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PAPER

Do 6-y changes in eating behaviors predict changes in body weight? Results from the Québec Family Study

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OBJECTIVE: This study was performed to examine changes in eating behaviors as assessed by the three-factor eating questionnaire (TFEQ) and to quantify the potential associations between these eating behaviors and body weight changes in a 6-follow-up study.
DESIGN AND SUBJECTS: Prospective study performed in men and women who were tested twice (Visit 1 = 1989–1995 and Visit 2 = 6 y later) in the Québec Family Study (QFS).
RESULTS: Women were more restrained and less hungry than men. To reduce food intake, women relied more on strategic dieting behavior and avoided more fattening food. However, they had higher emotional and situational susceptibility to eat than men. Significant decreases in the disinhibition score were noted over time in women ($P<0.01$), which resulted from a decrease in habitual susceptibility behavior to increase food intake. In men, we observed an increase in the avoidance of fattening food ($P<0.05$). In both genders, we found that the 6-y change in restraint behavior was negatively correlated with body weight changes ($P<0.05$). In women, a high restraint behavior seems to promote weight gain, whereas in men, it is associated with the opposite trend.
CONCLUSION: These results suggest that variables reflecting some eating behaviors are associated with body weight changes in a free-living context. However, these behaviors are expressed differently between men and women. These behaviors should be considered in clinical interventions for individuals seeking a better body weight control.
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Keywords: three-factor eating questionnaire; restraint; disinhibition; hunger; eating behaviors; weight changes

Introduction

The prevalence of obesity has increased considerably in many countries over the last decade, and eating behaviors could be important factors involved in this phenomenon. Intentional suppression of food intake (restraint) has been associated with lower total energy intake,[1–4] lower body weight,[5] lower body mass index (BMI),[6,7] and lower energy expenditure.[8] Surprisingly, restraint has also been associated with an increase in energy intake in distress or stressful conditions.[9–11] On the other hand, poor eating control in response to specific internal and external stimuli (high disinhibition) has been associated with higher energy intake,[4,12] more frequent episodes of overeating,[13] higher BMI,[4,7] frequent weight cycling, blunted thermic effect of food, and reduced physical activity level.[13] Since all these associations were observed in cross-sectional studies, it is difficult to define a specific eating behavior profile that could predict long-term weight change.

The few studies having investigated this issue longitudinally were performed in the context of weight loss programs[14–22] or of a community weight gain prevention trial,[5] and most of them failed to observe any significant relation between initial eating behavior and subsequent weight change. However, these studies showed that an increase in restraint behavior and/or a decrease in disinhibition behavior was related to weight loss[5,14–21] and to a better weight maintenance over time.[22] In addition, high restraint behavior combined with a reduced fat diet resulted in weight reduction over 6-month, whereas restraint behavior prevented weight gained when combined with a full fat diet.[23] Only one study, a retrospective study, investigating the impact of eating behaviors on body weight changes has been performed in a free-living context.[24] This study showed that higher disinhibition behavior measured in women aged

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55–65 y was associated with greater reported adult weight gain. Thus, more data are needed on the potential associations between indices of eating behaviors and body weight changes over time in individuals who are not involved in weight-loss programs or dietary manipulations. This is an issue that represented a major preoccupation in the present study.

The majority of prospective studies investigating eating behaviors assessed only cognitive restraint, disinhibition, and hunger with the use of the Three-Factor Eating Questionnaire (TFEQ).[12] However, it is possible to measure other aspects of eating behavior with the TFEQ in order to explore a more complex picture of eating behavior that could contribute to body weight gain.[6,25] Up to now, no prospective study has used these TFEQ subscales to better characterize factors potentially involved in body weight gain over time. This study was therefore performed to examine changes in TFEQ eating behaviors over a 6-y period and to characterize the associations between these eating behaviors and body weight gain in a free-living context.

