

# Women's regulation styles for eating behaviors and outcomes: The mediating role of approach and avoidance food planning

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**Abstract** The purpose of this article was to examine the role played by different orientations in planning for eating behaviors as mediators of the relationship between regulation styles and eating behaviors. In Study 1, a new scale was developed to assess approach food planning and avoidance food planning. Results from confirmatory analyses ( $N = 241$ ) supported the two-factor structure of the scale. In Study 2 ( $N = 202$ ), in agreement with past research on the effects of autonomous and controlled motivation for the regulation of eating behaviors, we found that approach food planning partially mediated the effects of autonomous regulation for eating behaviors on healthy eating behaviors, while avoidance food planning partially mediated the effects of controlled regulation for eating behaviors on dysfunctional eating behaviors. Implications of these results for self-determination theory and for promoting healthy eating behaviors are discussed.

**Keywords** Approach and avoidance plans · Self-Determination Theory · Healthy eating behaviors · Dysfunctional eating behaviors

## Introduction

Recent studies based on Self-Determination Theory (SDT; Deci and Ryan 1985, 2002) revealed that women have distinct

regulation styles for eating behaviors that are either associated with healthy eating behaviors or with dysfunctional eating behaviors (Pelletier et al. 2004; Pelletier and Dion 2007). While these studies revealed that different reasons to engage in the regulation of eating behaviors lead to different outcomes, they do not inform about the means used to regulate eating behaviors. The goal of this research is to examine planning strategies (approach vs. avoidance planning) as a potential mechanism through which regulation styles influence eating behaviors. More specifically, we propose that how eating behaviors are planned can better explain the relation between women's motivation for the regulation of their eating behaviors and the quality of their eating.

## Relation between regulation styles and eating behaviors

In line with SDT, the two main regulation styles for eating behaviors are autonomous and controlled regulation. The first refers to engaging in the regulation of eating behaviors out of a sense of choice and responsibility (e.g., "...because I believe it is a good thing I can do to ensure good health" or "...because eating healthy is part of the way I choose to live my life"). Conversely, controlled regulation is performed out of pressure from oneself or others (e.g., "...because I would feel ashamed of myself if I were not eating healthy" or "...because other people close to me are insisting that I do). A substantial amount of research in the health domain documents that autonomous regulation is linked to beneficial outcomes while controlled regulation is linked to negative outcomes (Hagger et al. 2006).

The impact of autonomous and controlled regulation styles for eating behaviors on eating behaviors has been examined among university students and medical patients. Two survey studies have tested a motivational model among university women in which regulation styles, eating

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behaviors, and psychological well-being were included (Pelletier et al. 2004; Study 2; Pelletier and Dion 2007). Results revealed that women with an autonomous regulation tended to report eating more healthy foods. Women with controlled regulation tended to report more bulimic symptoms and were also less likely to eat healthy foods. A weak negative relation was found between autonomous regulation and bulimic symptoms. Furthermore, healthy eating behaviors and dysfunctional eating behaviors were shown to associate positively and negatively, respectively, with an increase in psychological well-being.

In a medical setting, the role of autonomous regulation in achieving and maintaining changes in dietary behaviors was investigated with severely obese patients enrolled in a very-low-calorie weight-loss program (Williams et al. 1996). It was found that patients' autonomous regulation for weight-loss predicted their attendance in the program, which in turn predicted their weight-loss over the duration of the program (6 months). Furthermore, autonomous regulation predicted greater weight-loss and exercise maintenance at a 2-year follow-up.

Pelletier and colleagues (2004; Study 3) obtained similar results with patients at risk for coronary artery disease. Results from this study indicated that a global self-determined orientation measured at Time 1 was associated with autonomous regulation of dietary behaviors at Time 2 (13 weeks later), which in turn was associated with self-report of more healthy food choices (food with less % calories from fat), improvement in dietary behaviors, a decrease in body weight, and an improvement in blood lipid parameters at Time 3 (26-week after baseline). Based on these findings, we hypothesize a positive relation between autonomous regulation and healthy eating behaviors as well as a relation between controlled regulation and dysfunctional eating behaviors.

#### The nature of approach and avoidance

The proposed mediators of the relation between regulation styles and different eating behaviors are approach and avoidance food planning. According to Elliot et al. (1997), the main difference between approach and avoidance orientation lies in their regulatory focus. An approach orientation focuses on desirable objectives, and involves moving toward the desirable objectives (e.g., trying to exercise daily), whereas an avoidance orientation focuses on undesired objectives and involves moving away from undesired objectives (e.g., trying to avoid being late) (Elliot et al. 1997).

Some research has provided explanation for the link between the approach/avoidance distinction and well-being. For instance, people with a predominance of avoidance goals tend to perceive less goal progress and subsequently, tend to experience less positive affects and

life satisfaction (Elliot et al. 1997). Further, individuals who use approach goals are more likely to evaluate themselves positively and are less likely to report depressive symptoms than individuals who use avoidance goals (Coats et al. 1996). Regarding the approach/avoidance distinction at the planning level, mood-disturbed adolescents tend to use more avoidance plans than healthy adolescents (Dickson and MacLeod 2004). The authors argued that avoidance plans are especially emotionally and cognitively taxing because they require the active mental simulation of all future unwanted behaviors and the elaboration of strategies to avoid enacting these behaviors.

