THE SELF-REGULATORY FACTORS RELATED TO WEIGHT LOSS AND WEIGHT MAINTENANCE SUCCESS AND FAILURE

BY

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ABSTRACT

With the prevalence of obesity reaching epidemic levels both within the UK and worldwide there is an urgent need to explore ways in which to stem its burden on our society. There is a large body of research examining the positive effects of dietary and physical activity interventions for weight loss success, however much less is known regarding the psychological aspects, in particular the self-regulatory factors that contribute to both weight loss and weight maintenance success and failure.

The current thesis examines these factors through four studies. Study one highlighted the factors related to success and failure in weight maintenance. Study two investigated the characteristics contributing to successful attainment of a weight loss and a non weight loss goal simultaneously. Study three explored the factors related to dietary lapse occurrence. Building on the previous studies, study four consisted of a self-regulatory skills intervention to improve weight-related outcomes.

Results highlight the role of temptations and lapse occurrence and the threat they pose to weight loss and weight maintenance success. In addition, the current thesis outlines the need to not only identify influential self-regulatory factors but also to develop these factors in order to promote weight loss success.

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LIST OF PAPERS

This thesis is comprised of the following four papers. Study design, data collection, statistical analysis and writing were conducted by Heather McKee and Professor Nikos Ntoumanis advised on study design, data analysis and paper editing. Where listed, the secondary authors also advised on study design, data analysis and paper editing

1. McKee, H. C., Ntoumanis, N., & Smith, B. (2013) (in press). Weight maintenance: Self-regulatory factors underpinning success and failure. *Psychology and Health*.
2. McKee, H. C., & Ntoumanis, N. (2013) (in press). Multiple-goal management: An examination of simultaneous pursuit of a weight loss goal with another goal. *Journal of Health Psychology*.
3. McKee, H. C., Ntoumanis, N., & Taylor, I. (under review). An ecological momentary assessment of lapse occurrence in dieters. *Annals of Behavioral Medicine.*
4. McKee, H. C., & Ntoumanis, N. (under review). Developing self-regulation for weight loss: Intervention effects on physical, self-regulatory and psychological outcomes. *Journal of Behavioral Medicine.*

During the period of postgraduate study at the University of Birmingham's School of Sport and Exercise Sciences the following conference abstracts were published.

1. McKee, H. C., & Ntoumanis, N. (July 2011). Multiple-goal management: An examination of simultaneous pursuit of a weight loss goal with another goal. 13th Conference of the European Federation of Sport Psychology (FEPSAC), Madeira, Portugal.
2. McKee, H. C., & Ntoumanis, N. (August 2012). Multiple-goal management: An examination of simultaneous pursuit of a weight loss goal with another goal. 26th Conference of the European Health Psychology Society (EHPS), Prague, Czech Republic.
3. McKee, H. C., Ntoumanis, N., & Smith, B. (August 2012). Weight maintenance: Self-regulatory factors underpinning success and failure. 26th Conference of the European Health Psychology Society (EHPS), Prague, Czech Republic.

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CHAPTER 1

GENERAL INTRODUCTION

‘One can have no smaller or greater mastery than mastery of oneself.’

Leonardo da Vinci

Background

The prevalence of overweight and obesity has reached epidemic levels. Obesity is rife in the majority of populations; in fact the only region in the world where obesity is not a widespread issue is sub-Saharan Africa (Haslam & James, 2005). It is estimated that there are currently 1.1 billion adults and 10% of children that are overweight or obese worldwide. Furthermore, approximately 2.8 million of these people die each year as a consequence of being overweight or obese (Mathers, Fat, & Boerma, 2008). In the UK alone, at least six out of ten adults are thought to be currently overweight (Government Office for Science, 2007). In 2007, it was estimated that this burden of overweight and obesity in the UK is costing the economy £7billion a year (Government Office for Science, 2007).

Obesity has been associated with a number of physiological diseases, cardiovascular disease, diabetes, hypertension, high cholesterol, osteoarthritis (Must, 1999), as well as numerous cancers including those of the colon, breast, endometrium, oesophagus, and kidney (Bianchini, Kaaks, & Vainio, 2002). Additionally, obesity has been linked to psychological problems such as depression, lowered self-esteem, self-worth, self-efficacy (Gatineau & Dent, 2001) and anxiety related disorders (Gariepy, Nitka, & Schmitz, 2010). Obesity is generally classified by body mass index (BMI), which is determined by weight (kg) / height (m^2). In the majority of countries a BMI of 25-29.9 is classified as overweight and a BMI $\geq$ 30 is classified as obese (NHMRC, 1997; World Health Organization, 1995). Genetic, hormonal and metabolic influences can make some individuals more susceptible to obesity than others (Boutin & Froguel, 2001). Additionally changes in society in terms of food quality, quantity

and availability are considered recent contributors to the prevalence of obesity (Government Office for Science, 2007). However the nature of overweight and obesity is complex and multifaceted there is a need to investigate a multitude of factors that can influence weight loss success and failure.

In direct response to the outlined prevalence of obesity, the World Health Organization (WHO) prioritised improving diet and physical activity (Anderson et al., 2009). There is a large body of evidence to support dietary and physical activity interventions for weight loss and their ability to not only reduce weight but to improve both physiological and psychological outcomes (e.g., depression) (Blackburn, 1999; Butryn, Phelan, Hill, & Wing, 2007; Byrne, 2002; Wing & Phelan, 2005). However, these positive outcomes are only achieved if the weight is maintained (Shaw, O'Rourke, Del Mar, & Kenardy, 2005). Generally, those who lose weight in these dietary and physical activity interventions tend to regain the weight over time, with most dieters regaining almost one third of the weight lost one year post intervention and returning to their baseline weight or above three to five years after the original intervention (Wadden & Phelan, 2002). Research has indicated that this is due to an individual's failure to consistently maintain the positive dietary and exercise habits adopted beyond the prescribed intervention (Crawford, Jeffery, & French, 2000; McGuire, Wing, Klem, Lang, & Hill, 1999; Tapper et al., 2009). This illustrates that knowledge of dietary and physical activity methods alone is inadequate to promote the consistent behaviour change needed for weight loss and weight maintenance success. Thus, we need to explore other avenues of intervention.

Considering that weight maintenance success appears to be an unattainable goal for many individuals, it is increasingly important to understand the factors that determine why this occurs, not only to minimise the factors that contribute to failure but to simultaneously

maximise those that can contribute to success. Yet, in spite of the difficulties of the majority, research has shown that some overweight individuals (20%) are able to successfully maintain their weight (when classified as having lost 10% of their original body weight and maintaining this new weight for at least a year, to within a range of 2.2kg) (Wing & Phelan, 2005). Discovering why these individuals succeed when so many others fail is crucial for understanding the factors that underpin weight loss and weight maintenance success.

Accordingly, a number of studies have identified factors associated with weight loss and weight maintenance success. In addition to consistent physical activity (Wing & Hill, 2001), and sound dietary practices (low fat diet, consuming breakfast) (Wing & Phelan, 2005), several self-regulatory factors (i.e., those factors that can be altered by the self) have been associated with success. These include: Goal setting (Byrne, 2002; Elfhag & Rössner, 2005; Kitsantas, 2000), regular self-monitoring (Burke, Wang, & Sevick, 2011), and psychological factors such as self-efficacy (Byrne, 2002; Elfhag & Rössner, 2005) and active coping responses to lapse occurrence (e.g., treating a lapse as a small mistake) (Dohm, Beattie, Aibel, & Striegel-Moore, 2001). Although it has been demonstrated that the sustained application of physical activity and dietary changes can lead to weight loss there has been much less attention on the psychological factors needed in order to apply these consistent behaviours (Byrne, 2002). Interventions to date, involving the psychological factors that enhance weight loss success, remain relatively ineffective at producing long-term changes. For example, a Cochrane review of 36 psychological weight loss interventions, found that although results were promising, the majority of weight losses were not maintained. The review concluded that there is still much to be done in terms of developing a better understanding about how various psychological factors can contribute to weight loss and weight maintenance success. In particular, they called for further research investigating the

factors that could help prevent lapse occurrence (i.e., giving in to temptation) in those trying to lose weight (Shaw et al., 2005).

In light of the above, the current introduction discusses the role of self-regulation of one's goals in determining successful behaviour change with a particular emphasis on self-control and its relevance to temptation, a major factor undermining self-regulatory success. This introduction focuses on the research concerning the operation of temptations in the overweight in addition to other self-regulatory factors that have previously been linked to successful and unsuccessful weight loss.

An Overview of Self-Regulatory Behaviour

Human behaviour is regulated by goals. Goals are by definition future orientated processes by which people think about what they wish to achieve (Locke & Latham, 2006) and the strategies they use to pursue them (Bagozzi & Edwards, 1998). To achieve one's goals successfully an individual must engage in goal-related self-regulatory behaviour. Self-regulation is involved in a multitude of daily goal-based tasks, from getting out of bed in the morning, to maintaining attention during work, to going to the gym in the evening. It has been posited that adopting a self-regulatory approach to health behaviour is optimal in order to understand why, when and how people invest in their valued long-term goals (De Ridder & De Wit, 2006). There are a number of key theoretical approaches to self-regulation each of which are interlinked and complementary in their examination of the volatility of self-regulatory behaviour.

Carver and Scheier's (1982) approach is considered the foundation of self-regulation science (De Ridder & de Wit, 2006). They suggest that behavioural self-regulation implicates: 1) that the individual must have a goal; 2) that the individual is an active agent/decision maker

in their goal-related behaviour (which involves the process of revised goal setting, self-monitoring, debating competing goals and goal prioritisation); and 3) that goals are subject to volatility and an individual must exercise self-control in the ongoing pursuit of their goal. This approach highlights a number of essential factors in the understanding of health behaviours; having a clear goal, regular self-monitoring and regularly revising one's goal in order to overcome discrepancies between current state and their ultimate goal (Carver & Scheier, 1982; Carver, 2004).

Another fundamental aspect of self-regulatory research is focused on bridging the so called 'intention-behaviour gap'. In other words, people may frequently set goals but how they go about implementing these goals is important. It is thought that planning assists goal pursuit in providing a focus that helps enhance persistence and alleviate distractions such as temptations (Gollwitzer, 1999). Usually these intentions consist of specifying exactly where, when and how one is going to carry out their goal (Sheeran, Milne, Webb, & Gollwitzer, 2005). Forming implementation intentions has been shown to greatly facilitate goal attainment above the effects of mere goal intentions (Gollwitzer & Sheeran, 2006). Positively, this highlights that some people are able to successfully carry out planned health behaviours, however quite often people engage in unplanned behaviour in response to alluring temptations. In congruence with the weight loss research, a key issue central to self-regulation research concerns the ability of an individual to exercise the self-control necessary to persist at long-term goals when faced with numerous daily treats to their everyday success (i.e., temptations) (Baumeister & Tierney, 2011; De Ridder & De Wit, 2006; Hofmann & Van Dillen, 2012).

Self-control comes under the various monikers of self-regulation, willpower, impulsivity, self-discipline, and ego-strength (Duckworth, 2011). Self-control is the ability to

override or inhibit behaviours, urges, emotions or desires that would otherwise hinder goal-directed behaviour (Baumeister & Vohs, 2007). Research has found that levels of self-control in childhood can predict a multitude of health and other vital lifestyle indicators in adulthood. A study by Moffitt et al. (2011) following a cohort of 1,000 children from birth to 32 years of age found that levels of self-control in childhood predicted future income, occupation, savings, physical and mental health, substance use and criminal convictions in adulthood. This predictive power was comparable to that of intelligence and socioeconomic status in terms of life outcomes, leaving the authors to conclude that an individual's susceptibility to temptation may persist throughout his/her lifespan. This is important in terms of understanding why some individuals are better than others at avoiding temptation. Yet levels of self-control are also subject to daily fluctuations based on a number of factors including the frequency that one has to repeatedly resist temptation.

The ability to perform acts of self-control in the face of numerous daily temptations requires using a personal reserve or strength. Muraven and Baumeister (2000) believe that we have a limited consumable resource of self-control. This self-control reserve has been compared to a muscle; if too much force is exerted over a short-term period the muscle becomes depleted or fatigued and performance in subsequent muscular exertions declines. Baumeister, Bratslavsky, Muraven, and Tice (1998) demonstrated this over a number of different experiments involving two consecutive but unrelated acts of self-control. They found that subsequent resistance on the second act of self-control declined based on the effort involved in the first act. For example, one study within this body of research involved presenting participants with cookies and radishes; some were told to eat only the cookies; others, to eat only the radishes. Following resistance to eating either the cookies or the radishes participants completed a challenging puzzle task. Those in the radish group gave up

sooner than those in the cookie group (8 minutes vs. 19 minutes). It appeared that those in the radish group had consumed their self-control resources during the act of resisting the cookies, thus making them 'depleted' and subsequently less likely to persist on a task that requires further self-control (i.e., the puzzle task). In terms of depletion and weight loss, Vohs and Heatherton (2000) found that a group of dieters that had earlier resisted the temptation to eat chocolate, later over-consumed ice cream. This did not occur in non dieters as they did not have the goal of weight loss and thus did not have to actively attempt to reduce their calorie consumption. Furthermore, the act of self-control has been shown to cause glucose to drop below optimal levels, thus making one more vulnerable to temptation (Hagger, Wood, Stiff, & Chatzisarantis, 2010).

On a positive note, one is not doomed to self-control failure for life. Although self-control can become fatigued after repeated use it can be strengthened over time. Thus, it is similar to a muscle that tires after repeated use, however given active recovery; it can become stronger through practice. Muraven and colleagues found that simple tasks (e.g., keeping a food diary, improving one's posture, resisting sweets) undertaken over the course of two weeks resulted in better performance and persistence on self-control tests (Muraven, Baumeister, & Tice, 1999; Muraven, 2010). In terms of strengthening self-control and its impact on health behaviours, Oaten and Cheng, (2006) demonstrated that those who completed a two-month self-regulatory physical exercise regime performed better on lab based self-control tasks than controls. Additionally, they reported improvements in a range of other behaviours such as study habits, spending, healthier eating and reductions in smoking and drinking. These studies collectively demonstrate that levels of self-control are not fixed and that certain elements of self-control can be improved over time. Indeed, Muraven (2010) concluded that "it is possible to strengthen the self-control muscle through exercise, leading to

better outcomes" (p.468). These findings provide important implications for health behaviour interventions in terms of the ways in which to maximise self-control in order to promote successful behaviour change. Of particular interest are the ways in which we can strengthen self-control in order to overcome one of the largest threats to our self-regulatory success, temptation.

Overview of temptations in self-control research.

Whether immediate desires are temptations depends on if the behaviour implied by the desires is in contrast to one's values and self-regulatory goal standards. Thus, in order to experience temptation a person must experience conflict between immediate gratification and their higher order goals (Fishbach & Myrseth, 2010; Hofmann & Van Dillen, 2012). To date, the role of self-control in dealing with temptation has mainly been examined in laboratory conditions; there is minimal research concerning the operation of temptations in everyday life (Hofmann, Baumeister, Förster, & Vohs, 2012). Thus, a multitude of questions arise in relation to the operation of temptations: How often do they occur? Is the strength of the temptation influential in terms of one's ability to resist? And, ultimately, what are the factors that contribute to temptation resistance and can these be developed?

In response to these questions Hofmann et al. (2011) conducted a large scale experience sampling study involving 205 adults. Each participant used an electronic personal data assistant to record their 'everyday desires/temptations' (eating, drinking, socialising, and sleeping). The authors proposed a four-step model of motivated behaviour in order to detail the process of desire inception to action, incorporating desire strength, conflict, resistance and behavioural enactment. Their findings indicated that desires were frequent in nature and that their strength, conflict, resistance and whether or not they were acted upon were differentially predicted by various intrapersonal (e.g., alcohol consumption), situational (e.g., the presence

of others) and psychological variables (e.g., trait self-control). Additionally, the authors found that as desire strength increased an individual's resistance became weaker. This study provided the first systematic evidence of the impact of the strength of temptation and the prevalence and contribution of situational and dispositional factors in the operation of 'everyday desires'.

Self-Regulatory Factors Involved in Weight loss Goal Pursuit

Having established the background for their examination the self-regulatory factors implicated in weight loss pursuit will now be discussed. These were derived from a literature review into the factors related to successful and unsuccessful weight loss and weight maintenance. In particular the focus was on those self-regulatory factors that are known to be linked to the ability to resist temptation. A broad self-regulatory approach was taken that incorporated a number of these specific variables as it was felt that one conceptual framework would not be comprehensive enough to cover the multiple influences on temptation. Firstly, the focus will be on temptation and its operation in terms of weight loss goal attainment. Subsequently a number of other self-regulatory factors known to influence successful and unsuccessful weight loss will be looked at.

Dietary temptations.

As the findings by Hofmann et al. (2011) were in relation to a multitude of 'everyday desires', it is not possible to determine the variables that predict dietary temptation and lapse occurrence specific to weight loss. Carels et al. (2001) defined dietary temptations as "A sudden urge to break your diet (e.g., overeat, eat a forbidden food, etc.) in which you felt you had come close to the brink of breaking your diet". Dietary lapse occurrence was defined as, "An incident where you felt that you broke your diet (e.g., overeat, eat a forbidden food, etc.)" (Carels et al., 2001, p.311).

Over a decade ago, British dieticians ranked a 'lack of willpower' as more important to the development of obesity than genetic factors (Harvey, Summerbell, Kirk, & Hill, 2002). Given that the process of weight loss often involves conflict between immediate and long-term goals, it is surprising that there are still relatively few studies that document the operation of temptations in people who are overweight. A small collection of studies have indicated numerous factors that influence temptation and lapse occurrence in those striving to lose weight. Early research by Rosenthal and Marx (1981) found that situational factors such as the presence of others and psychological factors such as poor coping skills were the primary reasons for lapse occurrence in those on a weight-control programme. In concurrence with these findings, a study by Grilo, Shiffman, and Wing, (1989) on lapse occurrence in dieters found that emotional factors (mood) and situational factors (food cues in the environment) predisposed participants to lapsing. They also found that those who instigated both behavioural and cognitive coping responses were less likely to overindulge.

Although useful in providing guidance towards the specific factors that may be involved in the occurrence of temptation and lapse in the overweight, the majority of past research has been overly reliant on retrospective self-report measures of temptations and singular lapse occurrence. These methods have been criticised as it is thought that they fail to fully capture the nature and operation of temptation and lapse occurrence in the overweight, as a single lapse occurrence may not be representative of other occurrences and retrospective self-report can be skewed by recall biases and delay in reporting (Carels, Douglass, Cacciapaglia, & O'Brien, 2004; Stone & Shiffman, 2002). For example; it is argued that this type of research may have lead to participants responding based on their own theories about dietary lapses from their own or others' past experience (Carels et al., 2001). Additionally much of the temptation-based research to date has been conducted as part of clinical trials,

which undermines the ability to generalise this research to others outside of these trials. In fact it has been noted that "virtually no data exist" for the examination of temptation instances in those outside of clinical trials or laboratory settings (Carels et al., 2001, p.308).

Carels et al. (2004) sought to overcome these methodological issues by employing ecological momentary assessment (EMA) otherwise known as 'real time' assessment to examine the factors effecting temptation and lapse occurrence. EMA allows for multiple, repeated, immediate reports of people and their activities in their natural everyday environment (Stone & Shiffman, 2002). Carels et al. (2004) examined multiple temptation and lapse occurrences via paper-and-pencil reports (that were completed in immediate response to temptation) in a group of women ($N = 37$) in the final week of a weight loss intervention. Their aim was to determine the factors that influence temptation and lapse occurrence. Results found that mood and coping responses were the primary factors that distinguished resisting temptation from lapse occurrence. For example the greater employment of coping responses (e.g., encouraging oneself as to the benefits of dieting) was associated with diminished dietary lapses. The authors called for further research to investigate these and any other potential factors that could influence lapse occurrence. In particular, research that uses skills training in weight loss interventions to help promote the factors that are linked with successfully overcoming lapse which could have "critical clinical and public health implications" (p.348). The aforementioned studies by Hofmann et al. (2011) and Carels et al. (2004) highlighted the importance of examining a number of daily intrapersonal (e.g., temptation strength), situational (e.g., presence of others), psychological (e.g., coping responses) and general dispositional (e.g., trait self-control) factors related to lapse occurrence. Thus, it is important for future research to consider the contribution of these

and any other potential factors that may influence the ability to resist temptations in the overweight.

Other Self-Regulatory Factors Involved in Weight loss Goal Pursuit

Self-regulation is a complex multifaceted process so it can break down in numerous ways. As detailed earlier, in addition to temptation and lapse occurrence numerous other factors have been identified as being associated with weight loss and maintenance success. These include, but are not exclusive to: Goal setting, self-monitoring, self-efficacy, and coping. However, the weight loss literature cites that a large number of these factors that could plausibly influence weight loss and weight maintenance are somewhat poorly understood (Byrne, 2002; Shaw et al., 2005). Thus, further research is needed in order to understand how these factors influence weight loss goal attainment. This is necessary in order to design effective interventions to promote weight loss success. These key factors are outlined below.

Goal setting.

Considering goals are pivotal to self-regulatory behaviour, knowledge of their operation in terms of weight loss is crucial in order to promote success. Goal setting is a strategy frequently employed in weight loss interventions to promote success (Cullen, Baranowski, & Smith, 2001). Yet recommendations in terms of how high goals should be set are ambiguous. Although the general recommendation in terms of weight loss is to set realistic goals of 5-10% loss of total body weight over the course of a typical weight loss program (Health, 1998), it is common that participants in weight loss studies set higher goals and have even been found to find weight losses of 10% unsatisfactory (Dutton, Perri, Dancer-Brown, Goble, & Van Vessem, 2010). A qualitative study by Byrne, Cooper, and Fairburn (2003), investigating the experiences of weight regainers and maintainers, concurred with the

above research. They found that those who did not achieve the weight loss goals they had hoped to achieve considered any weight loss that was achieved insufficient and thus, were predisposed to abandonment of weight maintenance efforts. In contrast, recent research demonstrated that higher weight loss goals predicted the opposite, greater effort and weight loss (De Vet, Nelissen, Zeelenberg, & De Ridder, 2012). However, caution should be taken when interpreting these findings as they only related to short-term weight loss. Nevertheless the research illustrates the importance of examining goal setting in a weight loss context.

One should also keep in mind that the majority of weight loss goal based studies to date have been performed with clinical samples. As such, there is a lack of evidence of how goal setting operates outside of these clinical populations and settings (De Vet et al., 2012). Considering that more than 95% of individuals try to lose weight without entering a clinical or laboratory based weight loss research program (Fabricatore et al., 2008), understanding more about the factors related to attainment of weight loss goals is essential to assist in determining the best ways in which goals can facilitate weight loss success outside of these settings.

In particular, in terms of weight loss goal pursuit there are key issues in the ways in which goals have been examined. To date, goals have mainly been looked at in isolation. Yet, individuals are frequently involved in pursing many goals at once (e.g., health, family, career, social). Which often results in a juggling act between the effort allocation needed to pursue multiple-goals (Louro, Pieters, & Zeelenberg, 2007) and barriers such as finite resources (e.g., money or time) (Baumeister et al., 1998). Yet, equally, goals may facilitate one another, for example, the goal of losing weight may help with the goal of saving money in that the process may involve buying less non essential food items and having less frequent restaurant visits. This potential multiple-goal facilitation has previously been demonstrated in terms of exercise

behaviours and other valued life goals (e.g., academic goals) (Gebhart et al., 2007; Riediger & Freund, 2007; Jung & Brawley, 2010) and has been related to persistence at goal pursuits and improvements in general wellbeing (Riediger & Freund, 2004). However, the research to date, in terms of the operation of multiple-goals in weight loss pursuit, is sparse. Certain vital questions remain unanswered, such as: What happens when weight loss goals are in conflict with other goals? Can weight loss be positively facilitated by other goals? And importantly, what are the factors that influence successful and unsuccessful weight loss goal attainment whilst managing multiple-goals?

Self-monitoring.

Another key element of self-regulatory behaviour is self-monitoring (Carver & Scheier, 1982; Kitsantas, 2000). Self-monitoring involves purposeful attention to an element of an individual's behaviour and documenting or recording the details of that behaviour (e.g., keeping a food diary) (Burke, Wang, et al., 2011). Butryn et al., (2007) in their examination of self-weighing as a method of self-monitoring in those who had successfully maintained a weight loss of ≥30lbs for at least one year, found that more frequent weighing was associated with lower BMI and higher scores of cognitive restraint. In concurrence of the benefits of frequent self-monitoring, Burke et al., (2011) in their review of self-monitoring strategies for weight loss (diet and/or exercise diaries and/or self-weighing), found that all 22 studies reviewed supported consistent self-monitoring, which was more frequently and significantly associated with weight loss than less consistent self-monitoring.

It is thought that in order to enhance behaviour change one must be mindful of one's actions, the environment in which they occur, and their immediate and long-term impact (Kirschenbaum, 1987). Self-monitoring is thought to facilitate this heightened awareness and increases accountability and responsibility for one's actions (Bandura, 1998). Although highly

effective for weight loss, gaps still remain in relation to the optimal use of self-monitoring for weight loss success. The most common method of self-monitoring remains pen-and pencil diaries which are not only time consuming but have been related to under-reporting of behaviours (Burke, Conroy, et al., 2011). Recent research has demonstrated that technology may improve adherence to self-monitoring and subsequently result in greater weight loss success (Burke, Conroy, et al., 2011). This research called for future studies to consider the use of technology in their investigations. Nevertheless, the encouragement of self-monitoring in terms of weight loss interventions is warranted in order to maximise weight loss success (Boutelle & Kirschenbaum, 1998; Butryn et al., 2007).

Self-efficacy.