Subjects and methods

Subject characteristics

The subjects tested in this study were participants in the Québec Family Study (QFS), which is a much larger longitudinal study including three phases: Phase 1: 1980–1982; Phase 2: 1989–1995, and Phase 3: 1997–2001. Since the TFEQ has been included in the QFS only at the end of the second phase, only a small sample of the QFS participants could be selected for this study. Accordingly, the study sample included 30 men and 45 women (parents and/or children over 18 y of age) who completed for the first time the TFEQ in the QFS between 1989 and 1995 (Visit 1). The same subjects were recalled 6 y later (means $\pm$ s.d. $= 5.7 \pm 0.1$) for follow-up measurements of the QFS. The protocol of this study was approved by the Laval University Ethics Committee.

Measurements at Visits 1 and 2

Body mass was taken with a standard beam scale with no shoes. Waist circumference was measured with a standard tape according to the procedures of the Airlie Conference.[26] Body density was determined by the underwater weighing technique. The Siri formula[27] was used to estimate the percentage of body fat from body density, and fat-free mass was estimated from the derived percentage of body fat and total body weight.

Food intake was assessed by a 3-day dietary record,[28] which was completed during 2 week days and 1 week-end day. The diary was explained and reviewed by the study nutritionist during an interview with the subject. Food composition of the diet was estimated with a computerized version of the Canadian Nutrient File.[29] Daily energy expenditure was determined by a 3-day physical activity diary as previously described.[30]

Eating behavior measurements

All participants completed the TFEQ[12] as validated for the French population[31] in the first visit (1989–1995) and a second time 6 y later. Each item of the TFEQ (51 items) was scored as 0 or 1. The sum of points on 51 items were then aggregated into three scales: (1) 'dietary restraint', which measures the actual restrictive eating as well as the intention to restrain eating, (2) 'disinhibition', which measures how easily external factors, that is, environmental events and emotional reactions, disinhibit the control of eating, and (3) 'hunger', which measures the ability to cope with the sensation of hunger. This questionnaire has been shown to have good reliability and validity.[1,12]

We also calculated the score of two subscales of the TFEQ restraint behavior:[6] (1) 'flexible control', which is associated with a gradual approach to eating, dieting, and weight control in which fattening foods are eaten in little quantities without guilt, and (2) 'rigid control', which is an all-or-nothing approach to eating, dieting, and weight control.

Finally, we considered the eight TFEQ subscales described by Bond *et al*[25]: *TFEQ-restraint subscale*: (1) 'strategic dieting behavior', (2) 'attitude to self-regulation', (3) 'avoidance of fattening foods'; *TFEQ-disinhibition subscales*: (4) 'habitual susceptibility', (5) 'emotional susceptibility', (6) 'situational susceptibility'; and the *TFEQ-Hunger subscales*: (7) 'internal locus for hunger', (8) 'external locus for hunger'. Even though the range of values possible for some of these subscales is maybe too small to produce behaviorally significant data (maximal subscale values range from 3 for the 'emotional susceptibility to disinhibition' to 6 for both hunger scales), the investigation of these subscales is relevant since they permit to explore (not identify) a more complex picture of eating behavior than that provided by the original scale. At Visit 2, the participants were also invited to answer one more question regarding dieting behavior during the last 5 y. (Have you been on a diet over the past 5 y?)

Statistical analyses

All statistical analyses were separately performed for each sex because of the interaction of measured variables with gender. Eating behavior scores that included unanswered questions were corrected for the specific eating behavior total score. Eating behaviors Visit 1–Visit 2 correlations were also computed. A paired Student's *t*-test was used to detect differences between Visit 1 and Visit 2 characteristics, and changes over time. Partial correlations (adjusted for age and body weight at Visit 1) were also performed to evaluate the association between the TFEQ variables (Visit 1 and 6-y changes eating behaviors) and body weight changes over time (6-y change in weight = weight at Visit 2− weight at Visit 1). Stepwise multiple regression analyses (with a probability of 0.05) were also used to examine the contribution of eating behaviors to body weight variations.

