THE NATURE OF FOOD CRAVINGS FOLLOWING WEIGHT-LOSS SURGERY

Heidi Michelle Guthrie

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The University of Leeds
Academic Unit of Psychiatry and Behavioural Sciences
School of Medicine

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The candidate confirms that the work submitted is her own and that appropriate credit has been given where reference has been made to the work of others

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ABSTRACT

Despite the rise in obesity in western society, the nature of food cravings in individuals who have undergone weight-loss surgery has been relatively unstudied. This study aimed to provide a detailed analysis of the experience of food craving comparing groups of participants according to a) time post-surgery and b) type of surgical procedure. Two time groups emerged, those who were 3-8 months post-surgery and those who were one year+ post-surgery. In terms of surgical procedure, those having purely restrictive procedures (i.e. gastric band) were compared with those having both restrictive and malabsorptive procedures (i.e. Roux-en-Y).

Twenty one participants completed the study (10 3-8 months post-surgery, 11 one year+ post-surgery) of these, 13 had Roux-en-Y gastric bypass and 8 had a gastric band. All participants completed several questionnaires over a seven-day period. Measures included a food intake dairy, daily questionnaires, food craving records and a background questionnaire.

The frequency and intensity of food cravings did not differ significantly between groups but were thought to reflect higher levels than those reported by healthy women in other studies. Antecedents to the craving, target of food craving, situational context, time and interpersonal context did not differ between groups. Differences in the emotional context of craving versus non-craving days were found, some of which interacted with time post-surgery and surgery type.

This quasi-prospective study provides preliminary support for the existence of cravings within a group of participants having had weight-loss surgery, which are hunger-reducing experiences, related to negative mood states. It also offers insight into the persistent implication of food cravings in disordered eating symptomology more prevalent within weight-loss surgery groups.

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Food Cravings

Definition and Prevalence

Food craving is closely associated with liking, since the most commonly craved foods, such as chocolate, are highly palatable (Pelchat, 2002). However, craving is not synonymous with increased eating (Hill, 2007). Similarly hunger is not a pre-condition for craving. There are stronger links between mood and craving, particularly within a context of reduced hunger and increased negative affect.

The term 'food craving', although subjectively understood by most people, is a problematic term. It is a hypothetical construct that has been cited in a variety of ways in studies of eating behaviour. Previously the concept was defined as 'an irresistible urge to eat' or has been used in questionnaires without an accompanying definition, assuming individuals already have a subjective understanding of the concept. The use of this highly salient psychological term in studies has resulted in various difficulties because it has not been adequately operationalised. A strong desire for food may be experienced, for example, without the experience of craving.

Given these difficulties, most researchers define food craving pragmatically and based just on the subjective experience of craving. Based upon previous definitions in the literature and for the purpose of this study, a craving is defined as an intense desire or longing (Weingarten & Elston, 1990) to eat a particular food (Marlatt, 1987; Hill, Weaver & Blundell, 1991; Weingarten & Elston, 1991; Rodgers & Smit, 2000), without the accompanying implication that it is by definition acted upon. Strength and specificity are the core components. So, a craving needs to be both an intense desire and directed at a particular food, drink or taste (Hill, 2007). Like

other subjective experiences, the severity of a food craving should also be seen on a continuum of experience that ranges from mild to extreme.

It follows that estimates of prevalence vary depending on the parameters used to define a craving. It also varies according to population, but overall, cravings are considered to be a normative rather than pathological experience. Gendall *et al.* (1997) have found that 58% of a random sample of adult women report having experienced a food craving, which reduces to 52% when limited to non-pregnancy cravings. Weingarten and Elston (1990) found that 97% of female undergraduate students at a Canadian University experienced cravings. More specifically in relation to food cravings among samples with problematic eating patterns, approximately 50% of overweight women report carbohydrate cravings (Bjorvell, Ronnberg, & Rossner, 1985) and more than 70% of women with bulimia cite food cravings as a reason for their binge eating (Mitchell, Hatsukami, Pyle, & Eckert, 1985).

The point at which the intensity of an experience becomes sufficient to label it as a craving is debatable. This has led to some discrepancies in the literature regarding prevalence. Differences in definition have added to this discrepancy. Some studies employ narrower definitions of craving which not only stipulate the existence of an intense desire to eat a particular food but also that there is a demonstrable difficulty resisting the craved food, altered speed of consumption and anxiety when the food is not available. The prevalence of food cravings according to these studies is understandably much lower, according to Gendall, Joyce and Sullivan (1997) as low as 4%.

Measuring food craving

The term 'craving', in this case for food, is difficult to define and measure. Various ways of measuring cravings have been suggested including

psychophysiological measures such as heart rate, skin conductivity and salivary secretion. These measures only provide information regarding physiological changes to the body; they do not provide any descriptive information specifically about the craving. Other studies have attempted to measure tolerance, withdrawal and lack of control (Rozin, Levine & Stoess, 1991). The evidence for a link between these measures and intensity of craving experience is lacking (Rodgers & Smit, 2000).

Of the limited number of procedures used to measure the craving state, the most common method is self-report. Individuals are asked to rate their craving or desire on a scale. The number on the rating scale is taken to indicate the magnitude of the craving. Another popular measure of craving is consumption; the amount or speed of consumption of the desired substance is assumed to reflect the strength of the craving. Consumption however, is a problematic index to use in isolation since, as noted above, not all cravings are acted upon.

Several attempts have been made to fully characterise food cravings by scaling their subjective features, the accompanying emotions and consequent behaviours, and describing the circumstances in which they occur. For example, an incident report method has been developed by Hill et al. (Hill & Heaton-Brown, 1994; Hill, Weaver, & Blundell, 1991). This approach differs from the continuous sampling methodology often used to measure hunger motivation, in that participants are asked to monitor every occurrence of a food craving and to complete a detailed account of the experience once it has passed. The information is noted on a food craving record, a list of eighteen or more questions and ratings of the event contained on a single sheet of paper. The craving record builds on an earlier study (Hill, Weaver, & Blundell, 1991) and was first used to describe food cravings in a group of twenty-five healthy women (Hill & Heaton-Brown, 1994).

Another prospective approach to cravings is reported by Schlundt *et al.* (1993). They asked eighty moderately obese participants about whether they were craving sweets within a detailed food-intake diary completed over a two-week pre-intervention period. They also recorded situational aspects of eating and current emotional state at each craving event. Craving for sweets was shown to be closely associated with snacking and boredom but quite different from the experience of hunger. The sequential analysis technique used in this study allows eating behaviour to be predicted from events occurring at the previous meal. No evidence was found that missing an eating episode increased the likelihood of later craving sweets. These cravings were, interestingly, associated with impulsive eating and overeating.

Taking a different approach, Pelchat (1997) has used structured interviews to compare the food craving experience of old and younger adults. Elderly participants reported fewer cravings and for a more limited number of foods, it also suggested that craving for sweet foods declines with age.

Finally, Tiggemann & Kemps (2005) asked a sample of undergraduates to recall their last experience of food craving and to write a short paragraph about the experience as if it was happening right now, as well as completing ratings of its intensity and character. The focus was directed at descriptive characteristics of the experience rather than features such as frequency. From the 128 participants' ratings and written accounts, the intensity of the experience is apparent. Cravings for takeaway foods, meal foods and savoury treats were most common, followed by chocolate and other sweet foods, making up over 40% of the foods named. More women than men reported craving chocolate, whilst more men than women reported craving a meal.

Overall, these studies have encapsulated some of the intensity and variety of cravings but above all they demonstrate the individual's acquaintance with food cravings in a context that does not sensationalise or make the experience out of the ordinary.

Theories of food craving

Two classes of explanation are presented to explain the elicitation of cravings. The first is that cravings are activated after a period of abstinence from a highly desired substance. The second is that cravings are provoked by exposure to stimuli associated with a highly desired substance.

Abstinence

The abstinence model suggests that cravings are triggered by a dysphoric mood state produced by abstinence from a desired or needed substance, or by hunger or physiological need. Based upon this, some investigators assume that periods of food restriction, or severe dieting, elicit food cravings. For example, Mitchell *et al.* (1985, p. 484) wrote that: "...eating patterns or ... periods of minimal or little food intake ... would predispose to food craving ...". Presumably, abstaining from an appropriate level of food intake, or some depletion state produced by caloric restriction, triggers cravings for food. If food cravings are associated with abstinence or physiological need, a clear relationship between the two should be evident from research studies looking at the nature of dieting and food deprivation. However, before exploring these areas of research, the biological mechanisms by which the association between dieting and food cravings could arise must first be considered.

Biological mechanisms and food craving

The most common explanation accepted by lay people is that cravings are a response to a nutrient or caloric deficit in diet and as such have a regulatory function

(Michener & Rozin, 1994). It is suggested that cravings for a particular macronutrient-rich food arises when that macronutrient is removed from the diet (Li & Anderson, 1984). Gendall, Joyce and Sullivan (1997) found that participants' craving for carbohydrates increased more after a protein rich meal than after a high carbohydrate meal. This was offered as evidence for compensatory increases in carbohydrate intake regulation in certain individuals. However, evidence for this theory is limited and appears to be largely based upon experiences of more general food deprivation and malnutrition.

Another theory suggests that hormonal state influences cravings. Much of the supporting evidence comes from the observation that chocolate and other sweet foods are commonly craved during pregnancy (Dickens & Trethowan, 1971) and 7-10 days prior to menstruation (Cohen, Sherwin, & Fleming, 1987). This theory has been used to support the idea that cravings are a response to physiological need, such as a serotonin imbalance prior to menstruation (Dye & Blundell, 1997), which may make women more vulnerable to cravings and low mood, alleviated by the cathartic effects of food consumption.

Cravings are often referred to within the context of addiction, the term 'craving' being used to describe intense desires for a variety of substances of abuse. Although there does appear to be some similarity between food cravings and other addictions, such as alcohol (Cooper, 1989), there are limited similarities with models of addiction (Scott, 1983) and no evidence of physical dependence to any of the substances contained within chocolate (the most commonly craved food), withdrawal symptoms or tolerance to craved foods.

Dieting and food craving

If food cravings are psychological verifications of the body's energy depletion then there should be a clear association between dieting and food craving frequency or strength. A number of studies have failed to find this association (Hill, Weaver, & Blundell, 1991; Rodin, Mancuso, Granger, & Nelback, 1991; Weingarten & Elston, 1991). In a survey of a large sample of Canadian undergraduate women (Weingarten & Elston, 1991), the 15% who stated they were currently dieting were found to be no more likely to report food cravings than non-dieters. Similarly, when a group of American women were interviewed (Rodin, Mancuso, Granger, & Nelback, 1991) about their craving experiences over the preceding two weeks on four occasions over a two year period, those who reported food cravings scored no higher on dietary restraint than non-cravers.

The study of dietary restraint historically has focused on theories of obesity (Schachter, 1968; Nisbett, 1972). Schachter's internal-external theory of obesity postulates that the difference between the eating patterns of obese and normal weight people is due to the fact that normal-weight people are controlled by internal cues such as gastric contractions and obese people more by external cues such as the sight, smell and taste of food (Ruderman, 1986). Schachter later revised this view by suggesting that obese people are more responsive to environmental stimuli, which evokes a response when they are particularly compelling. Few studies have supported this view and many have failed to find a clear difference in the eating patterns of obese and normal weight people.

Herman & Polivy (1980) have suggested that differences underlying obese-normal patterns of eating behaviour are due to levels of restraint. They hypothesized that obese people are more likely to be restraining their eating. Herman and Polivy

(1980) extended this hypothesis to suggest that eating patterns are influenced by the balance between physiological factors that stimulate the desire for food and efforts to resist that desire. Therefore, "restraint" is the cognitively mediated effort to combat the urge to eat.

Despite this, a number of studies have failed to find any substantive link between food craving and dietary restraint (Hill, Weaver, & Blundell, 1991; Rodin, Slochower, & Fleming, 1977), or any association between chronic deprivation rather than true caloric restriction. Dieters try, often unsuccessfully, to avoid eating highly preferred but ''fattening'' foods. It may be the mere attempt to restrict the intake of desired foods that makes them even more attractive and unleashes craving in chronic dieters. This phenomenon is captured by the popular notion of repeated dieting, binge eating, and increased cravings reflecting psychological "forbidden fruit" and begs the question as to whether actual deprivation does contribute to food cravings.

On the other hand, Hill *et al.* (1991) did find a weak association between dietary restraint and craving strength however, craving strength and frequency were more strongly related to emotional and external eating which are scales describing conditions that provoke unplanned eating or overeating. Similarly, Delahanty, Meigs, Hayden, Williamson & Nathan (2002) found some associations after analysing baseline data from a cohort of participants on the Diabetes Prevention Program. They state that food cravings, binge eating severity and poor dietary restraint are independently and positively related to BMI. Overall, the evidence that dieting is associated with an increase in strength and frequency of food cravings is not strong.

Deprivation and food craving

One area in which food cravings appear responsive to dietary reductions is fasting. There is evidence that fasting in both the short-term (Lappalainen, Sjoden,

Hursti, & Vesa, 1990) and long-term (Harvey, Wing, & Mullen, 1993), is associated with fewer food craving experiences. This suppression of food craving is consistent with other observations of reduced appetite during weight loss on very low energy diets (Wadden, Stunkard, Day, Gould, & Rubin, 1987). Reduced hunger has also been reported in patients with eating disorders who have a similarly low energy intake (Halami & Sunday, 1991). Ketosis has been suggested as a mechanism for this decrease in hunger and food craving, although there is little evidence to support this association.

Dieters do not only potentially deprive themselves of food energy, but also foods they enjoy eating. Both monotony and self-restriction are associated with increased food-craving experiences (Hill, 2007). Polivy *et al.* (2005) asked participants to refrain from eating foods containing either chocolate or vanilla. They then looked at cravings and consumption of chocolate or vanilla-containing foods over the following week. Chocolate-deprived participants ate more chocolate than either vanilla-deprived or non-flavour deprived participants. Restraint scores qualify this outcome, with only the high restraint group showing this increased chocolate intake.

In a study looking at short-term carbohydrate and protein restriction, Coelho, Polivy & Herman (2006) showed a selective effect on craving for these food types. Abstaining from complex carbohydrate rich foods was found to be associated with an increase in craving them and higher intake. A similar effect was found for high-protein foods but without the increase in intake. Participants' restraint level was found to have no effect on either craving or intake. Restriction-induced craving may be a phenomenon dieters have more experience of or there is something special about chocolate to dieters that is not shared by chicken or bread (Hill, 2007).

Cravings and Mood

It is apparent that mood plays an important role in food craving. For example cravers are more likely to be bored or anxious during the day and to experience dysphoric mood immediately before cravings (Hill, Weaver, & Blundell, 1991).

There is a large body of scientific evidence linking dysphoric mood with the consumption of carbohydrate-rich foods – the consumption of carbohydrates generally leading to an improvement in mood. Wurtman (1988) suggests that dysphoric mood elicits carbohydrate craving and that carbohydrate intake ameliorates depression. This hypothesis is based on the observations of: (a) depressed affect in some individuals when carbohydrate consumption is low, (b) self-reports of carbohydrate craving under conditions of minimal carbohydrate intake, and (c) the amelioration of low mood with carbohydrate consumption. It is proposed that individuals self-medicate their depression with carbohydrates and that a craving for carbohydrates signals the need to consume carbohydrate-rich food. The obese, and individuals with Seasonal Affective Disorder or pre-menstrual syndrome, are also hypothesized to self-medicate low affect by carbohydrate consumption (Wurtman, 1988).

The idea that individuals choose to eat foods with the intention of regulating mood has a long history. Several biological pathways have been proposed, the most prominent being serotonin and endogenous opiods (Drewnowski, 1991; Wurtman & Wurtman, 1986; Wurtman, 1988). Serotonin is a neurotransmitter responsible for reducing appetite, alleviating irritability and elevating mood (Wurtman & Wurtman, 1995). The serotoninergic theory suggests that people crave carbohydrates when their brains are low in a substance as is implicated in depression and anxiety. When serotonin levels are low, people report feeling depressed, irritable and tense. As eating carbohydrate indirectly raises serotonin levels, according to the theory, it creates a

euphoric effect on mood (Fernstrom & Wurtman, 1971). Rodgers and Smit (2000) concluded from their review that these psychoactive compounds contained in food played little or no role in cravings. They also state that there may be several mechanisms that account for the relationship between mood and food, which do not need to be mutually exclusive.

Some mechanisms reflect the fact that frequently craved foods such as chocolate are very pleasurable to eat and so inherently rewarding. Macht & Simons (2000) found that motivation to eat is higher during negative emotion and in this state participants tend to eat to provide distraction, to relax and to feel better. Based upon this, it has been hypothesised that some individuals eat a particular food, and crave it for reasons of negative reinforcement, i.e. consumption reduces aversive mood states such as boredom and depression. In a study of self-defined chocolate 'addicts' and a group of women who liked chocolate but were not addicted, food diaries completed over one week were inspected for chocolate intake and mood ratings (Macdiarmid & Hetherington, 1995). Before eating chocolate the addicts were found to have higher ratings of intensity, guilt and depression, and to be less content and relaxed. Chocolate consumption was seen to decrease craving and hunger, with the only change in mood being a small increase in guilt that was greater for addicts. It may be that any alleviation from negative mood states occurs only during eating or is too transient to be detected.

Expectation

Unlike abstinence models that focus on the links between mood, restriction or deprivation and cravings, expectation models, suggest that cravings are triggered by exposure to either internal or external cues associated with the desired substance. For example, biscuits may be associated with drinking tea; therefore exposure to tea may

trigger biscuit cravings according to this theory due to the association between the two.

The environmental context is likely to play an important role in the aetiology of cravings. Cravings have been regarded in terms of classical and operant conditioning in that they may be, to some extent, conditioned responses to the context in which the food has previously been eaten (Weingarten & Parkinson, 1988). Foods may become associated with certain situations, moods or times of day. For instance, chocolate may become more desired by an individual when their mood is low because it has previously been associated with an improvement in mood.

