# A SELF-DETERMINATION THEORY PERSPECTIVE ON THE SUCCESS AND FAILURE OF EATING REGULATION IN WOMEN: DOES PLANNING AND SELF-MONITORING THE QUALITY VERSUS THE QUANTITY OF EATING MATTER?

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*"Eat food. Not too much. Mostly plants."*

-Michael Pollan, In Defense of Food: An Eater's Manifesto

## ABSTRACT

Based within the Self-Determination Theory (SDT), the overall objective of this thesis was to examine how motivational processes involved in the regulation of eating give rise to different self-regulation strategies in terms of eating quality and quantity, and how the adoption of these strategies influence women's eating behaviors and life satisfaction over time. This objective was achieved through a series of eight studies, divided into four manuscripts. First, a measure that would allow us to assess healthy and unhealthy eating behaviors based on recent recommendations of Canada's Food Guide was developed and validated. In Manuscript #1, we validated the Healthy and Unhealthy Eating Behavior Scale (HUEBS) by examining the structure of the scale (Study 1 $N$ = 360; Study 2 $N$ = 711) and by establishing convergent validity through the examination of the relationships between motivational concepts, healthy and unhealthy eating behaviors as measured by the HUEBS, and waist circumference (Study 2 $N$ = 711; Study 3 $N$ = 264). Results supported the factor structure of the scale. It was also demonstrated that as women moved along stages of change for eating regulation, they reported higher levels of self-determined (versus non-self-determined) motivation and a higher consumption of healthy (versus unhealthy) foods. Furthermore, findings showed that healthy eating fully mediated the relationship between self-determined motivation and waist-circumference, and that the relationship between self-determined motivation and healthy eating was moderated by stages of change. Since there was also a need to develop a scale that would allow us to measure planning and self-monitoring strategies in terms of eating quality (i.e., nutrient intake) and quantity (i.e., calories and portion sizes), Manuscript #2 validated the Planning and Self-Monitoring the Quality and Quantity Scale (PMQQS; Study 1 $N$ = 355; Study 2 $N$ = 318). Results supported the 6-factor structure of the scale and demonstrated that strategies related to the quality of eating

were more strongly and positively associated with healthy eating and more strongly and negatively associated with unhealthy eating, whereas strategies related to the quantity of eating were more strongly and positively associated with bulimic symptoms and Body Mass Index (BMI). Manuscript #3 then examined if the strategies assessed by the PMQQS provided additional variance to eating behaviors over and above the effects of motivation (Study 1 $N$ = 456) and if the strategies mediated the relationships between motivation and eating, while controlling for BMI (Study 1 $N$ = 456; Study 2 $N$ = 979). Overall, it was found that strategies played a significant role in explaining eating behaviors and that planning and self-monitoring the quality of eating mediated the relationships between autonomous motivation and healthy and unhealthy eating, whereas planning and self-monitoring the quantity of eating mediated the relationship between controlled motivation and bulimic symptoms. Finally, in Manuscript #4, we tested a longitudinal model ($N$ = 230) examining the roles of goals and motivation in the prediction of the strategies and various types of eating and the effects of adopting these behaviors on life satisfaction over a 3-month period. Results revealed that intrinsic goals were positively associated with autonomous motivation whereas extrinsic goals were positively associated with controlled motivation for eating regulation at Time 1 (the baseline), and that autonomous motivation positively predicted quality strategies whereas controlled motivation positively predicted quantity strategies at Time 2 (1 month). Planning and self-monitoring quality then predicted healthy and unhealthy eating behaviors, whereas planning and self-monitoring quantity predicted bulimic symptoms at Time 3 (3 months). Finally, healthy eating was positively associated with life satisfaction, whereas bulimic symptoms was negatively associated with life satisfaction at Time 3. Overall, this thesis increases knowledge on why some women succeed, whereas others fail, to regulate their eating behaviors over time.

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## CONTRIBUTIONS OF AUTHORS

This thesis is composed of six chapters: a general introduction, four manuscripts, and a general discussion. The general introduction (Chapter 1) provides an overview of the theoretical background that guided the research, the four manuscripts present the findings of eight studies (Chapters 2 – 5) and the general discussion (Chapter 6) presents an integration of the findings.

I, Camille Guertin, am responsible for the conceptualization, data collection, data analysis, and writing of this thesis, and I am the primary author on all manuscripts. My thesis supervisor, Dr. Luc Pelletier, provided guidance and feedback at all stages of the thesis, and is the second author on all manuscripts. Dr. Paige Pope also provided feedback on Manuscript #1 and is the third author of this manuscript.

The first and second manuscripts have been published in the *Appetite* journal.

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# *CHAPTER ONE*

## GENERAL INTRODUCTION

The regulation of eating behavior is a complex challenge for many individuals. This challenge is apparent in the increasing rates of overweight and obesity that often result from overconsumption of food and other eating-related issues such as disordered eating in Western societies. To illustrate the gravity of the problem, the prevalence of obesity in Canada has increased from 6.1 to 18.3% between 1985 and 2011, and obesity in classes I (BMI of 30.0 – 34.9), II (BMI of 35.0 – 39.9) and III (BMI ≥ 40.0) has increased from 5.1 to 13.1%, from 0.8 to 3.6%, and from 0.1 to 1.6% respectively, over the past three decades (Twells, Gregory, Reddigan, & Midodzi, 2014). It is also estimated that 30% of 10 – 14-year-old girls report dieting to lose weight despite being at a healthy weight (McVey, Tweed, & Blackmore, 2004, 2005); that around 40 to 60% of teenage girls engage in weight-loss behaviors (Daee, Robinson, Lawson, Turpin, Gregory, & Tobias, 2002); and that approximately 35 to 77% of adolescent girls engage in unhealthy weight control strategies such as crash dieting, fasting, self-induced vomiting, diet pills, and/or laxatives (Boutelle, Neumark-Sztainer, Story, & Resnick, 2002).

Unfortunately, problematic eating behaviors are not inconsequential and represent serious risk factors for individuals' physical and psychological health. For instance, dieting and the use of unhealthy weight control strategies have been associated with increases in weight, body mass index, and body fat percentage over the long-term (e.g., Field, Austin, Taylor, Malspeis, Rosner, Rockett, et al., 2003; León-Muñoz, García-Esquinas, Soler-Vila, Guallar-Catillón, Banegas, & Rodríguez-Artalejo, 2016; Neumark-Sztainer, Wall, Guo, Story, Haines, & Eisenberg, 2006; Neumark-Sztainer, Wall, Story, & Standish, 2012) and disordered eating behaviors such as bulimia and anorexia nervosa have been associated with lower self-esteem, life satisfaction, and

well-being, as well as depression and anxiety (e.g., Araujo, Santos, & Nardi, 2010; Pelletier & Dion, 2007; Pelletier, Dion, Slovinec-D'Angelo, & Reid, 2004; Tomba, Offidani, Tecuta Schumann, & Ballardini, 2014).

Although failing to properly regulate eating behaviors is the recurring reality of many people, there is a proportion of individuals who succeed in managing their eating behaviors on a regular basis. Some individuals who have previously experienced difficulties with eating regulation can successfully maintain weight loss during a significant amount of time (e.g., Wing & Hill, 2001) and to decrease binge eating episodes following a dieting intervention (e.g., Goodrick, Poston, Kimball, Reeves, Foreyt, 1998; Reeves, McPherson, Nichaman, Harrist, Foreyt, & Goodrick, 2001). Since eating regulation failure can have detrimental effects on individuals' physical and psychological health, scholars have shown great interest in examining the various factors involved in eating regulation success versus failure.

Over the past decade, motivational psychology has provided extensive insight on the etiology of adaptive and maladaptive forms of eating regulation. Several studies based on the Self-Determination Theory (SDT; Ryan & Deci, 2017) have demonstrated the importance of considering the more global motivational processes involved in eating regulation. These studies have examined two types of motivational dynamics: the "why" (i.e., regulatory processes) and the "what" (i.e., goal content) of behavior and how they influence eating patterns. By using the SDT as a guiding framework, the main objective of this research program is to build upon the literature on eating regulation and gain further knowledge on the processes (i.e., the "how" of behavior) that lead to (un)successful eating regulation. Specifically, different dimensions of self-regulation strategies will be observed as mediators of the relationship between individuals' goals and motivation and eating patterns, and their association with psychological health.

## The Self-Determination Theory

The SDT is a meta-theory of human motivation that is based on an organismic-dialectical approach. The "organismic" aspect of the theory refers to the assumption that human beings have natural tendencies to grow, master challenges, and integrate experiences into a unified and coherent sense of self. Although the SDT presumes this natural tendency toward self-development, it also acknowledges that it can only operate under social environments that provide optimal nutriments (Ryan & Deci, 2017). In other words, social environments can either support or thwart human propensities, which can have critical impact on human development. In this regard, the "dialectical" aspect of the theory refers to the inter-relationship between human beings as active and integrative agents, and social contexts that either nurture or impede their potential (Ryan & Deci, 2017).

According to the SDT, human beings have three basic psychological needs (autonomy, competence, and relatedness) which provide the basis for distinguishing an environment that leads to optimal (versus non-optimal) functioning. The need for *autonomy* refers to the need of being the agent of one's behaviors and acting out of one's personal interests and values (De Charms, 1968; Deci, 1975). The need for *competence* refers to feeling able to effectively interact with the social environment and experience opportunities to exercise one's capabilities (Deci, 1975; White, 1959). Finally, the need for *relatedness* refers to having a sense of belongingness and connectedness with others (Baumeister & Leary, 1995; Ryan, 1995). An environment that supports human basic psychological needs is theorized to contribute to healthy consequences, such as proactivity, integration, and well-being, whereas an environment that thwarts human basic psychological needs is thought to promote negative consequences, such as passivity, fragmentation, and ill-being (Vansteenkiste & Ryan, 2013).

From the SDT perspective, the concept of basic psychological needs has deep implications for understanding why people succeed or fail at self-regulation. Specifically, the SDT differentiates between the motivations and goals that are associated with the satisfaction of basic psychological needs and the ones that are associated with its frustration and the difference between these motivations and goals are generally associated with positive or negative outcomes.

**Motivation from the SDT Perspective**

According to the SDT, the reasons for which individuals engage in different activities is crucial for understanding differences in individuals' experiences (Ryan & Deci, 2017; Vansteenkiste, Ryan, & Deci, 2008). Contrary to other theories that conceptualize motivation in terms of *quantity* (Bandura, 1996; Baumeister & Vohs, 2007; Locke & Latham, 1990), the SDT emphasizes the importance of motivational *quality* (Ryan & Deci, 2017). More specifically, the SDT posits that there are three broad types of motivation (i.e., intrinsic, extrinsic, and amotivation) that can be distinguished into six behavioral regulations that differ in their level of internalization. Within the SDT, the quality of motivation is represented through the process of internalization, such that the more internalized or integrated a behavior is in the person's sense of self, the more positive the affective, cognitive, and behavioral outcomes will be. This internalization process can be viewed along a continuum that places the six behavioral regulations going from the least to the most self-determined forms of regulations (Ryan, 1995). The behavioral regulations situated at the lower end of the continuum are amotivation and external and introjected regulations; and the ones located at the upper end of the continuum are identified and integrated regulations, and intrinsic motivation.

Beginning with the least self-determined form of motivation is *amotivation,* which involves behavior that is unintentional and/or whose source of regulation is unknown to a person.

According to Ryan and Deci (2017), amotivation is defined as a separate construct to intrinsic and extrinsic motivation, in that it represents a complete lack of self-determination. When people are amotivated, they find no value, rewards, and/or meaning in performing a behavior. This type of motivation could be represented by a person who doesn't see the purpose of eating healthy and/or who doesn't understand how eating can be regulated. The next form of motivation is extrinsic motivation, which can be divided into four types of behavioral regulations. The first type of extrinsic motivation is *external regulation,* wherein individuals engage in behavior out of personal pressure and/or because they are rewarded for it. A person who eats healthily because their doctor prescribes them to do so would be considered externally regulated. The second type of extrinsic motivation is *introjection,* which refers to behavior that is engaged in to avoid feelings of anxiety and/or guilt. Because introjection represents behavior that is controlled by the self, as well as by the internalization of other people's approval, it is considered partially assimilated within the self. This type of regulation could be represented by an individual who follows a healthy diet because they don't want to be ashamed of how they look. The third type of extrinsic motivation, *identification,* involves the personal value of a behavior and is considered a self-determined form of extrinsic motivation. A person who recognizes the benefits associated with healthy eating is regulated by identification. The most self-determined form of extrinsic motivation is *integration,* which refers to behavior that is congruent with other values and goals, as well as other dimensions within the self such as one's health and well-being. Integration could be represented more generally by a person who regulates their eating behavior because it is part of their lifestyle. Finally, behavior regulated by *intrinsic* motivation is engaged in because it is inherently satisfying, it is conflict-free, and it represents a volitional expression of the self. A person who genuinely enjoys healthy eating would be considered intrinsically regulated.

According to the SDT, these behavioral regulations can be combined using different approaches. Two common ways of combining these regulations have been to distinguish between autonomous and controlled motivation, and self-determined and non-self-determined motivation. When using the first approach, an autonomous motivation score is created by regrouping the behavioral regulations that reflect individuals' volition to engage in a behavior (i.e., intrinsic motivation, and integrated and identified regulations) – in other words, the regulations that reflect *self*-determination. To contrast autonomous motivation, a controlled motivation score is also created by regrouping the behavioral regulations that reflect internal and external pressures to act a certain way (i.e., introjected and external regulations). The second approach combines the behavioral regulations in the same way as the first approach; however, non-self-determined motivation also considers the lack or the absence of motivation as part of controlled forms of regulations. Specifically, non-self-determined motivation represents the combination of introjected and external regulations, as well as amotivation.

Within the SDT, the hierarchical model of intrinsic and extrinsic motivation posits that motivation can occur at different levels of generality (Vallerand, 1997). More specifically, the model suggests that individuals can be motivated at the global, contextual, and situational levels, and each level is thought to influence the next proximal level through top-down and bottom-up processes. When considering each level of motivation, global motivation is akin to a personality trait and refers to a person' general motivation toward his/her environment, which is relatively stable. Contextual motivation refers to the type of motivation that individuals experience within a specific life domain, such as work, education, relationships, exercise, and eating. Finally, situational motivation pertains to motivation that is experienced daily or in the 'here and now.' Using the regulation of eating as an example of the different levels of motivation, an individuals'

motivation towards eating is influenced by the context in which they are trying to eat healthily and their global motivation, and their motivation towards eating influences how the individuals will go about their daily activities pertaining to eating (e.g., strategy use, food choices).

Considering that self-determined motivation arises from the satisfaction of basic psychological needs and through the process of internalization, people who engage in behavior for self-determined (versus non-self-determined) reasons are more likely to experience positive outcomes including greater weight loss (e.g., Silva, Markland, Carraça, Vieira, Coutinho, Minderico, et al., 2010; Williams, Grow, Freedman, Ryan, & Deci, 1996) and healthy eating behaviors (e.g., Guertin, Pelletier, Émond, & Lalande, 2017; Guertin, Rocchi, Pelletier, Émond, & Lalande, 2015; Pelletier, et al., 2004), and less depression, somatization, anxiety, and higher quality of life (for a review, see Ng., Ntoumanis, Thøgersen-Ntoumani, Deci, Ryan, Duda, et al., 2012). On the contrary, non-self-determined motivation has been associated with negative outcomes, such as decreased health, vitality, persistence, and success (Ryan & Deci, 2017).

**The examination of motivation within the eating regulation domain.** As part of the investigation of the SDT framework within the health domain, several studies have examined the consequences associated with self-determined and non-self-determined motivation in the context of eating regulation. For example, in a motivational model of the regulation of eating behaviors, Pelletier and colleagues (2004; study 2) found that self-determined motivation was positively associated with healthy eating behaviors (e.g., eating more fruits and vegetables) and fewer bulimic symptoms, whereas non-self-determined motivation was positively associated with bulimic symptoms and negatively associated with healthy eating behaviors. These researchers also found that self-determined motivation was positively associated with concerns over the *quality*, and to a lesser extent, the *quantity* of eating, whereas non-self-determined motivation

was positively associated with concerns over the *quantity*, and to a lesser extent, the *quality* of eating. Similar results were reported in Pelletier and Dion's (2007) study, in which self-determined motivation was positively associated with healthy eating behaviors and negatively associated with bulimic symptoms, and the reverse was true for non-self-determined motivation.

In a sample of middle-aged women, Leong and colleagues (Leong, Madden, Gray, & Horwath, 2012) found that self-determined motivation was positively associated with healthy food-related behaviors (e.g., consumption of fruits and vegetables) and negatively associated with less healthy food-related behaviors (e.g., consumption of meat pie/sausage rolls, burgers), whereas the opposite was found for non-self-determined motivation. In this study, binge eating frequency was also found to mediate the relationship between self-determined and non-self-determined motivation and body mass index. Guertin and colleagues (Guertin, Barbeau, Pelletier, & Martinelli, 2017) also showed that non-self-determined motivation was positively associated with unhealthy eating, whereas self-determined motivation was negatively associated with unhealthy eating behaviors. The same findings were demonstrated in Guertin, Barbeau, & Pelletier's (2018) study, with the addition of self-determined motivation that was also positively associated with healthy eating behaviors. Finally, Pelletier and colleagues (2004; study 3) found that global self-determination at Time 1 (the baseline) led to higher levels of contextual self-determination for dietary behaviors at Time 2 (13-week), which led to a reduction in the percentage of caloric intake in the form of fat and saturated fat and improved physiological health indicators at Time 3 (26-weeks) amongst patients with cardiovascular diseases.

In addition to examining the direct association between self-determined and non-self-determined motivation and eating behaviors, researchers have also examined mediators of the relationship between motivation and eating. For instance, Hagger and colleagues (Hagger,

Hardcastle, Chater, Mallett, Pal, & Chatzisarantis, 2014) examined the relative contribution of autonomous and controlled motivation in the prediction of several eating and drinking behaviors (e.g., controlling calorie intake, eating low-fat foods, keeping alcohol intake within guideline limits, avoiding eating 'junk' food, taking dietary supplements, avoiding foods high in sodium) and the mediating role of intentions between motivation and behavior. Within- and between-subject analyses revealed significant effects for autonomous motivation and modest effects for controlled motivation on intentions and behavior for all eating variables, except for the intake of high-fiber foods. Furthermore, Otis and Pelletier (2008) found that approach food planning (i.e., plans that specify *what to* eat) partially mediated the relationship between autonomous motivation and healthy eating behaviors, whereas avoidance food planning (i.e., plans that specify *what not to* eat) partially mediated the relationship between controlled motivation and bulimic symptoms.

Hagger, Chatzisarantis and Harris (2006) also reported that higher levels of autonomous (versus controlled) motivation was associated with positive attitudes and perceived behavioral control over dieting. Perceived behavioral control, in turn, was associated with intentions to diet and dieting behaviors. Similarly, Girelli, Hagger, Mallia, and Lucidi (2016) showed that autonomous motivation was a significant predictor of attitudes and perceived behavioral control over eating at least five portions of fruits and vegetables, having breakfast, and restricting the consumption of snacks everyday, and that perceived behavioural control, in turn, significantly predicted intention and behavior in these three behaviors. Finally, amongst cardiac populations, Guertin and colleagues (2015, 2017) demonstrated that perceived self-efficacy for healthy eating mediated the relationship between self-determined motivation and healthy eating behaviors.

Together, these findings support the assumption that self-determined motivation leads to positive outcomes, whereas non-self-determined motivation leads to negative outcomes. In relation to eating specifically, self-determined motivation has been associated with healthy eating behaviors, and alternatively, non-self-determined motivation has been associated with unhealthy eating behaviors and the development of disordered eating.

**Goals from the SDT Perspective**

In addition to distinguishing between the types of motivations that underlie individuals' behaviors, the SDT also argues that people can pursue two different types of life goals: intrinsic and extrinsic goals. Intrinsic goals (e.g., self-development, physical and psychological health) are thought to promote an "inward" orientation and are consistent with the satisfaction of basic psychological needs, since their attainment is focused on self-actualization and integration (Ryan, Sheldon, Kasser, & Deci, 1996; Vansteenkiste, Lens, & Deci, 2006). Conversely, extrinsic goals (e.g., fame, attractiveness and physical appearance) are thought to promote an "outward" orientation and are more conducive to the frustration of basic psychological needs, since they tend to focus on obtaining rewards, social status, and recognition (Vansteenkiste, Soenens, & Duriez, 2008). According to the SDT, when people chronically fail to satisfy their basic psychological needs, they engage in maladaptive behaviors such as need substitutes or compensatory behaviors to cope with their deficit in need-satisfaction (Sheldon, 2011; Verstuyf, Patrick, Vansteenkiste, & Teixeira, 2012). In the context of eating, the former refers to the pursuit of extrinsic goals that are salient in consumer culture (e.g., thin ideal), whereas the latter refers to the engagement in releasing (e.g., excessive or uncontrolled eating) or rigid behaviors (e.g., extreme restriction of calories and portions, and/or food types).

Given the distinctive nature of both types of goals, studies have repeatedly demonstrated that intrinsic goals are associated with positive outcomes, such as psychological need satisfaction, persistence, learning, achievement, reduced anxiety, and well-being (e.g., McLachlan & Hagger, 2011; Sebire, Standage, & Vansteenkiste, 2009; Vansteenkiste, Simons, Lens, Sheldon, & Deci, 2004; Vansteenkiste, Simons, Soenens, & Lens, 2004), whereas extrinsic goals are associated with negative outcomes, such as lower life satisfaction, self-esteem, and happiness, and higher levels of depression, negative affect, and anxiety (Kasser, 2015; Vansteenkiste et al., 2008). Within the eating domain, the principal contrast between intrinsic and extrinsic goals lies in the distinction between the goals of being healthy and fit (i.e., intrinsic goal) and looking good to others (i.e., extrinsic goal; Ryan, Williams, Patrick, & Deci, 2009).

**The examination of goals within the eating regulation domain.** A few studies have investigated intrinsic and extrinsic goals within the context of eating and have provided evidence for the positive and negative outcomes associated with both types of goals (for a review, see Verstuyf et al., 2012). In a first study, Putterman and Linden (2004) investigated whether dieting for health (vs. for appearance) was associated with the same negative consequences generally associated with chronic dieting. Consistent with the SDT, the findings revealed that dieting for appearance reasons was associated with the use of drastic dieting behaviors (e.g., restricting calories, excluding food groups, using laxatives) and higher levels of disinhibited eating (i.e., overeating) and lapses in restraint, whereas dieting for health reasons was associated with fewer negative outcomes. Amongst adolescent girls, Thøgersen-Ntoumani, Ntoumanis, and Nikitaras (2010) tested a process model based on the SDT and found that health goals were positively associated with psychological need-satisfaction, which was further negatively associated with body image concerns. Image goals, on the contrary, were positively associated with body image

concerns, which were further associated with unhealthy weight control behaviors (e.g., skipping meals, fasting). In the same line of research, Schelling and colleagues (Schelling, Munsch, Meyer, & Margraf, 2011) examined the relationship between health- and appearance-focused goals for weight loss and dieting, and found that both types of goals were positively associated with the number of diets, but that only dieting for appearance reasons in relation to oneself (versus others) was associated with binge eating episodes. Similarly, Verstuyf, Vaansteenkiste, and Soenens (2012) showed that appearance-focused (but not health-focused) goals were positively associated with diet-specific need frustration which, in turn, was positively associated with binge eating symptoms.

Furthermore, using a daily diary methodology, Verstuyf, Vansteenkiste, Soetens & Soenens (2016) demonstrated that appearance-focused goals were positively associated with disordered eating, whereas health-focused goals were negatively associated with disordered eating and positively associated with healthy eating behaviors throughout a one-week period. Guertin and colleagues (2017) also found that women who put more emphasis on extrinsic goals were more likely to engage in fat talk (i.e., negative conversations about one's and/or other people's bodies) which, in turn, was positively associated with contextual non-self-determined motivation for eating and unhealthy eating behaviors. On the contrary, women who placed more emphasis on intrinsic goals were less likely to engage in fat talk and instead, intrinsic goals were positively associated with contextual self-determined motivation for the regulation of eating and negatively associated with unhealthy eating behaviors. Similar results were reported in Guertin et al.'s (2018) study, where extrinsic goals were positively associated with fat talk which, in turn, was positively associated with contextual non-self-determined motivation. Conversely, intrinsic goals were positively associated with self-compassion which, in turn, was positively associated

with self-determined motivation for eating. Non-self-determined motivation was then positively associated with unhealthy eating, whereas self-determined motivation was negatively associated with unhealthy eating and positively associated with healthy eating behaviors.

In sum, the literature examining goals within the eating regulation domain provides clear evidence that the pursuit of intrinsic goals is associated with more health-promoting outcomes, whereas the pursuit of extrinsic goals is associated with more health-diminishing outcomes. The pursuit of health has been associated with outcomes such as need-satisfaction and less engagement in dieting and unhealthy eating behaviors. Conversely, the pursuit of physical attractiveness has been associated with outcomes such as need-frustration and drastic dieting and maladaptive eating behaviors.

**The Relationship Between Motivation and Goals Within the SDT**

Although the SDT suggests that motivation and goals are two separate constructs (Ryan & Deci, 2017), it is important to note that motivation and goals are related to the extent that the adoption of goals needs to be ongoingly regulated in order to be pursued and in some cases, achieved (Vansteenkiste, Lens, Elliot, Soenens, & Mouratidis, 2014). According to the SDT, goals indicate the direction of individuals' personal strivings, whereas motivation indicates the regulatory basis through which goals are pursued, hence suggesting that goal content precedes the motivational regulation of goal-directed behaviors. The SDT posits that motivation and goals both contribute unique variance to affective, cognitive, and behavioural outcomes; however, the theory also assumes that, on average, intrinsic goals are more often regulated by autonomous motivation and extrinsic goals are more often regulated by controlled motivation. Since intrinsic goals directly satisfy basic psychological needs of autonomy, competence, and relatedness, individuals who pursue intrinsic goals are more likely to engage in goal-directed behaviors out of

integration and volition. On the contrary, since extrinsic goals are generally pursued as a substitute and/or to compensate for unsatisfied needs, goal-directed behaviors are more likely to be controlled by external sources (Ryan & Deci, 2017).

The relationship between motivation and goals have long been debated within the SDT literature. Since intrinsic goals and autonomous motivation, as well as extrinsic goals and controlled motivation, are often correlated (e.g., Kasser & Ryan, 1993; Sheldon & Kasser, 1995), some researchers have stipulated that the effects of the content of goals are entirely reducible to the effects of motivation. For instance, Carver and Baird (1998) and Srivastava, Locke, and Bartol (2001) have argued that extrinsic goals are negatively related to psychological adjustment because individuals typically report feeling controlled and insecure while pursuing these types of goals. In other words, these researchers suggested that when predicting outcomes, it is not the content of individuals' goals that matter, but rather the motivation that underlie their goal pursuit. At the same time, others have argued that goals and motivation make independent contributions to well-being outcomes, thereby suggesting that it is both what you pursue *and* why you pursue it that matters. For example, Sheldon, Ryan, Deci, and Kasser (2004) conducted a series of three studies demonstrating that goals predicted significant variance in well-being outcomes over and above the effect of goal motives. Within the eating regulation domain, Verstuyf and colleagues (2016) also showed that intrinsic and extrinsic goals yielded unique variance to various types of eating behaviors, even after controlling for autonomous and controlled motivation.

To further demonstrate this controversy, findings have been inconsistent when examining mediation analyses between goals and motivation and outcomes. For instance, in the context of exercise, Gillison, Standard, and Skevington (2006) found that self-determined motivation for exercise partially mediated the relationship between intrinsic and extrinsic goals and reported

exercise and quality of life, whereas Markland (1999) found that autonomy fully mediated the relationship between goals and interest/enjoyment of exercise. Similarly, Ingledew and Markland (2008) showed that motivation for exercise fully mediated the relationship between intrinsic and extrinsic goals for exercise and exercise participation. In summary, although the SDT suggests that goals and motivation are correlated but nonetheless provide independent variance in affective, cognitive, and behavioral outcomes (Ryan & Deci, 2017), the independent effects of goals and motivation on outcomes have not always been clear.

## Limitations of the Literature

Despite the fact that significant advances have been made in the eating regulation literature over the past few decades, there remain some limitations that need to be addressed. First, with respect to the measurement of eating behaviors, there is currently no validated measure that allows researchers to easily assess healthy and unhealthy eating behaviors based on recent recommendations of Canada's Food Guide (Government of Canada, 2019). In fact, most of the research described above has measured healthy eating using a limited number of food items that were based on the recommendations of the food guide created back in 1992 and often failing to assess unhealthy eating behaviors. Since national dietary guidelines have since then undergone many changes and have important implications for the health of individuals, researchers could benefit from a scale that assesses healthy and unhealthy eating behaviors based on recent recommendations.

Second, at the theoretical level, the SDT has been extremely useful in establishing the relationships between motivation and goals and various eating patterns. What has been less researched, however, are the processes through which motivation and goals lead to such behaviors. According to models of self-regulation such as cybernetic control theory (e.g., Carver

& Scheier, 1982), models of willpower and self-control resources (e.g., Baumeister, Heatherton, & Tice, 1994; Mischel, Cantor, & Feldman, 1996), and behavioral enaction theories (e.g., Gollwitzer, Fujita, & Oettingen, 2004; Schwarzer, 2001), successful self-regulation involves two subsequent tasks or goal-regulated behaviours: goal setting and goal striving. Goal setting entails setting desired goals and establishing criteria for judging success, whereas goal striving entails engaging in behaviors and/or strategies in the service of goal attainment.

Based on these models, a review of the literature has made it evident that the SDT research mainly focuses on the former step of eating regulation (i.e., goal setting) and pays little attention to the latter step (i.e., goal striving). More specifically, most of the research examines the direct association of goals and motivation on eating behaviors, without necessarily examining *how* individuals self-regulate their eating behaviors. It is possible that differences in the use of self-regulation strategies may account for the effect of goals and motivation on eating behaviors, such that individuals who pursue intrinsic goals for self-determined reasons are more likely to use optimal self-regulation strategies, whereas individuals who pursue extrinsic goals for non-self-determined reasons may be more likely to use less optimal self-regulation strategies.

This research program addresses this issue by examining whether individuals with different goals and motivations engage in different strategies to self-regulate their eating behaviors which, in turn, should lead to distinct eating outcomes. Specifically, two self-regulation strategies that have consistently been shown to be effective in facilitating goal striving and goal attainment will be examined. The first strategy, planning, refers to a cognitive strategy that involves specifying actions that relate a future goal-relevant response with a situational cue (Gollwitzer, 1999; Sniehotta, Schwarzer, Scholz, & Schüz, 2005). Within the literature, planning is often referred to as “if-then” plans and could be exemplified by plans such as “if I crave an

unhealthy snack, then I will go for a walk" or "if I am going to a restaurant, I will choose a healthy option." Since planning improves perceptual readiness for specified cues (Gollwitzer, 2014; Orbeil, Hodgkins, & Sheeran, 1997; Sniehotta et al., 2005; Webb & Sheeran, 2004) and increases the automaticity of a behavior in a given situation (Aarts & Dijksterhuis, 2000; Brandstatter, Lengfelder, & Gollwtizer, 2001; Sheeran, Webb, & Gollwitzer, 2005; Webb & Sheeran, 2008; Webb, Sheeran, & Luszczynska, 2009), planning is thought to increase individuals' likelihood of achieving their goals. Indeed, a meta-analysis conducted by Adriaanse and colleagues (Adriaanse, Vinkers, De Ridder, Hox, & De Wit, 2011) has shown that planning in terms of "if-then" plans is effective for improving both healthy (Cohen's $d$ = .51) and unhealthy (Cohen's $d$ = .29) eating behaviors.

The second strategy, self-monitoring, involves the observation and recording of behaviors in the service of reducing the gap between a current state and an ideal state. More precisely, it involves noting the qualities of a specific behavior (e.g., the amount of food consumed in a week) and/or the outcomes associated with the behavior (e.g., weight gain, maintenance, or loss), to then compare it with one's ideal state (e.g., to lose 2lbs per week; Baumeister & Vohs, 2007; Carver & Scheier, 1982; Harkin, Webb, Chang, Prestwich, Conner, Kellar, et al., 2016; Webb, Chang, & Benn, 2013). Self-monitoring is supposed to facilitate goal achievement because it helps individuals identify situations in which they are progressing toward or regressing away from their goals, and thus allowing them to readjust their behaviors accordingly (Fishbach, Touré-Tillery, Carter, & Sheldon, 2012; Myrseth & Fishback, 2009). A meta-analysis conducted by Harkin et al. (2016) has shown that self-monitoring is an effective strategy for managing weight, and that interventions that include self-monitoring are more likely to lead to health behavior change.

Throughout this program of research, four important and distinct points relevant to eating behaviors will be examined. First, this thesis will provide validation for a new eating scale that will allow researchers to measure both healthy and unhealthy eating behaviors based on recent recommendations of Canada's Food Guide. Second, the respective roles of planning and self-monitoring will be examined as mediators of the relationships between goals and motivation and eating behaviors, in order to increase knowledge on how different types of goals and motivation lead to distinct eating outcomes. Third, since both goals and motivation will be considered in the present thesis, their unique or reducible contributions on eating outcomes will be examined in order to provide further evidence of their roles in eating regulation. Finally, we will further study planning and self-monitoring based on the findings of Pelletier and colleagues (2004), which demonstrated that women with an autonomous motivation were mainly concerned by the *quality* of the foods that they ate, whereas women with a controlled motivation were mainly concerned by the *quantity* of the foods that they ate. Specifically, planning and self-monitoring will be distinguished in terms of *quality* and *quantity*, in order to examine whether individuals with different types of goals and motivation differ in the way they use these strategies. Although no study has yet distinguished these strategies according to these dimensions, planning and self-monitoring are known to encompass a multitude of dimensions (Gollwitzer, 1999; Harkin et al., 2016), which could potentially include the quality and quantity distinction.

The distinction between eating quality and quantity is important to acknowledge when examining the regulation of eating, first because it represents two types of decisions – *what* and *how much* one should eat – that individuals may face when they decide to eat, and second, because it represents a distinction that is often recognized within national eating guidelines. For instance, the Canadian Food Guide (Government of Canada, 2019) recommends individuals to

consume and limit certain types of foods based on their nutritional value and to be mindful about calories and portion sizes when making dietary choices. Furthering knowledge on the antecedents and consequences associated with these ways of thinking is crucial since the quality and quantity of eating play integral roles in the ongoing regulation of eating and can provide important insight into the success and/or failure of eating regulation.

**Is Eating Quality Different from Eating Quantity?**

To date, no study has compared the effects of eating quality and quantity on individuals' eating behaviors and/or health; therefore, it remains difficult to determine which of the two dimensions is the most optimal for health. Despite the lack of research on this subject, however, there is some indication that focusing on the quality of one's eating behaviors may provide more beneficial outcomes than focusing on the quantity of eating. For instance, based on the work of Pelletier et al., (2004), Verstuyf and colleagues (2012) proposed that a quality approach to eating regulation may be more strongly associated with experiences that satisfy basic psychological needs of autonomy, competence, and relatedness, whereas a quantity approach to eating regulation may be more strongly associated with experiences that thwart basic psychological needs. In other words, individuals who focus on their caloric intake and/or portion sizes may find eating regulation more rigid and controlling than individuals who focus on their nutrient intake.

In the same line of reasoning, the quality/quantity dimension may act similarly to the approach/avoidance dimension examined in Otis and Pelletier's (2008) study, in that individuals who focus on the quality of eating may be more likely to choose food items that are good for their health, whereas individuals who focus on the quantity of eating may be more likely to avoid food items that are high in calories and/or to restrict portion sizes to control weight. If that is the case, according to the Dietary Restraint Theory (Polivy & Herman, 1985), strategies related to

the quantity of eating would represent forms of restrained eating. Restrained eating such as eating a limited number of calories per day has been associated with the "what-the-hell" effect, which is often seen in restrained dieters who overindulge after exceeding their daily caloric limit (Cochran & Tesser, 1996). According to Polivy and Herman (1985), eating for a daily subgoal of caloric intake is associated with susceptibility to disruption, creating dichotomous relationships with food such as an eat/don't eat or good/bad dichotomy, and giving up cognitive restraint of the subgoal following failure. Although focusing on the quality of eating may also be controlling in that individuals may develop a maniacal obsession for healthy foods (i.e., orthorexia nervosa; Donini, Marsili, Graziani, Imbriale, & Cannella, 2013), if the goal pursuit and regulatory basis of the goal is internalized within the self, planning and self-monitoring for the quality of eating may facilitate the engagement in healthy eating behaviors, in that focusing on the quality of eating may provide more flexibility in one's food choices.

Furthermore, although specific to self-monitoring caloric intake, a handful of studies have reported an association between calorie-tracking smartphone applications (e.g., My Fitness Pal, Livestrong Calorie Counter, Lose It!) and the triggering, maintenance, and/or exacerbation of eating disorder symptomatology. For example, Simpson and Mazzeo (2017) found that individuals who reported using calorie trackers were more likely to exhibit eating concerns and dietary restraint, even after controlling for BMI. Embacher and colleagues (Embacher, McGloing, & Aitken, 2018) also showed that female college students were more likely to use calorie-tracking apps than male college students and that body dissatisfaction – a risk factor for disordered eating – mediated the relationship between biological sex and the use of calorie-tracking apps. Additionally, Plateau, Bone, Lanning, and Meyer (2018) found that users of activity and food intake monitoring tools were more concerned about their eating behaviors and

weight and engaged in more dietary restraint and purging behaviors than nonusers. It was also found that participants who used these tools to manage weight and shape reported higher levels of eating and compulsive exercise psychopathology in comparison to participants who used these tools to improve health and fitness. Lastly, amongst participants recruited from a community eating disorder clinic, Levinson, Fewell, and Brosof (2017) showed that approximately 75% of individuals relied on My Fitness Pal to monitor their food intake and 73% of users perceived the app as a contributing factor to their eating disorder.

## Current Research

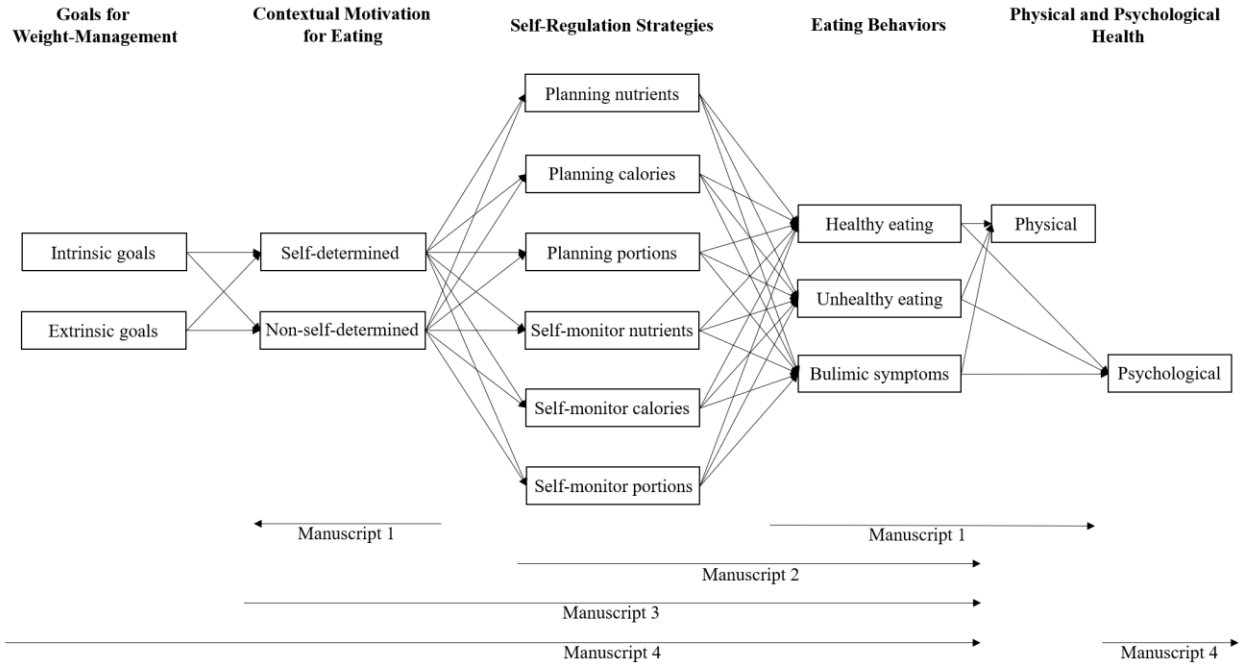
The objective of this thesis is to further examine how motivational processes involved in the regulation of eating behaviors give rise to different self-regulation strategies in terms eating quality and quantity, and how these processes influence eating behaviors and psychological health over time. Specifically, this program of research will examine whether individuals with different types of goals and motivation differ in the strategies they use to regulate their eating behaviors, and whether the different use of these strategies lead to distinct consequences in terms of eating behaviors and life satisfaction over time.

This program of research can be conceptualized into three phases. Phase I is dedicated to the development and validation of two scales that will allow us to address the objectives of this research. The first scale – the Healthy and Unhealthy Eating Behaviors Scale (HUEBS) – has been developed to assess individuals' healthy and unhealthy eating behaviors based on recent recommendations of Canada's Food Guide. The second scale – the Planning and Self-Monitoring the Quality and Quantity Scale (PMQQS) – has been developed to assess planning and self-monitoring strategies in terms of eating quality (i.e., nutrient intake) and quantity (i.e., calories and portion sizes). Phase II focuses on investigating the relationships between motivation (i.e.,

autonomous and controlled), strategies as assessed by the PMQQS (i.e., planning and self-monitoring nutrient intake, calories, and portion sizes), and various types of eating behaviors (i.e., healthy and unhealthy eating, and bulimic symptoms), using a cross-sectional design. Finally, phase III is centered on examining the predictive roles of goals and motivation on individuals' uses of the strategies and eating behaviors, and the influence of these processes on individuals' general life satisfaction over a 3-month period. It should be noted that none of the respondents who participated in this thesis overlap between studies and that no dataset has been used more than once across any of the studies.

**Proposed Model**

Based on the SDT, the following model is proposed for examining the motivational processes involved in eating regulation success and failure. Within this model, eating regulation success is represented by the engagement in healthy eating behaviors and consequently, higher levels of physical and psychological health, whereas eating regulation failure is represented by the engagement in unhealthy eating behaviors and the presence of bulimic symptoms and consequently, lower levels of physical and psychological health.




**Goals for weight-management.** This section focuses on the goals that individuals may pursue for weight-management.

***Intrinsic and extrinsic goals***. In accordance with the SDT, individuals' goals for weight-management will be assessed in terms of intrinsic and extrinsic goals. As previously mentioned, both types of goals have been shown to lead to distinct consequences, with intrinsic goals leading to more positive outcomes, and extrinsic goals leading to more negative outcomes (for a review, see Verstuyf et al., 2012). In line with previous work (e.g., Guertin et al., 2017, 2018), it is hypothesized that intrinsic goals will be positively associated with contextual self-determined motivation, whereas extrinsic goals will be positively associated with contextual non-self-determined motivation for eating regulation.

**Contextual motivation.** In the proposed model, contextual motivation represents the motivational processes that are thought to drive individuals to engage in specific strategies.

***Self-determined and non-self-determined motivation for eating.*** Individuals' motivation for eating regulation will be assessed in terms of the behavioral regulations proposed by the SDT

(intrinsic, integrated, identified, introjected, external, and amotivation). In line with Pelletier and colleagues' (2004; study 2) study, which demonstrated that individuals with an autonomous motivation were more concerned over the quality of their eating behaviors and individuals with a controlled motivation were more concerned over the quantity of their eating behaviors, the association between motivation at the contextual level and planning and self-monitoring in terms of quality and quantity will be examined. Consistent with previous research (e.g., Otis & Pelletier, 2008), individuals' contextual motivation for eating regulation should be a direct indication of *how* individuals go about regulating their eating behaviors. It is expected that autonomous motivation will be more strongly and positively associated with planning and self-monitoring the quality of eating (i.e., nutrient intake), whereas controlled motivation will be more strongly and positively associated with planning and self-monitoring the quantity of eating (i.e., calories and portion sizes).

**Self-regulation strategies.** This section focuses on the self-regulation strategies that are proposed as mediators of the relationship between motivation and eating behaviors.

***Planning and self-monitoring for nutrient intake, calories, and portion sizes.*** Planning and self-monitoring are two strategies that have consistently been shown to facilitate goal striving and goal attainment (for reviews, see Adriaanse et al., 2011, and Harkin et al., 2016). Although a myriad of studies has supported the beneficial effects of these two strategies, no study within the self-regulation literature has yet examined whether individuals utilize these strategies in qualitatively distinct ways. Based on Pelletier and colleagues' (2004; study 2) study, in this section, planning and self-monitoring will be distinguished in terms of quality (i.e., nutrient intake) and quantity (i.e., calories and portion sizes). This will allow us to examine if individuals with different types of motivation utilize the strategies in different ways, and if the

different uses of the strategies lead to distinct consequences in eating behaviors. It is expected that utilizing the strategies for quality purposes will be more strongly and positively associated with healthy eating behaviors, whereas utilizing the strategies for quantity purposes will be more strongly and positively associated with unhealthy eating behaviors and/or bulimic symptoms.

**Eating behaviors.** In this section, positive as well as negative eating outcomes will be examined in order to differentiate the strategies that lead to (un)successful eating regulation.

***Healthy and unhealthy eating***. Several studies interested in examining eating outcomes have distinguished between specific types of healthy and unhealthy eating behaviors, such as the consumption of fruits and vegetables and unhealthy snacks. Although many studies have attempted to conceptualize these two behaviors, no objective measure currently exists for assessing overall healthy and unhealthy eating behaviors based on recent recommendations of Canada's Food Guide. Part of this thesis will be to develop and validate a scale that will allow researchers to measure overall healthy and unhealthy eating behaviors based on national dietary guidelines. It is hypothesized that healthy eating behaviors will be negatively and positively associated with physical and psychological health indicators respectively, whereas unhealthy eating behaviors will be positively associated with physical health and negatively associated with psychological health indicators.

