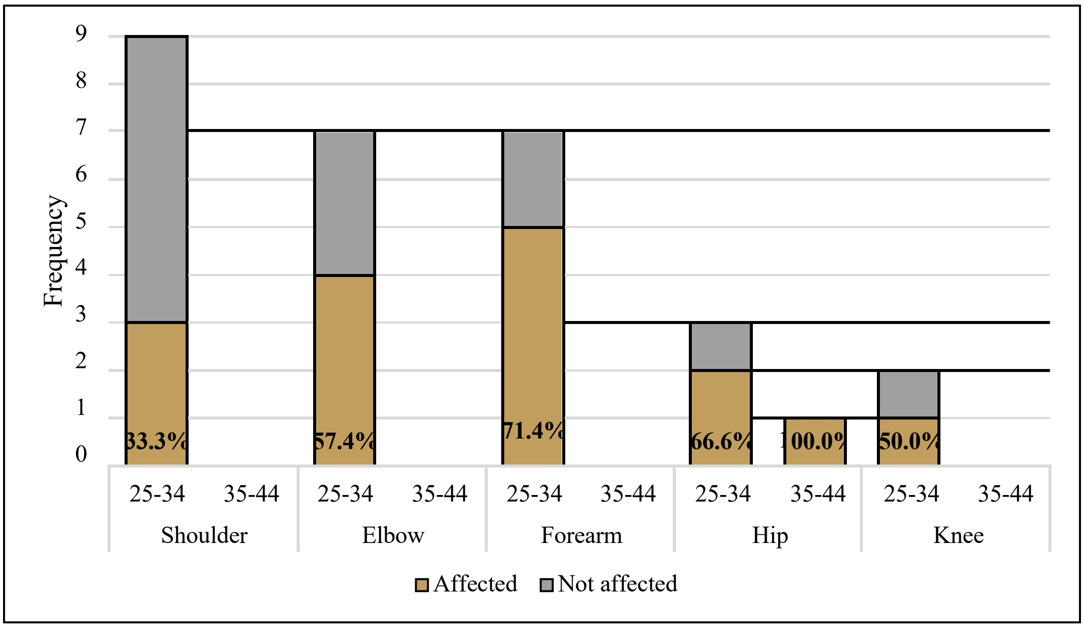

Figure III-23. Alambra: Frequency distribution of the entheses affected by EFs by age category. N:29.

Thus, neither additional graphs nor statistical tests were produced; it must be noted, however, that the only enthesis examined for the mature adult was ranked as moderate, while, of the two affections observed for the middle adult, one was ranked as mild and the other one as moderate.

Osteoarthritis

OA evaluation was based on the observation of only six joint surfaces recorded on three skeletons. The representativity values of these surfaces were very low. Only one joint surface, a femoral head, yielded an index of 50.0%. The majority of the joints under study was not recorded at all.

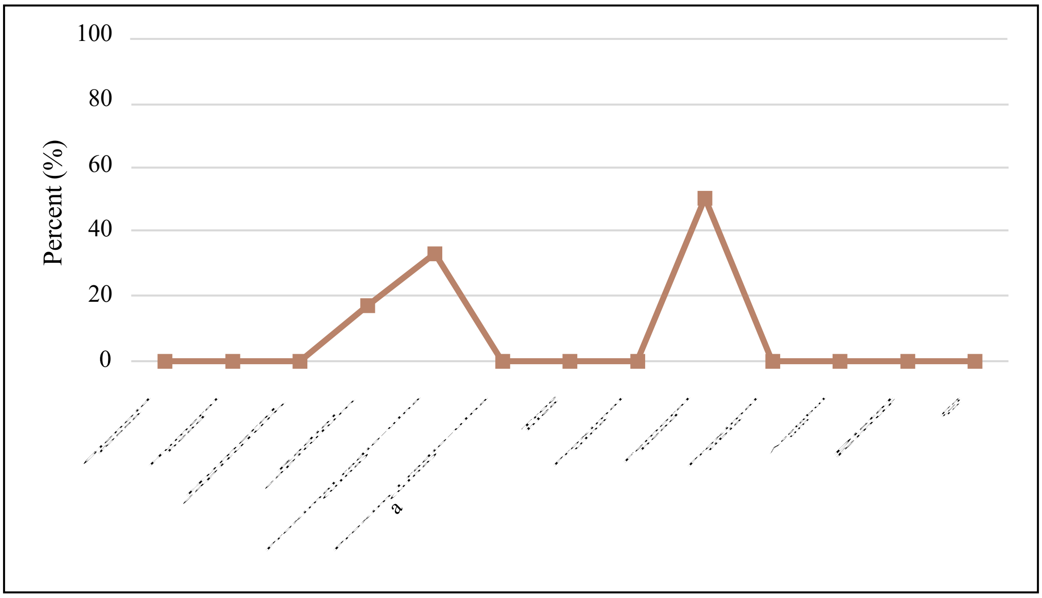

Figure III-24. Alambra: Joint surfaces representation (%) within the sample. N:6.

No cases of eburnation and fusion was observed. Two surfaces of six was found to be affected by OA: a proximal radio-ulna (radius) and a femoral head. The former was noted on a middle adult female, the last on a middle adult male.

Extra-masticatory dental wear

A total of 10 maxillary and 16 mandibular teeth belonging to four individuals were examined for evidence of extra-masticatory dental wear. No evidence was found.

Summary

In sum, the population from Alambra *Mouttes* was small and bias towards males; overall, they predominantly fell within the younger age range. On the basis of the evaluation of the robusticity ranks scored for ECs, it is possible to assert that the shoulder and elbow were the best represented functional complexes, but the hip displayed the most severe robusticity ranks. Overall, the right side was more developed than the left. The males were better represented than the females and exhibited the greatest percentages of moderate and severity robusticity on the *brachialis*, the *membrane interosseous*, and the *gluteus maximus*. Concerning the comparisons between age groups, the severity of this marker increased with age. Concerning the OLs, they occurred on four surfaces pertaining to the *supinator*, the *gluteus maximus*, the *iliopsoas,* and the *vastus medialis*; all ranked as mild. Since the very low number of affections, no differences between sides, sexes and age categories could be ascertained. Concerning the EFs, they occurred on 16 surfaces, predominantly included in the forearm and the hip. The right side was more affected than the left. The females exhibited more affections, but this may be due to the consistent bias in terms of representation between the sexes. Overall, the EF severity ranks increased with age. Concerning the OA, two of ten joint surfaces were found to be affected, both belonging to middle adults, one male and one female. Concerning the extra-masticatory dental wear, no evidence was noted.

Erimi Laonin tou Porakou

Paleodemography

The biological sex and mortality profile of adults from the EBA-MBA site of Erimi is presented in table IV-1. Sex estimation was possible for all the individuals. The number of male individuals is equal to the number of the females. Age estimation was possible for three individuals of four. Two of the four age categories are represented: the middle (25-34 years), which included one individual, and mature (35-44 years) adults, which included two individuals. Neither young (20-24 years) nor old adults (45+) were examined.

Table IV-1. Erimi: Age and sex composition of the sample. ND: not determined. %: within the sex.

	Young adult 20-24		Middle adult 25-34		Mature adult 35-44		Old adult 45+		ND		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Male	0	0.0	0	0.0	2	100.0	0	0.0	0	0.0	2	50.0.
Female	0	0.0	1	50.0	0	0.0	0	0.0	1	50.0	2	50.0.
Total	0	0.0	1	25.0	2	50.0	0	0.0	1	25.0	4	100.0

The bar chart in figure IV-2 illustrates the age distribution of the sample by sex. Overall, the males age distribution reflects the middle adult range; while the female assigned age at death were a young adult.

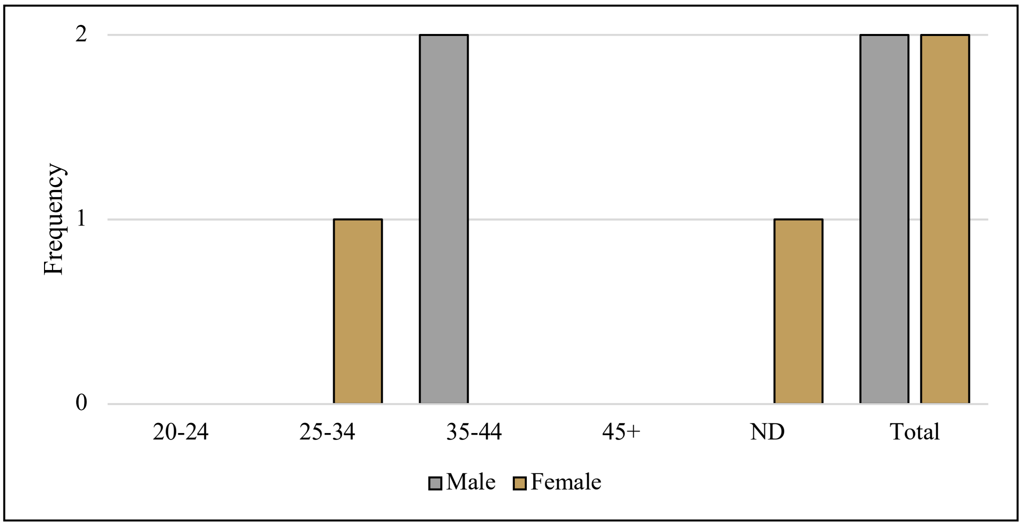

Figure IV-2. Erimi: Age distribution of the sample by sex. ND: not determined. N:4

Robusticity: relationship between score development, enthesis, and functional complex

The evaluation of the ECs of this sample was carried out on a total of 23 entheses belonging to three individuals. Only one enthesis, *interosseous membrane*, was well represented as its BRI value was 50.0%. The remainder were very poorly represented as the BRI index was comprised between 0.0% and 40.0%.

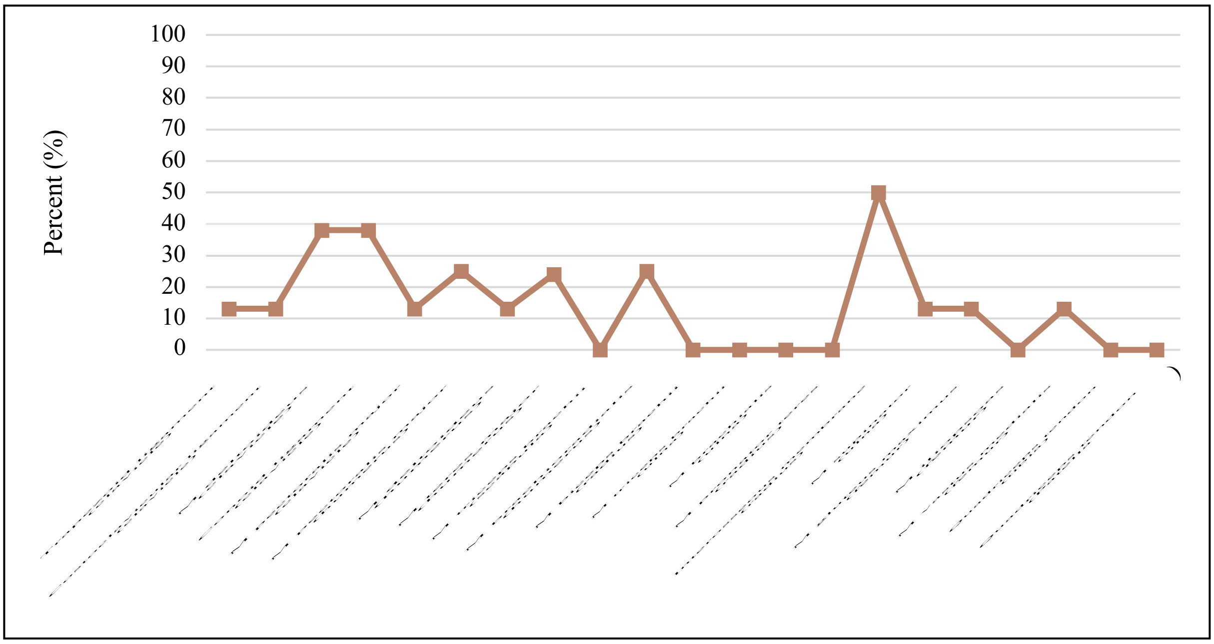

Figure IV-3. Erimi: Entheses representation (%) within the whole sample.

Thus, focusing on the entheses for which scores for ECs could be recorded by muscle, the *interosseous membrane* was the most frequently assessed (4/23, 17.4%). In contrast, seven entheses such as the *trapezoid ligament*, were recorded in only one case (4.3%).

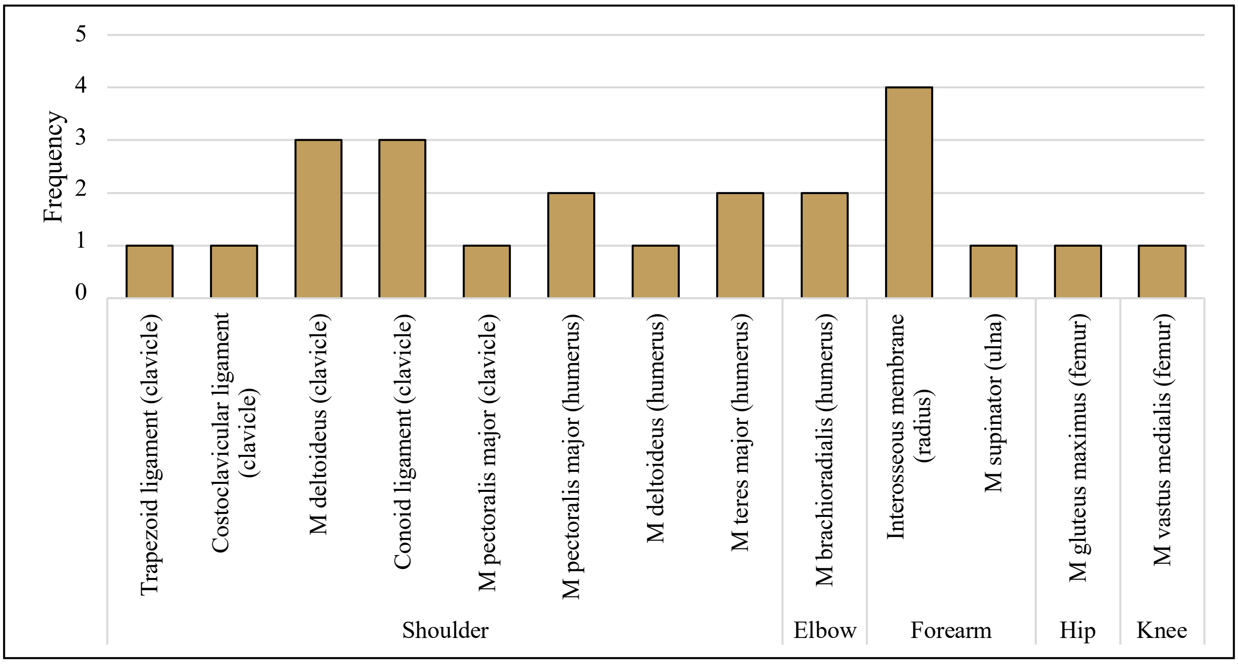

Figure IV-4. Erimi: Frequency distribution of the observed entheses by muscle. N:23.

Thus, this assessment highlighted a bias between the most and the least represented entheses was of the order of 4:1.

It can be said however that, overall, the number of mild degrees (=12) was equal to the number of moderate + severe evidence (=11). Moderate degrees were assigned in higher extent to the *trapezoid ligament,* the *deltoideus* (humerus), and the *pectoralis major* (clavicle). It must be specified, however, that these rates refer to a single observation. The same degree was observed, even if in lower extent, on the better represented *interosseous membrane* (1/4, 25.0%), *conoid ligament* (1/3, 33.3%), *deltoideus* (clavicle) (1/3, 33.3%) and *brachioradialis* (1/2, 50.0%). Severe score was assigned to the *costoclavicular* (1/1, 100.0%), the *conoid ligament* (2/3, 66.7%), and the *deltoideus* (clavicle) (1/3, 33.3%) (Figure IV-5).

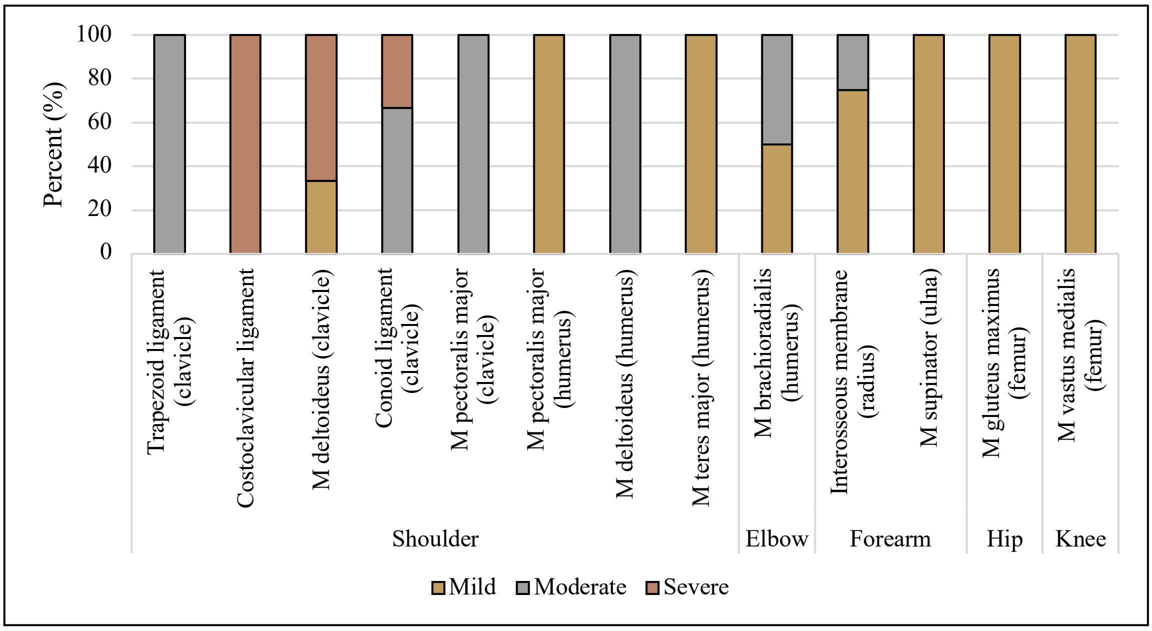

Figure IV-5. Erimi: Frequency distribution of mild, moderate, and severe robusticity ranks by muscle. N:23.

By pooling the entheses in functional complexes, it was much more evident the great bias between the shoulder, the best represented district (14/23, 60.9%), and the hip/knee, the least represented with only one observed enthesis (4.3%) (Figure IV-6).

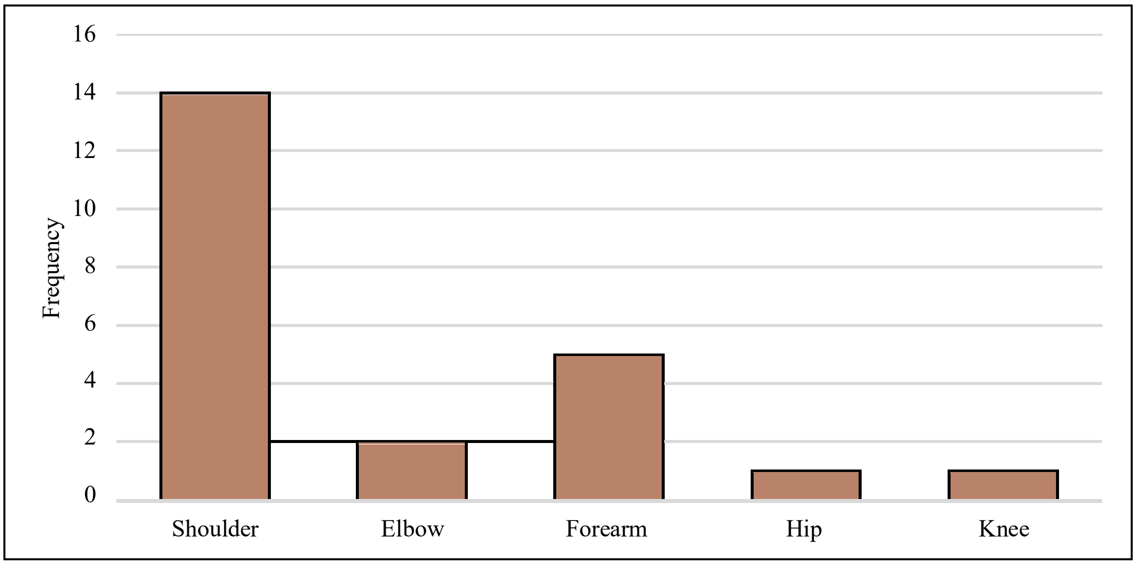

Figure IV-6. Erimi: Frequency distribution of the observed entheses by functional complex. N:23.

Thus, while taking into account this disparity in representation, figure IV-7 was designed to highlight the distribution of the robusticity ranks between the complexes. This second assessment shows that the shoulder was the functional complex which displayed the greatest percentages of moderate (5/14, 35.7%) and severe degrees (4/14, 28.6%), followed by the elbow, with 50.0%, (1/2) of moderate degrees and forearm, with 20.0% (1/5) of moderate ranks. For which concerns the hip and the knee, the scant number of observations did not allow any general consideration.

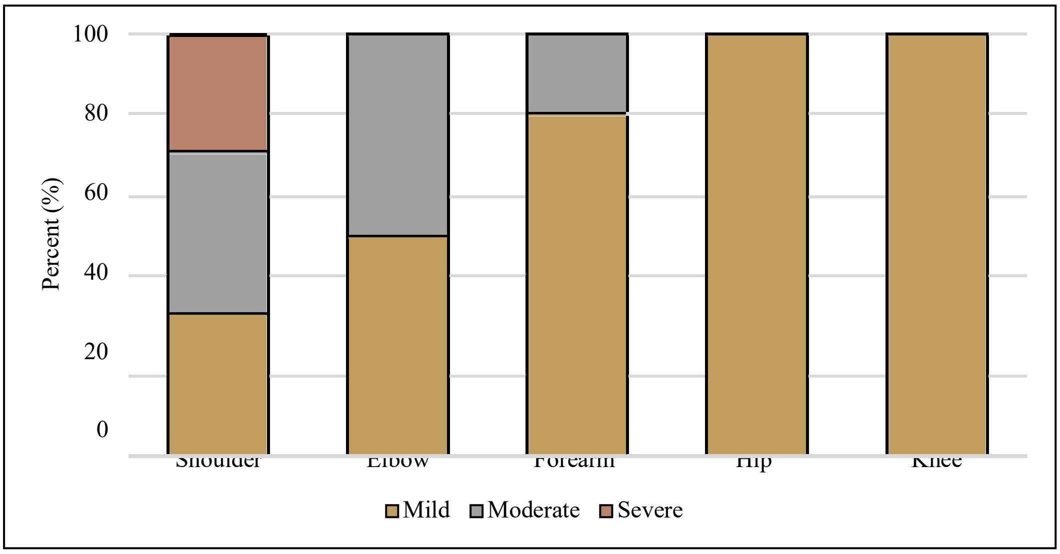

Figure IV-7. Erimi: Frequency distribution of the mild, moderate, and severe robusticity ranks by functional complex. N:23.