Research into cue reactivity and food cravings has been used to gain a better understanding of the processes involved in binge eating. This has been typically placed within a classical conditioning framework. Jansen (1998), for example, argues that in normal circumstances food intake is an unconditioned stimulus and its physiological and metabolic consequences are unconditioned responses. Cues that reliably signal food intake (sight, smell, taste or food) act as conditioned stimuli that trigger reactivity or conditioned responses. These conditioned responses can be physiological changes. The alternating binge and fasting behaviours of individuals with binge-eating problems facilitate the conditioning process, as the behaviours are extreme (strong unconditioned responses) and the range of cues (conditioned stimuli) limited and specific. Over time the physiological responses that define cue reactivity are subjectively experienced as cravings and lead to binge eating.

Ambivalence

In a shift away from purely biological explanations, Rogers & Smit (2000) suggest that it is ambivalence towards certain foods that leads individuals to attempt to resist them and subsequently to cravings for those foods. Those foods that are seen

as 'treats' and about which we hold a negative view of their nutritional content such as chocolate are likely to be resisted. Attempts to resist these foods make thoughts about them more salient (so leading people to label them as craving rather than hunger) whilst inducing anxiety. They also suggest that we may see eating food to alter mood as an inappropriate use of food and this may lead to concerns regarding lack of self-control and self-efficacy.

Evidence in support of this theory is provided by a study in which self-reported 'chocoholics' described a greater liking or desire to eat chocolate than controls but salivated less when exposed to it (Rogers, Anderson, Finch, Jas & Gatenby, 1994). Although these findings are in contrast to those studies looking at salivation in relation to palatability and hunger (Wooley & Wooley, 1973), they suggest that dieters are faced with greater anxiety when confronted with such foods. Although chocolate is often desired, it is seen as unhealthy and has associations with overeating and obesity. Therefore, Rogers & Smit's model of craving would suggest that the relationship between attempted restraint and successful dieting should be mediated by cognitions about and the ambivalence towards foods. The increased awareness of ambivalent thoughts about 'naughty but nice' foods leads us to view and experience them as craving.

Overview of food cravings

Despite a number of theories about the mechanisms involved in cravings, the complexity of the experience makes it near impossible to define the origins of food cravings in a comprehensive way using only one model. It is clear that food cravings are likely to have different causes or triggers (e.g. in depression, pregnancy and menstruation) in different situations and in different individuals. The most likely explanation is that of an interaction between physiological need (e.g. hormonal,

neurochemical, nutritional), environmental factors (e.g. contextual cues and triggers) and psychological mediators (e.g. learnt associations through conditioning).

Obesity

Obesity occurs when a person's calorie intake repeatedly exceeds the amount of energy expended. This relationship may be influenced by genetic, social, cultural, psychological, environmental and economic factors. Morbid obesity is a chronic condition associated with an increased risk of mortality and morbidity. It is internationally defined as a Body Mass Index (BMI) greater than or equal to 40 kg/m2, although in terms of treatment individuals with a BMI of 35 kg/m2 and co-morbid health problems may be considered morbidly obese.

Prevalence and cost to public health

The rising prevalence of obesity in developed societies is causing a major health threat in terms of morbidity and mortality (Kopelman, 2000). The prevalence of morbid obesity in the UK is 2.9% of women and 1.0% of men (Blake et al., 2004), and 5.1% of US adults are morbidly obese (Hedley et al., 2004). Furthermore, the prevalence of obesity in industrialised countries is said to be doubling every 5 to 10 years (Colquitt, Clegg, Loveman, Royle, & Sidhu, 2005).

The scale of the public health problem of obesity is rising and is of growing concern. It is a risk factor for cardiovascular disease, hypertension, type 2 diabetes, cancer, musculo-skeletal disease, reproductive disorders and respiratory disorders. In addition, people with a BMI greater than 35 kg/m2 have a rate of mortality at any given age double that of someone with a healthy BMI (range 20–25 kg/m2).

In addition to these risk factors, obesity is also associated with decreased quality of life. There is a social stigma attached to obesity and those affected often

face prejudice and discrimination. Obesity has a negative impact on mobility, productiveness, employment and psychosocial functioning, with many obese people left feeling depressed, defensive and unable to live life to the full.

The complications of obesity, especially type 2 diabetes mellitus, are placing growing demand on healthcare resources (Kopelman, 2000; Kortt, Langley, & Cox, 1998). Obesity has considerable costs for society, both direct, in terms of healthcare, and indirect, in terms of earnings lost through mortality or sickness. Direct costs of obesity in England in 1998 were estimated at £480 million, or 1.5% of NHS expenditure, and indirect costs at £2.1 billion (NICE, 2002).

Treatments

Non-surgical treatments offered within the NHS include advice on weight control, diet, physical exercise and lifestyle. Other interventions such as drug therapy, referral to specialist weight-loss clinics, behavioural therapy and low calorie and very-low-calorie diets may also be offered.

Many of these non-surgical approaches result in an initial weight loss of 10–15%, with the majority of people regaining this weight within 1 year. Modest weight loss that is maintained for some time (around 5% at 12 months and 3% at 2–3 years) has been reported in a specialist clinic, with maintenance being enhanced by exercise and behavioural therapies (NICE, 2002). While there is evidence to suggest that drug therapy is effective, much of the evidence available on weight loss using non-surgical treatments has been obtained from randomised controlled trials of obese people (BMI greater than or equal to 30 kg/m2), but not specifically of people with morbid obesity.

Surgery to aid weight reduction (bariatric surgery) is usually considered a last resort intervention, with patients having attempted other forms of medical management (such as behaviour change, diet, increased physical activity and drug

therapy) but without achieving permanent weight loss. Surgery is indicated for those with morbid obesity (body mass index (BMI) of 40 or more) or with a BMI of 35 or more with serious co-morbidities such as arthritis, back or disc disease, diabetes, hypertension, hiatus hernia (protrusion of the stomach up into the opening normally occupied by the oesophagus in the diaphragm), gallbladder disease, shortness of breath, fatigue, elevated serum cholesterol or disability (Colquitt, Clegg, Loveman, Royle, & Sidhu, 2005).

In the past, it has not commonly been undertaken in England and Wales. In 2002, it was estimated that little over 200 operations were performed annually, and many of these were privately funded (NICE, 2002). The average cost of the various surgical interventions, including pre-operative assessment and postoperative care in the first year, is in the region of £4500–£5300.

Bariatric Surgery

The aim of surgery is to reduce weight and maintain any loss through restriction of intake or malabsorption of food or both. It is hoped that as a consequence eating behaviour is modified, with patients consuming smaller quantities of food more slowly. In addition to modifying eating habits, patients are encouraged to commit to daily exercise as part of a wider change in lifestyle. Surgery for morbid obesity is a major surgical intervention with a risk of significant early and late morbidity and of perioperative mortality.

Types of procedures

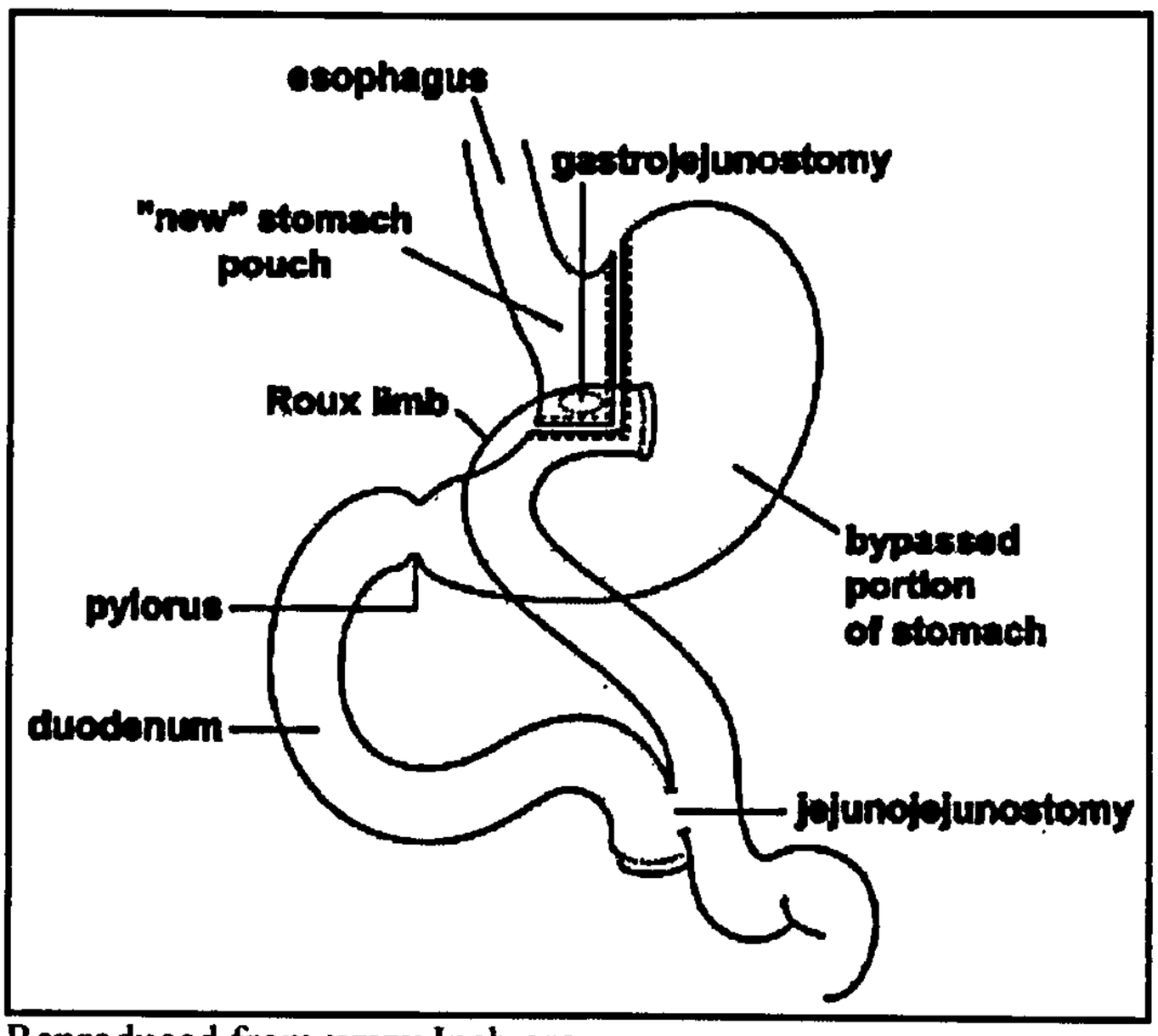
The three most common procedures currently performed worldwide are laparoscopic (i.e. keyhole surgery) gastric bypass (e.g. Roux-en-Y), laparoscopic

adjustable gastric banding and open gastric bypass. The two main procedures included in this research are outlined in more detail below.

Roux-en-Y

The Roux-en-Y combines restriction and malabsorption techniques, creating both a small gastric pouch and a bypass that prevents the patient from absorbing all they have eaten (figure 1). Complications associated with gastric bypass include failure of the staple partition, leaks at the junction of the stomach and small intestine, and acute gastric dilatation either spontaneously or secondary to a blockage at the Y-shaped anastomosis. Other complications following surgery include vomiting, wound hernias and intestinal obstruction, anaemia due to lack of absorption of iron, vitamin B12 and calcium deficiency (all are overcome by supplements) and dumping syndrome. The latter side-effect is caused by eating refined sugar and includes rapid heart beat, nausea, tremor, faint feeling and diarrhoea and is thought to aid weight loss by conditioning the patient against eating sweets.

Figure 1 Roux en Y gastric by-pass (RnY)



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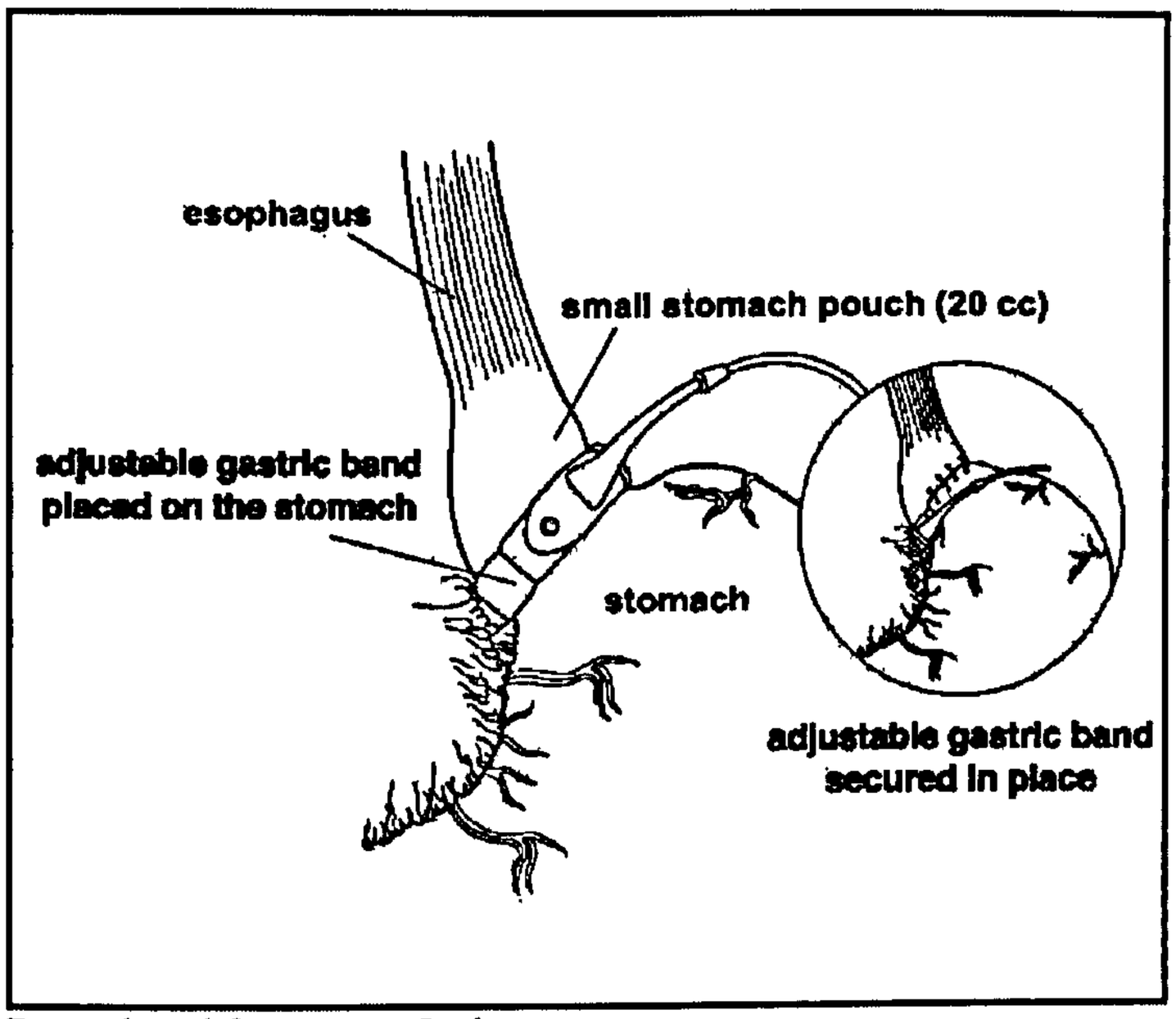
Gastroplasty and gastric banding

Gastric banding limits food intake by placing a constricting ring completely around the top end of the stomach, below the junction of the stomach and oesophagus (figure 2). While early bands were non-adjustable, those used currently incorporate an inflatable balloon within their lining to allow adjustment of the size of the stoma to regulate food intake. Increasingly, gastric bands are placed through laparoscopic surgery, decreasing time spent in hospital. Adjustment is undertaken without the need for surgery by adding or removing an appropriate material (for example saline) through a subcutaneous access port. As a restrictive procedure, gastric banding avoids the problems associated with malabsorptive techniques. Complications include splenic injury, oesophageal injury, wound infection, band slippage, reservoir deflation/leak, persistent vomiting, failure to lose weight and acid reflux.

Figure 2 Gastric band



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Effectiveness of surgery

Surgery versus non-surgical intervention

Evidence from two randomised controlled trials (Andersen, Backer, Astrup, & Quaade, 1987; Andersen, Stockholm, Backer, & Quaade, 1987; Mingrone et al., 2002) and three cohort studies (Sjostrom, 2003; Stoecldli, Chanda, Langer, & Keller, 2004; von Mach et al., 2004) with concurrent controls suggests that gastric surgery results in very good weight loss in patients who are very obese. In the study with 8 years of follow-up the surgical group had lost 21 kg whereas the control group had gained weight (Sjostrom, 2003).

Overall, patients who had surgery had improvements in quality of life. However some patients had side effects of the procedure such as heartburn and vomiting, and complications of surgery, such as wound infection and intra-abdominal abscesses. A few had to have re-operations. Four postoperative deaths were noted by the large cohort study (Sjostrom, 2003). The longer-term benefits included a reduction in the prevalence of diabetes and high blood pressure, and a reduction in the number of patients on cardiovascular disease medication and diabetes medication.

Gastric bypass versus gastroplasty (gastric banding)

From a total of 12 randomised controlled trials reviewed by Colquitt et al. (2005), most studies suggested that gastric bypass surgery leads to a greater loss of weight than from vertical banded gastroplasty or horizontal gastroplasty. Patients lost approximately 18-25% more excess weight by one year after gastric bypass than those patients who had vertical banded gastroplasty. By five years the difference had increased to 33%. However, two trials found no significant difference between the two procedures (MacLean, Rhode, Forse, & Nohr, 1995; Van Woert, Michalek, Alger, Carter, & Howard, 1992). Patients with gastric bypass lost on average 35-42%

of their initial weight, compared with 16-29% of initial weight lost with horizontal gastroplasty.