Approach and avoidance orientation can be easily applied to the planning of eating behaviors. For example, the goal of trying to eat healthier can be achieved by plans that can be framed in an approach manner (e.g., trying to drink two glasses of milk a day, trying to eat more green vegetables) and in an avoidance manner (e.g., avoiding fried foods, trying not to eat big portions). We found some reference to approach and avoidance food planning in treatment programs for serious eating disorders and in prevention programs for at risk individuals (Fairburn et al. 1993; Garner et al. 1997). Although these authors do not use these exact terms, there is some mention of the importance of planning to incorporate different foods and of the negative consequences of dietary restriction. In sum, there is some evidence that the investigation of the approach and avoidance distinction at the food planning level is worthwhile. However, no scale exists to measure approach and avoidance food planning. Therefore, a goal of this research is to develop such a scale.

#### Relation between regulation styles and planning

Approach and avoidance planning were chosen as mediators because their relationship with the proposed antecedents (autonomous and controlled regulation) and their proposed consequences (healthy food choices and dysfunctional eating behaviors) can be theoretically explained and supported by research (Chatzisarantis and Biddle 1998; Hagger et al. 2006; Ntoumanis 2001; Wilson and Rodgers 2004). Clear theoretical rationale and empirical findings support the hypothesis that regulation styles are differently related to food planning. For example, a recent study by Pelletier and colleagues (2004; Study 2) suggests that women with different regulation styles think differently about foods. These authors found that women with an autonomous regulation are more concerned by the quality of food they eat while women with a controlled regulation are more concerned by the quantity of food they eat. Because eating food high in quality is an action that often moves someone toward healthy eating, we hypothesize that women with an autonomous regulation use

predominately approach plans. Because concerns about the quantity of food often reflect the concerns of not eating too much, we hypothesize that women with a controlled regulation use predominately avoidance food planning.

Conceptually, the hypothesized positive link between autonomous regulation and approach food planning can also be explained. Autonomous regulation involves the decision to monitor one's eating behaviors because it reflects one's deep values, and interests, or it is useful for the individual. Thus, this well-thought decision may likely result in more approach planning, which is planning actions that will bring about healthy eating. In fact, autonomous regulation, in general, has been associated with consequences that suggest active involvement in an activity and a focus on the positive aspect, such as: creativity, enjoyment, deep-processing, information-seeking, enjoyment of challenges, persistence, and effort mobilization (Amabile and Gitomer 1984; Black and Deci 2000; Grolnick and Ryan 1987; Lee et al. 2003; Séguin et al. 1998).

A close examination of the definition of controlled regulation also supports the idea that it should be positively linked to avoidance planning. Controlled regulation for eating behaviors represents a regulation based on feelings of obligation and pressures (e.g., being thin, maintain self-esteem) instead of stable internal preferences and values (Koestner et al. 1996; Scherhorn and Grunert 1988). Given that controlled regulation lacks a sense of choice and a personal valuation of the regulation, it is not surprising that it has been linked with conflictual emotions, tensions, and vulnerability to persuasion (Koestner et al. 1996). Thus, women with a controlled regulation for eating behaviors may tend to use more avoidance planning in order to be less susceptible to adverse situational influences (e.g., tempting foods, situations when they tend to overeat).

#### Relation between planning and eating behaviors

Past findings support the hypothesis that different types of planning influence eating behaviors. A number of studies have found an association between meal planning and healthy eating behaviors. For example, Verplanken and Faes (1999) observed that participants, who were instructed to plan foods to be eaten at each meal for a chosen day in the week, reported having consumed more fruits and vegetables during the entire week. Similarly, Armitage (2004) examined the influence of detailed plans about how to eat a low-fat diet on dietary fat intake measured one month later. While controlling for motivation, this study observed a reduction in dietary fat intake only among participants who made plans. Parents who planned their meals in advance also reported eating more fruits and vegetables (Boutelle et al. 2003). Because meal planning is similar to approach plans in terms of their content and focus (they both specify

actions to be taken that allow advancement toward a goal), we propose that approach food plans are associated positively with healthy eating behaviors.

Although we could not find studies that have examined food plans that shared some characteristics with avoidance plans, we found several studies that have demonstrated the negative impact of food restriction. It has been long recognized that a common characteristic of eating pathology is avoidance of dietary fat (Drewnowski et al. 1988; Rock et al. 1996). Furthermore, food restriction and deprivation were found to cause eating disorders (McFarlane et al. 1999; Urbszat et al. 2002). Other studies have found that trying to ignore, and suppress bad foods leads to an intense preoccupation of these denied foods (Wegner et al. 1987). In sum, since restriction in diet was found to lead to negative outcomes, we propose that avoidance food planning is associated with eating concerns and bulimic symptoms.

#### The present studies

The main goal of the present research was to examine approach and avoidance planning as potential mediators responsible for the effect of regulation styles on eating behaviors. For this purpose, two studies were conducted. Study 1 was conducted to develop and provide initial validation of a scale designed to measure approach and avoidance food planning. Study 2 was designed to test a mediational model in which autonomous regulation would correlate positively with healthy eating behaviors and this significant relationship would at least be partially accounted for by differences in approach planning. We also tested a second mediational model in which controlled regulation would positively correlate with dysfunctional eating behaviors and this significant relationship would at least be partially accounted by differences in avoidance food planning.

#### Study 1

The goal of this study was to develop and provide a first validation of a new scale, namely the Planning of Eating Behaviors Scale (PEBS). The first step of this study consisted of generating items to measure the two proposed subscales of the PEBS, the approach food planning and the avoidance food planning subscales. Then Confirmatory Factor Analyses (CFAs) were performed to test the structure of the PEBS. It was hypothesized that responses to the PEBS could best be explained by two factors (subscales). Correlations between the two subscales and measures of well-being (vitality and subjective well-being) were examined in order to provide initial validation for the conceptualization of planning along the approach and avoidance dimensions. In line with past studies (Coats et al. 1996; Dickson and MacLeod 2004;

Elliot and Church 1997; Pelletier and Dion 2007), it was hypothesized that a weak positive correlation would exist between plans to approach food and well-being and a strong negative correlation would exist between plans to avoid food and well-being.