In order to further examine eating behaviors implicated in long-term weight gain, we identified two groups (lower and

upper half for each behavior) of restraint and disinhibition behaviors in men and women measured at Visit 1: low restraint score (3.3±0.4 and 3.9±0.5, respectively), high restraint score (7.8±0.4 and 11.8±0.5, respectively), low disinhibition score (3.0±0.7 and 3.4±0.4, respectively), high disinhibition score (9.5±0.7 and 9.5±0.4, respectively). Body weight, energy intake, and energy expenditure changes over time were compared between the low and the high restraint or disinhibition groups. An ANCOVA adjusting for age at Visit 1 and corresponding baseline morphological characteristics was performed to detect body weight, energy intake and expenditure changes differences between the low *vs* the high restraint or disinhibition score groups. All values are expressed as a mean±s.e. and differences were considered significant at $P<0.05$. All analyses were performed using Jump Software 3.1.6.2 from SAS Institute Inc. (Cary, NC, USA).

Results

Subjects' characteristics

Body weight, BMI, percent body fat, fat mass, and waist circumference were significantly increased in women over the 6 y follow-up period elapsing between the two visits in the laboratory (Table 1). The same tendency was observed in men, but it did not reach statistical significance (Table 1).

Eating behavior differences between men and women

Women were more restrained than men but this was significant only for the first visit. The higher restraint behavior in women was associated with a higher strategic dieting behavior (Visit 1 only) and a higher avoidance of fattening foods (Table 2). Women were more influenced by emotional reactions than men (Visit 1 only), and were less affected by situational susceptibility to overeat than men. Moreover, we observed that men were significantly more influenced by the sensation of hunger to eat than women (Table 2).

Eating behavior changes over time

A significant decrease in the disinhibition score was noted over time in women ($P<0.01$) (Table 2). The decrease in disinhibition in women was associated with a decrease in the habitual susceptibility TFEQ subscale. In men, we observed a tendency to increase the restraint behavior over time, which was explained by a significant increase in the avoidance of fattening foods with time. In general, the other TFEQ subscales scores remained stable over time (Table 2).

The Visit 1–Visit 2 correlations for the three main factors of the TFEQ were positive and significant in both men and women, suggesting stability of these scores over time ($0.90\geq r\geq 0.31$, $P\leq 0.05$). Most of the Visit 1–Visit 2 correlations for the TFEQ subscales were positive and significant ($0.85\geq r\geq 0.30$, $P\leq 0.05$) except for the rigid control which almost reached significance in women ($P<0.06$) and the avoidance of fattening foods (Table 2).

Intercorrelations among eating behaviors

At Visit 1, there was a negative relation between restraint behavior and hunger scores in men ($r=0.46$, $P<0.05$) and women ($r=0.32$, $P<0.05$). At Visit 2, rigid control was positively associated with disinhibition in men ($r=0.45$, $P<0.01$) and women ($r=0.29$, $P<0.05$), whereas flexible control was found to be negatively correlated with disinhibition in men only ($r=0.36$, $P<0.05$) and with hunger score in men (0.46, $P<0.01$) and women ($r=0.29$, $P<0.05$). Disinhibition and hunger factors were highly positively correlated in men and women at both visits ($0.81>r>0.51$; $P<0.0001$), with an exception for women at Visit 2 ($P=0.1$).

We also found some intercorrelations among the changes in eating behaviors. First, we observed a negative relation between the changes in restraint behavior and the changes in the susceptibility to hunger in women ($r=0.46$, $P<0.01$) and men ($r=0.35$, $P<0.06$). Finally, the change in rigid control was positively associated with the change in disinhibition in women only ($r=0.30$, $P<0.05$).

