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Diet Type and Changes in Food Cravings following Weight Loss: Findings from the POUNDS LOST Trial

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Abstract

Few well-controlled trials have evaluated the effects that macronutrient composition has on changes in food cravings during weight loss treatment. The present study, which was part of the POUNDS LOST trial, investigated whether the fat and protein content of four different diets affected changes in specific food cravings in overweight and obese adults. A sample of 811 adults were recruited across two clinical sites, and each participant was randomly assigned to one of four macronutrient prescriptions: (1) Low fat (20% of energy), average protein (15% of energy); (2) Moderate fat (40%), average protein (15%); (3) Low fat (20%), high protein (25%); (4) Moderate fat (40%), high protein (25%). With few exceptions, the type of diet that participants were assigned did not differentially affect changes in specific food cravings. Participants assigned to the high fat diets, however, had reduced cravings for carbohydrates at Month12 ($p < .05$) and fruits and vegetables at Month 24. Also, participants assigned to high protein diets had increased cravings for sweets at Month 6 ($p < .05$). Participants in all four dietary conditions reported significant reductions in food cravings for specific types of foods (i.e., high fat foods, fast food fats, sweets, and carbohydrates/starches; all $ps < .05$). Cravings for fruits and vegetables, however, were increased at Month 24 ($p < .05$). Calorically restricted diets (regardless of their macronutrient composition) yielded significant reductions in cravings for fats, sweets, and starches whereas cravings for fruits and vegetables were increased.

Keywords

Macronutrient composition; Caloric restriction; Food type; Fat; Carbohydrate; Protein

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Disclosure

The authors have no conflicts of interest to disclose.

Ethical Standards

This study was approved by the appropriate ethics committees and was performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki. All persons gave their informed consent prior to their inclusion in the study.

Introduction

Food craving has been defined as “an intense desire for a particular food (or type of food) that is difficult to resist”(1). In contrast to hunger, which can be reduced by any number of foods, food cravings are typically only alleviated by consumption of a particular type of food (2). A large percentage of the population (i.e., 97% of women and 68% of men) report experiencing food cravings on a weekly basis (2–4), and most (80–85%) food craving episodes lead to consumption of the craved or similar food (3;4). Moreover, food cravings have been positively associated with obesity and body mass index(1;5;6),which suggests food cravings may significantly impact both body weight and dietary intake. Over the past few years, a number of clinical trials and laboratory studies have evaluated the effects of restricting certain types of food on changes in macronutrient-specific food cravings. As discussed below, these studies have yielded conflicting results, and three theories have been developed to address the development and reduction of food cravings.

Weingarten & Elston (1991) hypothesized that food cravings result from food restriction, with food cravings increasing after periods of food restriction(4). Most clinical studies have failed to support the food restriction theory of food cravings and some studies have found that food cravings are actually decreased (rather than increased) during periods of caloric restriction(7). Furthermore, one study found that both a low-calorie food-based diet (LCD) and a restrictive very low calorie supplement-based diet (VLCD) led to significant decreases in food cravings with the reduction being greatest in the VLCD group(8). Findings such as these suggest that caloric restriction leads to a generalized reduction in food cravings. These studies also suggest that mechanisms other than food restriction may play an etiological role in the development and maintenance of food cravings. In line with this perspective, Gibson & Desmond conceptualized food cravings as conditioned expressions of hunger in which cravings develop from repeated pairings of particular foods with hunger states(9). Based on this theory, cravings for particular types of foods were hypothesized to decrease if those foods or food types are not eaten for a long enough period of time(i.e., extinction should cause a macronutrient-specific reduction of craving).

Another hypothesis is that food cravings result from the restriction of specific types of foods (e.g., sweets, high fat foods), which then lead to increased cravings for these foods(6). In line with this, laboratory-based studies suggest food cravings are increased following periods of deprivation of a particular food or food type. For example, Mann and Ward (2001) showed that forbidding participants from eating a particular food, which they commonly consumed, for five days resulted in increased thoughts and desire for that food, though consumption was not altered(10). In another laboratory study in which participants restricted their intake of either complex carbohydrates or animal proteins for three days before coming to the eating laboratory, both carbohydrate-restricted and protein-restricted participants were found to have increased cravings for the restricted type of food (11). In contrast to laboratory studies, findings from recent clinical trials suggest that cravings for specific types of foods are decreased (rather than increased) when these foods are reduced or eliminated from the diet(8;12). In line with the macronutrient-specific extinction hypothesis, restriction of high fat foods was recently found to reduce cravings for those types of foods

during a two-year dietary intervention(12). A potential explanation for this phenomenon is that not consuming certain types of foods (e.g., high fat foods or sweets) while dieting may lead to a reduction in cravings for these types of foods, because their association with relief from food cravings is diminished.