Robusticity: relationship between score development, side, sex, and age

Concerning the bilateral asymmetry, the *conoid ligament*, the *deltoideus* (clavicle), the *brachioradialis*, the *interosseous membrane* were the only four comparable entheses as they were found represented on both the sides. In all the four cases, the right side was found to be better represented (IV-8).

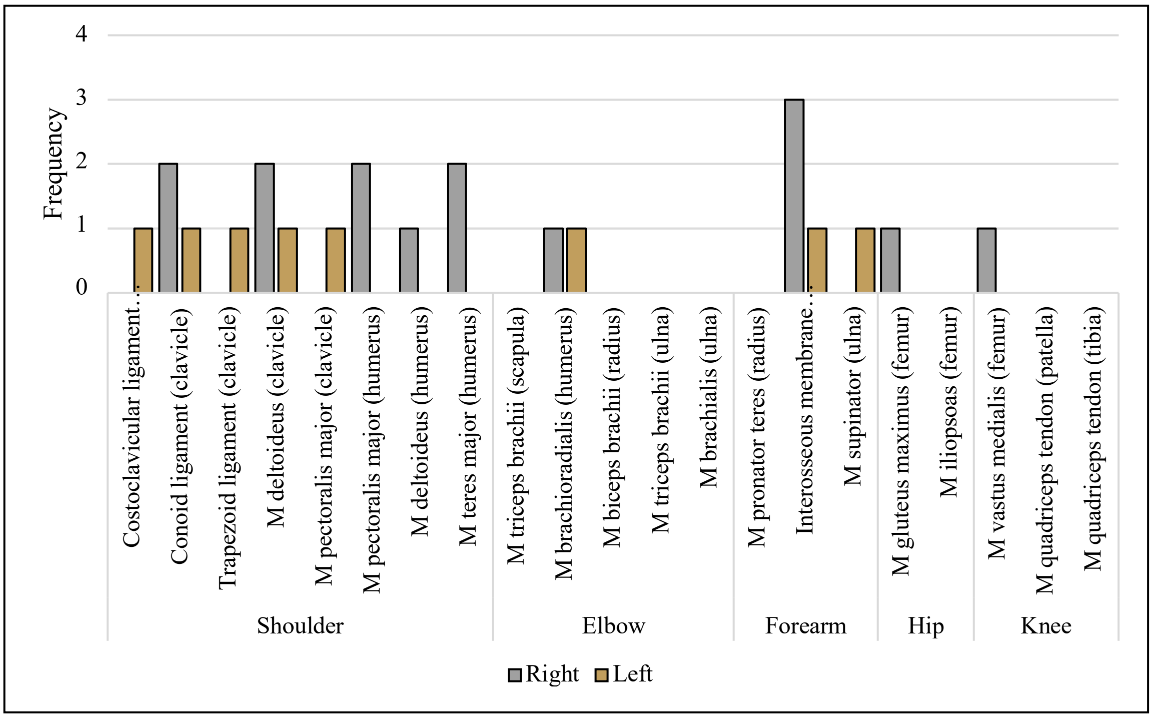

Figure IV-8. Erimi: Frequency distribution of the observed entheses by side entheses. N:23.

Thus, taking into account these disparities, figure IV-9 shows in all the cases, except the *brachioradialis*, the right side has been more utilized than the left.

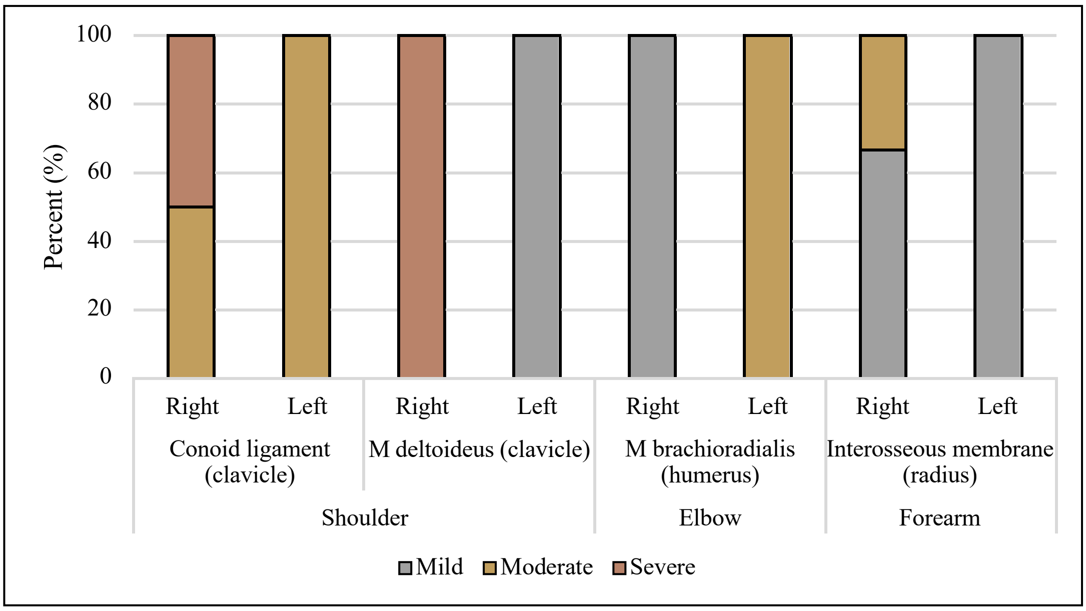

Figure IV-9. Erimi: Frequency distribution of mild, moderate, and severe robusticity ranks by side. N:14.

By looking at the functional complexes, only those pertaining to the upper limb were considered. Indeed, no left entheses for the hip and the knee were observed; thus, these two complexes were excluded. Overall, the right side was better represented than the left. The shoulder displayed the greatest bias between the right and left side (2:1), while the forearm was almost equally represented (Figure IV-10).

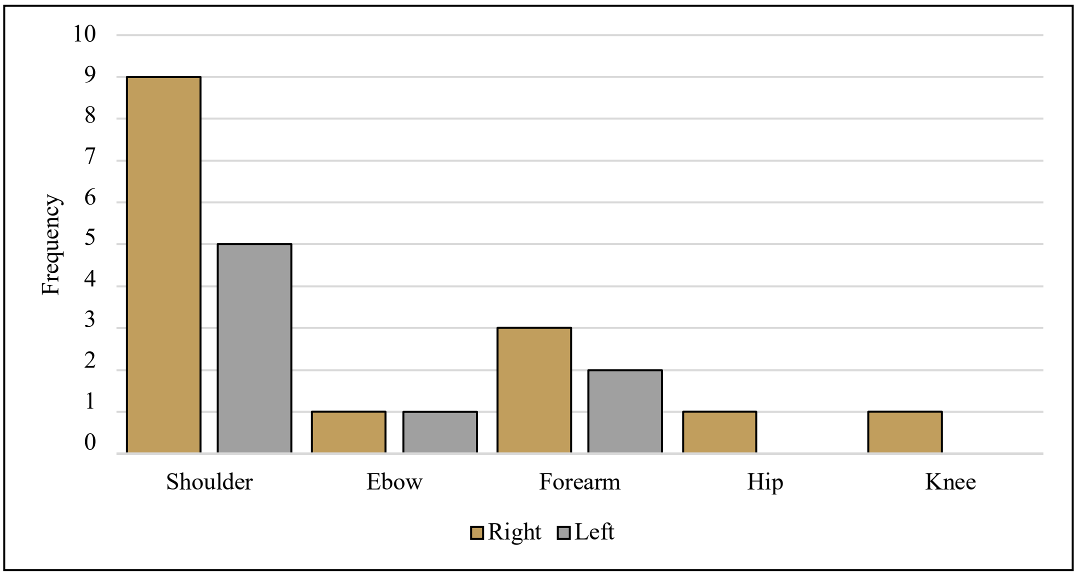

Figure IV-10. Erimi: Frequency distribution of the observed entheses by side (pooled functional complexes). N:23.

Thus, considering the upper limb, the left side of the shoulder provided a higher number of moderate (3/5, 60.0%) and severe degrees (1/5, 20.0%) compared with the right (3/9, 33.3% severe degrees and 2/9, 22.2% moderate degrees); as for the elbow, the left enthesis observed was ranked as moderate while the right enthesis was ranked as mild; as for the forearm, the right exhibited 33.3% (1/3) moderate robusticity, while 0.0% on the left side (Figure IV-11).

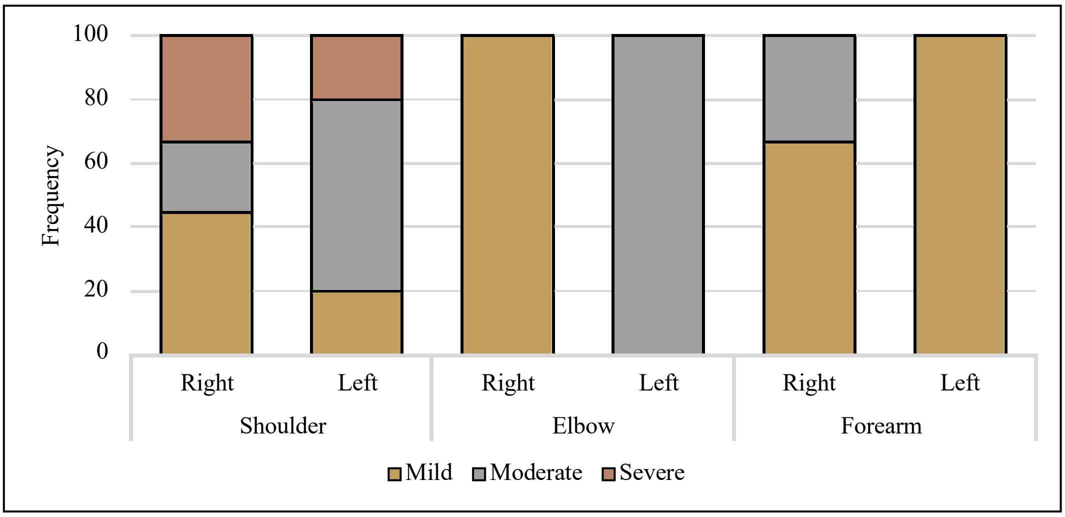

Figure IV-11. Erimi: Frequency distribution of mild, moderate, and severe robusticity ranks by side (pooled functional complexes). N:21.

Despite these findings, the Mann-Whitney *U*-test did not display any significant difference in the distribution of the robusticity ranks between the sides (shoulder p-value=0.797, elbow p-value=1.000, forearm p-value=0.800)

Looking at the comparisons between the sexes, only three muscle insertions (*conoid, deltoideus* and *interosseous membrane*) were represented on both the sexes; but only in the case of the *interosseous membrane* an equal number of entheses were observed (Figure IV-12).

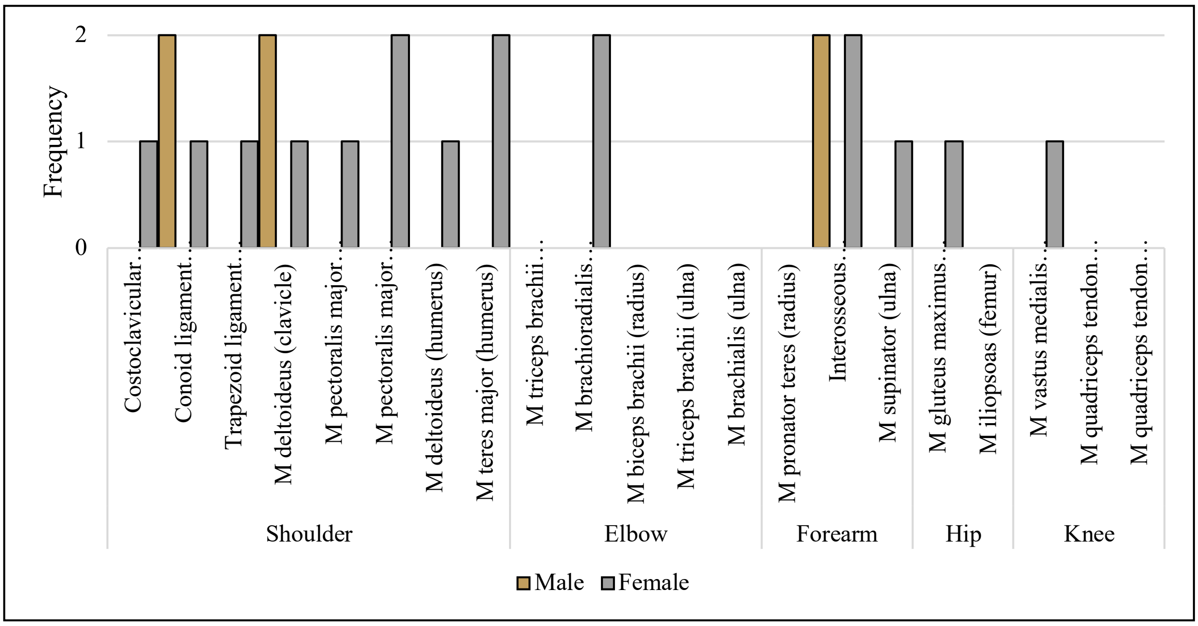

Figure IV-12. Erimi: Frequency distribution of the observed entheses by sex. N:23.

In terms of severity degrees, the males exhibited higher ranking at all the three muscles (Figure IV-13). However, females displayed increasing ranking at the *costoclavicular,* the *trapezoid, pectoralis major*, and the *deltoideus*.

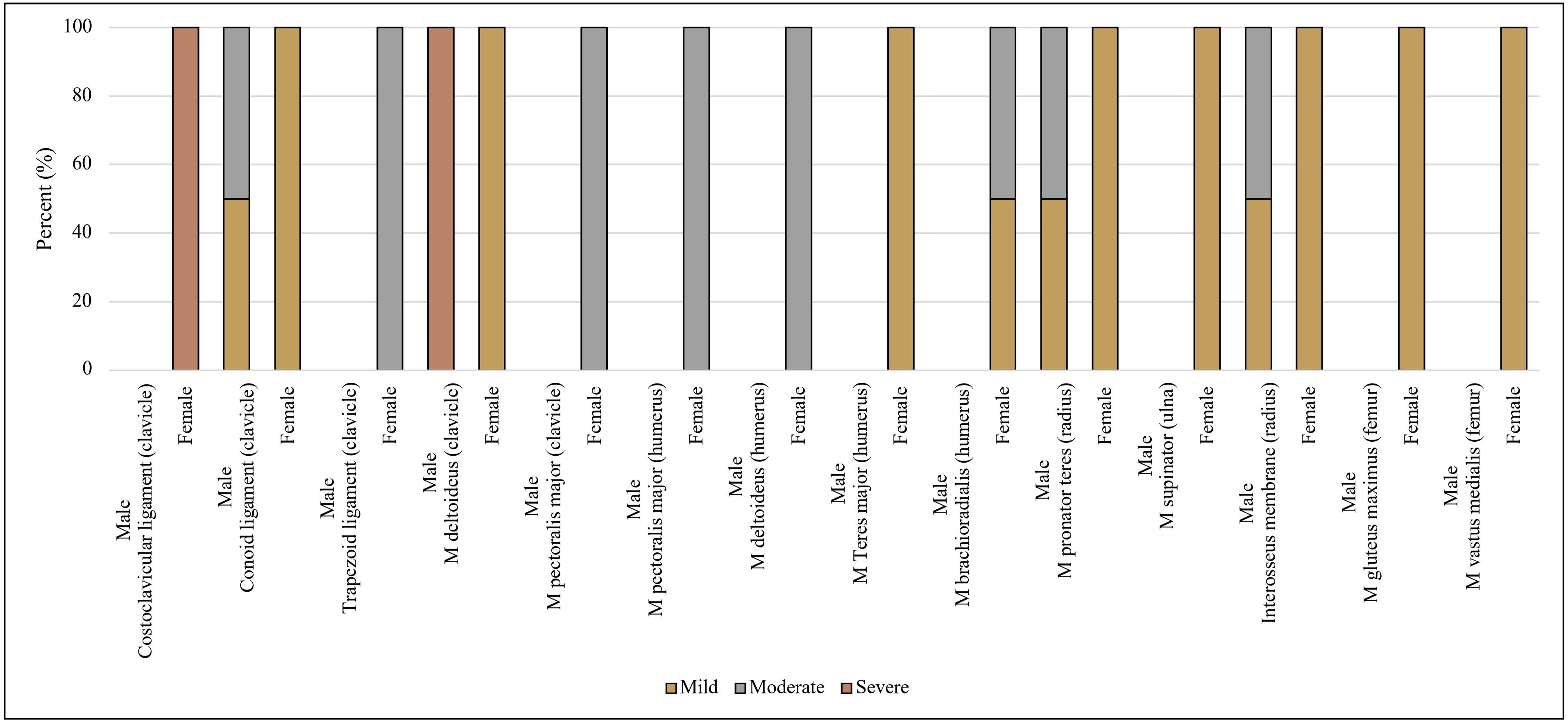

Figure IV-13. Erimi: Frequency distribution of mild, moderate, and severe robusticity ranks by sex. N:10.

By pooling the data in functional complexes, the elbow, the hip, and the knee were excluded from comparisons because of the absence of male entheses. For which concerns the shoulder, the number of the entheses belonging to females greatly exceeded the number of the those belonging to males (2:1). As for the forearm, the bias towards female was smaller (Figure IV-14).

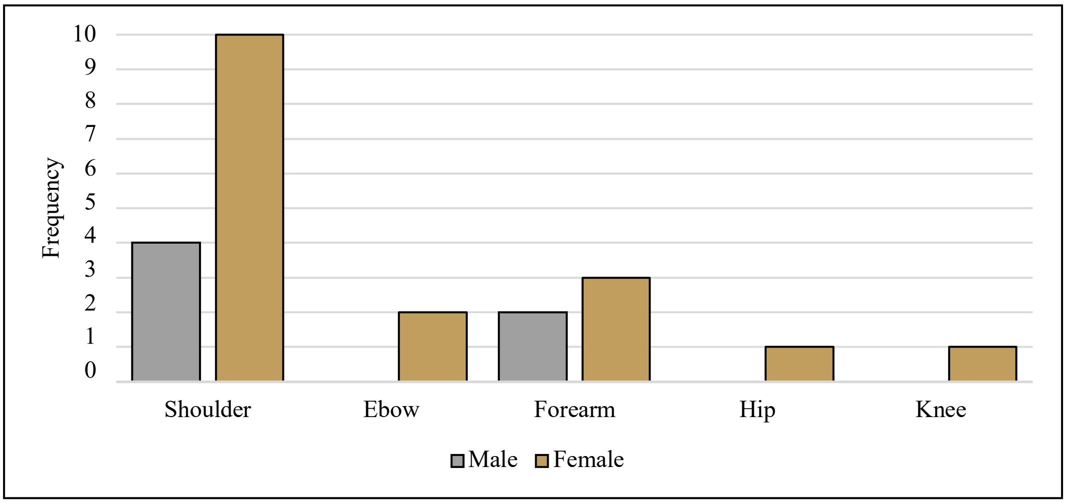

Figure IV-14. Erimi: Frequency distribution of the observed entheses by sex (pooled functional complexes). N:23.

Thus, focusing on the shoulder and the forearm, in both the complexes the male entheses exhibited more severe robusticity ranks compared with the females (Figure IV-15).

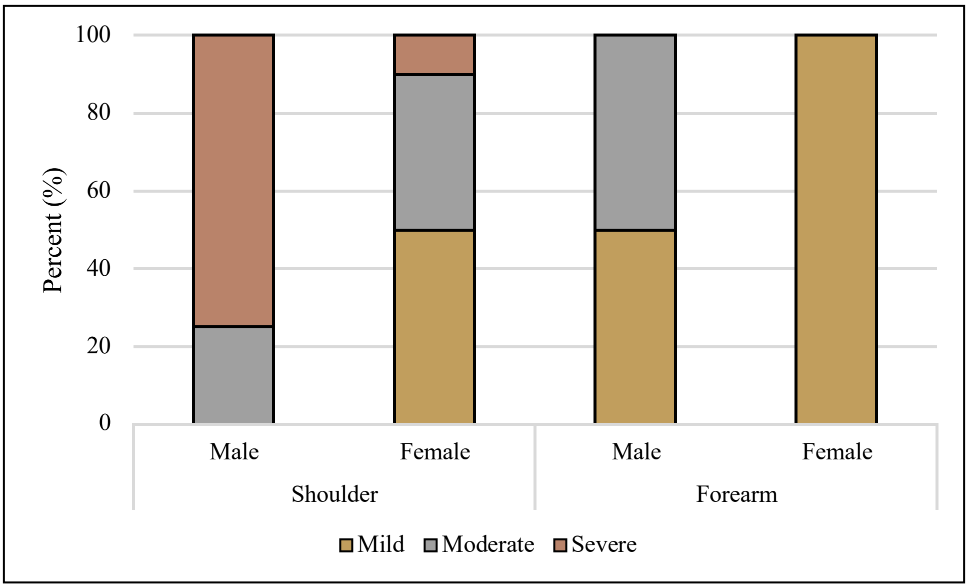

Figure IV-15. Erimi: Frequency distribution of mild, moderate, and severe ranks by sex (pooled functional complexes). N:19.

The Mann-Whitney *U*-test revealed significant differences between the sexes in the use the shoulder (p-value=0.024), no one for the forearm (p-value=0.400).

Finally, concerning the distribution of the robusticity ranks between the age groups, the sample under study was restricted to only ten entheses. The other belonged to the individual of undetermined age. No entheses belonged to the lower limb was included in this sub-sample. Moreover, only two functional complexes of three (shoulder and forearm) from the upper limb were considered because in the elbow the mature adult range was not represented (Figure IV-16). Both the shoulder and the forearm displayed a bias towards mature adults of the order of 2:1.