### Development of the PEBS

In a prior study, we instructed participants to list planning strategies for better eating (Koestner et al. in press). The development of items to represent approach food planning and avoidance food planning was partly based on these written responses given by participants. The development of items was also based on a brain storming session on planning of eating behaviors in which different researchers interested in health behaviors and self-regulatory strategies participated. Six items were generated for both approach and avoidance food planning for a total of 12 items.

## Method

### Participants and procedures

Participants were 250 women attending University of Ottawa (94% undergraduate students and 6% graduate students). Ages ranged from 17 to 46 years ( $M = 20.54$ ;  $SD = 3.37$ ). The average Body Mass Index (BMI;  $\text{kg}/\text{m}^2$ ), for a sub-sample of 237 participants who reported their weight and height, was  $22.37^1$  ( $SD = 3.58$ ; range 16.04–37.79).

Participants were recruited in the cafeteria of the University of Ottawa. The researcher approached individuals and small groups of people and introduced the purpose of the study. The study was described as an investigation of women's eating habits and their reasons for trying to regulate their eating behaviors. The questionnaire included the PEBS and a vitality measure, as well as some measures not relevant to this article. In order to limit the number of scales in the questionnaire, the well-being measure was added in the questionnaire only for a sub-sample of 167 participants.

### Measures

#### PEBS

The PEBS included 12 items divided equally in two subscales assessing approach and avoidance food planning.

<sup>1</sup> The BMI divides weight by height ( $[\text{weight (lbs)}/\text{height (in.)}^2] \times 703$ ). It serves as a valid measure of adiposity that is easy to use. The range of normal weight is situated at a BMI of 18.5–24.9. A BMI under 18.5 is considered underweight. A BMI of 25 and over is classified as overweight and a BMI of 30 and over is classified as obesity.

Participants indicated the extent they thought in advance about the activities described in the items on a scale ranging from 1 (“never”) to 7 (“always”). An example of items for the approach food planning subscale is “I think about the quality of food I will eat” and for the avoidance food planning subscale is “I think about the set of responses to be used when I encountered situations where I tend to overeat (i.e., parties, holidays)”. Cronbach alpha coefficient for the approach and avoidance subscales were respectively .82 and .84.

#### Vitality

The 7-item version of the vitality scale developed by Ryan and Frederick (1997) was used in this study. This scale measures the extent to which participants feel energetic, alert, and alive in general in their life. A sample item is “I feel alert and awake.” Participants indicated the extent they agreed with the different statements on a scale ranging from 1 (“Not at all true”) to 5 (“Very true”). The Cronbach alpha coefficient for this measure was .84.

#### Psychological well-being

Participants completed the short version of Psychological Well-being Scale (PWB; Keyes et al. 2002; Ryff and Keyes 1995), which measures six aspects of psychological well-being: self-acceptance, environmental mastery, positive relations with others, autonomy, purpose in life and personal growth (the alphas for the subscales range from .50 to .62). Examples of items are “I like most aspects of my personality” and “For me, life has been a continuous process of learning, changing, and growth”. Each subscale is assessed with 3 items, for a total of 18 items. Participants indicated their level of agreement with each statement on a scale ranging from 1 (Strongly disagree) to 6 (Strongly agree). Although the psychometric properties of the short version of the PWB may not be as good as the full version of the scale, Ryff and Keyes (1995) indicated that that the shortened scales correlated from .70 to .89, with the 20-item scales. The low reliabilities could limit the degree to which PWB scales correlate with other variables, however, as Keyes et al.'s (2002) findings and our own show, this has not occurred.

## Results

### Preliminary analyses

The data were screened in order to ensure compliance with the basic assumptions of multivariate analysis. Three cases displayed significant Mahalanobis' distances ( $\chi^2$  ( $df = 14$ ))

> 36.12,  $p < .001$ ) and these cases were deleted. Nine cases with missing data were also deleted. Thus, the final data set consisted of 241 participants. Descriptive statistics for all items (see Table 1) and the expected normal probability plots satisfied the assumption of normality. There was no evidence of multicollinearity or singularity, and the relations between the observed variables were linear.

Confirmatory factor analyses

The hypothesized 2-factor model was tested with CFA using maximum-likelihood estimation and the EQS 6.1 program. The fit indexes of the model revealed that the 2-factor model provided a marginal fit for the data ( $\chi^2$  (53,  $n = 241$ ) = 136.88,  $p < .001$ ; CFI = .91; RMSEA = .08 [.06–.10]; GFI = .91). Post hoc model modifications were performed to improve the fit of the model. The Lagrange multiplier test revealed that the inclusion of one error covariance (between the item “The quality of food I will eat” and the item “The variety of food I will eat”) in our two-factor model would lead to a large significant drop in  $\chi^2$ . Because this error covariance is likely representing non-random measurement error due to perceived redundancy in item content, the model was re-specified accordingly and provided an acceptable fit to the data, ( $\chi^2$  (52,  $n = 241$ ) = 112.56,  $p < .001$ ; CFI = .94; RMSEA = .07 [.05–.09]; GFI = .93). All factor loadings were significant (see Table 1). A moderate and positive correlation was observed between approach food planning and avoidance food planning ( $\beta = .45$ ;  $z = 4.35$ ). The internal consistency (alpha) for both subscales were satisfactory (approach:  $\alpha = .77$ ; avoidance:  $\alpha = .84$ ). An alternative single-factor was also tested,  $\chi^2$  (53,  $n = 241$ ) = 272.36,  $p < .001$ ; CFI = .78; GFI = .80; RMSEA = .13 [.12–.15]. This model provided a

significantly poorer fit than the hypothesized two factor solution;  $\chi^2_{df}(1) = 159.80$ ;  $p < .001$ .