Collectively, findings from clinical and laboratory-based studies to date suggest effects in opposite directions; thus, long-term, randomized controlled trials testing diets of differing macronutrient compositions are needed to clarify the conflicting findings. The primary objective of this study was to investigate whether dietary composition differentially affects changes in specific food cravings in overweight adults within the context of a two year clinical trial involving four different dietary interventions differing in macronutrient composition: moderate in fat (40% energy) with two different protein levels (15% and 25%); and low in fat (20% energy), also with 15% and 25% protein levels. The literature to date supports three different potential hypotheses regarding the effect that the dietary composition of calorie restricted diets has on food cravings: 1) caloric restriction (regardless of the macronutrient composition of the diet) leads to a reduction in food cravings for multiple types of foods (as seen in clinical trials), 2) a reduction in intake of specific types of foods leads to an increase in cravings for those types of foods (as seen in short-term laboratory-based studies), and 3)a reduction in intake of specific types of foods decreases cravings for those types of foods over time (as seen in recent longer-term clinical trials). Because the present study was a long-term clinical trial, we hypothesized that our findings would be in line with a recent long-term clinical trial conducted by Martin and colleagues (12)and that reducing specific types of macronutrients in the diet(e.g., dietary fat) would lead to a macronutrient-specific decrease in cravings for particular types of foods (e.g., high fat foods). The present study was part of the POUNDS LOST trial, the primary results of which have been previously reported(13).

Materials and Methods

This study was approved by the Institutional Review Boards at the Pennington Biomedical Research Center (PBRC), Baton Rouge, LA and the Harvard School of Public Health, Boston, MA.

Participants

Participants were 811 healthy, overweight men and women [(Body Mass Index (BMI) range = 25.0 – 40.9 kg/m^2)] between the ages of 30 and 70 years. All individuals volunteered to participate in a two-year study, the POUNDS LOST trial, which tested the efficacy of four diets of different macronutrient compositions for promoting weight loss over two years in overweight and obese adults. Major exclusion criteria included the presence of a chronic disease condition, such as uncontrolled diabetes or unstable cardiovascular disease, the use of medications known to affect body weight, and insufficient motivation or perceived ability to adhere to program guidelines based on a screening interview and questionnaire. Detailed descriptions of participant characteristics, as well as inclusion and exclusion criteria, have previously been provided (13).

Study Design

Participants were randomly assigned to one of four dietary interventions, stratified by site: (1) Low fat (20% of energy), Average protein (15% of energy); (2) Moderate fat (40%), average protein (15%); (3) Low fat (20%), high protein (25%); (4) Moderate fat (40%), high protein (25%). Thus, two diets were low-fat (20% of energy) and two were high-fat (40%); and two were average-protein (15%) and two were high-protein (25%), constituting a 2 × 2 factorial design. The low fat diets were based on diets currently recommended for obesity treatment. The moderate fat diet was patterned after a Mediterranean diet. All dietary approaches included carbohydrates with low glycemic indices,8% or less of saturated fat, and at least 20 grams of dietary fiber per day. Thus, the diets differed primarily in total fat, mono- and polyunsaturated fat, protein, and carbohydrate content. Each participant's caloric assignment represented a 750 kcal energy deficit from his or her baseline energy needs, which was intended to promote a weight loss rate of approximately 1.5 pounds per week (0.7 kg/week).

Weight Loss Intervention

Participants were provided with fourteen days of daily meal plans to help them follow their specific dietary assignment. The fourteen days of menus were developed at 1200, 1400, 1600, 1800, 2000, 2200, 2400, 2600, 2800, 3000, and 3200 kcal levels. In addition to structured menus, participants were taught the exchange system and were provided with the American Dietetic Association/American Diabetes Association booklets on this topic. To further assist participants in adhering to their assigned dietary plans, the structured menus were designed to allow participants to substitute appropriate exchanges for each food. Additionally, participants were provided tip sheets regarding general shopping and food preparation strategies, which were targeted to their macronutrient assignment.