The use of self-regulated strategies such as goal setting and self-monitoring can be beneficial to weight loss success (Boutelle & Kirschenbaum, 1998; Burke, Wang, et al., 2011; Butryn et al., 2007; Cullen et al., 2001). In addition it has been demonstrated that an individual's levels of self-efficacy can determine the employment of these strategies and their subsequent impact on self-regulatory success (Bandura, 1998). Self-efficacy is known as one's belief in his or her ability to succeed in a particular situation (Bandura, 1997). The higher the perceived self-efficacy, the higher the goal-related persistence and the higher belief in eventual goal attainment (Bandura, 2004). Having high levels of self-efficacy has been repeatedly linked to weight loss success (Byrne, 2002; Elfhag & Rössner, 2005; Kitsantas, 2000; Teixeira et al., 2004). In weight loss interventions, possessing low self-efficacy has been shown to be related to an inability to implement the self-regulatory strategies needed for success (Kitsantas, 2000). Involvement in weight loss interventions alone has also been shown to improve levels of self-efficacy in participants (Clark, Abrams, Niaura, & Eaton, 1991; Elfhag & Rössner, 2005). Moreover, it has been posited that deliberate implementation

of self-regulatory skills early in behaviour change can lead to enhanced future self-efficacy (Annesi & Gorjala, 2010), which is of particular importance in terms of weight maintenance as it promotes subsequent persistence and success (Kitsantas, 2000). Thus, self-efficacy is a crucial factor to explore when examining the determinants of weight loss success and failure. Additionally there has been little research examining how self-efficacy operates in terms of multiple-goal pursuit in weight loss and the impact it has on an individual's ability to resist temptation and, vitally, subsequent future temptation.

Coping.

Although lapse is frequently thought of as the primary reason for self-regulatory failure (Baumeister & Heatherton, 1996), minimal evidence exists detailing how coping with lapse affects goal attainment, in particular within self-regulation research (De Ridder & De Wit, 2006). In terms of the weight loss research, although sparse, a number of studies detail the importance of coping skills for weight loss success. Grilo, Shiffman, and Wing, (1989) found that when faced with temptation, those who performed at least one coping strategy (e.g., thinking positively) were better able to resist temptation whilst eating, during emotional episodes, or when eating alone. Carels et al. (2004) examined coping responses in dieters in reaction to lapse. They found that coping responses (e.g., encouraging oneself as to the benefits of dieting) distinguished temptations from lapses. The greater the employment of a range of coping responses the greater the ability to avoid dietary lapses. In their examination of the factors that promote weight maintenance success, Dohm et al. (2001) found that successful weight maintainers dealt better with adverse life events and stressful situations than unsuccessful maintainers. The successful maintainers did so through employing problem solving skills that did not interfere with their weight maintenance. For example, in response to lapse occurrence, maintainers used active coping skills (e.g., treating a lapse as a small

mistake) and were less likely than the regainers to rely on and seek help from others. The authors concluded that the key factor differentiating between weight maintenance success or failure was an individual's response to lapse and that helping participants to develop active coping responses through coping skills training "may be the single-most-effective way of preparing people to maintain their weight loss" (Dohm, Beattie, Aibel, & Striegel-Moore, 2001, p.114). Thus, examining coping responses in relation to how they influence weight loss success and failure, in particular in response to temptation and lapse, may assist us in determining the best ways of promoting positive coping responses to encourage weight loss and weight maintenance success.

Dispositional factors.

There are a number of dispositional measures that have been linked with self-regulation in weight loss, these include, but are not limited to: Trait self-control, dietary restraint and perceived self-regulatory success at dieting. These are discussed in terms of their potential impact on one's ability to resist temptation.

Whilst situational influences on self-regulatory success are thought to be subject to the daily volatility of one's self-control. Trait or dispositional self-control is considered to be quite stable. Indeed high scores on trait self-control measures such as the Brief Self-Control Scale (BSCS) are associated with better exam results, less episodes of binge eating and alcohol abuse, less pathology, higher self-esteem, better personal and interpersonal skills and more optimal emotional responses (Tangney, Baumeister, & Boone, 2004). In terms of weight loss studies there has been little evidence that directly tests the relationship between dispositional self-control and weight loss success (Crescioni et al., 2011). However there is some evidence in terms of weight gain. It has been shown that children who possessed lower levels of self-control were much more likely to develop obesity in adulthood than those with

higher self-control (Duckworth, Tsukayama, & Geier, 2010). In response to the sparse levels of existing literature and in order to establish the relationship between self-control and weight loss, Crescioni et al. (2011) performed a study that involved tracking 86 participants in a 12-week weight loss program. The participants attended weekly weight loss meetings in which they completed the BSCS. Results signified that those high in self-control had better attendance to the program, ate fewer calories and lost more weight than those with lower self-control. Indicating that the examination of trait self-control should be a potential consideration in weight loss research.

Some research shows that chronic dieters appear to be unsuccessful in weight loss. Indeed, it has been shown that the number of previous weight loss attempts an individual has engaged in is associated with a higher BMI (Delahanty, Meigs, Hayden, Williamson, & Nathan, 2002). The ongoing weight loss concern and constant restriction of food intake observed in chronic dieters has lead to the development of 'Restraint Theory' which proposes that restrained dieters eat in response to cognitive rather than physiological signals which can lead to them being particularly vulnerable to lapse and overeating, especially when their cognitive control is impaired (Herman & Mack,1975; Fedroff, Polivy, & Herman, 1997). Additionally eating behaviours in some individuals can be influenced by levels of emotional eating (eating in response to mood or events) and in response to external stimuli (eating in response to sight or smell of food) respectively termed emotional and external eating (Van Strien, Frijters, Bergers, & Defares, 1986). However although the inability to restrain eating after high calorie preloads has been demonstrated in laboratory settings the application of this theory points in the opposite direction outside of the laboratory (Johnson, Pratt, & Wardle, 2012). Johnson, Pratt, and Wardle in their recent review on the current status of restrained eating in weight loss, argued that a degree of deliberate self-imposed restriction may be

essential to avoid episodes of overeating and lapse. In agreement with the above literature on self-control a consistent self-regulatory effort is essential in order to promote successful weight loss (Johnson et al., 2012). Nevertheless an examination of eating restraint is necessary to investigate its potential contribution to self-regulatory success.

Finally an individual's perception of success at dieting may influence their ability to resist temptation. The Perceived Self-Regulatory Success in Dieting Scale (PSRS) was developed to identify the psychological factors contributing to dieting success (Fishbach, Friedman, & Kruglanski, 2003). Fishbach et al. found that in terms of weight loss pursuit one's ability to resist temptation was dependent on their perceptions of success at weight loss. They concluded that this was due to repeated instances of successful resistance of temptation facilitating the creation of a link between temptation cues and thoughts of dieting. Recent research based on the PSRS further furnishes this hypotheses by demonstrating that perceptions of success at dieting are related to inhibition of food cravings (Meule, Lutz, Vögele, & Kübler, 2012) and the activation of diet-related goals (Van Koningsbruggen, Stroebe, & Aarts, 2013). A recent validation study concluded that the employment of the PSRS in weight loss research "is of crucial importance" and can only serve to enhance research testing the effects of manipulations or interventions created to develop self-regulatory skills in dietary behaviour (Meule, Papies, & Kübler, 2012, p.825).

Although it is important to consider individual dispositions to various traits, the current literature is ambiguous with regard to the extent to which certain dispositional measures can be manipulated to produce weight loss and weight maintenance success (De Ridder, Lensvelt-Mulders, Finkenauer, Stok, & Baumeister, 2012; Hofmann et al., 2011; Shaw et al., 2005). Thus an examination of the relationships between weight loss and dispositional measures is not the primary aim of the current thesis.

In summary, there is much that needs to be done in terms of the examination of self-regulatory factors, in particular temptations, and their influence on weight loss success. A recent review found that the transfer of the findings from self-regulatory research into eating and weight loss domains remains "largely unexplored". The review called for further research to be carried out investigating the best ways in which to promote self-regulation for weight loss success (Johnson, Pratt, & Wardle, 2012, p.670). Considering that the self-regulatory processes involved in both weight loss and weight maintenance are multifaceted in nature, in order to promote success we must take a multifaceted approach. This is necessary to allow us to indentify the key self-regulatory factors implicated in both weight loss success and failure, in order to determine the best modes for intervention that promote sustained behaviour change.

Synopsis of the Thesis

Keeping in mind the importance of the influence of temptations in the process of weight loss and considering the limitations identified in the previous literature, the purpose of this thesis is to examine the self-regulatory factors related to weight loss and weight maintenance success and failure.

Weight loss goal attainment appears to elude the majority of individuals, yet there are a select few that manage to successfully maintain their weight (Wing & Phelan, 2005). Why these individuals succeed whilst so many others fail is a key question in determining the factors that contribute to weight loss success. The first study in this thesis concerns the qualitative examination of the self-regulatory factors related to weight maintenance success and failure. Conducted via interview in a group of successful maintainers (who had lost 10% of their body weight and maintained this weight for a minimum of 12 months) and unsuccessful maintainers (Regainers). As this is an inductive qualitative study no specific

hypotheses are detailed. The aim of this study is to identify and detail the key self-regulatory factors that differentiate between those who are successful at maintaining their weight and those who are not.

Health behaviour goals have mainly been studied in isolation, which may oversimplify the self-regulation needed to pursue multiple-goals in everyday life (Louro et al., 2007). Further research on how multiple-goals operate simultaneously is needed, in particular research that concerns how weight loss goals function in a multiple-goal context. Whether weight loss goals are consistently in conflict with other goals, or if they can be facilitated by other goals is unknown. To help address these gaps in the literature study two (integrating some of the factors identified in study one), aims to examine the concurrent management of a weight loss goal alongside a non weight loss goal. Among a battery of self-regulatory based questions the study will employ the Intergoal Relations Questionnaire (IRQ; Riediger & Freund, 2004) in order to independently examine the levels of facilitation and interference amongst goals. In particular the study aims to determine which self-regulatory factors contribute to both successful weight loss goal attainment and multiple-goal attainment. It is hypothesised that those with higher goal persistence, self-efficacy, intergoal facilitation and lower intergoal interference and temptations affecting their goals would have greater levels of weight loss goal attainment. Additionally it was hypothesised that those with higher levels of persistence, self-efficacy, and intergoal facilitation for both goals would be most likely to attain both goals simultaneously, whilst those with the highest levels of intergoal interference and temptation would be least likely to attain both goals simultaneously.

To date the operation of temptations in the overweight has mainly been examined in laboratory circumstances or using retrospective methods (Carels et al., 2001;Hofmann et al., 2012). Thus research is needed outside of these conditions in order to capture the dynamic

and often fleeting nature of temptation and lapse occurrence (Carels et al., 2004). Study three aims to overcome these barriers by employing ecological momentary techniques to instantaneously record the daily fluctuations in temptation and lapse occurrence and their relationship to the self-regulatory factors previously associated (in the literature, study one and two) with weight loss goal attainment. It is hypothesised that strength of temptations, hunger, stress, depletion, influence from others and the environment would be associated with more frequent lapse occurrence and the employment of coping strategies and high self-efficacy would be associated with less frequent lapse occurrence.

Thus far there has been minimal research into the factors that impact on self-control in weight loss, in particular those that relate to the ability to resist temptations and prevent lapse occurrence (Carels et al., 2004; Friese, Hofmann, & Wiers, 2011). Yet the capacity to resist temptation can be improved, research investigating self-control failure has demonstrated that simple practice tasks can improve outcomes in both general self-control (Baumeister, Gailliot, DeWall, & Oaten, 2006; Muraven, 2010) and the self-control necessary for successfully pursing a range of health behaviours (Oaten & Cheng, 2006). More specifically, self-regulatory skills training has been advocated for in weight loss research in order to build ones capacity to resist temptation (Johnson et al., 2012). Thus study four aims to integrate the previously examined self-regulatory factors (studies 1-3) (in addition to others cited in the recent literature) into a self-regulatory skills-based intervention, seeking through practice of these skills to improve their effectiveness with an aim to enhancing both weight-related and psychological outcomes in the overweight and obese. It is hypothesised that both groups will experience similar changes in physical and psychological skills however the self-regulatory group will experience greater increases in their self-regulatory skills than controls.

Following these four chapters the thesis will conclude with an overview of the above studies, their findings, limitations, practical implications, and future directions for subsequent research.

CHAPTER 2

WEIGHT MAINTENANCE: SELF-REGULATORY FACTORS UNDERPINNING SUCCESS AND FAILURE

This manuscript is in press in *Psychology and Health*

Abstract

To investigate the differences in the contributing factors involved in weight maintenance success and failure. Semi-structured interviews were conducted with both successful and unsuccessful weight maintainers. 18 participants were recruited (16 women), 9 of who had lost 10% of their body weight and maintained this weight for a minimum of 12 months (Maintainers), and 9 individuals who met the above criteria for weight loss but had subsequently regained their weight (Regainers). A thematic analysis was employed to compare the differences between the two groups. Two main themes highlighted the differences between the two groups, these were: Goal regulation and self-control. Within these overarching themes successful weight maintenance was related to the following subthemes: Long-term, realistic goal setting, consistent use of routines and self-monitoring, avoiding deprivation and effective coping skills. Unsuccessful maintenance was related to short-term unrealistic goal setting, inconsistent routines and self-monitoring, experiencing deprivation and poor coping skills. These factors are explained in terms of the interrelationships that they have on one another and their subsequent impact on weight maintenance success or failure.

Keywords: Weight loss maintenance, goal setting, self-control, self-regulation

Introduction

The prevalence of overweight and obesity has reached epidemic levels. It is estimated that there are currently one billion adults that are overweight, with 300 million being obese. Furthermore, at least 2.8 million people die each year as a consequence of being overweight or obese (Mathers, Fat, & Boerma, 2008). In direct response to such figures, the World Health Organization (WHO) has declared improving diet and physical activity a public health priority (Anderson et al., 2009). There is a large body of evidence that supports dietary and exercise-related interventions as a means to produce small to modest reductions in weight loss (around 5-10%). These losses have been consistently linked to enhanced physiological and psychological wellbeing (Wing & Hill, 2001). Unfortunately, the majority of individuals who are successful in these interventions are unable to maintain these losses over time (Green, Larkin, & Sullivan, 2009). Nearly half of the weight lost is regained one year post-intervention and the remaining weight is regained 3-5 years after the intervention with the majority of individuals returning to or exceeding their pre-intervention weight (Perri, 1998; Byrne, 2002).

Considering that weight maintenance success appears to be an unattainable goal for many individuals, it is increasingly important to understand the contributing factors relating to weight maintenance success and failure. Research to date has highlighted a number of such factors (Colvin & Olson, 1983; Green et al., 2009). These factors relate to both psychological and self-regulatory aspects of long-term weight maintenance, such as the importance of setting realistic goals (Byrne, 2002), having an effective weight-control routine (Sciamanna et al., 2011), planning meals (Kruger, Blanck, & Gillespie, 2006), consistent use of food diaries (Hollis et al., 2008), not overly strict diets (Byrne et al., 2003) and active coping responses (Dohm et al., 2001). However, to our knowledge, it is relatively unknown, how these

psychological and self-regulatory factors operate in terms of their relationship to both weight maintenance success and failure (Byrne, 2002).

Research has shown that a number of overweight individuals (20%) are able to successfully maintain their weight (when classified as having lost 10% of their original body weight and been able to maintain this new weight for at least a year to within a range of 2.2kg; Wing & Phelan, 2005). Understanding why these individuals are able to succeed when so many others fail is crucial for understanding the factors that underpin weight maintenance. Weight regain has been attributed to an inability to adhere to behaviours previously successfully adopted for weight loss, once trying to maintain rather than lose weight (Byrne et al., 2003). It is therefore vital to understand why these behaviours are abandoned when they are still needed. The present study aims to contribute to the existent literature by examining the differences between successful and unsuccessful weight maintainers in order to gain an insight into the factors related to success and failure in weight maintenance.

Method

Participants

We interviewed 18 participants, 16 of which were females (M_{age} = 44.75±14.51, age range: 26-71). Participants were non academic university staff, self-employed, or retired members of the public and were of British (n = 10), North American (n = 1), Caribbean (n = 1), Polish (n = 1) and South Asian (Indian, Pakistani and Bangladeshi) (n = 5) descent. Participants were recruited on the basis that they fit into one of two groups (see Table 1). The first group, successful weight maintainers (Maintainers), included those who had previously been overweight or obese (BMI ≥ 25 kg/m^2), had intentionally lost 10% of their overall body weight (through diet and/or exercise), and maintained this new body weight for at least 12 months (to within a range of 2.2 kg up to and including the day of the interview, to allow for

fluctuations). The second group, unsuccessful weight maintainers (Regainers), included those who had previously met the above criteria of a loss of 10% of their total body weight; however they had been unable to maintain their new weight for a 12 month period and had subsequently regained the weight lost. This classification was based on the current criterion for long-term weight maintenance (Wing & Phelan, 2005; Epiphaniou & Ogden, 2010). Whilst recognizing that saturation is not always appropriate for establishing the quality of all kinds of qualitative research, and can have a number of practical weaknesses (see O'Reilly & Parker, 2012), data saturation, or what is sometimes termed thematic saturation (Guest, 2006), was used in the current study. This kind of saturation generally refers to the point at which no new themes or information is generated during data collection (Guest, 2006). The interviews for both the Maintainers and the Regainers were considered separately for saturation. The same reoccurring themes became evident for both groups independently by the 9th interview; at this point no new themes or patterns were being presented. This saturation point was driven by the key themes that had emerged from listening to and reviewing previous interviews as part of the ongoing data analysis procedure.

Table 1

Participant Characteristics

	Regainers	Maintainers
	n = 9	*n* = 9
Mean age in years (*SD*)	47.21 (13.06)	41.30 (12.71)
Current BMI[1]	32.42 (5.50)	24.3 (4.16)
Highest weight (kg)	92.65 (13.78)	90.11 (19.75)
Lowest weight (kg)	73.14 (17.45)	70.15 (15.61)
Average length of maintenance (months)	7.8 (2.13)	31.6 (16.5)

[1]Body mass index is calculated as kg/m^2

Procedure

Participants were recruited via email and web advertisements circulated to non academic staff and through flyers distributed at community weight loss groups. Participants received no compensation for their involvement. Ethical approval for the current research was granted by a university ethics committee. Participants were aware that they could withdraw from the study at any stage without consequences. Interview participants were reassured that their responses were confidential and would be referenced under a name different to their own. Having read and signed an information sheet and consent form, participants were interviewed

and recorded via Dictaphone. All interviews were conducted by the lead researcher and lasted between 40-100 minutes. Pilot interviews were conducted on three separately recruited individuals to test the interview structure. A number of probes were developed and changed as an outcome of the pilot. The pilot interviews were not included in the analyses presented below.

The interview script consisted of semi-structured questions with numerous probes. The interviews, as a co-constructed process (Sparkes & Smith, 2013), were guided by the lead researcher who operated in terms of what Kvale and Brinkmann, (2009) described as a traveller rather than a miner who digs for very specific information and finds uncontaminated "nuggets of knowledge out of a subject's pure experiences, unpolluted by any leading questions" (p.48). One implication of this, and given our constructionist epistemology, we recognize that "the traveller's history, interests, and embodied stories he or she has gathered on their travels deeply influence the 'knowledge'" (Smith, 2010, p.96). This said, the interviewees' were encouraged to tell their own stories about weight loss and, acting as an active listener, the interviewer sought to be reflexive about what questions they posed and how. The questions were selected with the aim of gaining a greater understanding of each participant's individual weight loss journey, for example "What does success mean to you in terms of weight loss?" and "Tell me the story of your weight loss journey".

Analysis.

In light of the purpose of the current study being to identify the key differences between Maintainers' and Regainers', a thematic analysis was employed. This methodology was chosen as it is not strictly theoretically bounded, is adaptable, translatable and known to be particularly useful in terms of examining similarities and differences between groups

(Braun & Clarke, 2006). The current study specifically followed Braun and Clarke's (2006) method of thematic analysis in order to identify, organise, evaluate and report patterns within the data for the two different groups. This methodology follows a 6-step approach from familiarisation with the data to writing up the report. The current study incorporated these steps in the following way: 1. Familiarisation: The interview transcripts were read and re-read and the interview recordings were repeatedly listened to by the principal investigator. 2. Generating the initial codes: The data were coded by the principal investigator by systematically working through the transcripts and identifying any segments that appeared to reoccur and had the potential to form patterns. 3. Searching for themes: Items were included if it was felt that they had captured something important in a patterned response. Special consideration was given to any data which were different or suggested an alternative explanation from the main factors identified. 4. Reviewing themes: The entire data set was then examined for differences within and between the two groups. As an outcome of this process, it was felt that a number of the themes lacked distinctiveness. These themes were either excluded from the final list or, where relevant, condensed into subthemes of the main themes. 5. Defining and naming themes: The Maintainers and Regainers differed on two key themes: Goal regulation and self-control. These overarching themes were characterised by various subthemes that ran throughout the data. Details of these themes and their component subthemes are provided in the Results section of the manuscript. 6. Writing the report: The last step in the thematic analysis involved revising the key themes and subthemes in order to select the final quotes for inclusion in the current paper. A subsection of the dataset (transcripts from two Maintainers and two Regainers) was analyzed by an independent researcher. This researcher acted as a 'critical friend' separately coding and grouping potential patterns in the dataset. She was then given the opportunity to discuss her findings at length

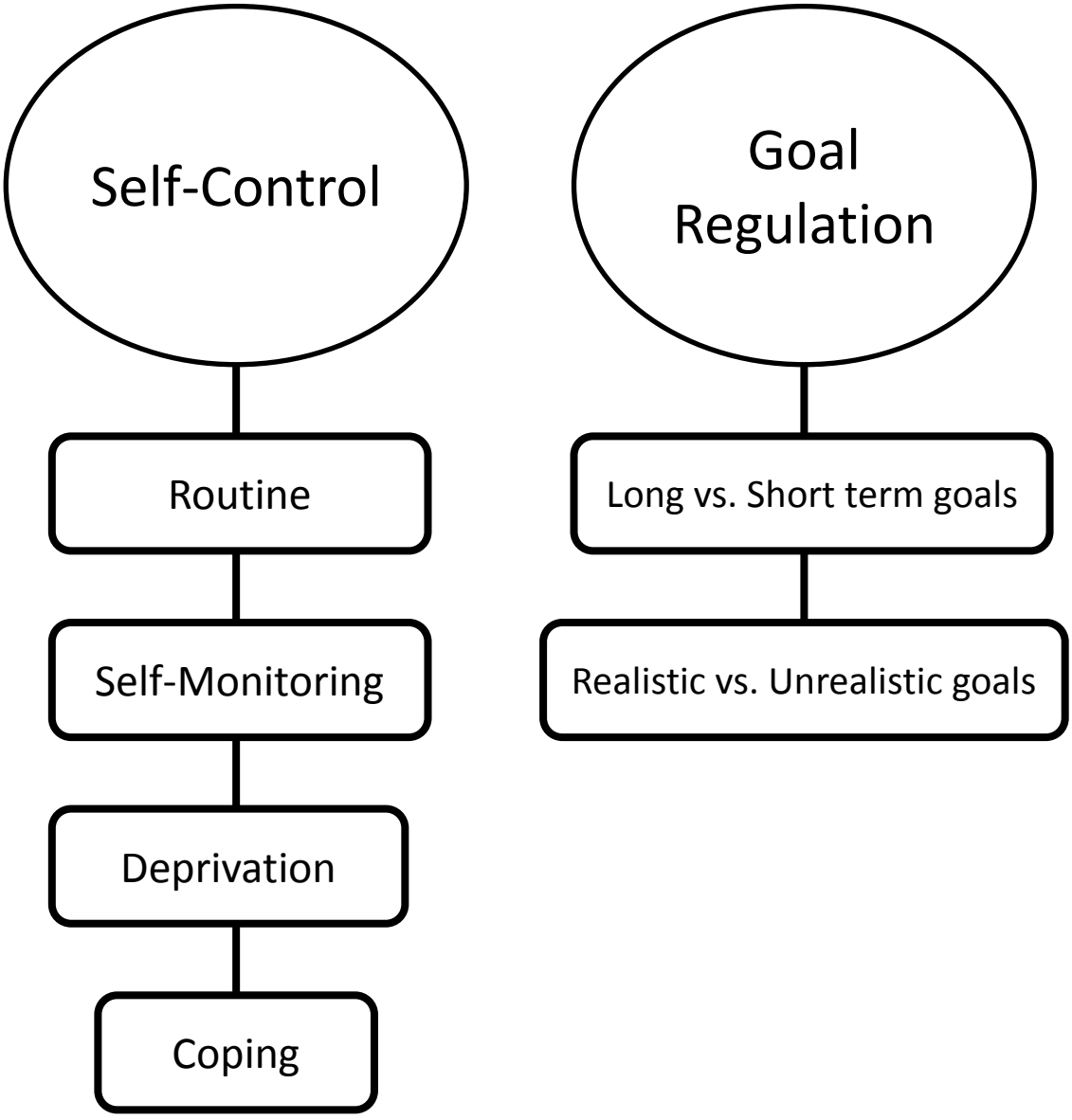
with the lead researcher without prior interference or influence. The conclusions drawn by the 'critical friend' were virtually identical to those of the lead researcher. The 'critical friend' identified both key themes in addition to the majority of the subthemes within the data.

Results/Discussion

The analysis detailed that the Maintainers and Regainers differed on two key themes: Goal regulation and self-control. These higher order themes were underpinned by various subthemes that ran throughout the data. Firstly, the dominant theme of goal regulation emphasised the differences between how Maintainers and Regainers approached their weight maintenance goals in terms of two subthemes. The first subtheme detailed whether participants adopted a long vs. short-term approach to their weight maintenance and its impact on their success. The second subtheme; realistic versus unrealistic goal striving, demonstrated how participants dealt with their weight loss goals and the impact this had on their subsequent success or failure at these goals. The second key theme was self-control which was divided into four contributing subthemes for which Maintainers and Regainers differed, these were: Routine, self-monitoring, avoiding deprivation and coping with lapses. The thematic map in Figure 1 illustrates these two primary themes and their relevant subthemes. These themes and their component subthemes are illustrated below.

Figure 1

Self-regulatory Factors Underpinning Weight Maintenance Success and Failure



Goal Regulation

Goal regulation is closely related to self-regulation which is broadly termed the ability of the self to alter the self (Vohs, Baumeister & Ciarocco, 2005). Goal regulation is in essence the self-regulation of goals. It mainly involves the processes of goal setting and goal striving and the barriers needed to overcome these in order achieve a valued goal (Mischel, Cantor, &

Feldman, 1996). The current study identified two subthemes within the overarching theme of Goal Regulation of weight-related goals. These were: Adopting a long-term vs. short-term approach to weight maintenance and realistic vs. unrealistic goal striving.

Adopting a long-term vs. short-term approach to weight maintenance.