***Bulimic symptoms.*** In parallel with the examination of healthy and unhealthy eating behaviors as outcome variables, researchers have also shown great interest in examining more dysfunctional eating patterns such as bulimic symptoms (e.g., Pelletier & Dion, 2007; Pelletier et al., 2004, study 2; Thøgersen-Ntoumani et al., 2010; Verstuyf et al., 2012). Consistent with previous research (e.g., Pelletier & Dion, 2007; Pelletier et al., 2004), it is expected that bulimic

symptoms will be related to lower psychological health when compared to healthy and unhealthy eating behaviors.

**Physical and psychological health.** Consistent with the SDT and with previous research (e.g., Guertin et al., 2014, 2017; Pelletier et al., 2004, study 3), physical and psychological health indicators will be examined as consequences of healthy and unhealthy eating behaviors, and bulimic symptoms.

***Physical health.*** Considering that eating regulation success and failure may play an important role in weight-management, studies have examined physical health indicators such as weight, waist circumference, body mass index, and body fat percentage as consequences of eating behaviors (e.g., Guertin et al., 2015, 2017; Pelletier et al., 2004; Silva et al., 2010; Williams et al., 1996). In this thesis, waist circumference will be examined as a physical health outcome to eating. This physical health indicator was chosen amongst others, since individuals can easily measure their own waist circumference and screen for possible health risks associated with overweight and obesity (Janssen, Katzmarzyk, & Ross, 2002; Klein, Allison, Heymsfield, Kelly, Leibel, Nonas, et al., 2012).

***Psychological health.*** In this thesis, the psychological health of individuals will be assessed by measuring their satisfaction with life. Life satisfaction is a relatively stable construct that is understood to be a good indicator of quality of life and has been examined as an outcome to various eating patterns in previous research within the SDT framework (e.g., Guertin et al., 2015, 2017; Pelletier & Dion, 2007).

## Research Objectives

The general objective of this research program is to investigate whether women engage in different strategies to self-regulate their eating behaviors based on their motivation, and if the use

of these strategies has distinct consequences in terms of eating behaviors and physical and psychological health. This objective is achieved through a series of eight studies, divided into four manuscripts.

**Manuscript #1 – Guertin, C., Pelletier, L., & Pope, P. (2020). The Validation of the Healthy and Unhealthy Eating Behavior Scale (HUEBS): Examining the Interplay Between Stages of Change and Motivation and their Association with Healthy and Unhealthy Eating Behaviors and Physical Health. *Appetite,* 144. Doi: 10.1016/j.appet.2019.104487. (Chapter Two).** For this thesis, the purpose of Manuscript #1 is to provide validation for the HUEBS, a new scale designed to assess healthy and unhealthy eating behaviors based on recent recommendations of Canada's Food Guide. The first objective of this manuscript is to examine the relationships between self-determined and non-self-determined motivation, healthy and unhealthy eating behaviors as measured by the HUEBS, and waist circumference across different stages of behavior change. The second objective is to develop and validate the HUEBS, which will be used in all subsequent manuscripts to assess individuals' healthy and unhealthy eating behaviors. These objectives are achieved through three studies. In Study 1, we provide a test of the factorial structure of the HUEBS through Principal Component Analysis, along with the internal consistency of the proposed subscales. In Study 2, we replicate the findings of Study 1 for factorial validity and reliability, and we examine if individuals report different patterns in terms of their motivation and eating behaviors, based on their stage of change for eating regulation. Finally, Study 3 examines moderated mediation models, in which healthy and unhealthy eating mediate the relationship between motivation and waist circumference, and in which stages of change moderate the relationship between motivation and eating.

**Manuscript #2 – Guertin, C., & Pelletier, L. (in press). Planning and Self-Monitoring the Quality and the Quantity of Eating: How Different Styles of Self-Regulation Strategies Relate to Healthy and Unhealthy Eating Behaviors, Bulimic Symptoms, and BMI. *Appetite.* (Chapter Three).** The purpose of Manuscript #2 is to develop and validate the Planning and Self-Monitoring the Quality and Quantity Scale (PMQQS), which will be used to measure planning and self-monitoring strategies in terms of quality (i.e., nutrient intake) and quantity (i.e., calories and portion sizes) in all subsequent manuscripts. This objective is achieved through two studies. The purpose of Study 1 is to develop and examine the validity of the PMQQS through Confirmatory Factor Analysis and convergent and discriminant validity, and the reliability of the subscales using internal consistency analyses. Structural equation models are also tested in order to examine the relationships between the strategies, eating behaviors, and BMI. In Study 2, we replicate the results of Study 1, in order to provide further validation of the scale.

**Manuscript #3 – Guertin, C., & Pelletier, L. (under review). The Relationship Between Autonomous and Controlled Motivation and Eating Behaviors: Examining the Roles of Self-Regulating Eating Quality and Quantity. (Chapter Four).** The purpose of Manuscript #3 is to examine whether planning and self-monitoring in terms of quality (i.e., nutrient intake) and quantity (i.e., calories and portion sizes) can provide some explanation for the relationships between autonomous and controlled motivation and healthy and unhealthy eating behaviors and bulimic symptoms. This objective is achieved through two studies. In Study 1, we examine if the strategies can account for additional variance in eating outcomes over and above the influence of motivation while controlling for BMI, using hierarchical multiple regressions. Additionally, we examine if the strategies mediate the relationships between

motivation and eating behaviors. In Study 2, we cross-validate the results found in Study 1 in SEM, using a new sample.

**Manuscript #4 – Guertin, C., & Pelletier, L. (under review). Motivational Dynamics in the Prediction of Self-Regulation Strategies for the Quality and Quantity of Eating, Eating Behaviors, and Life Satisfaction: A Longitudinal Investigation (Chapter Five).** The purpose of Manuscript #4 is to examine the roles of goals and motivation in the prediction of planning and self-monitoring the quality and quantity of eating and various types of eating behaviors, and the effects of adopting these behaviors on life satisfaction over a 3-month period. This objective is achieved through one study.

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## *CHAPTER TWO*

**Guertin, C., Pelletier, L., & Pope, P. (2020). The Validation of the Healthy and Unhealthy Eating Behavior Scale (HUEBS): Examining the Interplay Between Stages of Change and Motivation and their Association with Healthy and Unhealthy Eating Behaviors and Physical Health. *Appetite,* 144. Doi : 10.1016/j.appet.2019.104487**

### Abstract

The purpose of the present research was to examine how self-determined and non-self-determined motivation for eating was related to healthy and unhealthy eating behaviors at different stages of change. In Study 1 ($n$ = 360), the structure of a new scale designed to measure healthy and unhealthy eating behaviors based on recent recommendations of the Canadian Food Guide was examined through Principal Component Analysis. Study 2 ($n$ = 711) retested the structure of the scale and also examined whether women reported different patterns of motivation and eating behaviors depending on their stage of change for eating regulation. In Study 3 ($n$ = 264), moderated mediation models were used to examine if eating behaviors served to mediate the relationship between motivation and waist circumference, and whether stages of change moderated the link from motivation to eating behaviors. Overall, the studies provided evidence for the 2-factor structure of the scale, where the first factor represents healthy eating and the second factor represents unhealthy eating behaviors. It was also demonstrated that as women moved along the stages of change for eating regulation, they reported higher levels of self-determined motivation and lower levels of non-self-determined motivation, as well as a higher consumption of healthy foods and a lower consumption of unhealthy foods. Finally, findings indicated that healthy eating fully mediated the relationship between self-determined motivation and waist circumference, and that the relationship between self-determined

motivation and healthy eating was moderated by stages of change. Together, these studies highlight the interactive roles of motivation and stages of change in their association with healthy and unhealthy eating behaviors, as well as the importance of healthy eating for a lower waist circumference.

*Keywords:* Eating behaviors; motivation; stages of change

# The Validation of the Healthy and Unhealthy Eating Behavior Scale (HUEBS): Examining the Interplay Between Stages of Change and Motivation and their Association with Healthy and Unhealthy Eating Behaviors and Physical Health

## 1. Introduction

Adhering to healthy dietary practices has become a salient global health recommendation over the past few decades, due to the increasing rates of overweight and obesity and consequently, nutrition-related chronic illnesses (e.g., cardiovascular diseases and diabetes) in Western civilization. In order to reduce the risk of developing such diseases, guidelines such as *Eating Well with Canada's Food Guide* (Government of Canada, 2011a) have advocated that Canadian adults should consume a variety of foods such as fruits and vegetables, grain products, lower-fat milk and alternatives and meat and alternatives, and to limit their consumption of foods and beverages high in calories, fat, sugar and salt.

Although the recommendations exist for the purpose of informing individuals on the types of foods to consume in order to properly nourish themselves, research within motivational psychology has shown that only some individuals engage in healthy eating practices and that, most alarmingly, others mainly engage in unhealthy ones. In fact, a growing body of research within the Self-Determination Theory (SDT; Ryan & Deci, 2017), a leading theory of human motivation, provides consistent evidence that different styles of regulation for eating behaviors lead to distinct dietary patterns, which consequently put some individuals at risk for developing chronic illnesses (Guertin, Pelletier, Émond & Lalande, 2017; Guertin, Rocchi, Pelletier, Émond, & Lalande, 2015; Pelletier, Dion, Slovinec-D'Angelo, & Reid, 2004).

### 1.1. The Self-Determination Theory

Over the past 15 years, the SDT has contributed immense knowledge on the various factors associated with the initiation and maintenance of healthy behaviors, including the regulation of eating. Of these factors is the notion of motivational *quality*, which according to the SDT is central to distinguishing between behaviors that will be more or less successfully enacted and maintained (Ryan & Deci, 2017). Within the SDT, it is assumed that individuals engage in behaviors for different reasons and that the degree to which behaviors are internalized within the self fosters one's behavioral, cognitive, and affective experiences, such that the more internalized a behavior is, the greater the outcomes.

The motivations proposed by the SDT can be placed along a continuum, from the least to the most self-determined forms of regulations. Starting with the least self-determined form of motivation is *amotivation*, which refers to a behavior that is non-regulated or that is engaged in when the source of regulation is unknown to the person. This type of motivation is the least optimal, since individuals who are "amotivated" generally have either no intention to act or they question the value of engaging in a behavior (Ryan & Deci, 2017). The following type of motivation is extrinsic motivation, which can be divided into four types of behavioral regulations (i.e., external, introjected, identified, and integrated). The least internalized is *external regulation*, which consists of a behavior that is engaged in to obtain a reward, to avoid punishment, and/or to conform to social pressures. *Introjected regulation* is the next form of extrinsic motivation and marks the beginning of the internalization process. A behavior that is regulated by introjection is typically executed in order to avoid feelings of self-imposed guilt and/or shame. Following is *identified regulation*, which represents a behavior that is viewed as important and/or valuable to a person. Next, the most self-determined type of extrinsic motivation is *integrated regulation*, which consists of a behavior that is generally enacted

because it is in line with a person's core values and/or goals. Finally, the most optimal form of motivation is intrinsic motivation, which corresponds to a behavior that is engaged in because it brings personal satisfaction and/or pleasure. According to Ryan and Deci (2017), behavioral regulations that are situated at the lower end of the continuum (i.e., amotivation, and external and introjected regulations) are considered to be "non-self-determined"; whereas behavioral regulations that are situated at the upper end of the continuum (i.e., identified and integrated regulations, and intrinsic motivation) are considered to be "self-determined".

A considerable amount of research has examined and revealed the advantages of self-determined motivation and the disadvantages of non-self-determined motivation when attempting to understand individuals' engagement in healthy and dysfunctional eating behaviors. For instance, in the first set of studies that examined the relationship between motivation and eating, Pelletier et al. (2004; study 2) and Pelletier and Dion (2007) demonstrated that self-determined motivation for eating was positively associated with healthy eating behaviors and negatively associated with bulimic symptoms. In contrast, non-self-determined motivation was negatively associated with healthy eating behaviors and positively associated with bulimic symptoms (Pelletier & Dion, 2007; Pelletier et al., 2004). In Otis and Pelletier's (2008) study, it was also found that approach food planning (i.e., planning to move toward a desirable objective such as eating healthy) partially mediated the relationship between self-determined motivation for eating and healthy eating behaviors, whereas avoidance food planning (i.e., planning to move away from an undesirable objective such as eating unhealthy) partially mediated the relationship between non-self-determined motivation for eating and bulimic symptoms. Guertin, Barbeau, Pelletier, and Martinelli (2016) also found that non-self-determined motivation was negatively associated with unhealthy eating behaviors and similarly, Guertin, Barbeau, and Pelletier (2018)

showed that self-determined motivation for eating was positively associated with healthy eating behaviors and negatively associated with unhealthy eating behaviors, whereas the reverse was true for non-self-determined motivation.

In addition to having demonstrated the relationship between motivation and eating, some studies have also examined whether healthy eating behaviors mediate the relationship between motivation and physical health. For example, in a population at risk for coronary artery disease, Pelletier and colleagues (Pelletier at al., 2004; study 3) demonstrated that higher levels of general self-determined motivation at Time 1 (the baseline) predicted higher levels of self-determined motivation for eating at Time 2 (13-weeks). In turn, Time 2 self-determined motivation predicted a reduction in the percentage of caloric intake in the form of fat and saturated fat and improved physiological health indicators (i.e., reduced body weight, LDL-cholesterol and ratio of total cholesterol/HDL cholesterol, and triglyceride levels) at Time 3 (26-weeks). In individuals who had just undergone a major cardiac event, Guertin and colleagues (2015) further demonstrated that self-determined motivation (relative to non-self-determined motivation) was positively associated with self-efficacy for healthy eating at 3 months which, in turn, predicted improved healthy eating behaviors at 6 months and improved physiological health indicators (i.e. triglycerides, waist circumference, and cholesterol levels) at 12 months. Guertin et al. (2017) found similar results, where improved healthy eating behaviors at 6 months (which was predicted by self-determined motivation and self-efficacy for eating at 3 months) predicted improved waist circumference in a cardiac population at 12 months, over and above their engagement in physical activity.

### 1.2. Limitations of the Existing Research

Although significant research has established that self-determined motivation leads to healthy eating behaviors whereas non-self-determined motivation leads to dysfunctional eating behaviors, research within the eating regulation domain could be improved in several ways. First, the majority of the studies presented above have measured healthy eating based on the recommendations of the Canadian Food Guide created back in 1992. Since then, the food guide has undergone many changes and the measures used to assess healthy eating should therefore reflect more recent recommendations of the guide. Second, most of the studies exclusively examine the consumption of healthy foods or distinguish between eating healthy food and bulimic symptoms as outcomes to self-determined and non-self-determined motivation, without taking into consideration unhealthy food as an outcome to motivation. One reason why healthy eating is not often distinguished from unhealthy eating behaviors is because there currently exists no validated measure that allows researchers to measure both types of eating. This distinction is important, however, since the Canadian Food Guide has recommendations for the types of foods to consume, but also for the types of foods to limit or to consume in moderation. Engaging in unhealthy eating behaviors can also put individuals at risk for developing serious health issues.

Finally, although motivation can explain some variance in individuals' food choices, it is possible that an individual's engagement in healthy eating and disengagement in unhealthy eating may be due to their positioning in the behavior change process. Within the health domain, several studies have shown that self-determined motivation can help individuals move from deciding to make a lifestyle change, to implementing change, and finally, to maintaining change over time. In the context of exercise, for example, Daley and Duda (2006) and Thøgersen-Ntoumanis and Ntoumanis (2006) found that exercisers in later stages of change displayed more self-determined motivation than exercisers in early stages of change. Ingledew, Markland, and

Medley (1998) also found that extrinsic motivation for exercise was more dominant in early stages of change, whereas intrinsic motivation was especially important for progressing through the stages over time. Additionally, Fortier and colleagues (Fortier, Sweet, Tulloch, Blanchard, Sigal, Kenny, et al., 2012) showed that diabetic individuals who progressed through the stages of exercise change experienced an increase in self-determined motivation, whereas individuals who did not progress through the stages experienced a reduction in self-determined motivation.

In a similar manner, while research within the SDT suggests that high quality motivation is associated with the initiation and maintenance of healthy eating behaviors, it is possible that individuals are able to initiate and maintain eating behavior change *only* when their motivation allows them to move from one stage to the next in the behavior change process. More specifically, individuals may only succeed in adopting healthier eating behaviors because they experience the type of motivation that provides them with the necessary skills to initiate and maintain healthy eating over time. On the contrary, individuals who fail in adopting healthier eating behaviors may not hold the type of motivation that enables them to move toward maintaining change and therefore continue to engage in unhealthy eating behaviors.

As it has recently been suggested by Pelletier, Guertin, and Rocchi (2017), individuals who engage in health behavior change for self-determined reasons use different cognitive strategies than individuals who engage in health behavior change for non-self-determined reasons when dealing with the psychological discomfort they experience as they become aware of a health issue. Individuals with a self-determined motivation tend to modify their behaviors and avoid cognitive restructuring as strategies to deal with the discomfort associated with the discrepancy between their current and ideal selves. In contrast, individuals with a non-self-determined motivation tend to engage in cognitive restructuring or behavior modification *only*

when external pressures are present or may not engage in any action if they experience incompetence or indifference toward the discrepancy (Lavergne & Pelletier, 2016; Pelletier et al., 2017). Self-determined motivation therefore enables individuals to initiate and maintain change, as it allows them to develop the cognitive skills required to progress through the stages. Since self-determined motivation facilitates and non-self-determined motivation hinders health behavior change, it would be logical to think that motivation and stages of change interact when predicting behavioral outcomes.

### 1.3. Present Research

The main objective of the present studies was to examine how self-determined and non-self-determined motivation for eating was related to healthy and unhealthy eating behaviors at different stages of change. While pursuing this objective, a secondary objective was to develop and validate a new scale, namely the Healthy and Unhealthy Eating Behavior Scale (HUEBS), to examine whether healthy and unhealthy eating behaviors are related to distinct motivational orientations and waist circumference (as an indicator of physical health), and if these differences are moderated by individuals' stages of change. We believe that the HUEBS could be useful in allowing researchers to measure healthy and unhealthy eating behaviors according to recent recommendations made by Canada's Food Guide.

The items proposed in the HUEBS were developed by a team of researchers interested in nutrition and eating self-regulation. By relying on the recommendations of the food guide created

in 2011[1], eleven items were generated for both types of eating, for a total of 22 items. To explore the factorial validity of the HUEBS, in Study 1, the structure of the scale was examined, while Study 2 retested the structure found in Study 1. Convergent validity was established in Studies 2 and 3 by examining whether the subscales of the HUEBS were related to motivational concepts and waist circumference as would be expected. Study 2 examined whether motivational orientations and eating behaviors changed across stages of change and in Study 3, moderated mediation models were used to test whether eating behaviors mediated the relationship between motivation and waist circumference, and whether stages of change moderated the link from motivation to eating behaviors. Finally, the internal consistency reliability of the scale was examined in all three studies.

In relation to Studies 1 and 2, it was expected that these studies would demonstrate a two-factor (i.e., healthy and unhealthy eating) structure for the HUEBS. In Study 2, it was anticipated that individuals at more advanced stages of change for eating regulation would display higher levels of self-determined motivation and lower levels of non-self-determined motivation, and a higher consumption of healthy eating foods and a lower consumption of unhealthy eating foods. Finally, in Study 3, it was expected that healthy eating behaviors would mediate the relationship between self-determined motivation and waist circumference, whereas unhealthy eating behaviors would mediate the relationship between non-self-determined motivation and waist circumference, and that stages of change would moderate the relationship between motivation

[1] Although a newer version of Canada's Food Guide (Government of Canada, 2019) was published since the development of this scale, the food categories (healthy and unhealthy eating) proposed in this scale remain in accordance with the recommendations of the new guide. Significant changes have been made to the new guide in terms of food groups, specific portions and daily servings and "tips" for healthy eating; yet, food selections such as consuming fruits and vegetables, protein foods and whole grains, and limiting processed foods with added sodium, sugar and/or saturated fats remain consistent across the two guides.

and eating behaviors. It was also anticipated that the reliability of the scale would be consistent across all studies. It should be noted that in Studies 2 and 3, the participants were asked to affiliate themselves with a specific stage of change and therefore, change is measured at a specific moment in time rather than through time. Consequently, these studies do not examine behavior change in a dynamic way. Instead, they provide an overview of the processes of change (i.e., quality of motivation) and consequences (i.e., eating behaviors) associated with different stages of change.

## 2. Study 1

The purpose of Study 1 was to test the factorial validity for the HUEBS using Principal Component Analysis (PCA). It was hypothesized that the HUEBS would best be explained by two factors, representing healthy and unhealthy eating behaviors.

## 3. Method

### 3.1. Participants

The participants were 369 undergraduate female students recruited from a Canadian University's research participation pool in exchange for partial course credit. The participants were aged between 17 and 42 years ($M$ = 18.94; $SD$ = 2.25). The majority of the participants identified as Non-Hispanic white or European-American (51.4%). Others identified as East Asian or Asian American (11.4%), Middle Eastern or Arab American (10.6%), South Asian or Indian American (7.1%), Black, Afro-Caribbean or African American (7.1%), Latino or Hispanic American (1.9%), Native American or Alaskan Native (0.8%), or other (8.7%; 1.1% preferred not to disclose). The average Body Mass Index (BMI = $kg^2/m$) of the participants was 22.89 ($SD$ = 4.21). According to the Centers for Disease Control and Prevention (2001) criteria, 11.5% of the participants were considered underweight (≤18.49), 65.0% were in the normal range (18.50 –

24.99), 16.6% were overweight (25 – 29.99), and 6.9% were obese (≥ 30). Before conducting the study, the University's institutional review board approved the ethical conduct of the study and all participants provided electronic informed consent.

### 3.2. Measures

**Healthy and unhealthy eating behaviors scale.** The HUEBS was administered to the participants in order to assess the extent to which they generally consume different food items. The scale includes 22 items in total [i.e., 11 items corresponding to healthy foods and 11 items corresponding to foods that should be consumed in moderation according to Canada's Food Guide (Government of Canada, 2011a)] for which participants are asked to indicate the extent to which they generally consume the different food items on a scale going from 1 (*Never*) to 7 (*Always*). Examples of healthy food items included: "I eat fruits," "I eat vegetables," "I eat whole grains (e.g., brown rice, buckwheat, quinoa, oats)" and examples of food items that should be consumed in moderation included: "I eat refined grains (e.g., white rice, white bread, white flour)," "I use white sugar or artificial sweeteners," "I eat snack foods, such as chips, chocolate, and/or candy."

## 4. Results

Before conducting the main analyses, the data were screened for missing and out-of-range values, univariate and multivariate outliers, and normality. Missing data analysis revealed that the data was missing completely at random (Little MCAR test: $\chi^2 = 423.49$, $df = 388$, $p <$ .10) and missing values were therefore replaced using the expectation maximization (EM) algorithm. Next, following Tabachnick and Fidell's (2001) recommendations, values with standardized scores above and below +/-3.29 were recoded within the next most extreme values, but that remained within the normal range. Nine multivariate outliers were detected and were

thus removed from the subsequent analyses, reducing the sample size to 360 participants. Finally, normality was examined and all of the variables showed normal distributions (skewness range: -1.677 – 2.181; kurtosis range: -1.160 – 3.820). According to Byrne (2009), values above or below +/-3.00 for skewness and +/-7.00 for kurtosis demonstrate violation of normality.

### 4.1. Principal Component Analysis

The Kaiser-Meyer Olkin measure of Sampling Adequacy (KMO = .856) and Barlett's test of sphericity ($\chi^2$ (231) = 2413.33, $p < .001$) confirmed that the data was adequate for conducting a PCA. Since the scale was created to distinguish between healthy and unhealthy eating behaviors, a 2-factor solution was tested and accounted for 39.11% of the variance[2]. Oblique rotation was considered, since it was expected that healthy and unhealthy eating behaviors would be correlated to some extent. When applying Direct Oblimin rotation (Delta = 0), however, the factor correlation matrix demonstrated that the two factors did not correlate ($r$ = .000), which justified the use of Varimax rotation. After applying the rotation, all of the items separated cleanly onto healthy and unhealthy eating behaviors with factor loadings above .30, except for the item representing alcohol consumption (all rotated factor loadings are presented in Table 1.1). Cronbach's alpha also revealed that the two subscales had good internal consistency ($\alpha = .81$ for healthy eating and $\alpha = .82$ for unhealthy eating), even with the inclusion of alcohol consumption within the unhealthy eating factor (internal consistency was similar with and without the item included).

## 5. Discussion

[2] When examining initial eigenvalues, 5 factors had eigenvalues above 1. Consequently, a 3-, a 4-, and a 5-factor solution was also forced into the analysis. The results were difficult to interpret when examining each solution, however, since several items loaded onto more than one factor and/or were in the opposite direction within the same component.

The objective of Study 1 was to examine the structure of the HUEBS, a new scale that measures healthy and unhealthy eating behaviors according to Canada's Food Guide recommendations. As expected, the results from a PCA revealed that the best solution for the scale was a 2-factor solution, representing healthy and unhealthy eating behaviors. All of the items separated cleanly onto two clear groups, except for the item representing alcohol consumption. Cronbach's alpha also demonstrated good internal consistency for both factors.

## 6. Study 2

The first objective of Study 2 was to replicate the factorial analyses found in Study 1, in order to further test the factorial validity of the HUEBS. In addition to examining the structure of the scale, the second objective was to examine whether women reported different patterns in terms of motivation and eating behaviors according to their stage of change for eating regulation. It was anticipated that the structure of the HUEBS would hold within this sample. Furthermore, based on previous research (e.g., Daley & Duda, 2006; Fortier et al., 2012; Ingledew et al., 1998; Thøgersen-Ntoumanis & Ntoumanis, 2006), it was expected that women in earlier stages of change would report higher levels of non-self-determined motivation and lower levels of self-determined motivation, as well as a higher consumption of unhealthy food items and a lower consumption of healthy food items. Conversely, individuals in the later stages of change would report higher levels of self-determined motivation and lower levels of non-self-determined motivation, as well as a higher consumption of healthy food items and a lower consumption of unhealthy food items.

## 7. Method

### 7.1. Participants

This study included 725 undergraduate female students that were aged between 16 and 48 years ($M$ = 19.52; $SD$ = 3.35) and who were recruited using the same procedure as in Study 1. Most of the participants identified as Non-Hispanic white or European-American (53.9%); whereas others identified as Black, Afro-Caribbean or African American (10.6%), East Asian or Asian American (7.4%), Middle Eastern or Arab American (7.3%), South Asian or Indian American (6.8%), Latino or Hispanic American (2.5%), Native American or Alaskan Native (0.7%) or other (9.0%; 1.8% preferred not to disclose). The mean BMI of the participants was 23.27 ($SD$ = 4.60). According to the guidelines, 7.9% of the participants were underweight, 67.8% were in the normal range, 16.5% were overweight, and 7.8% were obese. The study was approved by the University's institutional review board and electronic informed consent was obtained from all participants prior to their participation.

**7.2. Measures**

The participants completed the same measure as in Study 1, with the addition of the measures below.

**Motivation for eating regulation.** The Regulation of Eating Behaviors Scale (REBS; Pelletier et al., 2004) was used to measure the different reasons why the participants might try to regulate their eating behaviors on a regular basis. This scale includes 24 items in total, which can be divided into six subscales representing the behavioural regulations proposed by SDT (Ryan & Deci, 2017) and further categorized into two subscales – self-determined and non-self-determined motivation. In this scale, the participants were asked to indicate how each statement corresponds to their personal reasons for regulating their eating behaviors (e.g., "because it is fun to create meals that are good for my health," "because other people close to me insist that I do") using a scale ranging from 1 (*Does not correspond at all*) to 7 (*Corresponds exactly*). To create

the composite scores, the means of each subscale was calculated and were then aggregated into two scores to represent self-determined and non-self-determined motivation. In this study, the internal consistency was .91 for self-determined motivation (intrinsic α = .88; integrated α = .88; and identified α = .75) and .85 for non-self-determined motivation (introjected α = .84; extrinsic α = .85; and amotivation α = .85).

**Stages of change for eating regulation**. A measure of stages of change for eating regulation was created based on the conceptual definitions outlined by Pelletier et al. (2017) and Pope, Pelletier, and Guertin (2018). This measure was used to assess the stage of change that best represented the participants' current situation regarding their eating behaviors. In this scale, participants were asked to choose one of five statements representing the detection ("I am trying to decide if I should change my eating behaviors"; stage 1), decision ("I am debating whether I am going to start changing my eating behaviors"; stage 2), implementation ("I want to know more about how I can change my eating behaviors"; stage 3), maintenance ("I want to learn more about things I can do to make healthy eating part of my lifestyle"; stage 4), and habit ("Healthy eating is already a part of my lifestyle"; stage 5) stages of change, using the stem "I am at the stage where…" In this sample, 51 participants were in the detection stage, 72 were in the decision stage, 125 were in the implementation stage, 255 were in the maintenance stage, and 222 were in the habit stage.

## 8. Analyses and Results

### 8.1. Preliminary Analyses

The same procedures as in Study 1 were used to prepare the data for the analyses. When examining missing values, Little's MCAR test revealed that the data were not missing completely at random ($\chi^2 = 942.34$, $df = 869$, $p < .05$); however, since fewer than 5% of the data

was missing on all of the variables, the data was imputed using the EM algorithm. Univariate outliers were identified when cases were above or below the absolute value of +/-3.29 and were modified by replacing their scores to the next most extreme case, but still within the normal range. Data screening identified fourteen multivariate outliers which were removed from the subsequent analyses, reducing the sample size to 711 participants. Finally, when screening for normality, the descriptive statistics showed that all of the variables had normal distributions (skewness range: -1.480 – 1.910; kurtosis range: -1.226 – 2.484).

### 8.2. Primary Analyses

**Principal component analysis.** The values for KMO (.854) and Barlett's test of sphericity ($\chi^2_{(231)} = 3425.21$, $p < .001$) indicated that the data was suitable for conducting PCA. Since no correlation was found between healthy and unhealthy eating behaviors when applying an oblique rotation in Study 1, only a Varimax rotation was applied. A 2-factor solution accounted for 34.33% of the variance[3]. This time, all of the items demonstrated factor loadings above .30 (see Table 1.1 for all rotated factor loadings). Cronbach's alpha also demonstrated good internal consistency for the two subscales ($\alpha = .80$ for healthy eating and $\alpha = .77$ for unhealthy eating). For the following analyses, healthy and unhealthy composite scores were created by calculating the mean of their respective items.

**Motivation across stages of change.** To examine whether motivation differed across the stages of change, two separate between-subject analyses of variance (ANOVA) were conducted. Significant overall group differences were found for both self-determined ($F_{4, 706} = 63.23$, $p <$

[3] As in Study 1, initial eigenvalues showed five factors with eigenvalues above 1. Accordingly, a 3-, a 4-, and a 5-factor solution was also forced into the analysis. The results were again difficult to interpret as several items loaded onto more than one factor and/or were in the opposite direction within the same component.

.001, $\eta^2 = .26$) and non-self-determined ($F_{4, 706} = 15.87$, $p < .001$, $\eta^2 = .08$) motivation. Tukey's b post-hoc tests were conducted and for self-determined motivation, it was found that the mean for women in the detection stage was not significantly different from the mean for women in the decision stage. However, the means for women in the implementation, maintenance, and habit stages of change were all significantly different from the means for women in the detection and decision stages, and the means for women in the implementation, maintenance, and habit stages were all significantly different from each other.

For non-self-determined motivation, it was found that the means for women in the detection and decision stages of change were not significantly different from each other. Post-hoc test results also demonstrated that the means for women in the decision, implementation, and maintenance stages of change did not significantly differ from each other, and that the means for women in the implementation and maintenance stages of change differed significantly from the means for women in the detection and decision stages of change. Finally, the results showed that the mean for women in the habit stage of change significantly differed from the means for women in the detection, decision, implementation, and maintenance stages of change.

**Eating behaviors across stages of change.** ANOVA results for healthy and unhealthy eating behaviors also demonstrated overall group differences for both types of eating (healthy eating = $F_{4, 706} = 29.75$, $p < .001$, $\eta^2 = .14$; unhealthy eating = $F_{4, 706} = 27.59$, $p < .001$, $\eta^2 = .14$). In relation to healthy eating, the Tukey's b post-hoc test showed that the means for women in the detection, decision, and implementation stages of change did not significantly differ from each other. Furthermore, no difference was found between the means for women in the implementation and maintenance stages of change, or between the mean for women in the maintenance stage of change and the means for women in the detection and decision stages of

change. Finally, the mean for women in the habit stage of change was significantly different from the means for women in all other stages.

As for unhealthy eating, no significant differences were found between the means for women in the detection, decision, and implementation stages or change, or between the means for women in the decision, implementation, and maintenance stages of change. It was found, however, that the mean for women in the maintenance stage of change was significantly different from the means for women in the detection, decision and implementation stages, and that the mean for women in the habit stage was significantly different from the means in all other stages. The differences that were found amongst the groups for motivation and eating behaviors can be found in Table 1.2.

## 9. Discussion

The first objective of this study was to replicate the results found in Study 1 by examining the factor structure of the HUEBS. As in Study 1, the results from a PCA revealed that the best solution for the scale was a 2-factor solution, representing healthy and unhealthy eating behaviors. Cronbach's alpha also revealed good internal consistency for both factors. The second objective was to examine whether individuals in different stages of change reported different patterns in terms of their motivation and eating behaviors. As expected, women in earlier stages of change reported higher levels of non-self-determined motivation and lower levels of self-determined motivation for eating, as well as a higher consumption of unhealthy food items and a lower consumption of healthy food items. On the contrary, women in later stages of change reported higher levels of self-determined motivation and lower levels of non-self-determined motivation for eating, as well as a higher consumption of healthy food items and a lower consumption of unhealthy food items.

## 10. Study 3

The first purpose of Study 3 was to examine the motivational determinants and physical outcomes associated with healthy and unhealthy eating behaviors, as measured by the HUEBS. Based on previous research within the SDT (e.g., Guertin et al., 2015, 2018; Pelletier et al., 2004, study 2), it was expected that healthy eating behaviors would mediate the relationship between self-determined motivation and waist circumference, whereas unhealthy eating behaviors would mediate the relationship between non-self-determined motivation and waist circumference. Building on the results found in Study 2, the second objective was to examine whether stages of change would moderate the relationship between motivation and eating (i.e., moderated mediation). It was anticipated that the relationship between motivation and eating behaviors would be moderated by stages of change, such that the relationship between self-determined motivation and healthy eating behaviors would be stronger for individuals who scored higher on the stage of change variable, whereas the relationship between non-self-determined motivation and unhealthy eating behaviors would be stronger for individuals who scored lower on the stage of change variable.

## 11. Method

### 11.1. Participants and Procedure

The sample included 265 undergraduate female students aged 17 to 33 ($M_{age}$ = 18.89; *SD* = 2.25) who were recruited using the same procedure as the previous studies. Of the total sample, 48.3% of the women identified as Non-Hispanic white or European-American, 10.9% as East Asian or Asian American, 9.8% as Middle Eastern or Arab American, 9.4% as Black, Afro-Caribbean, or African American, 8.7% as South Asian or Indian American, and 11.8% as other (1.1% preferred not to disclose). The mean BMI was 23.12 (*SD* = 4.77). In this sample, 6.4% of

the participants were considered underweight (≤ 18.49), 67.2% in the normal range (18.50-24.99), 14.7% overweight (25-29.99), and 6.0% obese (≥ 30; 5.7% missing). In relation to the stages of change, 16 participants were in the detection stage, 34 were in the decision stage, 40 were in the implementation stage, 117 were in the maintenance stage, and 58 were in the habit stage. The University's institutional review board approved the ethical conduct of the study and all participants provided electronic consent prior to collecting the data.

Data collection took place in two steps. First, participants were asked to complete an online questionnaire in a laboratory session, which took approximately 45 minutes. Second, after completing the questionnaire and after obtaining verbal consent, the participants' waist circumference was measured in centimeters using a tape measure. Participants were asked to stand with their feet, shoulder-width apart and to breathe normally, while waist circumference was measured midway between the lowest rib and the iliac crest at the end of the participants' normal expiration.

### 11.2. Measures

The participants completed the same measures as in Study 2, with the addition of obtaining waist circumference. Waist circumference was measured by the primary researcher in the laboratory. The same procedures as in Study 2 were used to create the composite scores for self-determined and non-self-determined motivation and for healthy and unhealthy eating behaviors. All of the Cronbach's alpha were within the acceptable range (a ≥ .73).

### 11.3. Data Analysis Plan

The study's hypotheses were tested into two steps. First, in order to examine whether healthy eating mediated the relationship between self-determined motivation and waist circumference, and whether unhealthy eating mediated the relationship between non-self-

determined motivation and waist circumference, two simple mediation models were tested using the PROCESS macro in SPSS (model 4; Hayes, 2013). In both models, the indirect effects were estimated using bootstrapping (samples = 5,000). Second, in cases where the relationship was mediated, the stages of change were added to the model in order to test for the moderated mediation hypothesis (model 7; Hayes, 2013), also using the PROCESS macro with bootstrapping (samples = 5,000). This afforded the opportunity to estimate the significance of conditional effects at different levels of stages of change.

## 12. Results

### 12.1. Preliminary Analyses

The data was screened and cleaned using the same procedure as in Study 1. When examining missing values, Little's MCAR test was non-significant ($\chi^2 = 782.51$, $df = 727$, $p = .08$). The missing data was therefore imputed using the EM algorithm. Univariate outliers were also recoded so that all items fell within a normal distribution. Only one multivariate outlier was identified and was removed from the analyses, reducing the sample size to 264 participants. Finally, when examining descriptive statistics, all of the variables displayed normal distributions (skewness range = -0.76 – 1.72; kurtosis range = -0.57 – 4. 99).

Table 1.3 shows the means, standard deviations, and correlations amongst the variables. Overall, it was found that on average, participants scored between the implementation and maintenance stage of change for eating regulation. Responses were higher on self-determined motivation than on non-self-determined motivation, and on healthy eating behaviors in comparison to unhealthy eating behaviors. The mean for waist circumference was considered to be at low risk for developing health problems according to the Government of Canada (2011b). As for the correlations, it was found that the stages of change were positively correlated with

self-determined motivation and healthy eating behaviors, and negatively correlated with unhealthy eating behaviors. Self-determined motivation was positively associated with healthy eating behaviors and negatively associated with unhealthy eating behaviors, and non-self-determined motivation was positively associated with waist circumference. Finally, healthy eating behaviors were negatively associated with both unhealthy eating behaviors and waist circumference.

**12.2. Primary Analyses**

**Tests of mediation.** Consistent with the hypotheses, results revealed that self-determined motivation was significantly associated with healthy eating (b = 0.34, $t$ =8.64, $p < .001$) and that healthy eating was significantly associated with waist circumference (b = -2.49, $t$ = -2.66, $p < .01$). The direct path going from self-determined motivation to waist circumference was non-significant (b = 1.05, $t$ = 1.54, $p$ = .13); however, the indirect effect of self-determined motivation on waist circumference through healthy eating was significant [b = -0.85, Bca CI (-1.57, -0.30)], thus suggesting that complete mediation had occurred.

When examining unhealthy eating behaviors as the mediator between non-self-determined motivation and waist circumference, none of the paths were significant, except for the direct relationship between non-self-determined motivation and waist circumference (b = 1.57, $t$ = 2.33, $p < .05$). Mediation was therefore not achieved.

**Tests of moderated mediation**. Since mediation was only found for the relationships between self-determined motivation, healthy eating, and waist circumference, tests of moderated mediation (model 7, PROCESS) was only conducted on this model. To examine whether the interaction between stages of change and motivation conformed to the hypothesis, simple slopes were plotted at 1 *SD* above and below the mean for stages of change (Aiken & West, 1991).

The results revealed a significant interaction between the stages of change and self-determined motivation (b = 0.09, *t* = 2.90, *p* < .01). Analysis of the moderation effect indicated that the relationship between self-determined motivation and healthy eating was stronger for individuals who scored high [b = .23, *SE* = .06, 95% CI (0.11, 0.35)], followed by moderate [b = .33, *SE* = .05, 95% CI [(0.24, 0.43)], then low [b = .44, *SE* = .06, 95% CI (0.32, 0.56)] on stages of change (see Figure 1.1 for a visual representation of the slopes).

**12.3. Additional Analyses**

Additionally, the moderating role of stages of change was tested in the relationship between self-determined motivation and unhealthy eating behaviors, and the relationship between non-self-determined motivation and healthy eating behaviors. When examining the relationship between self-determined motivation and unhealthy eating, a significant interaction between stages of change and self-determined motivation was found (b = -.07, *t* = -2.17, *p* < .05) and the results showed that the relationship was stronger for individuals who scored moderate [b = -.18, *SE* = .05, 95% CI (-0.28, -0.08)] and high [b = -.27, *SE* = .07, 95% CI (-0.40, -0.14)], but not for individuals who scored low [b = -.10, *SE* = .07, 95% CI (-0.23, 0.03); see Figure 1.2 for a visual representation of the slopes] on the stage of change variable. No significant interaction was found between stages of change and non-self-determined motivation when examining the association between non-self-determined motivation and healthy eating behaviors.

## Discussion

The purpose of Study 3 was to first test whether eating behaviors mediated the relationship between motivation and waist circumference, and second, whether stages of change moderated the relationship between motivation and eating. Overall, it was found that healthy eating fully mediated the relationship between self-determined motivation and waist

circumference. Further analyses also suggested that the relationship between self-determined motivation and healthy eating was moderated by stages of change, thereby confirming moderated mediation. Specifically, it was found that the relationship was stronger for individuals who scored high, in comparison to moderate or low on the stage of change variable. Finally, additional analyses demonstrated similar results when examining the relationship between self-determined motivation and unhealthy eating, such that the relationship between self-determined motivation and unhealthy eating was stronger for individuals who scored moderate and high on the stage of change variable.

## 14. General Discussion

The main purpose of the present research was to examine how self-determined and non-self-determined motivation for eating was related to healthy and unhealthy eating behaviors at different stages of change. Additionally, this research tested the psychometric properties (i.e., factorial and convergent validity, as well as internal consistency reliability) of the HUEBS, a new scale designed to measure healthy and unhealthy eating behaviors based on recent recommendations of the Canadian Food Guide. The objectives were examined through three studies. In Study 1, the structure of the scale was examined and it was found that the best solution for the scale was a 2-factor solution, representing healthy and unhealthy eating behaviors. Study 2 replicated the results found in Study 1 and demonstrated that as women moved along the stages of change for eating regulation, they reported higher levels of self-determined motivation and lower levels of non-self-determined motivation, as well as a higher consumption of healthy foods and a lower consumption of unhealthy foods. Finally, in Study 3, moderated mediation models showed that healthy eating behaviors fully mediated the relationship between self-determined motivation and waist circumference, and that the

relationship between self-determined motivation and healthy eating was moderated by stages of change. Additional analyses also showed that stages of change moderated the relationship between self-determined motivation and unhealthy eating behaviors.

The results from the PCAs that were performed in Studies 1 and 2 are in accordance with the recommendations of the Canadian Food Guide, such that in both studies, it was found that foods that support healthy eating (e.g., fruits, vegetables, whole grains) could be distinguished from foods that undermine healthy eating and that should only be consumed in moderation (e.g., sodium, free sugars, saturated fats). The only exception was the item representing alcohol consumption in Study 1, which did not demonstrate an adequate factor loading. One of the reasons that could explain why the item did not fall within the unhealthy eating category may be because not as much variance was obtained in individuals' responses on the item in Study 1. It is possible, especially with the smaller sample size in Study 1, that women reported lower alcohol consumption than women in Study 2, which could explain why different results regarding that specific item were obtained across the two studies. Good internal consistency was nevertheless obtained for healthy and unhealthy eating behaviors in both studies, even with and without the alcohol consumption item in Study 1. As a whole, the scale provides a useful measure to examine both healthy and unhealthy eating behaviors based on the recommendations of the Canadian Food Guide.

To the best of the authors' knowledge, the studies presented herein are the first to examine the interplay between stages of change and motivation within the eating regulation domain. To date, several studies have demonstrated that individuals are more likely to report higher levels of self-determined motivation and healthier behaviors at more advanced stages of change (e.g., Daley et al., 2006; Fortier et al., 2012; Ingledew et al., 1998; Thøgersen-Ntoumanis

& Ntoumanis, 2006), but these results have mostly been observed within the exercise domain. There are studies that have shown that individuals consume healthier foods (e.g., see Spencer, Wharton, Moyle, & Adams, 2007 for a review) and use different eating self-regulation strategies (e.g., Nothwehr, Snetselaar, Yang, & Wu, 2006) depending on their stage of change, but these studies tend to examine specific food items (e.g., fruit and vegetable consumption, fat intake) rather than examining healthy and unhealthy eating behaviors in general, and do not take into account individuals' motivation. As Studies 2 and 3 demonstrate, it is important to consider both individuals' motivation and stages of change when attempting to understand their eating behaviors; first, because motivation allows us to understand how people manage to initiate, implement and maintain healthy eating behaviors over time and second, because the examination of the interplay between motivation and stages of change allows us to better explain individuals' eating behaviors. In terms of practical implications, by distinguishing between individuals' stages of change, health professionals such as dietitians might find it easier to identify differences in the quality of their client's eating behaviors and assist them accordingly in their behavior change process.

In addition to having demonstrated a strong factor structure and good internal consistency, it was found in Study 3 that the healthy eating subscale of the HUEBS was negatively associated with individuals' waist circumference. These results not only suggest that the scale is useful for detecting indicators of physical health, but that the recommendations of the Canadian Food Guide are associated with a lower waist circumference in women. Although this measure represents only one of many indicators of physical health, previous research has shown that waist circumference is a key marker of obesity-related health risk (e.g., Janssen, Katzmarzyk, & Ross, 2002; Klein, Allison, Heymsfield, Kelly, Leibel, Nonas, et al., 2012).

Furthermore, one of the advantages of this type of measure is that individuals can easily screen for possible health risks associated with overweight and obesity by measuring waist circumference on their own.