Eating behaviors and 6-y body weight changes

Since eating behaviors and body weight changed over time, correlations between 6-y eating behavior and body weight changes were determined. In both genders, 6-y restraint and flexible control behavior changes were negatively associated

Table 1 Characteristics[a] of the subjects at the first (1989–1995) and second visit (6 y later) ($n=45$ for women and $n=30$ for men)

	Women		*Men*	
	Visit 1	*Visit 2*	*Visit 1*	*Visit 2*
Age (y)	38.0±2.0	43.6±2.0**	44.2±2.6	49.9±2.6**
BMI (kg/m^2)	28.3±1.1	29.3±1.1**	29.7±1.3	30.4±1.5
Percentage fat (%)[b]	32.2±1.6	34.1±1.7*	24.2±1.8	25.2±2.0
Waist Circ. (cm)[c]	86.3±2.5	89.7±2.6**	98.8±3.2	100.9±3.9

*$P<0.05$, **$P<0.01$ significantly different from the Visit 2 (paired Student's *t*-test).
[a]Means±s.e.
[b] $N=33$ for women and $n=24$ for men.
[c]Waist circumference.

Table 2 TFEQ score difference[a] between men and women, TFEQ changes over time[b] and correlations [c] between TFEQ scores obtained at Visit 1 and 2

TFEQ variables (range score)	*Women (n = 45)*			*Men (n = 30)*		
	Visit 1	*Visit 2*	*Visit 1/Visit 2 correlation*	*Visit 1*	*Visit 2*	*Visit 1/Visit 2 correlation*
Restraint (0–21)	7.8 ± 0.7	7.8 ± 0.7	0.31*	5.6 ± 0.5†	6.8 ± 0.9	0.37*
Flexible control (0–6)	2.8 ± 0.3	2.8 ± 0.3	0.32*	2.1 ± 0.2	2.6 ± 0.4	0.31
Rigid control (0–6)	2.0 ± 0.2	2.2 ± 0.3	0.28	1.3 ± 0.2	1.7 ± 0.3	0.27
Strategic dieting behavior (0–4)	1.0 ± 0.2	0.9 ± 0.2	0.30*	0.5 ± 0.1†	1.0 ± 0.2	0.21
Attitude to self-regulation (0–5)	2.2 ± 0.2	2.0 ± 0.2	0.45**	1.8 ± 0.2	1.9 ± 0.3	0.49**
Avoidance of fattening foods (0–4)	1.8 ± 0.2	2.1 ± 0.2	0.26	1.1 ± 0.1††	1.7 ± 0.2*†	0.05
Disinhibition (0–16)	6.5 ± 0.5	5.5 ± 0.5**	0.67**	6.2 ± 0.8	6.0 ± 0.7	0.90**
Habitual susceptibility (0–5)	1.4 ± 0.2	1.0 ± 0.2*	0.57**	1.2 ± 0.3	1.1 ± 0.3	0.85**
Emotional susceptibility (0–3)	1.6 ± 0.2	1.4 ± 0.2	0.55**	0.9 ± 0.2†	0.9 ± 0.2	0.81**
Situational susceptibility (0–5)	1.9 ± 0.2	1.6 ± 0.2	0.63**	2.7 ± 0.3†	2.5 ± 0.3†	0.76**
Hunger (0–14)	4.1 ± 0.5	3.3 ± 0.4	0.44**	5.9 ± 0.8†	5.6 ± 0.7††	0.80**
Internal locus of hunger (0–6)	1.6 ± 0.3	1.0 ± 0.2*	0.43**	2.4 ± 0.4	2.3 ± 0.4††	0.65**
External locus of hunger (0–6)	1.8 ± 0.2	1.6 ± 0.2	0.40**	2.4 ± 0.3	2.1 ± 0.3	0.82**

*$P<0.05$, **$P<0.01$ significantly different from Visit 2 or significant correlation.
†$P<0.05$, ††$P<0.01$ significantly different from women or men at the same phase.
[a]Means ± s.e.,
[b]paired Student's *t*-test.
[c]Pearson correlations, *$P<0.05$, **$P<0.01$.