Relationship between the PEBS subscales and well-being

As expected, (see Table 2) vitality was negatively related with the avoidance food planning subscale ( $-.22$ ,  $p < .01$ ), and positively related with the approach food planning subscale (.13,  $p < .05$ ,  $n = 238$ ). Further, the avoidance food planning subscale was found to associate negatively with a global score of PWB ( $-.22$ ,  $p < .05$ ), while the approach food planning subscale was not significantly related with a global score of PWB (.07,  $p > .05$ ).

Discussion

The results of Study 1 offer initial empirical support for the validity of the PEBS, and the measure of approach food planning and avoidance food planning. The PEBS subscales showed good item dispersion, adequate reliability, and hypothesized correlations with other constructs

**Table 2** Correlations between PEBS subscales and well-being scales: Study 1

	Approach food planning	Avoidance food planning
Vitality	.13*	-.22**
Psychological well-being	.07	-.22*

Note. \*\*  $p < .01$ ; \*  $p < .05$ ; Correlations with vitality are based on 238 participants. Correlations with psychological well-being scale are based on 165 participants

**Table 1** Descriptive statistics and confirmatory factor analysis loadings for the planning of eating behaviors items: Study 1

Item	<i>M</i>	<i>SD</i>	Skewness	Kurtosis	Factor loading
Easy and healthy meals to prepare when I anticipate a busy/stressful week	3.58	1.75	-.02	-1.05	<b>.61</b>
Which healthy restaurants I'll go	3.36	1.73	.11	-1.07	<b>.60</b>
New and healthy recipes I want to try	3.67	1.71	-.03	-.78	<b>.57</b>
The quality of food I will eat	4.71	1.44	-.76	.48	<b>.61</b>
The variety of food I will eat	4.41	1.50	-.49	.02	<b>.68</b>
New fruits and vegetables to introduce into meals	4.29	1.47	-.06	-.38	<b>.63</b>
Specific times when I refrained from eating	3.22	1.70	.31	-.70	[.53]
Strategies to avoid overeating/snacking when I get bored	3.61	1.71	.04	-.74	[.71]
Ways to avoid temptations	3.56	1.64	-.01	-.61	[.83]
Strategies to avoid succumbing to fattening food	3.73	1.64	.02	-.59	[.78]
Not looking at the dessert selection at restaurants	3.00	2.04	.67	-.91	[.60]
A set of responses to be used when I encountered situations where I tend to overeat (parties, holidays)	2.62	1.60	.67	-.52	[.64]

Note. Factor loadings for the approach subscale are in bold; Factor loadings for the avoidance subscale are in brackets

associated with individuals functional and well-being. The positive relation between the two types of planning may be attributable to the fact that whereas these two concepts differ in terms of their orientation, they both involve thinking about what to do in the future to attain healthy eating goals. The positive relation between approach and avoidance planning is similar to the reported relation between approach and avoidance achievement motivation (Elliot and Church 1997).

## Study 2: Testing the mediational models

Study 2 had two goals. The first goal was to replicate the 2-factor structure of the PEBS found in Study 1. The second goal consisted of testing two mediational models in which planning strategies would at least partially mediate the relationship between regulation of eating behaviors and the quality of eating behaviors. In the first model, we hypothesized that autonomous regulation for eating behaviors would associate significantly (positively) with approach planning strategies and non-significantly with avoidance strategies. This hypothesis is consistent with SDT theory assumptions that because autonomous regulation entails choosing willingly to engage in the activity, this should lead people to use more proactive strategies that direct behaviors toward positive stimuli (e.g., healthy food, healthy lifestyles). Finally, this model posited that by stipulating in advance what to do to achieve healthy eating, approach planning would in turn relate significantly (positively) to healthy eating behaviors and non-significantly to dysfunctional eating behaviors.

In the second mediational model, we hypothesized that because controlled regulation toward eating behaviors is based on feelings of obligation instead of true desires to control what to eat (Pelletier and Dion 2007), this regulation style would associate significantly (positively) with avoidance planning strategies as they reflect a mean of directing behaviors away from adverse situational influences (e.g., unhealthy food or situation when they tend to fail) and non-significantly with approach food planning. Avoidance planning would in turn relate significantly (positively) to dysfunctional behaviors (i.e., both bulimic symptoms and eating concerns) and non-significantly to healthy eating behaviors. Finally, we expected a small positive correlation between approach and avoidance planning.

## Method

### Participants

A total of 202 women attending University of Ottawa participated in Study 2. The age of the participants

ranged from 16 to 55 years ( $M = 20.49$ ,  $SD = 3.82$ ). The average Body Mass Index (BMI;  $\text{kg}/\text{m}^2$ ) was 22.59 ( $SD = 3.89$ ; range 15.95–39.93). Participants were recruited in the cafeteria using the same procedure described in Study 1.

### Measures

#### *Planning of eating behaviors*

Planning of eating behaviors was assessed using the PEBS developed in Study 1. The alpha coefficient for the approach food planning and the avoidance food planning subscales was .82, and .85, respectively.

#### *Regulation of eating behaviors*

The Regulation of Eating Behaviors Scale (REBS; Pelletier et al. 2004) measures the 5 different regulation styles proposed by the self-determination theory (Deci and Ryan 1985): intrinsic motivation, integrated regulation, identified regulation, introjected regulation, external regulation. The 5 subscales are composed of 4 items each, for a total of 20 items. Each item represents possible reasons why people might try to regulate their eating behaviors. Participants indicated the degree to which the proposed reasons corresponded to their reasons on a scale ranging from 1 (Does not correspond at all) to 7 (Corresponds exactly). Pelletier et al. (2004) present evidence of reliability, construct and external validity of the REBS. For this study's purpose, an autonomous regulation variable was computed by adding the intrinsic motivation, integrated regulation, and identified regulation subscales (12 items,  $a = .89$ ). A controlled regulation variable was also computed by adding the introjected regulation, and the external regulation subscales (8 items,  $a = .82$ ).