In summary, the limited evidence suggests that surgery is more effective than conventional management for weight loss in morbid obesity. Gastric bypass was associated with greater weight loss, better quality of life and fewer revisions, reoperations and/or conversions than gastroplasty, but had more side-effects

Eating changes after surgery

Weight loss after bariatric surgery occurs primarily because of a reduced caloric intake. This reduction is achieved by restriction (small gastric pouch and small outlet that restricts the volume of ingestible food) and in the case of gastric bypass also by a "dumping physiology", which is believed to help patients control their sweet intake (Hsu et al., 1998).

When dietary intake exceeds the small gastric pouch capacity, patients usually feel a strong discomfort that results in a cessation of eating. However, maladaptive eating behaviours can over-ride this after purely restrictive surgery by ingesting liquid foods, often of high-energy content such as chocolate, without the dumping syndrome which does not occur in purely restrictive gastroplasty or banding.

Gastric bypass procedures not only restrict the stomach but also limit the length and consequently the surface area of the small intestine to create decreased digestion and absorption. Although effective in reducing weight, the malabsorption of food can lead to nutritional deficiencies.

Patients usually experience less hunger after bariatric surgery. Many report eating at specific times rather than according to any internal stimulus and many foods have lower emotional valence (Delin, Watts, & Bassett, 1885, , 1995; Delin, Watts, Saebel, & Anderson, 1997). The tendency to eat for emotional reasons appears to

decline after gastric bypass and gastric banding (Delin et al., 1997; Horchner, Tuinebreijer & Kelder 2002). Also, the sensitivity to external stimuli such as smell and taste of food on eating behaviour appears to decrease after surgery (Horchner et al., 2002). Unsurprisingly, scores of disinhibition on the Three-factor eating questionnaire usually decrease significantly after surgery (Karlsson, Sjoestroem, & Sullivan, 1998).

Hormonal changes and their influence on appetite following surgery

Dramatic improvements in glycemic control have been observed in subjects with Type 2 Diabetes Mellitus following bariatric surgery, and specifically the Roux-en-Y gastric bypass procedure (Clements, Gonzales, & Long, 2004; Mason, 1999; Pories, MacDonald, & Morgan, 1992; Pories, Swanson, & MacDonald, 1995; Schauer, Burguera, & Ikramuddin, 2003). In the early postoperative period following RnY, many patients with type 2 diabetes discontinue all antidiabetic medication, and may achieve normal fasting plasma glucose concentrations even before substantial weight loss has occurred (Clements, Gonzales, & Long, 2004; Schauer, Burguera, & Ikramuddin, 2003). It has been postulated that the improvements in glycemic control, reduction in appetite, and subsequent weight loss following bypass surgery may be due to changes in circulating gut hormones (Atkinson & Brent, 1982; Cummings, Weigle, & Frayo, 2002; Rubino & Marescaux, 2004; Schauer, Burguera, & Ikramuddin, 2003).

A number of peptides released from the gastrointestinal tract have recently been shown to regulate appetite and food intake, by both stimulating appetite and suppressing it (Schwartz & Morton, 2002; Schwartz, Woods, & Porte, 2000). Ghrelin, a hormone produced from the stomach prior to eating increases expression of the appetite stimulating hypothalamic neuropeptide Y (NPY) and stimulates food intake.

In contrast, peptide YY (PYY), released after a meal from the distal gastrointestinal tract, inhibits the release of NPY, reducing food intake. Glucagon-like peptide 1 (GLP-1) promotes insulin release following a meal and has also been reported to inhibit food intake. Pancreatic polypeptide (PP) has recently been shown to inhibit appetite and food intake and promotes energy expenditure (le Roux et al., 2006).

Following Roux-en Y gastric bypass. Patients have increased PYY and GLP-1 levels following food intake, which results in enhanced satiety after a meal. Over time this may lead to a long-term reduction in calorie intake, while increased GLP-1 and insulin might contribute to immediate improvements in glycemic control.

None of these effects are observed in patients losing similar weight through gastric banding, suggesting that the hormonal changes are not secondary to weight loss alone and are specific to malabsorption procedures involving physical change to the small intestine and stomach.

Food cravings, restriction and bariatric surgery

There is a large body of evidence linking dysphoric mood with the consumption of carbohydrate-rich or sweet-tasting foods. However, following bariatric surgery evidence suggests that there is a decline in the tendency to eat for emotional reasons. This change may also impact on the occurrence or severity of associated food cravings.

Biological theories of food cravings suggest that they arise as a result of caloric or nutritional deficit. Bariatric procedures produce weight loss by restricting calorie intake and/or limiting digestion of food leading to a malabsorption of nutrients. It could therefore be hypothesised on this basis that food cravings would increase in patients having undergone bariatric surgery.

Schachter's internal-external theory of obesity postulates that the difference between the eating patterns of obese and normal weight people is due to the fact that normal-weight people are controlled by internal cues whereas obese people use external cues such as sight, smell and taste of food (Ruderman, 1986). Research suggests that sensitivity to external stimuli such as smell and taste of food on eating behaviour appears to decrease after surgery (Horchner et al., 2002); therefore it would seem reasonable to suggest that if obese people were more susceptible to external cues, which then decreases after surgery, this would also lead to a decrease in food cravings.

As regards restriction, Keys, Brozek, Henscel, Mickelson & Taylor (1950) documented the occurrence and intensity of food preoccupation in a number of semi-starved volunteers. Their desire for food was persistent and strong and their eating behaviour underwent a profound change. Dieting or restriction should therefore be associated with an increase in deprivation-induced food cravings. Since bariatric surgery reduces food intake, based on this principle of food cravings, deprivation-induced cravings would be expected to increase in this population following surgery. This would also be the case if food cravings are associated with a psychological deprivation, since sweet, high calorie foods are avoided through fear of dumping although, only in patients having undergone gastric bypass.

Clinical relevance of current study

The importance of the link between dietary restraint and food craving is demonstrated in the eating disorders literature. For example, it was found in a study by Mitchell *et al.* (1985), that over 70% of women with bulimia nervosa reported craving as an antecedent to binge eating. Other researchers have found similar results.

Up to 82% of women with bulimia nervosa have attributed the onset of binge eating to a craving for sweet foods (Abraham & Beaumont, 1982; Mitchell, Hatsukami, Pyle, & Eckert, 1985; Wurtman & Wurtman, 1986).

Binge eating disorder (BED) is one of the most common psychiatric disorders in patients presenting for obesity surgery (Sarwer et al., 2004). An estimated 30% of obese individuals seeking bariatric surgery have been reported to meet criteria for BED, when compared with just 2% in the general population (Saunders, 1999). Despite some indications that binge eating behaviour is eliminated by gastric restrictive surgeries, many patients continue to have maladaptive and psychologically distressing eating behaviors following surgery. Furthermore, studies that assessed the relationship between pre- and post-surgical binge eating and BED mostly indicate that in patients who continue to have binge eating and BED post-surgery, weight loss outcomes are worse compared with patients who never had these behaviors or who remained remitted (Lang, Hauser, Buddenberg, & Klaghofer, 2002; Larsen et al., 2004).

A central feature of a binge episode is a sense of loss of control accompanying the eating (i.e. difficult or impossible to stop from eating or to stop eating once started). Binge eating appears to cease following surgery in a large percentage of patients however, concluding that surgery is a cure for pre-surgical eating pathology should be approached with caution (Niego, Kofman, Weiss, & Geliebter, 2007). Studies that have dropped the ''large amount of food'' criteria in the assessment of post-surgical binge eating indicate an appreciation that, for many, binge behaviors continue after surgery though altered or limited in expression by the physiological changes brought on by the surgery (deZwaan et al., 2003; Mitchell et al., 2001).

Weight-loss surgery is the most effective treatment for achieving long-term weight loss in morbidly obese patients (Colquitt, Clegg, Loveman, Royle, & Sidhu, 2005). However, if a causal link between binge eating and food cravings remain following surgery this could have implications for individuals who are experiencing difficulty losing weight after surgery or complications due to continuing to eat foods that are restricted by surgery. Understanding the nature of food cravings in this population may help professionals working clinically with those individuals experiencing difficulties with their eating following weight-loss surgery

Background to current study

As mentioned previously, the concept of craving is difficult to measure, which poses methodological challenges. Hill & Heaton-Brown (1994) addressed some of these challenges in a prospective exploration of food craving phenomenology in healthy women. These women recorded their food cravings for five consecutive days in one week over a five week period, enabling any influence of their menstrual cycle to be detected.

The monitoring period yielded 219 craving episodes, averaging at approximately two per week. Craving for chocolate or chocolate-containing foods was found to be the most common, followed by 'sweet foods', cereals (biscuits, cakes, puddings) and finally, savoury foods. The great majority of cravings were found to occur at home or at work. Cravings were found to be equally likely alone or in company, to happen at all times of day and to be most frequently preceded by thinking about the craved food. Small but positive changes in mood were found across the craving experience and hunger decreased. This study characterised cravings as hunger-reducing, mood-improving experiences, directed at wanting to consume

highly-pleasant tasting food and most commonly triggered by thinking about that food.

The authors advocated the use of this analysis method to explore food cravings in other groups. As mentioned previously, there is an absence of a clear relationship between dieting and food cravings. This may partly be due to the continuous sampling methodology often used in studies to measure hunger motivation and the over-simplistic categorisation of participants into 'dieting' or 'not dieting' groups.

Massey (2003) adopted the quasi-prospective methodology used by Hill & Heaton-Brown (1994) when investigating the relationship between mood and food cravings in dieters, watchers and non-dieters. Dieters were found to have had a higher maximum past weight than non-dieters and were intermediate in their dietary restraint score. They were also found to be intermediate in the number of cravings experienced in the week of recording, with dieters reporting significantly more cravings than non-dieters. The craving experiences recorded by dieters were found to be stronger, more difficult to resist and slower to disappear than those of non-dieters. Craving onset was shown to be associated with less positive mood and lower hunger than in non-dieters. However no differences were found in the situations where cravings started, the time of day of onset, the foods that were craved or even whether cravings led to eating. Attempted restriction over eating was found to be one of the best discriminators between dieters, watchers and non-dieters.

The methodological differences in categorisation of participants, recruitment of a community sample from commercial slimming groups and the quasi-prospective reporting of craving experiences may account for the difference in these findings when compared to other studies exploring a relationship between dieting and craving. The method employed in this study gave a more detailed account of the craving

experiences, allowing more in-depth analysis of the different factors involved such as mood, restriction, situational context and the target food craved.

Study aims

Despite the diversity of theories of food craving, many studies investigating these theories have used evidence from healthy, dieting or eating disordered populations. The nature of food cravings within a group of patients receiving weight-loss surgery has been largely unstudied. This is surprising within the context of exploring abstinence and dietary restraint models of craving, since this is one of the few, if not only groups of people who experience both psychological and physically imposed dietary restriction and caloric depletion.

In this study I will use a similar methodology to that employed by Hill & Heaton-Brown (1994) and Massey (2003), as described previously. This will use a quasi-prospective methodology to examine the way in which cravings are experienced by individuals following both gastric band and Roux en-Y weight-loss surgeries over different time points post surgery. There has not, as yet, been a study that examines the experience of food cravings within a weight-loss surgery population in detail. In order to explore some of the current theories of food craving, the present study will attempt to understand food cravings within this population from a functional viewpoint, including information about the antecedents, context and consequences of food cravings. In order to get a fuller picture of the antecedents and context of food cravings, supplementary analyses of the target of the food craving and the preceding context in which the craving experience occurred. It is hoped that this will lead to an improved clinical understanding of the difficulties frequently associated with the craving experience.

If abstinence theories linking nutrient or caloric deficits with increased food cravings are correct, following weight-loss surgery individuals should experience a higher frequency of cravings, which should also increase over time as the deficit becomes more chronic. The frequency of cravings between the two types of weight-loss surgery is expected to differ. If cravings are more due to nutritional or caloric deficit, it might be expected that participants having RnY gastric by-pass would experience a higher frequency of cravings than those having had the gastric band. If however, cravings are more hormonally mediated, the reverse will be true.

In response to theories linking mood and food cravings, it has been suggested that eating for emotional reasons following weight-loss surgery reduces. However, consumption is not always a consequence of craving and there is a wealth of evidence linking dysphoric mood with increased craving in other populations. Since it has been hypothesised that the obese self-medicate low affect by carbohydrate consumption (Wurtman, 1988), a similar association between dysphoric mood and cravings should be found in a weight-loss surgery population.

If Rogers & Smit's hypothesis regarding ambivalence towards certain foods leading to more frequent and intense food cravings is correct, reports of the craving experience should change quantitatively between the two time groups. It should also result in qualitatively different reports between the two surgery groups due to different foods being restricted. It would be expected that a negative shift in mood would be induced in those who eat as a result of their craving. The number of cravings experienced should differ, with those one year post surgery experiencing a significantly greater number of cravings than the 3-8 month post surgery group. The degree to which individuals attempt to resist and restrict the craved food within their diet might also be expected to affect a) the strength of the craving, and b) whether the

craving is acted on. Given the normative nature of cravings it would be expected that the cravings themselves would occur in response to similar precipitants and in similar settings regardless of group.

It is hypothesised that:

1. Patients one-year post-surgery will experience more frequent and intense cravings than those who have had surgery more recently.
2. The gastric band group will experience more frequent and intense cravings than the Roux en-Y group.
3. There will be a relationship between hunger and cravings.
4. There will be a link between negative mood states and days when cravings are experienced.

CHAPTER 2 METHOD

Participants

Participants in this study were recruited from two sources. Firstly, a clinic sample was recruited from the post-surgery follow-up clinics of Mr Simon Dexter at Leeds General Infirmary and Nuffield Hospital, Leeds. Additional participants were recruited by placing an advertisement for the study on the 'weight-loss info' website (www.wlsinfo.or.uk). The website offers support to individuals who are either waiting for or who have had weight-loss surgery. The advertisement gave a brief description of the study and invited potential participants to contact the researcher should they wish to take part in the study. The reason for recruiting from two sources was mainly to maximise recruitment potential since the clinic sample was likely to be limited but also because the nationwide accessibility of the website increased diversity of participants in terms of geographical location. Participants from the clinic sample were given information about the study at clinic appointments, whereas participants recruited via the website advertisement were essentially a self-selecting sample.

Initially, forty one participants were recruited to take part in the study. Of these one withdrew, fifteen did not return their questionnaires, three completed their questionnaires incorrectly and one was removed from the analysis due to having had surgery only three weeks previously and still consuming a liquid diet. The remaining sample consisted of twenty one women who had either purely restrictive (gastric band) or restrictive and malabsorptive surgery (Roux en Y). Of the twenty one participants, seven were recruited via follow-up clinics and fourteen were recruited via the internet support website. Post surgery times ranged from 3.9-38.6 months post-surgery. Two time clusters were identified and used to group participants into either the 3-8 month post surgery group or the one year+ post-surgery group. Within the 3-8 month post-surgery group, five participants were recruited via the follow-up clinic

and five were recruited via the support website. Within the one year+ post-surgery group, two participants were recruited via the follow-up clinic and nine were recruited via the support website.

Permission to advertise the research on the weight-loss info website was obtained from the website administrator. All of the participants taking part were volunteers, responding positively either to a direct request to take part in the study from their surgeon or via an advertisement on the weight-loss info website. No financial incentive was offered for participation. Participants were informed that the study was investigating eating patterns and food cravings following weight-loss surgery. Participants gave information regarding the time since having weight-loss surgery but were not aware that this was a grouping variable. All participants received a participant information sheet (Appendix 1) and a consent form (Appendix 2) in which it was stressed to all participants that they were free to withdraw at any time without giving a reason and that participation or withdrawal from the study would not affect their on-going care. Ethical permission for the study was gained from the Leeds East Regional Ethics Committee (Appendix 3). To comply with the terms of this ethical permission, no information was recorded on participants who declined to take part in the study or who dropped out during the week of recording.

Measures

The following materials were used:

1) Background questionnaire (Appendix 4). A series of questions were directed at the anthromorphic and demographic characteristics of the individual participants. The body weight and height of each participant was requested and this information used to calculate a Body Mass Index (BMI=kg/m^2). Dates of birth were requested to calculate age. Information was gathered on the maximum and minimum

weight the participants have ever weighed at their current height and their ideal weight.

Individuals were presented with a series of nine line drawings of female figures, ordered from (A) extremely thin to (I) obese (developed by Stunkard, Sorenson & Schulsinger, 1983 and modified by Hill & Heaton-Brown, 1994). This pictorial scale was used to elicit current perceptions of body shape and body shape preferences; participants were presented with this scale and asked:

a) Which figure is most like you now?

b) Which figure would you most like to look like?

The discrepancy between the two images selected was then used to calculate a measure of body shape satisfaction or dissatisfaction. A value of zero would indicate satisfaction, whilst a positive value corresponds to a desire to be larger and a negative value to a desire to be thinner.

Participants were asked to provide information regarding their dieting status. They were presented with three statements and asked to choose one of these: 'currently dieting to lose weight' 'currently dieting of watching what you eat so as to not gain weight' and 'not dieting'. One participant did add 'trying to gain weight' as a further option to their questionnaire response.

2) Daily questionnaire (Appendix 5). This questionnaire was adapted from that used previously in a study by Waters, Hill & Waller (2001). It contained ten items relating to the participant's affective and food-related experience throughout the day. Seven of these items related to mood states. These were anxiety, contentment, tension, irritability, feelings of alertness, emotional vulnerability and boredom. The remaining three items related to feelings of hunger, thirst and control over eating. Ratings were made on 100mm visual analogue scales. Participants were required to put a mark

through the line at a point that best represented their experience over the day on a continuum ranging from 'extremely' to 'not at all' on each concept.