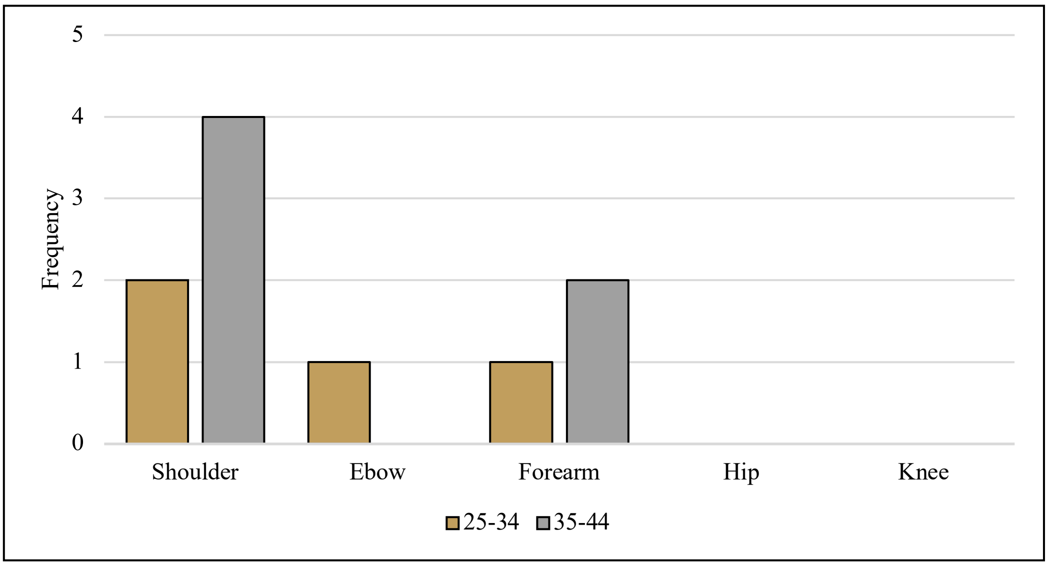

Figure IV-16. Erimi: Frequency distribution of the observed entheses by age group (pooled functional complexes). N:10.

Looking at the robusticity ranks distribution, the only moderate and severe expressions were detected on the entheses belonging to the mature adult in both the complexes (Figure IV-17).

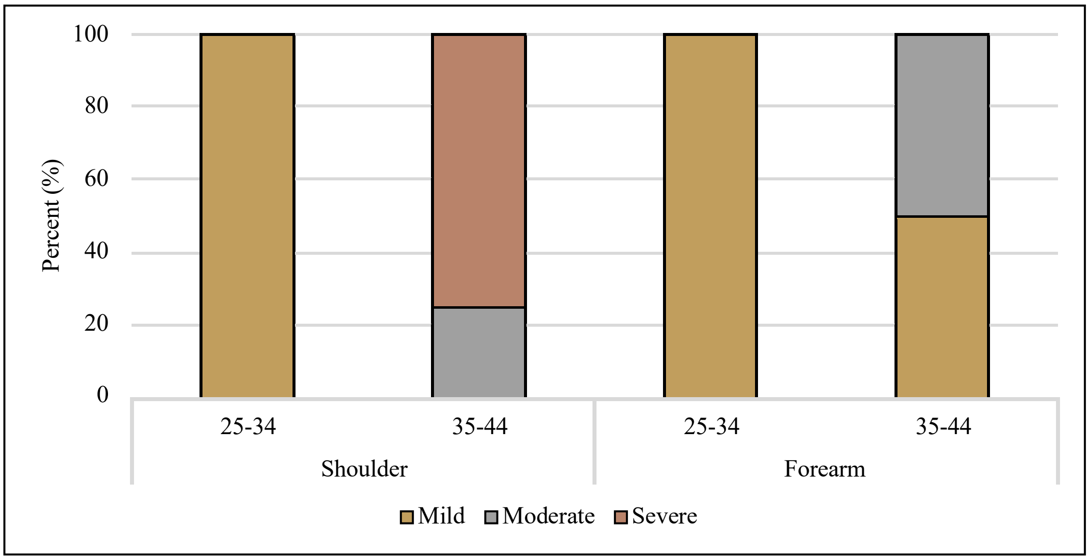

Figure IV-17. Erimi: Frequency distribution of mild, moderate, and severe ranks by age group (pooled functional complexes). N:9.

Dealing with only nine entheses in total, the Mann-Whitney *U*-test was applied on the pooled sample instead of on the separated functional complexes. The test revealed a significant difference in the distribution of the robusticity ranks by age category (p-value=0.038).

<u>Osteolytic and Enthesophytic formations: relationship between score development and enthesis</u>

OLs and EFs were not present on all the entheses observed. More specifically, the formers were rare, affecting only 17.4% (4/23) of the total observed entheses; the last were more frequent, affecting 34.8% (8/23) of the surfaces observed.

For which concerns the OLs, the four affected surfaces consisted of three *conoid ligaments,* two ranked as mild and one as moderate, and one *interosseous membrane*, ranked as mild (Figure IV-18).

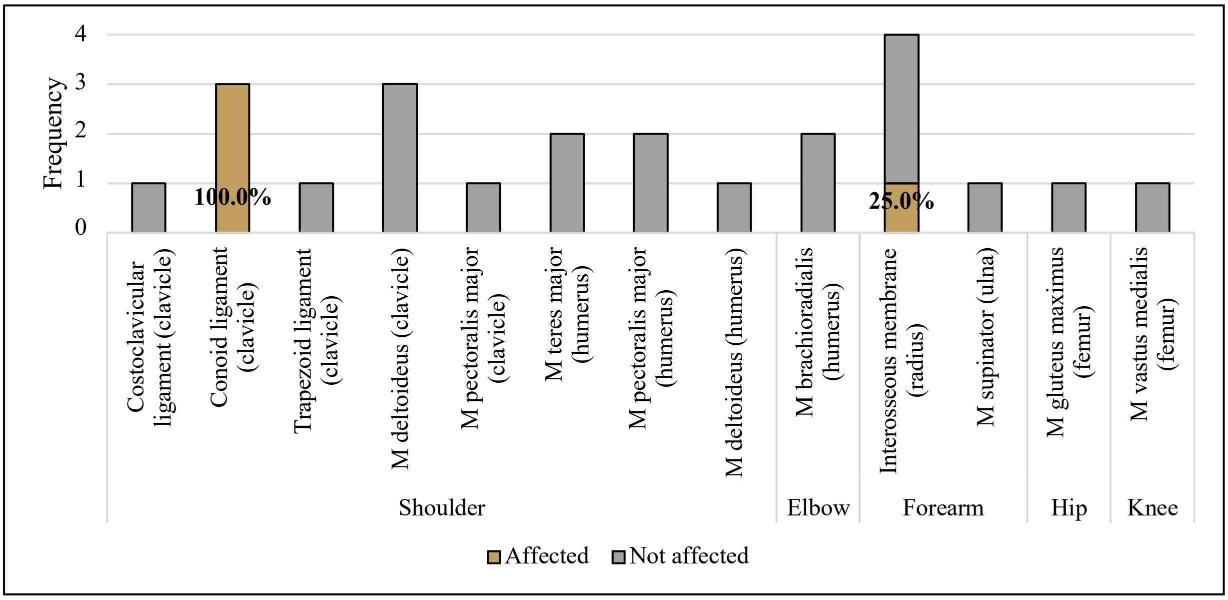

Figure IV-18. Erimi: Frequency distribution of the OLs by muscle. N:23.

No additional graph was produced to highlight the distribution of the affected entheses by functional complex, since the scant number of affections. Nevertheless, figure IV-18 clearly shows that the shoulder was the most affected encompassing three of the four entheses affected.

For which concerns the EFs, among the eight entheses affected, the *conoid* was one of the best represented and which yielded the highest percentages of affections (3/3, 100.0%) (Figure IV-19). High percentages were also recorded for the *costoclavicular*, *trapezoid, vastus medialis*, but they refer to a single enthesis observed.

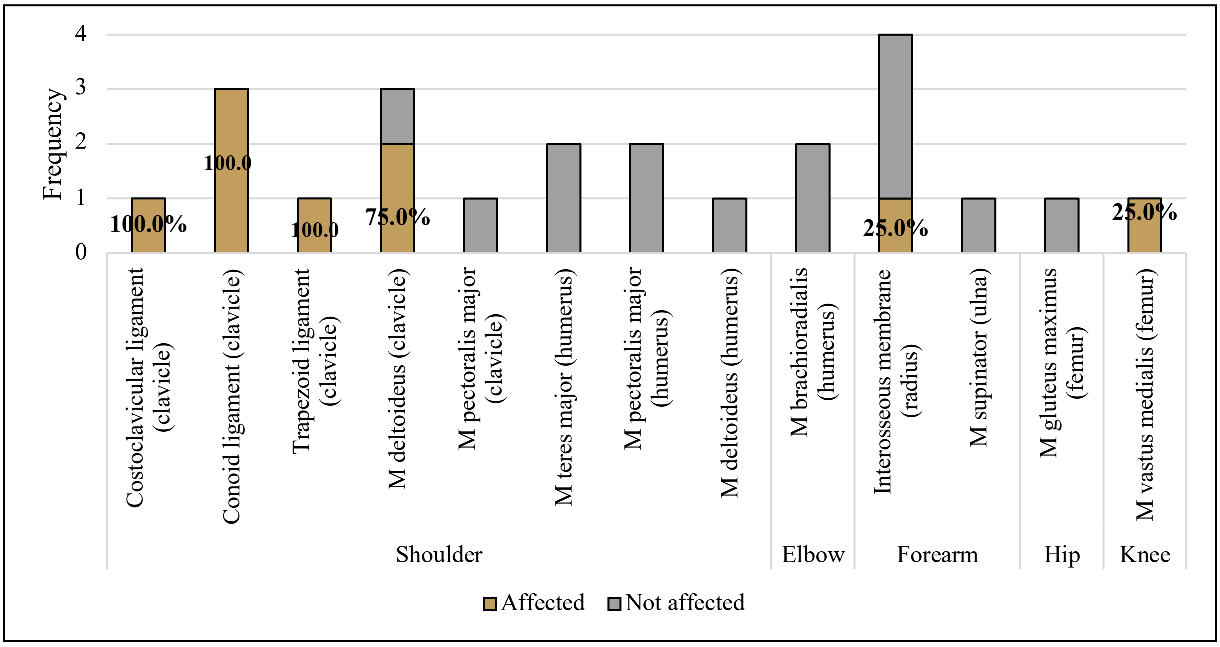

Figure IV-19. Erimi: Frequency distribution of the EFs by muscle. N:23.

In terms of severity distribution, all these eight entheses exhibited mild EFs, except the two *deltoideus* for which was ranked as moderate. No additional graph was produced to highlight the distribution of the affected entheses by functional complex, since the scant number of affections. Nevertheless, figure IV-19 clearly shows that, by pooling the entheses, the shoulder was the most affected encompassing seven of the eight entheses affected.

<u>Osteolytic and Enthesophytic formations: relationship between score development, side, sex, and age</u>

Since the OLs were observed in four cases of 23 entheses, no comparisons between sides, sexes or age categories were possible. It is worthy to say that two of these entheses (*conoid ligament*) belonged to an undetermined female, while the other two (*conoid ligament* and *interosseous membrane*) to a mature adult male.

EFs were observed on eight entheses of 23 as shown by figure IV-20. The shoulder was the only functional complex that was considered as both the sides were represented and provided affections. Despite the already stated bias towards the right side, the left entheses displayed the highest percentage of affections (3/5, 60.0%) compared with 44.4% (4/9) of the right entheses, and, in addition, the greatest percentage of moderate degrees (2/3, 66.7%) compared with the right (2/4, 50.0%).

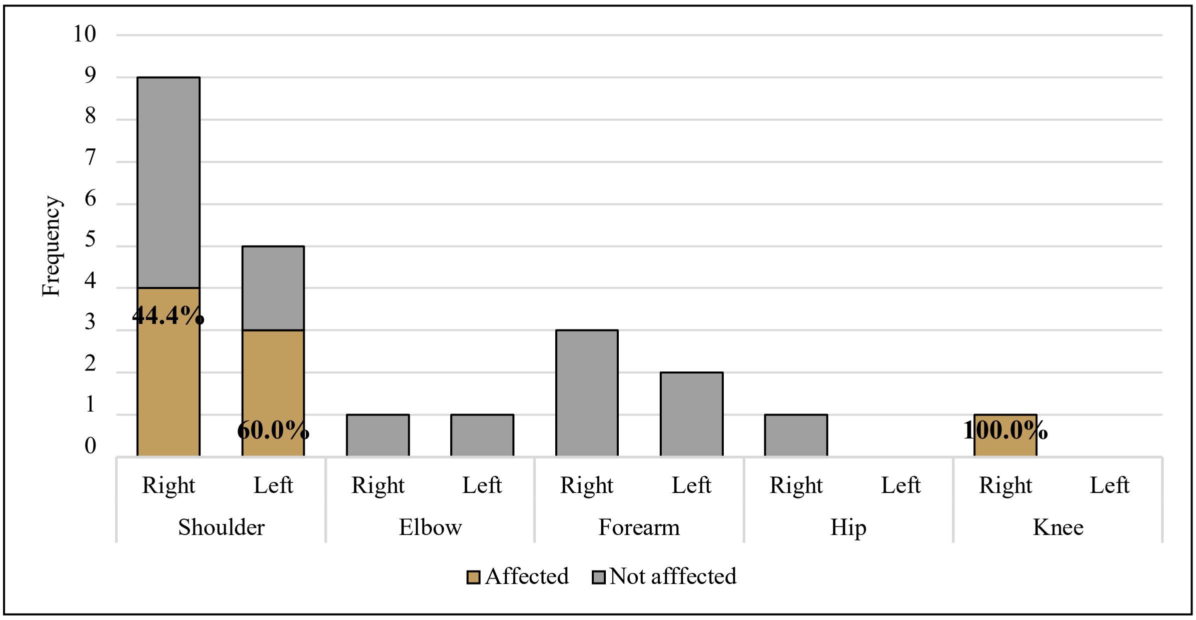

Figure IV-20. Erimi: Frequency distribution of the EFs by side (pooled functional complexes). N:23.

The Mann-Whitney *U*-test did not reveal any significant difference between the sides (p-value=0.571).

For which concerns the distribution of the EFs between sexes, the shoulder was the only functional complex that was considered as both the sexes were represented (Figure IV-21). Despite the bias, towards the females, of the order of 2:1, the males exhibited the highest rate of affections (4/4, 100%) compared with 30% (3/10) observed on the females.

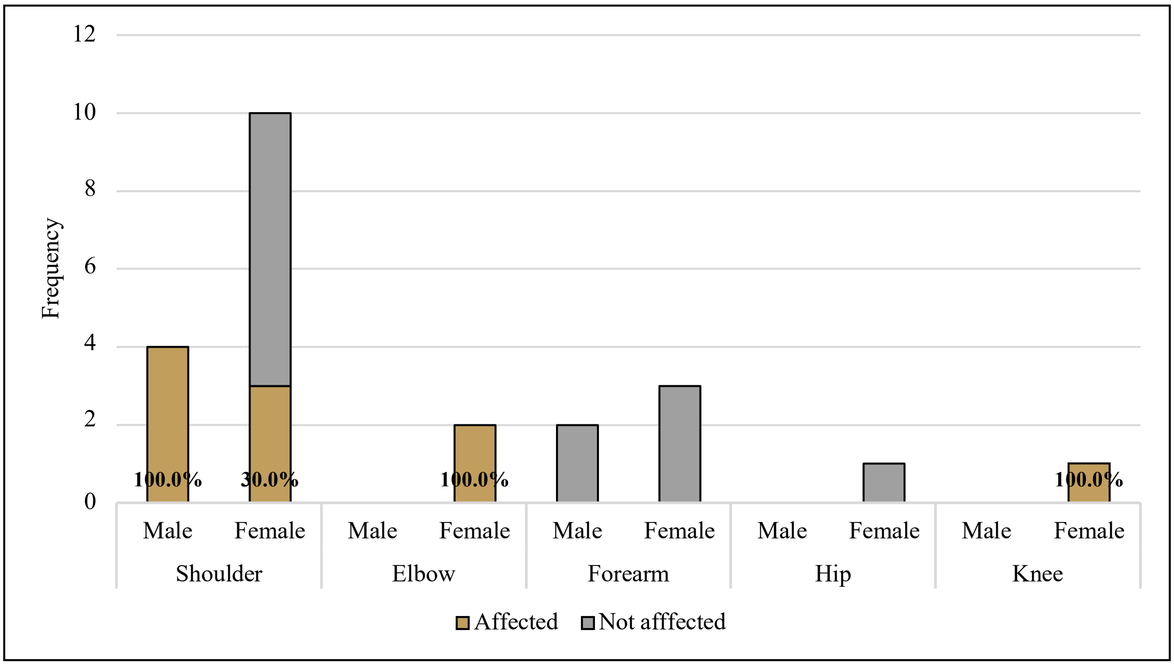

Figure IV-21. Erimi: Frequency distribution of the EFs by sex (pooled functional complexes). N:23.

Neither frequency assessment nor statistical test was carried out to highlight the severity distribution by sex, since the scant number of affections. It must be noted, however, that the females exhibited the highest rate of moderate degrees (66.7%).

For which concerns the distribution of the EFs between age categories, the entheses examined for the mature adult range were the only ones which yielded evidence of EFs (Figure IV-22). No affection was recorded on the middle adult entheses.

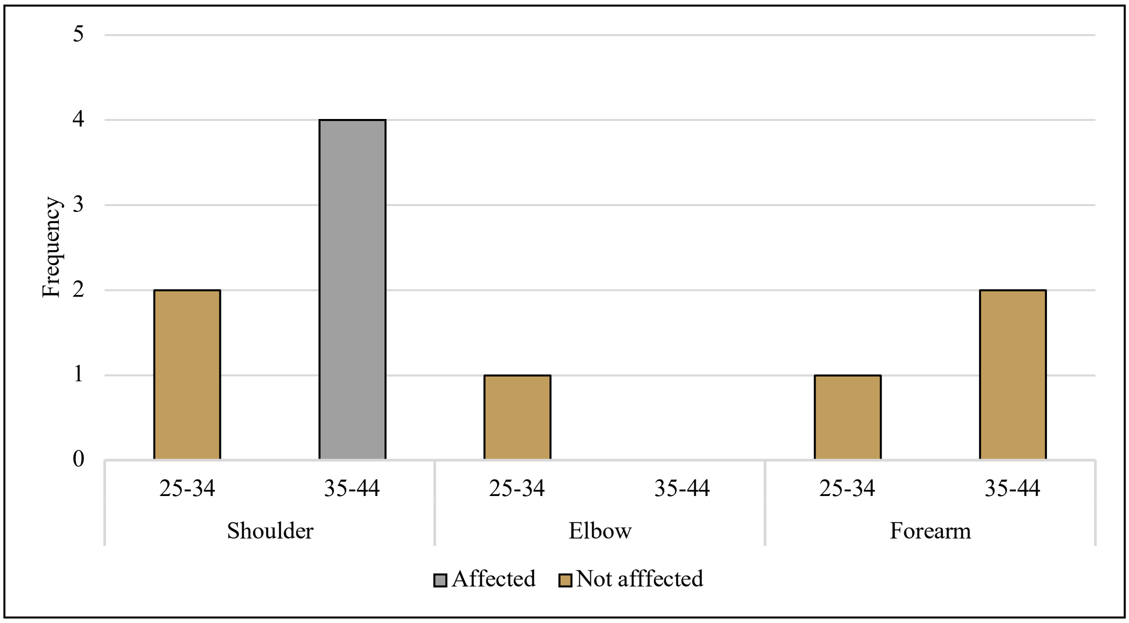

Figure IV-22. Erimi: Frequency distribution of the EFs by age category (pooled functional complexes). N:10.

Osteoarthritis

No joint surface was enough preserved to be included in this study.

Extra-masticatory dental wear

A total of 16 maxillary teeth belonging to three individuals were examined for evidence of extra-masticatory dental wear. No evidence was found.

Summary

In sum, the population from Erimi was small and constituted by an equal number of males and females; overall, they predominantly fell within the mature age range. On the basis of the evaluation of the robusticity ranks scored for ECs, it is possible to assert that the shoulder and forearm were the best represented and most developed functional complexes. Looking at the differences between the sides, in the shoulder and elbow, the left side appeared to be more utilized than the right; the opposite trend was noted for the forearm. The females were better represented than the males, but these latter exhibited the higher percentages of moderate robusticity. Females stood out for increasing ranking at the *costoclavicular,* the *trapezoid,* the *pectoralis major*, and the *deltoideus*, while males exhibited greater values at the *conoid* and the *interosseous membrane*. Concerning the comparisons between age groups, the severity of this marker increased with age. Concerning the OLs, they occurred on four surfaces pertaining to the *conoid ligaments* and the *interosseous membrane*: three of these were ranked as mild, the other as moderate. Since the very low number of affections, no differences between sides, sexes and age categories could be ascertained. Concerning the EFs, they occurred on 8 surfaces predominantly belonged to the shoulder. Among these, only one was ranked as moderate, the remaining as mild. The shoulder was evaluated for side comparison; and it resulted to be more severely affected on the left side. The same complex was also considered for the sex comparison: in this case, the males displayed the highest percentages of affections, but the females were more severely affected. No comparison between age groups was possible Concerning the OA, no joint surface was included in this study. Concerning the extra-masticatory dental wear, no evidence was noted.

Episkopi Phaneromeni

Paleodemography

The biological sex and mortality profile of adults from the MBAIII-LBAI site of Episkopi is presented in table V-1. Sex estimation was possible for all the observed skeletons (=14). The proportion of female individuals (10/14, 71.4%) greatly exceeds males (4/14, 28.6%). Age estimation was possible in only six of 14 cases (42.9%). All the four age categories are represented: young (20-24 years), middle (25-34 years), mature (35-44) and the old (45+ years) adults.

Table V-1. Episkopi: Age and sex composition of the sample. ND: not determined. %: within the sex

	Young adult 20-24		Middle adult 25-34		Mature adult 35-44		Old adult 45+		ND		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Male	0	0.0	0	0.0	1	25.0	1	25.0	2	50.0	4	28.6
Female	3	30.0	1	10.0	0	0.0	0	0.0	6	60.0	10	71.4
Total	3	21.0	1	7.0	1	7.0	1	7.0	8	57.0	14	100.0

In view of the large number of individuals for whom age could not be determined, it would be misleading to draw any detailed conclusions about mortality. It is, however, possible to assert that the majority of adults fell within the range of young adults (20-24 years). The bar chart in figure V-2 illustrates the age distribution of the sample by sex. Overall, it must be noted that the female age distribution reflects younger groups, while the males the middle-mature adult groups.