#### *Healthy eating habits*

The Healthy Eating Habits Scale (Pelletier et al. 2004) measures participants' food choices according to the recommendations made by the Canada's Food Guide. This 8 item-scale has two subscales (healthy foods and foods that should be eaten with moderation), each with 4 items. For this study's purpose, we used the four items of the healthy food subscale "I eat vegetables, fruits, and grain products"; "I eat foods that are low in fat, saturated fat, and cholesterol"; "I eat a variety of foods from each of the four groups recommended by the Canadian Food Guide (cereals, fruits, and vegetables, milk products, and meats and substitutes)"; and "I drink water". Participants indicated the extent to which they ate the different foods described in the items on a scale ranging from 1 ("Not at all") to 5

(“All the time”). The scale has been used successfully in prior research (Pelletier et al. 2004). The alpha coefficient for this measure was .75.

*Bulimic symptoms*

Participants completed the Revised Bulimia Test (BULIT-R) (Thelen et al. 1991). The BULIT-R is composed of 28-items based on the DSM-III-R criteria for bulimia and is useful for identifying people who are most likely to receive a diagnosis of bulimia on the basis of a clinical interview. Participants scoring 104 and above are likely to be diagnosed as bulimic in an interview in clinical settings (Thelen et al. 1991). Participants were presented five statements following each item and they were asked to choose the one that applies best to them. Representative examples are: “There are times I rapidly eat a very large amount of food”; and “I use laxatives or suppositories to help control my weight”. The scale has been shown to have high internal consistency ( $\alpha = .97$ ), good test–retest reliability ( $r = .95$ ), to discriminate well between bulimics and non-bulimics, and to correlate well with other measures of eating pathology (Thelen et al. 1991). The alpha coefficient for this measure was .92.

*Eating concerns*

We used 5 items from the eating concerns subscale of The Eating Disorder Examination-Self Report Questionnaire (EDE-Q; Fairburn and Beglin 1994): the *weight fluctuation* item (“Would a weight fluctuation of 5 lbs. affect the way you live your life?”), the *splurge alone* item (“Do you eat sensibly in front of others and splurge alone?”), the *food thoughts* item (“Do you give too much time and thought to food”), the *guilt after overeating* item (Do you have feelings of guilt after overeating?), and the *fear of losing control* item (“Do you fear loss of control over eating?”). Participants were asked to circle one of the 4 answers (1: Never; 2: Rarely; 3: Often; 4: Always). The alpha coefficient for this measure was .83.

**Results**

Descriptive statistics

Table 3 presents the descriptive statistics for the main variables in this study. In average, participants reported that autonomous motivation ( $M = 4.44$ ) corresponded the most with their reasons for regulating their eating behaviors. Controlled regulation ( $M = 2.64$ ) did not very much correspond to the reasons why they are regulating their eating behaviors. In general, participants reported a higher level of approach food planning ( $M = 3.96$ ) than avoidance food planning ( $M = 3.33$ ). Participants generally reported that they often eat according to the Canada’s Food Guide ( $M = 3.68$ ). Participants’ mean score on eating concerns fell in the middle of the 4-point scale ( $M = 2.09$ ). Participants’ bulimia score ranged from 33 to 105 ( $M = 56.33$ ,  $SD = 17.52$ ). Two participants (1%) met the BULIT-R criteria for bulimia (score of 104 or higher).

Table 3 also presents all zero-order correlations among the measured variables. In line with our hypotheses, autonomous regulation correlated positively with approach food planning while controlled regulation correlated positively with avoidance food planning. However, autonomous regulation correlated positively, but less substantially, with avoidance food planning. Similarly, controlled regulation correlated positively, but less substantially, with approach food planning. Again, as expected, autonomous regulation and approach food planning both correlated positively with healthy food choices. Conversely, controlled regulation and avoidance food planning both correlated positively with dysfunctional eating behaviors (i.e., eating concerns and bulimia symptoms). An unexpected finding is that avoidance food planning also correlated positively, but less strongly, with healthy eating.

Confirmatory factor analysis

The hypothesized 2-factor model was tested with CFA a second time using maximum-likelihood estimation and the

**Table 3** Descriptive statistics and correlations among variables: Study 2 ( $N = 198$ )

Construct	<i>M</i>	<i>SD</i>	Skewness	Kurtosis	Range	2.	3.	4.	5.	6.	7.
1. Autonomous regulation	4.44	1.08	−.66	.96	1/7	.10	.63**	.30**	.53**	.05	−.13
2. Controlled regulation	2.64	1.10	.82	.54	1/7		.19**	.46**	−.07	.57**	.52**
3. Approach planning	3.96	1.12	−.20	−.14	1/7			.44**	.54**	.13	−.09
4. Avoidance planning	3.33	1.27	.18	−.30	1/7				.31**	.59**	.38**
5. Healthy food choices	3.68	.80	−.32	−.53	1/5					.04	−.15*
6. Eating concerns	2.09	.72	.40	−.43	1/4						.79**
7. Bulimia symptoms	2.02	.64	.91	−.13	1/5						

EQS 6.1 program. Once again, the fit indexes of the model revealed that the 2-factor model provided a marginal fit for the data ( $\chi^2$  (53,  $n = 199$ ) = 119.36,  $p < .001$ ; CFI = .93; RMSEA = .08 [.06–.098]; GFI = .90). The Lagrange multiplier test revealed that the inclusion of the same error covariance (between the item “The quality of food I will eat” and the item “The variety of food I will eat”) would lead to a large significant drop in  $\chi^2$ . The model was re-specified accordingly and provided an acceptable fit to the data, ( $\chi^2$  (52,  $n = 199$ ) = 107.03,  $p < .001$ ; CFI = .94; RMSEA = .07 [.05–.09]; GFI = .92). All factor loadings were significant and of the same magnitude as those observed for the CFA performed in Study 1. Overall, these results offer strong support for the stability of PEBS’ factor structure.