3) Craving record (Appendix 6). This was an adaptation of the craving record used by Hill & Heaton-Brown (1994), and originally by Hill, Weaver & Blundell (1991). It is a quasi-prospective, self-monitoring measure, designed to be completed each time the participant experiences a craving. Mood prior to the craving can be completed prospectively however other items relating to the craving experience were completed completely retrospectively but as soon after the craving as possible to minimize bias. It consisted of eighteen questions regarding participants' subjective experience of each individual food craving.

Questions 1-8 asked about preceding situational and affective aspects of the craving. Participants were asked where they were when it began, whether they were alone or in company and at what time the craving commenced. Question four asked about the immediate antecedents to the craving in terms of participant's thoughts about, presence of and consumption of food, and whether it was craved food or other. Six options were given; 'see or smell the food craved'; 'see or smell other food'; 'simply think about food craved'; 'simply think about other food'; 'eat the food craved' or 'eat other food'. Since participants were asked to circle any that applied to the experience, multiple responses were possible.

Question five asked participants to rate how the felt immediately before the craving. A version of the UWIST mood adjective checklist (UMACL) (Mathews, Jones & Chamberlain, 1990) was used for this purpose. Although the original form consisted of twenty-four items, in this study participants were required to respond to only twelve (Leeds short form; Morley, 1993). The twelve mood states were presented and participants were required to rate the intensity of each on a simple four-

point response scale ranging from 'not at all' to 'extremely'. The mood states captured were converted into three subscales or dimensions: hedonic tone (i.e. happy, contented, dissatisfied and sad), energetic arousal (energetic, alert, sluggish and tired) and tense arousal (tense, nervous, calm and relaxed).

The next three questions were directed at antecedents to the craving and asked participants to rate their hunger prior to the craving experience, the strength of the craving and how difficult it was to resist. Visual analogue scales were used, again anchored by the statements 'not at all' and 'extremely'.

Details of the craving were then required. Participants were asked an open-ended question about what the craving was for and a rating of how much they were trying to restrict eating this food was specified on a visual analogue scale with anchor points of 'not at all' to 'a lot'. A yes/no response was asked for in response to the question 'Did you eat as a result of the craving?' and where this response was negative, an open response was requested in response to the question 'What did you do instead?' Those who ate as a result of their craving were asked to describe in detail what they ate, how long they resisted the craving in minutes and how pleasant the taste of the food was that they consumed.

The final three questions address the post-craving experience. Two visual analogue scales were presented asking about speed of disappearance of the craving ('not at all quickly' to 'extremely quickly') and how hungry the participant felt following the craving ('not at all hungry' to 'extremely hungry'). Participants were also asked to repeat the UWIST mood adjective checklist.

4) Food intake diary (Appendix 7). This measure was designed to provide a prospective account of participants' food intake over the seven-day period of the

study. They were asked to provide information about everything they consumed during the week in an A4 sized booklet with a half days information recorded on each page. Participants were asked to indicate whether food documented was consumed as a snack or as part of a main meal and to provide information about the time of consumption and approximate quantity of all food consumed.

5) Three Factor Eating Questionnaire – Revised (TFEQ-R18) (Appendix 8). The Three-Factor Eating Questionnaire (Stunkard & Messick, 1985) originally consisted of fifty-one items. Kalsson, Persson, Sjöström and Sullivan (2000) developed a reduced version of the original consisting of 18 items.

The revised 18-item version (TFEQ-R18) comprises three different scales - cognitive restraint, emotional eating and uncontrolled eating. The cognitive restraint scale includes statements such as 'I deliberately take small helpings as a means of controlling my weight' and 'I consciously hold back at meals in order not to weight gain'. The uncontrolled eating scale includes statements such as 'When I smell a sizzling steak or juicy piece of meat I find it very difficult to keep from eating, even if I have just finished a meal' and 'Sometimes when I start eating, I just can't seem to stop'. The emotional eating scale includes statements such as 'when I feel anxious, I find myself eating' and 'when I feel blue, I often overeat'.

On the first thirteen items, participants were asked to give their response on a four-point scale as to how much they agree with the statement, with responses ranging from 'definitely true' to 'definitely false'. A high score indicated agreement with the statements and a higher score on each of the scales indicated a higher degree of that characteristic, for example a high score on items relating to cognitive restraint indicated a higher presence of this characteristic.

Items fourteen to seventeen focus on the frequency of certain eating behaviour and item eighteen asks participants to rate their restraint in eating on a scale of 1-8, eight being total limiting of food intake and one being 'giving in' with little limitation of food intake.

The internal-consistency reliability estimates (Cronbach's alpha) for each of the subscales were: cognitive restraint (α 0.76), uncontrolled eating (α 0.83) and emotional eating (α 0.85) (Karlsson, Persson, Sjostrom, & Sullivan, 2000).

Procedure

Participants recruited via follow-up clinics were given a participant information sheet, consent form and freepost envelope (in which to return their consent form to the researcher). Participants recruited via the weight-loss info website indicated their interest by e-mailing the researcher. A participant information sheet and consent form was then emailed to them and returned electronically with their contact details completed if they were willing to take part in the research.

All consenting participants were then posted a study pack containing copies of the questionnaires, an information sheet and freepost return envelope. Participants were then contacted by telephone and given instructions on how to complete the questionnaires. Participants were asked to complete the questionnaires over a consecutive seven-day period of their choosing, usually beginning on the next day. They were instructed on the completion of the food intake diary and asked to complete daily questionnaires at the end of each of the seven days of the study. Participants were asked to complete the background questionnaire and Three Factor Eating Questionnaire at the beginning of the seven days. They were also asked to complete a food craving record on each occasion that they experienced a food craving over this same seven-day period. They were asked to do this as soon as possible after

the craving occurred. A food craving, for the purpose of this study, was defined as a strong desire to eat a particular food regardless of whether the participant ate as a response to it. Individuals were advised that they could request additional food craving records from the researcher should they require them. They were reminded that they should not be consulting anyone else they knew taking part in the study but that they could contact the researcher at any point.

It seemed particularly useful at this point to provide practice with marking responses on visual analogue scales. Participants were asked to talk the researcher through how they would complete the craving diary for a recent craving they experienced. During this telephone conversation, participants were asked about their weight at surgery, any current medical conditions and medication that could have an effect on their appetite.

After five days participants were contacted again by telephone to check for any difficulties in filling in the questionnaires and to remind them to return the questionnaires after seven days in the supplied freepost envelope. Participants were thanked for their participation and informed that they could request a written summary of the results from the researcher at completion of the research.

Data analysis

Data were analysed and reported first by time post-surgery. Where appropriate the following statistical tests were used: t-tests to make between group comparisons, chi square for within craving associations and two-way and repeated measures ANOVA to compare mood and craving characteristics across groups. A secondary analysis was conducted to compare surgery type using the same statistical procedures

Due to the way the data was compiled, and in keeping with previous studies using the craving record, the use of t-tests presented potential difficulties with the

assumption of independent observation. To minimise this, where a significant difference was found, the t-test was repeated with data from the first craving experience from each participant. In addition, in chi square analyses cells with low frequencies were collapsed to meet the minimum expected cell size.

CHAPTER 3. RESULTS

Participant characteristics

Participants' age, weight and weight history according to time post-surgery and surgery types are summarised in Tables 1 and 2 below.

Table 1 Mean (SE) age, weight and weight history of participants

	3-8 Months Post-surgery Group	1 year + Post-surgery Group	Total	Sig.
(n)	(10)	(11)	(21)	
Age (years)	43.88 (3.43)	42.58 (2.76)	43.19 (2.13)	NS
Current weight (kg)	107.05 (8.40)	77.86 (5.15)	91.76 (5.72)	**
Current BMI	41.47 (3.01)	28.95 (1.87)	34.91 (2.19)	**
Weight prior to surgery (kg)	134.29 (8.21)	121.68 (6.45)	127.69 (5.23)	NS
BMI prior to surgery (kg)	51.77 (7.22)	45.37 (8.30)	48.42 (8.29)	NS
Weight-loss post surgery (kg)	27.24 (5.31)	43.82 (4.36)	35.93 (3.80)	*
Max. weight (kg)	137.65 (8.09)	123.71 (6.27)	130.35 (5.17)	NS
Min. weight (kg)	78.40 (6.39)	73.95 (5.36)	75.95 (4.04)	NS
Ideal weight (kg)	74.31 (2.90)	68.75 (2.54)	71.40 (1.97)	NS

NS= Non significant difference between means (t-test), * $p<0.05$, ** $p<0.01$

The average age of the participants was 43.1 years old (range 27.6-60.4) and their mean BMI was 34.9 (17.9-60.7). Of the twenty one participants, 6 (28.6%) described themselves as 'dieting', 7 (33.3%) reported 'currently dieting or watching

what they ate so as not to gain weight', 7 (33.3%) stated they were 'not dieting' and 1 (4.8%) participant was 'trying to gain weight'.

The two time post surgery groups differed on several characteristics. Participants in the 3-8 month post-surgery group were heavier than the one year+ post surgery group on current weight ($t(19)=3.03$, $p=0.007$). As might be expected, the two groups also differed on current BMI ($t(19)= 3.61$, $p=0.002$) and weight lost since surgery ($t(19)= -2.43$, $p=0.03$).

Table 2 Mean (SE) age, weight and weight history of participants

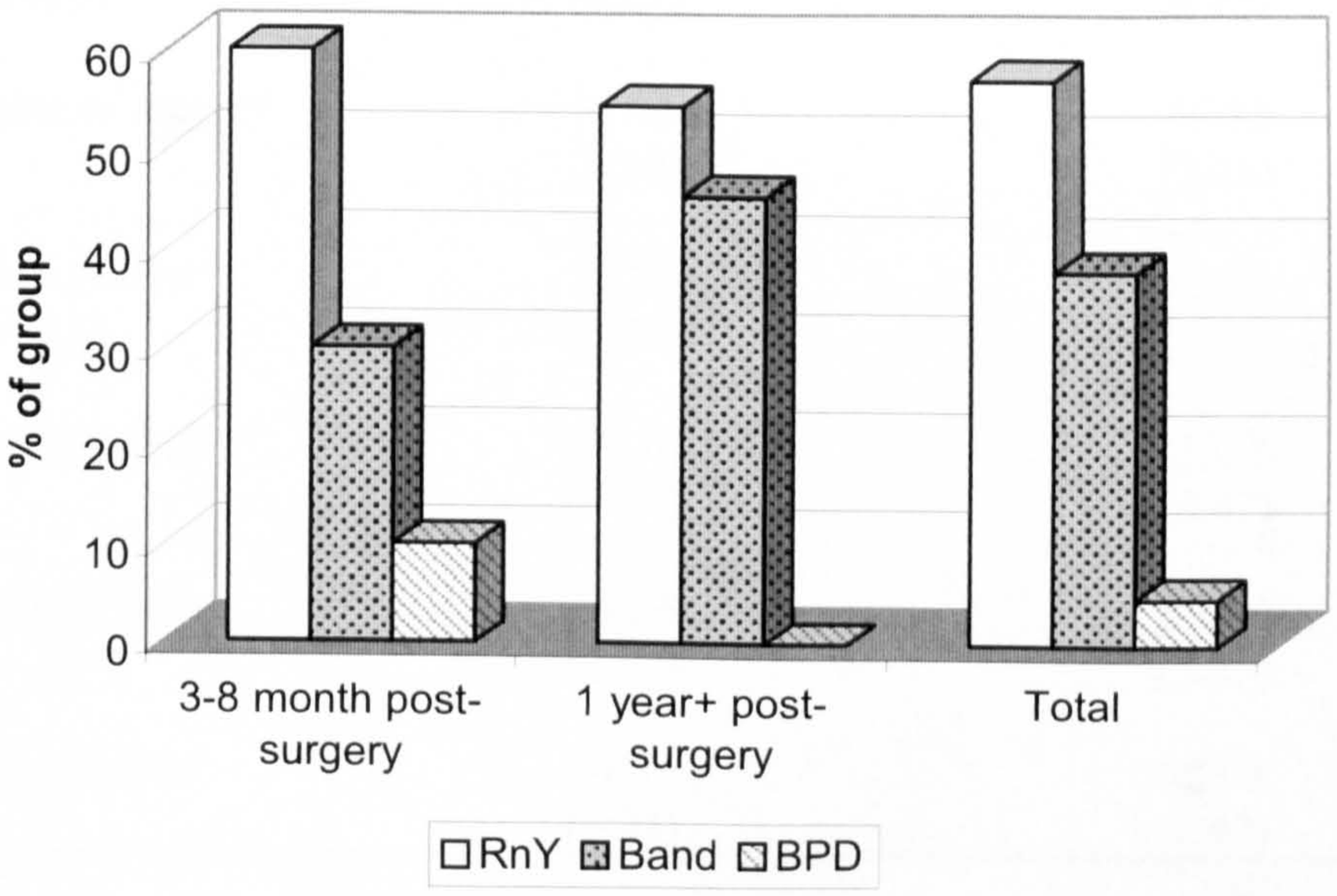
	RnY group	Gastric band group	Sig.
(n)	(13)	(8)	
Age (years)	46.26 (2.23)	38.21 (3.81)	*
Current weight (kg)	96.83 (8.07)	83.53 (6.94)	NS
Current BMI	35.32 (2.76)	34.25 (3.83)	NS
Weight prior to surgery (kg)	137.02 (6.63)	112.52 (5.30)	*
BMI prior to surgery (kg)	50.02 (2.15)	45.81 (3.18)	NS
Weight-loss post surgery (kg)	40.19 (5.37)	28.99 (4.10)	NS
Max. weight (kg)	141.32 (5.97)	112.52 (5.44)	**
Min. weight (kg)	78.11 (5.34)	71.94 (6.11)	NS
Ideal weight (kg)	73.67 (2.14)	67.70 (3.62)	NS

NS= Non significant difference between means (t-test), * $p<0.05$, ** $p<0.01$

Surgical groups differed only in pre-surgery weight and maximum weight. The RnY group were significantly heavier than the gastric band group on weight prior to surgery (137.0 vs 112.5 kg, $t(19)=2.58$, $p<0.02$). The RnY group also reported a greater maximum weight (141.3 vs 112.5 kg, $t(19)=3.31$, $p=0.004$).

The distribution of surgery type according to the two groups and overall sample is summarised in Figure 3 below.

Figure 3 Percentage surgery type according to post-surgery time status



The overall sample was recruited from two different sources. Of the twenty one participants, 7 were recruited via the follow-up clinic and 14 were recruited from the internet support website. Participants' age, weight and weight history according to recruitment source are summarised in Table 3 below.

Table 3 Mean (SE) age, weight and weight history of participants according to recruitment source

	Leeds clinic sample	Internet sample
(n)	(7)	(14)
Age (years)	46.20 (4.24)	41.69 (2.41)
Current weight (kg)	100.22 (12.90)	87.54 (5.74)
Current BMI	42.00 (4.43)	31.37 (1.91)
Weight prior to surgery (kg)	122.52 (9.42)	130.27 (6.41)
BMI prior to surgery (kg)	51.42 (2.89)	46.92 (2.26)
Weight-loss post surgery (kg)	22.30 (5.25)	42.73 (4.04)
Max. weight (kg)	124.87 (8.85)	133.09 (6.47)
Min. weight (kg)	66.36 (2.62)	80.06 (5.25)
Ideal weight (kg)	74.01 (3.25)	70.09 (2.47)

The small numbers within the Leeds clinic sample makes the use of inferential statistics to compare the two groups inappropriate. Based upon the means in table 3, the Leeds clinic sample appear to be older and heavier than the internet sample.

Craving characteristics

The first and second hypotheses relate to the frequency and intensity of the craving experience. It was predicted that patients who were one-year post-surgery would experience more frequent and intense cravings than those who have had surgery more recently and that the gastric band group would experience more frequent

and intense cravings than the Roux en-Y group. The following section aims to investigate these predictions.

Frequency of cravings

Of the 21 participants, 20 experienced at least one craving. The one participant who did not report having experiences any cravings over the seven day period was in the one year+ post-surgery group. When this participant was excluded from the analysis the mean number of cravings reported in the one year+ post-surgery group was 5.80 (SD=3.74). There were 87 cravings reported in total. Of these 28 (33.3%) were reported by participants in the 3-8 months post-surgery group and 58 (66.7%) by those in the one year+ post-surgery group.

Table 4 below shows the mean number of cravings experienced by all participants across the time two groups.

Table 4 Mean (SE) number of cravings

	3-8 months post-surgery	1 year+ post-surgery	Sig.
(n)	(10)	(11)	
Cravings (per week)	2.90 (.46)	5.27 (1.19)	NS
Range	1-6	0-15	

NS = Non-significant

There was no significant difference in the number of cravings experienced by the two time post-surgery groups ($t(19) = 1.79$, $p=0.09$). The range of craving frequency differed between groups. On closer inspection of the data (Figure 4), an outlier was identified in the one year+ post-surgery group having reported 15 cravings over the week. When this outlier was removed the mean frequency of cravings for the one year+ post surgery group was 5.51 (1.48) with a range of 1-7. Even when the

outlier was removed from the analysis, the difference in craving frequency remained non-significant (t(18)= 1.58, p=0.13).