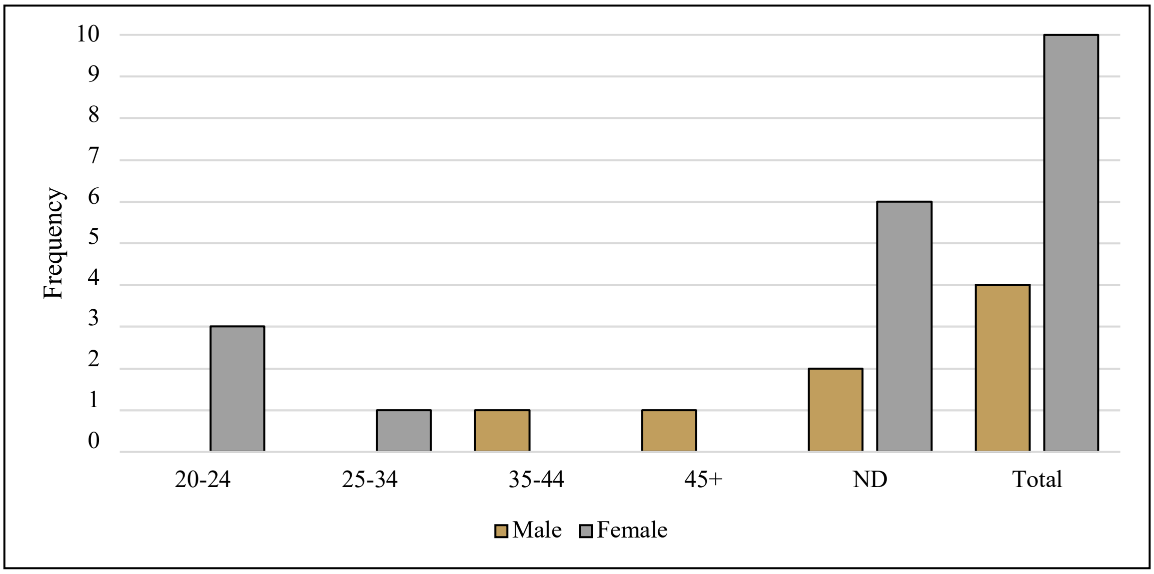

Figure V-2. Episkopi: Age distribution of the sample by sex. ND: Not Determined. N:14.

Entheseal Changes

<u>Robusticity: relationship between score development, enthesis, and functional complex</u>

The evaluation of the ECs of this sample was carried out on a total of 51 entheses belonging to nine individuals. Figure V-3 shows that the BRI values were very low suggesting a poor representation of all the observed entheses.

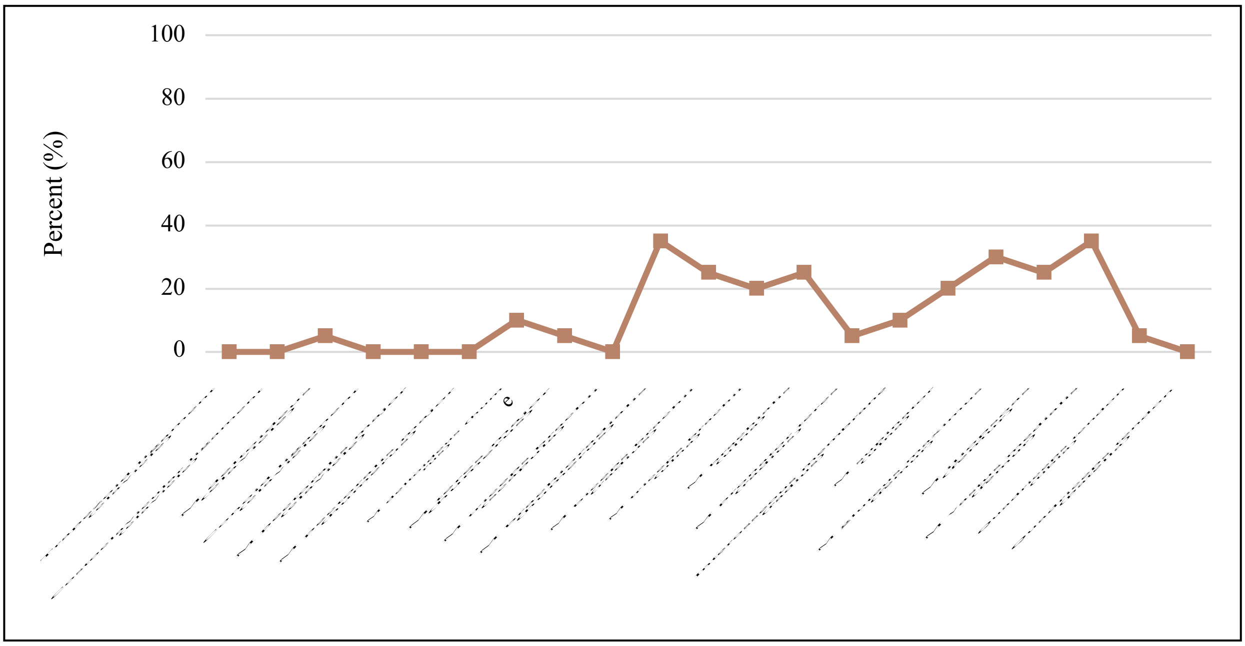

Figure V-3. Episkopi: Entheses representation (%) within the whole sample. N:51.

Thus, focusing on distribution of entheses for which scores for ECs could be recorded by muscle, figure V-4 shows that the *brachioradialis* and the *vastus medialis* were the most frequently assessed (7/51, 19.6%). In contrast, the *deltoideus* (clavicle), the *teres major*, the *pronator teres*, and the *quadriceps tendon* (tibia) were the less well preserved entheses (1/51, 2.0%).

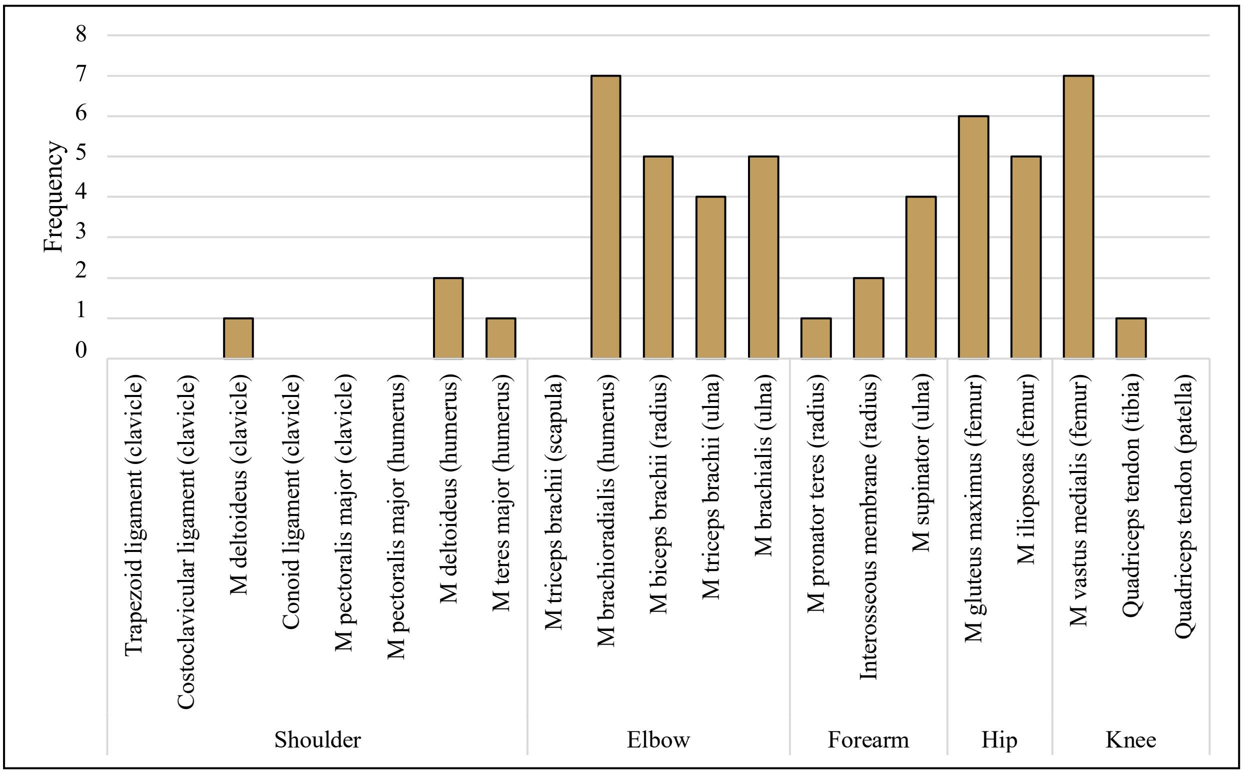

Figure V-4. Episkopi: Frequency distribution of observed entheses by muscle. N:51.

It is evident by this first assessment that there was a bias between the most and the least represented entheses of the order of 1:10. Thus, looking at the severity distribution by muscle, no severe expressions were scored on this sample. There was a high prevalence of mild modifications, except on the *pronator teres*, where the 100.0% (1/1) of moderate degrees was recorded (Figure V-5).

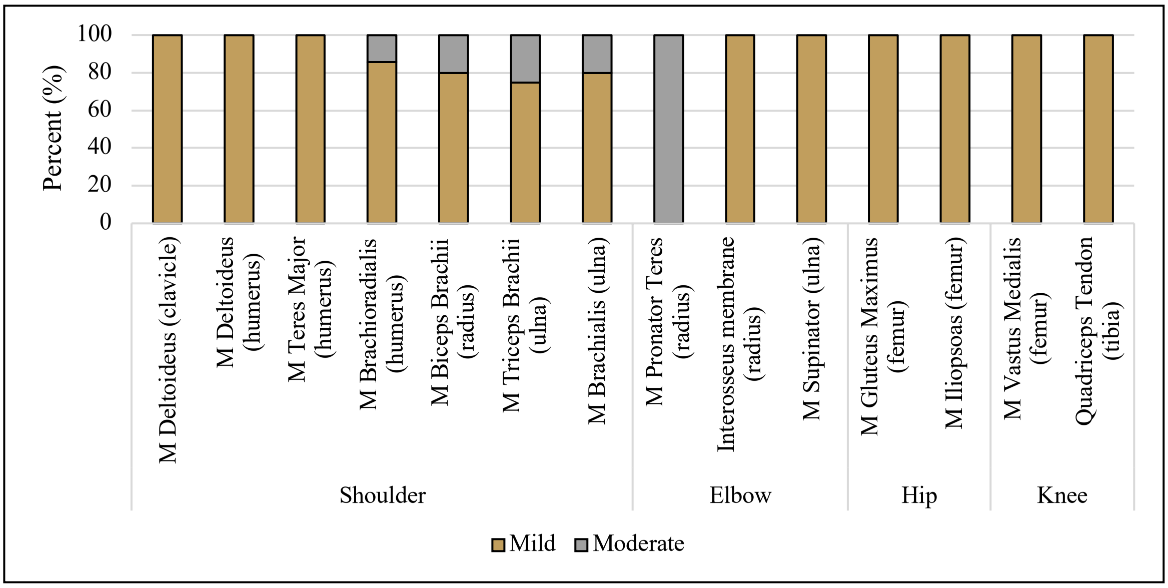

Figure V-5. Episkopi: Frequency distribution of mild and moderate robusticity ranks by muscle. N:51.

<u>Robusticity: relationship between score development, side, sex, and age</u>

Considering the bilateral asymmetry, it must be specified that the left entheses (=27) prevailed in number over the right ones (=24). Figure V-6 shows that no enthesis pertaining to the shoulder was comparable as they did not represent between the sides. As for the other entheses, the bias between the best and least represented enthesis was of the order of 1:4 towards the left.

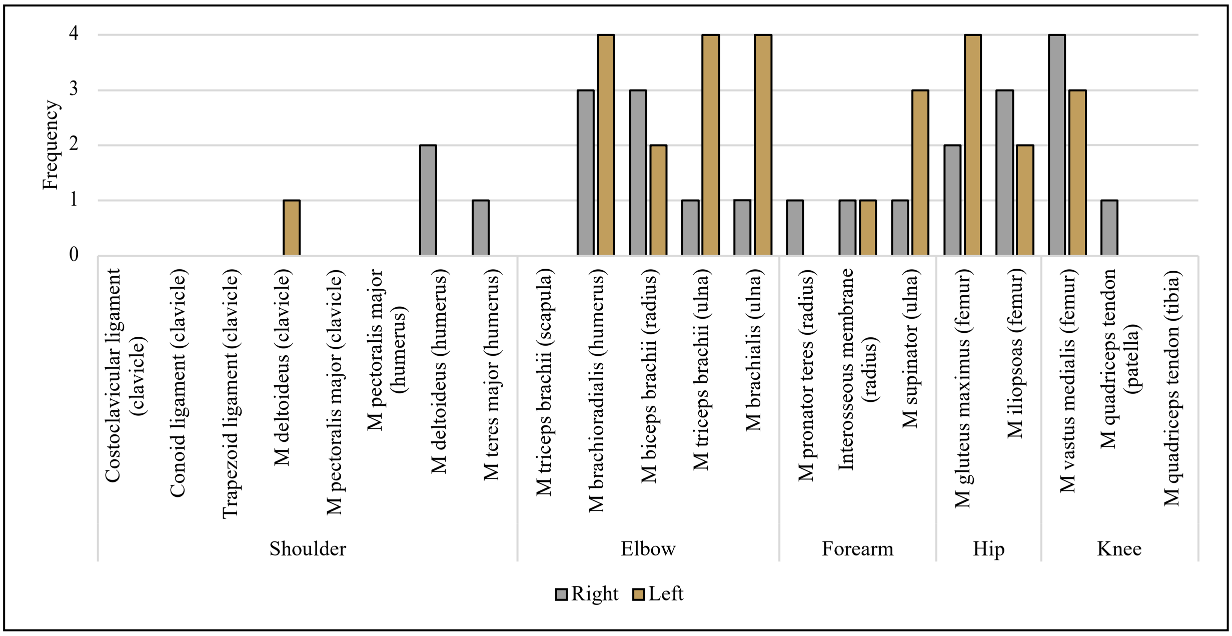

Figure V-6. Episkopi: Frequency distribution of the observed entheses by side. N:51.

As for the severity distribution between sides, only four entheses displayed differences in terms of development: the *brachioradialis* and the *brachialis* appear to have been more utilized on the left side, while the *biceps brachii* and the *triceps brachii* had pronounced development on the right side compared with the left side.

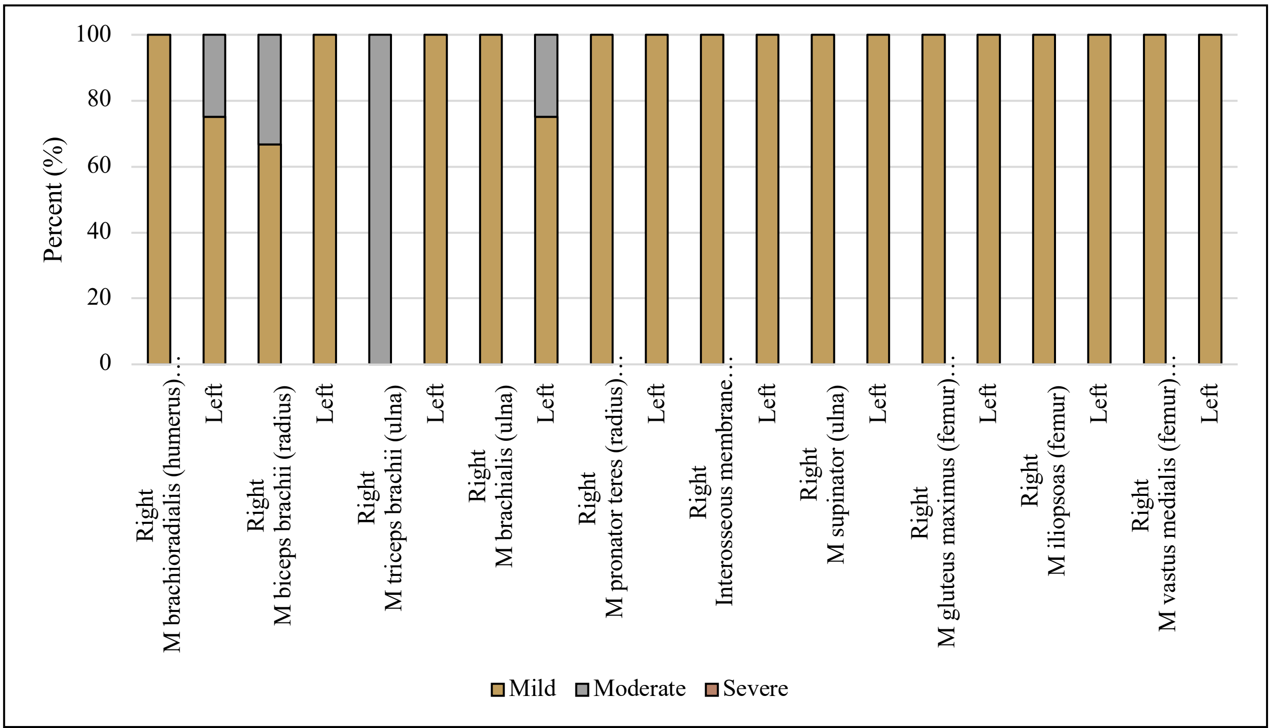

Figure V-7. Episkopi: Frequency distribution of mild and moderate robusticity ranks by side. N:51

By combining the entheses in functional complexes, the left side was represented in the elbow, the forearm, and the hip; while in the shoulder and the knee, the right side was better represented (Figure V-8).

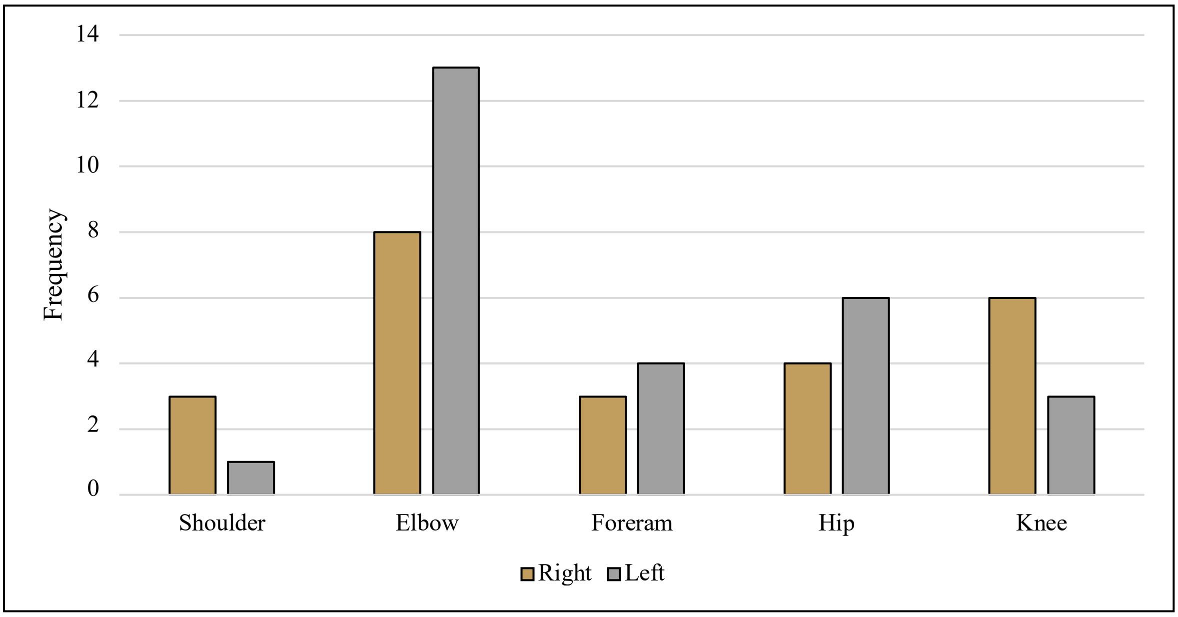

Figure V-8. Episkopi: Frequency distribution of the observed entheses by side (pooled functional complexes). N:51.

Concerning the robusticity ranks distribution, by side, the right side was more developed than the left providing 25.0% (2/8) and 33.3% (1/3) moderate degrees in the elbow and the forearm respectively. In the other functional complexes, no differences were noted between the sides.

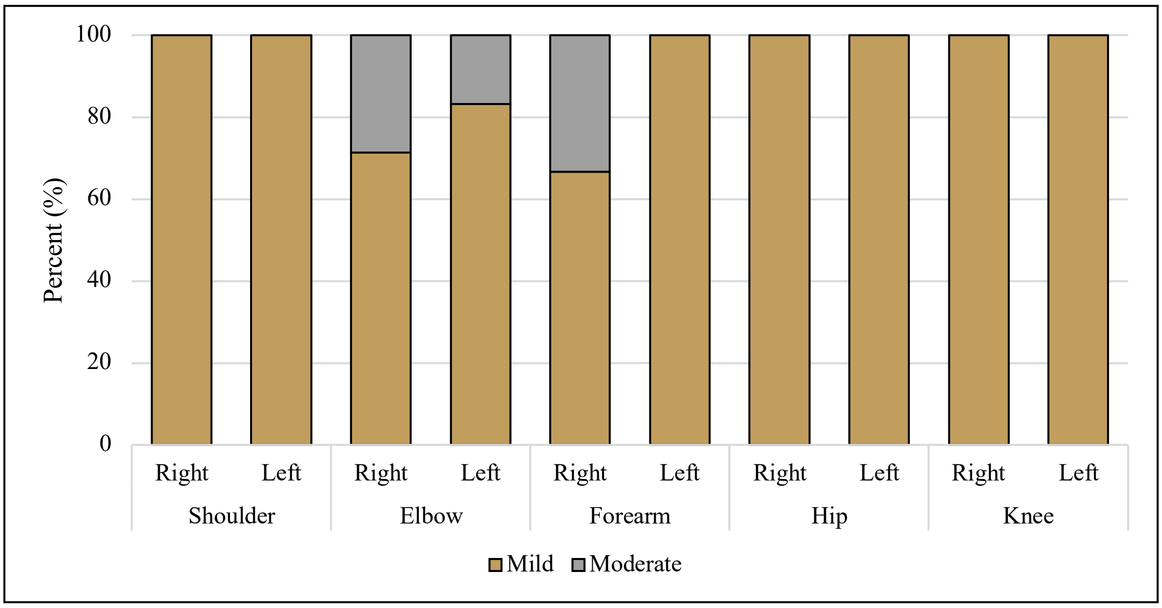

Figure V-9. Episkopi: Frequency distribution of mild and moderate robusticity ranks by side (pooled functional complexes). N:51.

These differences were however not significant (shoulder p-value=1.000, elbow p-value=0.711, forearm p-value=0.629, hip p-value=1.000, knee p-value=1.000).

Concerning the comparison between the sexes, only seven entheses were represented on both the sexes: among these, only the *supinator* was found to be equally represented. In the remainder cases, the female entheses greatly prevailed over the male entheses (Figure V-10).