Table 3 Correlations between 6-y eating behavior and body weight changes

Eating behaviors	r	P
Women (n = 45)		
▲ Restraint	−0.32	0.03
▲ Flexible control	−0.34	0.02
▲ Rigid control	−0.28	0.07
Men (n = 30)		
▲ Restraint	−0.48	0.01
▲ Flexible control	−0.60	0.001
▲ Rigid control	−0.40	0.03
▲ Strategic dieting behavior	−0.48	0.01
▲ Avoidance of fattening food	−0.45	0.01

[a]Partial correlations ajusted for age and body weight at Visit 1.
▲ Represents 6-y change for the eating behavior of interest.

with body weight changes (Table 3). In men, changes in strategic dieting behaviors and the avoidance of fattening foods were also negatively associated with body weight variations (Table 3).

Stepwise models including confounding factors such as initial age, initial body weight, education level, total incomes, smoking status changes, and *initial* and eating behavior changes (restraint, disinhibition, hunger) were calculated in order to identify the contribution of eating behaviors in body weight variations. In women, delta restraint was the only factor that significantly explained 10% ($P<0.05$) of the variance in body weight whereas, in men, two factors explained significantly body weight changes: initial body weight explained 26% ($P<0.01$) and delta restraint explained an additional 11% ($P<0.05$) of the variance of body weight changes.

Relations between initial eating behaviors and body weight gain in a free-living context were examined in order to evaluate the possible utility of the TFEQ in a clinical context. In women, we noted a negative association between initial hunger scores and the 6-y change in body weight ($r=-0.31$, $P<0.05$). In men, none of the initial three main eating behaviors or the eating behavior subscales could predict body weight change over time.

Since few significant associations were found between *initial* eating behaviors and body weight changes over time, we investigated body weight, energy intake, and expenditure changes between the low and the high restraint and disinhibition groups as measured at the baseline visit (Visit 1). This approach also allowed to document how the more or the less restraint/disinhibition individuals changed their behavior over time. In women, the high restraint group gained more weight, tended to show a greater increase in percent body fat and energy intake over time compared to the low restraint group (Table 4). In men, the high restraint behavior seemed to prevent an increase in waist circumference whereas it promoted a decrease in energy intake in comparison to the low restraint behavior (Table 4). The female high restraint group decreased restraint behavior over time in comparison to the low restraint group (-2.72 ± 1.1 *vs* 2.7 ± 1.0, $P \leq 0.01$). In men, the low and high restraint groups did not change their eating behavior over time. In men and women with a higher level of disinhibition, we found a higher hunger score but no significant difference in body weight changes over time (data not showed).

We asked individuals, at the second visit, if they had ever been on a diet during the past 5 y. We observed that men and women who were at baseline in the low restraint or disinhibition groups were less likely to have been dieting

Table 4 Characteristics[a] of women and men with low and high restraint at Visit 1

	Women		*Men*	
	Low restraint (n = 23)	*High restraint (n = 22)*	*Low restraint (n = 15)*	*High restraint (n = 15)*
Restraint score (Visit 1)	3.9 ± 0.5	11.8 ± 0.5**	3.3 ± 0.4	7.8 ± 0.4**
Disinhibition score (Visit 1)	6.6 ± 0.7	6.6 ± 0.8	6.3 ± 1.1	6.2 ± 1.1
Hunger score (Visit 1)	4.6 ± 0.7	3.6 ± 0.7	7.1 ± 1.1	4.7 ± 1.1
▲ Weight (kg)	0.5 ± 1.5	4.9 ± 1.5*	2.7 ± 1.9	1.6 ± 1.9
▲ Percent body fat (%)[b]	0.6 ± 1.2	3.4 ± 1.3	1.0 ± 0.8	1.0 ± 0.9
▲ Waist circumference (cm)	1.1 ± 1.6	5.9 ± 1.7*	3.2 ± 1.6	0.6 ± 1.6
▲ Energy intake (MJ/day)[c]	−165 ± 479	678 ± 503	2498 ± 786	−582 ± 786*
▲ Energy expenditure (MJ/day)[d]	50 ± 496	1473 ± 541	698 ± 823	−394 ± 787