Figure 4 Percentage of group members experiencing each number of cravings

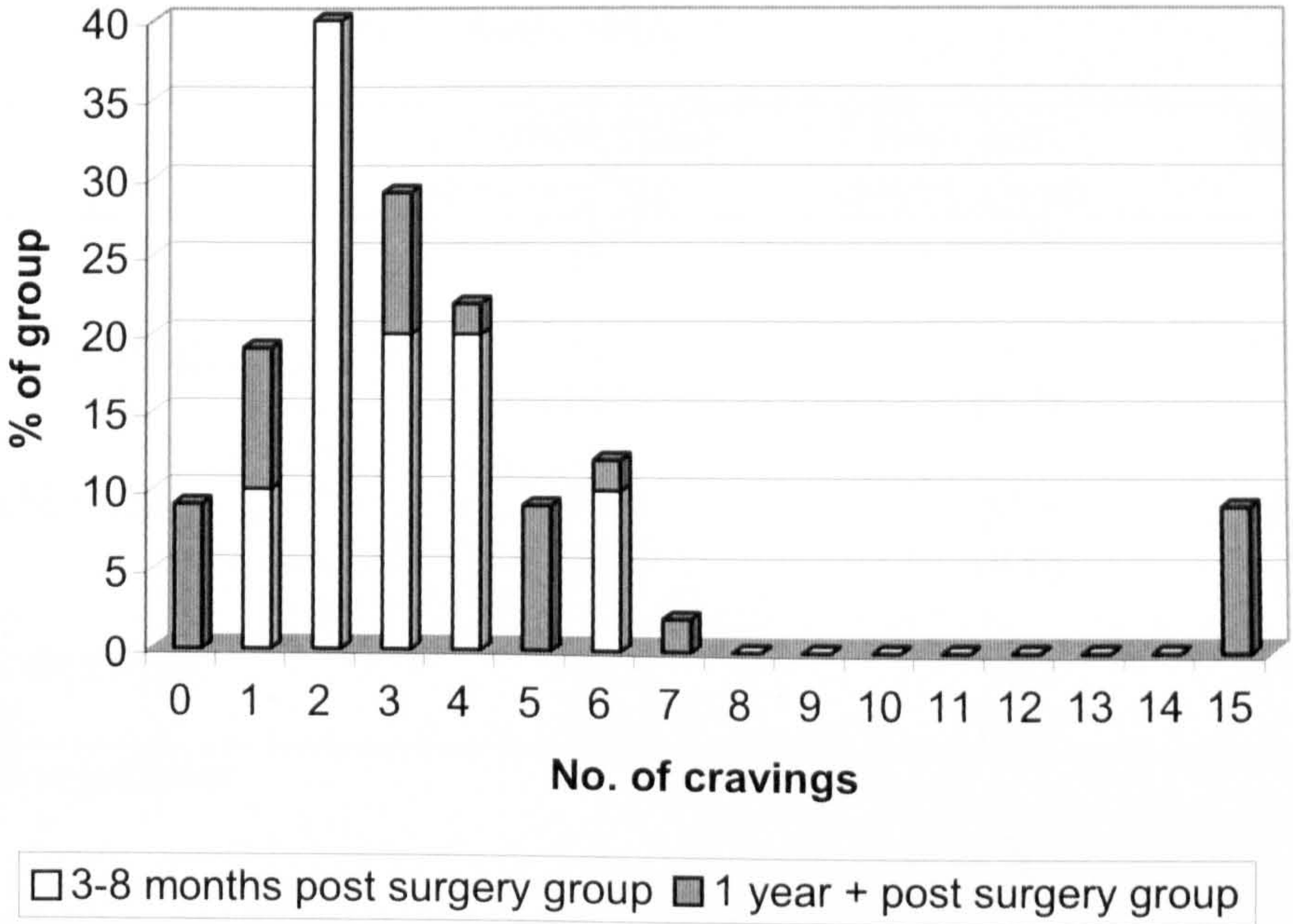


Table 5 Mean (SE) number of cravings according to surgery type

	RnY	Gastric band	Sig.
(n)	(13)	(8)	
Cravings (per week)	4.00 (4.09)	4.38 (0.57)	NS
Range	0-15	2-7	

NS = Non-significant

Of the 87 cravings reported in total, 28 (33.3%) were reported by participants in the RnY group and 58 (66.7%) by those in the gastric band group. Despite this, there was no significant difference in the mean number of cravings experienced by the two groups (4.0 vs 4.38 respectively, t(19)= 0.26, p=0.80).

Intensity of cravings

Tables 6 and 7 summarise characteristics of intensity of the craving experience according to time post surgery and surgery type.

Table 6 Intensity of cravings (means ±SE)

	3-8 months post surgery group	1 year+ post surgery group	Sig.
(n)	(29)	(58)	
Strength of craving	61.3 (4.3)	59.4 (2.7)	NS
Difficult to resist	53.6 (6.0)	52.3 (4.0)	NS
Amount target food restricted	45.9 (5.1)	38.5 (4.5)	NS

NS= Non significant

Strength of craving ($t(85)=0.38$, $p=0.71$), difficulty in resisting ($t(85)=0.18$, $p=0.86$) and the amount the target food was restricted ($t(85)=1.01$, $p=0.31$) did not differ significantly between groups. Mean scores were generally around the mid-point of the scales.

Table 7 Intensity of cravings (means ±SE)

	RnY	Gastric band	Sig.
Strength of craving	58.90 (3.12)	61.69 (3.47)	NS
Difficult to resist	51.17 (4.24)	55.14 (5.39)	NS
Amount target food restricted	44.15 (4.36)	36.17 (5.63)	NS

NS = Non-significant

Other indicators of intensity of the craving experience include the length of time the craving is resisted and how quickly it disappears. Characteristics of the post-craving experience are summarised in Table 8.

There were no significant differences between groups in how long the craving was resisted ($t(53)= 0.58$, $p=0.56$), how quickly it disappeared ($t(85)= 0.94$, $p=0.35$) or how pleasant the food tasted when eaten as a result of the craving ($t(55)=0.35$, $p=0.73$). Similarly, there was no significant difference between surgery groups on any of these factors.

Table 8 Response to craving (means ±SE)

	3-8 month post-surgery	1 year + post-surgery	Sig.
How long resisted? (mins)	53.6 (6.6)	52.3 (14.5)	NS
How pleasant? (all cravings)	62.8 (4.1)	60.8 (3.7)	NS
Speed of disappearance (all cravings)	49.2 (5.1)	55.0 (3.5)	NS
Speed of disappearance (didn't eat)	40.8 (7.6)	49.8 (5.4)	NS
Speed of disappearance (did eat)	52.4 (6.4)	58.2 (4.6)	NS

From the analyses, there appear to be no significant differences between either of the time post-surgery groups or surgery type groups on the frequency or intensity of cravings. Therefore, hypotheses one and two predicting more frequent and intense cravings in the one year+ post-surgery and gastric band groups were unsupported.

Hunger and cravings

The third hypothesis of the study relates to a relationship between hunger and cravings. Previous research has noted links between hunger and craving, with cravings occurring within a context of reduced hunger (Hill, 2007).

A two-way ANOVA was carried out to look at hunger ratings across the craving experience in the two time and surgery groups (Tables 9 and 10).

Table 9 Pre- and post-craving hunger (SE)

	3-8 months post surgery group	1 year+ post surgery group	Sig.
Hunger pre.	26.5 (4.5)	36.5 (4.0)	NS
Hunger after?	13.4 (2.3)	32.0 (3.9)	**
Hunger difference? (all cravings)	13.2 (3.7)	4.6 (4.1)	NS
Hunger difference? (did eat)	16.3 (4.5)	11.1 (5.5)	NS
Hunger difference (didn't eat)	4.9 (6.1)	-6.0 (5.1)	NS

** P<0.01, NS= non-significant

A two-way ANOVA was carried out to look at hunger ratings across the craving experience in the two groups (Table 8). There was a significant main effect of time on hunger ($F(1,85)=7.87$, $p<0.01$), with hunger falling in both groups following the craving.

There was no significant group difference or group by time interaction. However, post-craving, participants in the one year+ post surgery group had higher hunger ratings than the 3-8 month post surgery group ($t(85)= 3.20$, $p<0.01$).When re-

run with data from the first craving experience of each participant, this difference was not significant (t(18)=-0.95, p=0.35). Interestingly, hunger was rated relatively low on the 100mm visual analogue whilst craving strength was rated reasonably highly.

Analysis of food intake diary entries revealed no significant differences between groups in time since their last meal. The average time since last meal was 3.44 hours for the 3-8 month post-surgery group (SD = 1.98) and 3.59 hours for the one year+ post-surgery group (SD = 2.14). Likewise there was little difference when looking at time since last snack; 3-8 month post-surgery group 4.04 hours (SD = 1.99), and one year+ post-surgery group 4.57 hours (SD = 2.04).

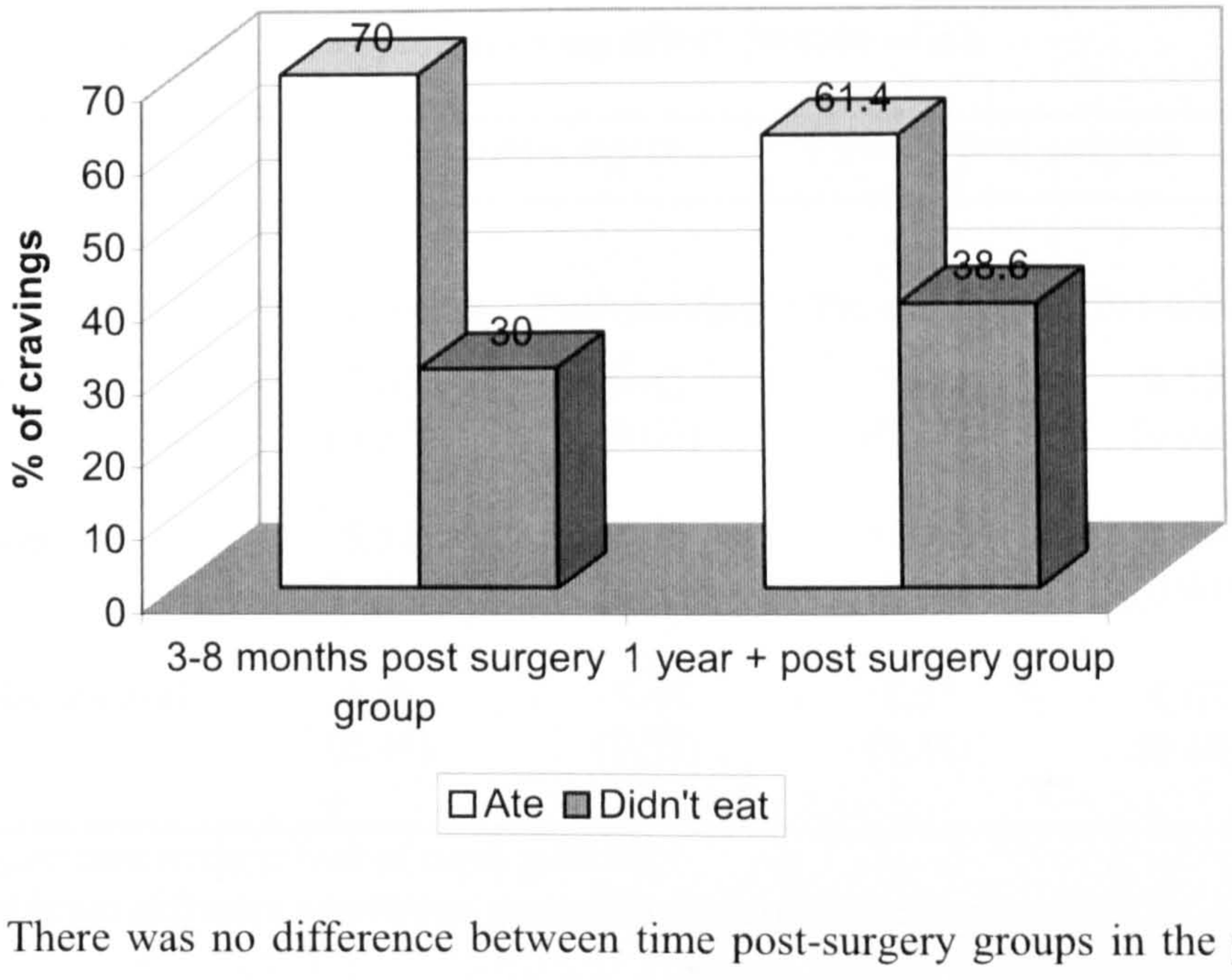
Table 10 Pre and post craving hunger (SE)

	RnY group	Gastric band group	Sig.
(n)	(52)	(35)	
Hunger pre.	32.9 (4.2)	33.7 (4.7)	NS
Hunger after?	24.2 (3.8)	28.2 (4.4)	NS
Hunger difference? (all cravings)	8.8 (3.8)	5.5 (4.9)	NS
Hunger difference? (did eat)	14.2 (5.2)	11.4 (5.8)	NS
Hunger difference (didn't eat)	-0.5 (4.7)	-7.6 (8.0)	NS

Table 10 summarises the pre and post-craving hunger ratings for both surgery groups. There was no significant difference between the groups in ratings of pre-craving hunger (t(85)= 0.12 , p<0.91) or hunger after the craving (t(85)= 0.69, p=0.49).

Frequency of eating as a result of craving

Figure 5 Percentage of cravings resulting in eating according to group



There was no difference between time post-surgery groups in the percentage of cravings that led to eating (χ^2 (1)= 0.92, p=0.34). Overall, it was more common for cravings to be acted on than not within both groups (Figure 5).

The analyses suggest that there is a link between hunger and craving. However, the pattern of results indicates that this relationship is likely to be a complex one.

Mood and Cravings

Tables 11 displays the affective context immediately preceding and after the craving have subsided. Tense arousal pre-craving differed significantly between groups (t(85)=1.95, p=0.05) but there were no other pre-craving mood differences. When re-run using data from the first craving experience of each participant, no significant difference was found (t(18)=0.54, p=0.12). ANOVA found a significant change in hedonic tone by time (F(1, 84)=6.50, p=0.01). However, there were no group effects or interactions on this or any other measure of mood.

Surgical group differences in mood were the same as those reported for time since surgery with only a reduction in hedonic tone apparent.

Table 11 Pre-craving and post-craving affect (means ±SE)

	3-8 month post-surgery		1 year + post-surgery		Sig.
	Pre-craving	Post-craving	Pre-craving	Post-craving	
Hedonic tone	7.00 (0.52)	6.82 (0.69)	7.91 (0.43)	6.33 (0.48)	T**
Tense arousal	5.52 (0.59)	5.18 (0.66)	4.07(*) (0.43)	4.86 (0.41)	
Energetic arousal	5.41 (0.46)	5.44 (0.55)	6.55 (0.46)	6.07 (0.44)	NS

T** significant main effect of time, $p<0.01$
(*) significant difference between groups in pre-craving mood, $p<0.05$

Daily ratings of appetite and mood

The daily experiences of each of the groups were analysed, comparing days when they had experienced one or more cravings and days when they had not. There were 83 days (56.5%) when cravings did not occur and 64 days (43.5%) days when they did. Several differences were noted (Table 12).

The two time post-surgery groups differed on levels of boredom ($F(1,145)=6.40$, $p=0.01$). Overall, participants in the 3-8 month post surgery group felt significantly more bored than the one year+ post-surgery group, but this did not change significantly according to whether they craved or not. Both groups felt significantly more hungry ($F(1,145)=8.78$, $p=0.004$), more tense ($F(1,145)=5.26$, $p=0.02$), and more irritable ($F(1,145)=4.38$, $p<0.04$) on days when they craved than those when they did not. Both groups also reported finding it significantly easier to

control their eating on days when they did not crave ($F(1,145)=14.19$, $p<0.001$) than on days when they did crave.

Table 12 Response to daily questionnaire according to whether craving had occurred (means ±SE)

	3-8 months post-surgery		1 year+ post-surgery		
	Craving days	Non-craving days	Craving days	Non-craving days	
Anxious	42.3 (5.7)	39.7 (4.46)	42.4 (4.6)	28.7 (4.0)	NS
Easy to control eating?	54.7 (5.2)	73.2 (4.0)	52.4 (4.9)	68.7 (4.2)	C***
Content	62.0 (3.5)	60.1 (4.0)	57.5 (4.1)	72.3 (3.5)	GxC*
Hungry	50.5 (4.7)	32.9 (3.7)	44.1 (4.1)	36.9 (4.2)	C**
Tense	51.2 (5.4)	43.0 (4.0)	45.2 (4.5)	32.5 (4.2)	C*
Irritable	49.0 (4.7)	43.7 (4.6)	44.7 (3.9)	32.0 (3.5)	C*
Alert	56.7 (4.2)	56.3 (3.9)	59.6 (3.4)	65.8 (3.3)	NS
Vulnerable emotionally	42.2 (5.6)	39.7 (4.5)	43.4 (4.5)	31.4 (3.9)	NS
Bored	38.1 (5.6)	39.8 (4.5)	28.8 (3.8)	27.3 (3.4)	G**

G main effect of group, C main effect of craving, GxC interaction
*** $p<0.001$, ** $p<0.01$, * $p<0.05$, NS Not significant

There were significant interactions between group and craving on how content participants felt ($F(1,145)=4.56$, $p=0.03$). The one year+ post surgery group felt significantly more content on days when they didn't crave

Table 13 Response to daily questionnaire according to whether craving had occurred

	RnY group		Gastric band group		Sig.
	Craving days	Non-craving days	Craving days	Non-craving days	
Anxious	49.7 (4.9)	36.0 (3.9)	31.6 (4.4)	31.8 (4.9)	G*
Easy to control eating?	56.4 (4.8)	78.0 (3.2)	48.9 (5.4)	59.0 (4.9)	G** C***
Content	53.9 (3.6)	66.8 (3.4)	67.3 (4.1)	64.5 (4.5)	GxC*
Hungry	50.7 (3.7)	30.7 (3.2)	40.9 (5.1)	42.0 (4.9)	GxC**
Tense	59.1 (4.3)	40.7 (3.8)	30.8 (3.8)	33.4 (4.7)	GxC*
Irritable	55.4 (3.7)	36.7 (3.9)	33.3 (3.9)	40.7 (4.6)	GxC**
Alert	56.5 (3.5)	60.9 (3.4)	61.4 (4.0)	60.8 (4.1)	NS
Vulnerable emotionally	51.0 (4.4)	35.7 (4.0)	31.0 (5.0)	35.8 (4.6)	GxC*
Bored	31.9 (4.6)	32.8 (3.9)	33.7 (4.4)	35.7 (4.1)	NS

G main effect of group, C main effect of craving, GxC interaction
*** p<0.001, ** p<0.01, * p<0.05, NS Not significant

Significant effects were found on seven of the nine measures. Groups differed on levels of anxiety ($F(1,145)=5.60$, $p<0.02$). Overall, participants in the RnY group felt more anxious than the those in the gastric band group, but this factor did not change significantly according to whether they craved or not. Both groups felt significantly less in control of their eating ($F(1,145)=12.28$, $p=0.001$), on days when

they craved than those when they did not. There was also a significant group difference on this factor ($F(1,145)=8.51$, $p=0.004$).