### Mediation analyses

To test for the two mediational models, we followed the procedure proposed by Kenny and his colleagues as well as their method for testing the significance of the mediating variable effect (Kenny et al. 1998).<sup>2</sup> The first mediational model tested whether approach food planning mediated the effect of autonomous regulation on healthy eating behaviors (Table 4, model 1a).<sup>3</sup> Given that the above correlations have established that avoidance planning was correlated with both autonomous regulation and healthy eating behaviors, it was appropriate to test avoidance planning as another potential mediator (Table 4, model 1b). For step 1, the regression showed that autonomous regulation was a significant predictor of healthy food choices,  $F(1, 199) = 80.58$ ,  $p < .001$  ( $\beta = .54$ ). In terms of the second step, autonomous regulation predicted approach food planning,  $F(1, 200) = 121.64$ ,  $p < .001$  ( $\beta = .62$ ) and avoidance food planning,  $F(1, 200) = 20.06$ ,  $p < .001$  ( $\beta = .30$ ). In the third step, we regressed simultaneously healthy eating behaviors on approach food planning and autonomous regulation  $F(2, 198) = 53.35$ ,  $p < .001$ . Approach food planning had a significant effect on healthy food choices ( $\beta = .32$ ), and the effect of autonomous regulation ( $\beta = .34$ ) on healthy food choices was significantly reduced ( $z = 4.05$ , CI [0.07–0.21]). Regressing healthy eating behaviors on both avoidance food planning and autonomous regulation, showed that there is a significant relation between

avoidance food planning and healthy food choices,  $F(2, 198) = 44.74$ ,  $p < .001$  ( $\beta = .16$ ) and a significant but weaker relation between autonomous regulation ( $\beta = .49$ ) and healthy food choices. The indirect effect of autonomous regulation (via avoidance food planning) on healthy food choices differed from zero ( $z = 2.13$ , CI [0.00–0.07]). The mediational analysis, therefore, establishes approach food planning and avoidance food planning as partial mediators of the relationship between autonomous regulation and healthy food choices. Overall, mediational model 1a and 1b accounted for 34% and 30% of the variance in healthy food choices respectively.

The second mediational model tested whether avoidance food planning could account for the effect of controlled regulation on dysfunctional eating behaviors. First we use bulimic symptoms (Table 5, model 2a) as an indicator of dysfunctional eating behaviors then we use food concerns (Table 5, model 2b). In model 2a (first step), there was a significant relation between controlled regulation and bulimic symptoms,  $F(1, 200) = 65.81$ ,  $p < .001$  ( $\beta = .50$ ). With respect to step 2, there was also a significant relation between controlled regulation and avoidance food planning,  $F(1, 200) = 57.35$ ,  $p < .001$  ( $\beta = .47$ ).

For step 3, a model that regressed bulimic symptoms simultaneously on controlled regulation and avoidance food planning, indicated a significant relation between avoidance food planning and bulimic symptoms,  $F(2, 199) = 35.95$ ,  $p < .05$  ( $\beta = .15$ ). However, this last result showed that the relationship between controlled regulation and bulimic symptoms is not significantly weaker when we control for the effect of avoidance food planning ( $\beta = .43$ ),  $z = 1.92$ , CI [0.02–0.14]. Thus, these analyses do not support the hypothesis that avoidance food planning is a partial mediator between controlled regulation and bulimic symptoms.

The same model was tested with food concerns. In step 1, a significant relation was found between controlled regulation and food concerns,  $F(1, 197) = 95.38$ ,  $p < .001$  ( $\beta = .57$ ). In step 2, a regression showed a significant relation between avoidance food planning and controlled regulation,  $F(1, 197) = 57.35$ ,  $p < .001$  ( $\beta = .47$ ). In step 3, a regression that tested the relation between controlled regulation and food concerns while controlling for avoidance food planning revealed a significant path between avoidance food planning and food concerns,  $F(2, 196) = 74.19$ ,  $p < .001$  ( $\beta = .36$ ). The impact of controlled regulation on food concerns was also reduced ( $\beta = .40$ ). A test of mediation confirmed that this reduction was significant ( $z = 4.34$ , CI [0.11–0.23]). Therefore, we concluded that avoidance food planning was a partial mediator of the relation between controlled regulation and food concerns. Overall, the mediational model accounted for 45% of the variance in eating concerns.

<sup>2</sup> Kenny et al.’s (1998) method consists of dividing the product of path a (link between the predictor and the mediator) and path b (link between the mediator and the outcome) by a standard error term, using this formula:  $a \times b / \sqrt{b^2sa^2 + a^2sb^2 + sa^2sb^2}$ , where  $a$  and  $b$  are unstandardized regression coefficients of  $a$  and  $b$  and  $sa$  and  $sb$  are their standard errors. If the resulting  $z$  score of the mediated effect is greater than 1.96, then the effect is significant at the .05 level.

<sup>3</sup> Mediational analyses were done on complete cases only.