During the first 26 weeks of the study, participants attended one hour group sessions for 3 out of every 4 weeks. The frequency of group meetings decreased to 2 out of 4 weeks for the remaining 18 months of the study (i.e., weeks 27– 104). During these group sessions, participants were provided with nutrition education and were also taught behavioral strategies (e.g., goal setting and problem solving) to help them adhere to their dietary assignment. During the entire two-year program, participants met individually with their assigned dietitian every 8 weeks. The individual sessions were structured to accomplish three objectives: (1) review adherence to the dietary intervention, (2) problem-solve any challenges encountered during the previous 8 weeks, and (3) develop action plans to maximize dietary adherence during the upcoming 8 weeks. The components of the behavioral program were standardized across the four dietary interventions; thus, the behavioral intervention delivered in all four dietary interventions was identical in terms of programmatic content and intensity level. Written treatment manuals were developed so that the same dietary and behavioral intervention was delivered at both sites. Detailed information regarding the study design and intervention has been provided elsewhere.(13)

Outcome Measure

Food Craving Inventory-II (FCI-II)—The FCI-II is a 33-item, self-administered measure with established reliability and validity that is designed to assess the subjective experience

of food craving across 33 different foods(1). Craving is defined as “an intense desire for a specific food that is difficult to resist.” Participants rate the frequency of cravings over the past 30 days on a 5-point Likert scale ranging from 1 (“not at all”) to 5 (“nearly every day”). The measure consists of five (5) empirically derived factors on scales measuring high fat foods (e.g., steak, fried fish, corn bread), sweets(e.g., cake, cookies, chocolate, candy), carbohydrates/starches(e.g., rolls, baked potato, pasta), fast food fats(e.g., pizza, hamburgers), and fruits and vegetables. Importantly, items that load on the scales are not necessarily characterized by being high on a single macronutrient. For example, the high fat scale includes savory foods that are high in fat and protein (e.g., steak), and high in fat and carbohydrate (e.g., corn bread). The sweets scale includes items that are high in sugar (e.g., candy), and high in fat and sugar (e.g., chocolate). The FCI-II is scaled in a frequency format assessing the frequency an individual experiences a craving for a particular food. All items are scored in the following manner: Never = 1, Rarely = 2, Sometimes = 3, Often = 4, Always = 5.

A pattern of findings in which food cravings for multiple types of foods are reduced, regardless of macronutrient diet assignment, would support the first hypothesis tested[i.e., caloric restriction (regardless of the macronutrient composition of the diet) leads to a reduction in food cravings for multiple types of foods]. A pattern of findings in which cravings for specific macronutrients were increased under conditions in which levels of these macronutrients were low would support the second hypothesis tested (i.e., a reduction in intake of specific types of foods leads to an increase in cravings for those types of foods). Finally, a pattern of findings in which cravings for specific macronutrients were reduced under conditions in which levels of these macronutrients were low would support the third hypothesis tested (i.e., reduction in intake of specific types of foods decreases craving for those types of foods over time).

Statistical Methods

The statistical analyses included descriptive statistics and modeling based on the intent-to-treat (ITT) principle, that is, all participants at randomization were included in the analyses, and the last observation was carried over for imputation of the missing data. The outcomes of interest were change scores in the Food Craving Inventory subscales and total score at a specific follow-up time (i.e., Months 6, 12, and 24). A linear mixed model was used to test if the change scores at Months 6, 12, and 24 were associated with the fat or protein content of the diet after controlling for baseline values, race, gender, age, and BMI. Because the experimental manipulation of the fat and protein content of the diets resulted in the carbohydrate content of the four different diets ranging from 35% to 65%, we also tested whether dietary carbohydrate content affected changes in Food Craving subscales at Months 6, 12, and 24. A p-value of 0.05 was used as the criteria for statistical significance. All analyses were performed in SAS 9.1.

Results

Descriptive Characteristics of the Study Sample

Demographic characteristics of participants are summarized in Table 1. The sample was predominantly Caucasian (n = 643; 79%); 127 participants were African American (16%), 29 participants were Hispanic (4%), five (5)participants were Asian (1%), and seven(7)participants were “other” or unknown (1%).