The Maintainers frequently referred to setting weight maintenance goals and presented the idea of weight maintenance as a lifestyle change rather than a '*diet*'. This is exemplified in the following quote by Stacey (37) who recently relocated to the UK where she joined a slimming club; she now maintains her weight at a healthy BMI and has done so for over two years: *Interviewer: Was it difficult (weight maintenance)? Why? Stacey: I think it's just a matter of bringing it into your routine. Not thinking of it as a diet, thinking from the time you joined (a slimming club) that you have changed your life you're not dieting. I mean people say they are on a diet when they are a member of a slimming club sometimes but I don't think that's what you're on, you don't ever intend to go back to what you were doing before so that is not a diet you have just changed the way you eat now.*

Stacy's experience reflects that of the other 8 Maintainers (5 female, 2 male) in their awareness of how weight maintenance has now become an inherent part of their lifestyle. Laura (62), who has been maintaining her weight at a BMI of 21 for nearly two years, echoes Stacey's comments: *I think you've got to tell yourself you're not on a diet you're just changing your way of life…… you're not on a diet which is a temporary thing -you've got to educate yourself to eat differently all the time.*

Additionally, Leanne (35), who struggled to lose weight throughout adolescence, but now in adulthood, has been a successful Maintainer for the past two years noted: *I think seeing it* (weight maintenance) *as a long game is important.* Stacey, Laura and Leanne's

comments typify those of the other Maintainers in the current study. This repeated emphasis on lifestyle change rather than being '*on a diet'* which is seen as short-term or '*temporary*' is consistent with previous research into weight maintenance success (Byrne, 2002; Epiphaniou & Ogden, 2010). Such research has demonstrated that post weight loss those who successfully maintain their weight often experience a shift in their personal identity from feeling restrained and trapped by their weight control practices to becoming a more liberated person in terms of both their weight control endeavours and in their own self-appraisal (Epiphaniou & Ogden, 2010). In other words by redefining themselves and their behaviours as long-term or lifestyle-related the Maintainers could have perhaps unknowingly been insuring their weight maintenance future.

Realistic vs. unrealistic goal striving.

Further, in relation to goal regulation, a number of the Maintainers emphasised the danger of being *'unrealistic'* in their weight-related goals. Mary (26), who suffered from childhood obesity involving a ten year struggle to reach a healthy weight, has in adulthood, successfully maintained her weight for the past three years. She highlights the importance of setting realistic weight-related goals: *Mary: I think people set themselves such a high goal that when they can't reach it straight away, when it's a hard goal, they kind of think "Oh forget it, I can't do it"…. I think that's quite an important thing to think of realistic goals rather than ones you can't achieve…. that was something I did the whole way through was set my own little goals.*

The above comments of the Maintainers in terms of the importance of setting realistic goals and not seeing weight maintenance as '*temporary'* are in stark contrast to those of the Regainers (9 female). Similarly to the work of Cooper, Byrne, and Fairburn (2003) the

majority of the Regainers in the current study appeared dissatisfied with their weight following weight loss and subsequently strived to achieve further weight loss. Often, regardless of whether they had already achieved their ideal weight. A number of the Regainers detailed that they reached a point where they were so focused on their ultimate and often knowingly *'unrealistic'* weight loss goal that they just gave up completely. Amy (42), a Regainer, who has been battling with her weight since she was 15 years old, described this process: *I think we all focus on all the mistakes we make rather than remembering the achievements but I've never in my adult life got down to a point where I was going to be able to maintain my weight at. I always wanted to lose more but never managed to carry on losing more. I always went back. Sometimes I managed to maintain at a certain level for a period of time but it wasn't the ultimate level that I wanted to say at and then eventually went back up again when I got tired of it I don't know lack of progress or the effort maybe.*

Amy's quote exemplifies the danger of unrealistic and unachievable weight loss goals. A danger that has been well documented in the literature, with the setting of unrealistic goals being repeatedly coupled with weight gain over time (Colvin & Olson, 1983; Jeffrey, Wing, & Mayer, 1998, Elfhag & Rössner, 2005). Indeed the feelings of frustration or '*getting tired of it'* experienced by a number of the Regainers have been linked with ongoing dietary failure, anger, low self-esteem and oftentimes self-hatred (Polivy & Herman, 2002). This unrealistic goal striving documented by a number of the Regainers may provide one possible reason for the desertion of their weight-related goals. The literature has noted that failure to reach a self-determined weight discourages an individual's belief in their ability to control their weight and can subsequently result in the abandonment of weight loss goals (Cooper & Fairburn, 2001). Leanne, (Maintainer), detailed a similar battle to Amy (Regainer) in terms of having unrealistic goals: *Interviewer: If you were to do it again what would you do differently?*

Leanne: I think I wasted a lot of time feeling like a failure at weight loss when I wasn't really. Instead of going up and down and now essentially at the same weight, I wish I just stayed here. I think I would spend less time beating myself up about it, it's much more helpful see it in a positive way –look at the lbs you lost as progress rather than seeing the pounds you still have to lose as failure.

However, recent research into weight loss goal attainment has found that those who set themselves high weight loss goals can display greater effort and persistence towards their weight loss; both of these variables are subsequently related to weight loss goal attainment (De Vet et al., 2012). However, the precise ways in which these processes operate for some individuals is unknown. One potential way this could occur is illustrated by Leanne. Although comparable to Amy in the struggle with weight cycling, in the latter end of her quote she refers to seeing the *'lbs you lost as progress'* this offers an insight into the mechanisms that may have lead to her subsequent weight maintenance success. Leanne's quote exemplifies the importance of focusing on accomplishments to date, which has been found to subsequently signal motivation to continue with the goal (Koo & Fishbach, 2008). This is known to be especially relevant at the beginning of goal pursuit as it conveys the message of progress and encourages the individual to adhere to the goal (Koo & Fishbach, 2012).

Self-Control

The second key theme identified in the current study was self-control. Self-control is the ability to override or inhibit behaviours, urges, emotions or desires that would otherwise hinder goal-directed behaviour (Baumeister & Vohs, 2007). A number of differences were identified between the Maintainers and Regainers, in how they exerted self-control over their weight control practices. The use of self-control appeared to influence how participants'

established routines, exercised vigilance in their daily weight control, dealt with temptations, and coped with lapses. There were four subthemes identified relating to the overarching theme of self-control: Establishing routines, self-monitoring, dietary deprivation, and coping with lapses.

Routine.

A number of the Maintainers highlighted the importance of being highly organised in their weight maintenance journey. They detailed how they planned in advance in order not to be *'caught out'* and have to make unhealthy choices. They often emphasised the importance of having an established routine as pivotal to their weight maintenance. For example Kate (45) who recently joined a running club and has been successfully maintaining her weight for close to three years, detailed: *Once I had a new routine and that was sort of established it wasn't that difficult to stick to it, I guess the difficult bit was coming up with what that new routine would be but once that was in place it was kind of comforting.*

Conversely, many of the Regainers detailed that they found that organising themselves and establishing a routine for weight loss quite difficult: Hazel (52); a Regainer who has been struggling with her weight for the past 30 years: *I think a lot of my weight problems are because I'm not organised, like not preparing meals beforehand and making sure the shopping is delivered every week. I go shopping every other week and then I'm stuck and then I'm looking for things to eat.*

Pamela (53) a Regainer, who after having two children and giving up attending her local slimming club regained a substantial amount of weight, which is now starting to affect her health. Here she details her battle with being organised on her own after leaving the slimming club: *The way a lot of these slimming clubs work is that they give you diets to start*

off with and I can follow the diets but when I have to start cooking and planning meals for myself it all goes to pot and the weight just comes back on again. Because I was actually following these diets to the point that the meals were all planned out for me…..somebody was telling me "have a boiled egg, slice of toast, glass of orange juice and then at 11 o' clock have a piece of fruit" I could do it then but when I have to sit and plan meals it goes all out the window.

Nancy, another Regainer, reflects this view, here she makes reference to 'going it alone' after giving up attending the slimming club: *I just found it really too much to think about; when you got to the point that you had to start planning meals and meal management on my own, I give up with it.*

Similarly to how they were aware of the dangers of setting unrealistic goals, the Regainers seemed acutely aware of the significance of having a routine and its impact on their weight loss. Here Pamela, a Regainer, notes: *Interviewer: If you were to do it all again, is there anything that you would do differently next time? Pamela: I think I would be a bit more prepared...it's just, you know, try not to be lazy. I would need to get myself back into a routine.*

Many of the Regainers discussed how they relied on attending slimming classes and being told what to do by others in order to keep organised. As with Nancy and Pamela above, the Regainers often cited that they had lost the motivation to continue with their weight control routine once they had left their slimming classes. One possible reason for this may be that their participation was more for extrinsic or external reasons i.e., they may have relied on other people telling them what to do to motivate them rather than working out how to do it for themselves. Self-determination theory (Deci & Ryan, 1985) proposes that the behavioural

change necessary to achieve weight maintenance must be self-determined, i.e., integrated within one's sense of self. For the Maintainers, as discussed above, their transition from being a *'dieter'* into becoming a person who leads and associates themselves with a healthy lifestyle illustrates this integration. In line with self-determination theory, successful maintenance will not occur if the motivation for behavioural change is not self-determined (e.g., relying on others to tell you what to do). This type of reliance does not allow for the development of the empowering skills needed in order to sustain weight maintenance (Williams, Grow, Freedman, Ryan, & Deci, 1996).

Self-monitoring.

Self-monitoring skills involve deliberate attention to one's behaviour and the recording of some details of that behaviour (Butryn et al., 2007). For example, monitoring ones weight or keeping a food diary. The majority of the Maintainers made reference to consistently monitoring their weight maintenance, in particular through the use of food diaries. The Maintainers often noted that they had learned from previous experience how important it was to keep track of what they ate for weight maintenance success. Here Jeff (63), a maintainer, who has kept note of his food intake and exercise for the last five years, details why he feels self-monitoring is important: *As long as you're counting something either calories or grams of fat it's helpful. I think it's that little mind trickery of it, it makes it present in the mind, it makes it something that you just can't kind of go "Well I'll think about that tomorrow", its difficult but if you just write it down and then when you see it, for me it's like "wow" and it makes you honest to yourself.*

Jen (42), a maintainer, who kept food diaries for four years up to and including the day of interview, echoes Jeff's feelings on the importance of self-monitoring for weight

maintenance: *I write everything down. I think if I don't, I'm only cheating myself and if I get to the end of the week and I have put weight on, I know the only person I've got to blame is me-it's in my hands sort of thing.*

Weight loss trials have shown that keeping food diaries increases weight loss (Hollis et al., 2008) and weight maintenance success (Elfhag & Rössner, 2005). It is thought that this occurs through the heightened attention, awareness and increased accountability that comes with writing things down-all factors necessary for successful self-regulation (Burke, Wang, et al., 2011). This sense of accountability is reflected above, with many of the Maintainers often mentioning how self-monitoring kept them 'honest' and 'on track'. In contrast, the Regainers did not appear to practice self-monitoring as conscientiously as the Maintainers. Here Nancy, a Regainer, details how she stopped her daily weighing once she had achieved her goal weight: *In maintenance you're not actually achieving anything as such, well you are, but not in terms of the tangible result of losing weight. Initially I keep weighing myself and then you get to a point where it starts to creep up a bit and then you stop weighing yourself-because you don't want to know how much it is.*

This 'not wanting to know' was in direct contrast to the honesty and sense of responsibility seen in the Maintainers. The Regainers' general attitude to self-monitoring appeared to indicate a lack of accountability and autonomy with regard to their weight control. Unlike the majority of the Maintainers who continually kept food diaries or regularly weighed themselves, a number of the Regainers, as illustrated by Nancy above, appeared to stop their self-monitoring practices once they had reached or were close to their goal weight. Here, Rachel noted that ceasing her weight loss tracking was concurrent with when she started to regain weight: *I think that writing it (what you eat) down is really important…. though I'm*

not doing it now, I'm fairly sure that I stopped writing it down once I reached my goal which was ok for a bit but then I started to eat crap and then I couldn't stop.

Similarly to Rachel above, a number of the other Regainers cited that they were aware of the importance of self-monitoring however had stopped it once they had reached their goal weight. It seems that these crucial self-monitoring activities were abandoned when they were needed most. One possible reason for this could be explained with reference to Louro, Pieters, and Zeelenberg's (2007) goal proximity theory. If commitment to the goal is uncertain, when attainment of the focal goal is in sight and emotions signal progress, individuals seem to then coast or ultimately abandon the focal goal in pursuit of other things. The quote below by Leanne, a maintainer, exemplifies this thought process. Whilst considering why she was unable to maintain her weight in the past, she commented: *I hadn't actually kind of thought about it, you know, the closer you get to your goal the less incentive you have to keep working hard. Which of course you need to think really hard about how much you want to lose the last stone because it's got to genuinely matter more than eating that piece of cake or whatever.*

In the case of the Regainers it may be that once they get to their goal weight or 'focal goal' they become less motivated to continue into weight maintenance.

Deprivation.

The Maintainers and Regainers were wholly different in their approach to food and their experience of dietary temptations. The Maintainers often discussed the importance of preventing feelings of *'missing out'* or *'deprivation'* when it came to their weight maintenance practices. For example here, Ali (40), a Maintainer who took up running to assist her weight loss, and has been maintaining her weight for nearly two years, commented*: You*

have to have some treats if you deny yourself completely, you're just going to go mad and start eating rubbish.

Interviewer: If you were to give people advice from what you've learnt what would you tell them? Jen: Try to follow a diet where you don't deprive yourself because that's the thing usually and that's why other diets failed for me ….you just don't want to do something that you're not going to enjoy and I think when you do enjoy it, as I say, I don't think about it as a diet anymore.

The Maintainers repeatedly emphasized how feelings of deprivation can lead to *'self-destructive'* dieting behaviour and how this is often the tipping point from partial success into weight maintenance failure. They talked about *'savouring'* their treats and always felt that they had *'earned their reward'*. They appeared to have learnt the importance of not feeling deprived through their own dietary failures. Here, Leanne, a Maintainer, notes: *I had this sort of massive realization the way I had behaved it was like, if I don't eat this now, I'll never be able to eat anything else like it again. So you end up feeling that you're deprived of chocolate or whatever-but chocolate will always exist.*

In contrast, the Regainers often talked about *'forbidden foods'* and banning treats whilst dieting. Yet, in retrospect they appeared to recognize the danger of their behaviours and the importance of *'not feeling deprived'*. Noting similarly to the Maintainers that being overly restrictive can be detrimental to their goal by leading to loss of motivation and even periods of binge eating: *Interviewer: If you were to give others advice, based on what you learned, what would you tell them? Pamela: If I were to do it again I wouldn't restrict myself too much. If you really want something, have it….. because the more you deny yourself the more it builds up, and if you go two or three days, (you would say) "right, now I'll eat a box*

of chocolates". Don't deprive yourself too much because I think that's what makes people fall off the wagon.

Self-control has been compared to a muscle; if too much force is exerted over a short-term period the muscle becomes depleted or fatigued and performance in subsequent exertions declines (Muraven & Baumeister, 2000). As mentioned by Pamela, being overly restrictive can often, over time result in binging on foods contrary to ones dieting goals. Thus the Regainers' extreme bouts of self-deprivation may have left their self-control fatigued or depleted. Potentially making them more vulnerable to future tempting situations and consequently more likely to *'fall off the wagon'*. One would have to exert huge amounts of self-control to restrict certain foods long-term. This sort of rigid control has been considered a risk factor for dieting failure and overeating (Urbszat, Herman, & Polivy, 2002).

Although it can be subject to depletion, if a muscle is consistently trained and given adequate rest (e.g., allowing for occasional treats), over time it can become stronger (Muraven, 2010). Through avoiding deprivation the Maintainers' consistent and moderate exertions of self-control potentially served to strengthen their future self-control efforts. Allowing for the occasional treat is a sign of flexibility in their weight loss pursuit. Having a flexible approach to ones diet is known to be associated with weight maintenance success (Byrne et al., 2003; Epiphaniou & Ogden, 2010)

Coping with lapses.

A dietary lapse is known as ''an incident where you felt that you broke your diet (e.g., overeat, eat a forbidden food, etc.)''(Carels, 2001). The Maintainers and Regainers differed in their ability to instigate effective coping responses following lapses. The Maintainers appeared to understand that one lapse does not constitute a complete dietary

failure and were able to move on from lapses and continue with their weight maintenance goals: *Jen: If you have a bad day it's just a bad day, don't beat yourself up about it, just think it's a bad day and now I've got the rest of the week to get over it.*

Kate: You can think one day, right I might have something I fancy like biscuits but you know you're just having them there and then and you're not thinking "oh I've messed up the diet I'll just have a load of rubbish then" you just carry on as before. What you do 95% of the time is what counts.

These quotes reflect the adaptable view of the Maintainers regarding having treats and overcoming lapses. They seemed to perceive a lapse as something temporary, making dietary allowances and increasing exercise to compensate; such behaviours have been associated with weight maintenance success (Dohm et al., 2001). The Regainers appeared to have a completely contrasting view in terms of dealing with periods of lapses. For example here, Amy discusses how she copes with dietary temptation and lapse: *I find it hard I guess it's that all or nothing mentality, you think "oh I will start my diet again on Monday and in the meantime I might as well have that pizza I've been missing". You know? And then it's sort of a steady decline. I think oh this is so good maybe I'll just have a couple of more things that I miss before I get back to healthier eating.*

This 'all or nothing' or dichotomous thinking style is known to be detrimental to weight maintenance success (Byrne et al., 2003). Here, Leanne, a Maintainer, reflecting on her past mistakes summarises the destructiveness of such thinking: *It's an obvious self-defeating concept that just because you have eaten one bad thing you should then eat lots of it. It's some sort of weird psychological thing to think it's all or nothing; if you can't do it perfectly you might as well not do it at all.*

The Regainers appeared passive or submissive in their responses to a lapse; rather than do something about it, they seemed to let a lapse turn into a relapse using it as an excuse to *'come off the wagon'*. This type of passiveness has been linked with weight regain and overeating (Kayman, Bruvold, & Stern, 1990). However, the Regainers appeared to be aware of what was needed in order to overcome lapses, yet they seemed unable to instigate the behaviour necessary to do so. This is exemplified by the following quote by Amy: *It's trying to stop that lapse becoming a pattern of behaviour is where I seem to struggle. I should have probably made a better note of the time I've overcome a lapse and that it didn't become a relapse but I didn't remember at the time. You never appreciate all those successes you remember the ones that turn into relapses. I guess the simple answer is you just say "oh that was a piece of chocolate well I'll not do it again" and you know get back to where I was.*

General Discussion

Many weight loss interventions to date, have produced small to moderate results, with the majority of individuals who lose weight in these interventions regaining this weight over time (Elfhag & Rössner, 2005). In an effort to explain these findings, calls have been made in the literature for further research to explore the contributing factors behind both weight maintenance success and failure (Byrne, 2002). An enhanced understanding of these processes will enable researchers to improve the effectiveness of future interventions.

Participants in the current study discussed their understanding and experiences of the factors related to their weight maintenance success or failure. Two main overarching factors for which the Maintainers and Regainers differed were identified in the interviews: Goal regulation and self-control. Goal regulation consisted of the subthemes: Adopting a long-term vs. short-term approach to weight maintenance and realistic vs. unrealistic goal striving. Self-

control consisted of four contributing subthemes; Routine, self-monitoring, avoiding deprivation, and coping with lapses. The aim of the current study was to explore the differences between Regainers and Maintainers in order to gain an insight into the factors related to success and failure in weight maintenance. Considering the findings of the current study it appears that weight maintenance success and failure does not occur in isolation; rather it is part of a bigger web of interlinking relationships. Seemingly there is an interplay occurring among these factors in both the Regainers and Maintainers with a number of factors potentially influencing and affecting success in the others. This brings about a 'domino' or cascade effect amongst the individual factors. For instance in the case of weight maintenance failure; the Regainers tended to see weight control as a short-term concept rather than a long-term or lifestyle change. It appears that this mindset potentially had a knock on effect on the other factors relating to their weight control practices. Due to the temporary or short-term nature of their goals the Regainers may not have applied any of the factors necessary for success long enough for them to become routine or habitual and thus is perhaps why they frequently commented on struggling with fitting in their weight loss alongside their other priorities. Indeed, they detailed that they self-monitored inconsistently, they tended to set unrealistic goals which may have lead them to be overly restrictive with their diets and hence their frequent reference to feelings of depletion and deprivation, potentially making them more vulnerable to lapsing. Furthermore, perhaps due to their inability to instigate adequate coping measures, these lapses had the potential to turn into relapses and consequently weight regain. As a consequence of seeing weight control as something temporary they have potentially experienced a 'domino' or knock on effect on the other factors necessary for weight maintenance success, perhaps therein preventing Regainers from making the crucial transition from weight loss to weight maintenance.

In contrast, the Maintainers tended to take a more long-term approach to their weight control. As a result of their long-term outlook and their realistic goal striving, it is embodied in their lifestyle and reflected in their sense of self. As a consequence, they have established routines to complement it. They often talked about how they managed to avoid feelings of deprivation, yet ensured they remained in control of their weight by allowing for the occasional treat. They seemed to instigate active and effective coping skills and, therefore, could potentially deal more effectively with lapses. In addition, by keeping a food diary it may have heightened their awareness of what they were eating-perhaps allowing them to avoid periods of 'mindless' consumption.

In sum, the present study, in congruence with previous literature, provides support for the importance of setting realistic goals (Byrne, 2002), having an effective weight-control routine (Sciamanna et al., 2011), planning meals (Kruger et al., 2006), consistently using food diaries (Hollis et al., 2008), avoiding overly restrictive diets (Byrne et al., 2003) and using active coping responses (Dohm et al., 2001). This study adds to the literature in emphasising the importance of the above key self-regulatory and psychological factors in weight maintenance goal pursuit. In addition to these findings, the current research is, to our knowledge, one of the first to detail the interrelationships that the above factors have on one another and their subsequent impact on weight maintenance success or failure, highlighting the importance of seeing weight maintenance as a long-term goal. Future longitudinal research is needed to further explore and verify the potential relationships identified. Furthermore there is a necessity to specifically understand why some people carry on consistently employing these factors while others stop once they have come close to their ideal weight. In order to encourage ongoing weight maintenance, less focus must be placed on continuous weight loss and more emphasis on the maintenance of losses and the self-

regulatory and goal management skills needed for successful weight maintenance. Perhaps weight loss groups should devote more attention and focus on getting participants to view weight control as a long-term objective and highlighting the benefits of such an approach. Such an approach is concurrent with research that argues that long-term behaviour change should be viewed as a chronic ongoing process and not as a short-term ideal (Anderson, 1999).

CHAPTER 3

MULTIPLE-GOAL MANAGEMENT: AN EXAMINATION OF SIMULTANEOUS PURSUIT OF A WEIGHT LOSS GOAL WITH ANOTHER GOAL

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Abstract

The current study investigated the factors contributing to successful goal attainment of a weight loss and a non weight loss goal simultaneously. Weight loss and non weight loss goals, self-efficacy, persistence, temptations, intergoal interference and facilitation were measured via an online questionnaire ($N = 103$, $M_{age} = 25.36 \pm 6.9$, 80% women). Weight loss self-efficacy, persistence, temptations and intergoal facilitation significantly predicted weight loss goal attainment. Those who were more successful in attaining both their goals simultaneously had higher self-efficacy, persistence, and experienced less temptation towards both goals. The study provides an insight into the characteristics necessary for successful simultaneous management of a weight loss goal with another goal.

Keywords: Multiple-goals, temptation, self-control, self-efficacy, interference, facilitation

Introduction

In the UK alone, at least six out of ten adults are thought to be currently overweight (Government Office for Science, 2007). In 2007, it was estimated that this burden of overweight and obesity in the UK is costing the economy £7billion a year (Government Office for Science, 2007). As such, physical activity and dietary interventions have become a public health priority (Anderson et al., 2009). These interventions have been shown to produce small to modest weight loss which has been repeatedly linked with improved physiological and psychological health (Shaw, Gennat, O'Rourke, & Del Mar, 2006; Wing & Hill, 2001). Yet, the majority of people fail to maintain the positive dietary and physical activity habits adopted beyond the prescribed intervention period (Sharma, 2007; Shaw et al., 2005). It is well-known that successful goal attainment is a function of how individuals think about their goals and the strategies they use to pursue them (Bagozzi & Edwards, 1998). Thus, investigation into the goal-related processes surrounding weight loss goal management is required in order to find out the key factors related to weight loss success (and failure).

People regularly juggle multiple-goals on a daily basis, consequently, much of people's daily activities involve deciding how much effort to invest in their goals, when to invest it, and which goals to invest it in (Gollwitzer & Heckhausen, 1990). To date, goals have mainly been studied in isolation from each other in order to understand a specific behaviour and how it relates to goal attainment (Latham & Locke, 1991). However, examining single goal-related behaviour without acknowledging the simultaneous influence of other goals fails to take into account the self-regulation skills needed to pursue multiple-goals in everyday life (Louro et al., 2007).

A small number of studies have specifically looked at managing multiple-goals in a health related context (Gebhart & Maes, 1998; Riediger & Freund, 2004; Karoly et al.,

2005; Li & Chan, 2008; Jung & Brawley, 2010). The majority of these studies focus on the interference or conflict that occurs as a result of managing exercise alongside other goals, and the implications of those processes for multiple-goal pursuit and attainment. For example, Gebhart and Maes (1998) found that sedentary participants had greater interference from a list of non exercise personal goals than more active participants. Li and Chan's (2008) research also examined the conflict between exercise and self-selected non exercise goals. They found that when conflict among the two goals was high, intention-behaviour relations were weaker with regard to exercising compared to individuals who experienced low goal conflict. In contrast, the ways in which goals complement or facilitate one another can enhance goal pursuit and subsequent attainment (Gebhart et al., 2007). For example, exercise and career goals may complement one another as exercising may relieve stress and subsequently boost performance at work. Studies looking at facilitation in terms of managing exercise goals alongside other personal goals, have found that the more active participants experienced greater facilitation between exercise and non exercise goals (Gebhart et al., 2007; Jung & Brawley, 2010). This pattern has also been replicated with other types of goals with mutual goal facilitation found to repeatedly predict high involvement in longer-term goal pursuit (Riediger, 2007, Riediger & Freund, 2004; Riediger & Freund, 2007). However, the majority of multiple-goal research has simply examined the impact of goal conflict (and ignored the possibility of intergoal facilitation), or has measured interference and facilitation as a single item measure (e.g., Gebhart et al., 2007; Jung & Brawley, 2010). This approach has been criticized in the past as it has been suggested that interference and facilitation are independent factors and not opposite sides of the same continuum. Riedger and Freund (2004) created the Intergoal Relations Questionnaire (IRQ) to overcome these issues. Their body of work found interference and facilitation to be two independent characteristics each having a differential

effect on subsequent goal pursuit. Although the IRQ has been employed to examine exercise in a multiple-goal context its utility with regard to weight loss goals is unknown.