In line with other research conducted within the SDT framework (e.g., Guertin et al., 2015, 2016, 2017, 2018; Otis & Pelletier, 2008; Pelletier & Dion, 2007; Pelletier et al., 2004), the results found in Study 3 also demonstrated that self-determined motivation was positively associated with healthy eating behaviors and negatively associated with unhealthy eating behaviors, and that non-self-determined motivation was positively associated with waist circumference. Unexpectedly, no significant relationship was found between non-self-determined motivation and unhealthy eating behaviors. To date, only the studies of Guertin and colleagues (2016, 2018) have examined the relationship between motivation and unhealthy eating behaviors, and in both studies, a positive relationship was found between non-self-determined motivation and unhealthy eating behaviors. In the present research, the unhealthy eating subscale included more items than was measured in the studies of Guertin et al. (2016, 2018), which might explain why no significant association between non-self-determined motivation and unhealthy eating behaviors was found. It may be that only a few items of the unhealthy eating subscale significantly correlate with non-self-determined motivation and that the relationship does not emerge when combining all of the items together. It should also be noted that in Study 3, the majority of the participants were in the implementation, maintenance and habit stages of change for eating regulation. Since individuals in the earlier stages of change generally show characteristics of non-self-determined motivation and unhealthy eating behaviors, the association between non-self-determined motivation and unhealthy eating

behaviors might not have emerged because it did not represent the reality of the individuals in the sample.

With that being said, researchers who wish to examine the association between motivation and healthy and unhealthy eating behaviors should try to include an equal distribution of individuals in each stage of change, in order to ensure that the relationships between self-determined and non-self-determined motivation and healthy and unhealthy eating behaviors emerge more systematically. By distinguishing individuals based on their stage of change and their motivational orientations, it becomes easier to detect and to reach statistical significance when examining the relationships between motivation and eating. If the sample would have included an adequate number of individuals in earlier stages of change in Study 3, for example, it is possible that the relationship between non-self-determined motivation and unhealthy eating behaviors would have been significant. Identifying individuals' stages of change may also be useful for better understanding a sample that is under study. If the sample mainly includes individuals in early stages of change, the relationship between self-determined motivation and healthy eating behaviors may be weaker or not significant at all; whereas if the sample mainly includes individuals in later stages of change, the relationships between different types of motivation and eating behaviors may demonstrate patterns that are more consistent with theoretical frameworks such as the SDT. In line with this proposition, the results of Study 3 clearly demonstrated that self-determined motivation was positively associated with healthy eating behaviors and negatively associated with unhealthy eating behaviors, and that these relationships were stronger for individuals who were at more advanced stages of change.

Finally, some dependent variables may be more relevant to specific stages of change than others. For instance, individuals in earlier stages of change (i.e., detection and decision stages)

may show intentions of changing their eating behaviors but may not yet demonstrate actual change within their eating behavior patterns. Individuals in the implementation stage may begin to engage in eating self-regulation strategies such as planning; yet, they may still demonstrate inconsistent eating behaviors. When at the more advanced stages of change (i.e., maintenance and habit stages), individuals may show healthier eating behaviors and more complex eating self-regulation strategies, which may translate into optimal health indicators, such as a lower waist circumference, BMI, or body fat percentage. The identification of individuals' stages of change is therefore important to understand the processes involved at each stage of change, but also to guide the selection of dependent variables that are more relevant at different stages of change.

**Limitations and Future Directions**

Although the present research adds to the current literature by highlighting the interactive roles of motivation and stages of change in their association with eating behaviors and providing researchers a new scale to measure healthy and unhealthy eating behaviors based on the recommendations of the Canadian Food Guide, several limitations warrant discussion. First, all of the studies presented herein followed a cross-sectional design and therefore, only correlations between the variables can be established. In Study 2, although it is assumed that individuals move through the stages of change over time, it would be interesting for future research to replicate the results using a longitudinal design in order to fully establish how the relationships between motivation, eating quality and stages of change unfold over time. Furthermore, the dynamic (versus static) nature of the behavior change process could be elucidated through longitudinal studies. A longitudinal design could also be useful for establishing the mediational effects found in Study 3, especially since mediation is often highly misleading in correlational designs (Maxwell & Cole, 2007). Second, with the exception of waist circumference that was

measured by the primary researcher in Study 3, the findings of the present studies relied on self-reported measures, which may have led to socially desirable response tendencies. Third, these studies were the first to use a newly designed scale to measure the stages of change, which were based on conceptual definitions outlined in previous research (Pelletier et al., 2017; Pope et al., 2018). Although the results from Studies 2 and 3 were all in the expected direction with regards to stages of change, future research examining the psychometric properties of this scale would be advisable. In relation to the HUEBS, it would also be important for future studies to provide further validation of the scale. Researchers could examine how the subscales of the HUEBS relate to motivational concepts and physical health indicators when compared to other dietary measures such as food frequency questionnaires and/or other self-reported measures of eating behaviors. Test-retest reliability could also be useful to further establish the reliability of the scale. Finally, the samples of all three studies were demographically limited in the sense that they mainly comprised of young adult Caucasian undergraduate women. The recommendations of the Canadian Food Guide are applicable to adults of all genders and ethnic backgrounds; therefore, it would be important to examine whether the results can be replicated in more diverse samples comprised of older women and men, and of different ethnicities.

**Conclusions**

In conclusion, the present research suggests that individuals can regulate their eating behaviors for different reasons and that self-determined motivation, when compared to non-self-determined motivation, propels individuals to adopt healthier eating behaviors when in more advanced stages of change. This research also offers a useful scale that will allow researchers to measure healthy and unhealthy eating behaviors based on the recommendations of the Canadian Food Guide. Researchers should consider the interplay between motivation and stages of change

when attempting to understand and/or explain individuals' eating behaviors, as both motivation and stages of change play interactive roles in the quality of individuals' eating behaviors.

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**Table 1.1**

*Means, standard deviations, and rotated factor loadings of the items designed to assess healthy (Factor I) and unhealthy (Factor II) eating behaviors in the HUEBS*

| Items | Study 1 | | | Study 2 | | |
|---|---|---|---|---|---|---|
| | Mean *(SD)* | *Factor 1* | *Factor II* | Mean *(SD)* | *Factor I* | *Factor II* |
| **Healthy eating** | | | | | | |
| I eat fruits | 6.19 (1.10) | **.70** | -.05 | 5.37 (1.69) | **.66** | -.12 |
| I eat vegetables | 5.96 (1.23) | **.72** | -.16 | 5.45 (1.66) | **.71** | -.20 |
| I eat whole grains (e.g., brown rice, buckwheat, quinoa, oats) | 4.80 (1.83) | **.68** | -.02 | 3.95 (2.13) | **.60** | -.13 |
| I eat foods that are low in saturated fats and cholesterol | 4.21 (1.83) | **.56** | -.21 | 3.76 (1.85) | **.60** | -.01 |
| I eat foods that are high in monounsaturated and polyunsaturated fats (e.g., fish, olive oil, avocados, nuts and seeds) | 4.85 (1.34) | **.68** | .05 | 3.91 (1.95) | **.69** | .09 |
| I use natural sweeteners (e.g., raw honey, maple syrup, coconut sugar, dates) | 4.40 (1.86) | **.51** | .01 | 2.76 (2.04) | **.51** | .17 |
| I drink water | 6.40 (0.98) | **.37** | -.07 | 6.29 (1.16) | **.35** | -.16 |
| I eat foods that are boiled, steamed, grilled, or poached | 5.48 (1.43) | **.64** | .17 | 4.32 (1.99) | **.60** | .19 |
| I eat lean meats, such as poultry, fish, and eggs | 5.92 (1.24) | **.67** | .17 | 4.67 (1.97) | **.54** | .20 |
| I eat low-fat dairy products (e.g., low-fat milk, yogurt, sour cream, cheese) | 4.24 (1.97) | **.30** | -.02 | 3.93 (2.13) | **.42** | .24 |
| I eat legumes (e.g., beans, lentils, peas, peanuts) | 5.01 (1.73) | **.68** | .01 | 3.90 (2.13) | **.63** | -.07 |
| **Unhealthy eating** | | | | | | |
| I eat refined grains (e.g., white rice, white bread, white flour) | 5.03 (1.74) | .12 | **.55** | 4.24 (2.02) | .12 | **.48** |
| I use white sugar or artificial sweeteners | 3.71 (1.95) | -.08 | **.62** | 2.1 (2.09) | .08 | **.58** |
| I eat snack foods, such as chips, chocolate, and/or candy | 4.63 (1.67) | -.06 | **.73** | 3.93 (1.98) | -.06 | **.63** |
| I drink sugar-sweetened beverages, such as soft drinks, fruit juices, and sports drinks | 3.58 (2.00) | -.20 | **.66** | 3.43 (2.10) | -.16 | **.63** |
| I eat foods that are deep-fried (e.g., fries, fried chicken) | 4.07 (1.76) | -.08 | **.81** | 2.81 (1.90) | -.16 | **.69** |
| I eat frozen and/or pre-packaged meals | 3.28 (1.77) | -.15 | **.62** | 2.19 (1.73) | .004 | **.49** |
| I eat processed meats, such as sausages, bacon, and/or cold-cuts | 3.71 (1.82) | .07 | **.50** | 2.91 (1.91) | .04 | **.56** |
| I add salt to my food | 3.51 (2.02) | .09 | **.40** | 3.05 (2.20) | .15 | **.34** |
| I eat fast-food | 3.93 (1.72) | -.10 | **.78** | 2.80 (1.90) | -.09 | **.67** |
| I eat pastries and/or baked goods (e.g., croissants, pie, cake, muffins, brownies) | 4.58 (1.71) | .16 | **.72** | 3.57 (1.93) | .09 | **.61** |
| I consume more than 10 alcoholic drinks (for women) and more than 15 alcoholic drinks (for men) per week | 1.51 (1.06) | -.14 | -.12 | 1.89 (1.69) | -.01 | **.32** |

*Note.* Study 1*: N* = 360. Study 2: *N* = 711. Factor loadings higher than .30 are indicated in bold. The first three columns indicate the results found in Study 1, whereas the last three columns indicate the results found in Study 2

**Table 1.2**

*Mean differences for motivation and eating behaviors across the five stages of change*

| | Stages of change | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Detection | | Decision | | Implementation | | Maintenance | | Habit | |
| | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* |
| Self-determined motivation | $3.92^{a}$ | 0.96 | $3.75^{a}$ | 1.00 | $4.46^{b}$ | 0.95 | $4.83^{c}$ | 0.98 | $5.52^{d}$ | 1.02 |
| Non-self-determined motivation | $3.48^{a}$ | 1.00 | $3.07^{ab}$ | 0.97 | $3.25^{b}$ | 0.97 | $2.96^{b}$ | 1.02 | $2.55^{c}$ | 0.95 |
| Healthy eating | $3.90^{a}$ | 0.99 | $3.85^{a}$ | 1.03 | $4.08^{ab}$ | 0.97 | $4.29^{b}$ | 1.01 | $4.97^{c}$ | 1.05 |
| Unhealthy eating | $3.39^{a}$ | 1.00 | $3.61^{ab}$ | 1.03 | $3.33^{ab}$ | 1.05 | $3.19^{bc}$ | 0.07 | $2.49^{d}$ | 0.06 |

*Note.* Stages of change with the same superscript letters in the same row do not differ significantly at $p < .05$.

**Table 1.3**

*Descriptive statistics: Means, standard deviations, and correlations amongst the variables*

| Variable | *M* | *SD* | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|---|
| 1. Stages of change | 3.63 | 1.14 | - | .57** | -.05 | .28** | -.44** | -.07 |
| 2. SDM for eating | 4.95 | 1.09 | | - | .03 | .47** | -.41** | .02 |
| 3. NSDM for eating | 2.76 | 0.97 | | | - | -.09 | .08 | .14* |
| 4. Healthy | 4.94 | 0.79 | | | | - | -.21** | -.13* |
| 5. Unhealthy | 3.36 | 0.79 | | | | | - | .00 |
| 6. Waist (cm) | 78.15 | 10.74 | | | | | | - |

*Notes*. $N$ = 264. SDM = Self-determined motivation; NSDM = Non-self-determined motivation. * = $p < .05$; ** = $p < .001$.

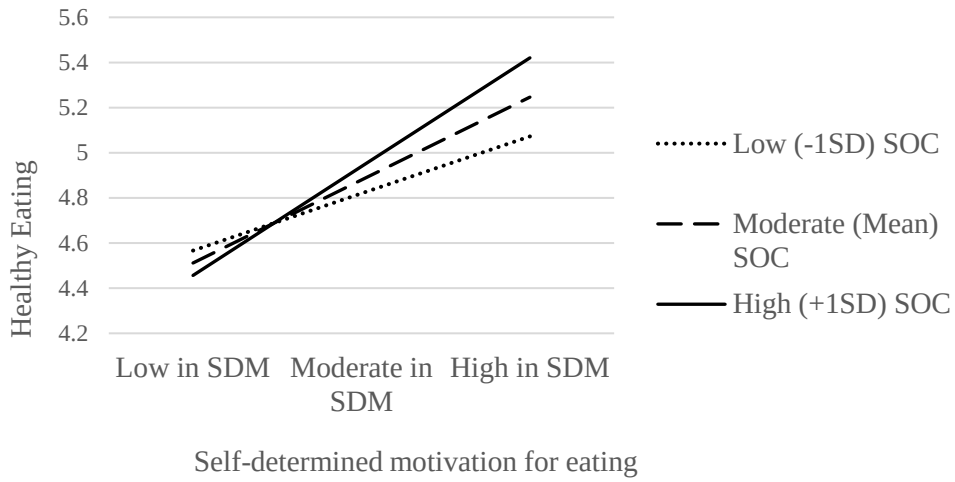


*Figure 1.1.* The moderating role of stages of change between self-determined motivation for eating and healthy eating behaviors. *Note*. *N* = 264. SDM = Self-determined motivation.

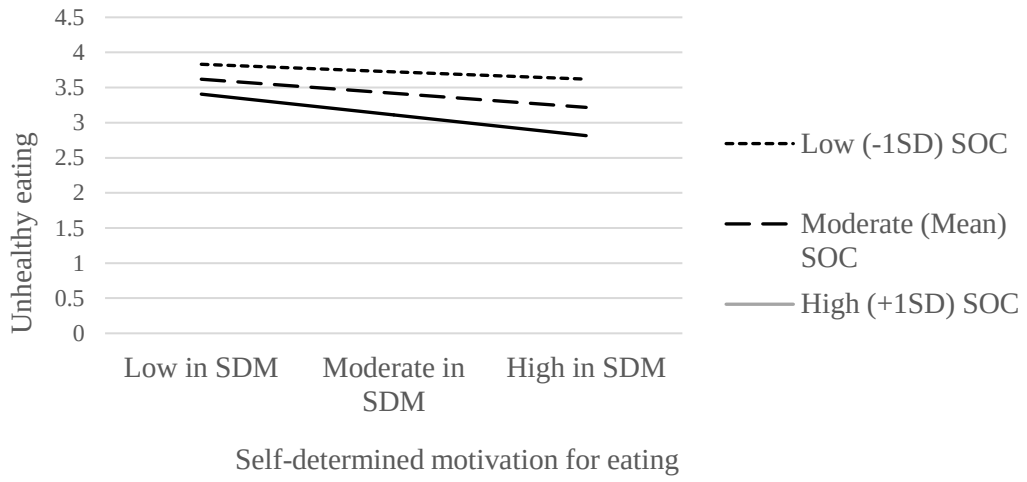


*Figure 1.2.* The moderating role of stages of change between self-determined motivation and unhealthy eating behaviors. *Note*. *N* = 264. NSDM = Non-self-determined motivation.

## *CHAPTER THREE*

**Guertin, C., & Pelletier, L. (in press). Planning and Self-Monitoring the Quality and the Quantity of Eating: How Different Styles of Self-Regulation Strategies Relate to Healthy and Unhealthy Eating Behaviors, Bulimic Symptoms, and BMI**. ***Appetite.***


### Abstract

This research examined if planning and self-monitoring could be distinguished in terms of quality and quantity, and if differences in the uses of these strategies were associated with distinct eating outcomes. In Study 1 ($n$ = 355), the structure of a new scale designed to measure planning and self-monitoring in terms of quality (i.e., nutrient intake) and quantity (i.e., calories and portion sizes) was examined through Confirmatory Factor Analysis. Structural equation models were also tested in which the relationships between the proposed strategies, healthy and unhealthy eating behaviors and bulimic symptoms, as well as BMI, were examined. The purpose of Study 2 ($n$ = 318) was to replicate the results found in Study 1, using a different sample. Overall, a 6-factor structure was found for the scale and results revealed that strategies related to the quality of eating were more strongly and positively associated with healthy eating and more strongly and negatively associated with unhealthy eating behaviors, whereas strategies related to the quantity of eating were more strongly and positively associated with bulimic symptoms and BMI. Results are discussed in terms of implications for health professionals who wish to improve individuals' eating behaviors and/or weight.


*Keywords:* Planning; self-monitoring; quality and quantity; eating behaviors

# Planning and Self-Monitoring the Quality and the Quantity of Eating: How Different Styles of Self-Regulation Strategies Relate to Healthy and Unhealthy Eating Behaviors, Bulimic Symptoms, and BMI

## 1. Introduction

Over the past few decades, prevalence rates of overweight and obesity have skyrocketed across the globe. According to the World Health Organization (2018), worldwide obesity has approximately tripled since 1975, and in 2016, more than 1.9 billion adults were overweight, of which 650 million were obese. If the obesity trend continues unabated, it is estimated that by 2030, 38% of the world's adult population will be overweight and 20% will be obese (Kelly, Yang, Chen, Reynolds, & He, 2008). These statistics are especially alarming since overweight and obesity represent serious risk factors for the development of health conditions such as coronary artery disease and stroke, type II diabetes, and certain types of cancers, all of which have been associated with increased co-morbidity and mortality (Tobias & Hu, 2018).

Weight gain results from a persistent positive imbalance between energy intake and energy expenditure. Both energy intake and energy expenditure, however, are influenced by complex interactions among metabolic, genetic, psychosocial, cultural and environmental factors (Wyatt, Winter, & Dubbert, 2006). With an increase in the availability of low-cost, palatable and convenient food, as well as sedentary lifestyles, many individuals are consuming more calories than they are expending being physically active (Wyatt et al., 2006). Despite being surrounded by environments conducive to obesity, individuals can adopt effective self-regulation strategies to control their food intake and maintain a normal (or reduce excess) body weight (Pelletier, Guertin, Pope, & Rocchi, 2016).

### 1.1. Self-Regulation Strategies

The simultaneous emergence of obesogenic environments and the increasing rates of obesity-related diseases has led many researchers to identify various self-regulation strategies that individuals could use to manage their eating behaviors and/or weight, in order to design effective interventions to support healthy eating and/or weight-loss efforts. For instance, using a qualitative design, Stok, De Vet, De Ridder, and De Wit (2012) asked a group of adolescents to generate statements reflecting the strategies they used to ensure healthy eating daily. A total of 357 statements were identified and combined into 13 strategies: food preparation, adhering to healthy eating patterns, reminding of consequences, substitutions, avoidance of temptations, setting goals, seeking information, mindful eating, stimulus control, distraction, planning, compensation, and seeking help. Bleich and Wolfson (2014) also used a qualitative approach to identify the strategies used by adults who were trying to lose weight. These comprised of making dietary changes such as eating less and choosing lower-calorie foods, engaging in physical activities, a combination of dieting and physical activity, and the use of commercial diets.

Furthermore, Allom and Mullan (2014) investigated the strategies used by young adults who perceived themselves as healthy eaters. Through semi-structured focus groups, this study suggested that young adults who were successful at maintaining healthy eating behaviors experienced the same barriers as their non-successful counterparts, and that their success was based on their continuous use of self-control strategies such as preparing their own meals, making access to unhealthy foods harder, and planning and self-monitoring their food intake. A recent study conducted by Gatzemeier, Price, Wilkinson, and Lee (2019) also identified four major themes – the use of exercise, manipulation of the availability of tempting food, implementation of cognitive strategies and strategic formation of meals – each with sub-themes of strategies used daily by adults who were attempting to reduce their consumption of tempting

food. A recent systematic review and meta-analysis (Santos, Sniehotta, Marques, Carraça, & Teixeira, 2017) also identified 37 strategies across 27 studies that were used within adult populations, which were grouped into 10 domains: dietary choices, energy compensation, information seeking, regulation: restrictions, regulation: rule-setting, restraint, self-monitoring, support: professional, weight-management aids, and extreme dieting strategies.

Collectively, these studies suggest that individuals resort to a multitude of strategies to regulate their eating behaviors and/or weight on a regular basis. What is less evident, however, is how self-directed strategies relate to eating behaviors. More specifically, individuals may rely on specific strategies because they assume that they're effective when they might have little to no effect, or even have adverse effects, on their eating behaviors and/or weight. For instance, in Keller and Siegrist's (2015) study, correlation analyses examining the relationships between self-directed strategies and body mass index (BMI; a measure of a person's weight in kilograms divided by his/her height in meters squared) revealed that higher BMIs were associated with mental strategies such as avoiding, inhibiting, reinterpreting, distracting oneself from food temptations, and reducing energy intake from fats and carbohydrates in foods and beverages. Some individuals also rely on extreme dieting strategies (e.g., weight loss pills, fasting and/or vomiting) to lose or manage their weight, despite that these strategies may lead to weight cycling and weight regain (Neumark-Sztainer, Wall, Story, & Standish, 2012) or even eating disorders (Neumark-Sztainer, Wall, Haines, Story, Sherwood, & van den Berg, 2007) over time.

Although there has been significant advancement in the self-regulation literature in terms of identifying strategies used for regulating eating behaviors and/or weight, there are two strategies that have consistently been shown to effectively support healthy eating and weight-loss efforts: planning and self-monitoring. The first strategy, planning, refers to a cognitive strategy

that prepares an individual for future actions. It entails identifying a future goal-relevant situational cue and a planned action that could be executed when the situation arises (Gollwitzer, 1999). Planning has been shown to assist individuals in the realisation of their goals by improving perceptual readiness for specific cues and by increasing the automaticity of the behavior when critical cues are encountered (Gollwitzer, 1999; overview by Gollwitzer & Oettingen, 2011). Within the eating domain, a meta-analysis has shown that planning in terms of implementation intention is effective for improving both healthy (Cohen's $d$ = .51) and unhealthy (Cohen's $d$ = .29; Adriaanse, Vinkers, De Ridder, Hox, & De Wit, 2011) eating behaviors.

The second strategy, self-monitoring, involves the observation and recording of some aspect of one's behavior. It entails identifying specific qualities of a target behavior (e.g., the number of calories consumed in a day) and/or the outcomes associated with the behavior (e.g., the amount of weight loss over a week), to then compare it with the desired state (e.g., to lose 2 lbs per week; Baumeister & Vohs, 2007; Carver & Scheier, 1982). This strategy is thought to facilitate goal attainment by helping individuals identify discrepancies and enabling them to recognize whether they are progressing toward their goals and whether they should adjust their behaviors accordingly (Harkin, Webb, Chang, Prestwich, Conner, Kellar, et al., 2016; Myrseth & Fishbach, 2009). In addition to demonstrating that self-monitoring is an effective strategy for weight-management, Harkin et al. (2016) concluded in their meta-analysis that interventions incorporating self-monitoring are more likely to promote successful health behavior change.

**1.1.1. Dimensions of planning and self-monitoring.** Given the continuous evidence in support of the effectiveness of planning and self-monitoring within the literature, these strategies are two of the most recognized and frequently applied strategies used in health behavior change interventions (Adriaanse et al., 2011; Michie, Abraham, Whittington, McAteer, & Gupta, 2009).

It is important to note, however, that planning and self-monitoring can be categorized into different dimensions and that these dimensions can differently relate to eating outcomes. For example, in Adriaanse and colleagues' (Adriaanse, Van Oosten, De Ridder, De Wit, and Evers's, 2011; study 3) study, it was demonstrated that forming *negation* implementation intentions (e.g., "If I want to have a snack, then I will *not* eat chocolate") resulted in an increased intake of unhealthy snacks, when compared to forming general goal intentions or *replacemen*t implementation intentions (e.g., "If I want to have a snack, then instead of having chocolate, I will go for a walk"). The study of Otis and Pelletier (2008) also showed that avoidance food planning (i.e., plans that specify *what not* to eat) was associated with bulimic symptoms, whereas approach food planning (i.e., plans that specify *what* to eat) was associated with healthy eating behaviors. In relation to self-monitoring, Harkin et al. (2016) also found that prompting individuals to monitor their behaviors had a positive impact on behavioral performance but not on outcomes, whereas prompting individuals to monitor outcomes had a positive impact on outcomes, but not on behaviors. They also found that progress monitoring had larger effects on goal attainment when the information was made public, than when it was kept private.

Based on these studies, we propose to examine whether planning and self-monitoring can be categorized into the dimension of quality (i.e., nutrient intake) and quantity (i.e., calories and portion sizes), and if the distinct use of these strategies is associated with different eating outcomes. Although the lack of research on diet quality and quantity makes it difficult to establish which of the two categories is most optimal for a successful regulation of eating behaviors, there is some indication that focusing on the quality of eating may be more beneficial. For instance, although this assumption has not yet been examined, a focus on the quantity of eating may be considered more rigid than a focus on the quality of eating, since individuals may

be more likely to focus on restraining how much to eat (e.g., not going over a specific number of calories), than on being mindful of one's food choices (e.g., choosing foods high in nutrients; Kristeller & Wolever, 2011). Along this line of thinking, the study of Pelletier, Dion, Slovinec-D'Angelo and Reid (2004) showed that individuals who reported being autonomous in the regulation of their eating behaviors were more concerned by the quality of the foods that they ate, whereas individuals who reported a controlling style of eating regulation were more concerned by the quantity of the foods that they ate. Furthermore, the quality/quantity dimension may act similarly to the approach/avoidance dimension proposed by Otis and Pelletier (2008), in that individuals who focus on the quality of eating may be more likely to choose food items that are good for their health, whereas individuals who focus on the quantity of eating may be more likely to avoid food items that are high in calories and/or to restrain portion sizes to manage their weight. Finally, since planning and self-monitoring calories and portion sizes may be used intentionally to restrict food intake and influence body weight, these strategies may represent forms of restrained eating which, according to the dietary restraint model, could have adverse effects by leading to the onset of bulimic symptoms, rather than the desired outcome of successful eating regulation (Polivy & Herman, 1985).

### 1.2. The Present Research

The main purpose of this research was to examine if planning and self-monitoring could be distinguished in terms of quality (i.e., nutrient intake) and quantity (i.e., calories and portion sizes), and if these strategies would differently relate to eating outcomes. These objectives were achieved through two studies. Since no scale has been developed or validated to measure planning and self-monitoring in terms of quality and quantity, the main objective of Study 1 was to develop and examine the validity of a new scale – the Planning and Self-Monitoring the

Quality and Quantity Scale (PMQQS) – designed to measure planning and self-monitoring along the quality/quantity dimension. The second objective was to test a structural model that included the strategies of the PMQQS, healthy and unhealthy eating behaviors, bulimic symptoms, and BMI. In order to provide further validation for the PMQQS, the purpose of Study 2 was to replicate the results found in Study 1, using a different sample. We believe that the development of the PMQQS could be useful in allowing researchers to establish instances in which a focus on the quality and/or the quantity of eating could lead to positive and/or negative outcomes in eating regulation.

**2. Study 1**

The main objective of Study 1 was to examine if planning and self-monitoring strategies could be distinguished in terms of quality (i.e., nutrient intake) and quantity (i.e., calories and portion sizes) by validating a new scale designed to assess planning and self-monitoring on the quality/quantity dimension. When examining the structure of the scale, it was anticipated that responses for the PMQQS would best be explained by six factors (i.e., planning and self-monitoring nutrient intake, calories, and portion sizes) and would demonstrate good internal consistency and convergent and discriminant validity. The second objective was to test a model examining the relationships between each of the strategies of the PMQQS and various types of eating behaviors (i.e., healthy and unhealthy eating, and bulimic symptoms), as well as BMI (see Figure 2.1). It was expected that planning and self-monitoring the quality of eating would be more strongly and positively correlated with healthy eating and more strongly and negatively correlated with unhealthy eating, than planning and self-monitoring the quantity of eating. Furthermore, whereas a non-significant or a negative relationship was expected between planning and self-monitoring the quality of eating and bulimic symptoms, it was expected that

planning and self-monitoring the quantity of eating would be positively correlated with bulimic symptoms. Finally, it was expected that BMI would be positively associated with dysfunctional forms of eating, such as strategies related to the quantity of eating and bulimic symptoms.

## 3. Method

### 3.1. Participants

The sample included 369 undergraduate female students aged 16 to 42 ($M_{age}$ = 19.5; *SD* = 2) who were recruited from a Canadian University's research participation pool in exchange for partial course credits. Participants identified as Non-Hispanic white or European-American (55.6%); Black, Afro-Caribbean, or African American (10.3%); East Asian or Asian American (9.5%); Middle Eastern or Arab American (6.5%); South Asian or Indian American (4.6%); Latino or Hispanic America (1.6%); Native American or Alaskan Native (1.6%); or other (10.3%; 2.2% preferred not to disclose). The average BMI was 22.9 (*SD* = 4.18; range 15.7 to 43.3), which falls within the healthy BMI category according to the Centers for Disease Control and Prevention (2001) guidelines. The project was approved by the institutions' research ethics board and electronic informed consent was obtained from each student prior to their participation.

### 3.2. Development of the PMQQS

The items of the PMQQS were developed by a group of researchers interested in self-regulation strategies for eating. During a brainstorming session, the researchers created three items for each of the intended subscales of the PMQQS, for a total of 18 items. The dimension of the PMQQS was based on the work of Pelletier et al. (2004), which demonstrated that some individuals were more concerned by the quality of the foods that they ate, whereas others were more concerned by the quantity of the foods that they ate. The quality dimension represents a

focus on nutrient intake, whereas the quantity dimension represents a focus on calories and portion sizes. We deemed it important to distinguish between calories and portion sizes, as nutrition guidelines often refer to the number of calories and/or portion sizes that one should consume in order to regulate their eating behaviors and/or weight.

### 3.3. Measures

Participants completed the measures below through an online questionnaire.

**3.3.1. Body mass index.** BMI was calculated by using the participants' self-reported responses on their weight and height.

**3.3.2. Healthy and unhealthy eating behaviors.** Healthy and unhealthy eating behaviors were measured using the Healthy and Unhealthy Eating Behaviors Scale (HUEBS; Guertin, Pelletier, & Pope, 2020). This scale includes 22 items in total, of which 11 items correspond to food items that are considered healthy (e.g., "I eat fruits," "I eat vegetables," "I eat whole grains [e.g., brown rice, buckwheat, quinoa, oats]") and 11 food items that should be consumed in moderation (e.g., "I drink sugar-sweetened beverages, such as soft drinks, fruit juices, and sports drinks," "I eat frozen and/or pre-packaged meals," "I eat processed meats, such as sausages bacon, and cold-cuts") according to Canada's Food Guide. The participants are asked to indicate the extent to which they generally consume the different food items using a scale going from 1 (*Never*) to 7 (*Always*). To reduce model complexity, the item-to-balance strategy was used to create parcels with three indicator variables representing healthy and unhealthy eating in the models. This strategy consists of balancing items with the highest and lowest item-scale factor loadings between the parcels (Landis, Beal, & Tesluk, 2000; Little, Rhemtulla, Gibons, & Schoemann, 2013; Rogers & Schmitt, 2004). In this sample, the Cronbach's alpha was .79 for healthy eating and .78 for unhealthy eating.

**3.3.3. Bulimic symptoms.** Bulimic symptoms were measured using the Bulimia subscale of the Eating Disorder Inventory (EDI-2; Garner, Olmstead, & Polivy, 1983). The Bulimia subscale includes seven items in total, which measure different instances pertaining to uncontrollable eating (bingeing; e.g., "I stuff myself with food") and self-induced vomiting (e.g., "I have the thought of trying to vomit in order to lose weight"). Participants were asked to indicate the extent to which they generally do the different things stated in each statement using a scale ranging from 1 (*Never*) to 7 (*Very often*). Although internal consistency, criterion-related validity and convergent and discriminant validity for all subscales of the EDI-2 have been established within clinical samples (Garner et al., 1983), internal consistency reliability estimates and test-retest reliability have also been confirmed in non-clinical samples (Garner, 1991). As with the HUEBS, the item-to-balance strategy was used to create parcels with three indicator variables representing bulimic symptoms in the model. In this study, the internal reliability for this measure was .89.

**3.3.4. Planning and Self-Monitoring the Quality and Quantity Scale (PMQQS).** Participants completed the PMQQS, an 18-item scale that measures planning and self-monitoring in terms of quality (i.e., nutrient intake) and quantity (i.e., calories and portion sizes). By using the stems "When I plan my meals…" and "When I monitor my food intake…", the participants are asked to indicate the extent to which they engage in different behaviors such as "I choose food items that are high in nutrients" (i.e., planning nutrient intake); "I think about the calorie content of the food I am going to eat" (i.e., planning calories); or "I ask myself whether or not my portion sizes were too big" (i.e., self-monitoring portions)." The statements are rated using a scale going from 1 (*Never*) to 7 (*Always*). Each item was used as an indicator variable to create

the constructs representing the strategies in the models. The items of the PMQQS are presented in Table 2.1.

### 3.4. Data Analysis

A confirmatory factor analysis (CFA) was first conducted to examine the factorial validity of the PMQQS. Since the items were expected to load onto predetermined factors, a CFA was judged more acceptable than an exploratory factor analysis to examine the validity of the scale. Model fit was assessed using the following fit indices: the Satorra-Bentler scaled chi-square ($SB\chi^2$) and its *p* value, the Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI), the Root Mean Square Error of Approximation (RMSEA) and its confidence interval (CI), and the Standardized Root Mean Square Residual (SRMR; Garson, 2015). For the CFI and the TLI, values above .90 represent acceptable fit and values above .95 represent excellent fit; whereas for the RMSEA and the SRMR, values below .08 represent acceptable fit and values below .06 represent excellent fit (Hooper, Coughlan, & Mullen, 2008). Standardized factor loadings were also examined and values below .40 were considered poor (Mullan, Markland, & Ingledew, 1997). Alternative models were also tested in order to confirm that the 6-factor model was the best fitting model.

Next, internal consistency for each subscale was examined using Cronbach's alpha. Internal consistency was acceptable if it had a value of .70 or higher (De Vellis, 2003). The average variance extracted (AVE) and the average shared squared variance (AVS) were also examined in order to establish convergent and discriminant validity. Finally, correlations between the subscales, eating behaviors (i.e., healthy and unhealthy eating, and bulimic symptoms) and BMI were examined in order to establish construct validity. These analyses were conducted using SPSS v26.0 software (IBM Corp, 2011).

In addition to these analyses, structural equation modeling was used to test the hypothesized model. In total, six different models were examined, in which each strategy was assessed individually. We proposed to examine the strategies separately, since it is possible that individuals only use one of the strategies, or a different combination of the strategies, to regulate their eating behaviors. The two-step procedure proposed by Kline (2011) was used to assess the adequacy of the models. First, a series of CFAs were conducted to examine whether the indices in each model measured the appropriate latent construct. Second, structural equation models (SEM) were conducted to estimate the fit of the structural models. Model fit was evaluated using the same fit indices that were used to evaluate the structure of the PMQQS. All measurement and structural models were tested using the maximum likelihood robust (MLR) estimation in Mplus (Version 7.0; Muthén & Muthén, 1998-2012).

## 4. Analyses and Results

### 4.1. Preliminary Analyses

Tabachnick and Fidell's (2013) recommendations for data screening and cleaning were used to prepare the data for missing values and univariate and multivariate outliers. For missing values, Little's MCAR test confirmed that missing items were not missing completely at random ($\chi^2 = 2141.69$, $df = 1897$, $p < .001$). Since less than 5% of data were missing on individual items the expectation maximization (EM) algorithm was used to replace the missing data. Next, all variables were standardized and modified to one unit larger or smaller than the next most extreme value if scores were found to be above or below +/-3.29. Mahalanobis distances detected 14 multivariate outliers, which were removed from the subsequent analyses, reducing the sample size to 355 participants. Finally, the data were screened for normality. Based on the guidelines proposed by Kline (2011), which suggests that values above or below +/-3.00 for skewness and

+/-10.00 for kurtosis deviate from normality, none of the variables demonstrated non-normal distributions (skewness range: -0.764 to 0.606; kurtosis range: -1.306 to -0.013).

### 4.2. Confirmatory Factor Analysis

The first model that was tested was the hypothesized 6-factor model. Then, a 4-factor model was examined as an alternative model, which represented planning and self-monitoring in relation to the quality and quantity (calories and portions combined) of eating. A 2-factor and a 1-factor model were also examined, where the 2-factor model represented planning and self-monitoring without distinguishing between quality and quantity, and the 1-factor model represented the strategies in general. As shown in Table 2.2, the results revealed that the 6-factor model was the best fitting model. All factor loadings were significant and loaded appropriately onto their predetermined factors (see Table 2.1). The subscales also demonstrated good to excellent internal consistency, where Cronbach's alpha was equal or greater to .81.

### 4.3. Convergent and Discriminant Validity

To establish convergent validity, the average variance extracted (AVE) was examined for each of the subscales. The values of the AVEs were all above .5, which confirmed that the convergent validity was achieved (Hair, Black, Babin, & Anderson, 2000). Furthermore, discriminant validity was assessed by examining the average shared square variance (ASV). Discriminant validity was confirmed, as all the ASV values were smaller than their respective AVEs (see Table 2.3; Hair et al., 2000).

### 4.4. Correlations Between the Subscales of the PMQQS, Healthy and Unhealthy Eating Behaviours, Bulimic Symptoms, and BMI

The correlation analyses are presented in Table 2.3. As expected, planning and self-monitoring the quality of eating were more strongly and significantly positively correlated with

healthy eating behaviors than were planning and self-monitoring for calories and portion sizes, and only the strategies related to the quality of eating were significantly negatively correlated with unhealthy eating. In relation to bulimic symptoms, planning and self-monitoring calories and portion sizes were all significantly positively correlated with bulimic symptoms. Contrary to the hypotheses, a significant positive correlation was also found between self-monitoring the quality of eating and bulimic symptoms. Finally, monitoring calories and bulimic symptoms were significantly positively correlated with BMI. In terms of the variables pertaining to eating, a significant positive correlation was also found between unhealthy eating and bulimic symptoms. Significant positive correlations were also found between the strategies, suggesting that some individuals may focus on the quality and the quantity of their eating behaviors.

### 4.5. Testing the Hypothesized Model

**4.5.1. The measurement models.** The models were built using four latent variables and one observed variable: the strategy examined (3 indicators), healthy eating (3 indicators), unhealthy eating (3 indicators), bulimic symptoms (3 indicators), and BMI (observed variable). As shown in Table 2.4, the results from the CFAs confirmed that each measurement model demonstrated a good fit, thereby supporting that the indicators loaded appropriately onto their factors.

**4.5.2. The structural models.** The fit indices of the SEM analyses are presented in Table 2.4. The results demonstrated that each model fit the data well. Table 2.5 presents the standardized regression coefficients that were obtained when examining each model, as well as the variance explained for each outcome variable. When examining the relationships between BMI and the strategies, it was found that BMI was only significantly positively associated with self-monitoring caloric intake. As expected, while all strategies were significantly positively

associated with healthy eating, the relationships were stronger when examining the strategies related to the quality of eating. The results also showed that only the strategies related to the quality of eating were significantly negatively associated with unhealthy eating. Furthermore, all strategies related to the quantity of eating were significantly positively associated with bulimic symptoms. Unexpectedly, self-monitoring the quality of eating was also significantly positively associated with bulimic symptoms. Finally, BMI was non-significantly associated with healthy and unhealthy eating, whereas it was significantly positively associated with bulimic symptoms in all models.

**5. Discussion**

The results offer support for the validity of the PMQQS. CFA results showed that planning and self-monitoring can be distinguished in terms of quality and quantity and that a 6-factor structure provides a better explanation of the data when compared to a 4-factor, a 2-factor, and a 1-factor structure. Strong internal consistency was achieved, and convergent and discriminant validity was established. Finally, most of the correlations between the strategy subscales and eating behaviors were in the expected direction. The only exceptions were the non-significant correlations found between the strategies related to the quantity of eating and unhealthy eating, and the positive correlation that was found between monitoring the quality of eating and bulimic symptoms. The same patterns of findings were demonstrated in SEM.

**6. Study 2**

The objective of Study 2 was to replicate the results found in Study 1, using a different sample. It was expected that the structure of the PMQQS would hold within this sample and that strategies related to the quality of eating would be more strongly and positively associated with healthy eating and more strongly and negatively associated with unhealthy eating, whereas

strategies related the quantity of eating would be more strongly and positively associated with bulimic symptoms. In line with the results found in Study 1, it was also expected that BMI would be positively or non-significantly associated with strategies related to the quantity of eating, and positively associated with bulimic symptoms.

## 7. Method

### 7.1. Participants

The sample comprised 327 undergraduate female students who were recruited using the same procedure as in Study 1. The mean age of the participants was 19.5 (*SD* = 3.7; range = 17 to 55). Most participants identified as Non-Hispanic white or European-American (49.2%), while others identified as East Asian or Asian American (11.6%); Black, Afro-Caribbean or African American (9.8%); Middle Eastern or Arab American (8.6%); South Asian or Indian American (3.4%); Latino or Hispanic America (3.1%); Native American or Alaskan Native (0.6%); or other (13.7%; 2.8% preferred not to disclose). The mean BMI was 22.9 (*SD* = 4.33; range 14.9 to 45), which falls within the healthy BMI category according to the Centers for Disease Control and Prevention (2001) guidelines. Before collecting the data, the institutions' research ethics board approved the study and informed consent was obtained electronically by each participant.

### 7.2. Measures

The participants completed the same measures as in Study 1, through an online questionnaire. The subscales of each measure demonstrated good internal consistency ($\alpha \geq .77$). Within SEM, the latent variables representing the strategies, healthy and unhealthy eating, as well as bulimic symptoms, were created using the same procedures as in Study 1.

## 8. Analyses and Results

### 8.1. Preliminary Analyses

As in Study 1, the data were screened and cleaned using Tabachnick and Fidell's (2013) recommendations. Little's MCAR test was non-significant ($\chi^2$= 450.75, *df*= 436, *p* = .303) and therefore, the EM algorithm was used to replace the missing values. For univariate outliers, all items were standardized and recoded within the normal range if they demonstrated z-scores above or below +/-3.29. Nine multivariate outliers were detected and were removed from the subsequent analyses, reducing the sample size to 318 participants. Finally, when examining univariate normality on all items from the PMQQS, none of the items demonstrated non-normal distributions (skewness range: -0.761 to 0.778; kurtosis range: -1.280 to -0.072; Kline, 2011).

**8.2. Examining the Structure of the Scale**

**8.2.1 Confirmatory factor analysis.** As shown in Table 2.2, the hypothesized 6-factor model showed a better fit to the data, when compared to a 4-factor, a 2-factor, and a 1-factor model. Furthermore, all factor loadings loaded appropriately onto their factors (see Table 2.1) and Cronbach's alpha also demonstrated good to excellent internal consistency ($\alpha \geq .80$).

**8.2.2. Convergent and discriminant validity.** Convergent validity was achieved since all AVE values were above .5 (range = .571 to .834). The ASV values were smaller than their respective AVEs (range = .160 to .299), thereby confirming discriminant validity (see Table 2.3).

**8.2.3. Correlations between the PMQQS, healthy and unhealthy eating behaviors, bulimic symptoms, and BMI.** As shown in Table 2.3, all strategies were significantly positively correlated with healthy eating and significantly negatively correlated with unhealthy eating. The correlations between the strategies and bulimic symptoms were like those found in Study 1, in that planning and self-monitoring calories and portion sizes were significantly positively correlated with bulimic symptoms. In this study, however, it was also found that planning the quality of eating was significantly negatively correlated with bulimic symptoms and that self-

monitoring the quality of eating was non-significantly correlated with bulimic symptoms. Furthermore, a significant positive correlation was found between planning and self-monitoring calories and portion sizes and BMI, as well as between bulimic symptoms and BMI. In relation to eating behaviors, healthy eating was significantly negatively correlated with unhealthy eating and bulimic symptoms, and unhealthy eating and bulimic symptoms were significantly positively correlated with each other.

**8.3. Testing the Hypothesized Model**

The results obtained from the measurement and structural models are presented in Table 2.4. Each measurement model demonstrated a good fit, thereby supporting that the indicators loaded appropriately onto their factors. The SEM results also showed that each model fit the data well. Standardized regressions coefficients and variance explained for each outcome variable can be found in Table 2.5.

The relationships between the strategies, eating behaviors, and BMI were similar to those found in Study 1, with a few exceptions. In this study, it was found that BMI was significantly positively associated with all strategies related to the quantity of eating, which was not the case in Study 1. Contrary to the previous study which showed that only strategies related to the quality of eating were significantly negatively associated with unhealthy eating, in this study, all strategies were significantly negatively associated with unhealthy eating. As expected, however, the relationships were stronger for the strategies related to the quality (versus the quantity) of eating. Furthermore, while Study 1 showed a significant positive correlation between self-monitoring the quality of eating and bulimic symptoms, this relationship was no longer significant in this study. Finally, this study found that BMI was significantly positively

associated with unhealthy eating behaviors in the models examining the strategies related to the quantity of eating.

**9. Discussion**

The objective of this study was to replicate the results found in Study 1 by examining the structure of the PMQQS in a different sample. As in Study 1, the CFA results showed that the 6-factor structure provided the best explanation for the PMQQS. The scale also demonstrated good internal consistency and strong convergent and discriminant validity. Finally, the correlation results were like those found in Study 1, with a few exceptions. In this study, the subscales related to the quantity of eating were significantly negatively correlated with unhealthy eating, which was not the case in Study 1. Furthermore, although a positive correlation between self-monitoring quality and bulimic symptoms was found in Study 1, the relationship between these variables was non-significant in this study. Finally, while only self-monitoring calories was positively associated with BMI in Study 1, in this study, all subscales pertaining to the quantity of eating were positively associated with BMI.

Regarding the hypothesized model, most of the paths were the same as those found in Study 1. Like Study 1, the results suggested that all strategies were related to functional eating behaviors in that they were all positively associated with healthy eating and negatively associated with unhealthy eating; however, the relationships between the strategies and eating behaviors were stronger when examining the strategies related to the quality of eating. Furthermore, all strategies related to the quantity of eating were related to bulimic symptoms, which suggests that planning and self-monitoring calories and portion sizes are also related to dysfunctional eating behaviors. BMI was associated with bulimic symptoms in all models, and with unhealthy eating only in the models examining calories and portion sizes.