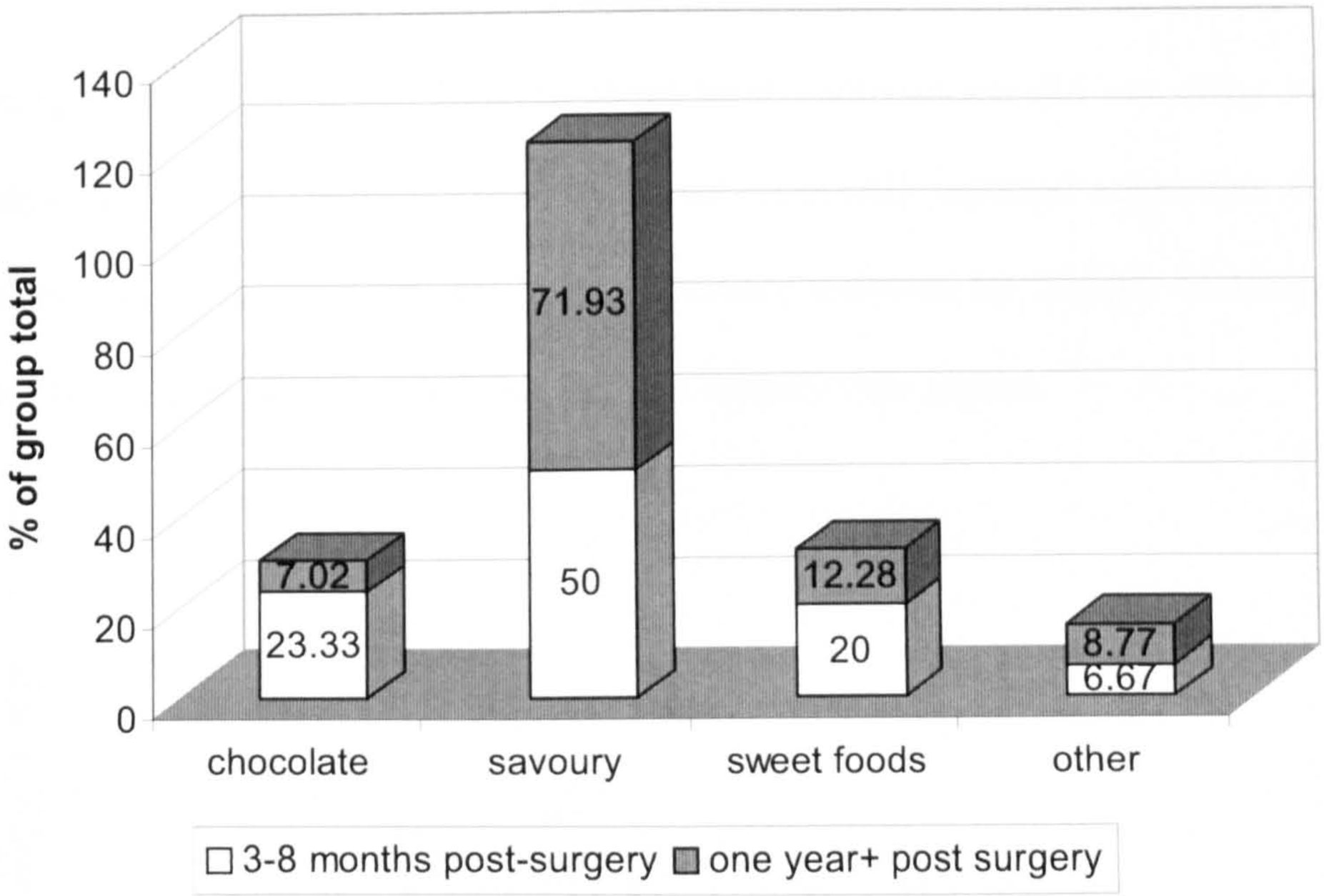
There were several significant interactions between group and craving status on how content ($F(1,145)=3.84$, $p=0.05$), hungry ($F(1,145)=6.39$, $p=0.01$), tense ($F(1,145)=5.84$, $p<0.02$), irritable ($F(1,145)=9.49$, $p=0.002$) and emotionally vulnerable ($F(1,145)=4.72$, $p=0.03$). These interactions all show that on craving days the RnY group rated themselves more hungry, tense, irritable and emotionally vulnerable, and less content than on non-craving days, and compared with the gastric band group on either type of day.

Supplementary analyses

Target of food craving

The targets of the food craving experience were divided into 'chocolate', 'savoury', 'something sweet' and 'other' according to a previously used categorization (Hill, Weaver, & Blundell, 1991). Savoury foods were the most commonly craved food when looking at all participants (52.9%). Chocolate was craved 24.1% of the time and sweet foods comprised 13.8% of the cravings. Other reported cravings were fruit, 'anything', and sweet/savoury combinations. Figure 6 shows that the one year+ post-surgery group experienced a relatively higher proportion of cravings for savoury foods than the 3-8 month post-surgery group.

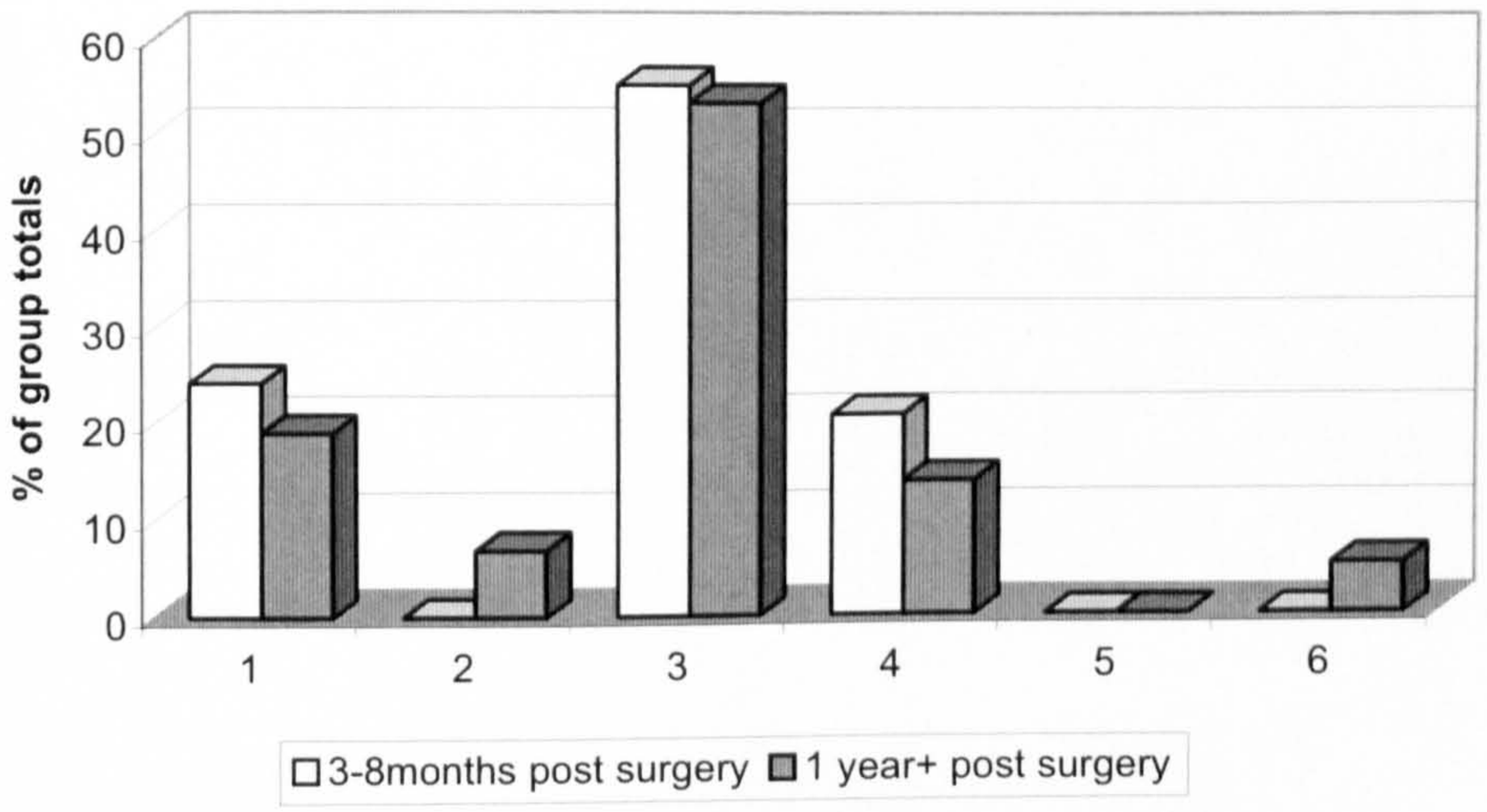
Figure 6 Targets of food craving as percentage of group total



Preceding context of craving

Figure 7 shows the most commonly reported antecedent to craving was 'simply thinking about the food craved'.

Figure 7 Antecedents to the craving experience



1 See or smell the food craved
2 See or smell other food
3 Simply think about the food craved
4 Simply think about other food
5 Eat the food craved
6 Eat other food

This was true of both time post-surgery groups, when cells were collapsed into 'seeing/smelling food' vs 'thinking about food', antecedents did not differ between groups ($\chi^2(1)=0.13$, $p=0.72$). The next most commonly reported antecedent for both groups was seeing or smelling the food craved, followed by 'simply thinking about other food'. This was also the case for both surgery type groups.

CHAPTER 4: DISCUSSION AND CONCLUSIONS

Overview of results

The present research set out to examine the nature of food cravings in participants having had weight-loss surgery, comparing two time post-surgery groups and two surgery types on several aspects of the craving experience. Specifically, this study attempted to determine whether food craving occurs with greater frequency and intensity as a function of longer time since surgery or increased caloric restriction due to surgery type (RnY).

The results of this study showed that although both the two time post-surgery and surgical groups did not differ significantly from one another on the number and strength of food cravings experienced during the recording period, some interesting observations with relation to previous research were noted. The targets of food cravings and response to cravings were found to be similar between groups. Differences were found in terms of affective context of the cravings. When comparing the context of days when cravings occurred with days when it did not, several differences in affect were observed. There was an interaction with surgery type and time-post surgery in some cases.

These findings will be discussed within the research previously carried out into theories of food craving with particular reference to abstinence theories and Rogers and Smit's hypothesis regarding ambivalence towards certain target foods.

Group characteristics

There was evidently a difference on background characteristics between the two time post-surgery and surgery-type groups. As expected, participants in the 3-8 month post-surgery group were heavier, had a higher BMI and less weight loss since surgery. Participants in the one year post-surgery group have potentially had restricted

calorie intake over a longer period of time giving more opportunity for weight-loss, however this finding may not be assumed to be a result of time alone and would require further analysis. As also expected, there were similarities between the two time groups on weight and BMI prior to surgery, this was in line with the guidance on use of surgery to aid weight-loss for people with morbid obesity (NICE, 2002).

When comparing the two surgical groups, they differed only in pre-surgery weight and maximum weight. Participants in the RnY group were heavier prior to surgery, this was as predicted by the effectiveness of surgery research, which advocates the use of this procedure in patients with a higher BMI due to its superior effect on weight-loss. The RnY group also had a higher maximum weight.

When comparing participants according to recruitment source, the Leeds clinic sample appeared to be older and heavier than the internet sample. There may be a relationship between weight and attendance at clinic. Those with a higher weight, seeking help to reduce this may have been more likely to attend, however this is speculative. Few differences were found between the two recruitment sources on the other participant characteristics.

The frequency and intensity of cravings

Frequency

Contrary to what was predicted, there was no significant difference in the number of cravings experienced over the seven-day recording period between either of the time post-surgery groups. The number of cravings experienced by the one-year+ post-surgery group was higher than that of the 3-8 month post-surgery group and the lack of significance may be due to the small sample size.

Although the differences between time post-surgery groups were not significant, the frequencies are higher than those found in non-dieting populations and

appear to increase over time. This suggests a possible relationship between chronic dietary restraint and craving, however this data does not allow us to imply a causal relationship. Whilst it may be that participants one-year post-surgery are experiencing a similar event more frequently, they may also be interpreting a 'strong desire for a particular food' in a different way. If the suggestion that cravings are experienced as a response to physiological need in terms of caloric deprivation or pharmacological reaction is to be believed, then hunger or target food might be expected to play an important role in the likelihood of craving occurrence. This idea will be explored later when looking at hunger before and after craving and the targets of craving reported.

There were no significant differences in craving frequency between surgical groups, contrary to expectation. Both groups experienced a similar frequency of cravings over the seven-day recording period. This finding is in contrast to other studies that suggest restriction of caloric intake or certain foods leads to preoccupation with food related thoughts (Keys, Brozek, Henscel, Mickelson, & Taylor, 1950; Mann & Ward, 2001; Warren & Cooper, 1988). If this were the case it would be expected that the RnY group would have experienced a higher frequency of cravings than the gastric band group due to malabsorption differences and hence higher levels of caloric and nutritional restriction. However it is difficult from these results to imply the relative contribution of cognitive and physiological factors.

Intensity

There were no overall differences between time post-surgery or surgical groups in how long the craving was resisted, how quickly it disappeared or how pleasant the food tasted when eaten as a result of the craving, suggesting a level of similarity in these aspects of the craving experience across the groups. Both time post-surgery groups reported cravings disappearing quicker when they ate in response to

the craving. It is therefore not surprising that they ate more frequently as a result of the craving. This supports the idea that cravings themselves are potentially unpleasant experiences that are negatively reinforced by eating. It is possible that the mood states associated with craving are dysphoric experiences, which are improved and subsequently further reinforced by eating; this is explored in more detail later.

When looking at the full sample there were no differences between either time post surgery or surgical groups on whether individuals ate in response to their cravings. In both groups eating as a result of the craving was the most frequent response but was highest among the 3-8 month post surgery group.

The overall tendency to eat as a result of cravings does not alter significantly over time since surgery, if anything it reduces slightly. Despite a lack of distinct difference in the frequency of eating as a result of craving between the groups, this overall tendency may say something about the weight-loss surgery sample as a whole. There may be a conditioned response to cravings in this group or a propensity to over-ride the physical restriction of surgery to satisfy the craving and reinforce the behaviour. Alternately, it may be related more closely to control of eating and these results may support Warren & Cooper's (1988) observation that dieters frequently reported feeling out of control of their eating. The cognitive process involved in eating, as a response to cravings is unclear from these results but would benefit from further study.

Hunger and cravings

A question relating to hunger provides valuable information regarding previously proposed biological triggers for cravings. The 3-8 month post surgery group showed the greatest reduction in post-craving hunger and a slightly inflated

tendency to eat, suggesting that eating as a result of craving is a more hunger-reducing experience and for this reason may be more negatively reinforcing.

The observation that both time post surgery and both surgical groups rated pre-craving hunger relatively low whilst craving strength was rated reasonably high, this supports the idea that hunger is not necessarily a pre-condition for craving. These observations do not fit with theories of food craving that suggest food cravings arise in response to a deficit in diet and so perform a regulatory function (Keys, Brozek, Henscel, Mickelson, & Taylor, 1950). If this were so, higher hunger ratings would be expected amongst the most deprived (i.e. RnY group). The group experiencing cravings most frequently did report the highest degree of hunger but this was relatively low and consistent with rates reported by dieters (Massey, 2003).

This finding is consistent with research that has found bingeing in response to cravings to be associated with lower levels of hunger as in women with bulimia nervosa (Waters, Hill, & Waller, 2001). Deprivation models appear to be useful in explaining such experiences and it may be that the hunger patterns of individuals having had weight-loss surgery more fit closely that of those on very low energy diets (Wadden, Stunkard, Day, Gould, & Rubin, 1987) or patients with eating disorders who have a similarly low energy intake (Halami & Sunday, 1991). The model however does not offer a comprehensive explanation of the mechanism by which this occurs.

Mood and cravings

The only difference observed between groups when looking at the affective context prior to craving was higher ratings of tense arousal in the 3-8 month post-surgery group. This suggests that mood state overall did not differentially influence the likelihood of craving occurring within these groups. Massey (2003) suggests that

eating in response to negative affect is a normative experience that is likely to be observed in non-clinical and non-dieting groups of women.

Post-craving mood was similar amongst both the surgical and time post-surgery groups, with the exception of hedonic tone. The finding that hedonic tone reduced following the craving was consistent across all groups. This reduction in hedonic tone illustrates the participants' negative response to the experience; they felt more dissatisfied and less happy. This contradicts Wurtman's (1988) suggestion that dysphoric mood elicits carbohydrate craving and that carbohydrate intake ameliorates depression unless any alleviation from negative mood states occurs only during eating or was too transient to be reported.

From a biological perspective it cannot be ruled out from these results that mood is not elevated as a result of eating in response to the craving. Neurotransmitters such as serotonin take time to act. It may be that the levels of hedonic tone reported post-craving are immediate and may increase over time once the neurotransmitter has had time to take effect.

The results do seem to be more in support of Rogers & Smit's (2000) theory that negative thoughts about frequently craved foods and their inappropriate use of them to alter mood leads to concerns regarding self-control and self-efficacy. These self-doubts may have manifested themselves as a reduction in hedonic tone.