Preliminary Findings

As previously reported (13), participants assigned to High Fat dietary conditions significantly increased their consumption of dietary fat compared to individuals assigned to the Low Fat dietary conditions (change in percent fat intake between groups at Month 6 = 8%, $p < .0001$; at Month 24 = 6.7%, $p < .0001$). Additionally, individuals assigned to the High Protein conditions significantly increased consumption of dietary protein compared to individuals in the Average Protein conditions (change in percent protein intake between groups at Month 6 = 4.2%, $p < .0001$; at Month 24 = 1.4%, $p = .05$). Differences in macronutrient intake among the diet groups were also confirmed through analysis of biomarkers of protein intake (i.e., urinary nitrogen excretion) and fat intake (i.e., respiratory quotient). Participants in each dietary condition lost an average of 6 kg at Month 6, which represented 7% of their initial body weight. Of the 80% of participants who completed the entire trial, the average weight loss was 4 kg at two years (13).

Age and Sex Effects—Cravings for fast food fats decreased with age ($p = 0.03$). Otherwise, age did not have a significant effect on changes in specific food cravings. Compared to women, men reported stronger cravings for high fat foods and fast food fats at baseline and throughout the intervention[$F(1, 663) = 16.6$, $p = 0.0001$]. In contrast, women reported greater cravings for sweets and fruits and vegetables at baseline and throughout the intervention[$F(1, 663) = 11.2$, $p = = 0.001$]. There were no significant differences, however, between men and women in changes in food cravings throughout the intervention. Table 2 presents changes in the subscales of the FCI-II score at each assessment time point (Baseline, Months 6, 12, and 24), as well as for men and women separately.

Findings of Specific Hypotheses

Hypothesis 1—*Caloric restriction (regardless of the macronutrient composition of the diet) leads to a reduction in food cravings for multiple types of foods*.

This hypothesis was generally supported. Participants in all conditions reported significant reductions for multiple types of foods (i.e., high fat foods, sweets, carbohydrates/starches, and fast food fats) at all assessment time points (see Table 2). Fruits and vegetables were the only type of food in which cravings were increased. Specifically, cravings for fruits and vegetables were increased at Month24, but not Month 6 or 12 of the intervention [$t(1, 810) = 2.4$, $p = 0.02$].

Hypothesis 2—*A reduction in intake of specific types of foods leads to an increase in cravings for those types of foods*.

This hypothesis was not well supported. As noted above, cravings for almost all food types decreased during the intervention. The only exceptions to this general pattern of findings was that cravings for sweets were increased among participants assigned to high protein diets compared to participants assigned to low protein diets at Month 6 [$F(7, 803) = 4.7$, $p = 0.03$] and Month 12[$F(7, 803) = 5.89$, $p=0.02$]. Aside from these exceptions, participants did not report a macronutrient specific increase in cravings for other foods that were reduced in the diet (all p values ≥ 0.05).

Hypothesis 3—*A reduction in intake of specific types of foods decreases craving for those types of foods over time*.

This hypothesis was also not well supported. As noted above, participants in the different dietary conditions had similar reductions in cravings for almost all types of foods (i.e., high fat foods, sweets, carbohydrates/starches, and fast food fats), and most of these foods were reduced in the prescribed diets. There were two exceptions to this general pattern of findings. First, participants who were assigned to the high fat diets had a greater reduction in cravings for carbohydrates and starches than participants assigned to low fat diets at Month 12 [$F(7, 803] = 8.25$, $p=0.004$]. Second, participants who were assigned to the high fat diets had a greater reduction in cravings for fruits and vegetables than participants assigned to low fat diets at Month 12 [$F(7, 803) = 13.64$, $p=0.0002$) and Month 24 [$F(7, 803) = 4.3$, $p=0.04$). Thus, participants generally did not report a macronutrient specific decrease in cravings for foods that were reduced in the diet (all p values ≥ 0.05).

Discussion

The primary objective of the present study was to investigate whether the fat and protein content of four different diets affected changes in specific food cravings in overweight and obese adults. In contrast to our primary hypothesis, the macronutrient content of the diet did not generally influence the degree of changes in specific food cravings throughout the study. Rather, participants in all four dietary conditions reported significant reductions in cravings for most types of foods (i.e., high fat foods, fast food fats, sweets, and carbohydrates/starches). There were a few exceptions to this general pattern of findings. First, participants assigned to high fat diets had reduced cravings for carbohydrates at Month 12 and for fruits and vegetables at Month 12 and 24 compared to participants assigned to low fat diets, which would partially support the macronutrient specific extinction hypothesis. Second, participants assigned to high protein diets had increased cravings for sweets at Month 6 and 12, which would support the macronutrient-specific increase in foods that are reduced in the diet. These findings, however, only provide partial support for the macronutrient specific hypotheses because the change in cravings did not directly correspond to the type of food reduced or increased in the diet. It should also be noted that many of the subscales of the FCI-II are not specific to a single macronutrient (e.g., fat), and that changes in some subscales may reflect changes in cravings for more than one type of macronutrient(1).