## 10. General Discussion

Within the present research, we wished to examine if individuals planned and self-monitored their eating behaviors in terms of quality (i.e., nutrient intake) and quantity (i.e., calories and portion sizes), and if differences in the uses of these strategies would be associated with different eating outcomes. These objectives were achieved through two studies. In Study 1, the structure of the PMQQS, a new scale designed to assess planning and self-monitoring in terms of the quality and the quantity of eating, was examined. Structural equation models were also tested in which the relationships between the strategies, healthy and unhealthy eating behaviors and bulimic symptoms, and BMI, were examined. The purpose of Study 2 was to replicate the results found in Study 1, using a different sample. Overall, it was found that the best solution for the scale was a 6-factor solution, which represented planning and self-monitoring nutrient intake, calories, and portion sizes. The results also revealed that the strategies related to the quality of eating were more strongly and positively associated with healthy eating behaviors and more strongly and negatively associated with unhealthy eating behaviors, whereas the strategies related to the quantity of eating were more strongly and positively associated with bulimic symptoms. In Study 2, it was also found that BMI was positively associated with strategies related to the quantity of eating, as well as with unhealthy eating behaviors in the models examining planning and self-monitoring calories and portion sizes, and with bulimic symptoms in all models. These studies provide additional support for the need to examine *how* individuals use self-directed strategies to regulate their eating behaviors, as different uses in the strategies can be associated with distinct eating outcomes.

Although it cannot be claimed that the strategies related to the quantity of eating are entirely harmful, Restraint Theory (Polivy & Herman, 1985) may be useful in clarifying the

positive relationships that were found between these strategies and bulimic symptoms. According to the theory, efforts made to intentionally restrict food intake contributes to the development of eating disorders via several mechanisms, one of which is disinhibition of food intake after failing in self-regulation (Herman, Polivy, & Leone, 2005; Polivy & Herman, 1985). Since planning and self-monitoring calories and portion sizes are strategies used to control the number of calories and/or the amount of food consumed, individuals who rely on these strategies may be more likely to self-impose rigid rules regarding how much to eat, which could have rebounding effects leading to the development of bulimic symptoms. In fact, the dietary restraint model shows that attempts to lose weight by means of caloric deprivation is associated with susceptibility to disruption, creating a dichotomous relationship with food such as an eat/don't eat or good/bad dichotomy, and giving up cognitive restraint of the subgoal following failure (Polivy and Herman, 1985).

Interestingly, in the models examining the strategies related to the quantity of eating in Study 2, BMI was positively associated with planning and self-monitoring calories and portion sizes, which were also positively associated with bulimic symptoms. Based on the dietary restraint model, these results may suggest that individuals with a higher BMI engaged in these strategies to restrict the amount of food intake in order to lose weight, which contributed to the onset of bulimic symptoms. Although the strategies themselves were negatively associated with unhealthy eating behaviors, the positive relationship that was found between BMI and unhealthy eating may reflect the idea of dietary disinhibition, in that individuals with a higher BMI may experience bulimic symptoms after failing to self-regulate their eating behaviors by consuming unhealthy foods. In line with this reasoning, experimental research has shown that individuals

high in dietary restraint were more likely to overeat after violating their dieting rule of consuming a daily "permissible" caloric intake (Herman & Mack, 1975).

Since these relationships are only hypothetical, researchers may wish to expand upon the present research by examining the cognitive processes associated with a focus on the quality and quantity of eating. For instance, researchers could evaluate the criterion validity of the PMQQS by examining how the subscales of the PMQQS relate to measures assessing dietary restraint (e.g., the Restraint Scale; Herman & Polivy, 1980) or inflexible eating behaviors (e.g., the Inflexible Eating Questionnaire; Duarte, Ferreira, Pinto-Gouveia, Trindade, & Martinho, 2017) as an indicator of adherence to rigid self-imposed dietary rules. This could help elucidate the relationships that were found between planning and self-monitoring the quantity of eating and bulimic symptoms, or even the positive correlation that was found between self-monitoring the quality of eating and bulimic symptoms in Study 1. Although this relationship was not expected, previous research has shown that individuals can develop a pathological obsession for healthy foods – often termed orthorexia nervosa – which has been associated with key components of dietary restraint such as self-imposing dietary rules (Barthels, Barrada, & Roncero, 2019).

Future studies may also wish to consider individual differences in motivational characteristics in order to examine whether specific types of motivations propel individuals to engage in some strategies but not others, and instances in which the strategies are associated with (dys)functional eating behaviors. Previous research has shown that individuals who regulate their eating behaviors out of personal interest and/or because it is in line with his/her goals (i.e., autonomous motivation) are more likely to resort to adaptive (versus maladaptive) strategies when compared to individuals who regulate their eating behaviors out of external pressure and guilt (i.e., controlled motivation). For instance, in Otis and Pelletier's (2008) study, it was found

that approach food planning partially mediated the relationship between autonomous motivation and healthy eating behaviors, whereas avoidance food planning partially mediated the relationship between controlled motivation and dysfunctional eating behaviors. In line with the present research, Pelletier et al. (2004) also showed that women with au autonomous motivation were more concerned over the quality of the food they ate, whereas women with a controlled motivation were more concerned over the quantity of the food they ate. Based on these results, it would be reasonable to expect that autonomous motivation would be more strongly associated with planning and self-monitoring the quality of eating, whereas controlled motivation would be more strongly associated with planning and self-monitoring the quantity of eating.

Other research has also shown that the pursuit of intrinsic goals (i.e., goals that reflect an "inward" orientation such as health) versus extrinsic goals (i.e., goals that reflect an "outward" orientation such as appearance) has differential effects on individuals' eating behaviors. For instance, Guertin, Barbeau, Pelletier, and Martinelli (2017) found that extrinsic (versus intrinsic) goals were positively associated with fat talk which, in turn, was positively associated with controlled motivation for eating and the engagement in unhealthy eating behaviors. In a follow-up study, Guertin, Barbeau, and Pelletier (2018) demonstrated that intrinsic (versus extrinsic) goals were positively associated with self-compassion which, in turn, was positively associated with autonomous motivation for eating and positively and negatively associated with healthy and unhealthy eating behaviors, respectively. In line with these studies, future research may wish to examine how the strategies presented herein mediate the relationships between different types of goals and eating behaviors, and whether the use of strategies facilitate or hinder goal pursuit over time. The advantage of the PMQQS is to allow researchers to establish instances in which a

focus on the quality and/or quantity of eating may lead to positive and/or negative consequences in eating regulation.

### 10.1. Limitations

Although the present research extends the self-regulation literature by demonstrating that women plan and self-monitor their eating behaviors in qualitatively distinct ways and that planning and self-monitoring the quality (versus the quantity) of eating may be more advantageous for promoting healthy eating behaviors, some limitations should be considered when interpreting the results. First, a cross-sectional design was used to conduct the studies and therefore, only correlations between the variables can be established. Future research should apply a longitudinal design to establish cause and effect for the relationships found between the strategies, eating behaviors and BMI, especially to establish the instances when the strategies lead to failure in eating self-regulation. Second, only self-reported measures were used in the studies, which could have biased the results. For instance, self-reported height and weight may have been inaccurate in the calculation of BMI, since previous research has demonstrated that women generally tend to overestimate their height and underestimate their weight (Engstrom, Paterson, Doherty, Trabulsi, & Speer, 2003). Third, the self-reported measures that were used in the studies are also considered Likert-scale data. Although there has been a great deal of controversy surrounding whether rating scales can be analyzed using parametric tests, it should be noted that parametric analytical approaches are acceptable provided certain criteria are met, such as data normality and large sample sizes which were the cases within our research (Harpe, 2015). Fourth, the samples were limited in that they only included undergraduate female students who were mostly Caucasian. Future research may want to replicate the results in more diverse samples, such as samples including males and females of older ages and of different ethnicities.

Finally, some results were inconsistent between the two studies. For instance, the relationships between the strategies related to the quantity of eating were non-significantly associated with unhealthy eating in Study 1, whereas they were significant and negative in Study 2. The different strategies should therefore be further investigated in future studies by examining in more details how the strategies relate to healthy and unhealthy eating with individuals that have been more or less successful at regulating their eating behaviors and/or weight.

### 10.2. Conclusion

To conclude, the present research demonstrates that individuals plan and self-monitor their eating behaviors in qualitatively distinct ways. Although more research is needed in order to confirm our results, health interventions would benefit from primarily encouraging individuals to focus on the quality of their eating behaviors. Future research should examine individual differences in the uses of the strategies and instances in which the strategies related to the quantity of eating are associated with healthy eating behaviors versus bulimic symptoms.

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**Table 2.1**

*Studies 1 and 2: Standardized factor loadings (FL), standard error (SE) and variance explained ($R^2$) for each item of the PMQQS*

| | Study 1 | | | Study 2 | | |
|---|---|---|---|---|---|---|
| Items | *FL* | *SE* | $R^2$ | *FL* | *SE* | $R^2$ |
| **STEM: *When I plan my meals…*** | | | | | | |
| Planning Quality | | | | | | |
| I choose food items that are high in nutrients. | .894 | .017 | .799 | .891 | .025 | .795 |
| I make sure that my meals include nutritious ingredients. | .937 | .012 | .878 | .904 | .019 | .818 |
| I think in advance about the *quality* of the food I am going to eat. | .784 | .031 | .615 | .736 | .043 | .542 |
| Planning Calories | | | | | | |
| I choose food items that are low in calories. | .848 | .020 | .718 | .812 | .025 | .659 |
| I make sure that the number of calories in my meals is below a certain number. | .850 | .018 | .722 | .869 | .019 | .755 |
| I think about the calorie content of the food I am going to eat. | .921 | .011 | .848 | .903 | .017 | .816 |
| Planning Portions | | | | | | |
| I think about the *quantity* of the foods I will eat. | .867 | .024 | .752 | .841 | .033 | .708 |
| I make sure to only have on serving size of the foods I consume. | .679 | .037 | .461 | .645 | .046 | .416 |
| I think about the amount of food I will eat. | .847 | .027 | .718 | .877 | .027 | .770 |
| **STEM: *When I monitor my food intake…*** | | | | | | |
| Monitoring Quality | | | | | | |
| I think about my daily nutrient intake (e.g., protein, fat, carbohydrates, vitamins and minerals). | .700 | .036 | .490 | .738 | .032 | .545 |
| I focus on whether or not I ate healthily throughout the day. | .826 | .024 | .683 | .829 | .029 | .688 |
| I actively keep track of the healthy and unhealthy foods that I eat. | .777 | .029 | .603 | .695 | .039 | .483 |
| Monitoring Calories | | | | | | |
| I focus on the number of calories I consumed throughout the day. | .902 | .014 | .814 | .891 | .019 | .793 |
| I think about whether or not I consumed too many calories in my day. | .922 | .012 | .851 | .923 | .012 | .852 |
| I examined whether the meals I consumed were too high in calories. | .920 | .015 | .847 | .926 | .012 | .857 |
| Monitoring Portions | | | | | | |
| I ask myself whether or not my portion sizes were too big. | .834 | .024 | .696 | .837 | .023 | .700 |
| I pay attention to how much food I consumed in one sitting. | .890 | .017 | .793 | .830 | .032 | .689 |
| I think about whether or not I am eating too little or too much. | .810 | .024 | .657 | .746 | .041 | .557 |

*Note.* Study 1: $N = 355$. Study 2: $N = 318$.

**Table 2.2**

*Studies 1 and 2: Model fit statistics for the PMQQS*

| Model | $SB\chi^2$ | *d.f.* | *p* | CFI | TLI | RMSEA ($CI_{95}$) | SRMR |
|---|---|---|---|---|---|---|---|
| **Study 1** | | | | | | | |
| Hypothesized 6-factor model | 253.518 | 120 | .001 | .960 | .949 | .064 (0.055, 0.073) | .044 |
| Alternative 4-factor model | 618.550 | 129 | .001 | .858 | .832 | .115 (0.107, 0.124) | .077 |
| Alternative 2-factor model | 1199.933 | 134 | .001 | .693 | .650 | .167 (0.159, 0.174) | .114 |
| Alternative 1-factor model | 1231.099 | 135 | .001 | .677 | .633 | .170 (0.163, 0.178) | .122 |
| **Study 2** | | | | | | | |
| Hypothesized 6-factor model | 313.30 | 120 | .001 | .938 | .921 | .078 (0.068, 0.087) | .064 |
| Alternative 4-factor model | 573.794 | 129 | .001 | .857 | .830 | .114 (0.105, 0.123) | .078 |
| Alternative 2-factor model | 1129.87 | 134 | .001 | .674 | .628 | .169 (0.160, 0.177) | .132 |
| Alternative 1-factor model | 1155.17 | 135 | .001 | .666 | .621 | .170 (0.162, 0.178) | .132 |

*Note*. Study 1: $N = 355$. Study 2: $N = 318$. $SB\chi^2$ = Satorra-Bentler Chi-Square test. *d.f.* = degrees of freedom. *p* = probability for model chi-square test. CFI = comparative fit index. TLI = Tucker-Lewis Index. RMSEA = root mean square error of approximation. SRMR = root mean square residual.

**Table 2.3**

*Studies 1 and 2: Descriptive statistics and correlations between PMQQS subscales and outcome variables*

| *Variables* | *M* | *SD* | AVE | ASV | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Study 1** | | | | | | | | | | | | | | |
| 1. Plan Quality | 4.9 | 1.49 | .764 | .229 | - | .38** | .52** | .60** | .27** | .32** | .49** | -.27** | .005 | -.03 |
| 2. Plan Calories | 3.5 | 1,78 | .763 | .512 | | - | .69** | .57** | .87** | .64** | .18** | -.06 | .35** | .09 |
| 3. Plan Portions | 4.2 | 1.51 | .643 | .464 | | | - | .57** | .60** | .67** | .24** | -.03 | .25** | .06 |
| 4. Monitor Quality | 4.4 | 1.56 | .592 | .496 | | | | - | .60** | .69** | .42** | -.16** | .16** | .04 |
| 5. Monitor Calories | 3.6 | 1.89 | .837 | .476 | | | | | - | .70** | .14* | -.03 | .37** | .13* |
| 6. Monitor Portions | 4.4 | 1.63 | .715 | .498 | | | | | | - | .24** | -.03 | .34** | .09 |
| 7. Healthy Eating | 4.5 | 1.08 | | | | | | | | | - | .000 | -.003 | -.02 |
| 8. Unhealthy Eating | 2.8 | 1.00 | | | | | | | | | | - | .18** | .03 |
| 9. Bulimic symptoms | 2.8 | 1.40 | | | | | | | | | | | - | .20** |
| 10. BMI | 23.0 | 4.18 | | | | | | | | | | | | - |
| **Study 2** | | | | | | | | | | | | | | |
| 1. Plan Quality | 4.8 | 1.51 | .719 | .253 | - | .34** | .38** | .71** | .24** | .38** | .62** | -.49** | -.19** | -.10 |
| 2. Plan Calories | 3.4 | 1.70 | .743 | .476 | | - | .61** | .56** | .88** | .63** | .20* | -.27** | .21** | .12* |
| 3. Plan Portions | 4.2 | 1.48 | .631 | .344 | | | - | .45** | .60** | .67** | .30** | -.22** | .12** | .13* |
| 4. Monitor Quality | 4.3 | 1.55 | .571 | .452 | | | | - | .54** | .58** | .46** | -.52** | .02 | -.001 |
| 5. Monitor Calories | 3.6 | 1.93 | .833 | .471 | | | | | - | .71** | .14* | -.18** | .32** | .16** |
| 6. Monitor Portions | 4.3 | 1.60 | .649 | .479 | | | | | | - | .23** | -.21** | .28** | .14* |
| 7. Healthy Eating | 5.0 | 0.86 | | | | | | | | | - | -.24** | -.13* | -.05 |
| 8. Unhealthy Eating | 3.5 | 0.97 | | | | | | | | | | - | .23** | .09 |
| 9. Bulimic symptoms | 2.8 | 1.42 | | | | | | | | | | | - | .27** |
| 10. BMI | 22.8 | 4.11 | | | | | | | | | | | | - |

*Note*. Study 1: $N = 355$. Study 2: $N = 318$. AVE = average variance extracted; ASV = average shared square variance. ** $p < .001$; * $p < .01$.

**Table 2.4**

*Studies 1 and 2: Results from confirmatory factor analyses (CFA) and structural equation modeling (SEM) examining the relationships between each strategy, healthy and unhealthy eating, bulimic symptoms, and BMI*

| Strategies | SB $\chi^2$ (df), *p* | CFI | TLI | RMSEA (90% CI) | SRMR |
|---|---|---|---|---|---|
| **Study 1** | | | | | |
| CFA | | | | | |
| Plan Quality | 107.97 (48), $p < .001$ | .97 | .96 | .06 (0.047, 0.076) | .05 |
| Plan Calories | 141.00 (48), $p < .001$ | .05 | .04 | .08 (0.061, 0.090) | .05 |
| Plan Portions | 130.22 (48), $p < .001$ | .95 | .94 | .07 (0.056, 0.084) | .05 |
| Monitor Quality | 121.76 (48), $p < .001$ | .96 | .94 | .07 (0.052, 0.081) | .05 |
| Monitor Calories | 114.77 (48), $p < .001$ | .97 | .96 | .06 (0.049, 0.078) | .05 |
| Monitor Portions | 129.31 (48), $p < .001$ | .96 | .94 | .07 (0.055, 0.084) | .05 |
| SEM | | | | | |
| Plan Quality | 120.52 (56), $p < .001$ | .97 | .95 | .06 (0.046, 0.073) | .04 |
| Plan Calories | 155.19 (56), $p < .001$ | .95 | .93 | .07 (0.059, 0.085) | .05 |
| Plan Portions | 139.74 (56), $p < .001$ | .95 | .93 | .07 (0.053, 0.079) | .05 |
| Monitor Quality | 132.58 (56), $p < .001$ | .95 | .94 | .06 (0.050, 0.077) | .05 |
| Monitor Calories | 126.72 (56), $p < .001$ | .97 | .95 | .06 (0.047, 0.075) | .05 |
| Monitor Portions | 138.24 (56), $p < .001$ | .96 | .94 | .07 (0.052, 0.079) | .05 |
| **Study 2** | | | | | |
| CFA | | | | | |
| Plan Quality | 72.00 (48), $p < .01$ | .98 | .97 | .05 (0.027, 0.063) | .05 |
| Plan Calories | 108.12 (48), $p < .001$ | .96 | .95 | .07 (0.050, 0.081) | .06 |
| Plan Portions | 85.75 (48), $p < .001$ | .97 | .96 | .05 (0.038, 0.071) | .05 |
| Monitor Quality | 71.39 (48), $p < .01$ | .98 | .97 | .05 (0.026, 0.062) | .05 |
| Monitor Calories | 101.49 (48), $p < .001$ | .97 | .96 | .06 (0.046, 0.078) | .06 |
| Monitor Portions | 74.54 (48), $p < .01$ | .98 | .97 | .05 (0.028, 0.063) | .05 |
| SEM | | | | | |
| Plan Quality | 77.31 (56), $p < .01$ | .98 | .98 | .04 (0.024, 0.058) | .04 |
| Plan Calories | 110.69 (56), $p < .001$ | .97 | .96 | .06 (0.045, 0.075) | .05 |
| Plan Portions | 98.78 (56), $p < .001$ | .97 | .96 | .06 (0.039, 0.070) | .05 |
| Monitor Quality | 83.13 (56), $p < .01$ | .98 | .97 | .05 (0.028, 0.061) | .04 |
| Monitor Calories | 107.13 (56), $p < .001$ | .97 | .96 | .06 (0.043, 0.073) | .05 |
| Monitor Portions | 85.36 (56) $p < .001$ | .98 | .97 | .05 (0.030, 0.063) | .05 |

*Note.* Study 1: $N = 355$. Study 2: $N = 318$. SB = Satorra-Bentler; CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual.

**Table 2.5**

*Standardized regression coefficients and variance explained ($R^2$) from SEM analyses examining the relationships between strategy use, healthy and unhealthy eating, bulimic symptoms, and BMI*

| | Direct Effects | | | | | | | $R^2$ | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Strategies | BMI↔ STR | STR→ HEAL | STR→ UNHE | STR→ BUL | BMI→ HEAL | BMI→ UNHE | BMI→ BUL | HEAL | UNHE | BUL |
| **Study 1** | | | | | | | | | | |
| Plan quality | -.01 | .57*** | -.32*** | -.004 | -.03 | .03 | .21*** | .33*** | .10** | .04 |
| Plan calories | .10 | .21*** | -.08 | .37*** | -.05 | .05 | .17** | .04 | .008 | .17*** |
| Plan portions | .06 | .27*** | -.05 | .26*** | -.05 | .04 | .19*** | .07* | .004 | .11** |
| Monitor quality | .05 | .51*** | -.20** | .17** | -.06 | .05 | .20*** | .26*** | .04 | .07* |
| Monitor calories | .14** | .18*** | -.04 | .39*** | -.05 | .04 | .15** | .03 | .003 | .19*** |
| Monitor portions | .10 | .29*** | -.05 | .37*** | -.06 | .04 | .17** | .08* | .004 | .17*** |
| **Study 2** | | | | | | | | | | |
| Plan quality | -.10 | .73*** | -.56*** | -.12 | .02 | .04 | .24*** | .54*** | .32*** | .08* |
| Plan calories | .12* | .24** | -.34*** | .27*** | -.09 | .14* | .22*** | .06 | .13** | .13** |
| Plan portions | .15** | .37*** | -.24*** | .14* | -.11 | .14* | .23*** | .14** | .07 | .08* |
| Monitor quality | -.003 | .58*** | -.64*** | .06 | -.06 | .10 | .25*** | .34*** | .42*** | .07* |
| Monitor calories | .16** | .19** | -.23*** | .34*** | -.09 | .14* | .19** | .04 | .06* | .18*** |
| Monitor portions | .15** | .30*** | -.27*** | .33*** | -.10 | .14* | .20** | .09 | .08* | .16*** |

*Note.* $N$ = 318. All coefficients represent standardized regression coefficients. STR = strategies; HEAL = healthy eating; UNHE = unhealthy eating; BUL = bulimic symptoms; BMI = body mass index. *$p$ < .05; **$p$ < .01; ***$p$ < .001.

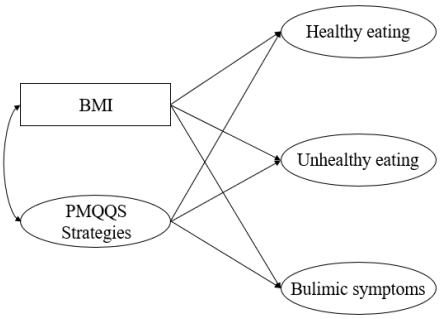


*Figure 2.1.* The hypothesized model of strategy uses and BMI on eating behaviors. Note: Unidirectional arrows represent hypothesized paths. Bidirectional arrows represent a correlation.

## *CHAPTER FOUR*

**Guertin, C., & Pelletier, L. (under review). The Relationship Between Autonomous and Controlled Motivation and Eating Behaviors: Examining the Roles of Self-Regulating Eating Quality and Quantity.**

### Abstract

To examine if planning and self-monitoring the quality (i.e., nutrient intake) and quantity (i.e., calories and portions) of eating could provide some explanation for the relationships between autonomous and controlled motivation and eating. Using hierarchical multiple regressions, Study 1 ($n$ = 456) examined if the strategies could account for additional variance in eating outcomes over and above the influence of motivation, and if the strategies mediated the relationships between motivation and eating. Study 2 ($n$ = 979) cross-validated the findings of Study 1 through structural equation models, using a new sample. It was found that strategies played a significant role in explaining eating behaviors and that planning and self-monitoring the quality of eating mediated the relationships between autonomous motivation and healthy and unhealthy eating, whereas planning and self-monitoring the quantity of eating mediated the relationship between controlled motivation and bulimic symptoms. Results are discussed in terms of the implications of the different self-regulation strategies for improving individuals' eating behaviors.

*Keywords:* Motivation; self-regulation strategies; quality and quantity; eating behaviors

# The Relationship Between Autonomous and Controlled Motivation and Eating Behaviors: Examining the Roles of Self-Regulating Eating Quality and Quantity

## Introduction

The regulation of eating behaviors is not a simple task for most individuals. It is now widely recognized that the types and amount of food that people consume are strongly influenced by their environment. As indicated by the World Health Organization (2000), the primary cause of the rapid increase in obesity within recent decades lies in the environmental and societal transitions that the Western world has undergone. Specifically, the industrialization of food production in conjunction with an economy based on trade has contributed to an increase in the availability of cheaper, bigger, and tastier foods, high in energy but poor in nutrients (Chandon & Wansink, 2012). Since the production of unhealthy commodities (e.g., processed foods high in fat, sugar and salt) is more profitable that the production of healthy commodities (e.g., fruits and vegetables that are easily perishable), global food companies have high economic incentives to market and sell such products (Stuckler, McKee, Ebrahim, & Basu, 2012). These changes in the food system have contributed to the emergence of a food environment that favors the consumption of unhealthy foods at the expense of population health.

As obesity rates escalated, the developed world also witnessed a shift in attitudes towards body shape and weight, especially towards women. While a "plump" body was previously considered desirable, thinness among women became a dominant cultural ideal during the 20$^{th}$ century (Garner, Garfinkel, Schwartz, & Thompson, 1980). According to the sociocultural model of eating pathology (Stice, 1994, 2001), the portrayal of the "thin ideal" in the media has led many women to perceive and endorse society's beliefs about thinness and obesity and consequently, to become dissatisfied with their bodies and to develop eating disorders.

Fortunately, although the current food environment fosters conditions that are conducive to eating regulation failure, not everyone falls victim of their environment to the same extent. According to the Self-Determination Theory (SDT; Ryan & Deci, 2017), one of the leading theories of human motivation, people have the potential to be active agents of their eating behaviors, instead of passively influenced by the social world. Indeed, central to the SDT is the concept of *internalization*, which is defined as an internal psychological process through which behaviors regulated by external forces are transformed into behaviors regulated by the self. This process can be viewed along a continuum depicting the behavioral regulations that go from the least to the most internalized.

**The Self-Determination Continuum**

The behavioral regulations proposed by the SDT can be categorized into two broad types of motivation: intrinsic and extrinsic motivation. Intrinsic motivation encompasses behaviors that are enacted out of volition and pure enjoyment. These behaviors represent an expression of the self and contribute to personal development and growth (Ryan, & Deci, 2017). Behaviors that fall under the category of extrinsic motivation represent a means to an end and are performed in order to satisfy external and/or internal demands. Within the SDT, extrinsic motivation is divided into four types of behavioral regulations, which differ in their degree of internalization. External regulation is the least internalized form of extrinsic motivation and represents behaviors that are initiated in order to receive a reward and/or to avoid social punishment. Introjected regulation marks the beginning of the internalization process, but is only considered partial, as behaviors regulated by introjection are not yet operating from an integrated sense of volition (Ryan & Deci, 2017). At this point in the process, an individual has taken in external controls but has not yet fully accepted them as one's own. With identified regulation, behaviors have been internalized

within the self, as individuals recognize the significance in performing the behavior. Finally, integrated regulation is the most internalized form of extrinsic motivation. People who behave out of integration have succeeded in bringing an action that was formally external to the self in congruence with other aspects of one's value system.

According to the SDT, intrinsic and extrinsic motivation can be further categorized into the dimensions of autonomous and controlled motivation. Autonomous motivation encompasses the behavioral regulations that reflect individuals' volition to engage in a behavior (i.e., intrinsic motivation, and integrated and identified regulations), whereas controlled motivation encompasses the behavioral regulations that reflect internal and external pressures to act a certain way (i.e., introjected and external regulations). The SDT postulates that the more autonomous the motivational form, the more positive the affective, cognitive, and behavioral outcomes will be (Ryan & Deci, 2017). This has been supported by many studies in the eating domain which have demonstrated the benefits of autonomous motivation not only for the adoption of healthier eating behaviors, but also for decreasing the likelihood of developing eating disorders such as bulimic symptoms (Verstuyf, Patrick, Vansteenkiste, & Teixeira, 2012, for a review). For instance, Pelletier, Dion, Slovinec-D'Angelo and Reid (2004a; study 2) demonstrated that autonomous motivation was positively associated with healthy eating and negatively associated with bulimic symptoms, whereas controlled motivation was positively associated with bulimic symptoms and negatively associated with healthy eating. Pelletier, Dion, and Lévesque (2004b) and Pelletier and Dion (2007) also showed that global autonomy in life buffered against sociocultural pressures about body image and the internalization of the "thin ideal", which reduced women's likelihood of experiencing body dissatisfaction and bulimic symptoms.

Recent studies (e.g., Guertin, Barbeau, & Pelletier, 2018; Guertin, Barbeau, Pelletier, & Martinelli, 2017; Guertin, Pelletier, & Pope, 2020) have also shown that autonomous motivation was positively associated with healthy eating and negatively associated with unhealthy eating, whereas controlled motivation was positively associated with unhealthy eating and negatively associated with healthy eating as defined by Canada's Food Guide. In Guertin and colleagues' (2020) study, it was also found that stages of change moderated the relationship between autonomous motivation and healthy and unhealthy eating, with individuals showing stronger relationships between motivation and eating as they scored higher on stages of change. Specifically, the authors reported that women in earlier stages of change – that is, stages in which people are considering changing their eating behaviors or have begun to implement changes – reported higher levels of controlled motivation and lower levels of autonomous motivation, as well as a higher consumption of unhealthy foods and a lower consumption of healthy foods. However, women in later stages of change – that is, stages in which people are trying to maintain or have been maintaining changes in their eating behaviors – reported higher levels of autonomous motivation and lower levels of controlled motivation, as well as a higher consumption of healthy foods and a lower consumption of unhealthy foods.

Together, these studies indicate that when people regulate their eating behaviours for autonomous, relative to controlled reasons, they are much more successful in navigating the current food environment. Although only a few studies have examined the mechanisms by which autonomous and controlled motivations are associated with different types of eating behaviors, there is some evidence that individuals approach the regulation of their eating behaviors in different ways depending on their motivation which, in turn, leads to different consequences in terms of their eating behaviors. For instance, in Otis and Pelletier's (2008) study, it was found

that approach food planning (i.e., planning *what* to eat) partially mediated the relationship between autonomous motivation and healthy eating behaviors, whereas avoidance food planning (i.e., planning *what not* to eat) partially mediated the relationship between controlled motivation and bulimic symptoms. Furthermore, Hagger, Chatzisarantis and Harris (2006) showed that higher levels of autonomy was associated with positive attitudes and perceived behavioral control over dieting, which was further associated with intentions to diet and dieting behaviors.

Pelletier and colleagues (2004a; study 2) also found that women who reported higher levels of autonomous motivation were more concerned over the *quality* of the food they ate, whereas women who reported higher levels of controlled motivation were more concerned over the *quantity* of the food they ate. Although these researchers did not examine the dietary outcomes associated these two types of approaches, they hypothesized that an emphasis on the quantity (versus the quality) of eating may put some individuals at greater risk of eating regulation failure, as controlled motivation was also found to be associated with bulimic symptoms. In line with this hypothesis, Guertin and Pelletier (in press) recently showed that individuals self-regulate their eating behaviors by planning and self-monitoring the quality (i.e., nutrient intake) and the quantity (i.e., calories and portion sizes) of their eating behaviors, and that strategies related to the quality of eating were positively associated with healthy eating and negatively associated with unhealthy eating behaviors, whereas strategies related to the quantity of eating were positively associated with bulimic symptoms and BMI. Although planning and self-monitoring have been recognized as beneficial strategies for engaging in healthy eating (e.g., Adriaanse, Vinkers, De Ridder, Hox, & De Wit, 2011; Harkin, Webb, Chang, Prestwich, Conner, Kellar, et al., 2016), the goal of Guertin and Pelletier's (in press) study was to demonstrate that

individuals engage in these strategies in qualitatively distinct ways, and that planning and self-monitoring in terms of quality versus quantity can have differential effects on eating behaviors.

**The Present Research**

The purpose of the present research was to build upon the studies of Pelletier and colleagues (2004a) and Guertin and Pelletier (in press) in order to further knowledge on the mechanisms by which different types of motivation are associated with different eating outcomes. Specifically, this research examined whether planning and self-monitoring the quality versus the quantity of eating could help explain the relationships between autonomous and controlled motivation, and healthy and unhealthy eating behaviors and bulimic symptoms.

This objective was achieved through two studies. First, as a preliminary step, Study 1 examined if the different self-regulation strategies could account for additional variance in eating outcomes over and above the influence of motivation, using hierarchical multiple regressions. In cases where motivation and the strategies were both significantly associated with eating behaviors, mediation analyses were then carried out to examine if the strategies mediated the relationship between motivation and eating. Study 2 then cross-validated the findings of Study 1 through structural equation models (SEM), using a new sample. Since Guertin and Pelletier (in press) found significant relationships between BMI and most of the variables that were examined in this research, BMI was controlled for in both studies.

## Study 1

The purpose of Study 1 was to examine if planning and self-monitoring the quality and quantity of eating play a role in the prediction of eating outcomes over and above the effects of motivation, while controlling for BMI. Mediation analyses were also conducted to examine if the strategies could partly explain the relationship between motivation and eating. In line with

Pelletier et al. (2004a, study 2) and Guertin and Pelletier (in press), it was expected that the strategies related to the quality of eating would add additional variance to autonomous motivation in the models examining healthy and unhealthy eating behaviors as outcome variables, and that akin to autonomous motivation, the strategies would be positively associated with healthy eating and negatively associated with unhealthy eating behaviors. In comparison, it was expected that the strategies related to the quantity of eating would add additional variance to controlled motivation in the models examining bulimic symptoms as the outcome variable, and that akin to controlled motivation, the strategies would be positively associated with bulimic symptoms. For the control variable, it was also expected that BMI would be non-significantly associated with healthy and unhealthy eating behaviors and positively associated with bulimic symptoms. Finally, in terms of mediation analyses, it was anticipated that strategies related to the quality of eating would, in part, explain the effects of autonomous motivation on healthy and unhealthy eating behaviors, whereas strategies related to the quantity of eating would, in part, explain the effects of controlled motivation on bulimic symptoms.

## Method

### Participants

The sample consisted of 467 undergraduate female students were who recruited from a Canadian University's research participation pool. Participants were aged between 16 – 40 years, with a mean age of 19.37 (*SD* = 2.81). They identified as Non-Hispanic white or European-American (54.7%), Black, Afro-Caribbean or African American (11.6%), East Asian or Asian American (6.9%), Middle Eastern or Arab American (6.4%), South Asian or Indian American (6.2%), Latino or Hispanic American (2.4%), Native American or Alaskan Native (1.1%), or other (8.8%; 1.9% preferred not to disclose). The average BMI of the participants was 23.22 (*SD*

= 4.54; range 15.62 to 48.76), which falls within the healthy BMI category (18.5 to 24.9) according to the Centers for Disease Control and Prevention (2001) guidelines. The study protocols were approved by the institutions' research ethics board and electronic informed consent was obtained from each participant prior to their participation. Students were compensated with partial course credit for participating in this study.

**Measures**

The measures below were completed by the participants through an online questionnaire.

**Body mass index.** BMI ($Kg/m^2$) was calculated by using the participants' self-reported height and weight.

**Autonomous and controlled motivation.** The Regulation of Eating Behaviors Scale (REBS; Pelletier et al., 2004a) was used to evaluate individual differences in autonomous and controlled motivation within the eating regulation domain. In this scale, individuals were asked to respond to 20 items, which assessed the different types of behavioral regulations – intrinsic, integrated, identified, introjected and extrinsic regulations – proposed by the SDT (i.e., 4 items per subscale; Ryan & Deci, 2017). Using a scale going from 1 (*Does not correspond at all*) to 7 (*Correspond exactly*), participants were asked to indicate the extent to which each item corresponded to their personal reasons for regulating their eating behaviors (e.g., "I take pleasure in fixing healthy meals," "other people close to me will be upset if I don't"). Composite scores for autonomous and controlled motivation were created by calculating an average score of all items that corresponded to the two different types of motivation. In the validation study of the REBS (Pelletier et al., 2004a), exploratory and confirmatory factor analyses supported the factorial structure of the scale. Construct validity was also established by demonstrating the relationships between autonomous and controlled motivation and other constructs related to the

regulation of eating behaviors. In this study, Cronbach's alpha was .91 for autonomous motivation (intrinsic α = .88; integrated α = .89; identified α = .75) and .85 for controlled motivation (introjected α = .85; extrinsic α = .85).

**Planning and self-monitoring the quality and quantity of eating.** The Planning and Self-Monitoring the Quality and Quantity Scale (PMQQS; Guertin & Pelletier, in press) was administered to the participants in order to measure the extent to which they generally plan and self-monitor the quality (i.e., nutrient intake) and the quantity (i.e., calories and portions) of their eating behaviors. In this 18-item scale (3 items per subscale), individuals were asked to rate each item using a scale going from 1 (*Never*) to 7 (*Always*). In the validation study of the PMQQS (Guertin & Pelletier, in press), confirmatory factor analyses provided support for the 6-factor structure of the scale and the PMQQS showed good internal consistency and strong convergent and discriminant validity. In this study, the Cronbach's alpha was .86 for planning nutrient intake, .87 for planning calories and .79 for planning portion sizes; and .80 for self-monitoring nutrient intake, .93 for self-monitoring calories, and .88 for self-monitoring portion sizes.

**Healthy and unhealthy eating behaviors.** The Healthy and Unhealthy Eating Behaviors Scale (HUEBS; Guertin et al., 2020) was used to measure individuals' general consumption of healthy and unhealthy food items. The HUEBS is a 22-item scale that identifies 11 food items that are considered to be healthy [e.g., "I eat fruits, " I eat whole grains (e.g., brown rice, buckwheat, quinoa, oats),"] and 11 food items that should be consumed in moderation [e.g., "I eat refined grains (e.g.., white rice, white bread, white flour)," "I eat processed meats, such as sausages, bacon, and/or cold-cuts"] according to Canada's Food Guide. Participants were asked to indicate the extent to which they generally consume each food item using a scale going from 1 (*Never*) to 7 (*Always*). Composite scores for healthy and unhealthy eating behaviors were created

by averaging the respective items of the two subscales. In the validation study of the HUEBS (Guertin et al., 2020), principal component analyses produced a 2-factor structure, with reliability coefficients that ranged from .80 to .81 for healthy eating and .77 to .82 for unhealthy eating behaviors. In this study, the reliability coefficients were .79 and .76 for healthy and unhealthy eating behaviors, respectively.

**Bulimic symptoms.** Participants completed the Bulimia subscale of the Eating Disorder Inventory (EDI-2; Garner, Olmstead, & Polivy, 1983) in order to evaluate their engagement in dysfunctional eating behaviors such as bingeing (e.g., "I have gone on eating binges where I have felt that I could not stop") and purging (e.g., "I have the thought of trying to vomit in order to lose weight"). This scale includes seven items in total, which were all rated on a scale going from 1 (*Never*) to 7 (*Very often*). The composite score for bulimic symptoms was created by averaging all items of the scale into one single score. Although the original validation study of the EDI-2 was conducted within clinical samples, test-retest reliability and internal consistency for the EDI-2 has also been confirmed within non-clinical samples (Garner, 1991). In this sample, Cronbach's alpha for bulimic symptoms was .89.

## Analyses and Results

### Preliminary Analyses

All analyses were conducted using IBM SPSS, version 26. Before proceeding with the main analyses, the data was screened and cleaned following the guidelines recommended by Tabachnick and Fidell (2013). A missing data analysis was first conducted and revealed that missing values were not missing completely at random (Little's MCAR test, $\chi^2$= 3997.83, *df*= 3744, *p* = .002). Since no variable had more than 5% of missing data, the values were replaced using the expectation maximization (EM) algorithm. Next, univariate outliers were dealt with by

identifying standardized scores that were above or below the normal distribution of ± 3.29. Outliers were recoded using the next most extreme value that was still within the normal range. Mahalanobis distances were then calculated and eight multivariate outliers were identified and excluded from further analyses. Three participants were also removed from the data, as they had missing values on their height and/or weight, which prevented us from calculating their BMI. The final sample included 456 participants. Finally, all variables showed normal distributions as none of the absolute values of skewness and kurtosis were above or below 3.00 for skewness and 10.00 for kurtosis (skewness range: -0.490 – 1.438; kurtosis range: -1.138 – 3.344; Kline, 2011).

The data was also screened to ensure compliance with the basic assumptions of the analyses that were conducted. The examination of scatterplots did not suggest violation of the assumptions for normality and linearity; however, the data did violate the assumption of homoscedasticity when examining unhealthy eating and bulimic symptoms as outcome variables (Breusch-Pagan test: $p = .04$ for unhealthy eating and $p < .001$ for bulimic symptoms). When we applied a square root transformation to unhealthy eating and a logarithmic transformation to bulimic symptoms, however, there was no longer indication of heteroscedasticity in the data (Breusch-Pagan test: $p = .09$ for the square root transformation of unhealthy eating and $p = .90$ for the logarithmic transformation of bulimic symptoms). The transformed variables were used in all subsequent analyses. No multicollinearity was found between the variables in the sample.

Table 3.1 presents the means, standard deviations and correlations between the variables. On average, participants reported higher scores on autonomous motivation than on controlled motivation. The means were similar between strategies, although the means were higher for planning and self-monitoring nutrient intake and portion sizes. Participants reported higher scores for healthy eating, followed by unhealthy eating and bulimic symptoms, respectively. In

terms of the correlations, autonomous and controlled motivation were positively associated with all strategies, except for controlled motivation that was non-significantly associated with planning quality. The relationships were stronger between autonomous motivation and the strategies related to the quality of eating, and between controlled motivation and the strategies related to the quantity of eating. Furthermore, autonomous motivation was positively associated with healthy eating, negatively associated with unhealthy eating and BMI, and non-significantly associated with bulimic symptoms, whereas controlled motivation was positively associated with bulimic symptoms and BMI. All strategies were positively associated with healthy eating and negatively associated with unhealthy eating, and only the strategies related to the quantity of eating were positively associated with bulimic symptoms. A significant positive correlation was also found between self-monitoring the quality of eating and bulimic symptoms, although this relationship was weak. Finally, planning quality was negatively associated with BMI, whereas self-monitoring calories and portion sizes were positively associated with BMI.

**Main Analyses**

In total, 18 hierarchical multiple regression models were tested. In all models, autonomous and controlled motivation, as well as BMI as a control variable, were entered at Step 1. The strategies were then entered in separate models at Step 2. This allowed us to examine the influence of each strategy on the outcome variables. Since it is possible that individuals may only use one of the strategies or a different combination of the strategies to regulate their eating behaviors, it was considered more appropriate to examine the strategies individually, rather than in combination. Table 3.2 shows the results from the hierarchical multiple regression analyses.

When examining healthy eating as the outcome variable, only autonomous motivation significantly positively contributed to the model in Step 1. The variables included in the first step

accounted for 18% of healthy eating variance [$F_{(3, 452)} = 34.20$, $p < .001$]. When individually entering the strategies in Step 2, it was found that only planning and self-monitoring the quality of eating provided additional variance to healthy eating over and above the influence of motivation and BMI. Planning quality provided additional variance of 6% and self-monitoring quality provided additional variance of 4% to healthy eating behaviors. For these strategies, we examined whether they mediated the relationship between autonomous motivation and healthy eating. All mediation analyses were tested using the PROCESS macro in SPSS (model 4; Hayes, 2013), with indirect effects that were estimated using bootstrapping (samples = 5,000). In the model that examined planning quality as the mediator, it was found that autonomous motivation was positively associated with planning quality (b = .76, $t = 16.12$, $p < .001$) and that both autonomous motivation (b = .23, t = 4.67, $p < .001$) and planning quality (b = .24, t = 6.15, $p < .001$) were positively associated with healthy eating. The indirect effect was also significant and positive [b = .18, BootCI (0.12, 0.24)], which suggested that partial mediation was achieved. Similar results were obtained in the model examining self-monitoring quality: autonomous motivation was positively associated with self-monitoring quality (b = .65, t = 12.12, $p < .001$) and both autonomous motivation (b = .31, t = 6.81, $p < .001$) and self-monitoring quality (b = .15, t = 4.36, $p < .001$) were positively associated with healthy eating, with an indirect effect that was significant and positive [b = .10, BootCI (0.05, 0.15)]. Again, it was concluded that partial mediation had occurred.

When examining unhealthy eating as the outcome variable, it was found that autonomous motivation was significantly negatively associated with unhealthy eating, whereas controlled motivation and BMI were non-significantly associated with unhealthy eating at Step 1. Together, the two different types of motivation and BMI accounted for 8% of the variance in unhealthy

eating [$F_{(3, 452)} = 13.62$, $p < .001$]. All strategies except for self-monitoring calories and portion sizes were significantly negatively associated with unhealthy eating at Step 2. Planning quality provided additional variance of 7%; planning calories provided additional variance of 2%; planning portions provided additional variance of 1%; and self-monitoring quality provided additional variance of 3% to unhealthy eating behaviors. In the mediation analyses that followed, results revealed that the direct effect from autonomous motivation to unhealthy eating was significant and negative (b = -.08, t = -6.25, $p < .001$). However, when planning quality was added as a mediator in the model, the relationship between autonomous motivation and unhealthy eating became non-significant (b = -.02, t = -1.57, $p$ =.12). Planning quality was significantly negatively associated with unhealthy eating (b = -.07, t = -5.96, $p < .001$). Since the indirect effect was also significant (b = -.05, BootCI (-0.07, -0.03), it was concluded that in this case, full mediation had occurred. The results also revealed that the indirect effects of planning calories [b = -.01, BootCI (-0.02, -0.003)] and self-monitoring quality [b = -.02, BootCI (-0.04, -0.008)] were significant. Partial mediation was achieved in both cases, as both autonomous motivation (b = -.06, t = -5.24, $p < .001$ in the model examining planning calories; and b = -.05, t = -3.82, $p < .001$ in the model examining monitoring quality) and the strategies (b = -.02, t = -2.73, $p < .01$ for planning calories; and b = -.04, t = -3.38, $p < .001$ for monitoring quality) were significantly negatively associated with unhealthy eating. The indirect effect for planning portion sizes was non-significant [b = -.01, BootCI (-0.02, 0.000)], which suggested that planning portion sizes was not a significant mediator of the relationship between autonomous motivation and unhealthy eating.