*$P<0.05$, **$P<0.01$ significantly different from the low eating behavior group (ANOVA for TFEQ score differences, ANCOVA adjusted for age at Visit 1 and corresponding baseline morphological characteristics).
▲ Represents six-y change for the variable of interest.
[a]Means ± s.e.m.
[b]Women low restraint $n=18$, high restraint $n=15$; men low restrain $n=11$, high restraint $n=13$.
[c]Women low restraint $n=22$, high restraint $n=20$.
[d]Women low restraint $n=19$, high restraint $n=16$; men low restraint $n=11$, high restraint $n=12$.

in the 5-y period that preceded the second visit (10 and 9%, respectively) than men and women in the high restraint or disinhibition group (23 and 20%, respectively).

Discussion

This study was designed to characterize the profile of three well-defined eating behaviors and their specific behavior subscales, as well as their relations with changes in body weight of men and women over a 6-y period. We observed gender differences for some eating behaviors, suggesting that women were more restrained, avoided more fattening foods, used more strategic dieting behavior and were more influenced by emotional susceptibility to eat than men. This seems not to be explained by a higher dieting behavior in our women. The higher restraint behavior in women has also been previously reported in the literature.[4,19,32–34] On the other hand, men had higher situational susceptibility to eat and were more influenced by the internal sensation of hunger than women, suggesting a more pronounced physiological hunger sensation in this group. Social values that discriminated more overweight women than men could be implicated in this eating behavior difference between genders.[35]

Eating behavior changes over time were also observed in this study. In this regard, we found that women disinhibition behavior, particularly the habitual susceptibility, and hunger motivations to eat decreased over time. These results seem to be contradictory to those of Rizvi *et al*[36] who investigated eating behavior changes in a 6-y prospective study in normal weight women. They found an increase in restraint and disinhibition behaviors after 6 y. However, they did not assess the TFEQ subscales and they had lower initial TFEQ scores than in the present study. In the present study, we observed in men a significant increase in the avoidance of fattening foods in order to restraint food intake over time. With age, men seemed to be more concerned with their weight. This is in accordance with other studies showing that men become more preoccupied by their eating patterns when they have health problems normally associated with age (eg cardiovascular diseases).[35]

We also found that most TFEQ subscale scores did not change after 6 y. In a 1-y follow-up study, Bond *et al*[25] reported similar results in a group of young women. Up to now, the Bond *et al* study was the only one that has investigated TFEQ subscale factors in a free-living context. It is also interesting to note that most of the eating behaviors measured in our study were positively correlated 6-y apart. Bond *et al*[25] found the same stability for the TFEQ subscales but they observed higher test–retest correlations, which is likely to be explained by their short follow-up period. However, as reported in the Bond *et al* study,[25] our results showed that some eating behaviors were not stable over time (eg disinhibition in women).

Another objective of this study was to examine the relation between eating behaviors and body weight changes over a 6-y period in a free-living context. In both genders, the 6-y restraint behavior changes were negatively associated with body weight changes. Changes in flexible control were the component of the restraint behavior that was the most strongly and negatively associated with body weight changes in men and women. These results are concordant with the literature in the sense that successful participants in a weight loss or weight gain prevention program and successful weight maintainers were those showing an increase in restraint over the intervention.[5,15–17,19,20,22] It was also observed by Westenhoefer *et al*[4] that successful participants to a 1-y weight-loss program were those who had higher flexible control at the beginning of the program and increased this behavior during the program. Even though we did not find that rigid and flexible control were related differently with body weight as demonstrated by Westenhoefer *et al*, we also

found that flexible control was negatively associated with disinhibition, whereas rigid control was positively associated with disinhibition. These partly different results could certainly be explained by the fact that our subject sample was very small compared to the one included in the Westenhoefer study (7400 *vs* 75 subjects).