Although the fat and protein content of the diets were what was experimentally manipulated in this study, this manipulation resulted in the carbohydrate content of the four diets ranging from 35% to 65%. In contrast to findings from some laboratory studies (10;11), lower levels

of carbohydrate intake did not increase cravings for high carbohydrate foods in the present study. As noted above, findings from clinical studies have generally found carbohydrate restriction decreases cravings for carbohydrates (8;12). The differences in findings between laboratory and clinical studies may be due to the short versus long-terms effects of carbohydrate restriction. In laboratory studies in which the experimental manipulation was less than a week, it appears carbohydrate restriction induces a temporary increase (rebound effect) in carbohydrate cravings, but this effect appears to change in the opposite direction over time. Thus, studies are needed to better understand the time frame in which cravings for carbohydrates or other macronutrients may decline following restriction of these macronutrients.

The findings of this study provide the strongest support for our first hypothesis and suggest that caloric restriction (regardless of the macronutrient composition of the diet) leads to a reduction in cravings for most types of foods. However, cravings for fruits and vegetables increased during the two-year intervention, except in the high fat dietary conditions. A potential explanation for these findings is that reduced intake of specific types of foods may decrease their association with emotional relief and thereby reduce cravings for those types of foods. In line with this, therapies that decrease association between particular cues or contexts and specific behaviors have been found to be effective treatment modalities for a number of addictive substances, including alcohol(14;15),cigarettes(16;17), and recreational drugs(18). The pattern of findings observed in the present study would support this explanation because all four diets were relatively low in saturated fats, fast food fats, and sweets.

There were also a few sex differences in overall levels of cravings for particular food types. Specifically, women had greater cravings for sweets and fruits and vegetables, whereas men had greater cravings for high fat foods and fast food fats at baseline and throughout the intervention. Our finding that women reported greater cravings for sweets (e.g., cakes and pies) is consistent with previous studies which found women often have cravings for sweet tasting foods(19;20). To our knowledge, no study has identified the specific types of foods craved by men; thus, the finding that men reported higher cravings than women for both high fat foods and fast food fats is novel. Moreover, these findings may help identify strategies for tailoring future weight loss intervention approaches to the specific needs of men and women.

The present study had a number of strengths. First, the sample size was much larger than the sample sizes used in previous studies; and the current study was sufficiently powered to detect changes in general and specific food cravings, as well as interaction effects (i.e., treatment by time). Identical methods were used to establish the participant's caloric assignment across all four dietary conditions. Specifically, each participant's caloric assignment was determined by taking into account his or her resting metabolic rate and activity level. As noted above, participants modified their dietary intake in line with dietary goals, and participant retention was high with 80% of enrolled participants completing the two year assessment.

The present study also had a few notable limitations. First, information about dietary compliance was obtained through self-report and thus may reflect inherent biases (21). Although participants appeared to comply with many aspects of the program, adherence to macronutrient assignments tended to deviate toward the sample average in terms of prescribed values, [i.e., participants prescribed higher macronutrient goals tended to have slightly lower levels of consumption of these macronutrients and participants prescribed lower macronutrient goals tended to have higher levels of consumption of these macronutrients(13;22)]. As previously noted, many of the subscales of the FCI-II are not specific to a single macronutrient. For example, the sweets subscale includes foods that are high in both fat and sugar (e.g., chocolate). Thus, changes in scores on the FCI-II subscale may reflect changes in cravings for general categories of foods that may contain more than one macronutrient. Although participants were randomly assigned to dietary conditions, they were not blinded to their dietary assignment, and preferences for particular dietary conditions may have affected a participant's response to his/her dietary assignment. To minimize this potential confound, participants were queried during a screening interview to ensure they did not have a strong preference for a particular dietary condition. Because there was not a control group, we are unable to examine the natural variation in food cravings that may occur over time independent of dietary modifications.