There were no notable differences between groups on ratings of tense and energetic arousal post-craving, although there were some interesting trends among the time post surgery groups. The one year post-surgery group felt slightly more tense and less energetic following a craving. It might be hypothesised that this group ate less than the 3-8 month post-surgery group in response to cravings because of this negative change in mood state they experienced. In contrast the 3-8 month post-

surgery group felt slightly less tense and marginally more energetic which might reinforce eating as a response to cravings. Unfortunately the results from this research are unable to determine these differences with any clarity or infer the cognitive processes influencing them with any certainty, this would be the focus for further study.

Daily mood ratings

Craving days were characterised by irritability, tension, difficulty controlling eating and feeling more hungry. This was a consistent finding regardless of time-post surgery. No causality can be implied here as whilst cravings may have been more likely to occur during days characterised by particular affective states, similarly affective state may have been influenced by whether cravings had been experienced. The fact that these ratings were made retrospectively may mean that perceptions of affective state were coloured by whether or not cravings had been experienced during the day. However, this finding is consistent with findings that depressed people consume more carbohydrates than those who are not depressed (Fernstrom & Wurtman, 1971). It also supports previous findings associating food cravings and mood (Hill, Weaver, & Blundell, 1991).

Several group differences were noted. Groups differed on levels of boredom. Participants in the 3-8 month post surgery group felt more bored than the one year+ post-surgery group, but this did not change according to whether they craved or not and may have been due to environmental factors unrelated to the craving experience. Both groups also reported finding it easier to control their eating on days when they did not crave than on days when they did crave. This is consistent with Warren & Cooper's (1988) observation that individuals restricting their dietary intake frequently report feeling out of control of their eating. Again causality cannot be inferred, it may

be that cravings are more likely to occur on days when there is difficulty controlling eating or that experiencing a craving and eating as a result becomes an indicator of loss of control over eating.

There were interactions between the time post-surgery groups and craving on how content participants felt. The one year+ post surgery group felt more content on days where they didn't crave, as would be expected.

Craving days within the surgical groups were characterised by a difficulty in controlling eating, similar to the time post-surgery groups. The gastric band group found it more difficult to control their eating on days when they craved. It is possible that this difference is due to hormonal changes, which reduce appetite in those having had RnY surgery however; ratings of hunger on days when cravings occurred were higher in the RnY group which does not support this hormonal explanation.

Ratings of anxiety differed most notably between Roux en-Y and gastric band groups. Participants in the RnY group felt more anxious, but this factor did not change according to whether they craved or not, suggesting that anxiety may be more related to surgery type or external factors than whether a craving occurred. This pattern of elevated anxiety in the RnY may support Rogers & Smit's (2000) theory that attempts to resist certain foods make thoughts about them more salient and induce anxiety.

There were several interactions between group and days when cravings occurred or not. On craving days the RnY group rated themselves more hungry, tense, irritable, emotionally vulnerable and less content than on non-craving days, and compared with the gastric band group on either type of day. This supports previous observations of a connection between craving and negative mood states (Hill, Weaver, & Blundell, 1991). In addition it also suggest that participants' with RnY gastric bypass may be more predisposed to either craving on days when their mood is more

dysphoric or feeling lower in mood on days when they have craved. Either way, it illustrates a stronger relationship between mood and craving within the RnY group.

Supplementary analyses

Target of food cravings

The targets of food cravings were not consistent with previous research findings suggesting that chocolate is the most commonly craved food (Gendall, Joyce, & Sullivan, 1997; Hill, Weaver, & Blundell, 1991). In both the time post-surgery and surgical groups, savoury foods were the most commonly craved, followed by chocolate and sweet foods. This is more consistent with Tiggemann & Kemps' (2005) findings that savoury food was the most commonly craved, followed by chocolate. If cravings were purely a response to caloric deprivation experienced by those having had weight-loss surgery, it might be expected that cravings experienced would be for foods which are high in nutritional value. This did not appear to be the case.

According to Rogers & Smit (2000), it is ambivalence towards certain foods that leads individuals to attempt to resist them and subsequently to cravings for those foods. Those foods that are seen as 'treats' and about which we hold a negative view of their nutritional content such as chocolate are likely to be resisted. The results of this study support this idea to some degree, since the target foods craved are predominantly foods that would be restricted by those having had weight-loss surgery. This is due either to the restrictive nature of the surgery limiting the consumption of savoury food, for example bread, which expands in the stomach and sweet foods such as chocolate causing 'dumping' in those with gastric by-pass. It is possible that a negative view of these foods is related more closely for these individuals to the unpleasant side effects of eating them rather than their nutritional content.

Another possibility is following weight-loss surgery, individuals simply miss eating 'normally', with a mix of foods from different nutritional groups. Over time this creates a desire to consume the absent food group, in this case carbohydrates such as bread. Clearly, more research looking at the cognitive processes during craving is needed to substantiate this idea.

Preceding context

The most common trigger to a food craving (reported in 54% of cases) was participants' 'simply thinking about the food craved'. This again was consistent with previous research. Hill & Heaton-Brown (1994), for example, reported that simply thinking about the food preceded the craving on 60% of occasions in their study on the experience of food craving in healthy women. Cognitions about the craved foods are reported as emerging without the subjective awareness of the existence of sensory precursors to the craving. As such, a functional analysis that might lead to appropriate 'treatment' with the aim of reducing the frequency of cravings becomes difficult. It may be that a cognitive approach towards this aim would focus on analysing the preceding thoughts and triggers in much more detail. Qualitative data within a similar research paradigm would provide more information in this regard.

There were no differences observed in relation to preceding thoughts between groups. The fact that the cognitive triggers in this sample resembles that of healthy women and does not display higher levels of reactivity to sight and smell triggers fails to support either the idea that obesity is related to reactivity to external cues (Schachter, 1968) or that biological deprivation is related to external responsiveness (Nisbett, 1972).

Methodological considerations

Sampling

Some sampling problems are acknowledged. Several participants who initially agreed to participate did not return their forms. This is most likely to be accounted for by two factors. Firstly, participants may not have realised the extent of the recording required in terms of length of time and number of forms to complete. Secondly, for some participants the research is likely to have touched on a sensitive area that provoked an emotional response and subsequent avoidance of responding to questions.

The characteristics of the sample meant that additional medical problems were inevitable. Most of the participants were either currently or had been morbidly obese previously and had undergone weight-loss surgery as an intervention. Some had also had medical complications related to their weight, which had been alleviated by weight-loss surgery. Although participants with additional medical problems included in the study were restricted to those without appetite-affecting problems, the influence of medical conditions, both diagnosed and undiagnosed, cannot be ruled out. It was beyond the scope of this research to analyse this in any depth but is something to either be the focus of further study or to be considered when designing research with this participant group in the future.

In many cases the difference between groups was either relatively small or just below significance. This may have been due, in part, to the small sample size, which limits the findings of the research. The sample size used should be considered when interpreting the results and should be thought out when designing future research. In addition, all of the participants in this study were female which may have biased the sample. Previous research has identified a premenstrual increase in cravings (Hill &

Heaton-Brown, 1994), information on menstruation was not collected in this study and, as such, may have influenced the results.

Clinic vs. internet sample

The fact that many of the participants were recruited via a weight-loss support website may have biased the conclusions of the study. The website is intended to provide support more specifically to individuals who are struggling with weight-loss or experiencing difficulties in relation to their surgery. Therefore, problems with food cravings may be over reported in this group, although this was not obviously apparent in the data. Participants recruited from this source were less likely to return their completed forms than participants recruited from follow-up clinics. This may indicate that individuals requesting to take part in the research via the support website may be struggling in other areas of their life or lead more chaotic lifestyles which prevented them from completing the forms. Differences between the website and clinic groups may be the subject of future research. However, if the present study was to be repeated recruitment source would need to be carefully considered for the reasons already outlined above.

Gastric bypass vs. gastric band

The physiologies of the two weight-loss procedures are quite different from each other. As discussed earlier, gastric bypass involves both restrictive and malabsorptive components, whilst the gastric band is purely restrictive. In creating the malabsorptive aspect of the gastric bypass, the structure and biochemistry of the digestive system undergoes a radical change. The effect on appetite of these chemical and hormonal changes was briefly outlined in the introduction, however this study focuses on the psychological aspects of food craving, and as such, an in-depth

analysis of the impact of these chemical changes on food cravings is beyond the scope of this study.

Undoubtedly there are differences between the two surgical procedures, which have likely impacted upon the results of this study, unfortunately the specific impact on individual variables is somewhat unclear and would require further deconstruction. The most obvious variable, which may have been affected, is that of hunger, and any differences between the two surgery groups on this measure may need to be interpreted with caution due to the potentially confounding nature of the physiological effects of surgery.

Study design

Causality cannot be assumed with regard to many of the results reported here due to the methodology of the study not being longitudinal in nature. Most importantly, it is impossible to know whether cravings are perceived differently cognitively, experienced differently physiologically or reported differently.

Definition of food cravings

As mentioned previously, the difficulty in defining food cravings is a problem for this type of research. Different results might be found when participants are provided with an exact description of the type of experience they should report. The difficulty here however is that there are no universally accepted definitions of food craving. Here the construct being examined was the subjectively defined experience of food craving and, as such, allowed participants to make their own evaluation of what to record. This may bias reporting of cravings to experiences, which are psychologically salient. As found by Gendall et al. (1997), if the definition was narrowed, for example to include only those cravings that were difficult to resist, or particularly strong, then frequency of reporting is likely to change dramatically.

Recording of food cravings

One potential advantage of the methodology of this study is the use of the craving record. This allows the rating of mood and craving either at the same time or close in time, giving a clearer understanding of the emotional and behavioural process of cravings. By rating mood chronologically both before and after the craving experience, links between mood and craving can be made with increased confidence. These changes in mood across the craving experience can also be corroborated with daily ratings of mood, which helps develop a clearer understanding of the relationship between emotion and food cravings.

Using this method also helps to overcome some of the difficulties associated with retrospective measures. By recording ratings of mood and the subjective features of the craving at the time of the experience, ratings are arguably more accurate due to less of a reliance on memory, which can become distorted over time.

Dichotomising variables

The variable of time since surgery was converted into dichotomous variables by splitting the sample into two time groups: the 3-8 month group and the one year+ group. The author acknowledges that this is a limitation of the research. McCallum, Zhang, Preacher, & Rucker (2002), outline the problems with dichotomizing variables including the loss of individual differences seemingly relevant to the understanding of such a differences and their relationship to other variables. Dichotomizing variables also influences the effect size and power which impacts upon statistical analyses.

Dichotomizing the time-since-surgery variable also means that any changes or plateaus across the time scale post surgery are difficult to identify. Further research into the impact of time post surgery on the nature of food cravings may wish to retain time-since-surgery as a continuous variable and to consider more

correlational/regression approaches to statistical analyses to minimize the difficulties outlined in this study.

Clinical implications of the research

As already outlined, previous research has made links between the onset of binge eating and the occurrence of food cravings (Abraham & Beaumont, 1982; Mitchell, Hatsukami, Pyle, & Eckert, 1985; Wurtman & Wurtman, 1986). It has also been noted that binge eating disorder is the most common psychiatric disorder in patients presenting for obesity surgery (Sarwer et al., 2004). From the results, not only do the time post-surgery groups report a higher frequency of cravings than healthy and non-dieting participants from other studies, but the RnY surgical group also report significantly higher ratings of uncontrolled eating. On days when cravings occurred, all groups reported feeling less in control of their eating. This could be a source of some concern since uncontrolled eating has been highlighted as a high-risk eating behaviour after surgery (Colles, Dixon, & O'Brien, 2008).

Based on research that demonstrates that functional treatments are most successful for other behaviour disorders, and suggestions that treatments for binge eating in individuals with binge eating disorder should address the antecedents, exact behaviour and consequences of cravings (Lee & Miltenberger, 1997; Meyer, Waller, & Waters, 1998; Waters, Hill, & Waller, 2001), identifying these factors would seem an essential step in understanding this phenomenon in those having had weight-loss surgery. Meyer *et al.* (1998) suggest that treatments be based on individual case formulation rather than generic formulation. This might be important in this case and represent a useful technique for clinicians working with individuals post weight-loss surgery who, despite similarities in many features of craving, may present very differently. For example, a different approach to preventing cravings would be taken

with individuals who report that they crave savoury food when bored and alone to that which might be taken with an individual who craves in company when feeling low in mood. The treatment would also be different according to the function served by eating in relation to the craving. Again, a craving that is acted on in response to feeling low in mood may be regarded differently to a craving that is viewed as a response to hunger.

Implications for future research

Although not possible within the scope of this research, the data collected here could be analysed in more detail. Further information could be reported in the context of eating according to information provided within the food intake diary. An example of this might be the study of longer-term effects of eating as a result of craving. It would be possible to assess whether, within this group of participants, eating as a result of craving led to increased consumption of restricted foods such as bread and pasta (and sweet foods among the RnY group). Information collected within the food diaries could also be used to look at the length of time participants abstained from the target food prior to craving.

Given the lack of research within this participant group in respect of food craving, this research could be repeated with a larger, more diverse sample in respect of gender and time since surgery. Considering the potential differences between the clinic and support website groups, it would be interesting to compare these two groups further within the context of craving characteristics.

Due to the design of this research, it is not possible to compare eating behaviours, mood and craving both pre and post surgery. It would be helpful to conduct a more longitudinal study to look in detail at these potential changes following surgery. Including a waiting-list control group may also be useful in making

comparisons between eating behaviours and changes likely due to weight-loss surgery.

Much of the research literature relating to eating behaviour and theories of cravings focuses either on eating disordered or dieting populations. In order to explore the food craving experience following weight-loss surgery in detail, it would be interesting to include dieting and non-dieting healthy weight groups in future research. This would be helpful in determining whether food craving patterns observed in weight-loss surgery groups were more similar to those of dieters or healthy-weight groups.

Further research might also include qualitative methodologies to examine reported changes in cravings following weight-loss surgery and the psychological aspects of craving individuals potentially continue to struggle with once their eating pattern stabilises over time. Gaining more detail regarding the thoughts prior to and during eating in response to cravings would be an interesting addition. It may also elicit information about what function cravers see their eating as fulfilling. Are they, for example, self-medicating or responding to a sensory desire and does this function change as a result of weight-loss surgery? This again might provide important information about the differences between those having had weight-loss surgery and other groups. It would be helpful to understand the balance of physical and psychological approach towards craving and the restriction of consumption.

The question of how to define food cravings remains an important one. It is arguable that those cravings that cause clinical difficulties for individuals are likely to be differentiated by employing more stringent criteria to the definition of craving used in research. Deciding what these criteria should be is difficult. This might be best discovered using groups of individuals with clinically significant eating disorders,

including those experiencing difficulties with their eating post weight-loss surgery and functionally differentiating cravings that cause a problem (i.e. lead to emotional distress or to bingeing) from those which are unproblematic.

Conclusion

This study has differed from previous studies in that it has provided a detailed account of the craving experience within a relatively unstudied population. Although similarities in the craving experience were found between both time post-surgery groups and different surgical groups on several situational measures, this was expected and was consistent with previous studies of food craving. Important aspect of the craving experience were noted, the first being craving frequency. Despite expectations of a significant difference between groups on this measure not being met, there were elevated levels of craving within the one year post-surgery group which may have reached significance had the sample size been larger. The frequency of craving in both time post-surgery groups was higher than that of healthy and non-dieting women in previous studies, suggesting that physiological and psychological restriction may lead to an increase in craving frequency and that the chronicity of this restriction may increase this frequency over time.

In contrast to previous studies, the target of the food craving for all groups was savoury food rather than chocolate. Savoury food however is a food often restricted within this population for reasons connected with the physiology of weight-loss surgery. Conditional support was offered for Rogers and Smit's hypothesis that ambivalence about certain foods lead to their being craved, although the ambivalence towards savoury foods in this population may be linked to the potential side effects of consumption rather than negative thoughts related to calorie content and weight-gain.

Cravings, for all groups, were hunger-reducing experiences whose occurrence was associated with more negative mood states. Eating, as a response to the craving did not appear to be mood enhancing. All groups rated feeling less happy and more dissatisfied following the craving experience.

Overall, the results failed to support abstinence and biological theories of food craving. The similarities in situational measures across groups may lend some support for the idea that cravings become conditioned responses to contextual cues and there are certainly some explanations in the literature placing binge eating pathology, common within weight-loss surgery populations, in the context of conditioning theories. The results in this study are perhaps most consistent with Rogers and Smit's 'ambivalence' hypothesis of food cravings.

Further research might concentrate on understanding the cognitive process involved in the craving experience and comparing the characteristics of craving in this weight-loss surgery group with dieters, watchers, non-dieting and binge eating populations.

The observation that the contextual experience of craving varied between individuals highlights the importance of any model being used to understand cravings in the context of weight-loss surgery and clinical difficulties focusing on individual factors implicated in the struggle to resist them. As the current trend towards increasing obesity and consequent weight-loss surgery, finding successful strategies for the control of food cravings also becomes more desirable. Hopefully the information contained within this thesis will be useful in this respect.

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APPENDIX 1

Participant information sheet

UNIVERSITY OF LEEDS

Information for Participants

The nature of food cravings following weight-loss surgery

You are being invited to take part in a research study. Before you decide, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully.

Introduction

This study aims to look at the experience of food cravings prior to and following weight-loss surgery.

What does this research involve?

Participation will involve filling in questionnaires about your experience of cravings, your eating style and also answering some questions about yourself. It will be necessary to fill in a number of questionnaires over a seven day period as well as completing a food intake diary for the week

At the beginning of the seven days I will contact you by telephone to give you detailed instructions on how to complete the questionnaires, check that you are happy with the procedure and answer any queries you may have. I will also be available to answer any questions at any time during the study on 07938032494. On the last day I will contact you again by telephone and ask you to return your questionnaires to myself in a stamped, addressed envelope supplied with the questionnaires.