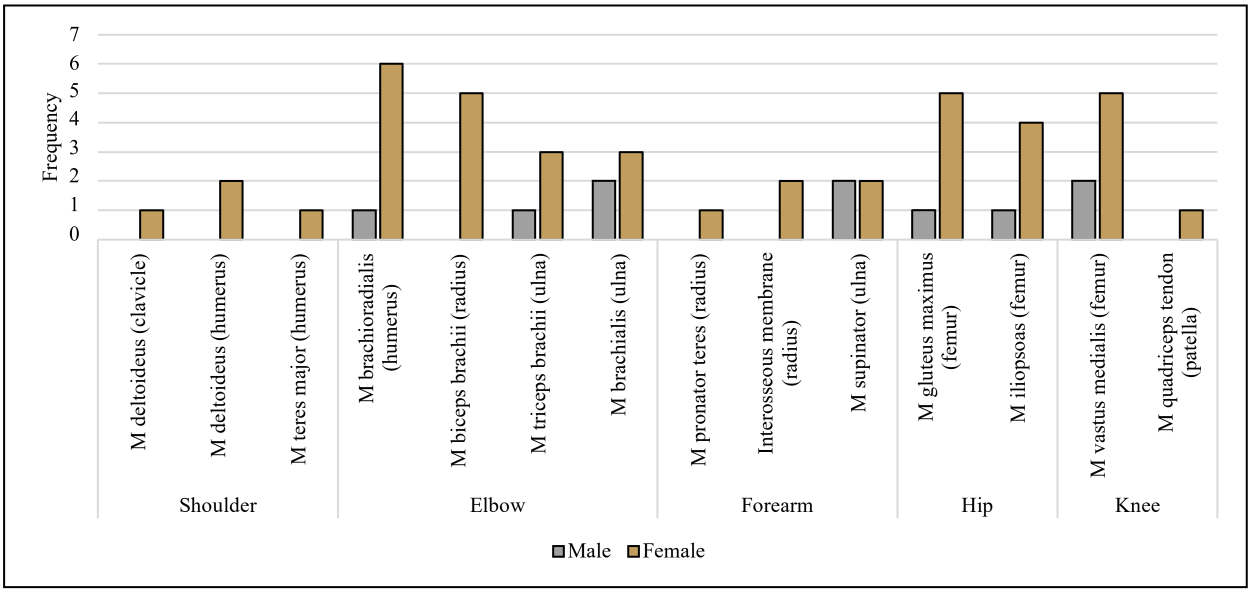

Figure V-10. Episkopi: Frequency distribution of the observed entheses by sex. N:51.

As for the robusticity distribution, despite being underrepresented, the males displayed greater ranking at the *triceps brachii* (ulna) and the *biceps brachii*. Conversely, the females had pronounced *brachialis* and *brachioradialis* compared with the males (Figure V-11).

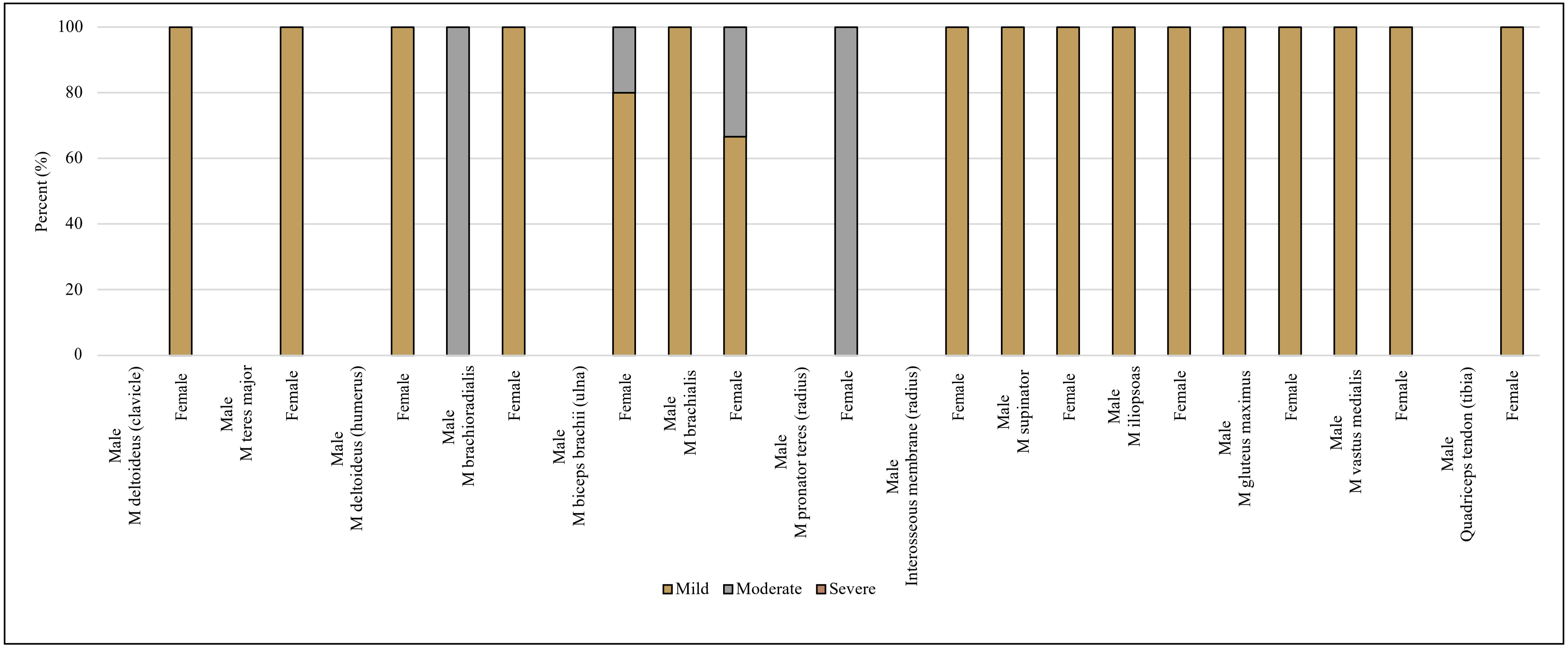

Figure V-11. Episkopi: Frequency distribution of mild and moderate robusticity ranks by sex. N:51.

As expected, by pooling the entheses in functional complexes, it is evident that the shoulder was represented only by entheses from female skeletons; in the remainder functional complexes the proportion of female entheses greatly exceed the male entheses.

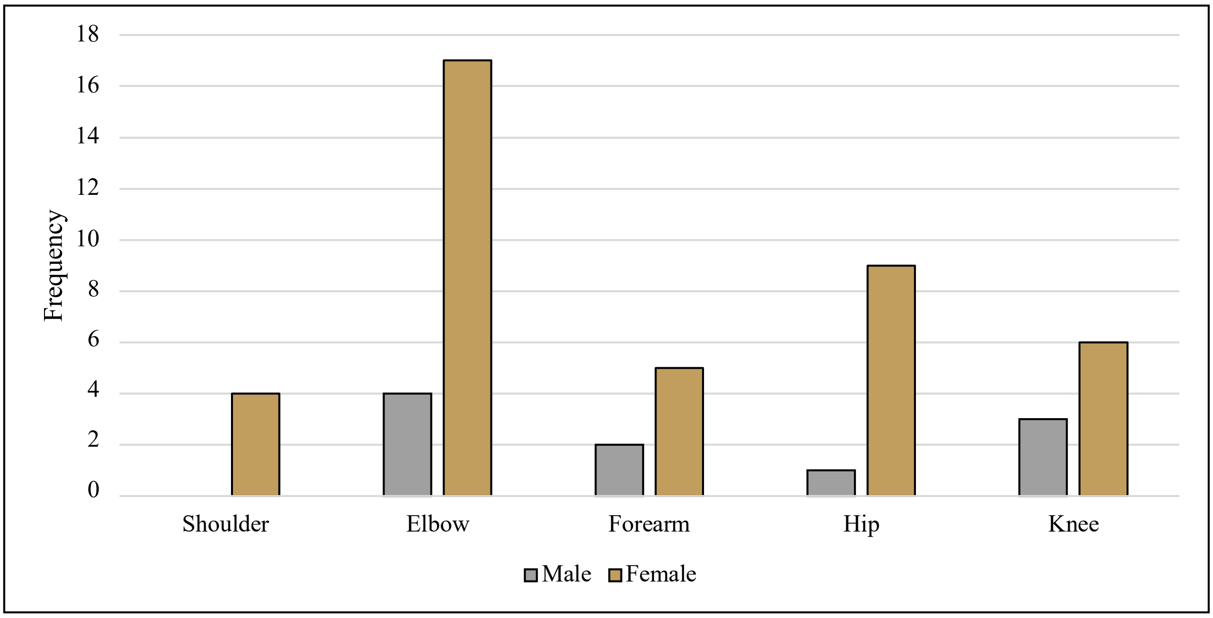

Figure V-12. Episkopi: Frequency distribution of the observed entheses by sex (pooled functional complexes). N:51.

Despite being underrepresented, the male entheses displayed the highest percentages of moderate degrees on the elbow (2/4, 50.0%) compared with the female entheses (2/17, 11.8%), while as for the forearm, the females displayed a greater number of moderate degrees (1/5, 20.0%) compared with the males, represented by only two entheses and that did not provide any moderate degrees. Overall, the females displayed a higher development of the forearm compared with the elbow (Figure V-13).

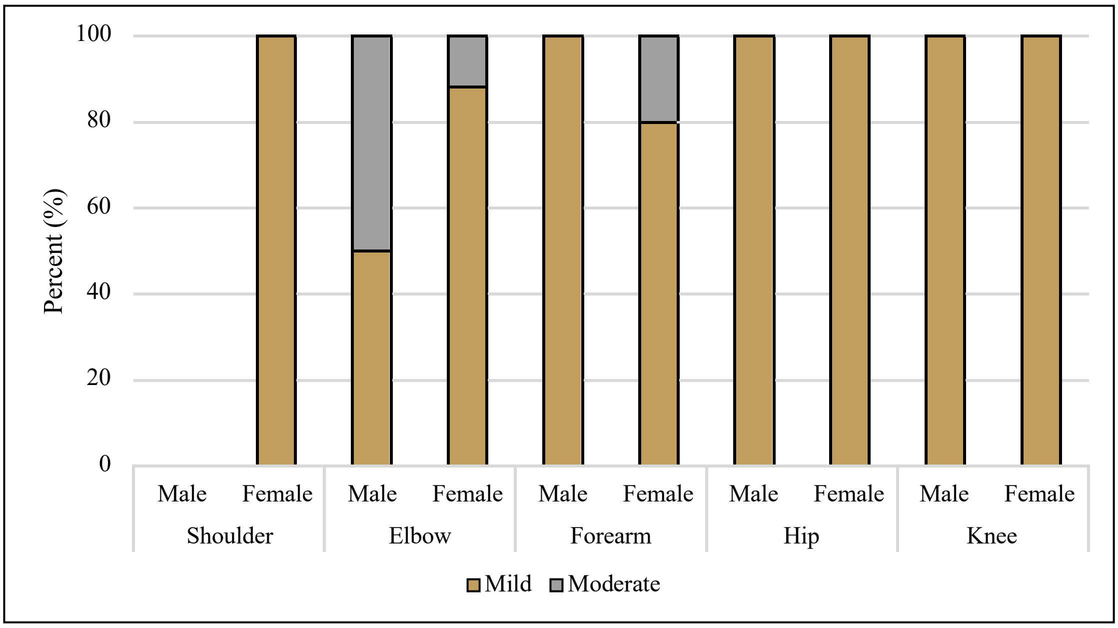

Figure V-13. Episkopi: Frequency distribution of mild and moderate robusticity ranks by sex (pooled functional complexes). N:45.

These differences were however not significant (elbow p-value=0.307, forearm p-value=0.857, hip p-value=1.000, knee p-value=1.000).

Concerning the distribution of the robusticity ranks by age category, the sample was restricted to only 10 entheses, namely those recorded on the skeletons with determined age. Moreover, among these 10 entheses, eight derived from a middle adult and only two from a young adult. Thus, no comparison between the age groups were conducted.

<u>Osteolytic and Enthesophytic formations: relationship between score development, enthesis, and functional complex</u>

OLs and EFs were not present on all the entheses observed. More specifically, the former were rare, affecting only 5.9% (3/51) of the whole sample; while the last were frequent and detected on 66.7% (34/51) of the surfaces observed. For which concerns the OLs, they were recorded on a *brachialis* of a female of not determined age and on the *brachioradialis* of a middle adult female. Thus, no comparison between sides, sexes and age categories was possible.

Among those affected by EFs, the entheses which exhibited the highest proportions were the *deltoideus* (clavicle) (1/1, 100.0%), the *pronator teres* (1/1, 100.0%), and the *quadriceps tendon* (tibia) (1/1, 100.0%) (Figure V-14). However, all these results cannot be considered as indicative of a major involvement of these entheses since the low number of included entheses. Thus, looking at the best represented, the *gluteus maximus* was the most affected (5/6, 83.3%) followed by the *vastus medialis* (5/7, 71.4%).

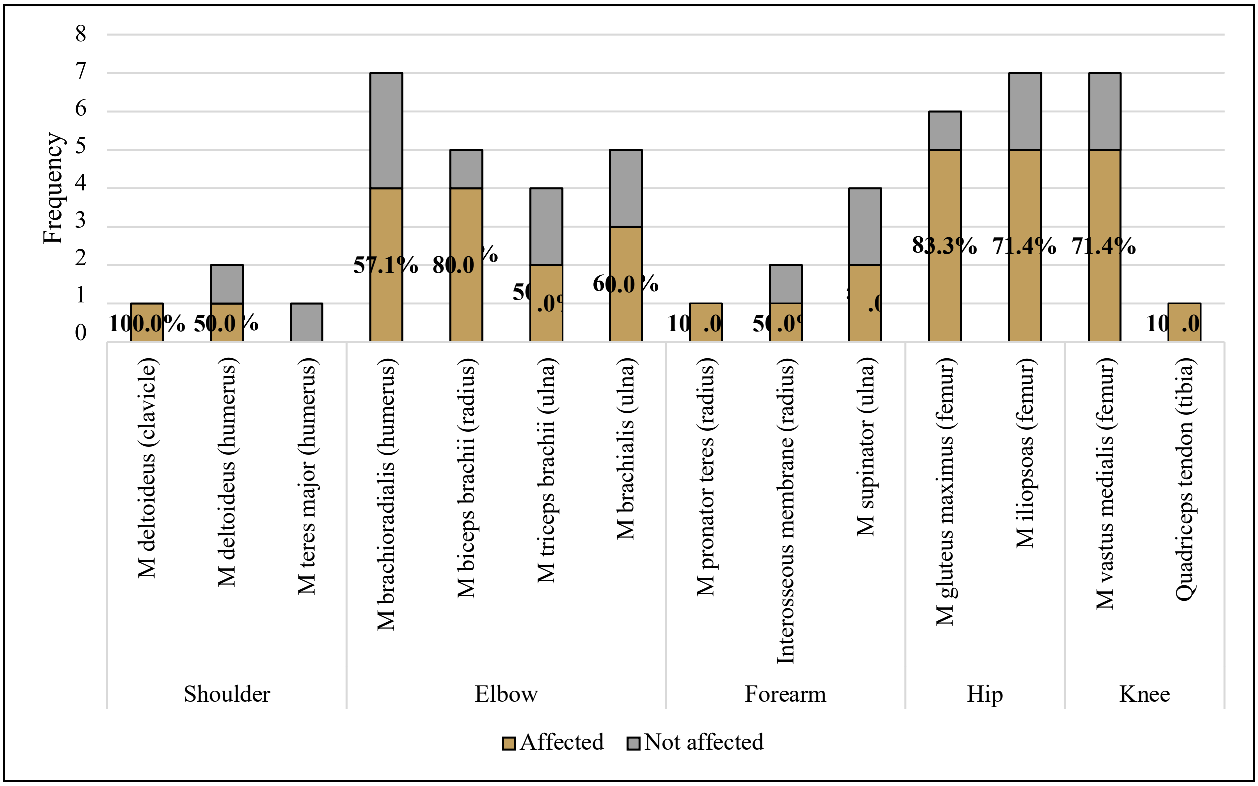

Figure V-14. Episkopi: Frequency distribution of the entheses affected by EFs by muscle. N:51.

Focusing on severity of the EFs, the highest percentages of moderate forms were observed on the *triceps brachii* and the *quadriceps tendon* (100.0%), but this percentage was calculated on the basis of only one observation. The slightly better represented *brachialis* displayed 66.7% (2/3) moderate degrees. For which concern the *biceps brachii*, of the four surfaces exhibiting EFs, two displayed mild degrees and two were ranked as moderate; in the same way, of the two recorded *supinator*, one enthesis was ranked as mild and the other one as moderate.

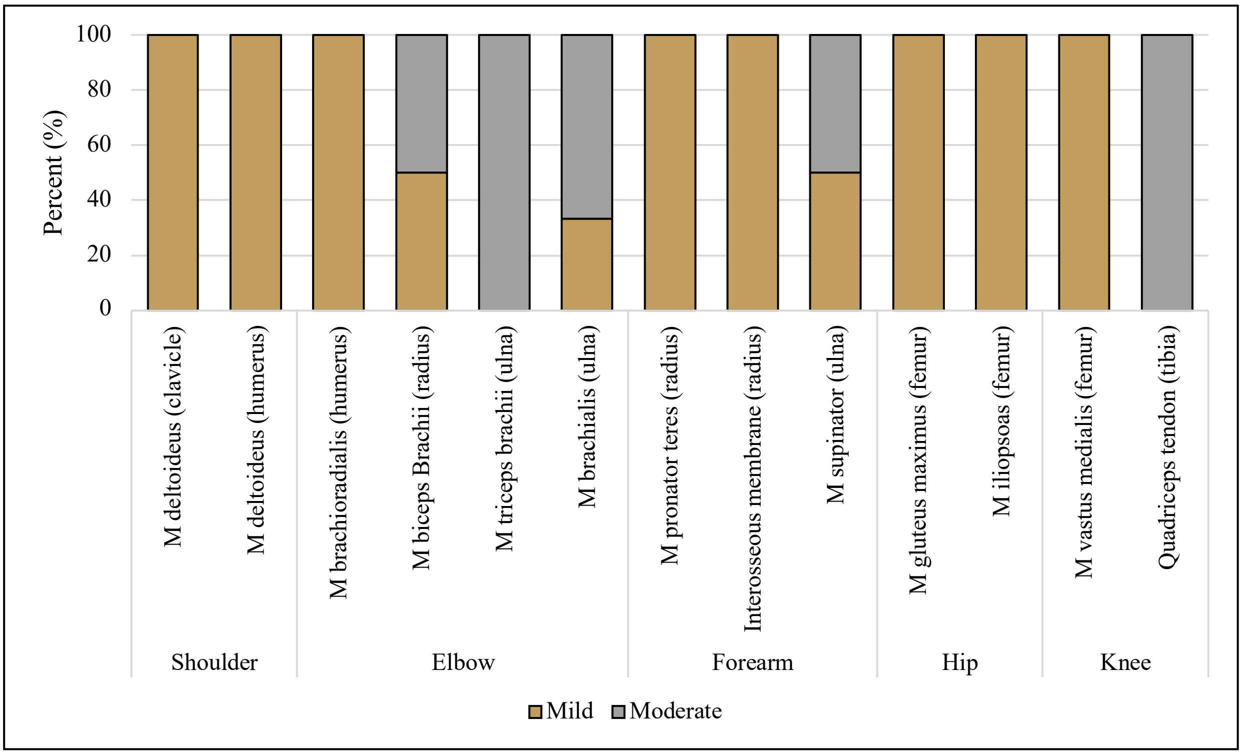

Figure V-15. Episkopi: Frequency distribution of mild and moderate EFs by muscle. N:34.

Turning to the functional complexes, figure V-16 shows that the functional complex which exhibited the greatest percentage of affections was the hip (8/10, 80.0%), followed by the knee (7/9, 77.8%). Among the functional complexes belonging to the upper limbs, the elbow was the most affected (13/21, 61.9%).

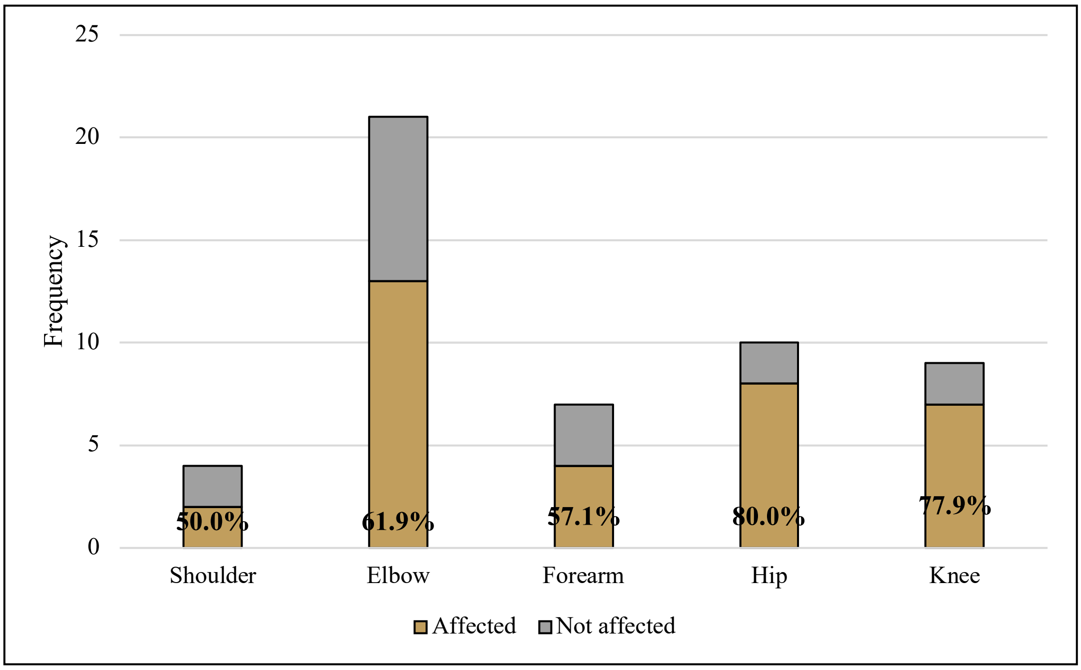

Figure V-16. Episkopi: Frequency distribution of the entheses affected by EFs by functional complex. N:51.

With regards to the severity distribution of these manifestations by functional complex, the elbow was the most severely affected (3/13, 23.1%) followed by the forearm (1/4, 25.0%). The remainder exhibited only mild expressions.