Finally, in the model examining bulimic symptoms as the outcome variable, both controlled motivation and BMI were significantly positively associated with bulimic symptoms

at Step 1. The variables included in the first step of the regression models accounted for 22% of the variance in bulimic symptoms [$F_{(3, 452)} = 44.23$, $p < .001$]. At Step 2, only planning and self-monitoring calories provided additional variance to bulimic symptoms over and above the effects of motivation and BMI. Both planning and self-monitoring calories provided an additional 2% to bulimic symptoms, individually. Since BMI was associated with bulimic symptoms in Step 1, BMI was controlled for in the mediation analyses. In the model that examined planning calories as the mediator, controlled motivation was positively associated with planning calories (b = .49, t = 8.55, $p < .001$) and both controlled motivation (b = .06, t = 8.18, $p < .001$) and planning calories (b = .02, t = 2.69, $p < .01$) were positively associated with bulimic symptoms. The indirect effect was also significant and positive [b = .007, BootCI (0.002, 0.01)], thereby suggesting partial mediation. Similarly, controlled motivation was positively associated with self-monitoring calories (b = .58, t = 8.94, $p < .001$). Furthermore, both controlled motivation (b = .06, t = 7.89, $p < .001$) and self-monitoring calories (b = .02, t =3.27, $p < .001$) were positively associated with bulimic symptoms and the indirect effect was significant and positive [b = 0.009, BootCI (0.004, 0.02)], which confirmed that self-monitoring calories partially mediated the relationship between controlled motivation and bulimic symptoms.

## Discussion

The goal of Study 1 was to examine if the strategies proposed by Guertin and Pelletier (in press) could account for additional variance in eating outcomes over and above the effects of motivation, while controlling for BMI. Mediation analyses were also conducted to examine if the strategies mediated the relationship between motivation and eating. As expected, it was found that planning and self-monitoring the quality of eating provided additional variance to autonomous motivation in the models examining healthy and unhealthy eating behaviors as

outcome variables. Like autonomous motivation, positive relationships were found between the strategies and healthy eating, and negative relationships were found between the strategies and unhealthy eating. Planning calories and portion sizes also provided additional variance to autonomous motivation in the models examining unhealthy eating as the outcome variable; however, the negative relationships were not as strong as the ones found for the strategies related to the quality of eating. Furthermore, planning and self-monitoring calories provided additional variance to controlled motivation in the models examining bulimic symptoms as the outcome variable. Like controlled motivation, positive relationships were found between the strategies and bulimic symptoms. Contrary to our hypotheses, planning and self-monitoring portion sizes were not significantly associated with bulimic symptoms.

In terms of mediation analyses, results suggested that planning and self-monitoring the quality of eating partially mediated the relationship between autonomous motivation and healthy eating; that planning quality fully mediated and that planning calories and self-monitoring quality partially mediated the relationship between autonomous motivation and unhealthy eating; and that planning and self-monitoring calories partially mediated the relationship between controlled motivation and bulimic symptoms. Finally, as expected, BMI was significantly associated with bulimic symptoms in the regression and mediation models.

## Study 2

The purpose of Study 2 was to cross-validate the findings of Study 1 within SEM, using a new sample. We chose to apply SEM in Study 2 as it allowed us to examine the relationships between the variables of interest while including all outcome variables in the same model; to reduce the contamination attributed to measurement error by representing constructs as latent

(versus observed) variables; and finally, to assess the tenability of the proposed models by obtaining model fit indices.

Based on Study 1, it was anticipated that autonomous motivation would be more strongly and positively associated with strategies related to the quality of eating, whereas controlled motivation would be more strongly and positively associated with strategies related to the quantity of eating. It was also expected that the strategies related to the quality of eating would be more positively and negatively associated with healthy and unhealthy eating behaviors respectively, and that they would partly or fully explain the relationships between autonomous motivation and healthy and unhealthy eating. In opposition, it was expected that the strategies related to the quantity of eating would be positively associated with bulimic symptoms and that they would partly or fully explain the relationship between controlled motivation and bulimic symptoms. Although no significant relationship was found between planning and self-monitoring portion sizes and bulimic symptoms in Study 1, this hypothesis was based on the significant and positive relationships that were found between these strategies and bulimic symptoms in Guertin and Pelletier (in press). Finally, it was expected that BMI would be positively associated with variables associated with the more dysfunctional processes of eating, such as with controlled motivation, strategies related to the quantity of eating and bulimic symptoms.

## Method

### Participants

The sample comprised of 1020 undergraduate female students aged between 16 and 49 ($M$ = 19.44; $SD$ = 3.26) years. Participants identified with the following ethnic backgrounds: Non-Hispanic white or European-American (51.6%); Black, Afro-Caribbean or African American (10.1%); East Asian or Asian American (8.9%); Middle Eastern or Arab American

(8.1%); South Asian or Indian American (6.4%); Latino or Hispanic American (2.4%); Native American or Alaskan Native (0.8%); or other (9%; 2.7% preferred not to disclose). The average BMI ($M$ = 23.00; $SD$ = 4.33) of the sample was within the healthy BMI category according to Centers for Disease Control and Prevention (2001) guidelines. As in Study 1, participants were recruited using a Canadian University's research participation pool in exchange for partial course credit. The study procedures were obtained from the institutions' research ethics board prior to conducting the study. Electronic informed consent was obtained from each participant.

**Measures**

The same measures as in Study 1 were used in Study 2. All subscales demonstrated good internal consistency ($\alpha \geq .77$). Composite variables were created for each subscale of the REBS to represent autonomous and controlled motivation in the model. The respective individual items of the PMQQS were used to represent the strategies. For healthy and unhealthy eating behaviors and bulimic symptoms, parcels were created using the item-to-construct balance strategy – a strategy that consists of creating composite scores by balancing individual scale items with the highest and lowest factor loadings between parcels. This strategy has been shown to perform well when creating parcels for unidimensional constructs (Little, Rhemtulla, Gibson, & Schoemann, 2013). Based on Little et al.'s (2013) recommendations, three parcels were created for each variable. Finally, BMI was calculated using the same formula as in Study 1.

**Data Analysis**

Preliminary analyses were conducted using IBM SPSS version 26 and SEM was performed using Mplus version 7. Six models were tested in total, in which each strategy was examined separately as a mediator in the models. The models were tested using the two steps proposed by Kline (2011). First, we conducted measurement model analyses to determine if the

observed variables loaded appropriately onto their latent factors and to determine whether the proposed structure provided a good fit to the data. Second, the structural models exploring the relationships between motivation, the strategies, and eating behaviors were examined. When testing the structural models, bootstrapping procedure (samples = 5,000) with bias-corrected confidence intervals was applied to estimate the significances of the indirect effects. The following fit indices were used to assess the adequacy of the measurement and structural models: the chi-square ($\chi^2$) and the Standardized Root Mean Square Residual (SRMR) as absolute fit indices; the Tucker-Lewis Index (TLI) as a relative fix index; and the Comparative Fit Index (CFI) and the Root Mean Square Error of Approximation (RMSEA) with its' confidence intervals as noncentrality-based indices. According to Hooper, Coughlan, and Mullen (2004), values below .08 indicate adequate fit and values below .06 indicate excellent fit for the SRMR and RMSEA; and values above .90 represent adequate fit and values above .95 represent excellent fit for the CFI and TLI.

## Analyses and Results

### Preliminary Analyses

Data screening and cleaning procedures were the same as in Study 1. Little's MCAR test was significant ($\chi^2$= 6998.02, *df*= 6718, *p* = .008), which suggested that missing values were not missing completely at random. Since missing values were less than 5% on each individual item, the EM algorithm was used to replace the missing values. For univariate outliers, cases that showed standardized scores that were above or below 3.29 were modified so that their values fell within the normal range. In total, 35 multivariate outliers were identified using Mahalanobis distances and were removed from the subsequent analyses. Six participants were also removed from the dataset as they had missing values on their height and/or weight and consequently, on

their BMI. The final sample included data from 979 participants. According to guidelines proposed by Kline (2011), univariate normality did not show to be problematic as none of the absolute values of skewness exceeded +/- 3.00 and none of the absolute values of kurtosis exceeded +/- 10.00 (skewness range: -0.683 to 1.175; kurtosis range: -1.273 to 4.987).

The means, standard deviations and correlations between the study variables can be found in Table 3.1. In this study, the mean of autonomous motivation was higher than the mean of controlled motivation. The means of planning and self-monitoring quality and portion sizes were also higher than the means of planning and self-monitoring caloric intake. In terms of eating behaviors, the mean for healthy eating was higher than the mean for unhealthy eating, followed by the mean of bulimic symptoms. For the correlations, it was found that autonomous and controlled motivation were significantly positively associated with all strategies, except for controlled motivation that was non-significantly associated with planning quality. As in Study 1, autonomous motivation was more strongly and positively associated with strategies related to the quality of eating, whereas controlled motivation was more strongly and positively associated with strategies related to the quantity of eating. Furthermore, autonomous motivation was significantly positively correlated with healthy eating and significantly negatively correlated with unhealthy eating and BMI. Controlled motivation was significantly positively correlated with bulimic symptoms and BMI. All strategies were significantly positively and negatively associated with healthy and unhealthy eating respectively, and significantly positively associated with bulimic symptoms, except for planning quality that was significantly negatively associated with bulimic symptoms. Planning quality was significantly negatively associated with BMI and self-monitoring quality was non-significantly associated with BMI, whereas all strategies related to the quantity of eating were significantly positively associated with BMI. Finally, a significant

positive correlation was found between bulimic symptoms and BMI. Neither healthy nor unhealthy eating were significantly associated with BMI.

**Main Analyses**

**Measurement models.** All models that were tested included six latent variables and one observed variable. The latent variables were: (1) autonomous motivation (three indicators); (2) controlled motivation (two indicators); (3) the strategies (three indicators); (4) healthy eating (three parcels); (5) unhealthy eating (three parcels); and (6) bulimic symptoms (three parcels). The observed variable was BMI, which served as a control variable in the models. When testing the measurement models, all latent factors were free to correlate. As demonstrated in Table 3.3, all measurement models showed adequate fit.

**Structural models.** The fit indices of the structural models presented in Table 3.3 showed that all six models presented a good fit with the data. The final hypothesized models with standardized coefficients can be found in Figures 3.1 to 3.6. As demonstrated in the figures, autonomous and controlled motivation were significantly associated with all strategies except for controlled motivation that was negatively associated with planning quality. Autonomous motivation was also more strongly and positively associated with strategies related to the quality of eating, whereas controlled motivation was more strongly and positively associated with strategies related to the quantity of eating. The only exception was the relationship between autonomous motivation and planning portion sizes, which was similar in magnitude to the relationship between controlled motivation and planning portion sizes.

In terms of the relationships between the strategies and eating, the same relationships were found as in Study 1. The strategies related to the quality of eating were associated with a higher consumption of healthy foods and a lower consumption of unhealthy foods, whereas the

strategies related to the quantity of eating were associated with bulimic symptoms. Contrary to Study 1, in this study it was also found that the relationships between planning calories and portion sizes were non-significantly associated with unhealthy eating, and a significant positive relationship was found between self-monitoring portion sizes and bulimic symptoms. In all models, BMI was positively correlated with controlled motivation and bulimic symptoms, and negatively correlated with autonomous motivation. BMI was also positively associated with planning calories, as well as self-monitoring calories and portion sizes.

**Tests of indirect effects**. The indirect effects of motivation on eating behaviors through the strategies were also examined to determine whether the strategies significantly mediated the relationships between motivation and eating. In total, 12 indirect effects were found to be significant. In the model that examined planning quality as the mediator, it was found that autonomous motivation was indirectly associated with healthy eating ($b$ = .21, $SE$ = .04, $p$ < .001) and unhealthy eating ($b$ = -.26, $SE$ = .04, $p$ < .001). In the model that examined planning calories as the mediator, it was found that both autonomous and controlled motivation were indirectly associated with bulimic symptoms (autonomous motivation: $b$ = .06, $SE$ = .02, $p$ = .002; controlled motivation: $b$ = .09, $SE$ = .02, $p$ < .001). No indirect effect was found in the model examining planning portion sizes as the mediator.

Four significant indirect effects were also found in the model examining self-monitoring quality as the mediator. Both autonomous and controlled motivation were indirectly associated with healthy eating (autonomous motivation: $b$ = .11, $SE$ = .04, $p$ = .002; controlled motivation: $b$ = .04, $SE$ = .01, $p$ = .007) and with unhealthy eating (autonomous motivation: $b$ = -.15, $SE$ = .04, $p$ < .001; controlled motivation: $b$ = -.05, $SE$ = .02, $p$ = .001). In the model that examined self-monitoring calories as the mediator, indirect effects of autonomous and controlled motivation on

bulimic symptoms were both significant (autonomous motivation: $b$ = .04, $SE$ = .01, $p$ = .003; controlled motivation: $b$ = .10, $SE$ = .02, $p$ < .001). Finally, in the model that examined self-monitoring portion sizes as the mediator, it was found that both autonomous and controlled motivation were indirectly associated with bulimic symptoms (autonomous motivation: $b$ = .05, $SE$ = .02, $p$ = .01; controlled motivation: $b$ = .07, $SE$ = .02, $p$ = .001).

## Discussion

The goal of Study 2 was to cross-validate the findings of Study 1 within SEM, using a new sample. As expected, autonomous motivation was more strongly and positively associated with planning and self-monitoring the quality of eating, whereas controlled motivation was more strongly and positively associated with planning and self-monitoring the quantity of eating. Results also showed that strategies related to the quality of eating were more strongly and positively associated with healthy eating and more strongly and negatively associated with unhealthy eating, whereas strategies related to the quantity of eating – except for planning portion sizes – were more strongly and positively associated with bulimic symptoms. In all models, it was also found that BMI was significantly positively associated with controlled motivation and bulimic symptoms and that BMI was significantly and positively associated with strategies related to the quantity of eating, except for planning portion sizes.

Results also supported the hypotheses regarding the mediation effects. We found support for the indirect effects of autonomous motivation on healthy and unhealthy eating through planning and self-monitoring the quality of eating. The indirect effects of controlled motivation on bulimic symptoms through planning and self-monitoring calories, and through self-monitoring portion sizes were also significant. Although the following results were unexpected, we also found support for the indirect effects of autonomous motivation on bulimic symptoms

through planning and self-monitoring calories and through self-monitoring portion sizes, as well as for the indirect effect of controlled motivation on healthy and unhealthy eating behaviors through self-monitoring quality. It should be noted, however, that these indirect effects were smaller and lower in magnitude than the indirect effects that were anticipated.

## General Discussion

The purpose of this research was to further knowledge on the mechanisms by which different types of motivation are associated with distinct eating outcomes. Building on the work of Pelletier and colleagues (2004a; study 2) and Guertin and Pelletier (in press), it was examined whether planning and self-monitoring the quality and quantity of eating could provide some explanation for the associations between autonomous and controlled motivation and healthy and unhealthy eating behaviors and bulimic symptoms. As a preliminary step, Study 1 examined if the strategies could account for additional variance in eating outcomes over and above the influence of autonomous and controlled motivation while controlling for BMI, and whether the strategies significantly mediated the relationships between motivation and eating. Study 2 cross-validated the results of Study 1 within SEM, using a new sample.

Overall, most of the results supported the hypotheses. In Study 1, hierarchical multiple regressions showed that the strategies related to the quality of eating provided additional variance to autonomous motivation in the models examining healthy and unhealthy eating as outcome variables, with positive relationships that were found between autonomous motivation and the strategies and healthy eating, and negative relationships that were found between autonomous motivation and the strategies and unhealthy eating. Planning and self-monitoring calories also provided additional variance to controlled motivation in the models examining bulimic symptoms as the outcome variable, with positive relationships that were found between

controlled motivation and the strategies and bulimic symptoms. Contrary to our hypotheses, planning and self-monitoring portion sizes were not associated with bulimic symptoms.

In line with Pelletier and colleagues (2004a; study 2) and Guertin and Pelletier (in press), Study 2 also demonstrated that autonomous motivation was more strongly and positively associated with strategies related to the quality of eating which, in turn, were positively associated with healthy eating and negatively associated with unhealthy eating behaviors. In opposition, controlled motivation was more strongly and positively associated with strategies related to the quantity of eating which, in turn, were positively associated with bulimic symptoms. In both studies, it was also found that planning and self-monitoring the quality of eating mediated the relationships between autonomous motivation and healthy and unhealthy eating behaviors, and that planning and self-monitoring calories mediated the relationship between controlled motivation and bulimic symptoms. Although it was expected that planning and self-monitoring portion sizes would also mediate the relationship between controlled motivation and bulimic symptoms, the only indirect effect that was significant was controlled motivation on bulimic symptoms through self-monitoring portion sizes in Study 2.

These results suggest that individuals may succeed or fail in the regulation of their eating behaviors when they adopt different strategies based on their motivation. As previously mentioned, Otis and Pelletier (2008) found that autonomous motivation was mainly associated with approach food planning, whereas controlled motivation was mainly associated with avoidance food planning. Although the quality/quantity dimension is distinct from the approach/avoidance dimension, they may be connected in that individuals who focus on the quality of their eating behaviors may be more likely to engage in behaviors that move them toward desired objectives such as eating healthy, whereas individuals who focus on the quantity

of their eating behaviors may be more likely to move away from undesired objectives such as not exceeding a specific number of calories and/or not eating too much. Indeed, Verstuyf and colleagues (2012) suggested that processes of dietary restraint are more closely related to a controlled (versus an autonomous) pattern of eating regulation. According to the dietary restraint model (Polivy & Herman, 1985), increased attention to food intake can lead to excessive indulgence after violating self-imposed cognitive rules regarding food intake, such as the consumption of a specific number of calories per day. Future research would benefit from examining how strategies related to the quantity of eating are associated with constructs such as avoidance tendencies and/or dietary restraint in order to better understand the relationships that were found between the strategies related to the quantity of eating and bulimic symptoms.

From a SDT perspective, it is also possible that the dimensions of eating quality and quantity may be associated with different eating behaviors as they offer different experiences in terms of satisfying basic psychological needs for autonomy, competence, and relatedness. As suggested by Verstuyf and colleagues (2012), a focus on the quality of eating may yield more need-satisfying experiences, in that individuals who mainly focus on their nutrient intake feel that they have choices in the regulation of their eating behaviors, they feel competent in their abilities to succeed, and/or they feel supported in their decisions. On the contrary, a focus on the quantity of eating may yield more need-thwarting experiences, in that individuals who mainly focus on their caloric intake and/or portion sizes feel pressured in the regulation of their eating behaviors, they feel unable to meet certain demands, and/or they feel unsupported by others. These different experiences may also explain why planning and self-monitoring portion sizes were not related to bulimic symptoms to the same extent as planning and self-monitoring caloric intake. Whereas planning and self-monitoring calories significantly mediated the relationship

between controlled motivation and bulimic symptoms in both studies, the results were not as clear for planning and self-monitoring portion sizes. It could be that focusing on portion sizes may be less need-thwarting than focusing on caloric intake. Furthermore, since planning portion sizes was non-significantly associated with bulimic symptoms whereas self-monitoring portion sizes was significantly associated with bulimic symptoms in Study 2, self-monitoring may serve as a more controlling strategy than planning when it comes to regulating portion sizes.

Although the results should be replicated in order to confirm their validity, this research may have important implications for health interventions. The classic SDT approach to increase motivation quality consists of supporting basic psychological needs (Ryan & Deci, 2017). When social contexts foster choices (autonomy support), provide information that increase levels of self-efficacy (competence support), and promote a sense of belongingness (relatedness support), individuals are more likely to become autonomously motivated in the regulation of their eating behaviors and, consequently, to achieve healthy eating outcomes (Verstuyf et al., 2012). Since this research also identified strategies as mediators of the relationships between motivation and eating, health professionals could also intervene at this level of intervention. While health professionals may find it logical to encourage individuals to focus on the quantity of their eating behaviors given that weight gain results from an energy imbalance, this advice may have backfiring effects for individuals motivated by external factors. Instead, encouraging individuals to mainly focus on the quality of their eating behaviors may have more beneficial effects for health. In fact, previous research (Mozaffarian, Hao, Rimm, Willett, & Hu, 2011) has shown that dietary quality influences dietary quantity, in that consuming higher quality foods such as fruits and vegetables reduces total number of calories consumed which, in turn, leads to less weight gain over time. That said, although the present research did not examine how strategies related to

the quality and quantity of eating interact, it is possible that advising people to focus on the quality of their eating behaviors would have the same desired effects as advising people to focus on the quantity of their eating behaviors.

**Limitations**

Although this research advances knowledge on the mechanisms by which different types of motivation are associated with distinct eating outcomes, they also have their limitations. First, a cross-sectional design was used in both studies and therefore, causation cannot be established. Since mediation analyses have been shown to be highly misleading in correlational designs (Maxwell & Cole, 2007), future research should replicate the proposed relationships using a longitudinal design. Second, self-reported measures were used in both studies, which may have biased the results in terms of social desirability. For instance, since the HUEBS is based on national eating guidelines, it is possible that individuals overreported intake of healthy foods and underreported intake of unhealthy foods. Third, BMI was examined as a determinant rather than a consequence of eating behaviors. Since calories and portion sizes can influence energy balance, future research should examine how the proposed strategies affect physical indicators such as weight and/or BMI over time. Fourth, the sample was not representative of the general population, as participants were undergraduate female students and most were Caucasian. The results should be replicated within more diverse samples.

Finally, although the present research suggest that motivational orientations may be associated with the use of different strategies, it remains unclear how individuals develop and use planning and self-monitoring strategies in terms of quality and quantity over time. As previously mentioned, Guertin et al. (2020) demonstrated that women in earlier stages of change reported higher levels of controlled motivation and lower levels of autonomous motivation, as

well as a higher consumption of unhealthy foods and a lower consumption of healthy foods, whereas the reverse was true for women in later stages of change. It may therefore be possible that strategies related to the quantity of eating would be more prominent in earlier stages of change, whereas strategies related to the quality of eating would be more prominent in later stages of change. Furthermore, whereas self-monitoring may be required in every stage of the behavior change process as it is nearly impossible to self-regulate a behavior without keeping track of it (Baumeister & Vohs, 2007), planning may only begin to play a role once individuals are ready to implement changes to their eating behaviors. An interesting avenue for future research would be to extend the results of Guertin and Pelletier (in press) and examine if people also report different levels of strategy use in terms of quality and quantity, depending on their stage of change.

**Conclusion**

In summary, this research suggests that people who regulate their eating behaviors for autonomous reasons engage in healthier eating behaviors since they tend to focus more on the quality of their food intake. On the contrary, people who regulate their eating behaviors for controlled reasons engage in dysfunctional eating behaviors, since they tend to focus more on the quantity of their food intake. Health professionals could benefit from future research examining why a focus on the quality (versus the quantity) of eating is associated with healthier eating behaviors. This would provide a better understanding of why strategies related to the quality of eating may be more beneficial to promote than strategies related to the quantity of eating, in individuals who feel more controlled in the regulation of their eating behaviors.

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**Table 3.1**

*Studies 1 and 2: Means, standard deviations and correlations between autonomous and controlled motivation, planning and self-monitoring the quality and quantity of eating, eating outcomes, and BMI*

| *Variables* | *M* | *SD* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Study 1** | | | | | | | | | | | | | | |
| 1. Autonomous | 4.79 | 1.16 | - | .12* | .60** | .28** | .40** | .49** | .25** | .28** | .43** | -.27** | -.04 | -.11* |
| 2. Controlled | 3.38 | 1.28 | | - | .06 | .38** | .32** | .21** | .40** | .36** | .02 | .02 | .45** | .20** |
| 3. Plan quality | 4.74 | 1.45 | | | - | .36** | .52** | .62** | .29** | .37** | .46** | -.37** | -.03 | -.10* |
| 4. Plan calories | 3.30 | 1.64 | | | | - | .63** | .57** | .85** | .59** | .19** | -.19** | .28** | .09 |
| 5. Plan portions | 4.06 | 1.42 | | | | | - | .58** | .60** | .67** | .22** | -.20** | .13** | .02 |
| 6. Monitor quality | 4.31 | 1.51 | | | | | | - | .61** | .62** | .37** | -.27** | .09* | -.07 |
| 7. Monitor calories | 3.48 | 1.89 | | | | | | | - | .69** | .16** | -.11* | .31** | .11* |
| 8. Monitor portions | 4.37 | 1.60 | | | | | | | | - | .18** | -.12* | .22** | .14** |
| 9. Healthy eating | 4.35 | 1.09 | | | | | | | | | - | .03 | -.02 | -.06 |
| 10. Unhealthy eating | 3.01 | 1.05 | | | | | | | | | | - | .06 | .03 |
| 11. Bulimic symptoms | 2.86 | 1.36 | | | | | | | | | | | - | .27** |
| 12. BMI | 23.07 | 4.13 | | | | | | | | | | | | - |
| **Study 2** | | | | | | | | | | | | | | |
| 1. Autonomous | 4.85 | 1.13 | - | .06 | .61** | .28** | .34** | .52** | .23** | .26** | .40** | -.29** | -.07 | -.08* |
| 2. Controlled | 3.40 | 1.26 | | - | -.03 | .36** | .29** | .17** | .40** | .35** | .006 | .04 | .45** | .16** |
| 3. Plan quality | 4.71 | 1.46 | | | - | .32** | .47** | .63** | .25** | .34** | .41** | -.38** | -.09** | -.07* |
| 4. Plan calories | 3.38 | 1.68 | | | | - | .63** | .54** | .85** | .61** | .17** | -.17** | .32** | .13** |
| 5. Plan portions | 4.12 | 1.43 | | | | | - | .54** | .58** | .69** | .20** | -.19** | .20** | .06* |
| 6. Monitor quality | 4.33 | 1.51 | | | | | | - | .58** | .63** | .33** | -.31** | .10** | .003 |
| 7. Monitor calories | 3.58 | 1.91 | | | | | | | - | .70** | .15** | -.12** | .36** | .17** |
| 8. Monitor portions | 4.39 | 1.58 | | | | | | | | - | .18** | -.16** | .29** | .12** |
| 9. Healthy eating | 4.54 | 1.04 | | | | | | | | | - | .05 | -.05 | -.03 |
| 10. Unhealthy eating | 3.20 | 1.08 | | | | | | | | | | - | .11** | .05 |
| 11. Bulimic symptoms | 2.87 | 1.41 | | | | | | | | | | | - | .25** |
| 12. BMI | 22.96 | 4.19 | | | | | | | | | | | | - |

*Note.* Study 1: $N = 456$. Study 2: $N = 979$. ** $p < .01$; * $p < .05$.

**Table 3.2**

*Hierarchical multiple regression models examining eating outcomes from motivation and strategies, while controlling for BMI*

| | Healthy eating | | | Unhealthy eating | | | Bulimic symptoms | | |
|---|---|---|---|---|---|---|---|---|---|
| Variables | *β* | *t* | $R^2$ change | *β* | *t* | $R^2$ change | *β* | *t* | $R^2$ change |
| *Step 1* | | | .18*** | | | .08*** | | | .23*** |
| Autonomous | .43 | 10.00*** | | -.29 | -6.34*** | | -.07 | -1.63 | |
| Controlled | -.03 | -0.74 | | .06 | 1.36 | | .43 | 9.98*** | |
| BMI | -.01 | -0.26 | | -.01 | -0.26 | | .15 | 3.47** | |
| **Plan quality** | | | | | | | | | |
| *Step 2* | | | .06*** | | | .07*** | | | .000 |
| Autonomous | .24 | 4.70*** | | -.10 | -1.73 | | -.08 | -1.47 | |
| Controlled | -.03 | -0.72 | | .06 | .06 | | .43 | 9.97*** | |
| BMI | .001 | .03 | | -.03 | -.03 | | .15 | 3.48** | |
| Plan quality | .31 | 6.12*** | | -.33 | -.33*** | | .01 | 0.27 | |
| **Plan calories** | | | | | | | | | |
| *Step 2* | | | .008 | | | .02** | | | .02** |
| Autonomous | .41 | 9.10*** | | -.25 | -5.25*** | | -.11 | -2.46** | |
| Controlled | -.07 | -1.43 | | .12 | 2.50** | | .37 | 8.31*** | |
| BMI | -.02 | -0.37 | | -.004 | -.08 | | .14 | 3.33** | |
| Plan calories | .10 | 2.10 | | -.17 | -3.47*** | | .15 | 3.26** | |
| **Plan portions** | | | | | | | | | |
| *Step 2* | | | .004 | | | .01** | | | .001 |
| Autonomous | .40 | 8.67*** | | -.24 | -4.90*** | | -.08 | -1.77 | |
| Controlled | -.05 | -1.16 | | .10 | 2.07 | | .42 | 0.34*** | |
| BMI | -.01 | -0.27 | | -.01 | -0.24 | | .15 | 3.46** | |
| Plan portions | .08 | 1.56 | | -.13 | -.13** | | .03 | 0.69 | |
| **Monitor quality** | | | | | | | | | |
| *Step 2* | | | .04*** | | | .03*** | | | .004 |
| Autonomous | .33 | 6.81*** | | -.20 | -3.89*** | | -.10 | -2.13* | |
| Controlled | -.07 | -1.57 | | .09 | 2.03 | | .41 | 9.56*** | |
| BMI | .001 | 0.02 | | -.02 | -0.49 | | .15 | 3.56*** | |
| Monitor quality | .22 | 4.56*** | | -.19 | -3.71*** | | .07 | 1.46 | |
| **Monitor calories** | | | | | | | | | |
| *Step 2* | | | .005 | | | .005 | | | .02*** |
| Autonomous | .41 | 9.35*** | | -.27 | -5.80*** | | -.11 | -2.49** | |
| Controlled | -.06 | -1.30 | | .09 | 1.85 | | .36 | 8.04*** | |
| BMI | -.02 | -0.38 | | -.007 | -0.14 | | .14 | 3.24** | |
| Monitor calories | .08 | 1.67 | | -.08 | -1.59 | | .17 | 3.78*** | |
| **Monitor portions** | | | | | | | | | |
| *Step 2* | | | .007 | | | .004 | | | .006 |
| Autonomous | .41 | 9.12*** | | -.27 | -5.74*** | | -.09 | -2.08* | |
| Controlled | -.06 | -1.34 | | .09 | 1.73 | | .40 | 8.88*** | |
| BMI | -.02 | -0.49 | | -.004 | -0.09 | | .14 | 3.24** | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Monitor portions | .09 | 1.99 | | -.07 | -1.38 | .09 | 1.87 |

*Note.* N = 456. *** $p < .001$; ** $p < .01$.

**Table 3.3**

*Fit indices for the measurement and structural models*

| Strategies | $\chi^2$ (*df*), *p* value | CFI | TLI | RMSEA (90% CI) | SRMR |
|---|---|---|---|---|---|
| **Measurement Models** | | | | | |
| Plan Quality | 410.56 (104), $p < .001$ | .96 | .95 | .06 (0.049, 0.061) | .05 |
| Plan Calories | 433.09 (104), $p < .001$ | .96 | .95 | .06 (0.051, 0.062) | .05 |
| Plan Portions | 451.85 (104), $p < .001$ | .95 | .94 | .06 (0.053, 0.064) | .05 |
| Monitor Quality | 443.34 (104), $p < .001$ | .95 | .94 | .06 (0.052, 0.063) | .05 |
| Monitor Calories | 423.17 (104), $p < .001$ | .96 | .95 | .06 (0.050, 0.062) | .05 |
| Monitor Portions | 447.95 (104), $p < .001$ | .95 | .94 | .06 (0.053, 0.064) | .05 |
| **Structural Models** | | | | | |
| Plan Quality | 460.99 (115), $p < .001$ | .96 | .94 | .06 (0.050, 0.061) | .05 |
| Plan Calories | 487.23 (115), $p < .001$ | .95 | .94 | .06 (0.052, 0.063) | .05 |
| Plan Portions | 505.59 (115), $p < .001$ | .95 | .93 | .06 (0.054, 0.064) | .05 |
| Monitor Quality | 491.48 (115), $p < .001$ | .95 | .93 | .06 (0.053, 0.063) | .05 |
| Monitor Calories | 472.46 (115), $p < .001$ | .96 | .95 | .06 (0.051, 0.062) | .05 |
| Monitor Portions | 496.55 (115), $p < .001$ | .95 | .93 | .06 (0.053, 0.064) | .05 |

*Note.* N = 979. $X^2$ = chi-square; df = degrees of freedom; CFA = comparative fix index; TLI = Tuker Lewis index; RMSEA = root mean square of approximation; CI = confidence intervals; SRMR = Standardized root mean square residual.

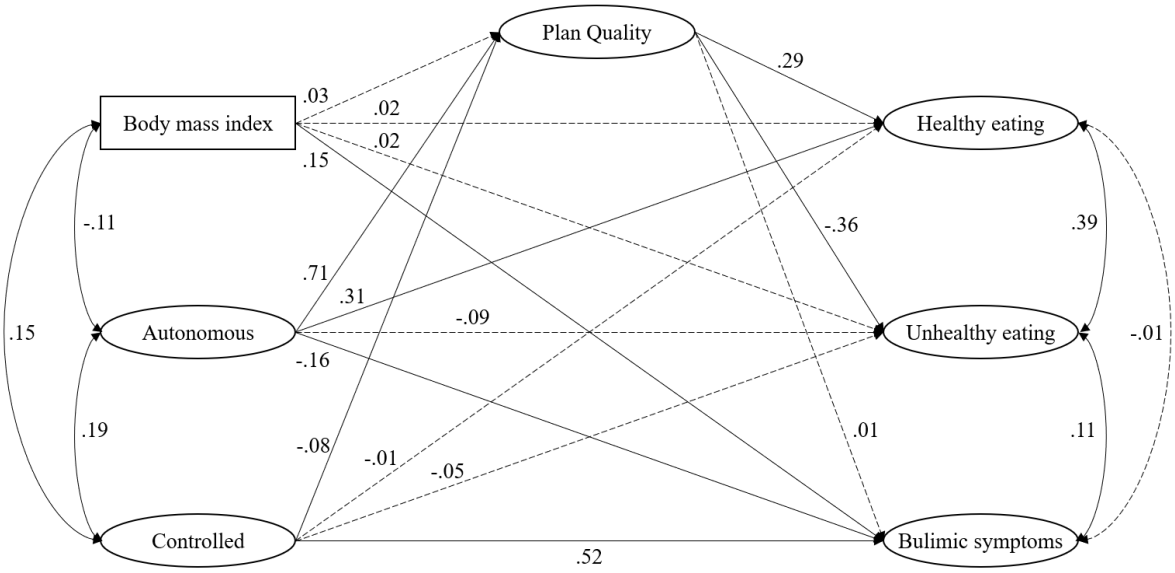


*Figure 3.1.* The hypothesized model for the regulation of eating where planning quality is examined as a mediator of the relationships between motivation and eating. Note: unidirectional arrows represent hypothesized paths; bidirectional arrows represent correlations. Solid lines = $p < .01$. Doted lines = *ns*.

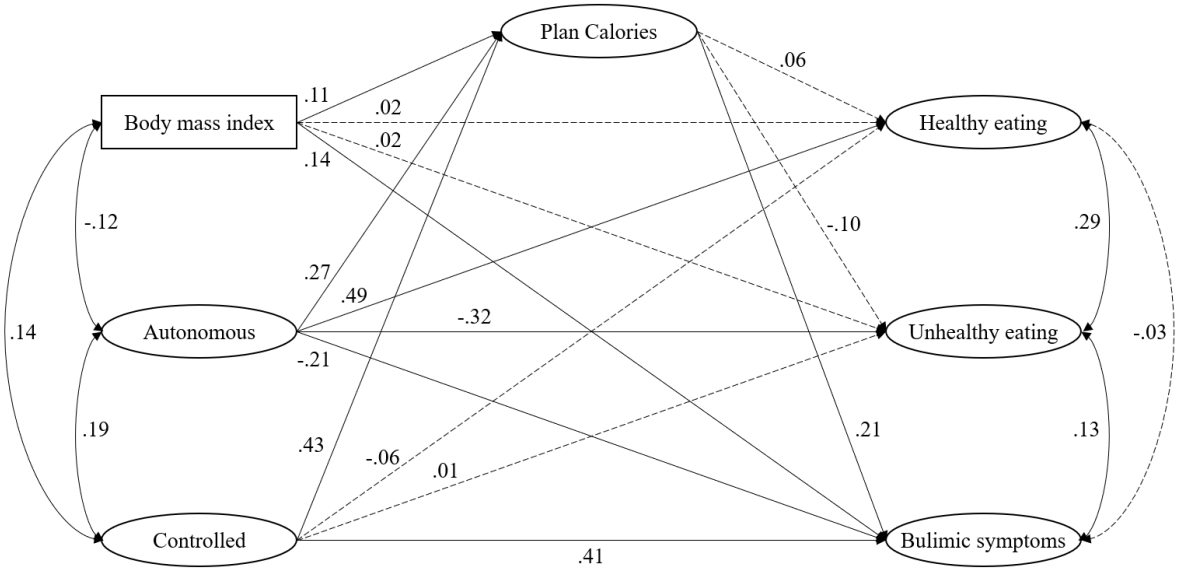


*Figure 3.2.* The hypothesized model for the regulation of eating where planning calories is examined as a mediator of the relationship between motivation and eating. Note: unidirectional arrows represent hypothesized paths; bidirectional arrows represent correlations. Solid lines = $p < .01$. Doted lines = *ns*.

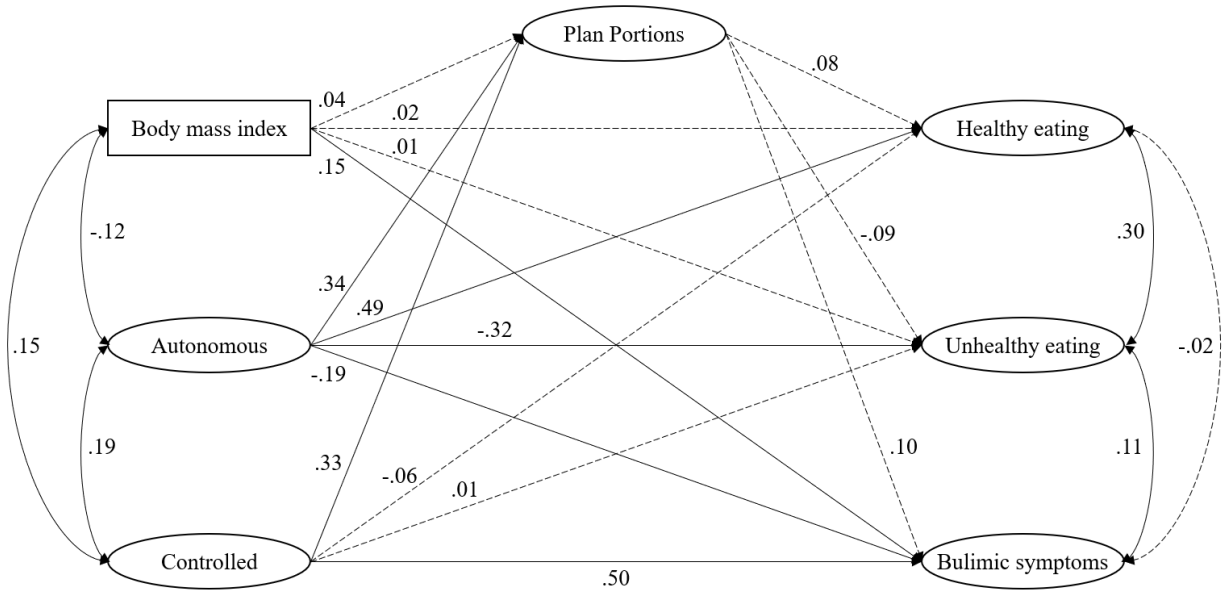


*Figure 3.3.* The hypothesized model for the regulation of eating where planning portions is examined as a mediator of the relationship between motivation and eating. Note: unidirectional arrows represent hypothesized paths; bidirectional arrows represent correlations. Solid lines = $p < .01$. Doted lines = *ns*.

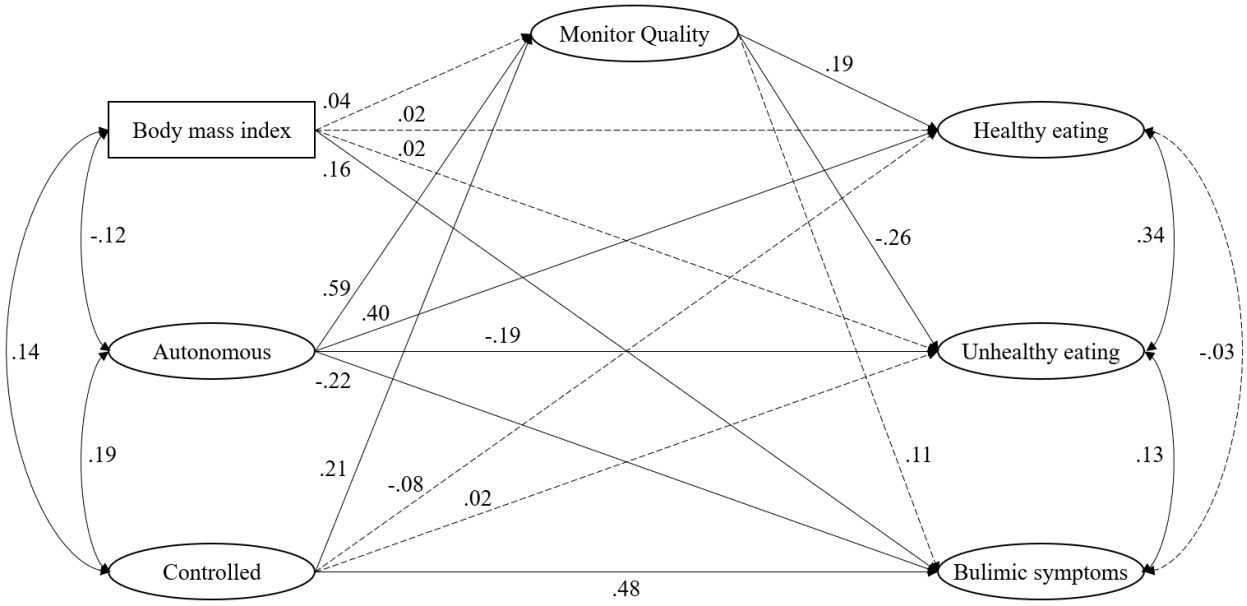


*Figure 3.4.* The hypothesized model for the regulation of eating where self-monitoring quality is examined as a mediator of the relationship between motivation and eating. Note: unidirectional arrows represent hypothesized paths; bidirectional arrows represent correlations. Solid lines = $p < .01$. Doted lines = *ns*.

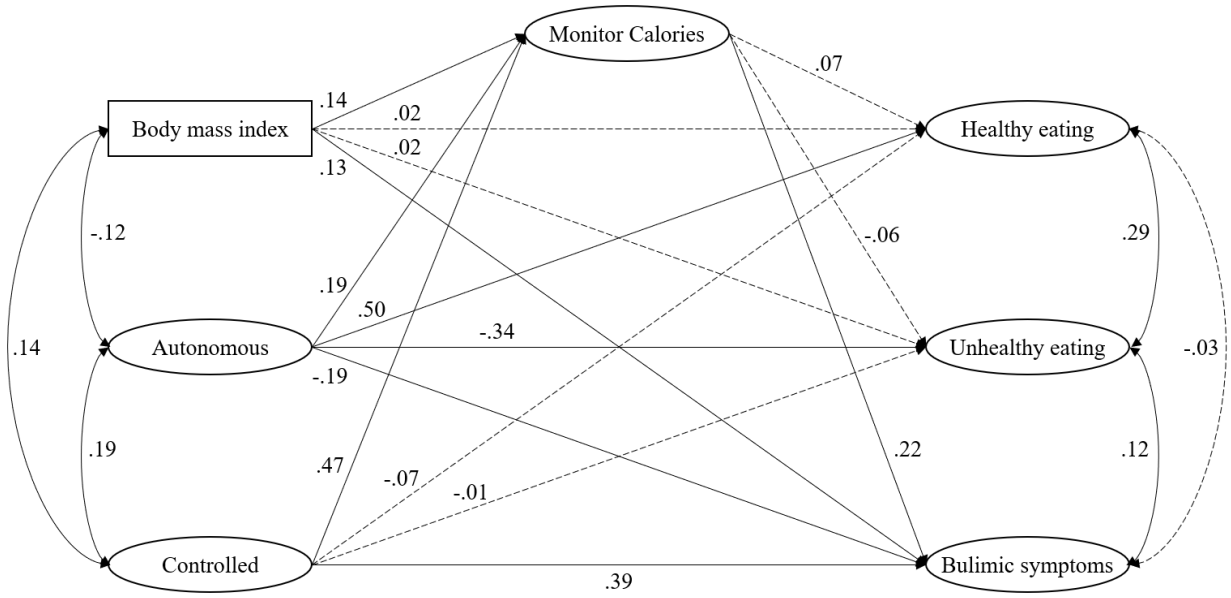


*Figure 3.5.* The hypothesized model for the regulation of eating where self-monitoring calories is examined as a mediator of the relationship between motivation and eating. Note: unidirectional arrows represent hypothesized paths; bidirectional arrows represent correlations. Solid lines = $p < .01$. Doted lines = *ns*.