The observation of the two extremes of the restraint behavior permits to better describe the differences observed between men and women. For instance, women with initially higher restraint score increased more their weight, BMI, and waist circumference over time compared to men. This weight gain could be explained by the decrease in the restraint behavior over time observed in the women from the high restraint group. These results are in accordance with those of Rizvi *et al*[36] who investigated the course of eating behaviors in a free-living context. They observed similar initial restraint scores than in our high-restraint women group combined with a small increase in BMI after a 6-y follow-up. This weight gain was probably attenuated by the fact that these women increased their restraint behavior over time,[36] whereas our high restraint women group decreased their restraint behavior over time. This suggests that in women, the high-restraint behavior was difficult to maintain over time, and that the almost inevitable decrease of this behavior was associated with a body weight gain.

Restraint eating behavior in men did not have the same consequence as in women in the present study. We observed that the high initial restraint men group tended to maintain their weight and waist circumference in comparison to the low-restraint group. This high restrained group was also able to maintain this behavior over time compared with highly restraint women. In addition, we observed that men (whole group) were less restrained than women and thus were able to increase at least some aspects of this behavior over time (strategic dieting behavior such as serving smaller portions and avoidance of fattening food). Therefore, this suggests that in men a high restraint behavior (which is lower than women) seems to be easier to maintain over time and that the maintenance of this behavior and/or the small increase was associated with a less important body weight change. As it has been suggested by de Castro,[32] restrained behavior may occur for different reasons in men and women. Men seemed to be restrained to lose weight, whereas women are restrained because they have a fear of weight gain.

In this study, we found that only initial hunger was negatively associated with weight gain over time in women. The negative relation between initial hunger and weight changes found in women was unexpected, since hunger has been associated with higher BMI[18,33] or weight relapse after weight loss.[37] This could be explained by the fact that susceptibility to hunger was negatively associated with restraint behavior and positively associated with disinhibition at baseline.

All these results suggest a certain utility of the TFEQ in a clinical context to identify individuals at higher risk of weight gain over time. According to our results, women with low initial hunger score or with a high restraint score could be at risk of weight gain over time. Since the first behavior is also associated with a higher restraint behavior, it suggests that restraint behavior should be carefully monitored in order to avoid an important variation that will be associated with body weight changes.

It is important to note that the subjects included in this study were participants of a much larger study divided in three visits. Since most of these subjects completed a minimum of two visits, it is likely that the participants selected for our study represent a group of individuals more health conscious and motivated, particularly those who have been in the QFS since the first phase. The consequences of possible or even likely sampling bias on the results are difficult to estimate. However, it seems realistic to consider that our results could not be extended to the overall population.

In conclusion, these results suggest that variables reflecting some eating behaviors are associated with body weight changes in a free-living context. It is very important to consider the gender difference regarding the expression of restraint behavior over time. Our results suggest that a high restriction in women is not sufficient to control body weight over time, whereas an increase in restraint behavior in men prevents body weight gain in a free-living context. However, promoting an important increase in restraint behavior in clinical interventions must be carefully considered since it is also associated with other problems in some individuals (eg stress,[38] subclinical menstrual disturbances,[39] lower bone mineral content,[40] and overeating in stressful situations[9–11]). The identification of more specific eating behaviors (TFEQ subscales) seems to be useful in order to characterize eating behaviors involved in individual weight gain in a free-living context. The clinical utility of the TFEQ could be relevant to identify women with low susceptibility to hunger or with high restraint behavior who are at higher risk of weight gain over time.

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