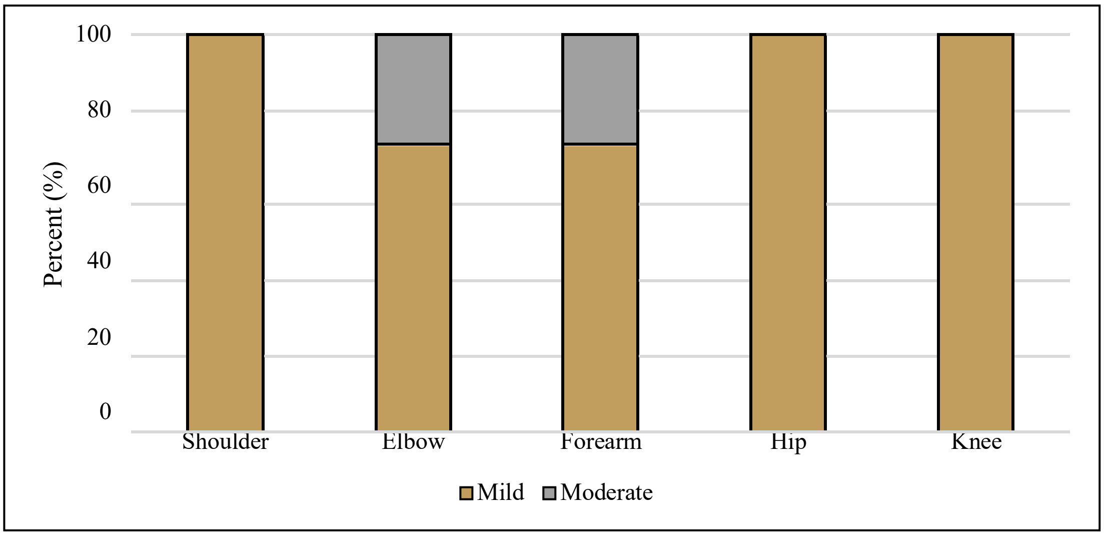

Figure V-17. Episkopi: Frequency distribution of mild and moderate EFs ranks by functional complex. N:34.

Enthesophytic formations: relationship between score development, side, sex, and age

Concerning the distribution of the EFs between the sides, it can be noted that the shoulder displayed 100.0% of affection (1/1) on the left side compared with 33.3% of the right. The first rates, however, was calculated on the basis of a single observation. In the other cases, the right side provided greater percentages of affections: in the elbow 75.0% (6/8) of affections on the right side compared with 53.8% (7/13) of the left; in the forearm, 66.7% (2/3) of the right compared with 50.0% (2/4) of the affections on the left; in the knee, 83.3% (5/6) of affections were recorded on the right side and 66.7% (2/3) on the left side.

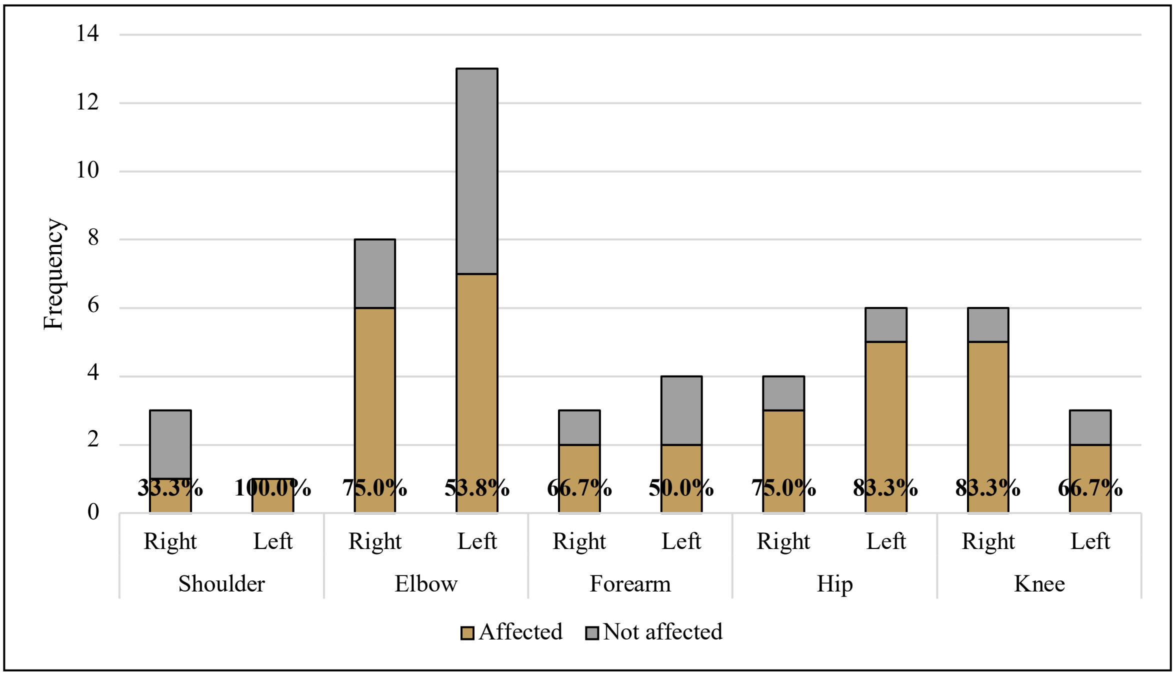

Figure V-18. Episkopi: Frequency distribution of entheses affected by EFs by side (pooled functional complexes). N:51.

Looking at the differences in terms of severity distribution, figure V-19 shows that the right side of elbow and the knee displayed the greatest percentages of moderate degrees (3/5, 60.0% and 1/5, 20.0% respectively) compared with the opposite side; conversely, in the forearm, the left side was more severely affected (1/2, 50.0%).

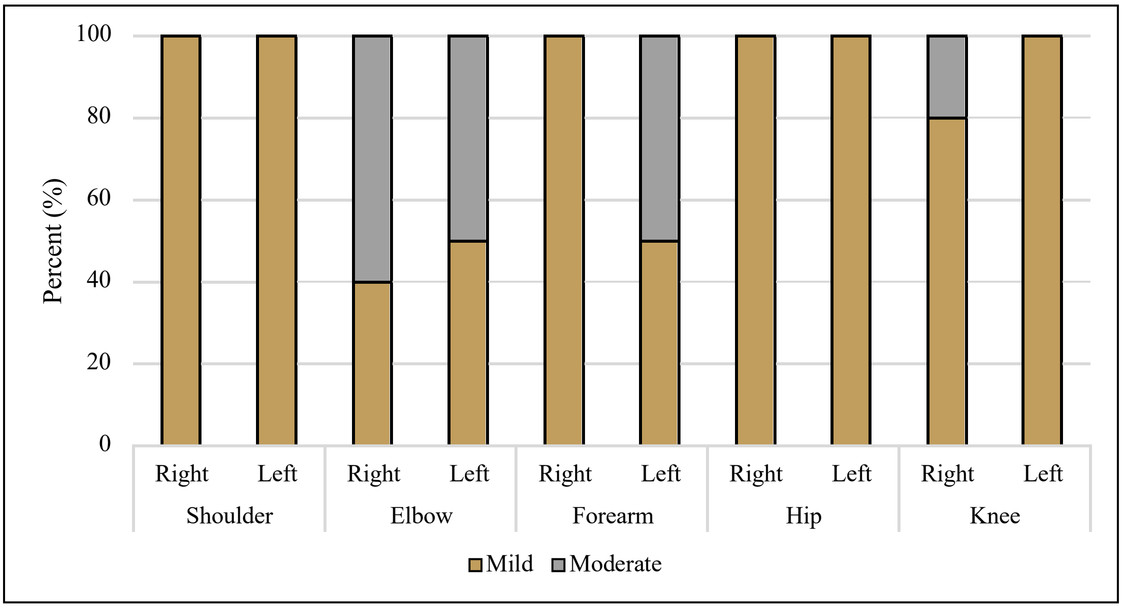

Figure V-19. Episkopi: Frequency distribution of mild, moderate, and severe EFs ranks by side (pooled functional complexes). N:34.

These differences were however not significant (shoulder p-value=1.000, elbow p-value=0.792, forearm p-value=0.667, hip p-value=1.000, knee p-value=0.857).

Concerning the comparison between the sexes, figure V-20 shows the number of entheses affected by EFs, distributed by functional complex, between the sexes. In all the functional complexes, the females displayed the highest percentage of affections. The only exception was represented by the hip, where the high percentage of affections (100.0%) recorded on the male enthesis was due to a single observation.

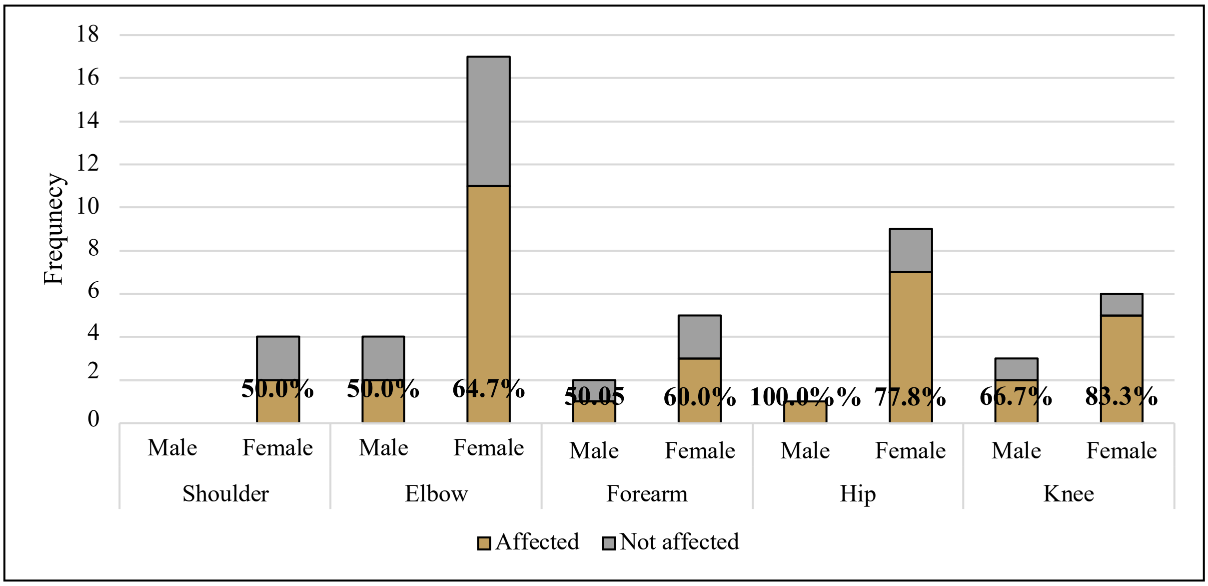

Figure V-20. Episkopi: Frequency distribution of entheses affected by EFs by sex (pooled functional complexes). N:51.

Concerning the severity distribution by sex, as expected considering the bias between males and females, these latter displayed the most severe forms on the forearm (1/3, 33.3%) and the knee (1/5, 20.0%). As for the elbow, the males displayed a higher percentage of moderate degrees (100.0%) compared with the females (44.4%), but the bias in this case was of the order of 2:1 towards the females.

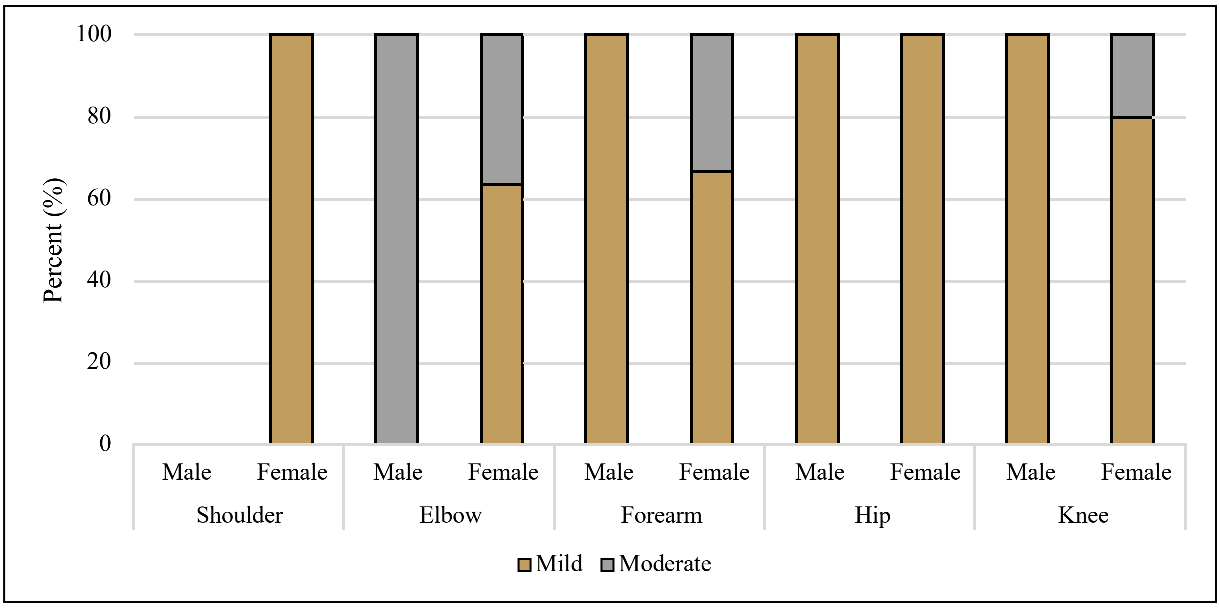

Figure V-21. Episkopi: Frequency distribution of mild, moderate and severe EFs by sex (pooled functional complexes). N:30.

These differences were however not significant (elbow p-value=0.327, forearm p-value=1.000, hip p-value=1.000, knee p-value=0.857).

As assessed for the robusticity evaluation, the number of entheses from age-assigned individuals was very low (=12). They were recorded on only two individuals (a young adult and a middle adult): more specifically, two from the young and eight from the middle adult. Thus, no comparison was carried out.

Osteoarthritis

OA evaluation was based on the observation of a total of 27 joint surfaces from five individuals. As already stated for the ECs, not all the skeletons included in this sample (n=14) provided articular surfaces enough well preserved to be examined. As can be noted in figure V-22, only two entheses yielded BRI values exceeding 50.0%: the femoral head and the distal femur. The remaining were poorly represented.

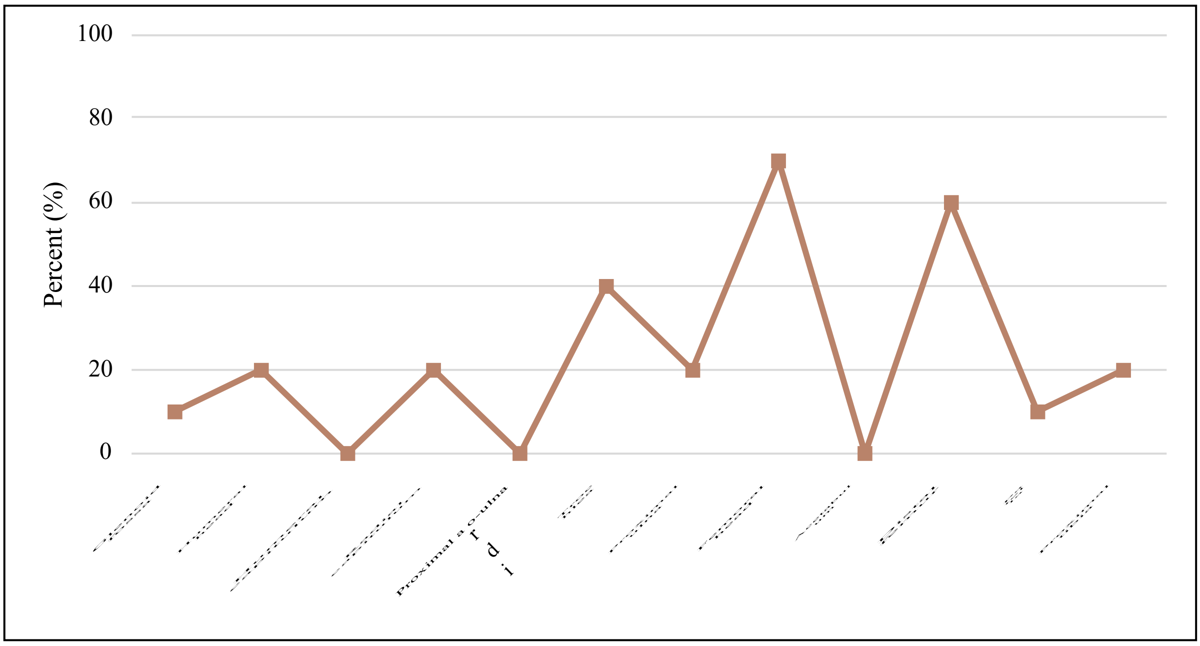

Figure V-22. Episkopi: Joint surfaces representation (%) within the whole sample. N:27.

Indeed, the femoral head and the distal femur were the joint surfaces most frequently assessed, 25.9% (7/27) and 22.2% (6/27) respectively.

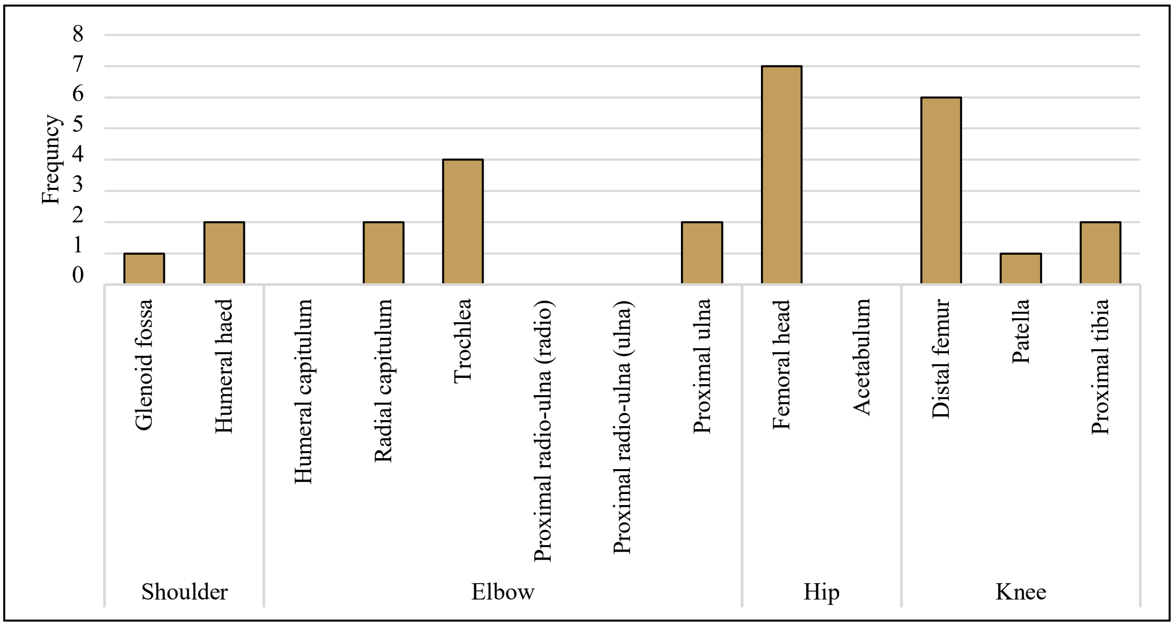

Figure V-23. Episkopi: Frequency distribution of the observed surfaces by joint. N:27.

Of these 27 surfaces, only two were affected by OA insofar as they present at least two of the three markers reported in literature (ML, PO, and SO): a femoral head and a proximal tibia. No cases of fusion and/or eburnation were found.

Since the very small number of surfaces affected by OA, no comparison between sexes, sides and age groups were allowed. It can be only said that the affected femoral head belonged to a middle adult female, while the proximal tibia belonged to a male of unknown age.

Extra-masticatory dental wear

A total of 96 maxillary and 94 mandibular teeth belonging to six individuals were examined for evidence of extra-masticatory dental wear. No evidence was observed on the examined materials; however, Anna Osterholtz indicated the presence of a case of LSAMAT on the maxilla of the male inhumated in tomb 25A (Figure V-24).

Figure V-24. Episkopi: Evidence of LSAMAT from Episkopi Phaneromeni (tomb 25A). Photos by courtesy of Anna Osterholtz.

Summary

In sum, the population from Episkopi *Phaneromeni* was small and highly biased towards females, with eight individuals for whom age could be assessed. On the basis of the evaluation of the robusticity ranks scored for ECs, it is possible to assert that males utilized the *triceps brachii* (ulna) and the *biceps brachii* more than the females, who, on the contrary, had pronounced *brachialis* and *brachioradialis* compared with males. In all the cases, the right side was more developed than the left. OLs and EFs provided different trends. The former affected a very low percentage of the surfaces observed 5.9% (3/51), more specifically, on a *brachialis* of a female of not determined age and on the two *brachioradialis* of a middle adult female. The last, recorded in higher percentage (34/51, 66.7%), mostly affected the lower limbs entheses with a greater involvement of the *gluteus maximus* and the *vastus medialis*. The shoulder and the hip were more affected on the left side compared to the right; while the elbow, forearm and knee were more affected on the right side compared with the left. Overall, the elbow was more severely affected in the males, while the shoulder, the forearm, and the knee in the females. Concerning OA, only two articular surfaces were affected: one belonging to a middle adult female and one to a male of uncertain age. The only extra-masticatory dental defect observed in this sample is a case of LSAMAT pertaining a mature adult male.

Appendix III

The Middle Bronze Age III-Late Bronze Age III collection

Enkomi Ayios Iakovos

Paleodemography

The biological sex profile of adults from the LBAI-III site of Enkomi is presented in table VI-1. Sex estimation was possible for all the observed skeletons (n=20). The proportion of female individuals (12/20, 60.0%) greatly exceeds males (8/20, 40.0%). Age estimation was not possible in any of the sub-mentioned cases.

Table VI-1. Enkomi: Sex composition of the sample. %: within the sex.

Male		Female		Total	
N	%	N	%	N	%
8	40.0	12	60.0	20	100.0

Entheseal Changes

Robusticity: relationship between score development and enthesis

The evaluation of the ECs of this sample was carried out on a total of 90 entheses belonging to 20 individuals. The BRI values indicated a very good level of representation of all three entheses which rising above 75.0 %.

Indeed, *gluteus maximus*, *vastus medialis,* and *iliopsoas* were equally represented (Figure VI-2).