Goal interference and facilitation are not the only characteristics that may influence multiple-goal pursuit. Karoly et al. (2005) examined whether regular exercisers and irregular exercisers differ in their self-regulation of exercise versus a goal that strongly interferes with exercise. They found that irregular exercisers favoured their non exercise goal (rather than their exercise goal) in terms of valuing it greater, monitoring it more consistently, and planning and rewarding themselves when they progressed towards attaining this goal. In contrast, those who were regular exercisers did not appear to make such preferences and were found to be more proficient in managing both goals simultaneously. A study by Jung and Brawley (2010) also explored the self-regulatory characteristics influencing exercise frequency whilst pursuing another goal. Their sample consisted of 336 university students who were required to specify their most valued non exercise goal and complete a questionnaire measuring physical activity levels, self-efficacy, persistence and interference/facilitation of concurrent goals. Jung and Brawley then dichotomized participants into frequent and less frequent exercisers. Similarly to Karoly et al. (2005), Jung and Brawley found that, frequent exercisers had higher levels of self-efficacy, persistence and experienced greater facilitation towards attaining both exercise and non exercise goals. Further research by Jung and Brawley, (2011) into the predictors of exercise adherence in working mothers found that persistence was highly influenced by self-efficacy in that when numerous barriers to attaining exercise goals were perceived those with higher self-efficacy on both goals had greater persistence on both goals and experienced greater facilitation of both goals.

The self-regulation needed to successfully pursue long-term goals is influenced by self-efficacy, that is ones belief in his or her ability to succeed in a particular situation

(Bandura, 1997). Having high levels of self-efficacy has been repeatedly linked to weight loss success (Kitsantas, 2000; Byrne, 2002; Elfhag & Rössner, 2005). In terms of multiple-goal management for exercise, self-efficacy has been outlined as a key factor relating to goal attainment (Jung & Brawley, 2010, 2011; Karoly et al., 2005). However, its effectiveness in terms of managing weight loss alongside other goals is relatively unknown.

To our knowledge, there are only two studies that have examined weight loss goal management in the context of other goals. Fishbach and Dhar, (2005; Study 1) looked at perceptions of progress in weight loss goal pursuit by examining how these perceptions affected goal-based choices. The researchers manipulated dieters' perceived levels of progress with their weight loss goal in order to examine how it affected their choice of healthy vs. unhealthy snacks. They found that when people perceived that they had progressed with their weight loss goal it often led to the choice of an unhealthy rather than healthy snack. However this particular study did not get participants to specify another goal outside of weight loss, and thus, was more focused on goal congruent actions than on multiple-goal pursuit. Furthermore, the authors acknowledged that they failed to measure participants' commitment to their goal. They did, however, measure commitment in subsequent studies in the same paper. Results demonstrated that when goal-related actions signified commitment, they were unlikely to be followed by behaviours that were inconsistent with that goal. Louro et al. (2007; Study 1) looked at weight loss and non weight loss goal pursuit. Participants kept a 21-day diary which examined perceptions of goal progress, effort, expectancies of success, emotions, proximity and attainment of both goals. Louro et al. found that when distant from attaining their goal, participants' positive emotions from the previous day led to increased effort on the goal the next day. In contrast, when attainment was close, positive goal-related emotions resulted in decreased effort the following day and a shift in effort to the other goal. This study illustrates

the balance individuals strike on a day-to-day basis in terms of multiple-goal management based on current and previous efforts, emotions, progress and proximity to goals.

The goals-based literature highlights the role of not only long-term objectives but also salient short-term temptations in goal pursuit (Trope & Fishbach, 2000). Avoiding obstacles that may hinder attainment of one's goal has been linked with successful goal attainment. Distractions such as temptations can hinder successful goal pursuit (Freitas, Liberman, & Higgins, 2002). In the context of weight loss, managing temptations can have a significant impact on subsequent success. A 'lack of willpower' or inability to resist temptation has been ranked by British dieticians as more important to the development of obesity than genetic factors (Harvey et al., 2002). Thus, another characteristic that may have a substantial impact on managing weight loss and non weight loss goals simultaneously is the frequency with which individuals deal with temptation.

Considering so many individuals fail in their weight loss goal attempts (Perri, 1998; Byrne, 2002), a greater knowledge of the processes related to weight loss striving in the context of multiple-goal pursuit is vital for the development of well-informed weight loss interventions. The primary purpose of the current study was to build on and extend the minimal research to date exploring the simultaneous management of a weight loss goal alongside another goal. We firstly aimed to investigate how a group of factors relating to weight loss self-regulation (self-efficacy and goal persistence) and a group of factors relating to the influence of other goals (temptation, interference and facilitation), predict weight loss attainment. Secondly, we aimed to examine variables that relate to successful attainment of both goals simultaneously. Drawing primarily from Jung and Brawley (2010; 2011), our hypotheses were that those with higher goal persistence, self-efficacy, intergoal facilitation and lower intergoal interference and temptations affecting their goals would have greater

levels of weight loss goal attainment. Additionally, we hypothesized that those with higher levels of persistence, self-efficacy, and intergoal facilitation for both goals would be most likely to attain both goals simultaneously, whilst those with the highest levels of intergoal interference and temptation would be least likely to attain both goals simultaneously.

Method

Participants and Procedure

Participants were deemed eligible for the present study if they were currently pursuing a weight loss goal. One hundred and three participants with weight loss goals were recruited to complete a web-based questionnaire (M_{age} = 25.36±6.9 years, age range: 18.87-67.99 years, mean BMI = 26.31±5.1, BMI range: 20.32-53.93, 80% women). Participants were White (n = 84), South Asian (Indian, Pakistani and Bangladeshi) (n = 10), Black (n = 2) and other racial categories (n = 2). They were primarily students (n = 70) and young professionals (with an income of less than £20K per year). Student participants were recruited via email and web advertisements. They were offered compensation in the form of research credits or £5 on completion of the questionnaire. The young professionals were recruited via an internet-based research participation pool. They received compensation of £5 on completion of the questionnaire. The questionnaire consisted of three sections: The first section examined multiple characteristics influencing the pursuit of weight loss goals, the second section was identical to the first however, participants were required to respond to questions in terms of their non weight loss goal, and the final section examined interference and facilitation involved in managing both goals simultaneously.

Measures

Goals. Participants were required to specify one weight loss goal and one non weight loss goal that they were currently pursuing. In terms of weight loss goals participants were

told: “Think about a specific weight loss goal that you are currently striving for (via exercise and/or diet)”. Participants were instructed the following regarding their non weight loss goal: “Think of a goal that you are currently striving for that is completely unrelated to weight loss, exercise, nutrition or health. It must be a goal that is personally meaningful and important to you.” Participants were excluded from the analyses if their non weight loss goal was exercise, sport, nutrition or health related ($N = 25$). Of the non weight loss goals defined in the final sample, 52% of goals were academic goals, 23.9% were career goals, 2.5% were family goals, 2.5% were financial goals, 2.0% were social goals, and 11.9% were various other types of goals. Analyses using questions adopted from Jung and Brawley’s (2010) study, measuring value on a scale from 1 (*do not value this goal at all*) to 9 (*value this goal very much*), showed that participants valued both their weight loss and non weight loss goals equally ($M = 7.10$ $SD = 1.50$; $M = 7.40$ $SD = 1.57$, respectively).

Goal characteristics.

Self-efficacy. The self-efficacy items were developed based on the self-efficacy literature (Bandura, 1997). Participants were asked “To what degree do you feel you possess the ability to realise your goal?”, and “To what extent do you feel you have the capabilities necessary to attain your goal?” each measured on a 1 (*not at all able/capable*) to 9 (*very much able/capable*) point scale. The mean of the two items for each goal was used in succeeding analyses. (Cronbach α for weight loss and non weight loss goals were .82 and .79 respectively).

Goal persistence. Participants were required to rate their persistence in the pursuit of both their weight loss and non weight loss goals. Specifically, they indicated how much time, persistence, effort and attention they had invested in the previous month in the pursuit of both their weight loss and non weight loss goal. The items were adapted from Jung and Brawley

(2010). Responses were scored on a 1 (*little to none*) to 9 (*as much as it takes*) point scale. Participants' average score of the four subscales was calculated for the subsequent analyses (Cronbach α for weight loss and non weight loss goals were .82 and .88 respectively).

Temptation. A measure of the frequency with which participants experienced temptations impacting both goals was created for the current study based on the goals literature (Freitas et al., 2002). Participants were asked "Rate on the scale below how often you experienced temptations that you didn't plan to engage in, that lured you away from your goal and that may have impacted upon your goal", and "Rate on the scale below how frequently over the last month you have felt that you've given in to temptations that have affected your goal". These questions were rated on a 1 (*never*) to 9 (*always*) point scale. The average Cronbach α for the weight loss and non weight loss goals were .72 and .74 respectively.

Intergoal relations questionnaire (IRQ). Intergoal facilitation and interference were measured using the Intergoal Relations Questionnaire (IRQ; Riediger & Freund, 2004). The facilitation scale was used to examine both goals in two ways: Instrumental relations among both goals ("The pursuit of goal A sets the stage for the realization of your weight loss goal"), and overlapping goal attainment strategies ("How often can it happen that you do something in pursuit of goal A that is simultaneously beneficial for your weight loss goal?"). These items were measured from 1 (*not at all true/never*) to 5 (*very true/often*). Averaging these items yielded the facilitation composite (Cronbach's α = .84). Intergoal interference was measured in terms of time, energy and financial investment (e.g., "How often can it happen that, because of the pursuit of Goal A, you do not invest as much time/energy/money into your weight loss goal as you would like to?"), and in relation to incompatible goal attainment strategies ("How often can it happen that you do something in the pursuit of Goal A that is

incompatible with your weight loss goal?"). These items were measured from 1 (*never/very rarely*) to 5 (*very often*). Averaging these items yielded the interference composite (Cronbach's α = .73).

Goal attainment. Participants were asked to indicate how much they felt they had attained each of their goals over the past month. They were required to indicate "To what extent do you feel you have attained your goal?" and "To what degree do you feel your goal has been met?" These questions were rated from 1 (*not at all attained/met*) to 9 (*completely met/attained*). The items were adapted from Louro et al.'s (2007) multiple-goals research. The mean of the two attainment scores was summed for both goals (average Cronbach's α = .97.)

Control measures.

These measures were distributed at the start of the first questionnaire and were completed in the following order:

Social desirability. It has been found that those that respond in a highly socially desirable manner overestimate their ability to succeed at weight loss (Carels, Cacciapaglia, Rydin, Douglass, & Harper, 2006). Social desirability was measured using a 13-item version (version C) of the Reynolds Short-Form of the Marlowe-Crowne Social Desirability Scale (MCSD) (Reynolds, 1982). Participants answered true or false in response to 13 questions (e.g., "No matter who I'm talking to, I'm always a good listener"). Items were keyed in a socially desirable direction, with a high score indicative of a strong socially desirable response tendency (M = 6.64, SD = 2.50, α = .66).

Self-control. High trait self-control is a known predictor of weight loss success (Crescioni et al., 2011). In order to assess levels of self-control, participants completed the Brief Self-Control Scale (BSCS; Tangney, Baumeister, & Boone, 2004), in which they responded to 13 items on a 5-point scale (e.g., I am able to work effectively toward long-term

goals) with items ranging from 1 (*not at all*) to 5 (*very much*). Higher scores are indicative of greater self-control ($M = 37.5$, $SD = 5.8$, $\alpha = .70$).

Optimism and pessimism. Levels of optimism have been positively associated with problem-focused coping and the employment of positive health habits (Scheier & Carver, 1992). Thus, we controlled for levels of optimism and pessimism using the revised Life Orientation Test (LOT-R; Scheier, Carver, & Bridges, 1994). This consisted of 10 items requiring participants to respond on a 5-point scale with items ranging from 0 (*strongly disagree*) to 4 (*strongly agree*). Items tap both optimism (e.g., "I'm always optimistic about the future") and pessimism (e.g., "If something can go wrong for me, it will"). A single score was derived by reversing the negatively worded items and summing the six items. Higher scores are indicative of greater optimism ($M = 12.72$, $SD = 4.94$, $\alpha = .70$).

Results

Descriptive statistics for the weight loss and the multiple-goal variables are presented in Table 1.

Table 1

Means and Standard Deviations of Weight loss (WL) and Non Weight loss (NWL) Goal Characteristics

Characteristic (range)	WL *M (SD)*	NWL *M (SD)*
Weight loss attainment (1-9)	4.35 (2.47)	5.32 (2.29)
Self-efficacy (0-9)	6.08 (2.01)	6.53 (1.84)
Goal persistence (1-9)	5.05 (2.09)	5.98 (2.21)
Temptation (1-9)	6.08 (1.54)	5.31 (1.87)
Intergoal Interference[a] (1-5)	1.88 (0.62)	
Intergoal Facilitation[a] (1-5)	2.81 (1.15)	

Note: [a]Intergoal interference and facilitation represent the combined contribution of both the weight loss and the non weight loss goal collectively.

Weight loss Goal Characteristics and Weight loss Attainment

The first aim of the current study concerned the examination of how individual weight loss characteristics predicted weight loss attainment. Two multiple regression analyses were employed to investigate the contribution of each weight loss characteristic in predicting weight loss attainment. All weight loss goal characteristics were assessed whilst controlling for the following three variables: Social desirability, trait self-control, and optimism/pessimism. The first regression (n = 98) investigated the self-regulatory goal characteristics of self-efficacy and goal persistence and their relationship to weight loss goal attainment. After controlling for social desirability (β = .10, p = .171), trait self-control (β =.22, p = .003), and optimism/pessimism (β = -.04, p = .960), the first regression found that

both variables positively predicted weight loss attainment: Self-efficacy (β = .37, p <.001) and goal persistence (β = .39 p <.001) [F (5, 93) = 22.08; p <.001, R^2 = .54].

The second multiple regression (n =79) explored the influence of other goals (i.e., intergoal interference, intergoal facilitation, and temptation) on weight loss goal attainment. After controlling for social desirability (β = .17, p =.532), trait self-control (β = -.05, p = .058), and optimism/pessimism (β = .24, p = .007), temptation negatively predicted weight loss attainment (β = -.57 p < .001), whilst intergoal facilitation positively predicted attainment (β =.22, p = .033); intergoal interference was not a significant predictor (β = -.10, p =.324) [F(5, 73) = 11.01; p <.001, R^2 = .47]. As some research (e.g., Riediger & Freund, 2007) has found that older adults spend more time engaged in goal pursuit and report more facilitation amongst multiple-goals, we repeated the analyses by excluding older participants (55+), however the results remained the same.

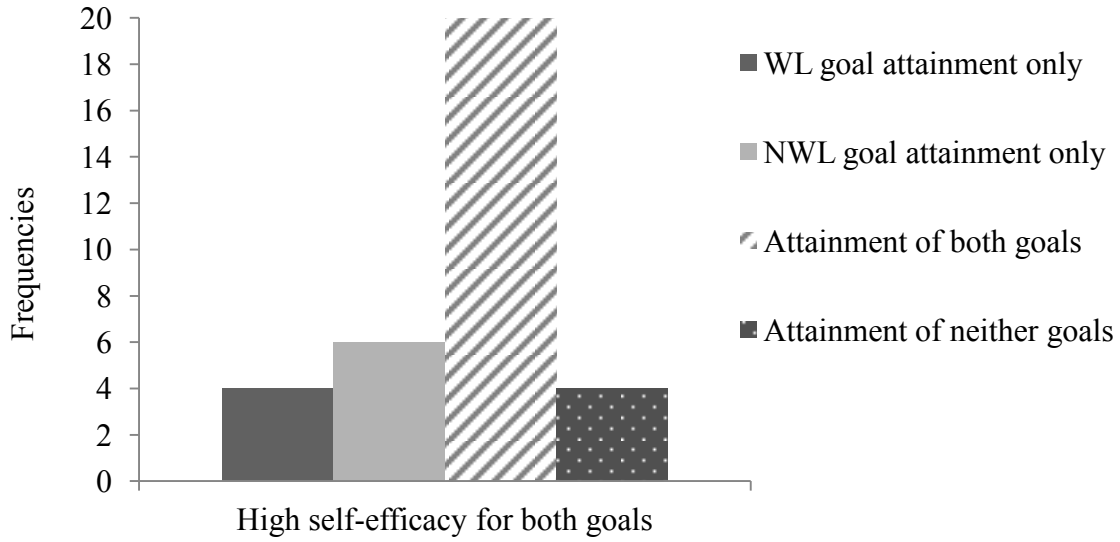
Multiple-Goal Characteristics and Multiple-Goal Attainment

The second aim of the current study concerned the examination of how goal characteristics (i.e., self-efficacy and goal persistence) and the influence of other goals (i.e., temptation and facilitation) predict concurrent attainment of both weight loss and non weight loss goals. Intergoal interference was not included in the analyses as it failed to predict weight loss attainment in the regressions above. A one way chi-square test was conducted in order to detect significant differences in the frequency of individuals successfully attaining both goals simultaneously rather than one of the goals or neither of the goals. The variables were created by conducting a median split on the goal characteristics categorizing them into high and low categories. A median split was also run on the attainment variables, creating four categories: Attainment of both goals, attainment of neither goals, attainment of the weight loss goal only and attainment of the non weight loss goal only. Among those with high self-efficacy for both

goals, there was a significantly greater number of individuals who were successful in attaining both goals simultaneously, than one of the goals only or none of the goals ($\chi^2 = 21.05$, $p < .001$; Figure 1). This was also the case for higher persistence for both goals ($\chi^2 = 18.67$, $p < .001$; Figure 2). Additionally, those who experienced the highest levels of temptation were the least likely to achieve success in attaining both goals ($\chi^2 = 13.52$, $p = .004$; Figure 3). The number of individuals with high intergoal facilitation was not predictive of goal attainment classification ($\chi^2 = .81$, $p = .84$)[1].

Figure 1

Individuals with High Self-Efficacy for Both Goals and the Frequency of their Goal Attainment for their Weight Loss Goal (WL), Non Weight Loss Goal (NWL), both Goals and neither Goals



[1] Additional analyses found that those with high SE for WL goals and low SE for NWL goals were more likely to attain their weight loss goals than their NWL goals, both goals or neither goals; those with high SE for NWL goals and low SE for WL goals were more likely to attain their NWL goals than their WL goals, both goals or neither goals ($\chi^2 = 10.33$, $p = .01$). There were not enough cases to complete analyses for those with low SE on both goals.

Figure 2

Individuals with High Goal Persistence for Both Goals and the Frequency of their Goal Attainment for their Weight Loss (WL) Goal, Non Weight Loss (NWL) Goal, both Goals and neither Goals

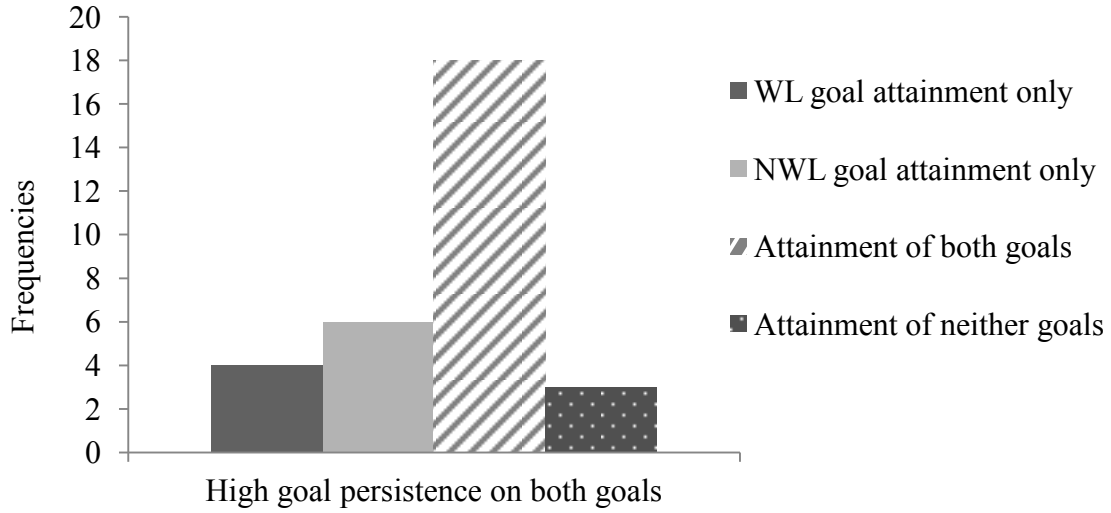
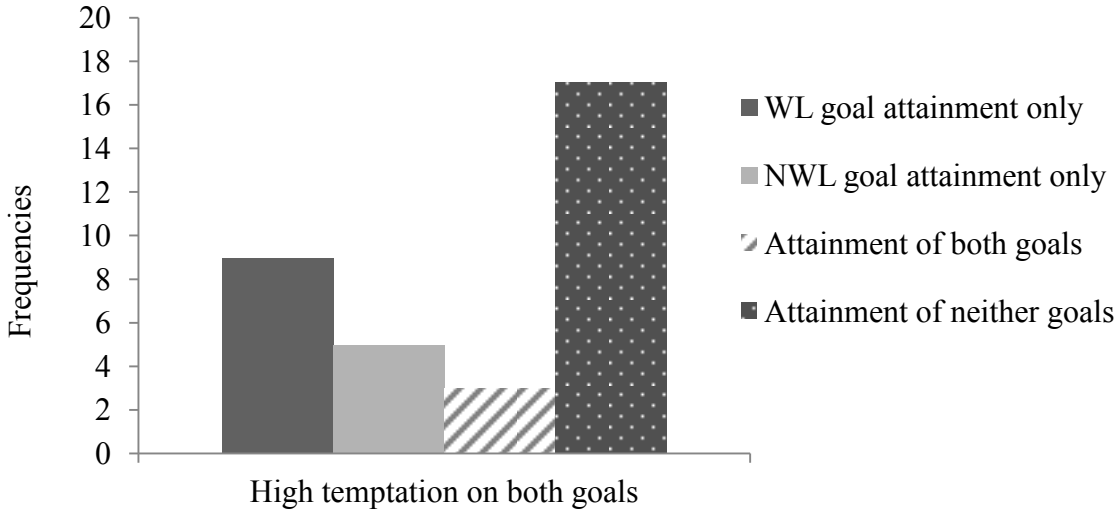


Figure 3

Individuals with High Temptation for Both Goals and the Frequency of their Goal Attainment for their Weight Loss (WL) Goal, Non Weight Loss (NWL) Goal, both Goals and Neither Goals



Discussion

Goals do not occur in isolation. Rather individuals typically pursue multiple-goals at once in an ongoing process of resource allocation, prioritization and self-regulation. To date, there has been limited research examining how individuals manage weight loss in a multiple-goal context. Considering so many individuals fail to attain their weight loss goals (Byrne, 2002; Green, Larkin, & Sullivan, 2009; Perri, 1998), it is necessary to investigate the self-regulatory characteristics that relate to successful weight loss goal attainment, whilst managing other goals, in order to determine pathways for future intervention. The current study extends the past literature, through identifying the characteristics that relate to successful attainment of both a weight loss and a non weight loss goal simultaneously. Our results demonstrate that successful attainment of the weight loss goal was positively related to the following variables: High self-efficacy and goal persistence, intergoal facilitation and low temptation. We also found that those with higher self-efficacy and persistence for both goals were more successful in attaining both goals simultaneously, whereas those with higher temptations for both goals were less successful in attaining both goals simultaneously.

Goal persistence was found to be positively related to weight loss goal attainment. The greater amount of time, energy, persistence and attention an individual gave to their goal, the greater their likelihood of weight loss success. Interestingly, a high level of persistence on both goals was found to be related to attainment of both the weight loss and the non weight loss goal simultaneously. Although it is understandable that a large amount of persistence towards an individual's weight loss goals would result in weight loss success, one would imagine that exerting a large amount of effort towards two goals would be negatively related to goal attainment due to competing demands for limited resources. However, this was not the case in our study. Our finding is consistent with past research on exercise adherence by Jung

and Brawley (2010; 2011) who found that persistence with exercise goals was positively related to multiple-goal attainment. The authors used self-efficacy theory (Bandura, 1997) to explain this finding. They argued that past accomplishments at simultaneous goal management increases self-efficacy and persistence towards concurrently managing multiple-goals. Additionally, recent research into weight loss goal attainment has found that those who set themselves high weight loss goals (greater than a 10% loss of initial body weight) had greater effort and persistence towards their weight loss; both of these variables were subsequently related to weight loss goal attainment (De Vet et al., 2012). It may be that in the current study those with greater persistence were those with goals of greater than 10% loss of their body weight, however further goal-specific research would be needed in order to verify this link. In our study we also found that self-efficacy positively predicted both weight loss and dual goal attainment. Our finding is consistent with the weight loss goals literature which highlights the importance of self-efficacy in weight loss attainment (Kitsantas, 2000; Byrne, 2002; Elfhag & Rössner, 2005). Additionally, individuals who had the highest self-efficacy for both goals were most likely to attain both goals simultaneously. It may be that increases in confidence from attaining one goal may subsequently enhance an individual's confidence in succeeding at multiple-goals.

Temptation was found to negatively predict goal attainment; the higher the frequency of temptations experienced the lower the likelihood of success in weight loss. In terms of multiple-goal pursuit, those who had the highest temptations for both goals had the lowest levels of success with both goals. It has previously been posited that the allure of temptation can have a negative impact on one's goal attainment (Trope & Fishbach, 2000; Freitas et al., 2002), including weight loss success (Carels et al., 2001; Kroese, Evers, & De Ridder, 2009). A recent study by Hofmann, Baumeister, Förster, and Vohs (2011) found that those most

successful at resisting temptations were the ones who experienced the least temptation. Similarly, in the current study it may be that rather than having to rely on their ability to resist one urge after another, those who experienced the lowest frequency of temptations had managed to engineer their lives to minimize temptations and as a result were able to attain both goals successfully.