Why have I been chosen?

All patients on Mr Simon Dexter and Mr Steven Pollard's caseloads, who have either had weight-loss surgery or are waiting for surgery, are invited to take part in the research.

What will happen to the information collected?

The data from completed questionnaire will be inputted into a computer and analysed. The questionnaires will be kept in a locked cabinet and destroyed at the end of the study. Anonymised versions of the questionnaires will be kept for 2 years and destroyed in accordance with the Data Protection Act.

The information collected in this research will be presented for a Doctorate in Clinical Psychology at the University of Leeds. It will be possible to obtain a written summary of the results of the research by contacting me on the number above once the study is completed.

Is participation voluntary?

Yes, it is up to you whether or not to take part. If you decide to participate, you are free to withdraw from the project at any time, without giving a reason. Withdrawing from the project will not affect your future care in any way.

What happens next?

If you would like to take part in this study, please send the enclosed reply slip with contact details in the stamped addressed envelope. I will then send you the questionnaires by post and telephone you to give further instructions.

Can I get further information?

If you would like more information about this research please contact me on 07938032494

Thank you for taking time to read this information

Ms Heidi Guthrie
Researcher & Trainee Clinical Psychologist

APPENDIX 2

Consent form

UNIVERSITY OF LEEDS

Informed Consent Form

The nature of food cravings following weight-loss surgery

Chief Investigator: Ms Heidi Guthrie, Trainee Clinical Psychologist, University of Leeds

Research Supervisors: Professor Andrew Hill, University of Leeds; Mr Simon Dexter, Leeds General Infirmary & Nuffield Hospitals; Mr Steven Pollard, St James's Hospital & Nuffield Hospitals

1. I confirm that I have read and understood the information sheet (dated 05/05/07) for the above study and have had the opportunity to ask questions. ☐

2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving a reason and without my medical care or legal rights being affected. ☐

3. I understand that sections of my notes may be looked at by the research assistant named above where it is relevant to my taking part in research. I give permission for this individual to have access to my records. ☐

4. I agree to take part in the above study. ☐

Name of Patient	Date	Signature
_____	_____	_____

Address.....

.....

.....

Home telephone number.....

Mobile number.....

Best time to contact me (please tick below)

Morning	*Afternoon*	*Evening*
☐	☐	☐

Please return this reply sheet in the envelope provided. Many thanks.

APPENDIX 3

Ethical permission

National Research Ethics Service
Leeds (East) Research Ethics Committee
Room 5 2, Clinical Sciences Building
St James's University Hospital
Beckett Street
Leeds
LS9 7TF

Telephone. 0113 2065637
Facsimile. 0113 2066772

25 July 2007

Ms Heidi Guthrie
Psychologist in Clinical Training
University of Leeds
Academic unit of psychiatry & Behavioural Sciences
15 Hyde Terrace
Leeds
LS2 9LT

Dear Ms Guthrie

Full title of study: **The nature of food cravings following weight-loss surgery**
REC reference number: **07/Q1206/27**

Thank you for your letter of 22 June 2007, responding to the Committee's request for further information on the above research and submitting revised documentation.

The further information has been considered on behalf of the Committee by the Vice-Chair.

Confirmation of ethical opinion

On behalf of the Committee, I am pleased to confirm a favourable ethical opinion for the above research on the basis described in the application form, protocol and supporting documentation as revised.

Ethical review of research sites

The Committee has designated this study as exempt from site-specific assessment (SSA. There is no requirement for [other] Local Research Ethics Committees to be informed or for site-specific assessment to be carried out at each site.

Conditions of approval

The favourable opinion is given provided that you comply with the conditions set out in the attached document. You are advised to study the conditions carefully.

Approved documents

The final list of documents reviewed and approved by the Committee is as follows:

Document	*Version*	*Date*
Application		05 March 2007
Investigator CV		

Protocol	1	05 February 2007
Letter from Sponsor		05 March 2007
Compensation Arrangements		06 March 2007
Questionnaire: 3 Factor eating behaviour	1	05 February 2007
Questionnaire: Background	1	05 February 2007
Questionnaire: Daily	1	05 February 2007
Sample Diary/Patient Card	1	05 February 2007
Participant Information Sheet	2	05 May 2007
Participant Consent Form	2	06 May 2007
Response to Request for Further Information		22 June 2007
Craving record	1	05 February 2007
Instruction sheet	1	05 February 2007
Supervisor's CV		

R&D approval

All researchers and research collaborators who will be participating in the research at NHS sites should apply for R&D approval from the relevant care organisation, if they have not yet done so. R&D approval is required, whether or not the study is exempt from SSA. You should advise researchers and local collaborators accordingly.

Guidance on applying for R&D approval is available from http://www.rdforum.nhs.uk/rdform.htm.

Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees (July 2001) and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

Feedback on the application process

Now that you have completed the application process you are invited to give your view of the service you received from the National Research Ethics Service. If you wish to make your views known please use the feedback form available on the NRES website at:

https://www.nresform.org.uk/AppForm/Modules/Feedback/EthicalReview.aspx

We value your views and comments and will use them to inform the operational process and further improve our service.

07/Q1206/27	**Please quote this number on all correspondence**

With the Committee's best wishes for the success of this project

Yours sincerely

Dr John Holmes
Chair

This Research Ethics Committee is an advisory committee to Yorkshire and The Humber Strategic Health Authority

The National Research Ethics Service (NRES) represents the NRES Directorate within the National Patient Safety Agency and Research Ethics Committees in England.

APPENDIX 4

Background questionnaire

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BACKGROUND QUESTIONNAIRE

Please answer the following questions as honestly as possible. Most questions simple need you to circle the answer you choose. Try not to leave any questions unanswered.

1. What is your date of birth? ____/____/____

2. Marital status. Are you? Married / Living with partner / Single

3. How would you describe your ethnic background?

Afro-Caribbean / Asian / U.K White / U.K Black / Other (please specify) _____

4. What is your main present (or previous) occupation? _____

5. How tall are you? _____

6. What is your current weight? _____

7. What is the most you have ever weighed at your present height? (excluding pregnancy)

_____

8. What is the least you have ever weighed at your present height? (excluding pregnancy)

_____

9. If you could choose, what would be your ideal weight today?

_____

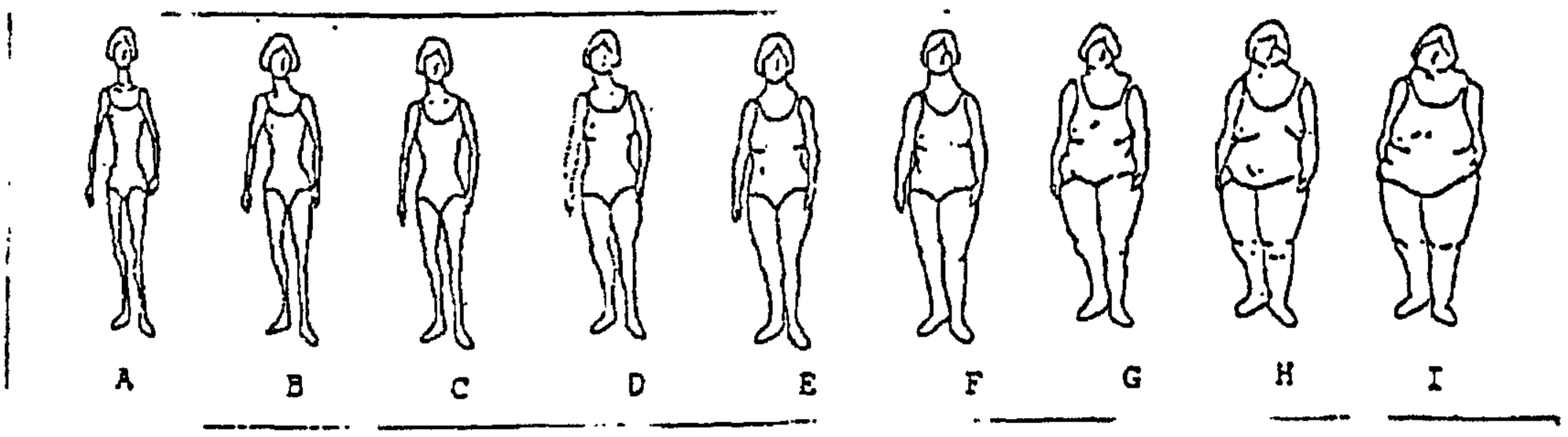
10. Which of the following would you describe yourself as:

Currently dieting to lose weight
Currently dieting or watching what you eat so as not to gain weight
Not dieting

11. Here are a number of body shapes ranging from very thin to very large. Please choose one letter to describe which figure

a) you feel is most like you now _____

b) you would most like to look like _____



APPENDIX 5

Daily Questionnaire

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DAILY QUESTIONNAIRE

NAME: DATE: TIME:

Please complete this questionnaire at the end of each day. Read each item carefully and put a mark through the line at the point that best represents your experience over the day.

1. How anxious have you felt today?

Not at all anxious ——— Extremely anxious

2. How easy have you found it to control your eating today?

Not at all easy ——— Extremely easy

3. How content have you been today?

Not at all content ——— Extremely content

4. How thirsty have you felt today?

Not at all thirsty ——— Extremely thirsty

5. How hungry have you felt today?

Not at all hungry ——— Extremely hungry

6. How tense have you felt today?

Not at all tense ——— Extremely tense

7.How irritable have you been today?

Not at all irritable ——— Extremely irritable

8. How alert have you felt today?

Not at all alert ——— Extremely alert

9. How vulnerable (emotionally) have you felt today?

Not at all vulnerable ——— Extremely vulnerable

10. How bored have you felt today?

Not at all bored ——— Extremely bored

APPENDIX 6

Craving record

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CRAVING RECORD

NAME: **DATE:**

Please complete a new record every time you have a food craving (a strong desire to eat a particular food), regardless of whether or not you eat.

1. Where were you when the craving began?

At home At work Elsewhere (please specify)

2. Where you? Alone In company

3. What time did the craving begin?

4. Immediately before the craving did you? (circle any that apply)

See or smell the food craved
See or smell other food
Simply think about the food craved
Simply think about other food
Eat the food craved
Eat other food

5. Rate how you felt immediately before craving

0=Not at all		1=Slightly		2=Moderately		3=Extremely	
Happy	____	Dissatisfied	____	Energetic	____	Relaxed	____
Alert	____	Nervous	____	Tense	____	Sluggish	____
Sad	____	Calm	____	Contented	____	Tired	____

6. How hungry were you immediately before the craving?

Not at all hungry _____ Extremely hungry

7. How strong was the craving?

Not at all strong _____ Extremely strong

8. How difficult was the craving to resist?

Not at all difficult _____ Extremely difficult

9. What exactly was the craving for?

10. Recently, how much have you tried to restrict eating this food?

Not at all ——————————————— A lot

11. Did you eat as a result of the craving? YES/NO

12. If 'NO', what did you do instead? .....

13. If 'YES', describe in detail what you ate .....

14. If 'YES', how long did you resist the craving? _____ mins

15. If 'YES', how pleasant was the taste of what you ate?

Not at all pleasant ——————————————— Extremely pleasant

16. Having experienced the craving, how quickly did it disappear?

Not at all quickly ——————————————— Extremely quickly

17. How hungry were you after the craving?

Not at all hungry ——————————————— Extremely hungry

18. Rate how you felt after the craving

0=Not at all		1=Slightly		2=Moderately		3=Extremely	
Happy	_____	Dissatisfied	_____	Energetic	_____	Relaxed	_____
Alert	_____	Nervous	_____	Tense	_____	Sluggish	_____
Sad	_____	Calm	_____	Contented	_____	Tired	_____

APPENDIX 7

Food intake diary

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FOOD INTAKE DIARY

INSTRUCTIONS

Food & Drink

- I would like to know exactly what you have had to eat and drink today.
- For each part of the day write down all the food and drink you consume, the amounts, and a description if necessary.
- On the next page is an example of the find of information we need to know. Please give as much detail as possible

If you have any problems or queries please contact:

Heidi Guthrie
At the Division of Psychiatry and Behavioural Sciences & School of Psychology, University of Leeds.

Telephone no: 07938032494

EXAMPLE

TIME	DESCRIPTION	QUANTITY, SIZE WEIGHT	*FOOD*	
			MEAL	*SNACK*
1.05	Wholemeal bread	**2 Slices**	√	
	Cream of tomato soup	**Small tin**		
	Coffee	1 cup		
	Sugar	1 tsp		
	Biscuits	4		
2.30	Diet coke	1 can		√
	Crisps	1 packet		
3.45	Coffee	1 cup		
5.00	Banana	1		√

Day 1 **Date** ..... **a.m**

TIME	DESCRIPTION	QUANTITY, SIZE WEIGHT	*FOOD*	
			MEAL	*SNACK*

Day 1 **Date** ..... **p.m**

TIME	DESCRIPTION	QUANTITY, SIZE WEIGHT	*FOOD*	
			MEAL	*SNACK*

Day 2 **Date** ..... **a.m**

TIME	DESCRIPTION	QUANTITY, SIZE WEIGHT	*FOOD*	
			MEAL	*SNACK*

Day 2 **Date** ..... **p.m**

TIME	DESCRIPTION	QUANTITY, SIZE WEIGHT	*FOOD*	
			MEAL	***SNACK***

Day 3 Date ..... **a.m**

TIME	DESCRIPTION	QUANTITY, SIZE WEIGHT	*FOOD*	
			MEAL	***SNACK***

Day 3 **Date** ..... **p.m**

TIME	DESCRIPTION	QUANTITY, SIZE WEIGHT	*FOOD*	
			MEAL	*SNACK*

Day 4 Date ..... **a.m**

TIME	DESCRIPTION	QUANTITY, SIZE WEIGHT	*FOOD*	
			MEAL	*SNACK*

Day 4 **Date** ..... **p.m**

TIME	DESCRIPTION	QUANTITY, SIZE WEIGHT	*FOOD*	
			MEAL	*SNACK*

Day 5 Date ..... **a.m**

TIME	DESCRIPTION	QUANTITY, SIZE WEIGHT	*FOOD*	
			MEAL	*SNACK*

Day 5 **Date** ..... **p.m**

TIME	DESCRIPTION	QUANTITY, SIZE WEIGHT	*FOOD*	
			MEAL	*SNACK*

Day 6 Date ..... **a.m**

TIME	DESCRIPTION	QUANTITY, SIZE WEIGHT	*FOOD*	
			MEAL	*SNACK*

Day 6 **Date** ..... **p.m**

TIME	DESCRIPTION	QUANTITY, SIZE WEIGHT	*FOOD*	
			MEAL	*SNACK*

Day 7 Date ..... **a.m**

TIME	DESCRIPTION	QUANTITY, SIZE WEIGHT	*FOOD*	
			MEAL	*SNACK*

Day 7 **Date** ..... **p.m**

TIME	DESCRIPTION	QUANTITY, SIZE WEIGHT	*FOOD*	
			MEAL	***SNACK***

APPENDIX 8

Three-Factor Eating Behaviour Questionnaire – Revised 18 (TFEBQ-R18)

The Three-Factor Eating Questionnaire—Revised 18-Item

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1. When I smell a sizzling steak or juicy piece of meat, I find it very difficult to keep from eating, even if I have just finished a meal.
Definitely true (4)/ mostly true (3)/ mostly false (2)/ definitely false (1)

2. I deliberately take small helpings as a means of controlling my weight.
Definitely true (4)/ mostly true (3)/ mostly false (2)/ definitely false (1)

3. When I feel anxious, I find myself eating.
Definitely true (4)/ mostly true (3)/ mostly false (2)/ definitely false (1)

4. Sometimes when I start eating, I just can't seem to stop.
Definitely true (4)/ mostly true (3)/ mostly false (2)/ definitely false (1)

5. Being with someone who is eating often makes me hungry enough to eat also.
Definitely true (4)/ mostly true (3)/ mostly false (2)/ definitely false (1)

6. When I feel blue, I often overeat.
Definitely true (4)/ mostly true (3)/ mostly false (2)/ definitely false (1)

7. When I see a real delicacy, I often get so hungry that I have to eat right away.
Definitely true (4)/ mostly true (3)/ mostly false (2)/ definitely false (1)

8. I get so hungry that my stomach often seems like a bottomless pit.
Definitely true (4)/ mostly true (3)/ mostly false (2)/ definitely false (1)

9. I am always hungry so it is hard for me to stop eating before I finish the food on my plate.
Definitely true (4)/ mostly true (3)/ mostly false (2)/ definitely false (1)

10. When I feel lonely, I console myself by eating.
Definitely true (4)/ mostly true (3)/ mostly false (2)/ definitely false (1)

11. I consciously hold back at meals in order not to weight gain.
Definitely true (4)/ mostly true (3)/ mostly false (2)/ definitely false (1)

12. I do not eat some foods because they make me fat.
Definitely true (4)/ mostly true (3)/ mostly false (2)/ definitely false (1)

13. I am always hungry enough to eat at any time.
Definitely true (4)/ mostly true (3)/ mostly false (2)/ definitely false (1)

14. How often do you feel hungry?
Only at meal times (1)/ sometimes between meals (2)/ often between meals (3)/ almost always (4)

15. How frequently do you avoid "stocking up" on tempting foods?
Almost never (1)/ seldom (2)/ usually (3)/ almost always (4)

16. How likely are you to consciously eat less than you want?
Unlikely (1)/ slightly likely (2)/ moderately likely (3)/ very likely(4)

17. Do you go on eating binges though you are not hungry?
Never (1)/ rarely (2)/ sometimes (3)/ at least once a week (4)

18. On a scale of 1 to 8, where 1 means no restraint in eating (eating whatever you want, whenever you want it) and 8 means total restraint (constantly limiting food intake and never "giving in"), what number would you give yourself?