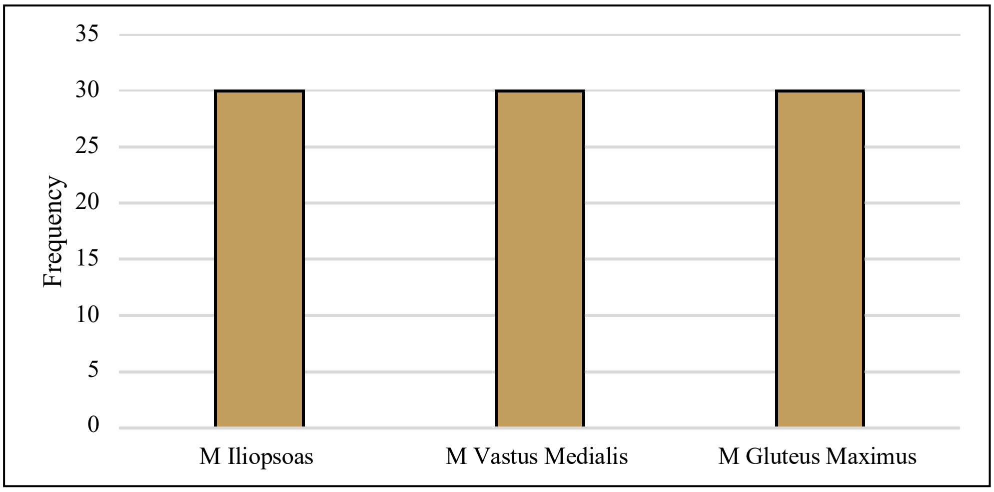

Figure VI-2. Enkomi: Frequency distribution of the observed entheses by muscle. N:90.

The evaluation of the robusticity ranks distribution suggested that the mild forms (=81) prevailed over the moderate (=6) and the severe (=3). Moderate degrees were observed in greater extent on the *gluteus maximus* (4/30, 13.3%); and in equal percentage on the *iliopsoas* and on the *vastus medialis* (1/30, 3.3%). Severe degrees were, instead, equally distributed between the three entheses (31/30, 3.3%). Overall, the *gluteus maximus* was the most developed.

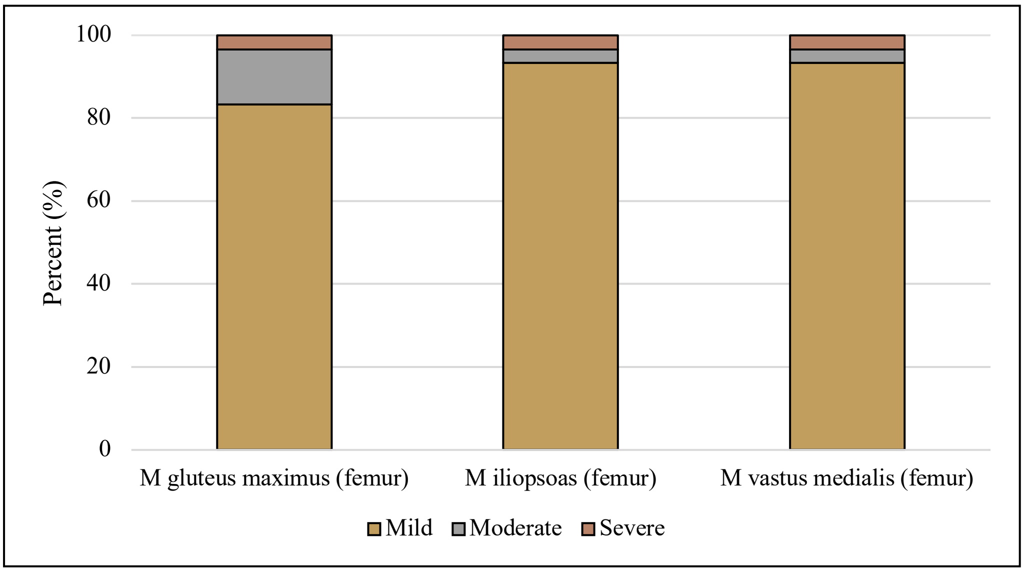

Figure VI-3. Enkomi: Frequency distribution of mild, moderate, and severe robusticity ranks by muscle. N:90

<u>Robusticity: relationship between score development, side, and sex</u>

The frequency assessment in figure VI-4 clearly showed that the left side was slightly better represented (=16) than the right on all the three entheses (=14).

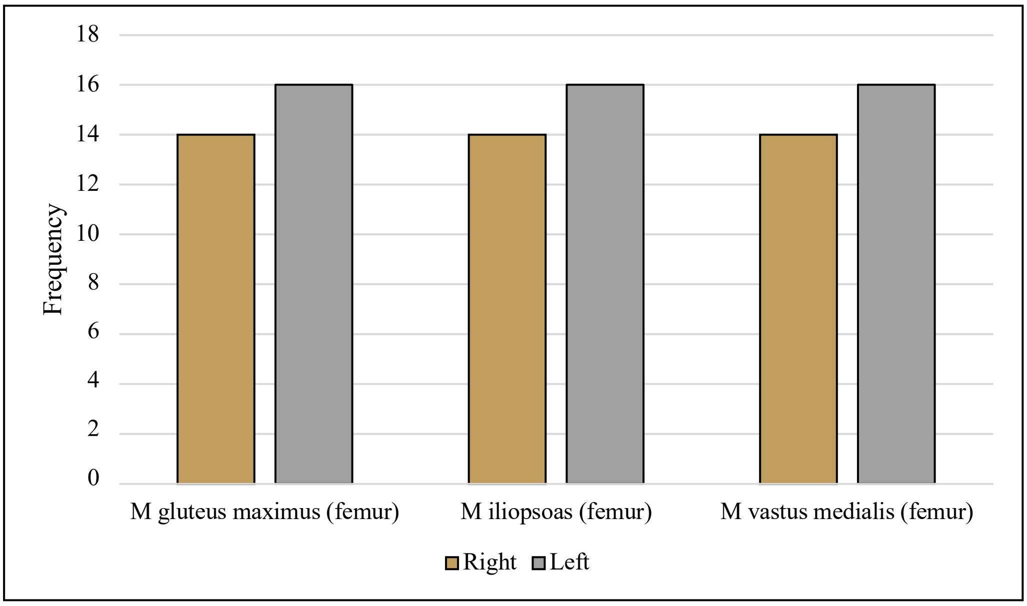

Figure VI-4. Enkomi: Frequency distribution of the observed entheses by side. N:90.

Interestingly, despite of the better representativity of the left side, the highest percentages of moderate and severe alterations were observed on the right side with the only exception of the *iliopsoas* which exhibited 6.3% (1/16) of severe manifestations on the left side (Figure VI-5).

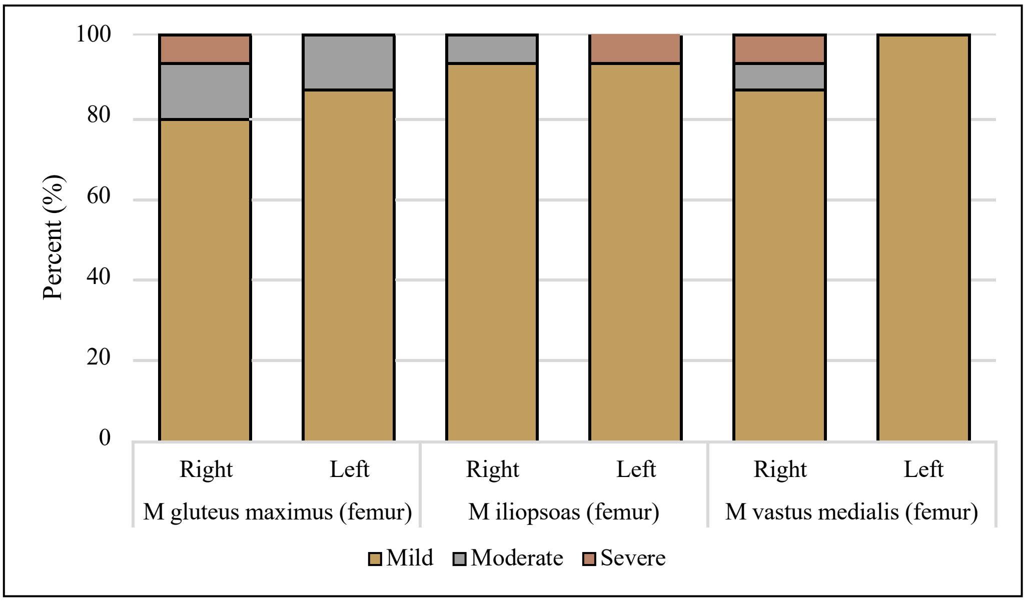

Figure VI-5. Enkomi: Frequency distribution of mild, moderate, and severe robusticity ranks by side. N:90.

However, the differences in the severity rank distribution between the sides were not statistically significant (*gluteus maximus* p-value= 0.667, *iliopsoas* p-value=0.984, vastus medialis p-value=0.525).

Since the prevalence of the females over the males, it cannot be surprised the better representativity of the female entheses (=20) over the whole sample (Figure VI-6).

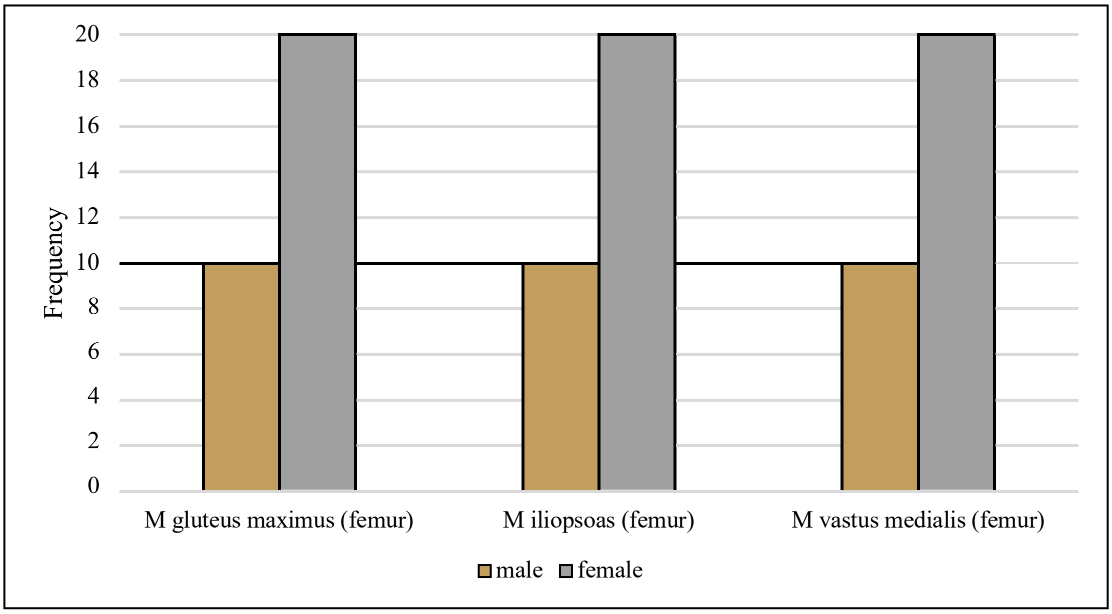

Figure VI-6. Enkomi: Frequency distribution of the observed entheses by sex. N:90.

While taking into account theses disparities, figure VI-7 shows that the males provided a higher number of moderate + severe degrees (3/10, 30.0%) on the *gluteus maximus* compared with the females which exhibited 20.0% (2/20) moderate degrees. In the other two cases, conversely, the only moderate and severe degrees were detected on the females (2/20, 10.0%). Overall, males seem to have utilized the *gluteus maximus* more than the *iliopsoas* or the *vastus medialis.* Conversely, the females utilized the *iliopsoas* and the *vastus medialis* more than the *gluteus maximus*.

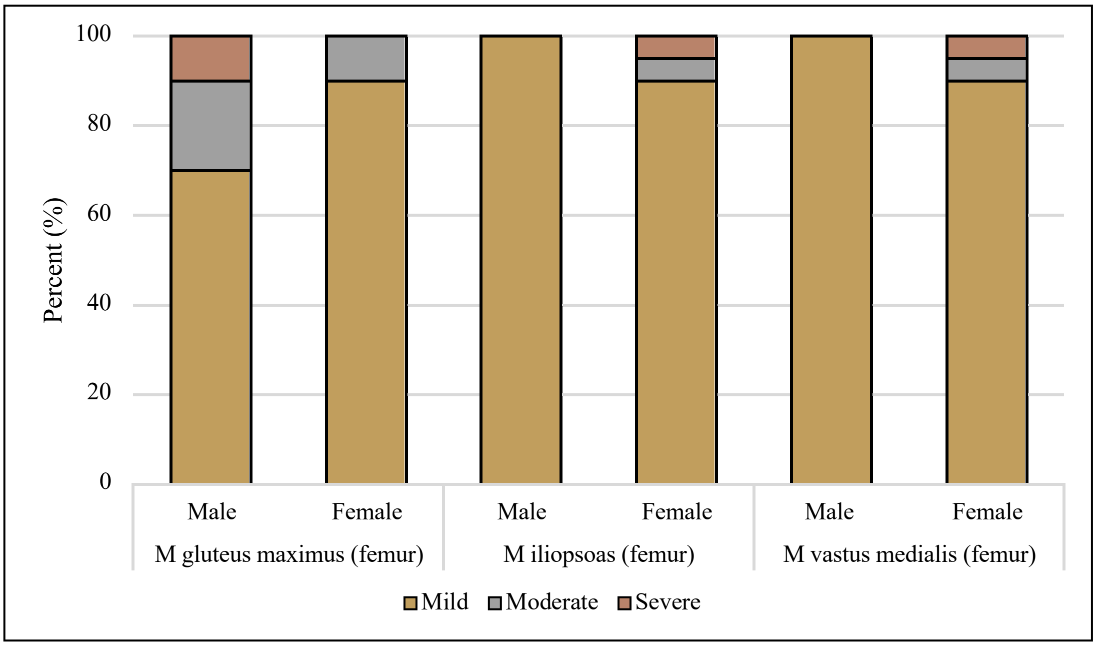

Figure VI-7. Enkomi: Frequency distribution of mild, moderate, and severe robusticity ranks by sex. N:90.

Despite such figures, the results of the Mann-Whitney *U*-test indicated the absence of significant differences between the sexes (*gluteus maximus* p-value= 0.373, *iliopsoas* p-value=0.681, *vastus medialis* p-value=0.681).

<u>Osteolytic and Enthesophytic formations: relationship between score development and enthesis</u>

OLs and EFs were not found on all the entheses observed. More specifically, the former affected 12.2% (11/90) of the entheses; while the last were detected on 44.4% (40/90) of the surfaces observed.

Looking at the OLs, they were recorded in a higher percentage on the *iliopsoas* (6/30, 20.0%) and in a lower percentage on the *gluteus maximus* (5/30, 16.7%) (Figure VI-8).

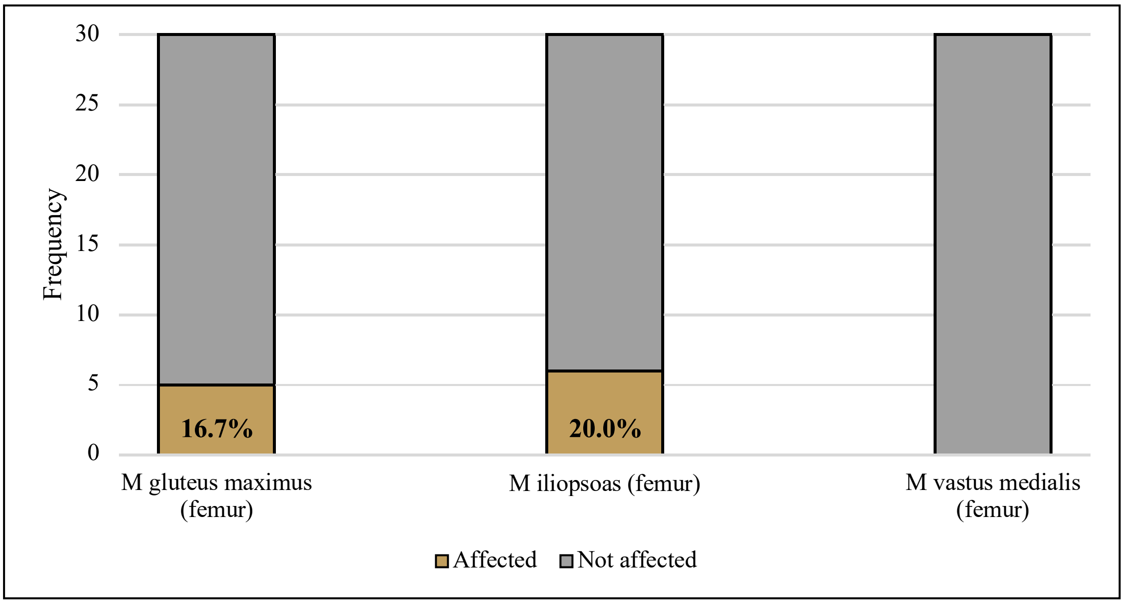

Figure VI-8. Enkomi: Frequency distribution of the entheses affected by OLs by muscle. N:90.

Thus, focusing on the number of the affected entheses, the *iliopsoas* provided the greatest proportion of moderate (2/6, 33.3%) and severe lesions (1/6, 16.7%).

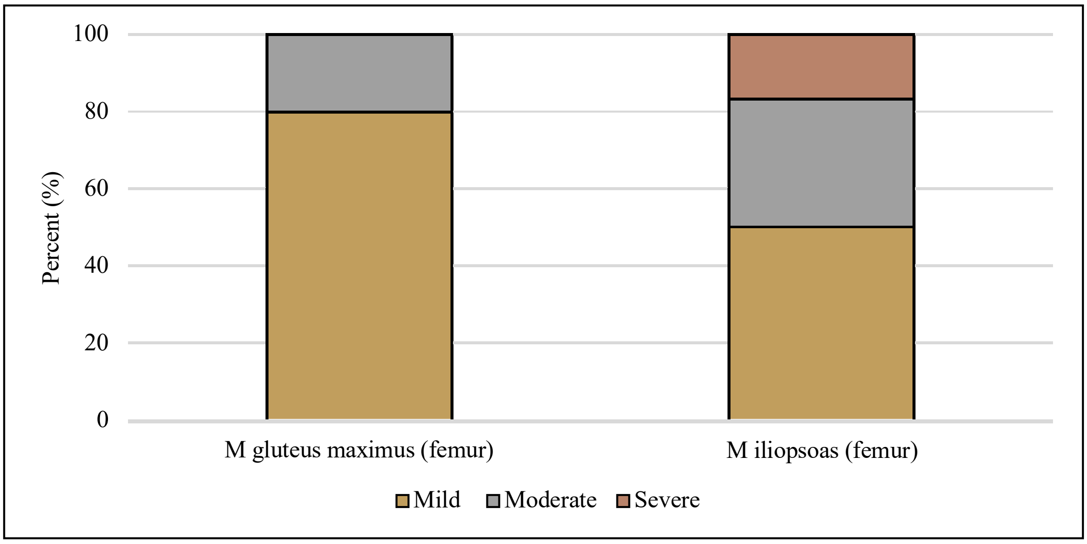

Figure VI-9. Enkomi: Frequency distribution of the mild, moderate, and severe OLs ranks by muscle. N:11.

Turning to the entheses affected by EFs, this evidence was found in a higher percentage on the *gluteus maximus* (15/30, 50.0%) and the *iliopsoas* (13/30, 43.3%), and in lower percentage on the *vastus medialis* (40.0%, 12/30) (Figure VI-10).

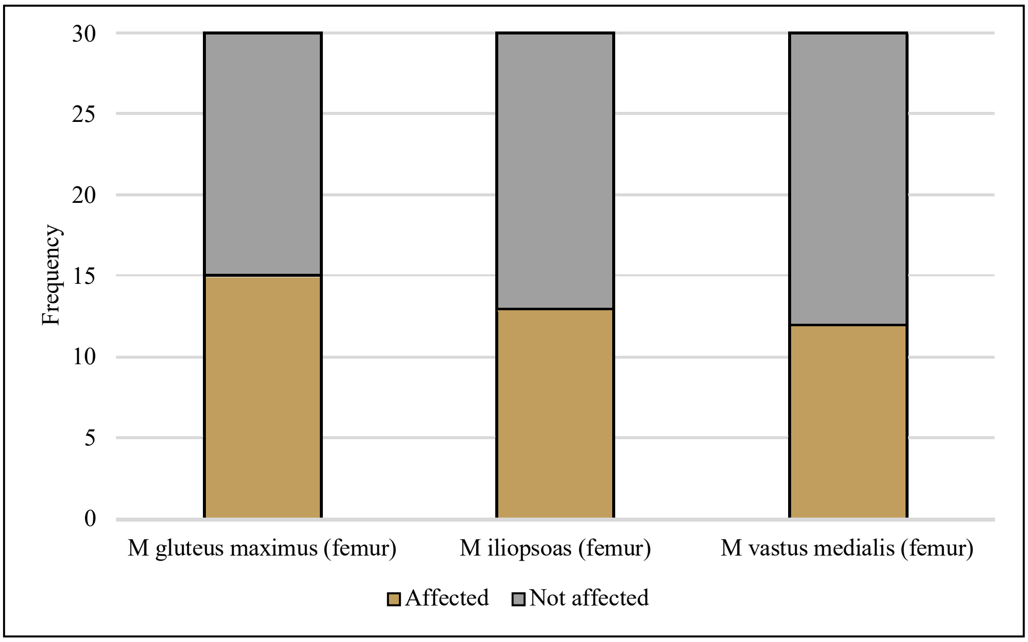

Figure VI-10. Enkomi: Frequency distribution of the entheses affected by EFs by muscle. N:90.

Among the surfaces affected, the *gluteus maximus* provided the highest percentage of moderate (12/15, 80.0%) and severe (1/15, 6.7%) EFs; it was followed by the *iliopsoas*, displaying 53.8% (7/13) moderate degrees, and by the *vastus medialis*, exhibiting only 33.3% (4/12) moderate robusticity (Figure VI-11).

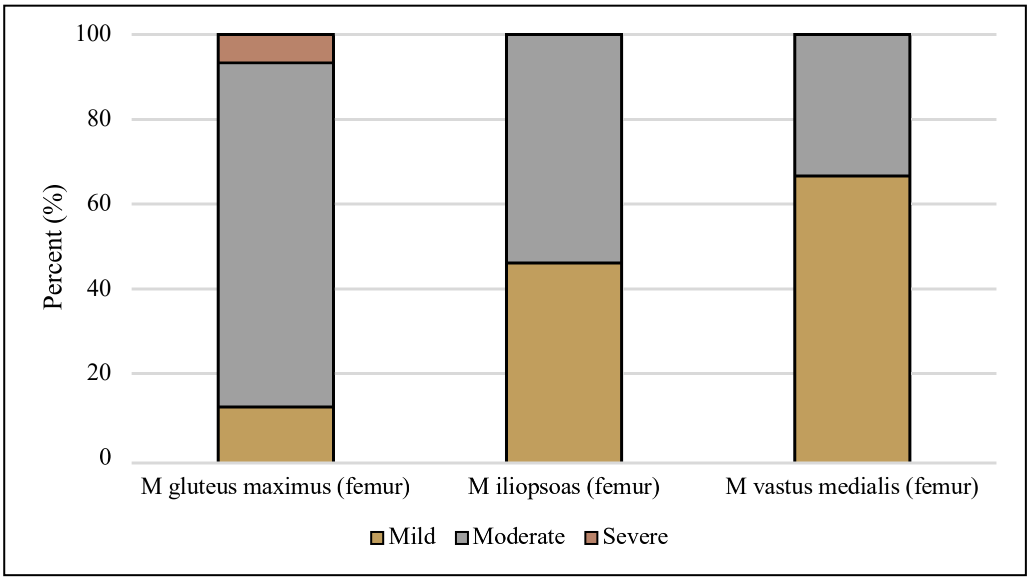

Figure VI-11. Frequency distribution of the mild, moderate, and severe EFs ranks by enthesis. N:90.