Finally, the present study examined the interference and facilitation of both goals and their relationship to concurrent multiple-goal attainment. To our knowledge, the current study is one of the first to apply the IRQ in a weight loss context. Results found that interference and facilitation differentially contributed to goal attainment. Similarly to past research on exercise that employed the IRQ, the current study found that interference was not related to goal attainment (Riediger & Freund, 2004). Facilitation, as in past research (Riediger, 2007;Riediger & Freund, 2004; Riediger & Freund, 2007) was related to successful goal attainment. The behaviours involved in pursuit of the weight loss goal were simultaneously beneficial in the attainment of the non weight loss goal (e.g., eating healthily can positively impact both weight loss but also academic performance, thus enhancing the attainment of both goals). It may be that the more facilitative one's goals are the less depleted the finite resources needed to successfully pursue multiple-goals become. In a similar way to temptation above, those that are successful in multiple-goal attainment may have engineered their lives to maximize the efficiency of the distribution of their resources, thus facilitating multiple-goal attainment. Identifying the pathways by which we can enhance the mutual facilitation of one's goals whilst managing weight loss is an important consideration for future weight loss interventions. Additionally, the findings of the differential contribution of interference and facilitation to goal pursuit in the current study lend support to the importance of examining interference and facilitation as individual goal dimensions. To date this measure

has mainly been examined in an exercise context (Riediger, 2007; Riediger & Freund, 2004; Riediger & Freund, 2007). Its construct validity has been measured in old and young adults with exploratory factor analyses indicating a one-factor solution as well as excellent internal consistency (Cronbach's α=.94) (Riediger and Freund 2004). It has also been used to predict wellbeing with intergoal interference being negatively related to wellbeing. However, future research is needed to test the validity of the IRQ scale specifically for weight loss research.

In summary, the current study offers an important insight into the self-regulatory characteristics necessary for success when managing a weight loss and a non weight loss goal simultaneously. The results indicate that in order to be more successful at weight loss, one needs to have high self-efficacy to achieve their goal, be highly persistent, experience intergoal facilitation and less frequent temptations. To successfully attain both goals simultaneously, individuals must possess high levels of goal persistence and self-efficacy and avoid high levels of temptation. On a positive note, the current study demonstrates that one can successfully pursue and attain a weight loss goal alongside another goal. The current findings are among the first to emphasise the significance of considering the influence of other goals and their impact on weight loss goals, and highlight the importance of the identification of possible temptations on one's goals in order to engineer one's life to avoid these threats. However, a two-goal comparison may oversimplify the numerous competing demands placed on an individual's daily resources, therefore, future studies may benefit from examining the concurrent management of several goals.

CHAPTER 4

AN ECOLOGICAL MOMENTARY ASSESSMENT OF LAPSE OCCURRENCE IN DIETERS

This manuscript is under review with the *Annals of Behavioral Medicine*

Abstract

The current study aims to investigate the factors related to dietary lapse occurrence in a predominantly overweight community sample. An ecological momentary assessment (EMA) methodology, via mobile phone-based diaries was employed to instantaneously record dietary lapse occurrences in a group of dieters ($N = 80$; $M_{age} = 41.21 \pm 15.60$ years; $M_{BMI} = 30.78 \pm 7.26$; 80% female) over a seven day period. Analyses indicated that lapses were positively associated with the strength of temptation, the presence of others, and the environment (exposure to food cues) in which the dieters were in; lapses were more likely to occur in the evening and were negatively associated with the use of coping mechanisms. Additionally, lapse occurrence was found to mediate the relationships among the above predictors of lapse and the self-efficacy to resist future temptations. The results provide an insight into the occurrence of lapses in a predominantly overweight sample and have implications for interventions focusing on weight loss maintenance and relapse prevention.

Keywords: Lapse, temptation, self-control, weight maintenance, ecological momentary assessment.

Introduction

Regardless of the increased knowledge, attention, and interest surrounding obesity, maintaining weight loss remains an unattainable goal for many individuals (Green et al., 2009). As knowing the means by which to lose weight appears to be insufficient for successful long-term weight maintenance, researchers have called for a focus on the psychological factors that lead to successful weight maintenance (Byrne et al., 2003). One such factor is the ability to resist short-term temptations in order to pursue long-term goals. This is known as willpower and is increasingly acknowledged as a key element influencing successful weight management (Crescioni et al., 2011). Willpower is a term used interchangeably with self-control to describe the effortful regulation of the self by the self (Duckworth, 2011). 'Lack of willpower' has been ranked by British dieticians as more important to the development of obesity than genetic factors (Harvey et al., 2002). Determining why individuals' willpower or self-control fails is therefore crucial to help prevent dietary relapse and preserve weight maintenance success.

The role of self-control in dealing with temptation (i.e., the urge to give in to a short-term desire which is often inconsistent with one's long-term goal) has mainly been examined in laboratory conditions; there is minimal research concerning the operation of temptations in everyday life (Hofmann, Friese, & Wiers, 2011). Additionally the majority of field-based research to date has been overly reliant on retrospective data. Such data can underestimate the strength or frequency of dietary lapse (i.e., giving in to temptation), as such characteristics are often subject to recall bias and inaccuracies (Stone & Shiffman, 2002). The small number of studies investigating how temptations operate outside laboratory conditions have sought to overcome the problems associated with retrospective recall by employing 'real time' methods, such as ecological momentary assessment (EMA). EMA using electronic diaries or phones in

particular (as opposed to employing paper and pencil diaries) is a data collection technique which allows for multiple, repeated, immediate reports of people and their activities in their natural everyday environment (Stone & Shiffman, 2002). EMA methods are particularly suited to study daily temptations as they are able to capture the immediate and often fleeting nature of a self-control dilemma (e.g., a dieter trying to decide whether or not to forgo the dessert course in a restaurant).

EMA studies (e.g., Carels, Douglass, Cacciapaglia, & O'Brien, 2004; Hofmann, Baumeister, Förster, & Vohs, 2011) have highlighted the importance of examining a number of daily intrapersonal (e.g., perceived strength of temptations), situational (e.g., presence of others), and psychological (e.g., coping responses) factors, and to a lesser extent, general dispositions (e.g., self-control) related to lapse. Carels et al. (2004) examined dietary lapse instances in a group of women ($N = 37$) in the final week of a weight loss intervention. They found that coping responses and mood determined whether an individual gave in to a lapse or not. However, dietary lapses were limited in number ($M = 2.7$, $SD = 1.9$), which the authors felt was a potential drawback of using paper-and-pencil diaries.

Hofmann et al. used electronic personal data assistants (PDAs) to record a multitude of 'everyday desires/temptations' experienced in a group of 205 university students over a period of a week. Each time they received a beeper message, participants recorded on the PDAs whether or not they were experiencing a desire, the strength of the desire, the conflict it caused, if they tried to resist it and whether they enacted on it. Results emphasized the importance of investigating the strength of desires in that as desire strength increased, an individual was less able to resist giving in to that desire. Additionally, results indicated that desire strength, conflict with one's goals, resistance and lapse were differentially predicted by situational (e.g., the presence of others) and dispositional variables (e.g., self-control). The

aim of the Hofmann et al. (2011) study was to document 'everyday desires/temptations' and thus it had a broad focus on a number of different types of temptation (eating, drinking, socializing, and sleeping). Therefore, it is not possible to determine from this study the specific variables that relate to dietary temptations alone. The current study aims to build on the above findings by using electronic EMA methods to assess the daily factors associated with lapse occurrence in a predominantly overweight community sample.

The self-control needed to successfully pursue long-term goals may be influenced by a multitude of daily fluctuating factors (intrapersonal, situational and psychological; presented in *italics* below) which can determine whether and individual will lapse or not. With regard to intrapersonal factors, as shown by Hofmann et al. (2011), perceived temptation *strength* can predict lapse occurrence. Further, repeated exertions of self-control fatigue or *deplete* one's limited self-control resource and hence one's ability to continually resist temptations (Baumeister et al., 1998). In addition, levels of *stress* have been linked with increased food consumption (Royal & Kurtz, 2010). Coping with stressors requires an individual to override or stop thoughts, urges and emotions and thus uses up self-control strength (Muraven & Baumeister, 2000). Moreover, running low on energy (i.e., being in a state of *hunger*) may have an impact on one's ability to resist temptation (Carels et al, 2001). The act of self-control causes glucose to drop below optimal levels, thus making one vulnerable to temptation (Hagger et al., 2010).

Previous research has indicated a number of situational factors that may be involved in the process of resisting temptation. For example, it has been found that the *presence of others* in social situations where food is available can contribute to increased consumption (Wansink, 2004). Additionally, a person's *environment* (i.e., their exposure to food cues) has been associated with overeating (Grilo et al., 1989). Those with dieting goals may make efforts to

control their environment by removing tempting foods and avoiding situations where they feel vulnerable to temptation, however, unexpected exposure to temptations may offset their self-control capabilities (Baumeister et al., 1998).

Previous research has also examined a number of psychological characteristics as predictors of how people react in tempting situations. For example, *coping responses* can distinguish between successfully dealing with temptation and lapsing (Grilo et al., 1989; Carels et al., 2004). In a tempting situation individuals may try to reduce their valuation of temptations (e.g., high calorie snack) whilst at the same time boost their valuation of their focal goal (e.g., diet) in order to protect the latter (Fishbach et al., 2003). Fishbach et al. also demonstrated that those who think of their long-term weight loss goal, in addition to the importance of that goal, when faced with temptation are less likely to lapse. However, to date such coping responses have only been measured in relation to a single isolated incidence of temptation.

Having high levels of self-efficacy (Bandura, 1997) has been repeatedly linked to weight loss success (Kitsantas, 2000; Byrne, 2002; Elfhag & Rössner, 2005). Investigating how future self-efficacy is linked to dietary relapse has been emphasized as a key area for weight loss research (Carels et al., 2004), however, the empirical evidence on this to date is scarce. In this study we examine how the aforementioned intrapersonal, situational, and psychological variables indirectly predict future self-efficacy via lapse occurrence.

Drawing from the above gaps in the extant literature, the current study aims to synthesize some of the diverse intrapersonal, situational, and psychological factors that have been previously associated with weight loss success and failure, and investigate whether these variables can also predict successful or unsuccessful resistance to dietary temptations in a sample of community dieters. To our knowledge, this is the first study to employ EMA with

mobile phones to record the longitudinal contribution of a diverse range of variables in predicting temptation and dietary lapse occurrences in an overweight community sample in everyday life situations.

Method

Participants

The sample included 80 participants (M_{age} = 41.21±15.60 years; M_{BMI} = 30.78±7.26, 80% female). Weight status was established by inspecting current slimming records; in the absence of such records participants self-reported their most recent weight (n = 49). Participants were obese (33%), overweight (29%), normal weight (17%), morbidly obese (14%), or their weight status was unspecified (7%). Participants completed a screening questionnaire to ensure they were currently dieting to lose weight (81.2%) or dieting to maintain their weight (18.8%). The majority was in full-time employment (40%); the remaining were university students (28%), in part-time employment (14%), retired (8%), householders (5%), unemployed (4%), or their employment status was unspecified (1%). Participants were White (80%), South Asian (Indian, Pakistani and Bangladeshi; 12%), Black (6%), or of other ethnic origin (2%). The majority of the participants' highest qualification was A-level education (30%). Participants' socioeconomic status (SES) was a continuous numerical score established based on current postcode and geo-demographic analysis software ("Cameo," 2012). The mean SES score was 799 (SD = 143.16), just above the UK average of 750. Participants were recruited from local weight loss groups (45%) or were dieting on their own. Ethical approval for the study was granted by a British University ethics committee.

Procedure

Upon receipt of the screening questionnaire and informed consent, participants were invited to an individual meeting. During this meeting they completed a demographics questionnaire (i.e., height, weight (if not available via slimming club records), age, gender, occupation, home postcode, and ethnicity) and questionnaires measuring the dispositional factors of self-control, eating restraint, self-regulatory success, and mindfulness. Following questionnaire completion, participants were provided with a phone (Samsung B2100) which was enabled with an application to record their daily temptations for the next seven days. Each application contained a questionnaire with 15 items relating to the participants' recorded instances of temptation and lapse. During the meeting all participants were given individual verbal and written instructions on how to recognise temptations and lapses, how to record these on the phone application, and how to respond to the 15 questionnaire items. Temptations were defined as ''a sudden urge to overeat, eat a forbidden food, etc. in which you felt you had come close to the brink of breaking your diet", and lapses were defined as ''an incident where you felt that you broke your diet (e.g., overate, ate a forbidden food, etc.)''(Carels et al., 2001, p.311). Participants were instructed to fill out the questionnaire on the phone as soon as possible or at least within 15 minutes of being tempted or having lapsed. After a week of diary entries participants returned the phone and completed a feedback questionnaire evaluating their compliance with the study procedures, using items adapted from Carels et al. (2004) .

Measures

***Phone diary*.** On experiencing a temptation, participants were firstly required to indicate whether they lapsed by selecting *Yes* or *No*. Participants then responded to a series of 15 questions which tapped eight relevant variables (Table 1) based on previous weight loss and self-control research (Carels et al., 2001, 2004; Fishbach et al., 2003; Hofmann et al.,

2011; Muraven & Baumeister, 2000). The questions examined the perceived strength of temptation and other intra-personal variables such as depletion, stress, and hunger (all rated from 1, *not very,* to 7, *extremely*). Next, participants rated situational factors on their temptations (1, *not at all,* 7, *very much*) such as the influence of others, and the environment in which the temptation became available (whether the temptation was unexpected (by selecting A on the keypad) or whether they sought for it (by selecting B). Participants then rated their attempts to cope with the temptation in terms of two coping strategies: Thinking about their long-term weight loss goal, and thinking about how important weight loss is to them (1, *not at all,* to 7, *very much*). Finally, participants were asked, thinking of their current temptation or lapse, 1. How confident they felt in terms of pursuing their future weight loss goals and 2. How capable they felt in terms of pursuing their future weight loss (1, *not very,* to 7, *extremely*).With the exception of hunger, environment and coping, the other five variables (strength, stress, depletion, the presence of others and future self-efficacy) were measured with two very similar items each and, therefore, their average score was used (average intra-variable *r* across the 7 days = 0.81).

Table 1

Descriptive Statistics of Daily Predictors of No Lapse and Lapse

Variable (range)	Temptation without lapse *M (SD)*	Temptation with lapse *M (SD)*
Intrapersonal variables		
1. Perceived strength of temptation (1-7)	4.80 (1.36)	5.37 (1.33)
2. Depletion (1-7)	3.83 (1.68)	4.12 (1.84)
3. Stress (1-7)	3.24 (1.42)	3.41 (1.60)
4. Hunger (1-7)	4.12 (1.95)	3.70 (1.91)
Situational variables		
5. Presence of others (1-7)	2.84 (2.09)	3.46 (2.34)
6a. Environment-sought out temptation	303	203
6b. Environment-unexpected temptation	170	219
Psychological variables		
7a. Coping-long-term thinking (1-7)	4.87 (1.66)	3.31 (1.70)
7b. Coping-importance of goal (1-7)	3.31 (1.68)	4.78 (1.63)
8. Future Self-efficacy (1-7)	4.35 (1.32)	3.68 (1.46)

Note. [1]Environment was a binary variable; participants had to choose one of two options: 0 = temptation unexpected, 1 = temptation sought out. Thus, for this variable frequencies rather than means and standard deviations are presented.

Data Analysis.

We employed multilevel modelling, using the MLwiN software (version 2.25; Rasbash, Browne, Healy, Cameron, & Charlton, 2012), as temptation events were nested within individuals. Models were constructed to predict strength of temptation, which was treated as a continuous outcome variable, and lapse occurrence which was treated as a binary (0 = no lapse, 1 = lapse) outcome variable. We first explored whether strength of temptations or lapses were stronger/more frequent on weekdays or weekends, and in the morning, afternoon, or evening, by including these time period classifications as categorical independent variables in separate multilevel models.

Next, we examined whether a variety of demographic predictor variables were associated with strength of temptation and lapse, respectively. Specifically, gender (coded as male = 0, female = 1), age, ethnicity (categorized as Asian, Black, White, and Other), socio-economic status, number of dependent children, and body mass index (BMI) were entered one at a time as predictors into the level 2 equation. Demographic variables were retained in the models if an association with the outcome variable was statistically significant. Building on these models, a number of dispositional variables which have been previously linked to weight maintenance success were measured; trait self-control (Tangney et al., 2004), restrained, emotional and external eating behaviours (Van Strien et al., 1986) perceived self-regulatory success in dieting (Fishbach et al., 2003), and mindfulness (Brown & Ryan, 2003). These were standardized, grand-mean centred, and entered as predictor variables, one at a time, into the level 2 equation. Only statistically significant associations among these dispositions and the two outcome variables were retained in the final multilevel models.

After establishing these baseline models, time-varying (level 1) scores of intra-personal, situational, and psychological variables (Table 2) were included as predictors of

strength of temptation and lapse in the respective multilevel models. These variables were standardized and group-mean centred to provide pure estimates of the within-person associations and, importantly, to remove all between-person variance (Enders & Tofighi, 2007). As an indicator of effect size, R_1^2 values were calculated for both dependent variables by comparing the final models with unconditional models. These values indicate the proportional amount of error of prediction reduced from the unconditional model to the final model at the within-person level (Hox, 2010). To establish these values for the binary variable of lapse occurrence, an approximation of the level 1 variance term was established by treating lapse occurrence as a continuous variable (Goldstein, Rasbash, & Browne, 2002).

Our final analysis tested whether the relationships among the statistically significant time-varying predictors of lapse occurrence (as identified in the analyses above), and the outcome variable of participants' self-efficacy to resist future temptations were mediated by lapse occurrence. In line with the guidelines outlined by Krull and MacKinnon (2001), we first examined whether the time-varying independent variables predicted the mediator (i.e., lapse occurrence). This was followed by identifying whether lapse occurrence predicted the outcome variable (i.e., future self-efficacy), after controlling for the independent variables. If these criteria were met, the significance of each indirect effect was examined using Sobel Z score.

Results

Descriptive Statistics

Participants reported 898 instances of temptation, an average of 11.22 (*SD* = .41) temptations per person over the seven day recording period. Of these instances, participants lapsed on average 52.4% of the time. Average perceived strength of temptation (measured from 1-7) was above moderate (*M* = 5.1, *SD* = 1.37); 15% of temptations were listed as *extremely* strong. Table 1 presents the descriptive statistics of the daily intrapersonal, situational, and psychological factors included in this study.

Diary adherence and reactivity.

Upon returning their phone, participants were asked to complete a questionnaire measuring their adherence to the diary entries. On average, participants reported skipping 3.7 (*SD* = 2.80) no lapse entries and 1.30 (*SD* = 1.65) lapse entries throughout the seven day recording period. When asked how much keeping a diary influenced their eating behaviours, the majority of individuals (30%) indicated *a little*. The majority of participants either *disagreed* (46.7%) or *strongly disagreed* (31.1%) with the statement that they were more tempted whilst keeping a diary; 52.3% and 29.5% either *disagreed* or *strongly disagreed* that they were more likely to lapse whilst keeping a diary. However, the majority of participants either *strongly agreed* (42%) or *agreed* (28%) that they were more aware of their behaviour whilst keeping the diary.

Do Strength of Temptation and Lapse Occurrence Vary as a Function of when the Temptation Occurred?

No differences in the strength of temptations were found at weekend compared to weekdays (*b* = .02, *p* = .81), nor across mornings, afternoons, or evenings (*b* = -.24 to .05, *p* =

.06 to .59). Lapses were equally likely at weekend compared to weekdays (b = .04, p = .82), however, lapses were more likely in the evening compared to the morning (b = .60, p = .002) and afternoon (b = 38, p = .01).

Predictors of the Strength of Temptation and Lapse Occurrence

None of the demographic or dispositional variables were significantly associated with perceived strength of temptation or lapse; therefore, they were not included in subsequent analyses. We then included all the variables of primary interest in this study, namely the time-varying intra-personal, situational, and psychological predictors. Standardized coefficients shown in Table 2 indicate that stress, hunger, the environment (whether the temptation was sought for or unexpected), and other people being present, were positively associated with the strength of temptation. Depletion and coping strategies (thinking of one's long-term weight loss goal, as well as the importance of their goal) did not predict the strength of temptation. The final model explained 11% of the within-person variance in strength of temptation. Regarding lapse occurrence, the strength of the temptation, others being present, and the tempting environment increased the likelihood of lapsing. Moreover, coping strategies (thinking of one's long-term weight loss goal and the importance of their goal) were negatively associated with lapse. Depletion, stress, and hunger were not associated with lapses. The final model explained 27% of the within-person variation in lapse occurrence.

Does Lapse Occurrence Mediate the Relationships among the Predictors of Lapse and Self-Efficacy to Resist Future Temptations?

According to MacKinnon and Fairchild (2009), direct relationships between the independent variable and the outcome are not necessary for testing mediation; therefore we did not examine such relationships. Rather, in our first step in testing for this mediation, we

ran a multilevel model that included only the significant predictors of lapse occurrence reported in Table 2. We did not include the non significant predictors as the previous models established that they would not meet the first criterion in establishing mediation (i.e., the independent variable must significantly predict the mediator). In the second step we tested a model in which lapse occurrence significantly and negatively predicted self-efficacy to resist future temptations, after controlling for the significant predictors in step 1. This implied mediation effects, which were confirmed by statistically significant Sobel Z scores for indirect effects (Table 3). The strongest standardized indirect effects were found for the two coping variables.

Table 2

Final Multilevel Models Exploring Predictors of Strength of Temptation and Lapse Occurrence

	Outcome Variable	
Predictor Variable	Perceived Strength of Temptation	Lapse Occurrence (0 = no lapse, 1= lapse)
Fixed Effects		
Intercept	5.263***	0.249*
Intrapersonal Variables		
Perceived strength of temptation	-	.326**
Depletion	-.024	.147
Stress	.176**	.023
Hunger	.279***	.087
Situational Variables		
Presence of others	.130**	.300**
Environment (unexpected vs. sought out temptation)	.137**	.279**
Coping (long-term thinking)	-.191	-.715***
Coping (importance of goal)	-.071	-.627**
Random Effects		
Intercept	.429***	.582**
Level 1 error	1.330***	-
R_1^2	.110	.268

Note. * $p < .05$, ** $p < .01$, *** $p < .001$.

The Level 1 error term is not reported for the logistic model because no single variance value can be obtained in binary response models (Rasbash et al., 2012).

Table 3

Multilevel Models Exploring Whether the Significant Intrapersonal, Situational, and Psychological Variables in Table 2 Indirectly Predict Self-Efficacy to Resist Future Temptations via Lapse Occurrence

Predictor Variable	Mediation Step 1 Outcome: Lapse Occurrence (0=no lapse, 1= lapse)	Mediation Step 2 Outcome: Self-Efficacy	Indirect Effects
Fixed Effects			
Intercept	0.251*	3.965***	-
Perceived strength of temptation	.360***	-.039	-.149***
Presence of others	.297**	.009	-.123**
Environment (unexpected vs. sought out temptation)	.291***	-.056	-.120**
Coping (long-term thinking)	-.727***	.064	.300***
Coping (importance of goal)	-.617**	.153**	.255**
Lapse occurrence	-	-.413***	-
Random Effects			
Intercept	.576**	1.564***	-
Level 1 error	-	.410***	-
R_1^2	.264	.212	

Note. * $p < .05$, ** $p < .01$, *** $p < .001$.

Discussion

The current study looked at dietary temptations, lapse occurrences and their daily intrapersonal, situational, and psychological predictors in a group of overweight dieters. To our knowledge, this is the first study to specifically examine these variables in relation to dietary temptations and lapse occurrences; in particular it is the first of its kind to do so through the medium of an EMA-based mobile phone application.

Results indicated that dietary lapses occur frequently (just over 50% of the time an individual is tempted) and could be due to a number of different daily fluctuating variables. The majority of participants reported that they were more aware of their behaviour whilst keeping a diary, a finding also reported by Carels et al. (2004). The process of keeping a daily record of certain occurrences is a method of self-monitoring and self-monitoring has been repeatedly linked to increased behavioural awareness (for a review see; Burke, Wang, & Sevick, 2011). It is therefore possible that such awareness may have had an impact on both the frequency of lapse occurrence and the factors influencing it. For example, asking about coping strategy options may prime participants to employ these strategies when normally they would not have used them (Carels et al., 2004). Nevertheless, the average number of lapses recorded in the current study ($M = 5.97$, $SD = .41$) was considerably higher than that of other weight-related research ($M = 2.7$, $SD = 1.9$, Carels et al., 2004; $M = 1.5$, $SD = 1.7$, Carels, Cacciapaglia, Rydin, Douglass, & Harper, 2006). The comparatively higher frequency seen in the current study lends support for the use of mobile phone applications for EMA investigations of dietary temptations and lapses. The findings of the current study allude to the potential utility of future specialized mobile phone applications that can be used as monitoring tools for individuals on weight management programs so that they can record

personal and situational circumstances under which they experience dietary temptations and/or lapses.

We first examined the predictive ability of various intrapersonal variables from the weight management and self-regulation literatures. We found that the stronger the temptation, the more likely a participant was to lapse. This finding was similar to that of Hofmann et al. (2011) who studied a number of different types of temptation. Hunger is known to increase the want for food, often increasing the temptation to eat, especially in the overweight (Ouwehand & De Ridder, 2008). Our finding that hunger did not predict lapse occurrence, whilst inconsistent with a number of previous studies (Grilo et al., 1989; Carels et al., 2001), is in agreement with a similar EMA based dietary temptations study by Carels et al., (2004). Carels et al. suggested that the dieters in their study, through experience, may have become accustomed to certain levels of hunger and thus were less likely to lapse. Indeed research has demonstrated via the 'cold-to-hot empathy gap' that those in a cold state (i.e., not hungry) overestimate their capacity for self-control and are much more likely to give in to temptation than those in a hot state (i.e., hungry) (Nordgren & Chou, 2011). Thus, it may be that participants experiencing hunger in the current study were more aware of their vulnerability to temptation whilst hungry or had grown accustomed to experiencing hunger potentially protecting them against lapse.