**Table 4** Mediation of the relationship between autonomous regulation and healthy eating behaviors by approach and avoidance food planning: Study 2

Variables	<i>B</i>	SE <i>B</i>	95% CI <sup>a</sup>	$\beta$	Mediation test <sup>b</sup>
<i>(1a) Healthy eating behaviors</i>					
Step 1					
Outcome: Healthy eating behaviors					
Predictor: Autonomous regulation	.39	.04	.31/.48	.54**	
Step 2					
Outcome: Approach planning					
Predictor: Autonomous regulation	.64	.06	.52/.75	.62**	
Step 3					
Outcome: Health eating behaviors					
Predictor: Autonomous regulation	.25	.05	.15/.36	.34**	4.05**
Mediator: Approach planning	.22	.05	.12/.33	.32**	
<i>(1b) Healthy eating behaviors</i>					
Step 1					
Outcome: Healthy eating behaviors					
Predictor: Autonomous regulation	.39	.04	.31/.48	.54**	
Step 2					
Outcome: Avoidance					
Predictor: Autonomous regulation	.35	.08	.20/.51	.30**	
Step 3					
Outcome: Healthy eating behaviors					
Predictor: Autonomous regulation	.36	.05	.27/.45	.49**	2.13*
Mediator: Avoidance planning	.10	.04	.02/.18	.16*	

<sup>a</sup> 95% CI = 95% confidence interval

<sup>b</sup> Mediation test gives a *z* score of the mediated effect; *z* > 1.96, *p* = .05

Note. *B* = unstandardized regression; SE *B* = Standard error;  $\beta$  = Standardized regression

\*\* *p* < .01; \* *p* < 0.05

**Table 5** Mediation of the relationship between controlled regulation and dysfunctional eating behaviors by avoidance food planning: Study 2

Variables	<i>B</i>	SE <i>B</i>	95% CI	$\beta$	Mediation test <sup>b</sup>
<i>(2a) Bulimic symptoms</i>					
Step 1					
Outcome: Bulimic Symptoms					
Predictor: Controlled regulation	.29	.04	.22/.36	.50**	
Step 2					
Outcome: Avoidance planning					
Predictor: Controlled regulation	.55	.07	.40/.69	.47**	
Step 3					
Outcome: Bulimic Symptoms					
Predictor: Controlled regulation	.25	.04	.17/.33	.43**	1.92
Mediator: Avoidance planning	.08	.04	.08/.14	.15*	
<i>(2b) Food concerns</i>					
Step 1					
Outcome: Food concerns					
Predictor: Controlled regulation	.38	.04	.30/.45	.57**	
Step 2					
Outcome: Avoidance planning					
Predictor: Controlled regulation	.55	.07	.40/.69	.47**	
Step 3					
Outcome: Food concerns					
Predictor: Controlled regulation	.26	.04	.19/.34	.40**	4.34**
Mediator: Avoidance planning	.21	.04	.14/.28	.36**	

<sup>a</sup> 95% CI = 95% confidence interval

<sup>b</sup> Mediation test gives a *z* score of the mediated effect; *z* > 1.96, *p* = 0.05

Note. *B* = unstandardized regression; SE *B* = Standard error;  $\beta$  = Standardized regression

\*\* *p* < .01; \* *p* < 0.05

## Discussion

Correlational analyses in Study 2 provided interesting results regarding the relations between regulation styles, food planning, and eating behaviors. First, we found that women with an autonomous regulation for eating behaviors are more likely to engage in approach food planning and that women with a controlled regulation are more likely to engage in avoidance food planning. Of interest, we found a positive and small relation between autonomous regulation and avoidance food planning. This finding suggests that even if women with an autonomous regulation engage more often in approach food planning, they also engage in avoidance food planning.

Second, we found that approach food planning is linked to healthy eating behaviors while avoidance food planning is linked to dysfunctional eating behaviors. Interestingly, our results revealed that avoidance food planning is also linked to healthy eating behaviors. This finding can be explained by Carver and Scheier's (1998) work on approach and avoidance goals. According to Carver and Scheier, avoidance goals on their own are less functional because they lead individuals moving away endlessly from their goal while not knowing in which direction they should move or what they want to attain. However, when avoidance goals are constrained by approach goals they can be adaptive and functional. Approach goals provide a positive value that guides the self-regulation in a precise direction. Thus, avoidance food planning may lead to healthy food choices if they are used simultaneously with approach food planning. Future studies could examine if using both approach food planning and avoidance food planning is better than using only approach food planning.

Finally and most importantly, regression analyses in Study 2 provided support for the two proposed mediational models. More specifically, we found that approach food planning partially accounted for the relationship between autonomous regulation and healthy eating behaviors. We also found that avoidance food planning partially accounted for the relationship between controlled regulation and dysfunctional eating behaviors (bulimic symptoms and eating concerns). In this last model, we found that avoidance food planning was a more powerful mediator of the relationship between controlled regulation and eating concerns than of the relationship between controlled regulation and bulimic symptoms.

One possible reason for this pattern of results is that these measures assess dysfunctional eating behaviors at different levels of severity. The measure of bulimic symptoms assesses the presence of bulimic symptoms (e.g., episodes of binge eating, the use of inappropriate compensatory methods to prevent weight gain) while eating concerns reflect warning signs that a woman may be at risk

for developing an eating disorder. Therefore, avoidance food planning seems more relevant to account for the effects of controlled regulation on the onset of dysfunctional eating patterns than on the development of more severe eating disorders.