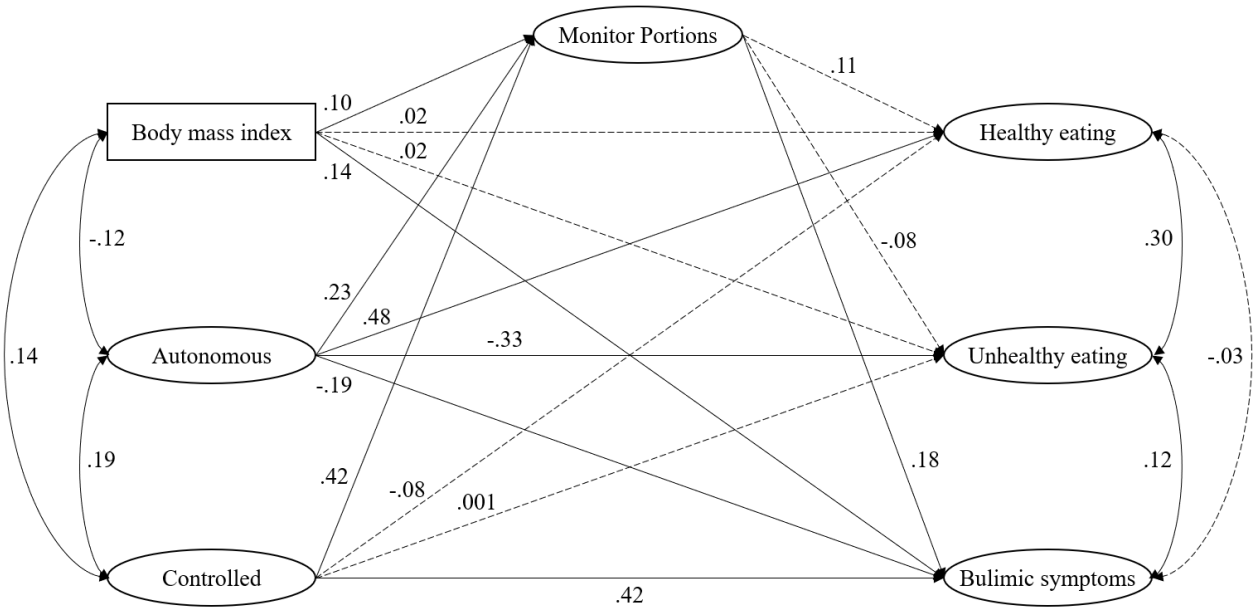


*Figure 3.6.* The hypothesized model for the regulation of eating where self-monitoring portions is examined as a mediator of the relationship between motivation and eating. Note: unidirectional arrows represent hypothesized paths; bidirectional arrows represent correlations. Solid lines = $p < .01$. Doted lines = *ns*.

## *CHAPTER FIVE*

**Guertin, C., & Pelletier, L. (under review). Motivational Dynamics in the Prediction of Self-Regulation Strategies for the Quality and Quantity of Eating, Eating Behaviors, and Life Satisfaction: A Longitudinal Investigation**

### Abstract

This study tested a longitudinal model examining the roles of goals and motivation in the prediction of planning and self-monitoring the quality and quantity of eating and various types of eating behaviors, and the effects of adopting these behaviors on life satisfaction over time. Participants ($n$ = 230) completed measures assessing their goals for weight-management and their motivation to regulate their eating behaviors (the baseline), their engagement in planning and self-monitoring strategies for the quality and quantity of eating (1 month), and healthy and unhealthy eating behaviors and bulimic symptoms (3 months). Life satisfaction was measured at the baseline and again at 3 months. Structural equation modeling supported that women who pursued health-focused goals were more likely to regulate their eating behaviors for autonomous reasons, whereas women who pursued appearance-focused goals were more likely to regulate their eating behaviors for controlled reasons. Autonomous motivation then predicted strategies in relation to the quality of eating, which were then associated with functional eating behaviors. By opposition, controlled motivation predicted strategies in relation to the quantity of eating, which were then associated with dysfunctional eating behaviors. Functional and dysfunctional eating behaviors were then positively and negatively associated with change in life satisfaction, respectively. This study provides some explanation for why some people succeed, whereas others fail, to regulate their eating behaviors over time.

*Keywords:* Goals; motivation; self-regulation strategies; eating behaviors; life satisfaction

Motivational Dynamics in the Prediction of Self-Regulation Strategies for the Quality and Quantity of Eating, Eating Behaviors, and Life Satisfaction: A Longitudinal Investigation

## Introduction

The adoption of healthy eating behaviors is notoriously difficult in an environment that encourages the consumption of unhealthy foods. Over the past several decades, the food environment has undergone many shifts due to changes in urbanization, economic growth, technology, and culture (Popkin & Gordon-Larsen, 2004; Roberto, 2020), which have led to opportunities such as consuming more meals outside the home (Guthrie, Lin, & Frazao, 2002; Nielson, Siega-Riz, & Popkin, 2002), an increase in food marketing (Harris, Schwartz, & Brownell, 2010; Powell, Harris, & Fox, 2013) and in the increased availability of unhealthy foods (Popkin, 2004), and lower costs of unhealthy relative to healthy foods (Darmon & Drewnowski, 2015; Mendoza, Pérez, Aggarwal, & Drewnowski, 2017; Roberto, 2020). Unfortunately, these changes within the food industry have not been inconsequential: they have contributed to the high prevalence of diet-related chronic diseases such as obesity (Swinburn, Sacks, Hall, McPherson, Finegood, Moodie, et al., 2011) and eating disorders (e.g., binge eating; Sonneville & Rodgers, 2019) and as a result to lower psychological adjustment (Marks, 2015; Pelletier & Dion, 2007; Pelletier, Dion, Slovinec-D'Angelo & Reid, 2004).

Although individuals in the Western world are more or less exposed to the same nutrition environments, research in motivational psychology has shown that some people are able to succeed at regulating their eating behaviors. To date, the Self-Determination Theory (SDT; Ryan & Deci, 2017) has been very useful in understanding and explaining the myriad of behaviors involved in eating regulation, including functional and dysfunctional forms of eating. Building

on related research within the SDT, the general aim of this study was to increase knowledge on why some people succeed, whereas others fail, at regulating their eating behaviors over time.

## The Self-Determination Theory

The SDT is a theory of human motivation that considers global motivational processes that move individuals to act. When attempting to explain and predict goal-directed behavior, the SDT relies on two different types of motivational dynamics: the "what" and the "why" that underlie people's behaviors. The "what" of behavior refers to the *content of goals* that individuals pursue, whereas the "why" of behavior refers to the *regulatory processes*, or the reasons or motives that individuals have for pursuing their goals (Ryan & Deci, 2017).

**The "what" of behavior.** Within the SDT, it is postulated that people can pursue two different types of life goals: intrinsic and extrinsic goals. On the one hand, intrinsic goals (e.g., health, close relationships, personal growth) represent goals that reflect an "inward" orientation since they tend to focus on what is inherently valuable. Because intrinsic goals generally emerge from people's natural growth tendencies, they are more satisfying of basic psychological needs and, therefore, are more likely to promote optimal functioning such as health and well-being (Deci & Ryan, 2008; Kasser & Ryan, 2001). On the other hand, extrinsic goals (e.g., wealth, recognition, image) represent goals that reflect an "outward" orientation since they tend to focus on instrumental outcomes, which are not inherently satisfying of basic psychological needs. Because extrinsic goals rely on external contingencies and are likely to be "exogenous", their pursuit is generally associated with non-optimal functioning such as ill-being and distress (Kasser, Rosenblum, Sameroff, Deci, Niemiec, Ryan, et al., 2014; Schmuck, Kasser, & Ryan, 2000; Sheldon & Krieger, 2014; Sheldon, Ryan, Deci & Kasser, 2004).

In the domain of eating regulation, the principle contrast between intrinsic and extrinsic goals lies in the distinction of wanting to pursue a healthier lifestyle (i.e., intrinsic) and of having a more attractive body (i.e., extrinsic; Ryan, Williams, Patrick, & Deci, 2009). Several studies within this domain have shown that health-focused goals are associated with positive outcomes, whereas appearance-focused goals are associated with negative outcomes. For example, Putterman and Linden (2004) examined if both types of goals were associated with outcomes generally associated with chronic dieting and found that dieting for appearance (versus health) reasons was related with the use of drastic dieting behaviors (e.g., restricting calories, excluding food groups), higher levels of disinhibited eating and lapses in restraint. Thøgersen-Ntoumani, Ntoumanis, and Nikitaras (2010) also found that health goals were positively associated with the satisfaction of basic psychological needs, which was then negatively associated with body image concerns. Image goals, on the contrary, were not satisfying of basic psychological needs and instead, were positively associated with body image concerns, which were then positively associated with unhealthy weight control behaviors such as taking laxatives or diet pills and skipping meals. Furthermore, Schelling and colleagues (Schelling, Munsch, Meyer, & Margraf, 2011) showed that health- and appearance-focused goals for weight loss and dieting were both positively associated with the total number of diets that individuals pursued in their lives; however, only appearance-focused goals were associated with binge eating episodes. Similar results were found in Verstuyf, Vansteenkiste, and Soenens' (2012) study, in which appearance-focused (but not health-focused) goals were positively associated with diet-specific need frustration which, in turn, was positively associated with binge eating symptoms. Together, these studies suggest that intrinsic goals are more likely to lead to functional eating behaviors, whereas extrinsic goals are more likely to lead to dysfunctional eating behaviors.

**The "why" of behavior.** The SDT also postulates that once individuals set goals for themselves, these goals need to be ongoingly regulated in order to be pursued and in some cases, achieved (Ryan and Deci, 2017; Vansteenkiste, Lens, Elliot, Soenens, & Mouratidis, 2014). As mentioned above, the "why" of behavior refers to the regulatory processes through which goals are pursued. According to the SDT, goal-directed behavior is energized by different sources of motivation, which influence the experiences and, ultimately, the quality of human behavior (Ryan & Deci, 2017). The SDT differentiates between various types of behavioral regulations that can be characterized in terms of the extent to which they represent controlled and autonomous regulations. These behavioral regulations are depicted on a continuum that go from the least to the most autonomous forms of regulations.

At one end of the continuum, the most controlled form of motivation is *external regulation*. External regulation refers to behavior motivated by external reinforcement and/or punishment contingencies; for example, an individual who regulates their eating behaviors in order to obtain social praise and/or to avoid criticism from others. While external regulation is dependent upon external contingencies, with *introjected regulation*, the source of control stems from within the person. This type of regulation is considered to be partially assimilated within the self, in that behavior motivated by introjection can be freed from external constraints and yet still involve self-imposed guilt and/or shame. An example of introjected behavior is an individual who regulates their eating behaviors because they would feel ashamed of themselves if they did not. Moving towards autonomous forms of motivation, *identified regulation* refers to behavior for which individuals have identified the importance of engaging in a behavior. For instance, an individual who regulates their eating behaviors because they see the benefit in doing so. Next, *integrated regulation* refers to behavior that is motivated by the desire of being congruent with

other aspects of the self. An example of integrated behavior is an individual who eats healthily in order to maintain a healthy lifestyle. Finally, at the other end of the continuum, the most autonomous form of motivation is *intrinsic regulation*. Behavior motivated by intrinsic regulation is engaged in because it brings pleasure and satisfaction to an individual; for example, an individual who genuinely takes pleasure in fixing healthy meals.

Since external and introjected regulations represent behaviors that have not yet been internalized within the self, these types of behavioral regulations are experienced as more controlled. In contrast, since identified, integrated, and intrinsic regulations represent behaviors that are part of the self, these types of behavioral regulations are experienced as more autonomous. Given the distinctive nature of autonomous and controlled motivation, research in the eating regulation domain has shown that autonomous motivation is associated with functional types of eating behaviors, whereas controlled motivation is associated with dysfunctional types of eating behaviors (for a review, see Verstuyf, Patrick, Vansteenkiste, & Teixeira, 2012). For instance, Pelletier et al. (2004; study 2) and Pelletier and Dion (2007) have shown that autonomous motivation was positively associated with healthy eating behaviors and negatively associated with bulimic symptoms, whereas controlled motivation was positively associated with bulimic symptoms and negatively associated with healthy eating behaviors. In these models, healthy eating behaviors were then positively associated with psychological well-being, whereas bulimic symptoms were negatively associated with psychological well-being.

Guertin, Barbeau, Pelletier, and Martinelli (2017) also tested a model in which extrinsic goals for weight-management were positively associated with fat talk (i.e., negative conversations about one’s body and/or eating behaviors) and controlled motivation for eating regulation which, in turn, was positively associated with unhealthy eating behaviors. In

opposition, intrinsic goals for weight-management were negatively associated with fat talk and instead, were positively associated with autonomous motivation for eating regulation. In turn, autonomous motivation was negatively associated with unhealthy eating. The same results were obtained in Guertin, Barbeau, and Pelletier's (2018) study; however, in this model, intrinsic goals were also positively associated with self-compassion. Self-compassion (as well as intrinsic goals) was then positively associated with autonomous motivation for eating which, in turn, was positively and negatively associated with healthy and unhealthy eating behaviors, respectively.

With the objective of better understanding *how* individuals with different types of motivation regulate their eating behaviors, Otis and Pelletier (2008) investigated if individuals planned their eating behaviors in different ways, based on their motivation type. Findings demonstrated that *approach* food planning (i.e., plans that specify *what to* eat) partially mediated the relationship between autonomous motivation and healthy eating behaviors, whereas *avoidance* food planning (i.e., plans that specify *what not to* eat) partially mediated the relationship between controlled motivation and bulimic symptoms. In the study of Pelletier et al. (2004; study 2), it was also reported that women who felt more autonomous in the regulation of their eating behaviors were more concerned over the *quality* of their food intake, whereas women who felt more controlled in the regulation of their eating behaviors were more concerned over the *quantity* of their food intake. Of particular interest to the present research, Guertin and Pelletier (under review) extended these results and showed that planning and self-monitoring the quality (i.e., nutrient intake) of eating fully or partially mediated the relationship between autonomous motivation and healthy and unhealthy eating behaviors, whereas planning and self-monitoring the quantity (i.e., calories and portions) of eating fully or partially mediated the relationship between controlled motivation and bulimic symptoms. These studies highlight that

the means through which people regulate their eating behaviors can, at least partially, explain why people with different types of motivation engage in (dys)functional eating behaviors.

**The Relationship Between the "What" and the "Why" of Behavior**

Despite the fact that the "what" and the "why" of behavior represent distinct motivational dynamics, the SDT assumes that intrinsic goals are most often regulated by autonomous motives, whereas extrinsic goals are most often regulated by controlled motives (Ryan & Deci, 2017). Since intrinsic goals directly satisfy basic psychological needs, it is more likely that individuals pursuing these goals will regulate their behaviors out of integration and volition. In opposition, since extrinsic goals are generally pursued to compensate for unsatisfied needs, individuals pursuing these goals will often regulate their behaviors in order to obtain the approval of others.

Researchers have long debated the relationship between the "what" and the "why" of behavior and how these motivational dynamics interact with each other. Some have argued that intrinsic and extrinsic goals are completely parallel to autonomous and controlled motivation and that the effects of the content of goals are entirely reducible to the effects of motivation (e.g., Carver & Baird, 1998; Strivastava, Locke, & Bartol, 2001). In other words, individuals' goals make no contribution to the prediction of outcomes after considering their motivation. Others have also argued the independent effects of the "what" and the "why" of behavior on well-being outcomes (e.g., Garðarsdóttir, Dittmar, & Aspinall, 2009; Sebire, Standage, & Vansteenkiste, 2009, 2011; Sheldon et al., 2004). For instance, in the context of eating, Verstuyf, Vansteenkiste, Soetens, and Soenens (2016) have shown that health-focused goals and autonomous motivation positively predicted healthy eating behaviors, whereas appearance-focused goals and controlled motivation positively predicted drive for thinness over a one-week period. In this study, it was also found that only health-focused and appearance-focused goals (and not autonomous and

controlled motivation) negatively and positively predicted binge eating symptoms, respectively. Since both motivational dynamics will be addressed in the present study, the unique contributions of goals and motivation in the prediction of eating strategies and behaviors will be examined.

**The Present Study**

The main purpose of this study was to build upon the research of Guertin and Pelletier (under review) by testing a longitudinal model examining the roles of goals and motivation in the prediction of strategy use and eating behaviors, and the effects of adopting these behaviors on individuals' life satisfaction over a 3-month period. Specifically, this study will examine the relationships between intrinsic and extrinsic goals and autonomous and controlled motivation in the prediction of planning and self-monitoring the quality and the quantity of eating, various types of eating behaviors, and life satisfaction over time.

Our research will expand the research of Guertin and Pelletier (under review) in the following ways. First, since goals represent a critical factor in the process of eating regulation, both goals and motivation will be considered as predictors of strategy use and eating behaviors. The inclusion of both types of motivational dynamics will allow us to examine whether goals and motivation contribute unique variance to individuals' strategy use and eating behaviors over time. Second, this study will replicate their results using a more diverse sample; that is, a mix of women recruited from a university and from the community, and of women of older age. Third, while the research of Guertin and Pelletier (under review) was cross-sectional, this study will test the relationships between goals and motivation, strategy use and eating behaviors over a 3-month period. Finally, in line with previous research that has examined the relationships between eating behaviors and psychological well-being (e.g., Pelletier & Dion, 2007; Pelletier et al., 2004),

change in life satisfaction will be examined as a psychological outcome to the processes examined.

In line with the SDT and past research (e.g., Guertin et al., 2016, 2018), it is expected that (1) intrinsic goals for weight-management will be positively associated with autonomous motivation, and negatively or non-significantly associated with controlled motivation for eating regulation, whereas (2) extrinsic goals for weight-management will be positively associated with controlled motivation, and negatively or non-significantly associated with autonomous motivation for eating regulation at Time 1 (the baseline). Consistent with Verstuyf and colleagues (2016) and Guertin and Pelletier (under review), it is also anticipated that (3) intrinsic goals and autonomous motivation will more strongly and positively predict planning and self-monitoring the quality of eating, whereas (4) extrinsic goals and controlled motivation will more strongly and positively predict planning and self-monitoring the quantity of eating at Time 2 (1 month). In turn, it is hypothesized that (5) strategies related to the quality of eating will more strongly and positively predict healthy eating and more strongly and negatively predict unhealthy eating behaviors, whereas (6) strategies related to the quantity of eating will more strongly and positively predict bulimic symptoms at Time 3 (3 months). Finally, it is expected that (7) healthy eating behaviors will be positively associated with life satisfaction, whereas (8) unhealthy eating behaviors and bulimic symptoms will be negatively associated with life satisfaction at Time 3.

## Method

### Participants

The sample included 243 women participants who were recruited from a Canadian University's integrative research participation pool (n = 46) or through the Ottawa community (n = 197). The women were aged between 17 and 72 ($M$ = 30; $SD$ = 11.31). Identified ethnicities of

the sample included: Non-Hispanic white or European-American (77.7%); Middle Eastern or Arab American (5.0%); South Asian or Indian American (2.5%); Black, Afro-Caribbean, or African American (1.6%); East Asian or Asian American (1.7%); Latino or Hispanic American (1.2%); Native American or Alaskan Native (0.4%); or other (9.9%). The sample presented a mean BMI of 24.97 (*SD* = 4.94). Most women were within the healthy BMI range (18.50-24.99; 57.9%) according to Centers for Disease Control and Prevention (2001) criteria; however, some were also considered underweight (≤ 18.49; 2.5%), overweight (25-29.99; 26.0%), and obese (≥ 30; 13.6%). Amongst participants who were recruited from the research participation pool, the highest level of education was a high school degree and the majority received a yearly income of less than 5,000$ (47.8%). Amongst the participants who were recruited from the community, the highest level of education was a bachelor's degree (50.3%) and the majority received a yearly income of 80,000$ and greater (20.9%). Additional information on the women's demographics is provided in Table 4.1.

**Procedure**

Data collection took place at three different time points over the course of three months. At each time point, the participants were asked to complete an online questionnaire, which took approximately 45 minutes to complete. Participants who were recruited from the research participation pool completed the questionnaires for Time 1 in exchange for partial course credit. At the end of this questionnaire, they were asked if they were interested in participating in Time 2 and Time 3 of the study. Participants who indicated their interest were sent an email with the links to the online questionnaires at both time points. For their participation in Time 2, these participants received 0.5 points toward their course, whereas for their participation in Time 3, they entered a draw to win one of two bank money orders of 100$. Participants from the

community were recruited using advertisements posted on social media, such as Facebook. These advertisements described the objectives and procedures of the study and provided participants with the contact information of the principal investigator. Participants who were recruited from the community received a 50$ gift card from a local restaurant, until there were no more gift cards available. In total, 125 gift cards were provided to the participants. Individuals were still allowed to participate without compensation, if they were interested in doing so.

At Time 1 (the baseline), participants completed measures of their intrinsic and extrinsic goals for weight-management, their autonomous and controlled motivation for eating regulation, as well as their general satisfaction with life. At Time 2 (1 month), they completed a measure assessing the strategies they generally used to regulate their eating behaviors. Finally, Time 3 (3 months) assessed their eating behaviors and again, their general life satisfaction. The ethical conduct of the study was approved by the University's institutional review board prior to conducting the study, and electronic informed consent was obtained from each participant at each time point.

**Measures**

**Intrinsic and extrinsic goals for weight-management.** A modified version of the Aspiration Index (AI; Kasser & Ryan, 1996) was used to measure individuals' intrinsic and extrinsic goals in reference to weight-management. In this scale, participants were asked to indicate how important various goals were to them when thinking of controlling their weight. The scale included eight items, which consisted of four intrinsic goals (e.g., "be physically healthy", "keep myself healthy and well") and four extrinsic goals (e.g., "be beautiful", "have an image that others find appealing"). Participants responded to the items using a scale going from 1 (*Not at all important*) to 7 (*Extremely important*). The AI has been previously validated amongst

a sample of college students from various cultures and factor analyses haves supported the 11-factor structure of the scale, in which appearance and health goals were two of those factors (Grouzet, Kasser, Ahuvia, Dols, Kim, Lau, et al., 2005). Each individual item was used to create the latent variables for intrinsic and extrinsic goals in the model. Internal consistency was .72 for intrinsic goals and .86 for extrinsic goals.

**Autonomous and controlled motivation for eating.** The Regulation of Eating Behaviors Scale (REBS; Pelletier et al., 2004) was administered to the participants in order to measure their general tendency to regulate their eating behaviors for autonomous and controlled reasons. This scale included 20 items in total, which represented the behavioral regulations proposed by the SDT (4 item per subscale; Ryan & Deci, 2017). Participants were asked to indicate the extent to which each item corresponded to their personal reasons for regulating their eating behaviors (e.g., "because I believe it is a good thing I can do to feel better about myself in general," "because I don't want to be ashamed of how I look") using a scale going from 1 (*Does not correspond at all*) to 7 (*Corresponds exactly*). The original validation study of the scale has provided evidence for the factor structure and validity of the REBS amongst female university students (Pelletier et al., 2004). The autonomous (i.e., intrinsic, integrated, and identified) and controlled (i.e., introjected and external) motivation latent variables were created by using the mean score of each behavioral regulation. In this study, internal consistency was .89 for intrinsic, .88 for integrated, .58 for identified, .79 for introjected, and .82 for extrinsic regulations.

**Life satisfaction.** The Satisfaction with Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985) was administered to the participants to evaluate their general satisfaction with life. Participants were asked to indicate the extent to which they agreed with five statements (e.g., "In most ways, my life is close to my ideal," "The conditions of my life are excellent") using a scale

going from 1 (*Do not at all agree*) to 7 (*Strongly agree*). In the validation study of the scale (Diener et al., 1985), the 1-factor structure of the scale was established, and results provided support for the psychometric properties of the scale, including internal consistency and high temporal reliability. Each item of the SWLS was used to create the latent variables representing life satisfaction at the baseline and at 3 months. Internal consistency for life satisfaction was .91 at the baseline, and .90 at 3 months.

**Planning and self-monitoring the quality and quantity of eating.** The Planning and Self-Monitoring the Quality and Quantity Scale (PMQQS; Guertin & Pelletier, in press) was administered to the participants to assess their engagement in planning and self-monitoring strategies for the quality (i.e., nutrient intake) and quantity (i.e., calories and portion sizes) of their eating behaviors. By using the stems "When I plan my meals" and "When I monitor my food intake", participants were asked to rate 18 items (3 items per subscale) using a scale ranging from 1 (*Never*) to 7 (*Always*). Examples of items include: "I choose food items that are high in nutrients," "I think about the calorie content of the food I am going to eat," and "I pay attention to how much food I consume in one sitting." A 6-factor structure was supported in the validation study of the PMQQS (Guertin & Pelletier, in press) and results demonstrated good internal consistency and strong convergent and discriminant validity. Cronbach's alpha for each subscale was the following: .88 for planning nutrient intake, .84 for planning calories, .82 for planning portions; and .75 for self-monitoring nutrient intake, .93 for self-monitoring calories, and .87 for self-monitoring portions.

**Healthy and unhealthy eating.** Participants' general consumption of healthy and unhealthy food items were measured using the Healthy and Unhealthy Eating Behaviors Scale (HUEBS; Guertin, Pelletier, & Pope, 2020). In this scale, participants were asked to indicate

their general consumption of 22 food items, which assessed 11 food items that are considered healthy (e.g., “I eat fruits”, “I eat vegetables”) and 11 food items that should be consumed in moderation (e.g., “I eat frozen and/or packaged meals”, “I eat processed meats such as sausages, bacon, and/or cold cuts”) according to Canada’s Food Guide. Each item was answered using a scale ranging from 1 (*Never*) to 7 (*Always*). Factorial validity and internal consistency for both healthy and unhealthy eating behaviors has been established in the validation study of the scale (Guertin et al., 2020). To represent healthy and unhealthy eating in the models, we created three parcels from each of the subscales by using the item-to-construct balance strategy (Landis, Beal, & Tesluk, 2000; Little, Rhemtulla, Gibson, & Schoemann, 2013; Rogers & Schmitt, 2004) – a strategy that consists of balancing items with the highest and lowest factor loadings between the parcels. Internal consistency was .78 for healthy eating and .74 for unhealthy eating.

**Bulimic symptoms.** To assess the extent to which participants experienced bulimic symptoms, the Bulimia subscale of the Eating Disorder Inventory (EDI-2; Garner, Olmstead, & Polivy, 1983) was administered to the participants. This 7-item scale measures bulimic behaviors of bingeing (e.g., “I stuff myself with food”) and purging (e.g., “I have the thought of trying to vomit in order to lose weight”). Each item was rated on a scale going from 1 (*Never*) to 7 (*Very often*). Although this scale was originally validated within clinical samples, previous research has reported test-retest reliability and internal consistency within non-clinical samples (Garner, 1991). The parceling procedure described above for healthy and unhealthy eating was also used to create indicator variables for bulimic symptoms. Internal consistency in this sample was .86.

## Data Analysis

Preliminary analyses were conducted in IBM SPSS version 26, and all structural models were performed in Mplus version 7. Since it is possible that individuals only use one of the

strategies or a different combination of the strategies, each strategy was examined individually in different models. The two-step procedure proposed by Kline (2011) were used to evaluate the models. First, measurement model analyses were conducted to determine if the observed variables loaded appropriately onto their latent factors. Second, the structural models were tested using the maximum likelihood robust (MLR) estimator. Criteria for acceptable model fit were based on the following fit indices: the Satorra-Bentler scaled chi-square ($SB\chi^2$) and the Standardized Root Mean Square Residual (SRMR) as absolute fit indices; the Tucker-Lewis Index (TLI) as a relative fix index; and the Comparative Fit Index (CFI) and the Root Mean Square Error of Approximation (RMSEA) with its' confidence intervals as noncentrality-based indices. For the SRMR and RMSEA, a value below .08 was considered adequate and a value below .06 was considered excellent, and for the CFI and TLI, values above .90 were considered adequate and values above .95 were considered excellent (Hooper, Coughlan, & Mullen, 2008).

Since we were interested in examining the roles of goals and motivation in the prediction of strategy use and eating behaviors, various sets of models were tested. First, we examined models in which intrinsic and extrinsic goals were associated with autonomous and controlled motivation, and in which only motivation predicted the strategies and eating behaviors. This allowed us to examine the motivational sequence proposed by the SDT, as well as the contribution of motivation on strategy use and eating behaviors, without considering the effects of goals. Then, in order to examine if goals predicted the strategies and eating behaviors over and above motivation, we tested a set of models in which goals and motivation both predicted these variables, while still proposing a sequence between goals and motivation. Next, in line with Verstuyf et al. (2016), we examined the contribution of goals and motivation on strategy use and eating behaviors, without proposing a sequence between goals and motivation. Finally, in order

to determine whether the effects of goals were reduced by the effects of motivation, we examined a set of models in which only goals were included in the models. Since the strategies were examined separately, six different models were tested in each set of models.

## Analyses and Results

### Preliminary Analyses

Prior to screening and cleaning the data, the participant flow was examined. Of the 243 individuals who participated at Time 1, four participants dropped out after Time 2 and 25 participants dropped out after Time 3. Since four of the participants did not provide any data for Time 2 and Time 3, these participants were removed from the analyses. The data of another participant was removed as this person did not correctly answer validation questions used to ensure the quality of the data. Missing data analysis revealed that the data was missing completely at random (Little MCAR test: $\chi^2 = 1658.67$, $df = 1654$, $p = .463$). Missing values were imputed using the expectation maximization algorithm. Following Tabachnick and Fidell's (2013) recommendations, univariate outliers were dealt with by recoding standardized scores that were above and below +/- 3.29 to the closest value within the acceptable range. Mahalanobis distance detected eight multivariate outliers, which were removed from the sample. The final sample size was 230 participants. Finally, all variables showed normal distributions, as none of the skewness values were above or below +/- 3.00 (range: -1.794 – 1.803) and none of the kurtosis values were above or below +/- 10.00 (range: -1.246 – 3.447; Kline, 2011).

The means and standard deviations, as well as the correlations between the variables are presented in Table 4.2. On average, participants in this sample reported higher scores on intrinsic goals than on extrinsic goals, and on autonomous motivation than on controlled motivation. High and moderate scores were reported for all strategies, with higher scores reported for planning and

self-monitoring the quality of eating. The average was highest for healthy eating, followed by unhealthy eating and bulimic symptoms, respectively. Finally, for life satisfaction, participants obtained a high score on this variable at both Time 1 and Time 3, although the average was higher at Time 3.

In terms of the correlations, intrinsic goals were non-significantly associated with extrinsic goals, and were significantly positively and negatively associated with autonomous and controlled motivation, respectively. On the contrary, extrinsic goals were non-significantly associated with autonomous motivation and significantly positively associated with controlled motivation. Intrinsic goals and autonomous motivation were significantly positively associated with life satisfaction, whereas extrinsic goals and controlled motivation were significantly negatively associated with life satisfaction at Time 1. Furthermore, intrinsic goals and autonomous motivation were significantly positively associated with planning and self-monitoring the quality of eating. Autonomous motivation was also significantly positively associated with planning portions. Extrinsic goals were significantly negatively associated with planning quality, and extrinsic goals and controlled motivation were significantly positively associated with planning and self-monitoring calories and portion sizes. Furthermore, intrinsic goals and autonomous motivation were significantly positively associated with healthy eating and significantly negatively associated with unhealthy eating and bulimic symptoms, whereas extrinsic goals and controlled motivation were significantly negatively associated with healthy eating, non-significantly associated with unhealthy eating, and significantly positively associated bulimic symptoms. Finally, both intrinsic goals and autonomous motivation were significantly positively associated with life satisfaction, whereas extrinsic goals and controlled motivation were significantly negatively associated with life satisfaction at Time 3.

In relation to the strategies, planning and self-monitoring quality were significantly positively associated with healthy eating; planning quality was significantly negatively associated with unhealthy eating, whereas self-monitoring quality was non-significantly associated with unhealthy eating. Planning quality was also significantly negatively associated with bulimic symptoms, whereas self-monitoring quality was significantly positively associated with bulimic symptoms. Planning and self-monitoring calories and portion sizes were non-significantly associated with healthy and unhealthy eating behaviors – except for planning portions that was significantly positively associated with healthy eating – and were significantly positively associated with bulimic symptoms. Finally, healthy eating was significantly positively associated with life satisfaction, whereas unhealthy eating and bulimic symptoms were significantly negatively associated with life satisfaction at Time 3.

**Main Analyses**

**Measurement models.** Each model was built from ten latent variables. The latent variables at Time 1 (the baseline) were intrinsic goals (four indicators), extrinsic goals (four indicators), autonomous motivation (three indicators), controlled motivation (two indicators) and life satisfaction (five indicators). At Time 2 (1 month), the latent variables were the strategies (three indicators). Finally, at Time 3 (3 months), the latent variables were healthy eating (three parcels), unhealthy eating (three parcels), bulimic symptoms (three parcels), and life satisfaction (five indicators). All latent factors were free to correlate when testing the measurement models. The measurement models showed adequate fit with the data (see Table 4.3).

**Structural models.** The final structural models with standardized coefficients can be found in Figures 4.1 – 4.6[4]. As shown in Table 4.3, all structural models presented a good fit with the data. In all models, intrinsic goals were significantly positively associated with autonomous motivation and non-significantly associated with controlled motivation, whereas extrinsic goals were significantly positively associated with controlled motivation and non-significantly associated with autonomous motivation. It was found that autonomous motivation significantly predicted planning and self-monitoring quality, as well as portion sizes, at Time 2. In opposition, controlled motivation predicted planning and self-monitoring calories and portion sizes at Time 2. For the strategies related to the quality of eating, it was found that both planning and self-monitoring quality positively predicted the consumption of healthy foods at Time 3, and that planning quality (but not self-monitoring quality) negatively predicted the consumption of unhealthy foods at Time 3. Instead, self-monitoring quality positively predicted bulimic symptoms at Time 3. For the strategies related the quantity of eating, it was found that planning and self-monitoring calories and portion sizes positively predicted bulimic symptoms at Time 3. Finally, in all models, healthy eating was significantly positively associated with life satisfaction, whereas bulimic symptoms were significantly negatively associated with life satisfaction at Time 3. Life satisfaction at Time 1 also positively predicted life satisfaction at Time 3 in all models.

**Tests of indirect effects**. As part of the analyses, indirect effects were also examined in order to determine whether the strategies significantly mediated the relationship between motivation and eating. In total, seven indirect effects were found to be significant. In the model that examined planning quality as the mediator, the indirect effects of autonomous motivation on

[4] It should be noted that demographic variables (e.g., age, income) and physical indicators of health (e.g., BMI, weight), were examined as control variables in the models. Since none of these variables provided relevant results, we did not include them in the final hypothesized models.

healthy eating ($b$ = .22, $SE$ = .08, $p$ < .01) and unhealthy eating behaviors ($b$ = -.22, $SE$ = .09, $p$ < .05) were significant. In the model that examined planning calories as the mediator, it was found that controlled motivation was significantly indirectly associated with bulimic symptoms through self-monitoring calories ($b$ = .05, $SE$ = .02, $p$ < .05). The indirect effect of controlled motivation on bulimic symptoms was also significant when examining planning portions as the mediator ($b$ = .05, $SE$ = .02, $p$ < .05). In the model that examined self-monitoring quality as the mediator, a significant indirect effect was found for the relationship between autonomous motivation and bulimic symptoms ($b$ = .10, $SE$ = .04, $p$ < .05). Controlled motivation was also significantly indirectly associated with bulimic in the models examining self-monitoring calories ($b$ = .06, $SE$ = .03, $p$ < .05) and self-monitoring portions ($b$ = .10 $SE$ = .03, $p$ < .001) as mediators.

It should be noted that some suppression effects were found in the final hypothesized models. Suppression effects are identified when the addition of a new variable to a model reverses the relationship between two other variables (MacKinnon, Krull, & Lockwood, 2000). When examining the results, the bivariate correlations suggested a significant and positive relationship between autonomous motivation and life satisfaction at Time 3. In the structural models, however, this relationship was found to be negative but non-significant. Additionally, the bivariate correlation between planning quality and bulimic symptoms was significant and negative, but the relationship between these variables was positive but non-significant in the model examining planning quality as a strategy. As mentioned in Kline (2010), suppression effects are not uncommon un SEM. Several indirect effects were included in the models; therefore, it is not surprising that a few suppression effects emerged. Since both relationships were non-significant in the models, the suppression effects were left as is.

**Alternative Models**

Since research in the SDT has shown that both goals and motivation can provide unique variance to individuals' eating behaviors (Verstuyf et al., 2016), alternative models were tested in order to examine the relationships between goals and motivation on strategy use and eating behaviors. The first set of alternative models examined the same models as the ones presented in Figures 4.1 – 4.6, but with the added links between intrinsic and extrinsic goals and each of the strategies and eating outcomes. The second set of alternative models examined how each type of goals and motivation predicted the strategies and eating behaviors, without establishing relationships between goals and motivation. In both sets of models, neither intrinsic or extrinsic goals predicted variance in strategy use or eating behaviors, suggesting that goals did not play a significant role in predicting the means through which individuals regulate their eating behaviors at Time 2, or their eating behaviors at Time 3.

Finally, in order to determine whether the effects of goals were reduced by the effects of motivation, we also examined a third set of alternative models in which only goals predicted the strategies and eating behaviors (see Appendix H for a presentation of these models). In these models, intrinsic and extrinsic goals predicted strategy use and eating behaviors similarly to autonomous and controlled motivation, in that intrinsic goals more strongly and positively predicted strategies related to the quality of eating, whereas extrinsic goals more strongly and positively predicted strategies related to the quantity of eating. Furthermore, intrinsic goals were positively associated with healthy eating and negatively associated with unhealthy eating and bulimic symptoms, whereas extrinsic goals were negatively associated with healthy eating and positively associated with bulimic symptoms. Since these models demonstrated that goals significantly predicted the strategies at Time 2 and eating behaviors at Time 3, and that these

relationships were non-significant when considering individuals' motivation in the previous models, it appears as though the effects of goals were reduced by the effects of motivation.

## Discussion

The main purpose of this study was to build upon the research of Guertin and Pelletier (under review) by testing a longitudinal model examining the roles of goals and motivation in the prediction of strategy use and eating behaviors, and the effects of adopting these behaviors on women's life satisfaction over time. On the one hand, it was found that intrinsic goals were positively associated with autonomous motivation for the regulation of eating at Time 1 (the baseline) which, in turn, positively predicted planning and self-monitoring strategies in terms of eating quality at Time 2 (1 month). Planning and self-monitoring the quality of eating then positively predicted healthy eating at Time 3 (3 months), which was then positively associated with change in life satisfaction at Time 3. Although it was expected that both planning and self-monitoring quality would also negatively predict unhealthy eating behaviors, only planning quality negatively predicted unhealthy eating at Time 3. Unexpectedly, self-monitoring quality positively predicted bulimic symptoms at Time 3. On the other hand, extrinsic goals were positively associated with controlled motivation for the regulation of eating at Time 1 which, in turn, positively predicted planning and self-monitoring the quantity of eating (calories and portion sizes) at Time 2. These strategies then positively predicted bulimic symptoms at Time 3, which were then negatively associated with life satisfaction at Time 3.

These results replicate the ones found in Guertin and Pelletier (under review), with a few exceptions. First, although no significant relationship was found between planning portions and bulimic symptoms in Guertin and Pelletier's (under review) research, this study found that planning portions at Time 2 positively predicted bulimic symptoms at Time 3. This result is

consistent with the hypothesis that strategies related to the quantity of eating would be positively associated with dysfunctional eating behaviors and could be explained by the fact that controlled motivation was more strongly related to planning portions than autonomous motivation. Second, the results demonstrated that self-monitoring the quality of eating at Time 2 positively predicted bulimic symptoms at Time 3, which was not the case in Guertin and Pelletier's (under review) research. While this finding is inconsistent with our hypothesis that planning and self-monitoring quality would be associated with functional eating behaviors, past research suggests that some people can develop a pathological obsession with the nutritional quality of foods – often termed "orthorexia nervosa" – which can have negative impacts on health (Barthel, Barrada, & Roncero, 2019; Koven & Abry, 2015; McComb & Mills, 2019). While restrictive dieting such as limiting calories and/or portion sizes is concerned with the amount of food that one ingests, "orthorexia nervosa" has been defined as a condition in which people become *overly* preoccupied by proper nutrition (Koven & Abry, 2015). Orthorexic individuals engage in behaviors that are similar to restrained eating (e.g., inflexible dietary rules, persistent preoccupation with food, compulsive behaviors), which consequently impacts well-being (e.g., medical and/or psychological complications, distress, and/or impairment in functioning; Barthels et al., 2019; Cena, Barthels, Cuzzolaro, Bratman, Brytek-Matera, Dunn, et al., 2018). Since orthorexia nervosa shares a few key components with restrained eating, it is not that surprising that focusing on the quality of food could also lead to dysfunctional eating.

In addition to applying a longitudinal (versus a cross-sectional) design and using a more diverse sample, this study expanded the results of Guertin and Pelletier (under review), first by examining the contribution of both goals and motivation on individuals' strategy use and eating behaviors, and second, by examining the psychological outcomes associated with the adoption of

different types of eating behaviors. In relation to the contribution of goals and motivation in the prediction of strategy use and eating behaviors, it was found that only motivation predicted planning and self-monitoring the quality and quantity of eating and eating behaviors over time, and that the effects of goals were reduced by the effects of motivation. These findings contradict the results of Verstuyf and colleagues (2016), as well as other researchers (e.g., Garðarsdóttir et al., 2009; Sebire et al., 2009, 2011; Sheldon et al., 2004), who have argued that goals and motivation both yield unique variance to individuals' behaviors and well-being. It is possible that goals predict unique variance over and above motivation only in the short-term (e.g., 1-week period, Verstuyf et al., 2016), and that motivation becomes more prominent in predicting behaviors in the long-term, as individuals need to be continuously motivated to regulate their behaviors in the long run. In other words, since motivation is required to regulate goal-directed behaviors, motivation should be more proximally related, and therefore relevant, to behaviors that are adopted for the pursuit of goal attainment. Since this study is only the second study to examine the contribution of goals and motivation in eating outcomes, more research is needed to fully understand how these motivational dynamics relate to eating behaviors over time.

Our findings also showed that healthy eating behaviors were positively associated with change in life satisfaction, whereas bulimic symptoms were negatively associated with change in life satisfaction at 3 months, even after controlling for this variable at the baseline. These results are consistent with the studies of Pelletier & Dion (2007) and Pelletier et al. (2004; study 2), which demonstrated the same patterns between healthy and dysfunctional eating behaviors, and overall psychological well-being. In addition to providing further evidence of the benefits of adopting healthy eating behaviors for psychological health, these results are promising in terms

of national health guidelines, since healthy eating behaviors were measured based on recent recommendations of the Canadian Food Guide.

**Implications for Weight-Management and Dieting**

Our findings have important implications for the way that health professionals (e.g., doctors, dietitians, health coaches) communicate with their patients in the context of weight-management and dieting. To assist individuals in adopting healthy eating behaviors, it is essential that health professionals guide their patients toward the pursuit of intrinsic goals and autonomous motivation for the regulation of eating. The SDT postulates that when individuals' basic psychological needs for autonomy, competence, and relatedness are satisfied within a social context, their needs are more likely to be satisfied (Ryan & Deci, 2017). Since intrinsic goals and autonomous motivation stem from the satisfaction of basic psychological needs, a social context that supports individuals' needs should therefore lead to more adaptive forms of motivational dynamics. Health professionals can engage in need-supportive behaviors by considering their patients' point of views and experiences, providing choices, and avoiding use of controlling pressures or incentives (i.e., autonomy support); by helping individuals identify barriers and obstacles and providing constructive feedback on goal progress (competence support); and by taking interest in their patients and showing authenticity and transparency (relatedness support; Ryan & Deci, 2017). Since the behaviors of individuals depend on their motivational dynamics, within the SDT, therapy does not focus on behavioral outcomes, but rather on the processes that lead individuals to engage in healthier behaviors, hence the importance of supporting individuals' needs.

Based on our results, it is also important that health professionals focus on the quality of eating when counselling their patients. In the context of weight-management, health

professionals may be likely to encourage patients to limit the amount of food they consume because of the popular conception that weight is based solely on "calories in, calories out." Although focusing on the quantity of eating is not harmful for everyone, advising patients to focus exclusively on the amount of food they consume can have backfiring effects if they do not regulate their weight and/or eating behaviors for the right reasons. While encouraging people to focus on the quality of their eating behaviors should have positive benefits for everyone despite their motivation, focusing on the quantity of eating should only be advised for people once they have started to incorporate healthy eating into their lifestyles.

**Strengths, Limitations, and Future Directions**

Several strengths of the present research should be noted. First, given the longitudinal design applied to the study, cause and effect relationships can be established between motivation, strategy use, and eating behaviors. To the best of our knowledge, this is the first study to examine *how* individuals regulate their eating behaviors based on their goals and motivation, over the long-term. Second, life satisfaction was controlled for at the baseline, which allowed us to examine how processes related to the regulation of eating behaviors contribute to improved life satisfaction over time. Although we acknowledge that there is a multitude of other factors that contribute to psychological well-being, our study provides evidence that eating behaviors can positively and negatively play a role in individuals' life satisfaction. Third, we relied on latent variables when building our models, which reduced the risk of bias related to measurement error (Cole & Preacher, 2014). Fourth, our sample was diversified in that it was composed of University students and women from the community, thus including women of different age groups. Fifth, participation attrition was extremely low, considering that attrition rates from 30 to 70% are often reported in longitudinal studies (Gustavson, von Soest, Karevold, & Røysamb,

2012). Low attrition rate in our study could have been due to several factors, including receiving compensation for participating or the fact that most participants (i.e., participants recruited from the community) needed to voluntarily contact the principal investigator in order to participate. Furthermore, participation was convenient in that participants received the questionnaires by email and could therefore complete the questionnaires online, at a time and location that was suitable to them.

Although this study had many strengths, it also had limitations. First, since goals and motivation were both assessed at the baseline, causality could not be established between these variables. Future research may wish to assess individuals' goals for weight-management once they have decided to manage their weight and examine how eating self-regulation processes unfold over time. Similarly, only correlations can be established for the relationships between eating and life satisfaction, as these variables were evaluated at the same time point. Previous research has provided evidence for reciprocal relationships between eating and life satisfaction (for a review, see Marks, 2015); therefore, it could be that (dis)satisfaction in life influences eating behaviors, rather than the reverse. An interesting avenue for future research could be to introduce an intervention based on the processes examined and repeatedly measure outcomes to examine change over time. As mentioned above, researchers could support individuals' basic psychological needs to influence the goals that individuals pursue and/or their motivation to regulate their eating behaviors, or they could encourage individuals to plan and self-monitor the quality of their eating behaviors to examine change in eating and psychological health over time. Second, although the sample was more diverse than the sample in Guertin and Pelletier's (under review) research, the sample remained limited in that it included only women and whose ethnicity was predominantly Caucasian. Future research should aim to replicate the results using

a mix of individuals of different genders and ethnicities. Third, this study relied on self-reported measures, which could have biased the results. For instance, since healthy and unhealthy eating behaviors were measured based on national eating guidelines, it is possible that individuals responded in favor of the guidelines. Fourth, only life satisfaction was examined as a psychological outcome to eating behaviors. Future studies may wish to examine how healthy and unhealthy eating behaviors, as well as bulimic symptoms, relate to other psychological health outcomes that have been previously associated with eating regulation (e.g., positive and negative affect, depression, self-esteem; Pelletier & Dion, 2007; Pelletier et al., 2004). Finally, since intrinsic and extrinsic goals were measured in relation to weight-management, the addition of physical health indicators (e.g., weight, BMI, body fat percentage, waist circumference) to our models would be extremely beneficial in order to examine whether these processes can also lead to improved health indicators over time.