The finding that depletion was not related to temptation strength or lapse occurrence was inconsistent with that of previous research that linked depletion to diminished self-control and subsequent vulnerability to dietary temptation (Baumeister et al., 1998). However, the non significant findings in the current study may be due to the subjective nature of the measurement of depletion. Previous studies examined depletion objectively by investigating differences between experimental and control groups in a self-control task (e.g., hand grip

strength) following a depleting task (e.g., thought suppression or unsolvable anagrams) in which participants were blinded to the fact that their self-control was being depleted (Baumeister et al., 1998). It is possible that the participants in our study were unable to recognize the signs of depletion and thus were unable to report it accurately. Indeed, the finding demonstrating differences in lapse occurrence over the course of a day provides support for this speculation. The result that participants were most likely to lapse in the evening may indicate that they became depleted throughout the course of the day perhaps due to resisting multiple morning and afternoon temptations. The depletion model posits that engaging in multiple acts of self-regulation can deplete one's subsequent ability to control their behaviour (Hagger et al., 2010). Therefore participants may have become more depleted as the day went on making them vulnerable to lapsing in the evening. In support of this, the self-control literature has found that failures at self-control are more likely later in the evening than during the day (Baumeister, Heatherton, & Tice, 1994). Thus although participants may have been unable to detect their perceived levels of depletion via self-report, they may have through repeated resistance of temptation over the course of the morning and afternoon non consciously become depleted, and thus more susceptible to lapse in the evening.

Finally, reported stress was positively linked to the strength of the temptation but not lapse occurrence. Research has demonstrated a link between stress and food consumption (Royal & Kurtz, 2010). Similarly to the way that hunger was related to strength but not lapse occurrence, it may be that the dieters in the current study have experience or knowledge of their potential vulnerability to temptation whilst stressed. Perhaps the information they received (in their weight loss groups or whilst trying to lose weight on their own) with regard to the dangers of overeating whilst hungry or stressed, could have led to them being more accustomed to feelings of temptation whilst hungry or stressed and thus better able to resist.

This hypothesis is in concurrence with Fishbach et al.'s (2003) study which found that dieters primed by tempting stimuli activated the goal of dieting in order to resist lapse occurrence. Fishbach et al. posited that these 'momentary allurements' may activate self-control mechanisms overriding the need to give in to temptation thus keeping an individual on track with their own goal directed pursuits.

Daily situational factors, namely the presence of others and the environment in which the participant was present (whether the temptation was unexpected or whether participants sought for it) both positively predicted the strength of temptation and lapse occurrence. These findings are in agreement with previous research on relapse in weight maintenance. Past research has shown that simply being around others increases susceptibility to temptations and lapses (Carels et al., 2001; Grilo et al., 1989). It is thought that the presence of others influences not only what is eaten but how much is eaten (Wansink, 2004). Eating with familiar people is known to reduce an individual's ability and motivation to monitor consumption (Wansink, 2004). Furthermore, the impact of social cues has been found to be particularly salient in obese individuals (Herman, Olmsted, & Polivy, 1983).

The current study also found that unexpected temptations in the environment led to ratings of greater temptation strength and an increased likelihood of lapse, compared to temptations that were sought for. It is possible that familiar others were involved in the presentation of unexpected temptations in the environment (e.g., cakes in the office), thus increasing the susceptibility of the participants and their inability to control their environment. Given the findings of the current study in relation to situational factors, it could be potentially useful for future dietary relapse programs to highlight the danger of social influence and norms in terms of a dieter's vulnerability to temptation.

Lapse occurrence was negatively associated with the use of the specific coping mechanisms of thinking of one's long-term weight loss goal and the importance of their goal. These findings are consistent with past research which found that dietary lapses were associated with lower levels of coping efforts (Carels et al., 2004; Grilo et al., 1989). This is the first study to examine the aforementioned coping mechanisms using EMA. Past research by Fishbach et al. (2003) on single instances of temptation has shown that thinking of one's long-term goal and the importance of that goal buffered participants against temptation. It was posited that this might occur as thinking in this way keeps one's goal firmly in focus.

Lapse occurrence was found to negatively predict self-efficacy to resist future temptations. This finding is expected given that self-efficacy is not only the confidence in one's ability to overcome obstacles and accomplish goals but also entails expectations of future success (Elfhag & Rössner, 2005). There is a substantial amount of research linking self-efficacy and weight loss success (Kitsantas, 2000; Byrne, 2002; Elfhag & Rössner, 2005). However, the current study is among the first to demonstrate the link between momentary lapse occurrence and future self-efficacy. Indeed, improving an individual's responses following lapse (i.e. whether they see it as a small mistake vs. feeling terrible and going off the diet) "may be the single-most-effective way of preparing people to maintain their weight loss" (Dohm, Beattie, Aibel, & Striegel-Moore, 2001, p.114). The findings of the current study have implications for practice and highlight the significance of targeting an individual's self-efficacy following lapse. Our mediation analysis further shows that underscoring the importance of seeing lapses as temporary and reinforcing positive coping responses (such as those detailed above), can positively predict perceptions of future self-efficacy following lapse. In contrast, the presence of others in tempting situations and unexpected temptations undermine one's self-efficacy to resist future temptations.

No significant relationships were found between lapse strength or occurrence and any of the dispositional factors examined in the study. Our findings are somewhat similar to those of Hofmann et al. (2011) who found that the operation of certain dispositional variables (e.g. trait self-control, perfectionism, narcissistic tendencies) were related to factors that occurred in the middle of their model (conflict and resistance) and unrelated to the final stage, behavioural enactment. This is in concurrence with the current study which did not find a link between trait self-control and lapse occurrence. Hofmann et al. (2011) considered their findings to be a result of an individual avoiding being exposed to temptations in the first instance. For example, individuals with high trait self-control make attempts to control their environment to avoid temptations and this might explain why trait self-control was unrelated to lapse occurrence in the present study.

Conclusions

Taken together, the results emphasise that dietary temptations and lapses could be predicted by a variety of daily fluctuating intrapersonal, situational and psychological factors. However, our study had a few limitations. Firstly a small proportion of our sample consisted of participants who were of 'normal weight' (17%); although these may have been previously overweight dieters striving to maintain their weight, the experience of dietary temptations in this group may differ from those who are overweight or obese. Additionally, although a one-week period is the current standard in EMA studies of this kind, longer periods may be needed to fully capture how lapses impact on future self-efficacy and possible weight regain. Finally, a consideration of all of the factors contained in the 4-step model outlined by Hofmann et al. (2011) (i.e., an examination of conflict and resistance in addition to strength and behavioural enactment/lapse occurrence) could provide a more comprehensive

understanding of dietary temptations and lapse occurrences and should be employed by future research.

In the fight against obesity we need to help individuals become more aware of the various personal, situational and environmental factors that expose them to dietary temptations, or equally help them to develop skills so they can cope successfully with such temptations. The current study provides a first step in this direction and its findings could be utilized in future dietary relapse and weight maintenance programs.

CHAPTER 5

DEVELOPING SELF-REGULATION FOR WEIGHT LOSS: INTERVENTION EFFECTS ON PHYSICAL PSYCHOLOGICAL AND SELF-REGULATION SKILLS

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Abstract

To investigate the utility of a self-regulatory skills intervention to improve weight loss-related outcomes. 55 participants (M_{BMI} = 32.60±4.86) were randomized into experimental and control groups and received two training workshops and weekly practice tasks. The experimental group trained six self-regulatory skills: Delayed gratification, thought control, goal setting, self-monitoring, mindfulness, and coping. The control group received dietary and physical activity advice for weight loss. Physical, self-regulatory and psychological measures were taken at baseline, end of intervention (week 8) and at follow-up (week 12). Using intention-to-treat analysis, weight, waist circumference, body fat and BMI were significantly reduced at follow-up for both groups. There were significant increases in all six self-regulatory skills and the psychological measures of self-efficacy, self-regulatory success, and physical self-worth for both groups. Results indicate that self-regulatory skills training might be as effective as dietary and physical activity advice in terms of weight loss and related outcomes.

Keywords: Self-control, self-regulation, weight loss, self-efficacy, diet, physical activity

Introduction

Worldwide overweight and obesity is thought to account for approximately 44% of the burden of disease (Anderson et al., 2009). As a result, the World Health Organization has made improving diet and physical activity a public health priority (Anderson et al., 2009). There is a large body of evidence that supports dietary and physical activity interventions as a means to produce small to modest reductions in weight loss (around 5-10%). The latter has been linked with improvements in physical health, for example, cardiovascular disease and diabetes (National Institute of Health, 1998), and psychological health such as depression and self-esteem (Gatineau & Dent, 2001). Yet, the majority of people fail to maintain the positive dietary and physical activity habits adopted beyond the prescribed intervention period (Sharma, 2007; Shaw et al., 2005). Thus, knowledge of the best behavior change methods alone is insufficient for weight regulation success.

As such, researchers have called for a focus on the psychological factors that lead to weight loss and weight maintenance success (Byrne et al., 2003). One particularly salient factor is self-control (often referred to as self-regulation). This is defined as an individual's ability to override or inhibit behaviors, urges, emotions, or desires that would otherwise hinder goal-directed behavior (Baumeister & Vohs, 2007). Although the overuse of self-control can lead to depletion which can subsequently increase vulnerability to temptation, consistent moderate exertions of self-control are thought to strengthen one's ability to resist temptation (Baumeister et al., 2006). As such, recent calls have been made for research that specifically investigates the self-regulatory skills that facilitate an individual's ability to resist temptation as well as successfully overcome lapse occurrence (i.e., giving in to temptation; Carels, Douglass, Cacciapaglia, & O'Brien, 2004; Johnson, Pratt, & Wardle, 2012). To this end, the current study aims to examine how training one's self-regulatory skills to resist

dietary temptation relates to improvements in the perceived effectiveness of these skills, weight loss, as well as a number of associated physical and psychological outcomes, compared to an intervention providing information on best dietary and physical activity practices.

Change in body weight is commonly used to measure weight loss success (Jeffery et al., 2000) and, thus, the primary outcome measure of the current study will be weight loss (in kilograms). Additionally, the current study will measure: Waist circumference-as it is thought to be one of the best indicators of intra-abdominal fat change during weight loss (Van der Kooy, Leenen, Seidell, Deurenberg, & Hautvast, 1993), body fat percentage-as weight loss is not consistently equivalent to fat loss and, thus, it is recommended that interventions employ body fat measures that allow for this distinction (Prentice & Jebb, 2001), and finally Body Mass Index (BMI)-widely used for current classifications of obesity (World Health Organization, 1995).

As mentioned above, one's ability to successfully self-regulate behavior in the face of temptations is influenced by a multitude of self-regulatory factors or skills (these are presented in *italics* in the following paragraphs). One such factor is an individual's capacity to successfully *delay gratification,* which involves resisting immediate rewards in favor of long-term goals. In order to be able to successfully delay gratification one must repeatedly resist temptation. Such repeated acts of self-control can lead to depletion and as a consequence make one more susceptible to lapse occurrence (Baumeister et al., 2006). However, the 'strength hypothesis' of self-control suggests that consistent regular practice of self-regulatory tasks can enhance one's self-control strength and decrease instances of depletion (Muraven, 2010; Muraven & Baumeister, 2000). Corroborating the strength hypothesis, a recent review from Johnson et al. (2012) suggested that research should focus on promoting controlled and

supported exposures to tempting situations which might contribute to strengthening self-control and preventing relapse. Indeed, the ability to delay gratification has been identified as a key self-regulatory strategy or skill that taps the processes necessary for effective impulse control and for sustaining "strength in the face of strong temptation" (Metcalfe & Mischel, 1999, p.4). Thus, training individuals to practice delayed gratification by allocating times in which to allow temptations on a weekly basis (i.e., controlled and supported exposure to temptation) may help improve their ability to repeatedly resist temptation in the pursuit of their weight loss goals.

Another important self-regulatory skill is *thought control.* This is particularly important in social situations where food is available, as the presence of others can increase susceptibility to lapse (Carels et al., 2004; Wansink, 2006). Research has found that an individual is much more likely to resist temptation from others when framing his/her thoughts about refusal as "I don't" versus "I can't", because using "I don't" is thought to be more psychologically empowering than using "I can't" and can motivate goal-related pursuit (Patrick & Hagtvedt, 2012). Other thought-based strategies one can employ when faced with temptation involve thinking of one's weight loss goal and the importance of that goal, as these strategies have been found to increase one's ability to resist temptation (Fishbach, Friedman, & Kruglanski, 2003; Van Koningsbruggen et al., 2011) and facilitate self-regulatory success (Fishbach et al., 2003).

A fundamental aspect of self-regulatory behavior is the ability to develop goal setting skills (Carver, 2004; De Ridder & De Wit, 2006). Indeed, having a clear actionable goal is important to successful weight loss (Cullen et al., 2001; Pearson, 2012). A recent review investigating the use of *goal setting* as a self-regulatory skill in overweight and obese adults concluded that "goal setting shows promise as a useful, cost-effective, and empowering tool

that can be incorporated easily into community-based weight reduction programs" (Pearson, 2012; p.41).

Closely related to goal setting behavior is the *self-monitoring* of one's goals. The ability to self-monitor is a key element in developing successful self-regulation (Carver, 2004; De Ridder & De Wit, 2006). Self-monitoring involves deliberate purposeful attention to an element of an individual's behavior by recording the details of that behavior (e.g., keeping a food diary). More frequent self-monitoring has been consistently related to weight loss success (for a review, see Burke, Wang, & Sevick, 2011) and has been shown to increase self-control capacity (Muraven, 2010). Self-monitoring is thought to facilitate heightened awareness and increased accountability for one's actions (Bandura, 1998), and thus, it is a useful skill to develop in order to resist temptation.

In addition to self-monitoring, another skill that may increase one's awareness of temptation is *mindfulness*. Mindfulness is created by focusing on body signals as well as sensory experiences, thoughts, and emotions (Brown & Ryan, 2003). An enhanced sense of mindfulness has been linked with improved self-regulation (Brown & Ryan, 2003) and weight loss success (Tapper et al., 2009). The increased awareness that comes with mindfulness training may assist individuals in overcoming periods of 'mindless' eating (Kristeller & Wolever, 2011). Research evidence demonstrates that the development of mindfulness skills can enhance self-control strength (Masicampo & Baumeister, 2007). Indeed, in terms of weight loss it is recommended that becoming aware of the environmental influences on eating and altering our environment to avoid these temptations (e.g., replacing the cookie jar with fruit) can prevent mindless lapse occurrence and subsequently enhance weight loss success (Wansink, 2006).

Research has demonstrated that those who are unsuccessful at maintaining weight loss tend to have a poor range of *coping skills* (Dohm et al., 2001). Coping strategies have been previously identified as a key skill to develop in self-regulatory interventions (Johnson et al., 2012; van Genugten, van Empelen, Flink, & Oenema, 2010). Dohm and colleagues (2001) found that the key difference between weight maintenance success and failure was an individuals' response to lapse, and that helping these individuals develop adaptive coping responses (e.g., treating lapse as a small mistake) through coping skills training "may be the single-most-effective way of preparing people to maintain their weight loss" (Dohm et al. 2001, p.114).

The current study will investigate the impact of self-regulatory skills training on a number of psychological factors that have previously been found to improve as result of weight loss success. Previous research has found that improving self-regulatory skills can improve self-efficacy, as these skills enhance feelings of accomplishment and success (Annesi & Gorjala, 2010; Marlatt & Gordon, 1985). Research investigating the self-efficacy of eating behaviors, in particular, has found that as the use of self-regulatory skills increase over time, so too do weight loss and perceived self-efficacy in relation to eating behavior (Annesi & Gorjala, 2010). Besides self-efficacy, another important psychological factor to consider is one's perceived self-regulatory success at dieting. Recent research has shown that perceptions of success at dieting are influenced by how one responds to temptation (Meule, Lutz, et al., 2012; Papies, Stroebe, & Aarts, 2008), and the strategies they have in place to deal with temptation (Fishbach et al., 2003; van Koningsbruggen et al., 2013). Thus, improving one's self-regulatory skills for resisting temptation may have a positive impact on one's perceived self-regulatory success at dieting. A further psychological factor to consider in this investigation is physical self-worth, which is one's general feelings of happiness, satisfaction,

pride, respect, and confidence in the physical self (Fox & Corbin, 1989). Studies have found that physical self-worth can improve as an outcome of weight loss and weight maintenance success (Elfhag & Rössner, 2005). However, thus far enhancements in physical self-worth have mainly been measured in relation to physical activity interventions (Fox & Corbin, 1989; Fox, 2007; Lindwall, Aşçi, Palmeira, Fox, & Hagger, 2011) and, thus, the extent to which physical self-worth can improve as a result of training self-regulatory skills is as of yet unknown.

To date, the use of self-regulatory skills has been associated with improved weight loss in interventions (Annesi & Gorjala, 2010; O'Neil, Theim, Boeka, Johnson, & Miller-Kovach, 2012). These findings show promise for the utility of self-regulatory skills to improve weight loss outcomes. However, these interventions tended to incorporate physical activity and dietary advice alongside their self-regulatory skills training. Therefore, it is difficult to isolate the independent effect of training self-regulatory skills. Thus, further research is needed in order to examine the key self-regulatory skills for weight loss success and determine if training these skills alone is as effective as providing information about physical activity and dietary changes. This is tested in the present study.

Although often associated with positive behavior change, many weight loss interventions are thought to be overly expensive and complex, requiring a large amount of contact time with intervention staff (Franz et al., 2007; Kiernan et al., 2013; Lombard, Deeks, Jolley, Ball, & Teede, 2010). In reality, the majority of community-based weight loss programs are limited by time and resources, therefore more intensive research interventions are not always feasible in terms of their ability to be rolled out to primary care and community samples (Economos & Irish-Hauser, 2007; Fabricatore et al., 2008).However, less intensive-community based weight loss programs (e.g., lower amount of contact time with intervention

staff) provide a unique opportunity to reach those who may be in need of help but do not have adequate resources (i.e., those with lower income, poor access to facilities; Economos & Irish-Hauser, 2007). Thus, there have been calls for interventions that are of lower intensity and lower cost, and are therefore easily deliverable and applicable to a diverse range of individuals in the community (e.g., Lombard, Deeks, Ball, et al., 2009).

In conclusion, the current study aims to be one of the first to train a specific collective group of temptation-related self-regulatory skills (delayed gratification, thought control, goal setting, self-monitoring, mindfulness and coping skills) via a low intensity intervention. Furthermore, it addresses an important gap in the literature by investigating the effects of training these self-regulatory skills on weight-related outcomes independently of dietary or physical activity advice. We hypothesized that participants who received training in these skills (the experimental group) would demonstrate greater changes over a period of 12 weeks in these skills relative to those in the control group who will receive information on the best dietary and physical activity practices for weight loss. We also expected that those in the experimental group will experience similar positive changes to the control group in physical (weight loss, lower waist circumference, body fat, BMI, and higher physical activity) and psychological (higher self-efficacy, perceived self-regulatory success, and physical self-worth) outcomes over time.

Method

Participants

The sample included 60 participants, but we analyzed data from 55 of them (M_{age} = 37.60 years, SD = 13.47, M_{BMI} = 32.60, SD = 4.86, 72% female). Based on objectively assessed BMI, participants were classified as obese (62%), overweight (35%), or morbidly obese (3%). In order to qualify for inclusion in the study, participants completed a screening

questionnaire to ensure they were currently dieting to lose weight. The average number of previous attempts at weight loss per participant was 6.08 (*SD* = 8.20). Participants were White (54%), South Asian (Indian, Pakistani and Bangladeshi; 24%), Black (13*%*), Chinese (6%), or of other ethnic origin (3*%*). The majority of the sample was in full-time employment (42%); the remaining were primarily students (36%). The most frequently reported highest qualification was university honors degree (43%). Participants were recruited via an email bulletin sent to university hospital staff and non academic university staff, students, and community members. The duration of recruitment was one month. Participants were selected if they currently held weight loss or weight maintenance goals, if they were overweight (a BMI ≥ 25) and had no health conditions that required medical supervision of diet or exercise. For those in employment, they were asked to specify their work department and those in the same department were allocated to the same group to avoid contamination between groups. Thus, our study was more of a 'pragmatic randomization' which is appropriate to the real life circumstances in which the intervention operated (Hotopf, 2002). As a result, our intervention followed the Transparent Reporting of Evaluations with Nonrandomized Designs (TREND) protocol (Des Jarlais, Lyles, & Crepaz, 2004). Ethical approval for the study was granted by a British University ethics committee.

Procedure

The procedure and measures for both the experimental and control groups were piloted in a separate group of dieters (*n* = 11). The purpose of the pilot was to test if the participants understood the content of the intervention and the instructions for practicing the self-regulatory skills. Based on feedback from the pilot, the content of the workshops was modified by increasing the amount of interactive tasks and decreasing the reliance on audiovisual presentation slides. Thus the intervention workshops incorporated different

methodologies to adapt to participants' different levels of learning (e.g., audiovisual presentation, group discussions, individual and interactive tasks). All workshops were conducted by the lead researcher and data were collected by research assistants who were unaware of the study's hypotheses. Both experimental and control groups completed nearly identical study protocols, the only difference being the content of the interventions. Both groups participated in a 3-hour workshop at baseline outlining the principals of their intervention and a 1.5-hour booster session (week 3) recapping the key intervention components. The workshops were supplemented by weekly practice tasks sent via email throughout the 8 weeks of the intervention. A considerable focus of the baseline and booster workshops was to encourage the practice of these tasks at home. All workshops took place in a seminar room within a university. Details of the experimental group workshops and the weekly practice tasks sent via email are displayed in Table 1.

The workshops for both groups were deliberately low in intensity requiring equal or less contact hours with the participants than in other weight loss studies which were labelled as 'low intensity' (Iqbal et al., 2010; Lombard et al., 2010; Mayer-Davis et al., 2005; Shaw et al., 2005). In order to independently assess the key strategies of the intervention, the experimental group did not receive any specific advice on diet or exercise practices; equally, the control group did not receive any specific information on the six self-regulatory strategies. To ensure contamination did not occur, all participants were asked "Have you gained/asked for any information about the other weight loss group running simultaneously to yours?" (Rated from 1, *none*, to 5, *a lot)*. The majority of the sample did not receive any information from the other weight loss group however, three participants rated that they received *a lot* of information and two *a small amount.* Based on the criteria for exclusion in previous intention-

to-treat studies, it was felt that the exclusion of these five individuals from subsequent analyses was justified (Abraha & Montedori, 2010; Gupta, 2011).

Experimental group (*n* = 27). The experimental intervention involved the development of the aforementioned six key self-regulatory skills.

Control group (*n* = 28). The control intervention was based on evidence of the best dietary and physical activity methods for weight loss and weight maintenance (Sharma, 2007; Shaw et al., 2006). Content included: The food pyramid, the dangers of high sugar/fat/salt consumption, portion control, how to read food labels, healthy and unhealthy restaurant options, and the importance and benefits of different types of exercise. Participants received weekly practice tasks via email which were based on the content of the workshops (e.g., physical exercises and recipes).

Measures

Participants' weight, waist, body fat, self-regulatory skills, and responses to psychological measures were assessed at baseline, end of intervention (week 8), and follow-up (week 12).

Physical measures. Height was measured at baseline using the Leicester Height Measure (SMSSE-0260). Weight (kg) and body fat (%) were measured using a recently calibrated Tanita Scale (SC-331s) with the participant in light clothing, without footwear or socks (participants were instructed to wear the same clothing at each measurement session). Weight loss was calculated as the change in kilograms from baseline to follow-up (week 12). Waist circumference was measured to the nearest 0.1cm. Participants' weight, waist circumference and body fat were measured at baseline, week 8, and week 12. Physical activity completed over a week was measured using the short version of the International Physical

Activity Questionnaire (Booth, 2000). The questionnaire contained six items measuring the duration and frequency of vigorous and moderate exercise, as well as walking behavior (e.g., "During the last 7 days, on how many days did you walk for at least 10 minutes at a time"?, and "how much time did you usually spend walking on one of those days?"). The total physical activity score was determined by the summation of the duration (minutes) and frequency (days) scores. The MET equivalents were as follows: vigorous exercise (8.0), moderate exercise (4.0), and walking activities (3.3). The scale scores have demonstrated adequate reliability and validity in previous research (Hallal & Victora, 2004). Cronbach's α for the IPAQ items in the current study were 0.96, 0.66, 0.67 for baseline, end of intervention, and follow-up, respectively.

Self-regulatory skills. Participants in both groups reported on the frequency of employment and perceived effectiveness of six self-regulatory skills: Delayed gratification, thought control, goal setting, self-monitoring, mindfulness, and coping. Each of these items was rated twice (e.g., self-monitoring effectiveness; "The effectiveness of monitoring your weight loss goals on a daily/weekly basis", and "The effectiveness of recording some aspect of your weight loss on a regular basis"), and these two items were then summed to give average scores for frequency of employment and for effectiveness. Items were rated from 0 (*do not use*) or 1 (*not frequently used/not effective at all*), to 5 (*very frequently used/very effective*). The average intra-variable *r* across the six variables for both frequency and effectiveness was 0.77, thus only the findings regarding self-regulatory skill effectiveness are presented. Correlations between the two effectiveness items across the six skills ranged from $r = .63$, to $r = .94$ (Median $r = .81$).

Psychological measures.

Weight Efficacy Lifestyle Scale (WEL). Self-efficacy for appropriate eating was measured using the WEL scale (Clark et al., 1991). The scale is comprised of 20 items measuring five dimensions of eating self-efficacy (negative emotions, availability, social pressure, physical discomfort, and positive activities), each consisting of 4 items (e.g., availability: "I can control my eating on the weekends"). Items were rated from 0 (*not confident*) to 9 (*very confident*). All items were summed to give a total score. Previous Cronbach alphas for the five dimensions ranged from 0.70-0.90 (Clark et al., 1991); in the current study the average alphas across the five scales were 0.95, 0.95, 0.96, at each of the three time points.

Perceived Self-Regulatory Success in Dieting Scale (PSRS). Perceptions of success in weight loss were measured using the PSRS (Fishbach et al., 2003). Participants responded to three items indicating how successful they felt in terms of losing weight, watching their weight, and how difficult they found it to stay in shape (reverse coded). Items were rated from 1 (*strongly disagree*) to 7 (*strongly agree*). Higher scores are indicative of greater success in dieting (Cronbach α = 0.96, 0.81, 0.67). The scale scores have been previously demonstrated as reliable and valid measures of dieting success (Meule, Papies, et al., 2012).

Physical Self-Worth Scale (PSW). PSW was measured using five items from the revised physical self-perception profile (PSPP-R; Lindwall, Aşçi, et al., 2011). Items were categorized into four responses, ranging from 1 (*not at all true for me*) to 4 *(really true for me*; e.g., "I am happy with how I am and what I can do physically"). Items were summed to give a total PSW score (Cronbach α = 0.97, 0.86, 0.93, for each time point). The scale scores have previously demonstrated adequate reliability and validity (Lindwall, Asci, & Hagger, 2011).