## General discussion

The main goal of this research was to examine how food planning affects the relation between regulation styles and eating behaviors. Past studies (Pelletier et al. 2004; Pelletier and Dion 2007; Williams et al. 1996) have consistently shown that autonomous regulation for eating behaviors is associated with the adoption of healthy eating behaviors and that controlled regulation for eating behaviors is associated with the development of dysfunctional eating behaviors. We posited that approach food planning could account for the effect of autonomous regulation on healthy eating behaviors. We also proposed that avoidance food planning could explain the effect of controlled regulation on dysfunctional eating behaviors. A related goal of this research was to conceptualize approach and avoidance food planning and to develop a new scale to measure these concepts (the PEBS).

### The PEBS

Confirmatory factor analyses performed on the PEBS provided initial evidence for the existence of two distinct types of food planning. It seems like individuals can plan their eating behaviors by either thinking about what to do in order to achieve their goal (approach food planning) or thinking about ways to avoid engaging in actions inconsistent with their goal (avoidance food planning). Although our study suggests that it is the preponderance of one type of plans over the other that is important, the substantial correlation ( $\beta = .44$ ) between approach food planning and avoidance food planning suggests that participants use both types of food planning. Finally, we recognize that the findings on the PEBS' validity are preliminary in nature. It would be important for future studies to provide further evidence for the construct validity of the PEBS, as well as demonstrating that the PEBS subscales are reliable predictors of eating behaviors. In addition, the temporal stability of PEBS remains to be examined.

### Test of the proposed mediational models

We found supportive evidence for the two proposed mediational models. First, our data were consistent with the model postulating that autonomous regulation for eating behaviors is associated with greater use of approach food

planning which subsequently is associated with the development of healthy eating behaviors. Second, our data was also consistent with the model postulating that controlled regulation for eating behaviors is associated with greater use of avoidance food plans, which, in turn, is associated with the development of eating concerns. Because, for both regression models, we found that the direct path between the regulation styles and eating behaviors remained significant, we can suggest that food planning variables represent partial mediators of these regulation styles-eating behaviors relations. Therefore, we conclude that regulation styles influence eating behaviors directly, as well as indirectly, by their effects on food planning. Thus, this finding underlines once more that successful regulation requires both motivation to drive individuals to self-regulate and the elaboration of strategies in order to translate that motivation into purposeful actions for affecting their behaviors and the outcomes of the self-regulation (Corno 1992; Khul 1985; Slovinec-D'Angelo et al. 2007).

Partial mediation often suggests multiple mediating factors. Food planning may represent only one route by which regulation styles influence the development of different eating patterns. The inclusion of additional mediating variables may provide a better understanding of the process by which regulation styles affect eating behaviors. In fact, several theories propose that self-regulation is a controlled and effortful process that requires the use of many self-regulatory strategies (Baumeister et al. 1994). Future research might examine different types of monitoring strategies as potential mediators of the relationship between regulation styles and eating behaviors. For example, women with an autonomous regulation may be more successful at the regulation of their eating behaviors because they use more process-focused strategies, such as keeping food records, trying to become more aware of satiety and hunger signals, and seeking information. By contrast, women with controlled regulation may fail more at the regulation of eating behaviors because they use more outcome-focused strategies, including weighing oneself, or imagining positive and negative consequences of eating behaviors (be thin vs. shortened life). Consistent with this line of reasoning, Patrick et al. (2004) found that autonomously motivated individuals used more weight loss strategies focused on the process of changing one's lifestyle (e.g., change eating habits; start exercise) and controlled motivated individuals used more weight loss strategies focused on quickly seeing results (e.g., diet supplements; weight-loss programs).

#### Implications for interventions

An investigation of the process through which regulation styles affect the outcomes of the regulation of eating

behaviors is important for developing interventions. To date, studies suggest that one way to improve eating behaviors is to increase patients' autonomous regulation for eating behaviors through supporting their autonomy (Bellg 2003; Williams et al. 1996). It was also suggested that interventions aimed at promoting autonomous regulation of eating behaviors may imply making women more aware of the reasons why they want to regulate their eating behaviors and encouraging them to reflect on these reasons (Pelletier and Dion 2007; Stice et al. 2005). The identification of food planning as a mediator that can be changed suggests another mean through which we could intervene to increase women's success at the regulation of eating behaviors.

The mediational analyses in this research suggest that an intervention designed to teach women how to plan their eating behaviors in an approach manner could complement the recommended interventions based on increasing self-determination. Teaching women to think about what they will eat in terms of what they want to achieve is consistent with an emerging trend toward favoring approach-based strategies in treatment programs. Indeed, approach-oriented treatment programs for sexual offenders and alcohol abusers have been found to have advantages, such as greater engagement in treatment, over more traditional approaches focusing on avoiding and controlling risks (Cox et al. 1991; Mann et al. 2004).

#### Limitations

The current findings are limited by a number of factors. First, our data are correlational, so one must be careful about drawing causal inferences. We have to acknowledge the possibility that the data could fit an alternate model. For example, it is possible that women with bulimic symptoms tend to regulate their eating behaviors because they feel they have to in order to prevent further episodes of binge eating. This controlled regulation leads to planning with an emphasis on avoiding specific foods that trigger binge eating or on avoiding eating large portions. To obtain more solid evidence of the proposed sequence, future studies could examine the proposed relationship with a longitudinal design. Second, there is also the possibility that omitted variables could explain both planning and eating behaviors. To that effect, future studies should control for potential confounding variables such as body dissatisfaction, social desirability, and dieting. A third limitation is that our studies have used samples of women students. Therefore, it would be important to examine if the results observed in our studies generalize to a general population of women and possibly to men.

Notwithstanding these concerns, our research has important theoretical and practical implications. This

research suggests that approach food planning should be favored over avoidance food planning. Further, this research established these different orientations in food planning as one of the mechanisms that accounts for the effect of regulations styles for eating behaviors on the development of healthy eating behaviors vs. dysfunctional eating behaviors.

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