**Conclusion**

To conclude, this study provides additional evidence for the benefits associated with the pursuit of health-focused (versus appearance-focused) goals, as well as autonomous (versus controlled) motivation, for the regulation of eating behaviors. Our results extend the SDT literature by demonstrating that autonomous and controlled motivation are associated with distinct dietary outcomes due to the means by which individuals with different types of goals and motivation regulate their eating behaviors. These findings have important implications for understanding how eating behaviors can influence psychological health over time.

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**Table 4.1.**

*Demographic information of the study's participants*

| Variables | Participation Pool (N/%) | Community (N/%) | Total (N/%) |
|---|---|---|---|
| *Age* | | | |
| 17 – 24 | 43 (93.5%) | 44 (22.6%) | 87 (36.1%) |
| 24 – 34 | 1 (2.2%) | 102 (52.3%) | 103 (42.7%) |
| 35 – 44 | 2 (4.3%) | 21 (10.8%) | 23 (9.5%) |
| 45 – 54 | 0 (0%) | 13 (6.7%) | 13 (5.4%) |
| 55 – 64 | 0 (0%) | 13 (6.7%) | 13 (5.4%) |
| 65+ | 0 (0%) | 2 (1.0%) | 2 (0.8%) |
| *BMI* | | | |
| Underweight (18.5 and under) | 4 (8.7%) | 2 (1.0%) | 6 (2.5%) |
| Normal weight (18.5 – 25) | 35 (76.1%) | 105 (53.6%) | 140 (57.9%) |
| Overweight (25 – 30) | 6 (13.0%) | 57 (29.1%) | 63 (26.0%) |
| Obese (30+) | 1 (2.2%) | 32 (16.3%) | 33 (13.6%) |
| *Ethnicity* | | | |
| Non-Hispanic White or European-American | 30 (65.2%) | 158 (80.6%) | 188 (77.7%) |
| Black, Afro-Caribbean or African American | 3 (6.5%) | 1 (0.5%) | 4 (1.7%) |
| Latino or Hispanic American | 1 (2.2%) | 2 (1.0%) | 3 (1.2%) |
| East Asian or Asian American | 0 (0%) | 4 (2.0%) | 4 (1.7%) |
| South Asian or Indian American | 3 (6.5%) | 3 (1.5%) | 6 (2.5%) |
| Middle Eastern or Arab American | 5 (10.9%) | 7 (3.6%) | 12 (5.0%) |
| Native American or Alaskan Native | 0 (0%) | 1 (0.5%) | 1 (0.4%) |
| Other | 4 (8.7%) | 20 (10.2%) | 24 (9.9%) |
| *Highest level of education* | | | |
| High school graduate | 39 (84.8%) | 15 (7.6%) | 54 (22.2%) |
| Some college credits | 3 (%6.5) | 38 (19.3%) | 41 (16.9%) |
| Associate degree | 2 (4.3%) | 1 (0.5%) | 3 (1.2%) |
| Bachelor's degree | 1 (2.2%) | 99 (50.3%) | 100 (41.2%) |
| Master's degree | 0 (0%) | 33 (16.8%) | 33 (13.6%) |
| Professional degree | 0 (0%) | 10 (5.1%) | 10 (4.1%) |
| Doctorate degree | 0 (0%) | 1 (0.5%) | 1 (0.5%) |
| I prefer not to disclose | 1 (2.2%) | 0 (0%) | 1 (0.4%) |

| | | | |
|---|---|---|---|
| *Income* | | | |
| Less than 5,000 | 22 (47.8%) | 16 (8.2%) | 38 (15.7%) |
| 5,000 – 11,999 | 11 (23.9%) | 21 (10.7%) | 32 (13.2%) |
| 12,000 – 15,999 | 2 (4.3%) | 3 (1.5%) | 5 (2.1%) |
| 16,000 – 24,999 | 1 (2.2%) | 9 (4.6%) | 10 (4.1%) |
| 25,000 – 34,999 | 0 (0%) | 9 (4.6%) | 9 (3.7%) |
| 35,000 – 49,999 | 0 (0%) | 18 (9.2%) | 18 (7.4) |
| 50,000 – 64,999 | 1 (2.2%) | 31 (15.8%) | 32 (13.2%) |
| 65,000 – 79,000 | 0 (0%) | 37 (18.9%) | 37 (15.3%) |
| 80,000 and greater | 0 (0%) | 41 (20.9%) | 41 (16.9%) |
| I don’t know | 4 (8.7%) | 3 (1.5%) | 7 (2.9%) |
| I prefer not to disclose | 5 (10.9%) | 8 (4.1%) | 13 (5.4%) |

**Table 4.2**

*Mean, standard deviations, and correlations between the study variables*

| *Variables* | *M* | *SD* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Intrinsic | 6.12 | 0.75 | - | -.10 | .58** | -.14* | .26** | .37** | -.02 | .10 | .26** | -.05 | .02 | .30** | -.16* | -.20** | .21** |
| 2. Extrinsic | 3.78 | 1.49 | | - | -.11 | .58** | -.21** | -.14* | .23** | .20** | .04 | .21** | .22** | -.14* | .13 | .36** | -.27** |
| 3. Autonomous | 5.24 | 1.02 | | | - | -.14* | .33** | .57** | .04 | .19** | .32** | -.03 | .04 | .48** | -.31** | -.22** | .27** |
| 4. Controlled | 2.61 | 1.01 | | | | - | -.27** | -.21** | .17** | .23** | .02 | .20** | .28** | -.21** | .07 | .38** | -.35** |
| 5. Life satisfaction T1 | 5.21 | 1.21 | | | | | - | .29** | -.14* | -.07 | .05 | -.14* | -.18** | .27** | -.10 | -.33** | .65** |
| 6. Plan quality | 5.52 | 1.23 | | | | | | - | .15* | .35** | .56** | .10 | .13* | .50** | -.39** | -.18** | .27** |
| 7. Plan calories | 3.39 | 1.57 | | | | | | | - | .58** | .48** | .87** | .56** | .11 | -.04 | .26** | -.14* |
| 8. Plan portions | 4.38 | 1.41 | | | | | | | | - | .47** | .52** | .72** | .17* | -.13 | .20** | -.10 |
| 9. Monitor quality | 4.60 | 1.42 | | | | | | | | | - | .47** | .49** | .28** | -.19** | .13 | .04 |
| 10. Monitor calories | 3.52 | 1.88 | | | | | | | | | | - | .62** | .03 | .03 | .30** | -.15* |
| 11. Monitor portions | 4.48 | 1.47 | | | | | | | | | | | - | .05 | .04 | .35** | -.13* |
| 12. Healthy eating | 5.32 | 0.75 | | | | | | | | | | | | - | -.30** | -.17** | .33** |
| 13. Unhealthy eating | 2.86 | 0.71 | | | | | | | | | | | | | - | .17** | -.19** |
| 14. Bulimic symptoms | 2.02 | 0.90 | | | | | | | | | | | | | | - | -.40** |
| 15. Life satisfaction T3 | 5.37 | 1.10 | | | | | | | | | | | | | | | - |

*Note*. N = 230. ** $p < .01$; * $p < .05$.

**Table 4.3.**

*Fit indices for the measurement and structural models*

| Strategies | SB$\chi^2$ (*df*), *p* value | CFI | TLI | RMSEA (90% CI) | SRMR |
|---|---|---|---|---|---|
| **Measurement Models** | | | | | |
| Plan Quality | 720.33 (515), $p < .001$ | .94 | .93 | .05 (0.039, 0.053) | .06 |
| Plan Calories | 765.00 (515), $p < .001$ | .93 | .92 | .05 (0.042, 0.055) | .06 |
| Plan Portions | 737.40 (515), $p < .001$ | .94 | .93 | .05 (0.040, 0.053) | .06 |
| Monitor Quality | 757.38 (515), $p < .001$ | .93 | .92 | .05 (0.042, 0.055) | .06 |
| Monitor Calories | 756.83 (515), $p < .001$ | .93 | .92 | .05 (0.042, 0.055) | .06 |
| Monitor Portions | 733.12 (515), $p < .001$ | .94 | .93 | .05 (0.039, 0.053) | .06 |
| **Structural Models** | | | | | |
| Plan Quality | 753.26 (536), $p < .001$ | .93 | .93 | .05 (0.040, 0.053) | .07 |
| Plan Calories | 802.68 (536), $p < .001$ | .92 | .92 | .05 (0.043, 0.056) | .07 |
| Plan Portions | 777.35 (536), $p < .001$ | .93 | .92 | .05 (0.041, 0.054) | .07 |
| Monitor Quality | 797.75 (536), $p < .001$ | .92 | .91 | .05 (0.043, 0.056) | .07 |
| Monitor Calories | 796.21 (536), $p < .001$ | .93 | .92 | .05 (0.043, 0.056) | .07 |
| Monitor Portions | 775.60 (536), $p < .001$ | .93 | .92 | .05 (0.041, 0.054) | .07 |

*Note.* N = 230. SB$\chi^2$ = Satorra-Bentler chi-square; df = degrees of freedom; CFA = comparative fix index; TLI = Tuker Lewis index; RMSEA = root mean square of approximation; CI = confidence intervals; SRMR = Standardized root mean square residual.

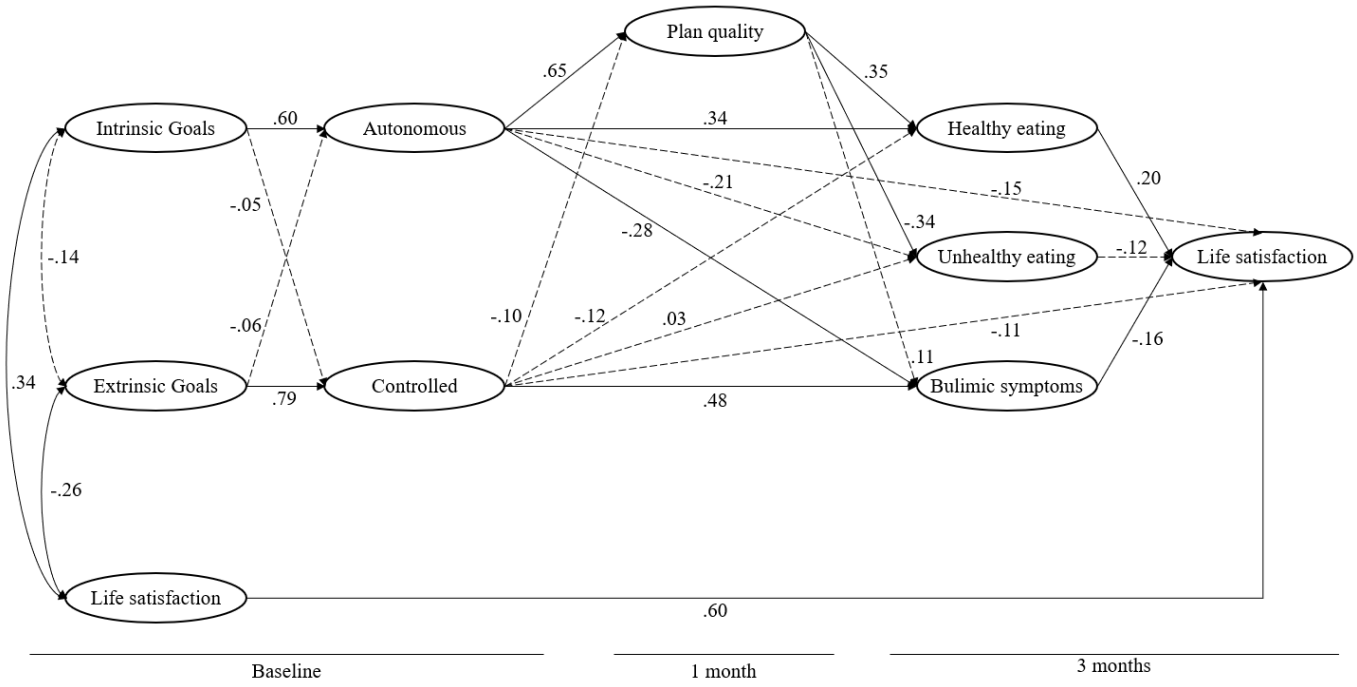



*Figure 4.1*. The hypothesized model for the regulation of eating in which planning quality is examined in the model. Note: unidirectional arrows represent hypothesized paths; bidirectional arrows represent correlations. Solid lines = $p < .05$. Dotes lines = *ns*.

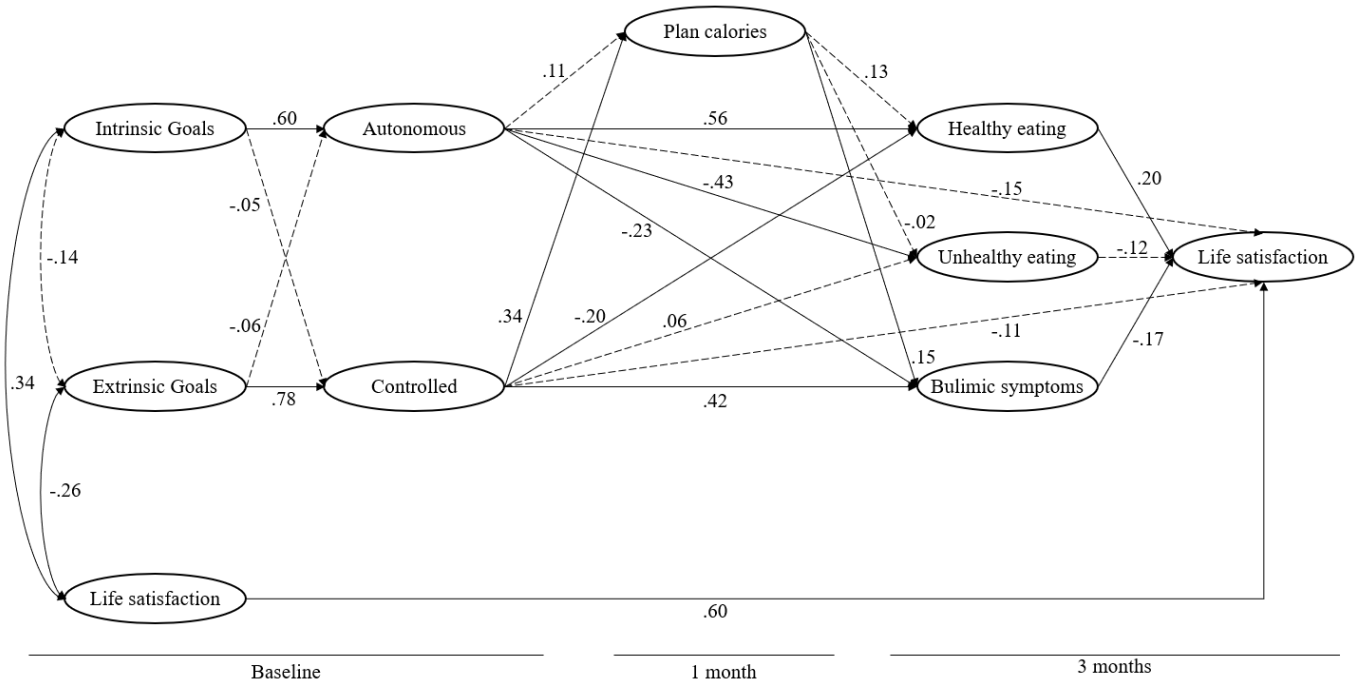



*Figure 4.2*. The hypothesized model for the regulation of eating in which planning calories is examined in the model. Note: unidirectional arrows represent hypothesized paths; bidirectional arrows represent correlations. Solid lines = $p < .05$. Dotes lines = *ns*.

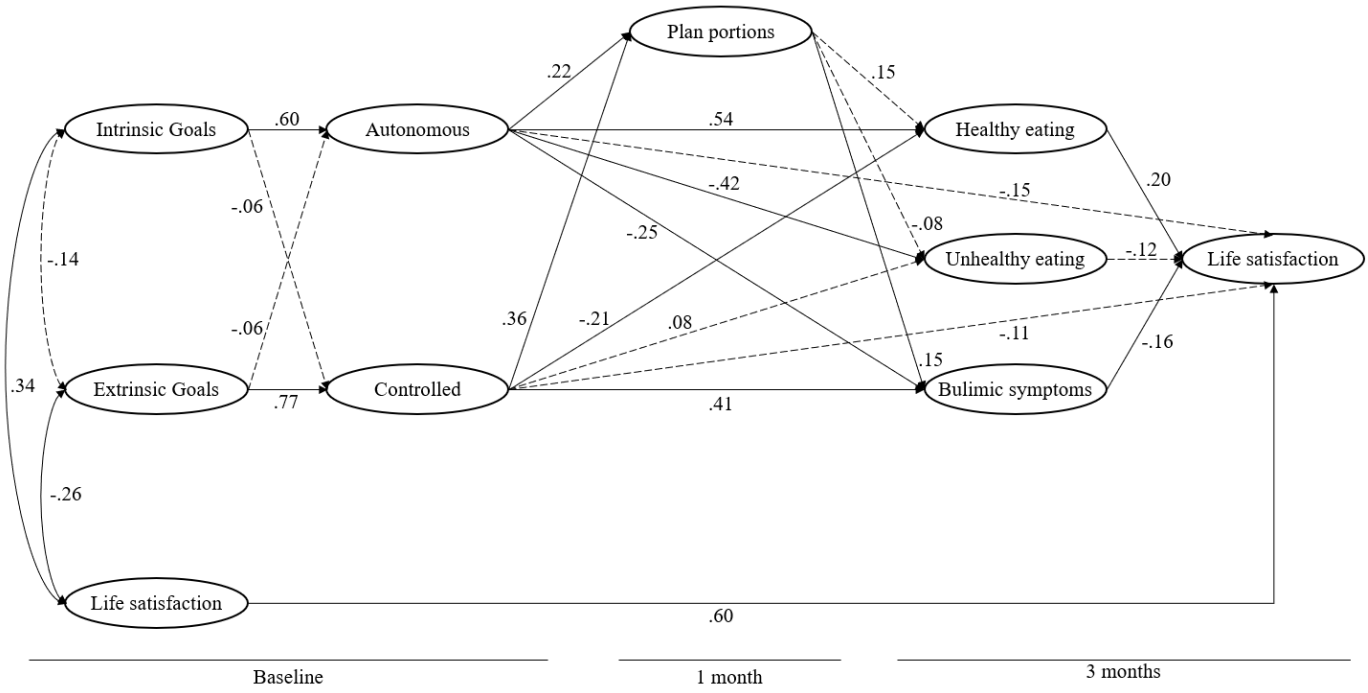



*Figure 4.3*. The hypothesized model for the regulation of eating in which planning portions is examined in the model. Note: unidirectional arrows represent hypothesized paths; bidirectional arrows represent correlations. Solid lines = $p < .05$. Dotes lines = *ns*.

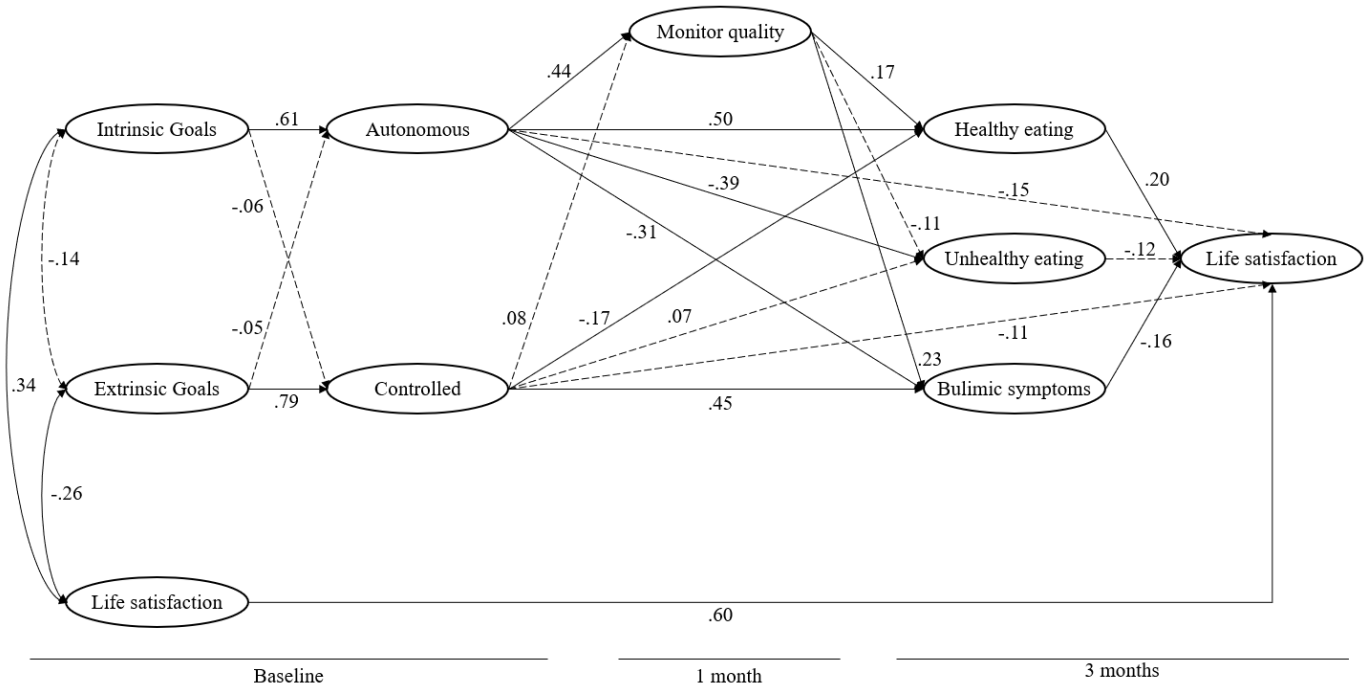



*Figure 4.4*. The hypothesized model for the regulation of eating in which monitoring quality is examined in the model. Note: unidirectional arrows represent hypothesized paths; bidirectional arrows represent correlations. Solid lines = $p < .05$. Dotes lines = *ns*.

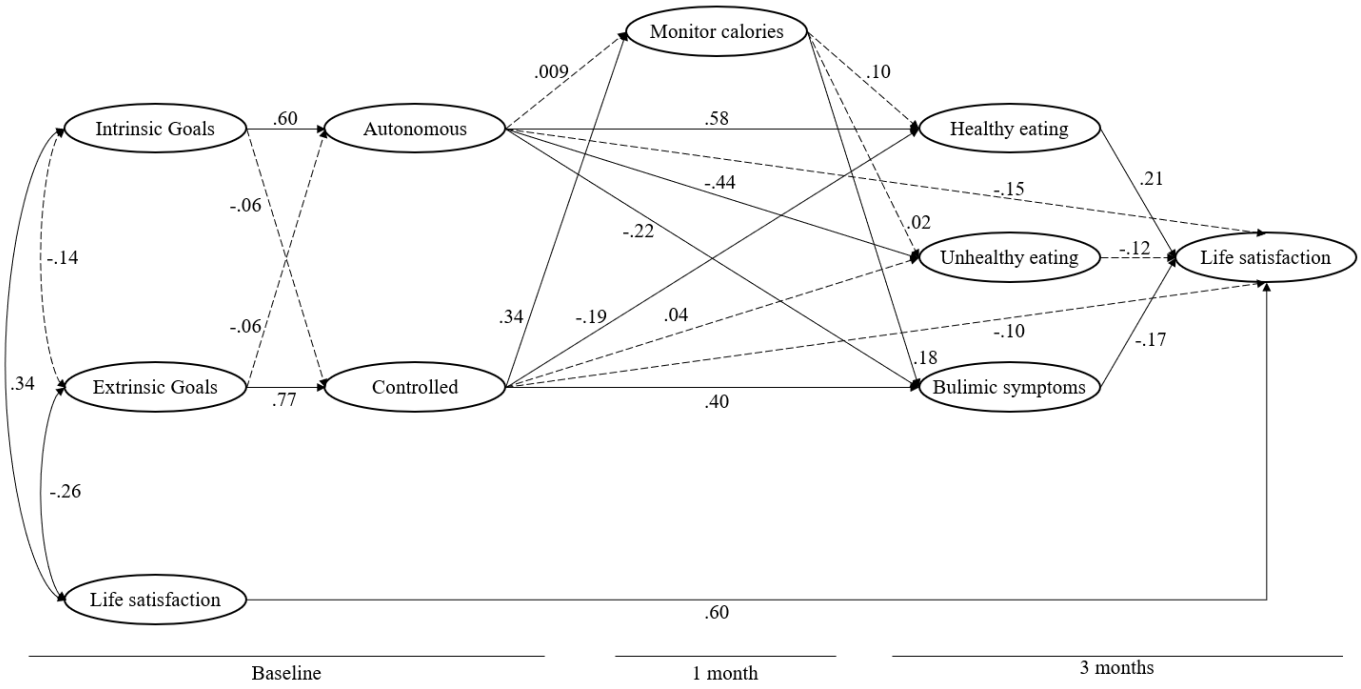



*Figure 4.5*. The hypothesized model for the regulation of eating in which monitoring calories is examined in the model. Note: unidirectional arrows represent hypothesized paths; bidirectional arrows represent correlations. Solid lines = $p < .05$. Dotes lines = *ns*.

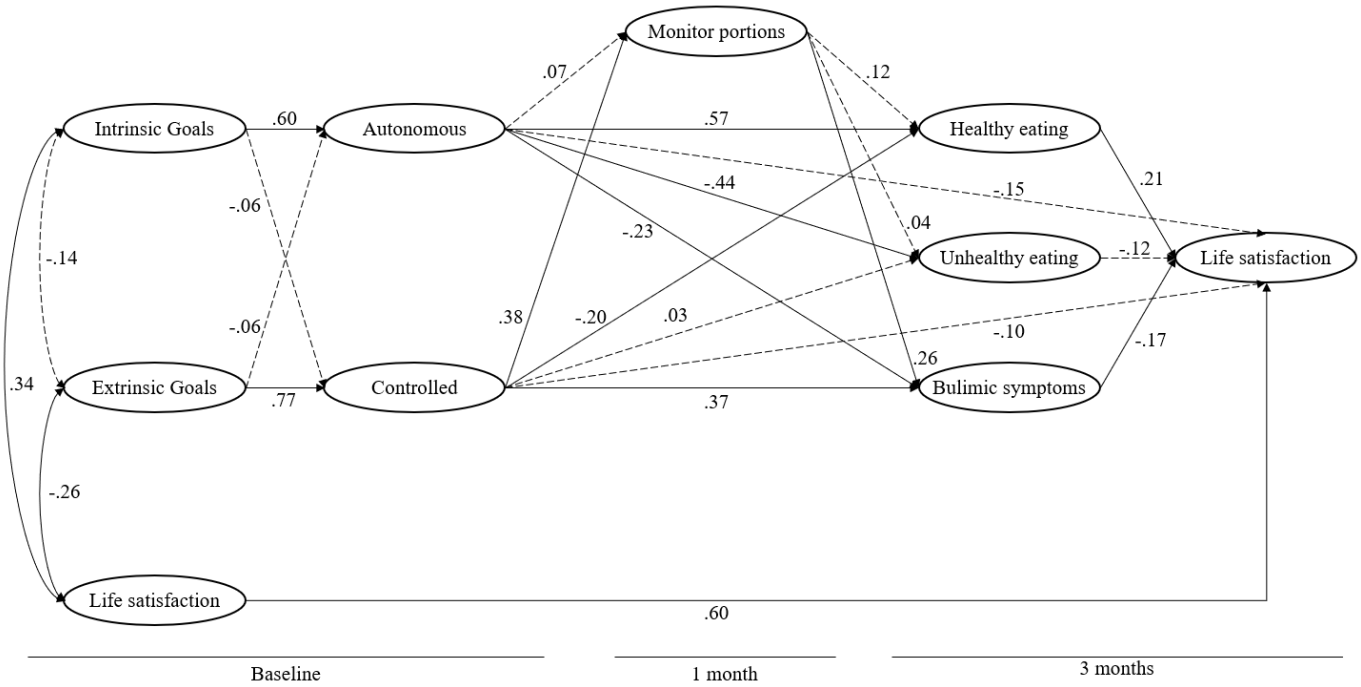


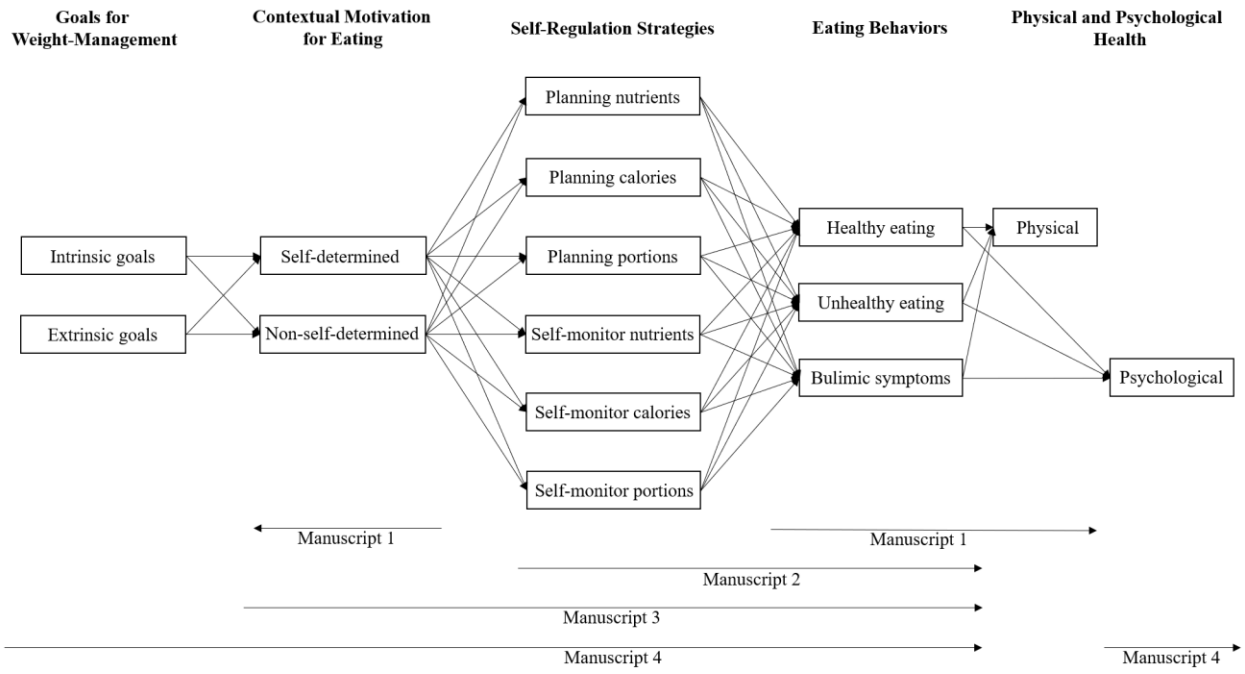

*Figure 4.6.* The hypothesized model for the regulation of eating in which monitoring portions is examined in the model. Note: unidirectional arrows represent hypothesized paths; bidirectional arrows represent correlations. Solid lines = $p < .05$. Dotes lines = *ns*.

# *CHAPTER SIX*

# GENERAL DISCUSSION

## Summary of Thesis Objectives

The overall objective of this thesis was to examine how motivational processes involved in the regulation of eating behaviors give rise to different self-regulation strategies in terms eating quality and quantity, and how these processes influence eating behaviors and psychological health over time. Specifically, we examined if individuals who pursued intrinsic and extrinsic goals for weight-management and who regulated their eating behaviors for autonomous or controlled reasons engaged in planning and self-monitoring for the quality (i.e., nutrient intake) and/or the quantity (i.e., calories and portion sizes) of eating, and whether the different uses of these strategies were associated with distinct eating outcomes and increased or decreased life satisfaction. The following model was proposed to examine this objective.




This objective was achieved through a series of eight studies, divided into four manuscripts. Before pursuing the objective of the thesis, there was a need to create a measure

that would allow us to assess individuals' healthy and unhealthy eating behaviors based on recent recommendations of Canada's Food Guide. As such, the Healthy and Unhealthy Eating Behavior Scale was developed and validated in Manuscript #1 (Chapter Two). Since no study has distinguished between planning and self-monitoring the quality (i.e., nutrient intake) and the quantity (i.e., calories and portion sizes) of eating, there was also a need to create a scale that would allow us to distinguish between these different types of strategies. In Manuscript #2 (Chapter Three), the Planning and Self-Monitoring the Quality and Quantity Scale was therefore developed and validated. Once these measures were validated, Manuscript #3 (Chapter Four) examined if the strategies assessed by the PMQQS provided additional variance to healthy and unhealthy eating behaviors and bulimic symptoms over and above the effects of autonomous and controlled motivation, and if the strategies mediated the relationship between motivation and eating, while controlling for BMI. Finally, Manuscript #4 (Chapter Five) tested a longitudinal model examining the relationships between goals and motivation, strategy use and eating behaviors, and life satisfaction in women over a 3-month period.

**Main Findings**

The main findings from each of the studies of this thesis are highlighted in the following section. Each study is discussed in the context of its' respective manuscript.

**Manuscript #1 – Guertin, C., Pelletier, L., & Pope, P. (2020). The Validation of the Healthy and Unhealthy Eating Behavior Scale (HUEBS): Examining the Interplay Between Stages of Change and Motivation and Their Association with Healthy and Unhealthy Eating Behaviors and Physical Health. *Appetite,* 144. Doi: 10.1016/j.appet.2019.104487. (Chapter Two).** The purpose of this manuscript was to develop and validate a scale – the Healthy and Unhealthy Eating Behavior Scale (HUEBS) – that would allow researchers to

measure healthy and unhealthy eating behaviors based on recent recommendations of Canada's Food Guide. This manuscript had two objectives: the first was to examine the relationships between self-determined and non-self-determined motivation, healthy and unhealthy eating behaviors, and waist circumference across different stages of behavior change, and the second was to develop and validate the HUEBS.

In Study 1 ($N$ = 360), the factorial validity of the HUEBS was explored and results from a Principal Component Analysis provided evidence for a two-factor solution (11 items/subscale), representing healthy and unhealthy eating behaviors. Cronbach's alpha also showed that the two subscales had strong internal consistency.

In Study 2 ($N$ = 711), the factorial validity and the internal consistency of the HUEBS were again examined. Additionally, we investigated whether individuals in different stages of behavior change reported different patterns in terms of their motivation and eating behaviors. Like in Study 1, the results suggested a 2-factor structure for the scale and again provided evidence of strong internal consistency for the two subscales. It was also found that women in earlier stages of change reported higher levels of non-self-determined motivation for eating and lower levels of self-determined motivation for eating, as well as a higher consumption of unhealthy foods and a lower consumption of healthy foods. On the contrary, women in later stages of change reported lower levels of non-self-determined motivation for eating and higher levels of self-determined motivation for eating, as well as a lower consumption of unhealthy foods and a higher consumption of healthy foods.

Finally, in Study 3 ($N$ = 264), moderated mediation models in which healthy and unhealthy eating behaviors mediated the relationship between self-determined and non-self-determined motivation and waist circumference, and in which stages of change moderated the

relationship between motivation and eating, were tested. The results showed that healthy eating fully mediated the relationship between self-determined motivation and waist circumference, and that the relationship between motivation and eating was moderated by stages of change. Specifically, the relationship was stronger for individuals who scored high (versus moderate and low) on stages of change. It was also found that the relationship between self-determined motivation and unhealthy eating was moderated by stages of change, in that the relationship was stronger for individuals who scored moderate or high (but not low) on stages of change.

Overall, these studies provide researchers with a new scale that will allow them to measure healthy and unhealthy eating behaviors based on recent recommendations of Canada's Food Guide. This research also provides evidence for the interactive roles of motivation and stages of behavior change in the process of eating regulation, as well as the importance of healthy eating for reducing waist circumference.

**Manuscript #2 – Guertin, C., & Pelletier, L. (in press). Planning and Self-Monitoring the Quality and the Quantity of Eating: How Different Styles of Self-Regulation Strategies Relate to Healthy and Unhealthy Eating Behaviors, Bulimic Symptoms, and BMI. *Appetite*. (Chapter Three).** The purpose of this manuscript was to develop and validate a scale – the Planning and Self-Monitoring the Quality and Quantity Scale (PMQQS) – that would allow researchers to measure planning and self-monitoring in terms of eating quality (i.e., nutrient intake) and quantity (i.e., calories and portion sizes).

In Study 1 ($N$ = 355), the factorial validity, the internal consistency, as well as the convergent and discriminant validity of the PMQQS were examined. The results from a CFA showed that planning and self-monitoring strategies can be distinguished in terms of eating quality and quantity and that a 6-factor (versus a 4-factor, a 2-factor, and a 1-factor) solution

provided the best explanation for the data. Strong internal consistency for the six subscales was achieved, and convergent and discriminant validity was established. Correlations also showed that strategies related to the quality of eating were more strongly and positively correlated with healthy eating and more strongly and negatively correlated with unhealthy eating, whereas strategies related to the quantity of eating were more strongly and positively correlated with bulimic symptoms and BMI. The same patterns of findings were presented in SEM in which the relationships between the strategies, eating behaviors, and BMI were examined.

In Study 2 ($N$ = 318), the results of Study 1 were replicated using a different sample. This study provided further evidence for the validity of the PMQQS, and similar results were found for the relationships between the strategies, eating behaviors, and BMI within SEM.

Overall, these studies highlight that planning and self-monitoring strategies can be distinguished along the quality/quantity dimension, and that a focus on the quality (versus the quantity) of eating may be more beneficial for the adoption of healthy (versus dysfunctional) eating behaviors.

**Manuscript #3 – Guertin, C., & Pelletier, L. (under review). Examining the Role of Eating Quality and Quantity as Mechanisms of the Relationship Between Autonomous and Controlled Motivation and Healthy and Unhealthy Eating Behaviors and Bulimic Symptoms. (Chapter Four).** The purpose of this manuscript was to determine if the strategies proposed by the PMQQS could provide some explanation for the relationships between autonomous and controlled motivation and healthy and unhealthy eating behaviors and bulimic symptoms. The first objective was to examine if the strategies could account for additional variance in eating outcomes over and above the effects of motivation while controlling for BMI,

and to examine if the strategies mediated the relationship between motivation and eating. The second objective was to cross-validate the results of Study 1 in SEM, using a different sample.

In Study 1 ($N$ = 456), it was found that planning and self-monitoring the quality of eating provided additional variance to autonomous motivation in the models examining healthy and unhealthy eating behaviors as outcome variables. Planning calories and portion sizes also provided additional variance to autonomous motivation in the models examining unhealthy eating behaviors as the outcome variable and planning and self-monitoring calories (but not portion sizes) provided additional variance to controlled motivation in the models examining bulimic symptoms as the outcome variables. In terms of mediation analyses, it was found that planning and self-monitoring the quality of eating partially mediated the relationship between autonomous motivation and healthy eating; that planning quality fully mediated and that planning calories and self-monitoring quality partially mediated the relationship between autonomous motivation and unhealthy eating; and that planning and self-monitoring calories partially mediated the relationship between controlled motivation and bulimic symptoms. BMI was also associated with bulimic symptoms in all analyses.

In Study 2 ($N$ = 979), SEM results showed that autonomous motivation was more strongly and positively associated with planning and self-monitoring the quality of eating, whereas controlled motivation was more strongly and positively associated with planning and self-monitoring the quantity of eating. In turn, strategies related to the quality of eating were more strongly and positively associated with healthy eating and more strongly and negatively associated with unhealthy eating, whereas strategies related to the quantity of eating (except for planning portion sizes) were more strongly and positively associated with bulimic symptoms. BMI was significantly positively associated with controlled motivation and bulimic symptoms

and was significantly and positively associated with strategies related to the quantity of eating, except for planning portion sizes. In this study, we also found support for the indirect effects of autonomous motivation on healthy and unhealthy eating through planning and self-monitoring the quality of eating, and for the indirect effects of controlled motivation on bulimic symptoms through planning and self-monitoring calories, and through self-monitoring portion sizes.

Taken together, these studies suggest that autonomous and controlled motivation may be associated with distinct eating outcomes due to the means through which individuals with different types of motivation regulate their eating behaviors.

**Manuscript #4 – Guertin, C., & Pelletier, L. (under review). Motivational Dynamics in the Prediction of Self-Regulation Strategies for the Quality and Quantity of Eating, Eating Behaviors, and Life Satisfaction: A Longitudinal Investigation (Chapter Five).** The purpose of this manuscript was to test a longitudinal model examining the roles of goals and motivation in the prediction of strategy use and eating behaviors, and the effects of adopting these behaviors on individuals' life satisfaction over a 3-month period. In this study ($N$ = 230), we found evidence for two distinct pathways during eating regulation. On the one hand, intrinsic goals were positively associated with autonomous motivation at Time 1 (the baseline), which then positively predicted planning and self-monitoring the quality of eating at Time 2 (1 month). In turn, these strategies positively predicted healthy eating behaviors at Time 3 (3 months), which were then positively associated with life satisfaction at Time 3. Although it was also expected that planning and self-monitoring quality would also negatively predict unhealthy eating behaviors, only planning quality significantly negatively predicted unhealthy eating at Time 3 and, instead, self-monitoring quality positively predicted bulimic symptoms at Time 3. On the other hand, extrinsic goals were positively associated with controlled motivation at Time

1, which then positively predicted planning and self-monitoring the quantity of eating at Time 2. These strategies then positively predicted bulimic symptoms at Time 3, which were then negatively associated with life satisfaction at Time 3.

This study provides further evidence that the pursuit of health-focused goals and the regulation of eating behaviors for autonomous reasons leads to more beneficial outcomes over time, in comparison to the pursuit of appearance-focused goals and the regulation of eating behaviors for controlled reasons. This study sheds light on why some people succeed, while others fail, in regulating their eating behaviors, and how adopting different types of motivational dynamics may influence general life satisfaction in the long term.

## Implications of the Thesis

The studies presented in this thesis have significant theoretical and practical implications, which are discussed in more detail below.

**Theoretical Implications.** First and foremost, this thesis contributes to the SDT literature by demonstrating that individuals with different types of goals and motivational orientations regulate their eating behaviors in qualitatively distinct ways, which impacts their eating behaviors and life satisfaction over time. Although a few studies have provided evidence that individuals motivated by autonomous versus controlled reasons engage in (dys)functional eating behaviors due to different ways of thinking about eating (e.g., Hagger, Chatzisarantis, & Harris, 2006; Otis & Pelletier, 2008; Pelletier, Dion, Slovinec-d'Angelo, & Reid, 2004), the studies presented in this thesis are the first to examine if individuals with different types of goals and motivations focus more on the quality and/or the quantity of their food intake, when planning and self-monitoring their eating behaviors. More precisely, this thesis contributes to the literature

by establishing *how* people with different goals and motivation regulate their behaviors in the pursuit of their goals.

Furthermore, although only the final manuscript of this thesis examined the respective roles of goals and motivation in the prediction of strategy use and eating behaviors, this manuscript adds to the debate on the interactive roles of goals and motivation in the prediction of outcomes within the SDT. While research conducted within the eating regulation domain has shown that goals and motivation both matter in the prediction of individuals' eating behaviors (Verstuyf, Vansteenkiste, Soetens, & Soenens, 2016), our findings showed that motivation played a more significant role than goals in the prediction of strategy use and eating. Our results were more in line with the assumption that the effects of the content of goals are reducible to the effects of motivation, as hypothesized by many other researchers (e.g., Carver & Baird, 1998; Strivastava, Locke, & Bartol, 2001). Since this study was only the second to examine the respective roles of goals and motivation in the prediction of eating and that our findings contradict those of Verstuyf et al. (2016), further research is needed in order to elucidate instances in which goals and motivation independently contribute to individuals' eating behaviors.

In addition to contributing to the SDT literature, this thesis also adds to the general eating regulation domain in two ways. First, researchers in this field often fail to distinguish between healthy and unhealthy eating behaviors, as no valid scale prior to this thesis existed to measure both types of eating. By validating the HUEBS, researchers will now have access to a scale that measures both the types of foods to consume, but also to limit or to consume in moderation based on recent recommendations of Canada's Food Guide. Second, our findings demonstrate that planning and self-monitoring can be distinguished along the quality/quantity dimension.

Previous research has shown that planning and self-monitoring can be distinguished along various dimensions such as forming negation or replacement implementation intentions (Adriaanse, Van Oosten, De Ridder, De Wit, and Ever, 2001) or approach and avoidance plans (Otis & Pelletier, 2008), or self-monitoring in private versus in public (Harkin, Webb, Chang, Prestwich, Conner, Kellar, et al., 2016). The studies presented in this thesis, however, are the first set of studies to suggest that planning and self-monitoring can also be distinguished in terms of nutrient intake, calories, and portion sizes. As discussed in the next section, this has important implications for the promotion of self-regulation strategies for the regulation of eating and/or weight-management.

**Practical Implications.** In addition to having theoretical implications, this thesis has significant practical implications for helping people engage in healthier eating behaviors and/or improve their weight. To assist individuals in making healthier dietary choices, our findings suggest that health professionals (e.g., doctors, dietitians, health coaches) could intervene at three levels of intervention: at the motivation level, at the goal level, and at the strategy level.