Finally, participants were asked to rate the extent to which they adhered to their own weight loss practices during the intervention. As a fidelity check, they were also asked to rate the extent to which they applied the intervention principals. These two items were rated from 1 (*never*), to 5 (*all of the time*)*;* both were measured at the end of the intervention (week 8). Descriptive statistics for all baseline, end of intervention, and follow-up variables are presented in Table 2.

Table 1

Experimental Groups Workshop Content and Practice Tasks

Self-regulatory skills	**Workshop and booster session content**	**Weekly practice tasks (sent via email)**
Delayed gratification	Introduce: Concept of delayed gratification Practice: Allocating time for treats	Planning for delayed gratification
Thought control	Introduce: Positive self-talk vs. negative self-talk, refusal framing, long-term goal thinking Practice: Interactive self-talk tasks	Refusal framing, long-term goal thinking, and positive self-talk
Goal setting	Introduce: Guided goal setting-focusing on the importance/value of one's weight loss goal Practice: How to set short, medium, and long-term goals, how to be realistic and specific in goal setting	Goal prompts, visibility of goals, engaging others, re-evaluating goals (week 6), vocalization of goals, positive reminders of success so far, and visual tools
Self-monitoring	Introduce: Self-monitoring and its links to weight loss success Practice: Exploring different methods of self-monitoring, in particular encouraging temptation monitoring	Reviewing self-monitoring: Learning-when, where, and why we are tempted
Mindfulness	Introduce: Mindfulness, its origins and applications; Mindless eating and the influence of the environment on consumption Practice: Eating-related mindfulness (savoring eating exercise) and satiety-related mindfulness (water drinking exercise)	Consuming one meal a week with a focus on a different aspect of mindful eating: Sight, smell, taste, size, pace, and satiety Switching glasses, using smaller serving plates, limiting food exposure
Coping skills	Introduce: Coping, including examples of passive and active coping strategies Practice: Strategy building on how to overcome coping failure	Self-reflection on past coping failures e.g., reassessing goals, and exercises to improve active coping during stressful periods

Table 2

Descriptive Statistics for the Physical, Self-Regulatory, and Psychological Measures at Baseline, End of Intervention, and Follow-up

Variable	Baseline		End of intervention (week 8)		Follow-up (week 12)	
	Experimental	Control	Experimental	Control	Experimental	Control
Physical measures						
Weight (kg)	88.02 (13.68)	87.97 (13.07)	85.71 (14.02)	86.52 (12.49)	85.52 (13.67)	86.21 (12.65)
Waist (cm)	101.56 (10.84)	103.64 (11.11)	97.32 (11.84)	100.06 (12.22)	96.31(12.92)	99.29 (11.79)
Body fat (%)	37.56 (8.27)	40.69 (8.31)	36.97 (8.76)	40.05 (8.62)	36.85 (8.96)	39.40 (8.94)
BMI	31.58 (4.38)	32.96 (4.13)	30.80 (4.57)	32.46 (3.72)	30.73 (4.43)	32.35 (3.84)
Physical activity	1420.24 (1127.67)	1370.46 (1577.08)	1852.98 (1771.67)	2915.30 (2756.38)	2490.32 (2621.98)	3011.65 (2759.88)
Self-regulatory skills						
Delayed gratification	1.11 (1.21)	1.18 (1.35)	2.44 (1.60)	1.50 (1.56)	2.3 (1.42)	1.43 (1.49)
Thought control	1.11 (1.47)	1.07 (1.38)	2.40 (1.55)	1.45 (1.61)	2.62 (1.44)	1.45 (1.55)
Goal setting	0.90 (1.09)	0.79 (1.22)	1.53 (1.15)	1.02 (1.2)	1.57 (1.19)	1.12 (1.32)
Self-monitoring	1.48 (1.34)	1.15 (1.40)	2.40 (1.30)	1.54 (1.36)	2.64 (1.36)	1.41 (1.41)
Mindfulness	2.00 (1.29)	1.92 (1.39)	2.83 (1.39)	2.35 (1.77)	2.98 (1.28)	2.50 (1.75)
Coping	0.87 (1.18)	0.78 (1.20)	1.96 (1.54)	1.66 (1.66)	2.05 (1.54)	1.43 (1.58)
Psychological measures						
Self-efficacy	90.88 (40.49)	104.81 (41.67)	101.95 (45.23)	108.76 (46.68)	109.62 (46.23)	111.46 (49.90)
Self-regulatory success	2.33(0.87)	2.77 (1.16)	8.58 (3.7)	7.92 (3.50)	9.12 (3.82)	8.42 (3.55)
Physical self-worth	1.92 (0.73)	2.12 (0.90)	2.13 (0.78)	2.13 (0.94)	2.21 (0.87)	2.25 (0.98)

Results

Retention and Treatment

We powered on weight loss as this was the variable for which we had the most available information from past literature. Based on previous estimates (e.g., Forman, Butryn, Hoffman, & Herbert, 2009), a small-to-medium effect size was expected (partial eta squared = 0.03). Thus, for a two-tailed analysis for three time points over which the data were collected, we calculated that a total sample size of 36 was necessary to detect this effect size. However, based on the attrition rates of similar past weight loss research (Forman et al., 2009), and cognisant of literature specifically examining attrition rates in weight loss interventions (Honas, Early, Frederickson, & O'Brien, 2003; Teixeira et al., 2004), we built into our sample size calculations an extra 35%.

We were able to recruit 60 participants, but five were excluded (see Methods). Of the 55 participants eligible for analysis, 32 participants completed the entire 12 weeks. Given the 34% attrition, analyses are presented as intention-to-treat (ITT) including all 55 participants, carrying forward the last observation. The unit of analysis was the individual. No blocking was used. All data were analyzed using SPSS version 21.0. Figure 1 displays the flow of participants throughout the study.

Preliminary and Main Analyses

Three MANOVAs were run on the physical, self-regulatory skills, and psychological measures in order to determine if there were any differences in baseline values between those who completed assessments at all time points and those who did not; no differences were found for any of the variables ($p > 0.05$). A series of *t*-tests were run to examine if there were any significant differences at baseline between the

experimental and control groups for all the study variables; no differences were observed ($p > 0.05$). There were also no significant differences between the groups in the extent to which participants rated that they adhered to the allocated program principals ($p = 0.89$), or to their own dietary and physical activity practices ($p = 0.30$), during the intervention.

Three doubly MANCOVAs (which involved multiple dependent variables at multiple time points), were employed to analyze the changes in physical, self-regulatory and psychological measures, respectively. We chose multivariate analyses as opposed to univariate tests to control for Type I error. We controlled for sex and number of previous weight loss attempts. The number of previous weight loss attempts was included as a covariate as it is thought to be one of the most consistent predictors of poor weight loss success and drop-out in intervention studies (Kiernan, King, Kraemer, Stefanick, & Killen, 1998; Pasman, Saris, & Westerterp-Plantenga, 1999; Teixeira et al., 2004). Each doubly MANCOVA had time (baseline, week 8, week 12) as the within-subject factor and group (experimental vs. control) as the between-subject factor. Results are presented in Table 3.

Physical measures. Both groups experienced significant decreases over time in weight (kg), waist circumference (cm), body fat (%), and BMI; significant increases in physical activity also occurred. However, no significant group or interaction effects were observed.

Self-regulatory skills. Significant improvements over time were found for both groups for all the self-regulatory skills measured. There were no significant group or interaction effects.

Psychological measures. A significant main effect for time was found in both groups for self-efficacy, perceived self-regulatory success, and physical self-worth. No other main or interaction effects were found.

Protocol analysis using complete cases only demonstrated similar findings for the physical, self-regulatory, and psychological outcomes (Piaggio, Elbourne, Altman, Pocock, & Evans, 2006).

Figure 1.

Participant Randomization and Retention Flow Chart

Table 3

Results of the Doubly MANCOVA's Predicting the Physical, Self-regulatory, and Psychological Measures

Variable	Wilk's Lambda	*F*	*df*	*p*	Partial eta squared
Physical measures					
Time	.42	4.48	10,33	.00***	.57
Group	.83	1.50	5,38	.21	.16
Time x group	.87	.454	10,33	.91	.12
Self-regulatory skills					
Time	.49	2.85	12,33	.00**	.50
Group	.85	1.11	6,39	.37	.14
Time x group	.67	1.33	12,33	.24	.32
Psychological measures					
Time	.66	3.22	6,39	.01*	.33
Group	.97	.298	3,42	.82	.02
Time x group	.83	1.27	6,39	.29	.16

Note. * $p < .05$, ** $p < .01$, *** $p < .001$.

Discussion

The present study investigated the efficacy of improving self-regulatory skills in individuals with weight management goals. To our knowledge, this is one of the first interventions to examine whether this specific group of temptation-related self-regulatory skills can be trained in order to facilitate (independent of physical activity and dietary advice) weight loss and associated physical and psychological outcomes. Results indicated that this minimal intervention can be as effective as a physical activity and dietary advice in producing significant changes in physical, self-regulatory and psychological outcomes. Although some significant group by time interactions emerged in univariate analyses (not reported in the Results) indicating greater improvements in the experimental group, we focused our interpretation on significant multivariate effects to reduce the risk for Type I error.

Physical Measures

Both the experimental and control groups had significant reductions in weight, waist circumference, body fat, and BMI over time. Given that there is substantial evidence showing the effectiveness of dietary and exercise behaviors in producing small to moderate effects on weight loss (Health, 1998; Sharma, 2007), it is positive to note that for the experimental group training specific self-regulatory skills alone (without encouraging specific dietary and physical activity practices) produced similar short-term weight-related improvements.

Physical activity significantly increased over time in both groups; however, there were no group differences in this trend. This was unexpected, as promoting physical activity was a particular focus of the intervention in the control group. One potential explanation for the increase in physical activity in the experimental group is that, as the previous self-control research has shown, training certain aspects of self-regulatory behavior can have a positive

impact on other elements of one's behavior, including physical activity (Baumeister et al., 2006; Oaten & Cheng, 2006). We did not assess dietary practices in the experimental group, but it is possible that these could have also improved, given somewhat similar previous findings (Oaten & Cheng, 2006).

Self-Regulatory Skills

Both groups experienced significant increases in the effectiveness of the six self-regulatory skills over time. The increases in the experimental group were expected given that the training in this group focused on improving these skills. However, the significant increase in all six self-regulatory skills in the control group was unexpected. It is plausible that the weekly dietary and physical activity-based practice tasks that the control group completed led to a simultaneous strengthening of their self-regulatory skills. Indeed, as previously illustrated by Oaten and Cheng (2006), practice in one area of self-control (e.g., physical activity) can lead to improvements on a number of other self-regulatory behaviors, and this may explain why the control group also experienced significant increases in the six intervention skills.

Psychological Measures

Both experimental and control groups experienced significant increases in all psychological outcomes assessed. First, both groups had comparable significant increases in self-efficacy for appropriate eating. The significant increases in self-efficacy in the experimental group may be due to the self-regulatory skills trained in the intervention. Indeed, research investigating the self-efficacy of eating behaviors has found that as self-regulatory skills increase, perceived self-efficacy in relation to eating behavior can also increase (Annesi & Gorjala, 2010). The increases in the control group may be explained by the fact that a specific focus of the control intervention was on improving knowledge of the best dietary

methods for weight loss success; dietary interventions have been known to be associated with improving self-efficacy for appropriate eating (Clark et al., 1991; Shin et al., 2011). Second, both groups also reported increases in perceived self-regulatory success. In view of the significant decreases in weight, waist circumference, body fat, and BMI, it is unsurprising that both groups experienced increases in their perceptions of success at weight loss. Third, both groups experienced significant increases in physical self-worth. Research has shown that weight loss and weight maintenance are associated with increased self-worth (Elfhag & Rössner, 2005). As both groups had relatively similar levels of weight loss, it is perhaps unsurprising that they also experienced similar increases in physical self-worth.

Limitations, Future Directions, and Conclusions

The current study was subject to a few limitations. First, the substantial attrition (34%) may limit the ability to draw firm conclusions. It is possible that those who were in attendance at follow-up were more motivated and lost more weight than those who dropped out at an earlier stage. Yet, the current study's attrition of 34% is well within the range of that found by related research (Forman et al., 2009; Honas et al., 2003; Teixeira et al., 2004). Additionally, a follow-up period of four weeks is relatively short in comparison to other weight loss interventions which tended to have follow-up periods of 6 to 12 months (for examples, see Gourlan, Trouilloud, & Sarrazin, 2011; Lombard, Deeks, & Teede, 2009). Yet, weight loss is a complex process and many people experience frequent changes in their persistence, effort, and commitment. Thus, it has been argued that a small follow-up time period may be necessary to capture the immediate psychological and behavioral outcomes of weight loss programs (De Vet et al., 2012). Nevertheless, we can only conclude as to the positive effects that training self-regulatory skills has on short-term weight loss success. Further, although the self-regulatory skills we examined have been previously shown to facilitate an individual's

ability to resist temptation or to successfully overcome lapse occurrence (i.e., giving in to temptation), we did not assess at pre- and post-intervention the impact of our experimental training on the frequency of temptations and lapse occurrence. This could be a useful addition in future studies in this area.

Considering that multiple studies have called for research that occurs in community-based settings (Economos & Irish-Hauser, 2007; Fabricatore et al., 2008; Lombard et al., 2010), the current study's low intensity, low cost approach (which required a minimal commitment of attendance of two workshop sessions and regular involvement via email practice tasks) may have the potential to be more accessible to and accepted by a wide range of individuals in the community. Given the rising financial burden of obesity on the already strained national health service in the UK (estimated at £5.1bn per year; Scarborough et al., 2011), future research could investigate the economic costs of running both the experimental and control interventions. Results of this cost analysis could potentially be used to promote interventions that train one's self-regulatory skills for weight loss (with or without also providing advice about physical activity and diet).

In summary, the current study emphasizes the potential utility of training self-control skills to improve weight loss-related physical, self-regulatory, and psychological outcomes. The results provide initial evidence to suggest that helping people improve temptation-related self-regulatory skills may be just as important as helping them change their physical activity and dietary behaviors.

CHAPTER 6

GENERAL DISCUSSION

Spanning four empirical chapters, employing a wide variety of methodologies (i.e., qualitative, cross-sectional, ecological momentary assessment and an intervention) the current thesis highlights the importance of the consideration of a number of self-regulatory factors instrumental in weight loss goal pursuit. Specifically this thesis emphasises the role of temptations and lapse occurrence and the threat they pose to successful weight loss and weight maintenance. Further it underlines; the importance of long-term goal setting and consistent self-monitoring; the need to consider the impact of multiple-goals in weight loss goal pursuit; the influence of the presence of others on behaviour; the importance of avoiding feelings of depletion/deprivation; utilising active coping skills and promoting high levels of self-efficacy. In addition the current thesis outlines the need to not only identify but also to develop these factors in order to help prevent lapse occurrence and promote weight loss success.

This final chapter summarises and synthesises the results of studies 1-4 (chapters 2-5), the limitations of these findings, their practical implications and potential avenues for future research.

Summary of the Research Findings

Although sustained weight loss appears to allude the majority, there are a number of individuals that can successfully maintain their weight over the long-term (Jeffery et al., 2000). Understanding the differences between these individuals and those that fail is necessary in order to determine the factors that can be improved to promote sustained weight maintenance success.

Study one (chapter two) set out to determine the key self-regulatory factors influencing weight maintenance success and failure. This qualitative examination using thematic analysis explored, compared and contrasted the experiences of a group of successful

maintainers (who had lost 10% of their body weight and maintained this weight for a minimum of 12 months) and unsuccessful maintainers (Regainers). Two key themes emerged that distinguished the groups in terms of their self-regulatory success; goal regulation and self-control. The first of these, goal regulation, involved two overarching themes related to the self-regulatory management of goals; adopting a long-term vs. short-term approach to weight maintenance and realistic vs. unrealistic goal striving. Maintainers saw their weight loss goals as long-term and thus thought of weight loss as a lifestyle change rather than a diet. Maintainers also consistently prioritised their weight loss and were inclined to have more realistic goals and targets. In contrast the Regainers tended to set short-term, unrealistic weight loss goals revolving around dieting rather than health or lifestyle change.

The second key overarching theme was self-control, which encompassed the factors that influenced one's ability to resist temptations in the pursuit of their weight loss goals. This theme consisted of four subthemes for which there were clear differences between the Maintainers and Regainers, these were: Routine, self-monitoring, deprivation and coping. The maintainers reported consistently using routines, planning their weight loss and regularly self-monitoring. They commented on how they avoided feelings of deprivation with regard to their diet by occasionally allowing themselves to indulge in temptations and employed active coping skills such as seeing a lapse as something temporary and moving on. In contrast the Regainers appeared to have inconsistent routines, poor planning and infrequent self-monitoring and tended to be very restrictive with their diets when trying to lose weight which made them feel depleted and deprived and more susceptible to lapse occurrence. These results support previous literature in emphasising the utility of setting long-term goals (Epiphaniou & Ogden, 2010), the importance of realistic goals (Byrne, 2002), having a weight loss routine (Sciamanna et al., 2011), the need for self-monitoring for weight loss success (Boutelle &

Kirschenbaum, 1998; Burke, Wang, et al., 2011; Butryn et al., 2007), having active coping responses to help prevent lapse (Dohm et al., 2001) and the danger of feelings of deprivation and depletion which can increase ones susceptibility to temptation (Muraven & Baumeister, 2000). Interestingly, the findings seem to indicate that the factors that influence weight maintenance success or failure may not operate in isolation but rather there may be an interwoven relationship between the factors that contribute to goal pursuit. In that for the Maintainers when effectively employed these factors appear to have a positive impact and facilitate one another in bringing about weight maintenance success. In contrast for the Regainers when one factor fails it appears to have a 'domino effect' on the others perhaps making an individual more likely to fail overall. For example, having mainly short-term goals meant that the Regainers were generally unrealistic in their weight loss expectations. This led to them being unnecessarily restrictive in their diets which consequently left them feeling deprived and depleted potentially increasing their susceptibility to temptation. This study adds to the literature in emphasising the importance of a number of key self-regulatory factors in weight maintenance goal pursuit and also in illustrating the potential overlapping relationships and the consequences that these could have on subsequent weight maintenance success and failure.

Study two (chapter three) also involved an exploration of the self-regulatory factors influencing weight-control, however it extended study one in examining weight loss goals in the context of other goals. To date goals have mainly been studied in isolation, however this over simplifies the self-regulatory skills needed to successfully manage multiple-goals at once. Study two focused on a cross-sectional examination of the simultaneous pursuit of a weight loss goal with another goal. The aim of this study was to determine the factors that were necessary for success at weight loss goal attainment whilst managing another important

non weight-related goal, and also to determine what factors were necessary for the successful attainment of these two goals simultaneously. Additionally, the study aimed to test the utility of the Intergoal Relations Questionnaire (IRQ) in a weight loss context.

Firstly, the study found that goal persistence, self-efficacy and multiple-goal facilitation positively predicted attainment, while the frequency of temptations experienced negatively predicted weight loss goal attainment. In terms of successful multiple-goal attainment, those who were more successful in attaining both their weight loss and non weight loss goals simultaneously had higher self-efficacy, goal persistence, and experienced less frequent temptations within both goals. One would imagine that that exerting a large amount of persistence and effort towards two unrelated goals would potentially be negatively related to goal attainment (due to competing demands for limited resources; Baumeister & Tierney, 2011). However the current study found the opposite that greater persistence at both goals led to greater multiple-goal attainment. This finding was consistent with previous exercise-related multiple-goal research which posited that greater persistence is due in part to the enhanced self-efficacy experienced through past multiple-goal attainment, in that the confidence gained from attaining one goal may simultaneously improve one's confidence for attaining multiple-goals at once (Jung & Brawley, 2010). In support of this hypothesis self-efficacy was associated with both successful weight loss and multiple-goal pursuit, which again is consistent with that of the exercise-related multiple-goal research (Jung & Brawley, 2010, 2011; Karoly et al., 2005).

Finally study two also illustrated that a low frequency of temptation was positively associated with both weight loss and multiple-goal attainment. We saw in study one that the Maintainers allowed themselves to occasionally indulge in temptation and in so doing they alleviated feelings of deprivation and depletion. Perhaps, as Hofmann et al. (2011) also

surmised, that rather than having to rely on their ability to repeatedly resist temptations those who experienced the lowest frequency of temptations had managed to engineer their lives to minimize temptations in general.

A second purpose of study two was to examine the utility of the Intergoal Relations Questionnaire (IRQ) in a weight loss context. Results found that goal facilitation (i.e., the extent to which one goal positively enhances the pursuit of another goal) was associated with weight loss goal attainment. This supports previous literature which found that the more mutually facilitative a person's goals were the more likely a person was to persist and commit to them (Riediger & Freund, 2004). This study is one of the first to demonstrate the facilitation of multiple-goals in a weight loss context and lends utility to the employment of the IRQ to distinguish between interference and facilitation in weight loss. However future research is needed in order to test the validity of this scale for weight loss studies. Study two also adds to the literature in being amongst the first to emphasise the importance of considering the role of other non weight-related goals in influencing weight loss goal pursuit and highlights the importance of developing a greater knowledge surrounding the influence of temptations on ones weight loss goal attainment.

One key factor consistently identified in the aforementioned studies that determined subsequent successful weight loss goal attainment was the ability for an individual to resist temptation. Thus collectively proposing a key question in terms of weight loss goal pursuit- what factors determine one's ability to successfully overcome temptation? Study three (chapter 4) employed an ecological momentary assessment via a mobile phone application to record daily fluctuations in temptation and lapse occurrence and the relationships of these fluctuations to the self-regulatory factors previously associated with weight loss success (in both the current thesis and the recent literature).

In line with previous research lapse occurrence was associated with a number of intrapersonal, situational and psychological factors including the strength of temptation, which can enhance ones susceptibility to temptation (Hofmann, Baumeister, et al., 2012), the presence of others and social norms, which is known to increase ones vulnerability to lapse (Hofmann, Baumeister, et al., 2012; Wansink, 2006), and the environment (exposure to food cues) that the dieter is in, which reinforces the literature on the importance of being aware of one's environment in order to avoid 'mindless eating' and overconsumption (Wansink, 2004, 2006). Furthermore lapses were more likely to occur in the evening, which was discussed in terms of the 'strength hypothesis' of self-control in that repeated resistance of temptation throughout the day may deplete one's ability to resist temptation in the evening (Baumeister et al., 1994). Further in support of previous literature this study found that the greater use of the coping mechanisms, of thinking of one's weight loss goal and thinking of the importance of that weight loss goal were negatively associated with lapse. Which supports prior temptation related research that found that dietary lapses were associated with lower levels of coping (Carels et al., 2004; Grilo et al., 1989). Lapse occurrence was not related to trait self-control which was similar to findings of previous research in that lapse occurrence or behavioural enactment was not related to dispositional traits (i.e., self-control) (Hofmann et al., 2012).

Finally, lapse occurrence was found to mediate the relationships among the outlined predictors of lapse and the self-efficacy to resist future temptations which supports past research linking self-efficacy and weight loss success (Kitsantas, 2000; Byrne, 2002; Elfhag & Rössner, 2005). It also supports the findings of study two in that greater self-efficacy was associated with greater weight loss goal attainment. Study three is among the first to demonstrate this link between momentary lapse occurrence and future self-efficacy.

To our knowledge, this study is the first of its kind to examine this specific group of variables in relation to dietary temptations and lapse occurrences; in particular it is the first to do so through the medium of an EMA-based mobile phone application. Collectively the results illustrate the importance of examining a number of fluctuating intrapersonal, situational and psychological factors and their impact on lapse occurrence.

As before, it has been recommended in the literature that the optimal way to deal with temptation is to minimise or avoid exposure to it. In order to do so one must make efforts to engineer temptations out of their lives, thus there has been a call for self-regulatory research that focuses on empowering people with the best 'mental' strategies for avoiding lapse occurrence (Hofmann, Vohs, & Baumeister, 2012).

Whilst studies 1-3 focused on identifying the factors related to weight loss success and failure; the final study of this thesis (study four; chapter five) integrated the previous findings of the thesis with those of the recent literature in order to develop a self-regulatory skills-based weight loss intervention. The key aim of this study was to improve the self-regulatory skills necessary to help overweight individuals resist temptation and subsequently improve weight-related outcomes. The study employed a low intensity intervention involving the training of six key self-regulatory skills: Delayed gratification, goal setting, temptation control strategies, coping, self-monitoring and mindfulness. This was compared to a control intervention focused on providing information on the best dietary and physical activity practices for weight loss.

There were significant reductions in the physical measures; weight, waist circumference, body fat and BMI at follow-up for both experimental and control groups. There is a large body of research illustrating the effectiveness of dietary and exercise behaviours at producing small to moderate improvements in weight loss (Anderson et al.,

2009; Health, 1998; Sharma, 2007). Therefore it is positive to note that for the experimental group training specific self-regulatory skills alone (independent of encouraging dietary and physical activity practices) can produce similar short-term weight losses. Furthermore those in the experimental group also achieved significant increases in physical activity over the course of the intervention. Previous research has found that practice in one area of self-control can lead to improvement on a number of other self-regulatory and health-related behaviours (Baumeister et al., 2006) which may explain the increases in physical activity found in the experimental group.

The hypothesised greater differences in the experimental group for the self-regulatory skills (e.g., delayed gratification etc.) were not observed, however, positively both the experimental and control groups' experienced significant increases in all self-regulatory skills. Whilst it was plausible that the experimental group should experience increases in the six self-regulatory skills taught in the intervention it was surprising to observe comparable increases in the control group. It was thought that this may have occurred as the act of weekly practice of tasks (even though these tasks were physical activity and diet-based) strengthened the control groups self-regulatory skills in general. Indeed Oaten and Cheng (2006) found that the practice of self-regulation via regular physical activity lead to the improvement in other self-regulatory behaviours (e.g., increasing positive study habits, saving and healthier eating).

Similar increases in both groups were found for the psychological measures (self-efficacy for appropriate eating, perceived self regulatory success, and physical self worth). These were discussed in terms of the following potential explanations; the fact physical activity is known to increase perceptions of self-worth (Fox, 2007) and that dietary interventions have previously been shown to improve the self-efficacy to regulate ones eating (Clark et al., 1991; Shin et al., 2011). In terms of perceptions of success at dieting, the similar

significant improvements found for both groups were thought to be due to the comparable significant improvements in the physical, the psychological and the self-regulatory skills-based measures.