In conclusion, calorically restricted diets, regardless of their dietary composition, produced significant reductions in cravings for most types of foods(i.e., high fat foods, fast food fats, sweets, and carbohydrates/starches). Only cravings for fruits and vegetables were increased during the intervention. With few exceptions, the fat and protein content of the four different diets did not affect changes in specific food cravings in overweight and obese adults participating in a two year weight loss intervention.

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Table 1

Baseline Characteristics

	Treatment Condition							
	Low fat, Average protein (n = 204)		Low fat, High protein (n = 202)		High Fat, Average protein (n = 204)		High Fat, High protein (n = 201)	
	M	SD	M	SD	M	SD	M	SD
Age (yr)	51	9.0	50	10.0	52	9.0	51	9.0
BMI (kg/m^2)	33	4.0	33	4.0	32	4.0	33	4.0
Systolic BP (mmHg	118	13.0	120	13.0	120	13.0	120	15.0
Diastolic BP (mmHg)	75	9.0	75	9.0	76	9.0	76	10.0
Glucose (mg/mL)	93	12.0	92	17.0	92	12.0	92	13.0
Total Cholesterol (mg/dL)	199	38.0	203	36.0	203	37.0	204	35.0
LDL Cholesterol (mg/dL)	124	33.0	126	32.0	128	32.0	126	31.0
HDL Cholesterol (mg/dL)	49	15.0	49	13.0	48	12.0	51	16.0
Triglycerides (mg/dL)	135	82.0	144	79.0	147	93.0	141	85.0

M: mean; SD: standard deviation; BMI: body mass index; BP: blood pressure; LDL: low-density lipoprotein; HDL: high-density lipoprotein

Table 2

Change in the Food Craving Inventory-II Subscales over Time.

	Baseline Value Mean SD		6 Month Value Mean SD		Percent Change (6 months)	12 Month Value Mean SD		Percent Change (12 months)	24 Month Mean Value SD		Percent Change (24 months)
Entire Sample											
High Fat Foods	1.86	0.6	1.77	0.6	−4.8%**	1.75	0.6	−5.9%**	1.77	0.6	−4.8%**
Sweets	2.40	0.8	2.24	0.7	−6.7%**	2.23	0.7	−7.1%**	2.21	0.7	−7.9%**
Carbohydrates/ Starches	2.15	0.7	2.10	0.7	−2.3%*	2.10	0.7	−2.3%*	2.12	0.7	−1.4%
Fast Food Fats	2.34	0.8	2.23	0.7	−4.7%**	2.24	0.7	−4.3%**	2.25	0.7	−3.8%**
Fruits/Vegetables	2.23	0.6	2.21	0.9	−0.9%	2.28	0.9	+2.2%	2.29	0.9	+2.7%†
Women											
High Fat Foods	1.79	0.6	1.70	0.5	−5.0%**	1.69	0.6	−5.6%**	1.70	0.5	−5.0%**
Sweets	2.49	0.8	2.33	0.7	−6.4%**	2.31	0.7	−7.2%**	2.29	0.7	−8.0%**
Carbohydrates/ Starches	2.17	0.7	2.08	0.6	−4.1%**	2.11	0.6	−2.8%†	2.11	0.7	−2.8%†
Fast Food Fats	2.29	0.7	2.19	0.7	−4.4%**	2.20	0.7	−3.9%**	2.23	0.7	−2.6%*
Fruits/Vegetables	2.30	0.8	2.25	0.9	−2.2%	2.33	0.9	+1.3%	2.33	0.9	+1.3%†
Men											
High Fat Foods	1.97	0.7	1.88	0.6	−4.6%**	1.87	0.6	−5.1%**	1.90	0.6	−3.6%*
Sweets	2.25	0.8	2.09	0.7	−7.1%**	2.10	0.7	−6.7%**	2.08	0.7	−7.6%**
Carbohydrates/ Starches	2.13	0.7	2.12	0.7	−0.5%	2.08	0.7	−2.3%†	2.12	0.7	−0.5%
Fast Food Fats	2.42	0.8	2.30	0.7	−5.0%*	2.32	0.7	−4.1%*	2.30	0.7	−5.0%*
Fruits/Vegetables	2.12	0.8	2.14	0.9	+0.9%	2.20	0.9	+3.8%†	2.22	0.9	+4.7%†

† $p < 0.05$;

* $p < 0.01$

** $p < 0.001$.

M: mean; SD: standard deviation