In relation to intervening at the motivation level, the SDT presumes that when people's basic psychological needs for autonomy, competence, and relatedness are supported within a social context, their needs are more likely to be satisfied, which should be conducive to an increase in autonomous motivation for change (Ryan & Deci, 2017). Within a therapeutic context, support of basic psychological needs is a method in which health professionals interact with their clients in a way that supports (versus thwarts) their basic needs. Specifically, need-supportive environments are created by health professionals who communicate with their clients by acknowledging their perspective and offering choices (autonomy support); by focusing on optimal challenges and offering relevant and informational feedback on goal progress

(competence support); and/or by taking genuine interest in their clients (Ryan & Deci, 2017). In contrast, need-thwarting environments are created by health professionals who impose their knowledge and opinions on their clients (autonomy thwarting); who make them feel incapable of implementing change (competence thwarting); and/or who disregard and misunderstand their clients' point of views (relatedness thwarting; Ryan & Deci, 2017).

The benefits of need-supportive environments have been reported in many studies within the eating regulation domain. For instance, support from healthcare providers (e.g., Williams, Grow, Freedman, Ryan, & Deci, 1996), significant others (e.g., Ng, Ntoumanis, & Thøgersen-Ntoumani, 2013; Ng, Ntoumanis, & Thøgersen-Ntoumani, Scott, & Hindle, 2013; Powers, Koestner, & Gorin, 2008) and parents (Thøgersen-Ntoumani et al., 2010) has been shown to be associated with healthy dietary intake or weight loss through increased autonomy. Studies have also reported the disadvantages of need-thwarting environments for the regulation of eating, in that controlling contexts have been shown to be conducive to the development of dysfunctional eating disorders (e.g., Soenens, Vansteenkiste, Vandereycken, Luyten, Sierens, & Goossens, 2008; Thøgersen-Ntoumani et al., 2010). Based on the SDT and relevant studies, creating need-supportive climates within a therapeutic context should have substantial advantages for helping individuals regulate their eating behaviors and/or weight.

In relation to intervening at the goal level, health professionals can attend to their clients' aspirations by eliciting and listening to their clients' personal strivings and/or by guiding them toward the pursuit of goals that are inherently satisfying (Ryan & Deci, 2017). Research on goal pursuit has also shown that motivators can frame goals in more intrinsic or extrinsic terms, and that the promotion of these goals leads to distinct outcomes. Indeed, Vansteenkiste and colleagues conducted a series of studies in the context of learning and sport and exercise, which

collectively showed that when people were exposed to intrinsic framed messages, they reported lower stress, higher mastery, enhanced performance, free choice persistence, deeper processing and/or conceptual learning. However, when people were exposed to extrinsic framed or a combination of intrinsic and extrinsic framed messages, they reported higher levels of rote learning (memorization), enhanced levels of social comparison and ego-orientation, and lower levels of activity commitment (Vansteenkiste, Matos, Lens, & Soenens, 2007; Vansteenkiste, Simons, Lens, Sheldon, and Deci, 2004; Vansteenkiste, Simons, Lens, Soenens, & Matos, 2005; Vansteenkiste, Simons, Soenens, & Lens, 2004; Vansteenkiste, Timmermans, Lens, Soenens, & Van Den Broeck, 2008). These studies suggest that the way in which nutrition information is communicated to individuals could have important implications for the way that people respond to such information. As suggested in previous research (Pelletier, Guertin, & Rocchi, 2017; Pope, Pelletier, & Guertin, 2018), information provided to the public should emphasize intrinsic (versus extrinsic) goals (and autonomous versus controlled motivation) in order to increase the likelihood that the behavior will be internalized and maintained long-term.

Finally, at the level of the strategies, health professionals could encourage individuals to focus more on the quality (versus the quantity) of their eating behaviors when planning and self-monitoring their food intake. For instance, rather than suggesting individuals to plan and self-monitor their food intake in general, health professionals could teach individuals to plan high quality meals and/or to monitor their daily requirements of a specific food group (e.g., consuming 7 – 10 servings of fruits and vegetables daily). Since weight gain results from a persistent positive energy imbalance between energy intake and energy expenditure, coaches might be prompted to encourage individuals to reduce food intake, either through limiting calories and/or portion sizes. Although well-meant, the results of this thesis indicate that

promoting this type of focus might backfire in individuals who feel externally or internally pressured to regulate their eating behaviors. Before encouraging individuals to focus on their calories and/or portion sizes, it might be worthwhile to evaluate the types of goals and motivation that are propelling individuals to regulate their eating behaviors. Interestingly, a study conducted by Mozaffarian, Hao, Rimm, Willet, and Hu (2010) has shown a causal relationship between dietary quality and dietary quantity, in that consuming higher quality foods reduces total number of calories consumed, which leads to less weight gain over time. An interesting avenue for future research could be to examine whether advising individuals to plan and self-monitor the quality of eating behaviors lead to the same desired effects (e.g., reduced caloric intake, weight loss) of advising individuals to focus on the quantity of their eating behaviors.

It should be noted that while the HUEBS dichotomizes eating behaviors in terms of healthy and unhealthy eating behaviors, health professionals should be mindful of the language they use when encouraging their clients to focus on the quality of their eating behaviors. According to the dietary restraint model (Polivy & Herman 1985), having a dichotomous relationship with food can have backfiring effects and lead to disordered eating behaviors. Although most of the unhealthy food items in the HUEBS predominantly consist of ingredients associated with disease (e.g., sugar, saturated fats, cholesterol) and provide no nutritional value to diet, we believe that a balanced diet should be mainly composed of foods that promote health, with the inclusion of foods that should only be consumed in moderation. A more acceptable way to talk about food may be to refer to “healthy” foods as foods to promote, and “unhealthy” foods as foods to consume in moderation, or to not categorize foods at all and to simply communicate that all foods are healthy when consumed in moderation (Schwartz & Henderson, 2009).

**Limitations of the Thesis**

Although this thesis contributes to the eating regulation literature in many ways, some limitations warrant discussion. Each of these limitations are discussed below, along with suggestions on how these limitations could be addressed in future research.

**Limited Samples.** As discussed within each of the manuscripts, the samples that composed this thesis were limited in gender and ethnicities. All samples consisted of women only and most participants identified as Caucasian. Although this represents, in some way, a strength of the thesis in that the processes examined were replicated across multiple studies and therefore provides a thorough analysis of the regulation of eating behaviors in women, healthy and unhealthy eating behaviors were measured based on recent recommendations of the Canadian Food Guide which are applicable to adults of all genders and ethnicities. Previous research has shown that women and men differ in the goals that they pursue, with women being more preoccupied with thinness (Swami, 2015) and men being more preoccupied with leanness and masculinity (Thompson & Cafri, 2007). Although both of these cultural "ideals" represent extrinsic goals within the SDT, a study conducted by Hamilton and colleagues (Hamilton, Hoffman, Arsiwalla, Volpe, Schmidt, & Gropper, 2018) showed that women scored higher on behavioral regulations of the REBS in intrinsic, identified, introjected, and external regulations, which suggested that women may be more aware of their overall eating regulation patterns than men. In their review of gender differences in eating behaviors, Herman and Polivy (2010) also demonstrated that women and men differ in the quality (food preferences and selection) and quantity (how much) of their eating behaviors. Furthermore, although reported ethnic differences in eating disorder diagnoses and risk factors such as the thin ideal have been mixed, studies have shown that cardiovascular risk factors (e.g., diabetes, hypertension, BMI) vary dramatically by ethnic groups (Liu, So, Mohan, Khan, King, & Quan, 2010). Since these studies suggest

potential gender and ethnic differences in the processes examined in this thesis, it is imperative that future research examines how the results of this thesis replicate in more diverse samples.

Furthermore, although Manuscript #4 included women that were recruited from the community and who were of older age, all other samples consisted of women recruited from a Canadian university. Although this population was relevant to the thesis in that university women have been found to display the highest level of disordered eating behaviors (e.g., Lewinsohn, Seeley, Moerk, & Striegel-Moore, 2002), university students are not representative of the general women population. University students often have a different lifestyle than working women and therefore, may not be as equipped to engage in healthy eating behaviors. For instance, some students may still live with their parents or follow a university meal plan and, as evidenced in Manuscript #4, university students generally have a lower income than working women. These factors could limit their opportunities to prepare their own meals and/or impact their food choices in that healthy foods are often more expensive than unhealthy foods (Epstein, Handley, Dearing, Cho, Roemmich, Paluch, et al., 2006). Recent research has also shown that within younger and older adults, concerns about feeling unattractive predicted intentions to prevent weight gain; however, health consequences of weight gain were also important motivators in older adults (Beeken, Mahdi, Johnson, & Meisel, 2018). As such, in addition to examining group differences amongst genders and ethnicities, future research should also examine how the results of this thesis differ between individuals of different age groups.

Finally, although we included measures of dysfunctional eating behaviors within most of our manuscripts, the samples that were collected were non-clinical samples. Most participants displayed healthy eating behaviors and low unhealthy eating behaviors and bulimic symptoms, and BMI was mostly within the normal range in each study. Future research may wish to

examine how our results manifest in clinical samples of individuals who meet the diagnostic criteria for an eating disorder, and/or for overweight or obese individuals who are trying to lose weight. In 2018, it was estimated that 56.7% of the general Canadian women population who were 18 years and older were overweight or obese (Canadian Community Health Survey, 2018). Although our data was limited in that it represented emerging female adults who mostly presented BMIs within the normal range, understanding the various processes that lead to (un)healthy and/or dysfunctional eating behaviors at this developmental period is crucial for preventing continued weight gain into middle age.

**Self-reported Data.** Other than waist circumference that was measured by the primary researcher in Manuscript #1 (Study 3), all other measures that were used in this thesis were self-reported measures. Therefore, individuals' goals and motivation, strategy use, eating behaviors and life satisfaction, as well as their BMI, were not entirely accurate as self-reports can often be biased. Researchers have proposed other ways to assess eating behaviors using more objective measures. For instance, collecting multiple assessments of web-based 24h dietary recalls has been shown to increase the likelihood of capturing individuals' general food intake (Freedman, Commins, Moler, Arab, Baer, Kipnis, et al., 2014; Ma, Olendzki, Pagoto, Hurley, Magner, Ockene, al., 2009) and allows researchers to calculate an overall indicator of the adherence to dietary guidelines. Image-based dietary assessment methods have also gained popularity during the past decade, which consist of enabling people to capture their food intake by taking momentary images of their meals (Daugherty, Schap, Ettienne-Gittens, Zhu, Bosch, Delp, et al., 2012; Harray, Boushey, Pollard, Delp, Ahmad, Dhaliwal, et al., 2015). Future research may wish to examine how the HUEBS compares with such measures in order to provide further validation to the scale. Furthermore, although bulimic symptoms involve both the actions of bingeing and

purging, binge eating episodes can be measured somewhat more objectively by asking people to report the number of episodes over the past 28 days when they met the criteria of eating a large amount of food and losing control, using the Eating Disorder Examination (EDE; Fairburn & Cooper, 1993). While the use of self-reports is not ideal, it was necessary to rely on this type of data given the breadth of the research covered in this thesis.

**Limited Measures of Disordered Eating Behaviors.** One of the strengths of this thesis is that the strategies proposed within the PMQQS were predictive of bulimic symptoms within our samples. While this provides some validity to our scale, the inclusion of other measures of disordered eating would have been beneficial for examining how the strategies of the PMQQS relate to other types of disordered eating behaviors. For instance, we hypothesized that planning and self-monitoring the quantity of eating would be associated with bulimic symptoms, since these strategies share a key component with restrictive dieting which, in itself, has been associated with bulimic symptoms. The inclusion of a measure assessing dietary restraint would have been beneficial for better understanding the relationships between the strategies related to the quantity of eating and bulimic symptoms.

We also proposed that the relationship between self-monitoring the quality of eating and bulimic symptoms that was found in some of our samples could be explained by the fact that some individuals can develop a pathological obsession with consuming “pure” foods, often termed “orthorexia nervosa”. Researchers may wish to investigate how planning and self-monitoring the quality of eating relates to this type of dysfunctional eating. The Teruel Orthorexia Scale (TOS; Barrada & Roncero, 2018) could be an interesting option, since it assesses two components of orthorexia nervosa: *orthorectic efforts*, which evaluates a “healthy” preoccupation with healthy eating, and *orthorectic concerns*, which evaluates a pathological

preoccupation with healthy eating that is related to the negative social and emotional impact of following a healthy diet. Based on our findings, self-monitoring the quality of eating for autonomous reasons should be positively associated with orthorectic efforts, whereas self-monitoring the quantity of eating for controlled reasons should be positively associated with orthorectic concerns.

Finally, several other forms of dysfunctional eating behaviors have been examined within the SDT literature, such as binge eating (e.g., Leong, Madden, Gray, & Horwath, 2012) and unhealthy weight control strategies including the use of diet pills, skipping meals and fasting (e.g., Thøgersen-Ntouman, Ntoumanis, and Nikitaras, 2010). The addition of other types of dysfunctional eating behaviors in our models could help shed light on how motivational dynamics are associated with others forms of dysfunctional eating through focusing on the quality versus the quantity of eating.

**Physical Health as a Determinant (Versus a Consequence) of Eating.** In Western societies, individuals generally engage in efforts to regulate their eating behaviors in order to manage their weight. Depending on personal standards, an individual may wish to reduce the discrepancy between their current and ideal state either by losing or gaining weight, or to maintain their current state. Other than waist circumference that was examined as a consequence of eating behaviors in Manuscript #1 (Study 3), physical health indicators – specifically BMI – were examined as a determinant of eating behaviors in all subsequent studies of the thesis. Past research has shown that the relationship between physical health and diet is reciprocal (for a review, see Marks, 2015 and Pelletier, Guertin, Pope & Rocchi, 2016 for comments); therefore, physical health indicators could be examined as both a determinant and a consequence to eating. Our research was limited in that no study examined whether the proposed processes lead to

improved physical health indicators over time. Since our research was specifically interested in examining self-regulation strategies used to manage eating behaviors and ultimately weight, future studies would do well by examining how the proposed processes influence weight loss, gain, and/or maintenance over time. This type of investigation would not only be beneficial for providing further validity to our scales, but also for understanding how motivational dynamics within the SDT influence physical health over time.

**Directions for Future Research**

**The Role of Basic Psychological Needs.** As proposed within the SDT, need-supportive and need-thwarting interpersonal styles differently relate to basic psychological needs which, in turn, influence the types of goals that individuals pursue and the regulatory basis for which goals are pursued. Since basic psychological needs were not assessed in the present research, it would be interesting for future research to replicate our final model with the addition of variables assessing need-supportive and need-thwarting interpersonal contexts, as well as the satisfaction and thwarting of basic psychological needs as antecedents to goals and motivation and strategies related to the quality/quantity of eating. Going a step further, future research could also implement an SDT-based intervention and examine whether the support of others (e.g., significant others, family members, doctors, health coaches) can influence the processes examined over time. Recent meta-analyses have demonstrated that SDT-based interventions aimed at supporting individuals' basic psychological needs are efficient in promoting health-behavior change, mainly through increased autonomy and perceived competence (Ntoumanis, Ng, Prestwich, Quested, Hancox, Thøgersen-Ntoumani, et al., 2020; Sheeran, Wright, Avishai, Villegas, Lindemans, Klein, et al., 2020). This type of experiment would allow us to examine the full process of eating regulation as proposed by the SDT.

In future studies, basic psychological need satisfaction should also be examined as a mediator between the strategies assessed by the PMQQS and eating behaviors. In Verstuyf and colleagues' (Verstufy, Patrick, Vansteenkiste, & Teixeira, 2012) review, it has been suggested that individuals who experience need satisfaction (versus need-thwarting) in their life in general will be more likely to adopt a quality (versus a quantity) approach to eating regulation; however, the reverse was also proposed in that adopting a quality (versus a quantity) approach to eating regulation could lead individuals to experience more need-satisfying (versus need-thwarting) experiences during eating regulation. A daily diary methodology could be useful in examining how the strategies proposed by the PMQQS relate to the daily satisfaction/thwarting of basic psychological needs, and how the satisfaction/thwarting of basic needs then influence eating behaviors. This type of investigation could help explain why strategies related to the quality of eating are associated with healthier eating behaviors, whereas strategies related to the quantity of eating are associated with dysfunctional eating behaviors.

**The Role of Stages of Behavior Change.** As part of the validation process of the HUEBS, the interactive roles of motivation and stages of change were examined in Manuscript #1. Specifically, in Study 2 of this manuscript, we examined if women reported different patterns of motivation and eating behaviors, based on where they situated themselves on the behavior change process for eating regulation. In Study 3 of the manuscript, we also tested moderated mediation models to examine if eating behaviors mediated the relationship between motivation and waist circumference, and if the relationship between motivation and eating was moderated by stages of change. Our results revealed that women who situated themselves on the lower end of the behavior change process – that is, who were deciding or who were beginning to make changes to their eating behaviors – reported higher levels of non-self-determined motivation and

lower levels of self-determined motivation, as well as a higher consumption of unhealthy foods and a lower consumption of healthy foods. By opposition, women who situated themselves on the higher end of the behavior change process – that is, who were trying to maintain or who had been maintaining changes in their eating behaviors – reported lower levels of non-self-determined motivation and higher levels of self-determined motivation, as well as a lower consumption of unhealthy foods and a higher consumption of healthy foods. Additionally, our results showed that the relationship between self-determined motivation and healthy eating was moderated by stages of change, in that the relationship was stronger for individuals who scored high (versus moderate and low) on stages of change.

Although these results suggest that motivation and stages of change both play significant roles in explaining eating behaviors, none of the subsequent studies of this thesis examined the interactive roles of motivation and stages of change when examining self-regulation strategies. This thesis rather focused on the motivational processes involved in the adoption of the strategies, without considering the behavior change process underlying eating regulation. In order to obtain a more complete representation of the processes examined, researchers may wish to examine how each variable included in our models relate to stages of change. For example, researchers could re-examine how motivation and eating behaviors, as well as the different strategies proposed by the PMQQS, differ across stages of change. Based on the overall findings of this thesis, it would be logical to hypothesize that, in addition to reporting higher levels of non-self-determined motivation and lower levels of self-determined motivation, as well as a higher consumption of unhealthy foods and a lower consumption of healthy foods, individuals in lower stages of change should report a higher use of planning and self-monitoring the quantity (versus the quality) of eating. On the contrary, individuals in higher stages of change should

report a higher use of planning and self-monitoring the quality (versus the quantity) of eating, in addition to reporting higher levels of self-determined (versus non-self-determined) motivation, as well as a higher consumption of healthy (versus unhealthy) foods.

This type of investigation could also be useful for understanding how planning and self-monitoring strategies unfold as people move along stages of behavior change. As indicated by Carver and Scheier's (1982) TOTE model (Test-Operate-Test-Exit), self-regulation requires monitoring in order to be effective. Self-regulation involves monitoring any discrepancy between one's current state and personal standards ('Test'), engaging in behavior in order to meet that standard ('Operate'), and continuing to evaluate progress until the standard is met ('Test'). Once the current state is in line with the standard, the individual can exit the feedback look. Based on the TOTE model, if a person does not engage in some form of self-monitoring, they cannot know whether they are progressing towards or regressing away from their goal, or whether they should maintain or change their behaviors in order to reach their goal. Since the behavior change process represents the transitions that individuals undergo towards the achievement of their goals, self-monitoring is likely to be prominent at every stage of the behavior change process. In regard to planning, we believe that this strategy may only begin to play a significant role in the behavior change process once people are ready to implement changes to their eating behaviors. Whereas self-monitoring is a key component in the first step of the self-regulation process – that is, the comparison between the self and personal standards, – planning only begins to be prominent in the 'operation' phase, in that it represents a strategy used to change the self in order to bring it up with personal standards. We believe that planning only begins to significantly increase once people enter the implementation stage, since people at this stage have identified their personal standards and are ready to transform their intentions into actions.

Gaining knowledge about how these strategies unfold along the behavior change process could also have important implications for the communication of information on weight-management and diet. For instance, Pope and colleagues (2017) recently suggested that health messages should be framed in a way that promotes intrinsic goals and autonomous motivation, and tailored to individuals' stages of behavior change since people differently attend to and process information, and form decisions based on their stage of change. If people rely on different strategies depending on their stage of change, health information should emphasize the use of strategies that are useful to people at specific stages of change.

Finally, although Manuscript #1 suggested that stages of change moderated the relationship between motivation and eating, research has yet to determine how stages of change and motivation relate to each other. While an interaction between these variables was proposed, longitudinal studies (e.g., Fortier, Sweet, Tulloch, Blanchard, Sigal, Kenny, et al., 2012; Ingledew, Markland, & Medley, 1998) in the exercise domain have demonstrated that behavioral internalization can facilitate the process of going from initiating to maintaining health behaviors over time. It is therefore possible that stages of change mediate, rather than moderate, the relationship between motivation and eating. Future studies could investigate the respective roles of stages of change and motivation by examining how results from mediation and moderation analyses compare.

**The Interaction Between Planning and Self-Monitoring.** Researchers may also wish to investigate how planning and self-monitoring interact during self-regulation. Planning and self-monitoring were examined separately in our models, since our research designs did not permit us to effectively examine their interaction. Based on the TOTE model, individuals should engage in planning and self-monitoring strategies in a reciprocal manner, in that once people have decided

to implement changes to their eating behaviors, they may begin to plan their meals and evaluate the effectiveness of the strategy. If they perceive the strategy as effective, they will likely continue to engage in planning behaviors and assess their progress until they believe it necessary. In order to effectively investigate the relationship between planning and self-monitoring, future research could assess planning and self-monitoring at different time points over the course of a few weeks and/or months. Since most people plan their meals at least once a week (Ducrot, Méjean, Aroumougame, Ibanez, Allès, Kesse-Guyot, et al., 2017), researchers could alternate between assessing planning and self-monitoring each week and examine how the combined use of these strategies facilitate goal achievement over time. This would allow researchers to better understand the interaction between planning and self-monitoring and integrate self-regulation processes more effectively within self-regulation models.

An important next step of this research would also be to encourage individuals to utilize the self-regulation strategies examined in this research in order to examine whether the promotion of the strategies in terms of eating *quality* can help individuals engage in healthier eating behaviors. For instance, researchers could educate participants on the entailment of planning and self-monitoring strategies and encourage individuals to form plans and self-monitor the quality of their eating behaviors for a given amount of time. By controlling for baseline measurements of the participants' goals and motivation, as well as their eating behaviors, researchers could examine if the engagement in the strategies leads to positive changes in diet over time. Based on previous meta-analyses that have shown the benefits of planning and self-monitoring strategies for facilitating goal attainment (e.g., Adriaanse, Vinkers, De Ridder, Hox, & De Wit, 2011; Harkin et al., 2016), such interventions should be beneficial to individuals. Interestingly, research conducted by Koestner and colleagues has demonstrated that planning

behaviors are a good supplement to autonomous motivation and perceived competence (Koestner, Lekes, Powers, & Chicoine, 2002; Koestner, Otis, Powers, Pelletier, & Gagnon, 2008) as motivation represents the starting point for successful goal striving, whereas planning behaviors provide individuals with the necessary tools to attain their goals. That said, future research may wish to design interventions in a way that support individuals' needs, while educating them on optimal strategies they can use to regulate their eating behaviors.

**Conclusion**

The broad aim of this thesis was to better understand why some people succeed, whereas others fail, to regulate their eating behaviors by examining the means through which individuals with different types of goals and motivation regulate their eating behaviors. In this thesis, we addressed several important limitations of the eating regulation literature. First, we validated an instrument measuring healthy and unhealthy eating behaviors based on recent recommendations of Canada's Food Guide; second, we demonstrated that planning and self-monitoring can be distinguished in terms of eating quality and quantity by validating an instrument that would allow researchers to assess these strategies along the quality/quantity dimension; and third, we demonstrated through cross-sectional and longitudinal studies that individuals with different goals and motivation engage in (dys)functional eating behaviors because they regulate their eating behaviors in qualitatively distinct ways. The results from this thesis support that our physical and mental health greatly depends on the way that we think about food and that it is much more than just "calories in, calories out." It is in our hope that this research will positively influence the communication of information on weight-management and diet in order to facilitate the integration of healthy eating behaviors into people's lifestyles and improve their health and quality of life.

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# APPENDIX A

## The Healthy and Unhealthy Eating Behavior Scale

Using the scale from 1 to 7 below, please indicate to what extent you generally consume the different food items below.

| Never 1 2 3 Sometimes 4 5 6 Always 7 | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1. I eat fruits. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 2. I eat vegetables. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 3. I eat refined grains (e.g., white rice, white bread, white flour). | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 4. I eat whole grains (e.g., brown rice, buckwheat, quinoa, oats). | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 5.I eat foods that are low in saturated fats and cholesterol. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 6. I eat foods that are high in monounsaturated and polyunsaturated fats (e.g., fish, olive oil, avocados, nuts and seeds). | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 7. I use natural sweeteners (e.g., raw honey, maple syrup, coconut sugar, dates). | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8. I use white sugar and artificial sweeteners. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 9. I eat snack foods, such as chips, chocolate and/or candy. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 10. I drink water. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 11. I drink sugar-sweetened beverages, such as soft drinks, fruit juices, and sports drinks. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 12. I eat foods that are deep-fried (e.g., fries, fried chicken). | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 13. I eat foods that are boiled, steamed, grilled, or poached. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 14. I eat frozen and/or pre-packaged meals. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 15. I eat processed meats such as sausages, bacon, and/or cold-cuts. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 16. I eat lean meats, such as poultry, fish, and eggs. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 17. I eat low-fat dairy products (e.g., low-at milk, yogurt, sour cream, cheese). | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 18. I add salt to my food. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 19. I eat fast-food. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 20. I eat pastries and/or baked goods (e.g., croissants, pie, cake, muffins, brownies). | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 21. I consume more than 10 alcoholic drinks (for women) and 15 alcoholic drinks (for men) per week). | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 22. I eat legumes (e.g., beans, lentils, peas, peanuts). | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

# APPENDIX B

## The Regulation of Eating Behaviors Scale

Listed below are several statements concerning **possible reasons why people might try to regulate their eating behaviours.** Using the scale from 1-7 below, please indicate the degree to which the proposed reasons **correspond to your reasons** for regulating your eating behaviours (i.e., "try to eat healthy" or "pay attention to your eating habits").

| Does not correspond at all 1 2 3 | Corresponds moderately 4 5 6 | Corresponds exactly 7 | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1. Because it is fun to create meals that are good for my health. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 2. Because I believe it`s a good thing I can do to feel better about myself in general. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 3. Because I would be humiliated if I was not in control of my eating behaviours. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 4. I don`t really know. I truly have the impression that I`m wasting my time trying to regulate my eating behaviours. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 5. For the satisfaction of eating healthy. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 6. Because regulating my eating behaviours has become a fundamental part of who I am. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 7. Because I believe it will eventually allow me to feel better. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8. Because I don`t want to be ashamed of how I look. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 9. Because I think it's a good idea to try to regulate my eating behaviours. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 10. Because other people close to me insist that I do. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 11. Honestly, I don't know. I can`t really see what I`m getting out of it. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 12. Because other people close to me will be upset if I don`t. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 13. Because I like to find new ways to create meals that are good for my health. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 14. Because eating healthy is part of the way I have chosen to live my life. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 15. Because I would feel ashamed of myself if I was not eating healthy. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 16. Because I feel I must absolutely be thin. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 17. Because eating healthy is an integral part of my lifestyle. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 18. Because I take pleasure in fixing healthy meals. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 19. Because it is a way to ensure long-term health benefits. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 20. I don`t know. I can`t see how my efforts to eat healthy are helping my health situation. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 21. Because it is expected of me. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 22. Because eating healthy is congruent with other important aspects of my life. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 23. Because people around me nag me to do it. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 24. I don`t know why I bother. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

# APPENDIX C

## Stages of Change for Eating Regulation

Please read the following six statements. Choose the one that best applies to your current situation regarding your eating regulation. **Choose only one statement.**

**I am at the stage where…**

1. I am trying to decide if I should change my eating behaviors.
2. I am debating whether I am going to start changing my eating behaviors.
3. I want to know more about how I can change my eating behaviors.
4. I want to learn more about things I can do to make healthy eating part of my lifestyle.
5. Healthy eating is already a part of my lifestyle.

# APPENDIX D

## Bulimic Symptoms

Please indicate to what extent you do the different things stated below:

| Never | | | Sometimes | | | Very often |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1. I eat when I am upset. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 2. I stuff myself with food. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 3. I have gone on eating binges where I have felt that I could not stop. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 4. I think about bingeing (overeating). | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 5. I eat moderately in front of others and stuff myself when they're gone. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 6. I have the thought of trying to vomit in order to lose weight. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 7. I eat or drink in secrecy. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

# APPENDIX E

## Planning and Self-Monitoring the Quality and Quantity Scale

The following statements reflect different strategies that people engage in when trying to regulate their eating behaviors. Using the scale from 1 to 7 below, please indicate to what extent you engage in the different behaviors stated below.

**When I plan my meals…**

| Never 1 | 2 | 3 | Sometimes 4 | 5 | 6 | Always 7 |
|---|---|---|---|---|---|---|
| 1. I choose food items that are high in nutrients. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 2. I make sure that my meals include nutritious ingredients. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 3. I think in advance about the quality of the food I am going to eat. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 4. I choose food items that are low in calories. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 5. I make sure that the number of calories in my meals is below a certain number. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 6. I think about the calorie content of the food I am going to eat. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 7. I think about the quantity of the foods I will eat. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8. I make sure to only have one serving size of the foods I consume. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 9. I think about the amount of food I will eat. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**When I monitor my food intake…**

| Never 1 | 2 | 3 | Sometimes 4 | 5 | 6 | Always 7 |
|---|---|---|---|---|---|---|
| 1. I think about my daily nutrient intake (e.g., protein, fat, carbohydrates, vitamins and minerals). | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 2. I focus on whether or not I ate healthily throughout the day. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 3. I actively keep track of the healthy and unhealthy foods that I eat. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 4. I focus on the number of calories I consumed throughout the day. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 5. I think about whether or not I consumed too many calories in my day. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 6. I examined whether the meals I consumed were too high in calories. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 7. I ask myself whether or not my portion sizes were too big. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8. I pay attention to how much food I consumed in one sitting. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 9. I think about whether or not I am eating too little or too much. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

# APPENDIX F

## Intrinsic and Extrinsic Goals for Weight-Management

The following statements enumerate various goals you might have with weight-management. Please indicate the extent to which you find each one important with regards to weight.

**When thinking of controlling your weight, how important are these goals to you:**

| Not at all important 1 | 2 | 3 | Important 4 | 5 | 6 | Extremely important 7 |
|---|---|---|---|---|---|---|
| 1. Be beautiful. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 2. Grow and learn new things. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 3. Be physically healthy. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 4. Be admired by many people. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 5. Have people comment often about how attractive I look. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 6. Keep myself healthy and well. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 7. Have an image that others find appealing. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8. Have a healthy lifestyle. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

# APPENDIX G

## Life Satisfaction

Below are five statements that you may agree or disagree with. Using the scale below, please indicate your agreement with each item.

| Do not at all agree 1 | 2 | 3 | Moderately agree 4 | 5 | 6 | Strongly agree 7 |
|---|---|---|---|---|---|---|
| 1. In most ways my life is close to my ideal. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 2. The conditions of my life are excellent. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 3. I am satisfied with life. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 4. So far, I have gotten the important things I want in life. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 5. If I could live my life over, I would change almost nothing. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

# APPENDIX H

## Alternative Models for Manuscript #4

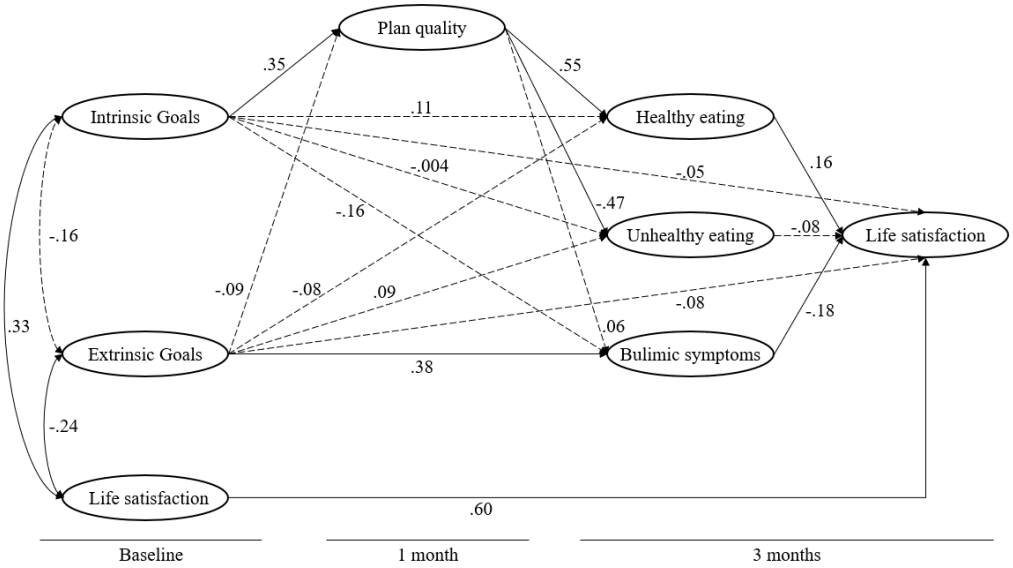


*Figure 1.* Alternative model in which only goals for weight-management is included in the model, and in which planning quality is examined as the mediator between goals and eating behaviors. Note: unidirectional arrows represent hypothesized paths; bidirectional arrows represent correlations. Solid lines = $p < .05$. Dotes lines = *ns*. Model fit: $SB\chi^2_{(385)} = 522.97$, p < .001, CFI = .95, TLI = .94, RMSEA = .05 (95% CI [.04, .05]), SRMR = .07.

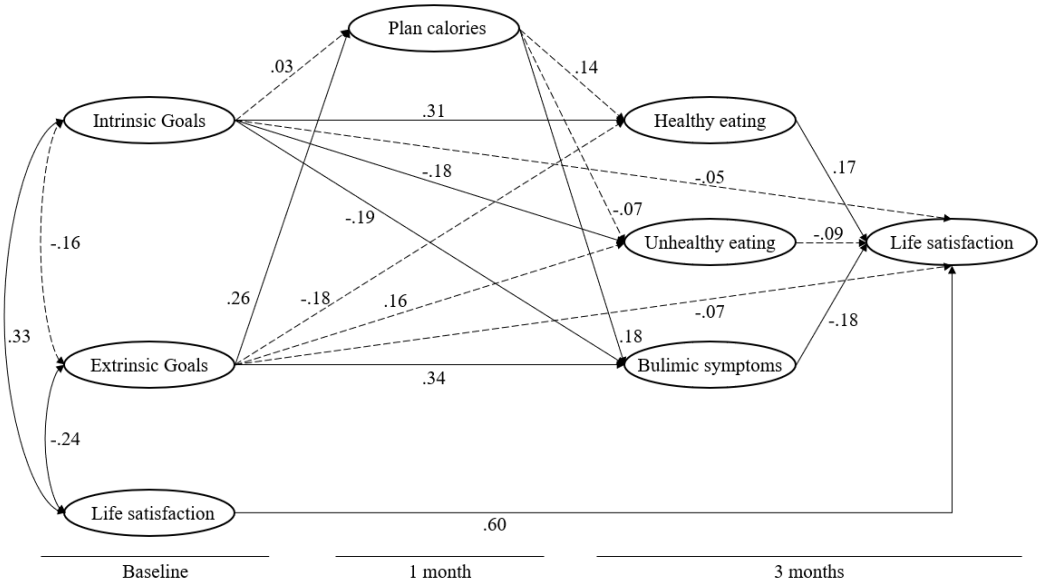


*Figure 2.* Alternative model in which only goals for weight-management is included in the model, and in which planning calories is examined as the mediator between goals and eating behaviors. Note: unidirectional arrows represent hypothesized paths; bidirectional arrows represent correlations. Solid lines = $p < .05$. Dotes lines = *ns*. Model fit: $SB\chi^2_{(385)} = 559.55$, p < .001, CFI = .94, TLI = .93, RMSEA = .05 (95% CI [.04, .06]), SRMR = .08.

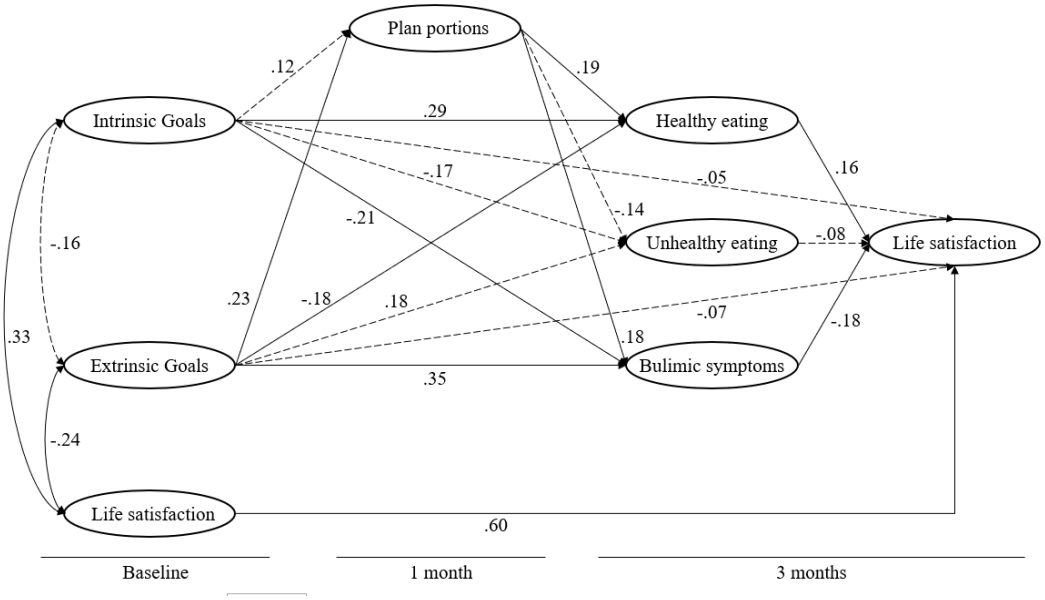


*Figure 3.* Alternative model in which only goals for weight-management is included in the model, and in which planning portions is examined as the mediator between goals and eating behaviors. Note: unidirectional arrows represent hypothesized paths; bidirectional arrows represent correlations. Solid lines = $p < .05$. Dotes lines = *ns*. Model fit: $SB\chi^2_{(385)} = 548.31$, p < .001, CFI = .94, TLI = .93, RMSEA = .05 (95% CI [.04, .06]), SRMR = .07.

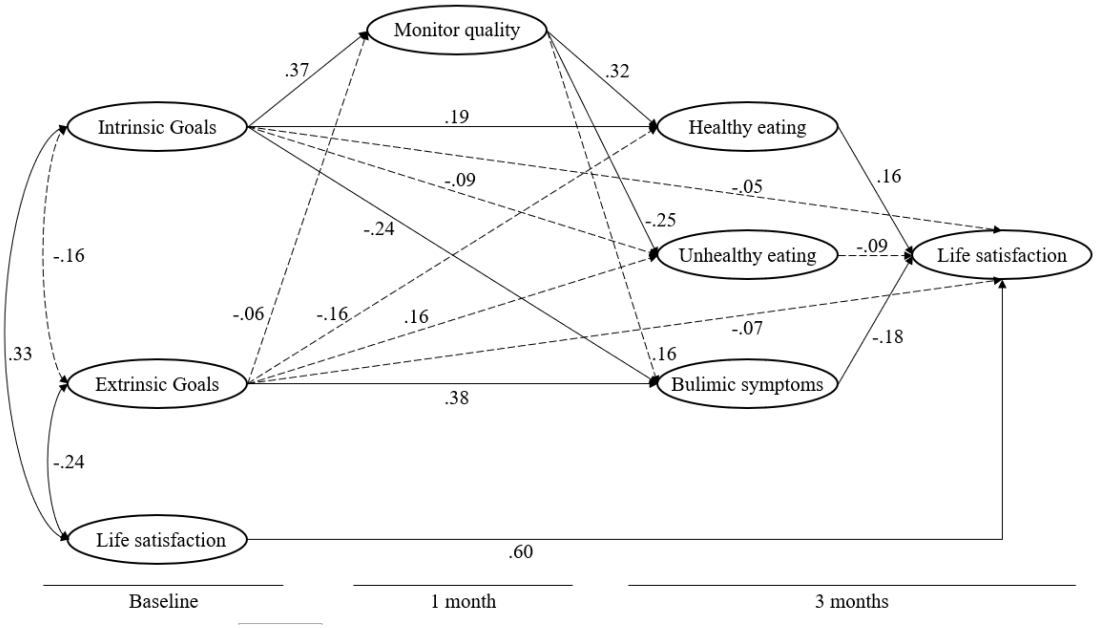


*Figure 4.* Alternative model in which only goals for weight-management is included in the model, and in which monitoring quality is examined as the mediator between goals and eating behaviors. Note: unidirectional arrows represent hypothesized paths; bidirectional arrows represent correlations. Solid lines = $p < .05$. Dotes lines = *ns*. Model fit: $SB\chi^2_{(385)} = 552.88$, p < .001, CFI = .94, TLI = .93, RMSEA = .05 (95% CI [.04, .06]), SRMR = .08.

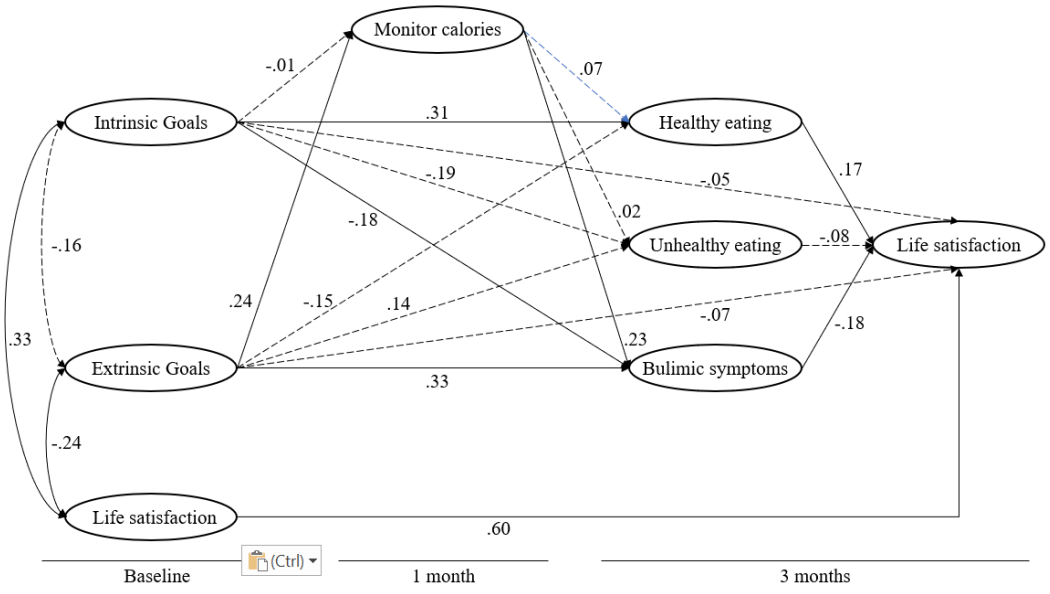


*Figure 5.* Alternative model in which only goals for weight-management is included in the model, and in which monitoring calories is examined as the mediator between goals and eating behaviors. Note: unidirectional arrows represent hypothesized paths; bidirectional arrows represent correlations. Solid lines = $p < .05$. Dotes lines = *ns*. Model fit: $SB\chi^2_{(385)} = 546.18$, $p < .001$, CFI = .94, TLI = .94, RMSEA = .05 (95% CI [.04, .06]), SRMR = .07.

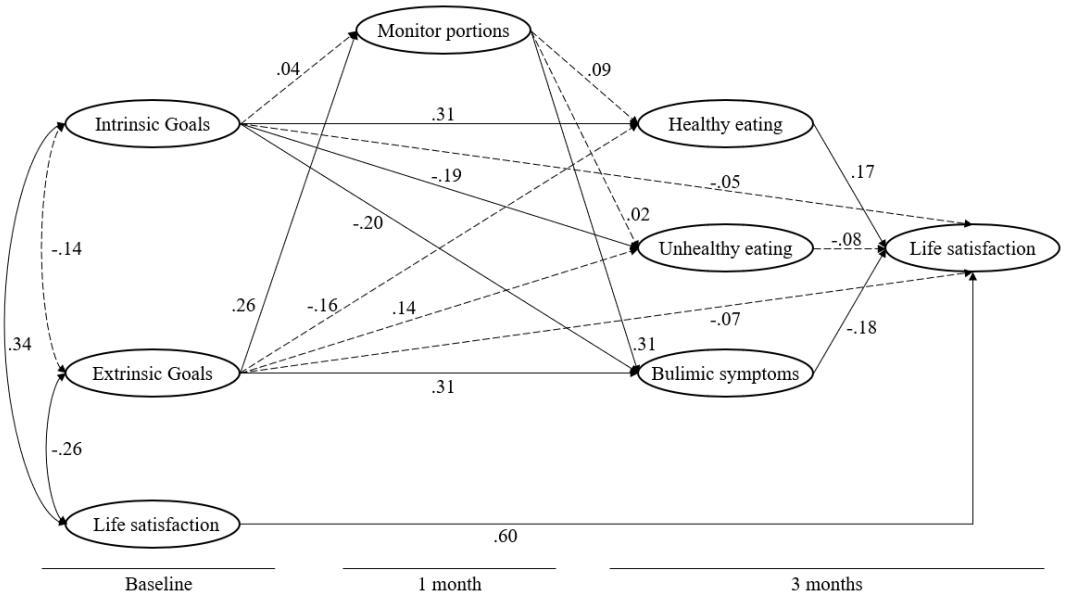


*Figure 6.* Alternative model in which only goals for weight-management is included in the model, and in which monitoring portions is examined as the mediator between goals and eating behaviors. Note: unidirectional arrows represent hypothesized paths; bidirectional arrows represent correlations. Solid lines = $p < .05$. Dotes lines = *ns*. Model fit: $SB\chi^2_{(385)} = 555.93$, $p < .001$, CFI = .94, TLI = .94, RMSEA = .05 (95% CI [.04, .06]), SRMR = .08.