Osteolytic and Enthesophytic formations: relationships between score development, side, and sex

As previously assessed, only 11 entheses displayed evidence of OLs, they were examined to test for the asymmetrical distribution of this marker. Thus, the *vastus medialis* was excluded from comparisons as it did not provide affections.

As can be appreciated by figure VI-12, the *gluteus maximus* exhibited the highest number of surfaces affected on the right side (3/14, 21.4%) compared with 12.5% (2/16) of the left side, the *iliopsoas* displayed the greatest number of lesions on the left side (5/16, 31.3%) compared with 7.1% (1/14) of the right.

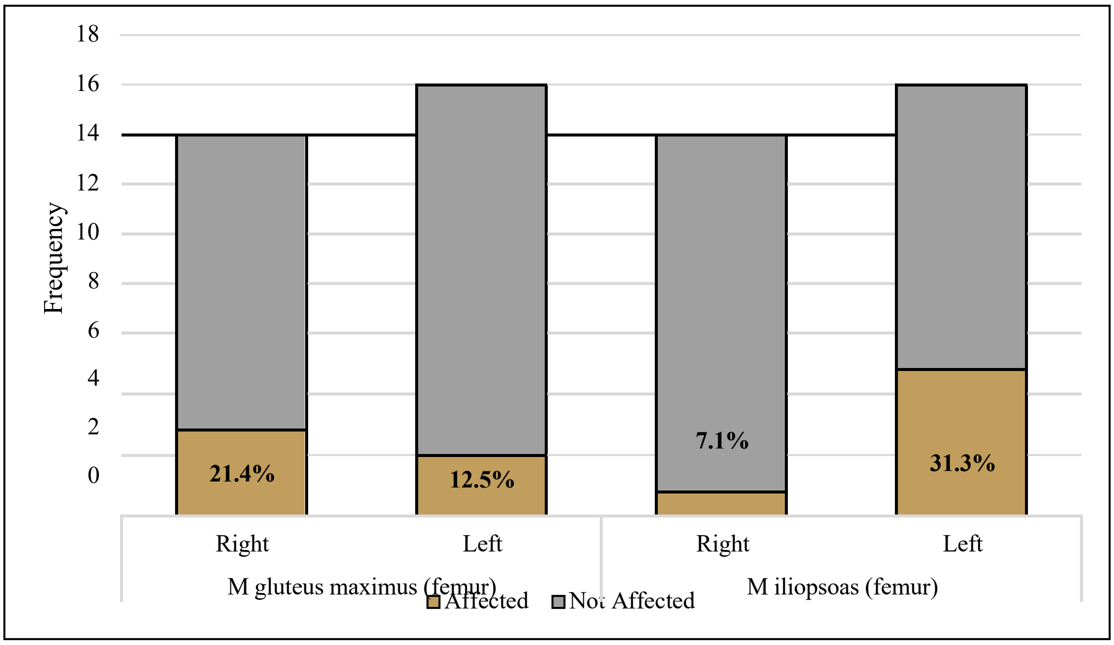

Figure VI-12. Enkomi: Frequency distribution of the entheses affected by OLs by side. N:60.

For which concerns the severity distribution, although affected in a lesser extent, the left side of the *gluteus maximus* displayed 50.0% (1/2) moderate degrees, while the three affected right *gluteus maximus* were ranked as mild. The only affection on the right side of the *iliopsoas* was ranked as severe, while the left *iliopsoas* exhibited 40.0% (2/5) moderate degrees and 60.0% (3/5) mild degrees.

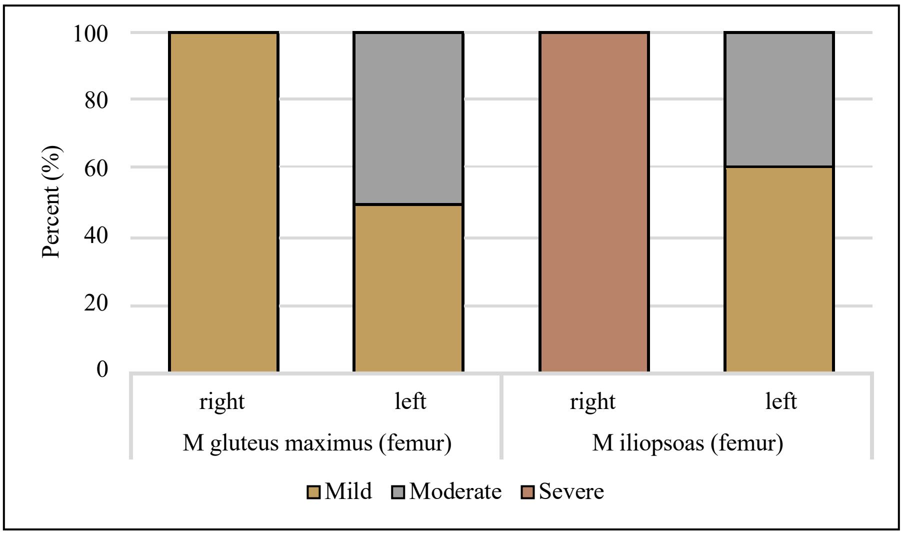

Figure VI-13. Enkomi: Frequency distribution of mild, moderate, and severe OLs ranks by side. N:11.

No significant differences in the distribution of the OLs ranks between the sides were revealed by the Mann-Whitney *U*-test (*gluteus maximus* p-value=0.400, *iliopsoas* p-value=0.333).

Turning to the EFs, figure VI-14 shows the distribution of the affected entheses by side. The *gluteus maximus* was equally interested by this marker on the two sides (7/14, 50.0% on the right and 8/16, 50.0% on the left). As for the *iliopsoas,* the left side was slightly more interested (7/16, 43.8%) compared with the right (6/14, 42.9%). Conversely, for the *vastus medialis*, the right was more affected (7/14, 50.0%) compared with the left (5/16, 31.3%).

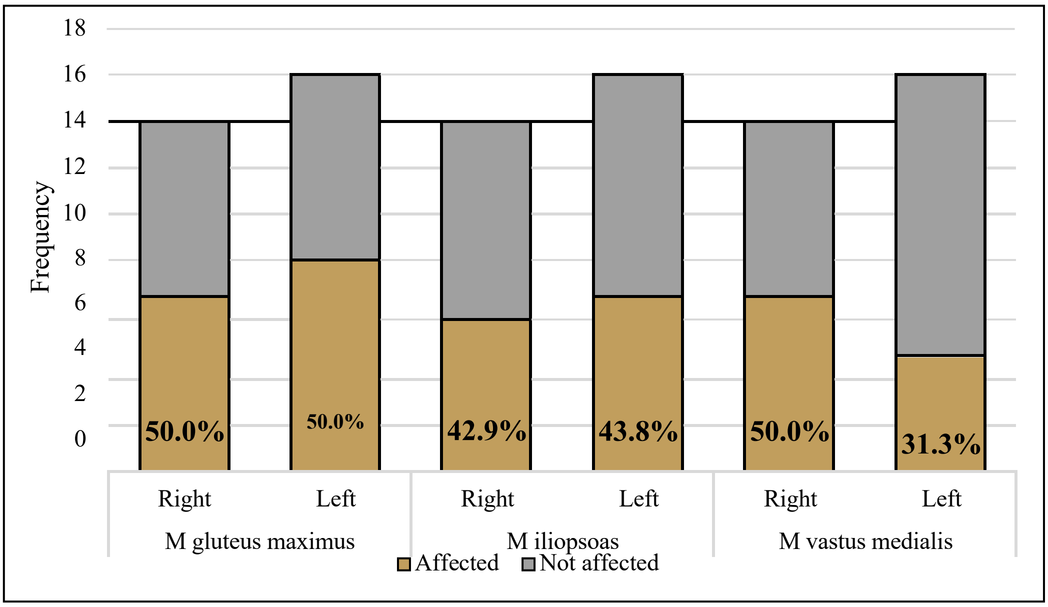

Figure VI-14. Enkomi: Frequency distribution of the entheses affected by EFs by side. N:90.

The frequency assessment performed on the 40 entheses affected by EFs in order to test for significant differences in the rank distribution between the sides revealed that the *gluteus maximus* and the *vastus medialis* were more severely affected on the right side (7/7, 100.0% and 3/7, 42.9% respectively) compared with the left side (6/8, 75.0% and 1/5, 20.0% respectively). Conversely, the *iliopsoas* was found to be more severely affected on the left side (4/7, 57.1%) than the right side (3/6, 50.0%) (Figure VI-15).

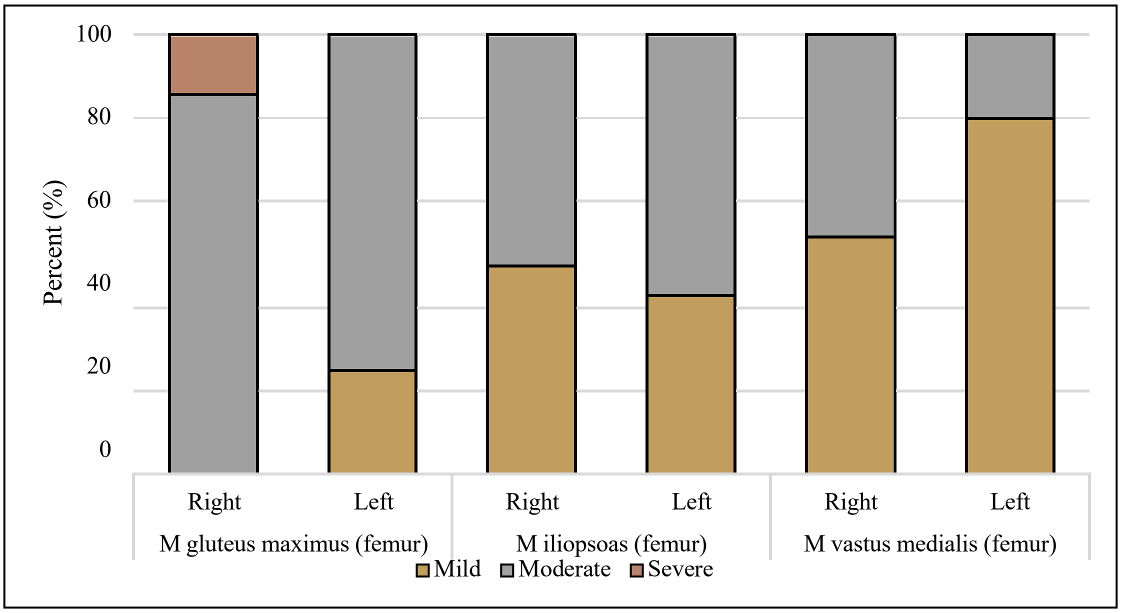

Figure VI-15. Enkomi: Frequency distribution of the mild, moderate, and severe EFs ranks by side. N:40.

These differences were however not significant (*gluteus maximus* p-value= 0.281, *iliopsoas* p-value= 0.836 and *vastus medialis* p-value= 0.530).

For which regards the sexual distribution of the asserted OLs, figure VI-16 shows that they equally affected the *iliopsoas* of both the sexes; while, concerning the *gluteus maximus*, the male entheses displayed a greater proportion of affections (2/10, 20.0%) that the females (3/20, 15.0%).

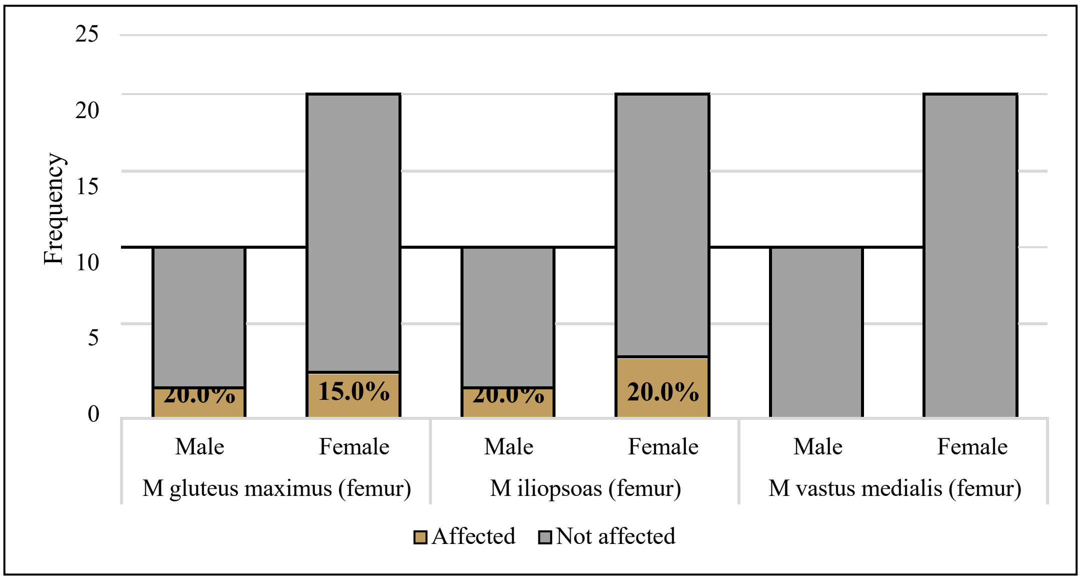

Figure VI-16. Enkomi: Frequency distribution of the entheses affected by OLs by sex. N:90.

Looking at the rank distribution between the sexes, concerning the *gluteus maximus*, only one moderate OL was recorded on the female entheses (1/3, 33.3%) and only two mild lesions on the males (2/2, 100.0%). Conversely, the *iliopsoas* of the males was found to be more severely affected (2/2, 100.0%) compared with the females, which provided only one severe evidence of OLs (¼, 25.0%) and the remaining mild forms (¾, 75.0%) (Figure VI-17).

Figure VI-17. Enkomi: Frequency distribution of mild, moderate, and severe OLs ranks by sex. N:11

These differences were however not significant (*gluteus maximus* p-value= 0.800, *iliopsoas* p-value= 0.533).

For which regards the sexual distribution of the asserted EFs, as can be appreciated by figure VI-18, the *vastus medialis* is the only type of enthesis equally affected by sex (4/10, 40.0% on the males and 8/20, 40.0% on the females). In the other two cases, the males exhibited a higher percentage of EFs (7/10, 70.0% on both the entheses) compared with the females (8/20, 40.0% on *gluteus maximus* and 6/20, 30.0% on the *iliopsoas*).

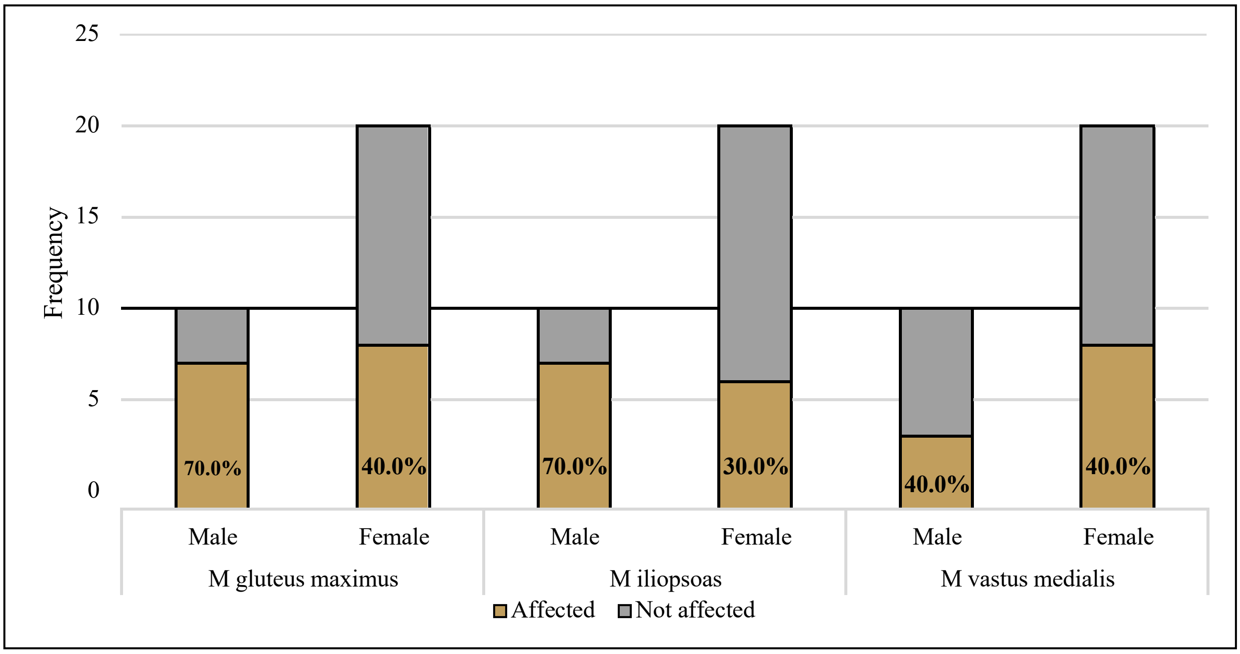

Figure VI-18. Enkomi: Frequency distribution of the entheses affected by EFs by sex. N:90.

The frequency assessment carried out to test for difference in the distribution of the EFs ranks between the sexes has revealed that, despite being less affected, the females displayed a higher percentage of moderate degrees on the *gluteus maximus* (7/8, 87.5%) compared with the males, which exhibited 5/7, 71.4% moderate ranks and 1/7, 14.3% severe degrees. As for the *iliopsoas*, the males exhibited the greatest proportion of moderate ranks (4/7, 57.1%) compared with the females which provided 50.0% (3/6) moderate degrees. Again, on the *vastus medialis*, females displayed 50.0% (4/8) moderate degrees compared with the males (0/4, 0.0%) (Figure VI-19).

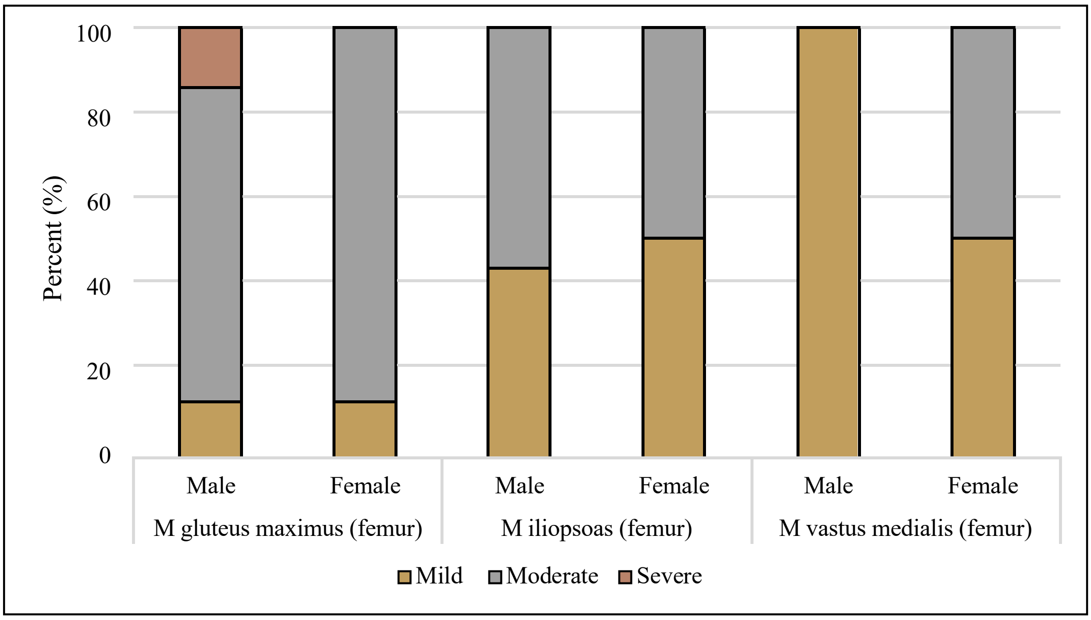

Figure VI-19. Enkomi: Frequency distribution of mild, moderate, and severe EFs ranks by sex. N:40

Results of the Mann-Whitney U test applied on the three entheses separately revealed no significant difference the distribution of the EFs ranks by sex (*gluteus maximus* p-value=0.779, *iliopsoas* p-value=0.836, *vastus medialis* p-value=0.214).

Osteoarthritis

A total of 45 joint surfaces (25 femoral head and 20 distal femurs) from 19 individuals was examined for evidence of OA. Concerning the index of representation (BRI) of the two joint surfaces included in the sample, both articular surfaces were well represented: the former, the femoral head, provided a BRI value of 52.6%, and the last, the distal femur, yielded a value of 65.8%. No cases of eburnation and fusion was observed. No one of the observed joint surfaces resulted to be affected by OA since they did not display more than one of the following markers: of ML, PO and SO.

Summary

In sum, the sample from Enkomi was represented by a selection of femurs relocated to Stockholm Museum from the site of origin. The remaining of the sample was inaccessible for study. They belonged to twenty individuals, of which the majority were represented by females and no age range could be assessed. On the basis of the evaluation of the robusticity ranks scored for ECs, it is possible to assert that the *gluteus maximus* was mostly developed in the males compared with the counterpart; the *vastus medialis* and the *iliopsoas* were, instead, more developed in the females. On all three entheses, the right side was more utilized than the left. For which concerns the OLs and the EFs, these two markers highlighted different trends. The formers affected a very low percentage of the surfaces (11/90, 12.2%). More specifically, on the *iliopsoas*, they were equally distributed by sex, but the females were more severely affected; while, considering the *gluteus maximus*, they were mostly detected on the male skeletons which were also the more severely affected. The right side of the *gluteus maximus* resulted to be most involved but the less severely affected; while the left side of the *iliopsoas* was the most affected but the less severely interested. The EFs, recorded in higher percentage (40/90, 44.4%), affected in greater extent the males than the females. The most involved enthesis was the *iliopsoas,* even if the most severe forms were observed on the *gluteus maximus*. The right side was greatly interested than the left, with the only exception of the *iliopsoas* which displayed a higher number of evidence on the left side. No joint surfaces were found to be affected by OA, and no evidence of extra masticatory dental wear could be ascertained.