Results indicated that this low intensity intervention can be as effective as a physical activity and dietary intervention in producing significant changes in physical, self-regulatory and psychological outcomes.

General Limitations and Recommendations for Future Research

The current thesis lends support to the importance of examining self-regulatory factors, in particular those that influence lapse occurrence, and their impact on weight loss and weight maintenance success. However the individual studies within this thesis were not without their shortcomings and thus it is important to acknowledge these limitations in order to learn from them and potentially guide future research and practice. A number of study specific limitations and future recommendations have been discussed within each individual chapter of the thesis. Here we will present the general limitations that affect the current thesis as a whole and stemming from these in the latter half of this section some future recommendations for research are provided.

A potential shortcoming of the current studies may be the frequent use of self-report questionnaire measures (Studies two and three employed self-report measures of psychological and weight-related characteristics). Self-report measures are frequently employed in social psychology as they are easy to administer and provide vital information on a wide range of psychological characteristics. However they have been criticised in the past as they can also be subject to socially desirable responding and recall bias (Breakwell, Hammond, & Fife-Schaw, 2000). In the current thesis, study two which was exclusively

based on a single cross-sectional questionnaire was the most vulnerable to these shortcomings and as a result no direct or causal relationship can be inferred from its results. However this study did make efforts to overcome some of the known limitations of self-report questionnaires by controlling for social desirability in its analysis. Furthermore although self-report questionnaires were frequently employed in the current studies, study two was the only study that solely relied on this methodology. Indeed the present findings go beyond the sole reliance on questionnaire measures known to dominate the social psychology field (Baumeister, Vohs, & Funder, 2007) by utilising a range of techniques to capture the factors relating to self-regulatory success and failure in weight loss (i.e., interviews, ecological momentary assessment and an intervention). Finally in addition to using whole questionnaires studies two, three and four employed a number of items that were adapted from previous questionnaires and scales from the relevant literature. Although efforts were made to test the reliability of these items (measuring each item twice to measure internal consistency and running Cronbach's α and inter-item correlations) future work should look to run exploratory factor analyses in order to provide more comprehensive detail about the validity of these items.

Self-reported weight is commonly used in weight loss studies due to its convenience and low cost (Lombard, Deeks, & Teede, 2009). However, self-reporting ones weight is thought to underestimate actual weight and accordingly it is recommended in the weight loss literature that objective measures are used when possible (Casey et al., 1991). Thus, the utilisation of self-reported weight measurement in studies 1-3 may be considered a potential limitation. Nevertheless, although self-reported weight was employed in studies 1-3, (unlike study four; which employed objective measures of weight), self-reported weight was not one of the main outcome measures of these studies and was only used for descriptive purposes.

Furthermore research indicates that self-reported height and weight is relatively accurate when compared with objective measures, in particular for females (Lois, Kumar, Williams, & Birrell, 2011). The burden of this limitation in the current studies is potentially reduced given that the mean percentage of females in the current study was 80%, together with the fact that weight change was not a key priority of the first three studies.

However this illustrates a further possible constraint in terms of the characteristics of the participants involved in the thesis. Firstly, as above, the majority of our sample were female (80%), thus the pattern of results found may not be fully applicable to men. Nevertheless it is a common issue in the weight loss research that more male participants are needed (Colvin & Olson, 1983; Hill & Wing, 2003; Svetkey et al., 2008) and future weight loss research should seek to attract more male participants in order to provide results that can be generalised to both genders. Further restrictions in relation to the participants recruited to the studies include the prominence of participants of white ethnicity and the use of convenience sampling. Whilst these conditions reduce the potential generalisability of the thesis they are consistent with that of other studies examining weight loss goal pursuit (Jeffery et al., 2000; Kayman et al., 1990; Perri, 1998; Reyes et al., 2012). Finally, both study two and three included participants who were of normal weight (i.e., BMI < 25). Although these participants may have been previously overweight dieters striving to maintain their weight, their results may differ from those who are currently overweight or obese and a comparison amongst these groups based on BMI may have been useful. However our sample sizes for these studies were too small to carry out the statistical tests necessary. Further research including more diverse ethnicities, male participants and comparing those of different weight categories is necessary in order to apply the findings of the current thesis to the general public.

A key issue within the weight loss literature, in particular the psychological-based research is the paucity of long-term studies. Given that the majority of those who initially lose weight via weight loss interventions tend to regain this weight over time longer studies are necessary to examine the clinical relevance of any improvements found (Lillis, Hayes, Bunting, & Masuda, 2009). The current group of studies may be too short to fully capture the true nature of the self-regulatory processes surrounding weight loss and crucially weight maintenance pursuit.

In study one the interviews were carried out on one occasion only. While this facilitated some in depth interpretation a second series of interviews would have allowed any thoughts stimulated by a previous interview to be discussed at a future interview. However, although a greater amount of interviews may provide a more comprehensive picture of the relationships among the self-regulatory factors over time, the single interview format appears to be the norm in similar weight maintenance research (Chambers & Swanson, 2012; Epiphaniou & Ogden, 2010; Green et al., 2009). Furthermore, the key self-regulatory factors identified in study one that were associated with weight maintenance success and failure were consistent with that of other studies (Byrne, 2002; Elfhag & Rössner, 2005), which increases our confidence in this methodology. However future longitudinal research could help explore how the factors indentified in study one develop and evolve over time, in particular to pinpoint their involvement in the transition from weight loss to weight maintenance. This is necessary in order to determine what factors are operational at this crucial time so that future interventions can aim to target and develop these factors so they can be employed when needed most.

Studies two and three may have also benefited from being longitudinal in nature. In terms of study two, examination of multiple-goal pursuit over a longer time frame would have

allowed for a more detailed investigation into the fluctuations in the self-regulatory factors influencing attainment for both the weight loss and non weight loss goals. For example it would be interesting to observe how goal pursuit changes during times when one goal is particularly salient (e.g., for academic goals; in the run up to exams or for weight loss goals; at a certain time of year such as January). Further, although the current study was necessary to initially establish how weight loss operates in the context of another valued goal, a two-goal comparison may oversimplify the numerous competing demands placed on an individual's daily resources, therefore, future longitudinal studies may benefit from examining the concurrent management of several goals at once.

In terms of study three, although a one-week period is the current standard in EMA studies of this kind (Carels et al., 2001, 2004; Hofmann et al., 2012), longer monitoring periods may be needed to fully capture the relationship between future self-efficacy and lapse occurrence.

Finally one of the shortcomings of study four was that the length of the follow-up period only spanned four weeks post-intervention. Generally, weight loss interventions tend to have follow-up periods of at least six months (Gourlan, Trouilloud, & Sarrazin, 2011; Lombard, Deeks, & Teede, 2009). A longer follow-up would potentially have allowed us to examine if greater changes in weight loss emerged over time for the experimental group. Unfortunately a follow-up period of this length was beyond the scope and time frame of the current thesis. However it remains notable that this low cost, low intensity and short duration intervention still managed to produce significant changes in a number of physical, self-regulatory and psychological measures.

Practical Implications

This thesis has provided an insight into the factors relating to self-regulatory success and failure in weight loss, with a particular focus on those factors that relate to one's ability to resist temptations. As the obesity crisis continues to tighten its grip on our society there is an urgent need not only to contribute to the literature but to inform and advance future practice.

Practical recommendations stemming from study one imply that weight loss programs should devote a significant amount of attention to getting participants to view weight loss as a long-term or chronic process and in doing so highlight the advantages of such an approach. Additionally study one indicates that the field could benefit from a focus on promoting active coping behaviours, looking at the best ways to encourage self-monitoring and importantly allowing treats or temptations in moderate doses to help avoid the feelings of deprivation and depletion which were associated with lapses.

Positively study two demonstrates that people can successfully pursue and attain their weight loss goals alongside other important goals, even if it takes a large amount of time and effort. Importantly, the study found that weight loss goals can have a mutually facilitative relationship with other non weight-related goals, which can subsequently have a positive effect on weight loss goal attainment. Furthermore the findings of the differential contribution of facilitation and interference to weight loss goal attainment promote the employment of the IRQ in future weight loss research and practice. Crucially future weight loss programs need to assist participants in identifying pathways by which they can enhance the mutual facilitation of their weight loss goals whilst simultaneously pursing other non weight-related goals.

Study three provides an insight into the way people deal with the intrapersonal, situational and psychological factors that impact their lapse occurrence on a daily basis. Given the findings in relation to the situational factors, it could be potentially useful for future

weight loss programs to highlight the danger of the influence of others and social norms on a dieter's exposure to temptation. Further, the findings for the utility of coping and self-efficacy for overcoming lapse occurrence corroborate those of the previous studies in this thesis which found that they were both key factors relating to weight loss and weight maintenance success (study one: Coping, study two: Self-efficacy). Collectively emphasising the need for weight loss programs to encourage active coping responses following lapse in order to increase ones future self-efficacy and simultaneously reduce future lapse occurrences.

Importantly the findings in study three allude to the potential value of the employment of mobile phone applications as self-monitoring tools in weight loss programs. This is supported by the findings from study one that identified self-monitoring as a key factor in successful weight maintenance pursuit. Further, these apps could be used as a diagnostic tool for individuals prior to entry into weight loss programs in order to determine when they are tempted and why. This could enable intervention staff and the individuals themselves, to tailor the program to their specific needs. Finally, considering the majority of weight loss attempts occur outside of formal weight loss interventions (Fabricatore et al., 2008) future research could also develop the app in order to provide personalised feedback following a week of recording. This may be useful as it could be made available to a large range of individuals in the community. This could allow individuals, independent of a formal weight loss program, to self-monitor their own lapse occurrence, enabling them to target areas for improvement and potentially enhancing their chances of weight loss success. Stemming from this, future applications of study four could benefit from the use of the mobile app employed in study three. This could be useful to compare the frequency of lapse occurrence both pre-and-post intervention in order to determine the impact that training self-regulatory skills alone has on lapse occurrence, in comparison to dietary and physical activity based intervention.

Recent research suggests that although more intensive interventions can bring about positive behaviour change they tend to promote reliance on intervention staff contact, are expensive and complex to deliver (Franz et al., 2007; Kiernan et al., 2013; Lombard et al., 2010). Thus it has been recommended that future weight loss interventions should look for ways in which to overcome these barriers (Kiernan et al., 2013). It is notable that study four, although brief, low cost and less intensive (low contact with intervention staff) than other interventions still produced favourable physical, self-regulatory and psychological outcomes. Further, given the rising financial burden of obesity on the already strained national health service (estimated at £5.1bn per year; Scarborough et al., 2011), future studies should look into providing a cost analysis of interventions such as the above in order to promote similar low intensity and low cost interventions that are easy to disseminate in order to potentially reap greater, more sustainable benefits for a wide range of individuals throughout the community.

Conclusion

Considering the current obesity epidemic we need to help individuals identify the self-regulatory skills needed for success. However awareness alone is not enough we also need to help them to develop the necessary self-regulatory skills so they can cope successfully with temptations and crucially help to avoid future lapse occurrence. The current thesis provides a first step in this direction by identifying and aiming to develop via intervention a number of the key psychological and self-regulatory factors related to weight loss, weight maintenance and dietary lapse occurrence in dieters. Its findings could be employed to inform future weight loss interventions.

Obesity is complex and multi-factorial in nature and can have a detrimental impact not only on our physical and but also our psychological health. Urgent action is needed to stem

the rising tide of obesity in our society. However to date, there appears to be no single ‘silver bullet’ that determines success. Instead we must continue to strive for ways to improve the multitude of factors influencing weight loss and maintenance success in particular the factors that affect one’s ability to resist temptation. Only then can we maximise our chances of triumph in the fight against obesity.

APENDICIES

Appendix A

Interview Transcript Employed in Study One

Section One: Weight Loss Goal Characteristics

1) Tell me the story of your weight loss journey…..

Potential probes:

- *Why did you start to pursue weight loss?*
- *Why is weight loss important to you?*
- *What contributed?*
- *What helped /facilitated?*
- *Who helped/facilitated?*
- *What motivated you to continue?*

2) What does success mean to you in terms of weight loss?

Potential probes:

- *Define success?*
- *Turning points of this process?*
- *When did you become successful?*
- *How did you become successful?*
- *What barriers stopped you from being successful?*
- *Was it difficult? Why?*
- *Who was involved? Friend who where they? How did they help?*

- *When do you consider yourself more successful? Give an example of when you are successful/unsuccessful at weight loss.*
- *How hard do you find your weight loss goal now in comparison to before?*

Section Two: Temptation

Lead on from previous section example of unsuccessful.....

3) How do you deal with temptations?

Potential probes:

- *What are these temptations?*
- *Where are they?*
- *Can you give an example of giving in/resisting temptations?*
- *Why were you tempted?*
- *Was anyone with you?*

Section Three: Relapse

4) If I mentioned the word relapse to you, what would your interpretation of this be?
5) Could you tell me about a time you relapsed....

Potential probes:

- *When have you relapsed?*
- *Why did you relapse?*
- *How did you respond/react to it?*

Section Four: Future Possibilities

6) What are your plans for future weight loss/maintenance?

- *What would you do differently?*

7) How confident do you feel you will be able to maintain this loss alongside your other personal/professional goals in the future?

- *Why are you confident/ unconfident?*

8) If you were to give advice to others about maintaining weight loss from what you learnt what would you advise people?

Appendix B

Questionnaire Items Employed in Study Two

Reynolds Short-Form of the Marlowe-Crowne Social Desirability Scale (MCSD) (Version C) (Reynolds, 1982).

Please respond to each question by circling T=true or F=false in relation to your own personality characteristics.

Please be honest in your responses.

	True	False
It is sometimes hard for me to go on with my work if I am not encouraged.	T	F
I sometimes feel resentful when I don't get my way.	T	F
On a few occasions, I have given up doing something because I thought too little of my ability.	T	F
There have been times when I felt like rebelling against people in authority even though I knew they were right.	T	F

No matter who I'm talking to, I'm always a good listener.	T	F
There have been occasions when I took advantage of someone.	T	F
I'm always willing to admit it when I make a mistake.	T	F
I sometimes try to get even rather than forgive and forget.	T	F
I am always courteous, even to people who are disagreeable.	T	F
I have never been irritated when people expressed ideas very different from my own.	T	F
There have been times when I was quite jealous of the good fortune of others.	T	F
I am sometimes irritated by people who ask favours of me.	T	F
I have never deliberately said something that hurt someone's feelings.	T	F

Brief Self-control Scale (BSCS; Tangney, Baumeister, & Boone, 2004)

Using the scale provided, please indicate how much each of the following statements reflects how you typically are.

	Not at all				Very much
I am good at resisting temptation	1	2	3	4	5
I have a hard time breaking bad habits	1	2	3	4	5
I am lazy	1	2	3	4	5
I say inappropriate things	1	2	3	4	5
I do certain things that are bad for me, if they are fun	1	2	3	4	5
I refuse things that are bad for me	1	2	3	4	5
I wish I had more self-discipline	1	2	3	4	5
People would say that I have iron self-discipline.	1	2	3	4	5
Pleasure and fun sometimes keep me from getting work done	1	2	3	4	5

I have trouble concentrating	1	2	3	4	5
I am able to work effectively toward long-term goals	1	2	3	4	5
Sometimes I can't stop myself from doing something, even if I know it is wrong	1	2	3	4	5
I often act without thinking through all the alternatives	1	2	3	4	5

Life Orientation Test (LOT-R; Scheier, Carver, & Bridges, 1994)

Please answer the following statements about yourself;

	Strongly disagree				Strongly agree
In uncertain times, I usually expect the best	0	1	2	3	4
It's easy for me to relax	0	1	2	3	4

If something can go wrong for me, it will	0	1	2	3	4
I'm always optimistic about the future	0	1	2	3	4
I enjoy my friends a lot	0	1	2	3	4
It's important for me to keep busy	0	1	2	3	4
I hardly ever expect things to go my way	0	1	2	3	4
I don't get upset too easily	0	1	2	3	4
I rarely count on good things happening to me	0	1	2	3	4
Overall, I expect more good things to happen to me than bad	0	1	2	3	4

Goal Characteristics

Self-efficacy (adapted from Bandura, 1997)

	Not at all able/capable								Very much able/capable
To what degree do you feel you possess the ability to realize your goal?	1	2	3	4	5	6	7	8	9
To what extent do you feel you have the capabilities necessary to attain your goal?	1	2	3	4	5	6	7	8	9

Goal persistence (adapted from Jung and Brawley, 2010)

How much time, effort, persistence and attention have you invested in order to pursue your weight loss goal/goal 1 over the previous month?

	Little to none		As much as it takes

Time	1	2	3	4	5	6	7	8	9
Effort	1	2	3	4	5	6	7	8	9
Persistence	1	2	3	4	5	6	7	8	9
Attention	1	2	3	4	5	6	7	8	9

Temptation (adapted from Freitas et al., 2002)

	Never								Always
Rate on the scale below how often you were exposed to temptations that you didn't plan to engage in, that lured you away from your goal and that may have impacted upon your goal	1	2	3	4	5	6	7	8	9
Rate on the scale below how frequently over the last month you have felt that you've given in to temptations that have affected your goal	1	2	3	4	5	6	7	8	9

Goal Attainment (Adapted from Louro et al., 2007)

	Not at all attained/met								Completely met/attained
To what extent do you feel you have attained your goal?	1	2	3	4	5	6	7	8	9
To what degree do you feel your goal has been met?	1	2	3	4	5	6	7	8	9

Intergoal Relations Questionnaire (IRQ; Riediger & Freund, 2004)

Keeping both goal 1 and your weight loss goal in mind. Please answer the following questions:

How often over the last month did it happen that, because of the pursuit of goal 1, you do not invest as much a) time b) energy c) money into your weight loss goal as you would have liked to?

	Never/very rarely				Very often
Time	1	2	3	4	5
Energy	1	2	3	4	5
Money	1	2	3	4	5

How often over the last month did it happen that, because of the pursuit of your weight loss goal, you did not invest as much a) time b) energy c) money into goal 1 as you would liked to?

	Never/very rarely				Very often
Time	1	2	3	4	5
Energy	1	2	3	4	5
Money	1	2	3	4	5

IRQ continued:

	Never/very rarely				Very often
How often did it happen over the last month that you did something in the pursuit of goal 1 that was incompatible	1	2	3	4	5

with your weight loss goal?					
How often over the last month did it happen that you did something in the pursuit of your weight loss goal that was incompatible with goal 1?	1	2	3	4	5
The pursuit of your goal (goal 1) sets the stage for the realization of your weight loss goal	1	2	3	4	5
The pursuit of your weight loss goal sets the stage for the realization of goal 1	1	2	3	4	5
How often did it happen that over the last month you did something in the pursuit of goal 1 that was simultaneously beneficial for your weight loss goal?	1	2	3	4	5
How often did it happen that over the past month you	1	2	3	4	5

did something in the pursuit of your weight loss goal that was simultaneously beneficial for goal 1?					

Appendix C

Study three Mobile Phone Application Script

Did you lapse (i.e., give in to the temptation)?

Yes or No

	Not very						Extremely
How attractive did you find this temptation?	1	2	3	4	5	6	7
How strong was this temptation?	1	2	3	4	5	6	7
What was your level of stress immediately prior to temptation?	1	2	3	4	5	6	7
How mentally fatigued did you feel immediately prior to	1	2	3	4	5	6	7

temptation?							
What degree of strain were you experiencing immediately prior to temptation?	1	2	3	4	5	6	7
Did the presence of others contribute to how you responded to the temptation?	1	2	3	4	5	6	7
How depleted did you feel prior to temptation?	1	2	3	4	5	6	7
How hungry were you immediately prior to the temptation?	1	2	3	4	5	6	7
Did others influence your reaction to temptation?	1	2	3	4	5	6	7

Please choose one statement below:	
A. This temptation became available to me unexpectedly	B. I sought this temptation out

	Not at all						Very much
Rate your attempts to cope, if any, when faced the temptation							
A. I thought about my long term weight loss goal	1	2	3	4	5	6	7
B. I thought about how important weight loss is to me	1	2	3	4	5	6	7

How capable do you now feel in terms of pursuing your weight loss goals?	1	2	3	4	5	6	7
Thinking of your current temptation or lapse, how confident did you feel in terms of pursuing your future weight loss goal?	1	2	3	4	5	6	7

Appendix D

Questionnaire Measures Employed in Study Four

Weight Efficacy Lifestyle Scale (WEL; Clark, Abrams, Niaura, & Eaton, 1991).

Item responses range from 0 (Not confident) to 9 (Very confident)

	Not confident									Very confident
I can resist eating when I am anxious (nervous).	0	1	2	3	4	5	6	7	8	9
I can resist eating when I am depressed (or down).	0	1	2	3	4	5	6	7	8	9
I can resist eating when I am angry (or irritable).	0	1	2	3	4	5	6	7	8	9
I can resist eating when I have experienced failure.	0	1	2	3	4	5	6	7	8	9
I can control my eating on the weekends.	0	1	2	3	4	5	6	7	8	9
I can resist eating when there are many different	0	1	2	3	4	5	6	7	8	9

kinds of food available.										
I can resist eating even when I am at a party.	0	1	2	3	4	5	6	7	8	9
I can resist eating even when high-calorie foods are available.	0	1	2	3	4	5	6	7	8	9
I can resist eating even when I have to say "no" to others.	0	1	2	3	4	5	6	7	8	9
I can resist eating even when I feel it's impolite to refuse a second helping.	0	1	2	3	4	5	6	7	8	9
I can resist eating even when others are pressuring me to eat.	0	1	2	3	4	5	6	7	8	9
I can resist eating even when I think others will be upset if I don't eat.	0	1	2	3	4	5	6	7	8	9
I can resist eating when I feel physically run down.	0	1	2	3	4	5	6	7	8	9
I can resist eating even when I have a headache.	0	1	2	3	4	5	6	7	8	9

I can resist eating when I am in pain.	0	1	2	3	4	5	6	7	8	9
I can resist eating when I feel uncomfortable.	0	1	2	3	4	5	6	7	8	9
I can resist eating when I am watching TV	0	1	2	3	4	5	6	7	8	9
I can resist eating when I am reading.	0	1	2	3	4	5	6	7	8	9
I can resist eating just before going to bed.	0	1	2	3	4	5	6	7	8	9
I can resist eating when I am happy.	0	1	2	3	4	5	6	7	8	9

Perceived Self-Regulatory Success in Dieting Scale (PSRS; Fishbach et al., 2003)

To what extent do you agree or disagree with the following statements:

	Strongly disagree						Strongly agree
I find it difficult to stay in shape	1	2	3	4	5	6	7
I am successful in losing weight	1	2	3	4	5	6	7

I am successful in watching my weight	1	2	3	4	5	6	7

Physical Self Worth subscale of the Revised Physical Self Perception Profile (PSPP-R) (Lindwall, Aşçi, et al., 2011)

These are statements that allow people to describe themselves. Please tick the box under each sentence or question to say how much you think the sentence is true for you or how important it is to you. There are no right or wrong answers, since people differ a lot. Your responses are anonymous.

	Not true at all for me	Only a little true for me	Sort of true for me	Really true for me
I am proud of who I am, and what I can do, physically.				
I am happy with how I am and what I can do physically.				
I feel very confident about myself physically.				
I have positive feelings about myself physically				

I have a lot of respect for myself physically				
I am very satisfied with myself physically				

International Physical Activity Questionnaire (IPAQ) (Booth, 2000)

Think about all the vigorous activities that you did in the last 7 days. Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

1. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?

_____ **days per week**

No vigorous physical activities → ***Skip to question 3***

2. How much time did you usually spend doing **vigorous** physical activities on one of those days?

_____ **hours per day**

_____ **minutes per day**

Don't know/Not sure

*Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.*

3. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

   _____ **days per week**

   No moderate physical activities → ***Skip to question 5***

4. How much time did you usually spend doing **moderate** physical activities on one of those days?

   _____ **hours per day**

   _____ **minutes per day**

   Don't know/Not sure

*Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise, or leisure.*

5. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time?

_____ **days per week**

No walking → ***Skip to question 7***

6. How much time did you usually spend **walking** on one of those days?

_____ **hours per day**

_____ **minutes per day**

Don't know/Not sure

Self-Regulatory Skill Measures:

	Do not use	Not effective at all				Very effective
Goal setting						
I regularly record my weight loss goals						
Effectiveness of regularly recording your goals on your weight loss success	0	1	2	3	4	5
I revise my short, medium and long-term weight loss goals regularly						
Effectiveness you feel revising your goals is on your weight loss success	0	1	2	3	4	5
Coping						

I use strategies to overcome lapses and continue with my weight loss goals						
Effectiveness of your strategies on your ability to overcome lapses and continue with your weight loss goals	0	1	2	3	4	5
I have ways in which to overcome lapses in order to stay on track with my weight loss goals						
Effectiveness of your ways in which to overcome lapses on your weight loss success	0	1	2	3	4	5
Delay gratification						
I'm good at resisting temptations as I allocate times to allow treats						
Effectiveness of allocating certain times for treats on your ability to stick to your weight loss goals	0	1	2	3	4	5
I plan for when I'm going to eat things contrary to my weight loss goals in order to help me stay on track						

Effectiveness of planning when you are going to eat things contrary to your weight loss goals on keeping you on track	0	1	2	3	4	5
Mindfulness						
I find I can pay attention to the food I'm eating (I am always aware of what I am eating and how much of it I am eating) and the sensations I feel whilst eating it						
Effectiveness of paying full attention to your food on your weight loss success	0	1	2	3	4	5
I am fully aware of what I am eating, my pace of eating, fullness and how much I eat when having meals and snacks						
Effectiveness of being fully aware of what you are eating on your weight loss success	0	1	2	3	4	5
Thought control						
I have thought based strategies that I employ when faced with temptation						

Effectiveness of the strategies that you employ when faced with temptation on your weight loss success	0	1	2	3	4	5
I have strategies that I think of when tempted						
Effectiveness of the strategies you think of when tempted	0	1	2	3	4	5
Self-monitoring						
I monitor my weight loss on a daily/weekly basis						
Effectiveness of monitoring your weight loss on a daily/weekly basis	0	1	2	3	4	5
I record some aspect of my weight loss on a regular basis (e.g., weight, food diary, exercise)						
Effectiveness of recording an aspect of your weight loss on a regular basis on your weight loss success	0	1	2	3	4	5

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