Short-Term Effects of a "Health-At-Every-Size" Approach on Eating Behaviors and Appetite Ratings

Véronique Provencher, Catherine Bégin,† Angelo Tremblay,‡ Lyne Mongeau,§ Sonia Boivin,‖ and Simone Lemieux**

Abstract

PROVENCHER, VÉRONIQUE, CATHERINE BÉGIN, ANGELO TREMBLAY, LYNE MONGEAU, SONIA BOIVIN, AND SIMONE LEMIEUX. Short-term effects of a "Health-At-Every-Size" approach on eating behaviors and appetite ratings. *Obesity.* 2007;15:957–966.

Objective: To assess the effects of a "Health-At-Every-Size" (HAES) intervention on eating behaviors and appetite ratings in 144 premenopausal overweight women.

Research Methods and Procedures: Women were randomly assigned to one of the 3 groups: HAES group, social support (SS) group, and control group ($N = 48$ in each group). Interventions were conducted over a 4-month period, and measurements were taken before and after this period. Eating behaviors (cognitive dietary restraint, disinhibition, and susceptibility to hunger) were evaluated by the Three-Factor Eating Questionnaire. Appetite ratings (desire to eat, hunger, fullness, and prospective food consumption) were assessed by visual analogue scales before and after a standardized breakfast.

Results: More important decreases in susceptibility to hunger and external hunger were observed in the HAES group when compared with the SS group ($p = 0.05$, for susceptibility to hunger) and the control group ($p = 0.02$ and $p = 0.005$, for susceptibility to hunger and external hunger, respectively). In addition, women from the HAES group had more important decreases in postprandial area under the curve for desire to eat ($p = 0.02$) and hunger ($p = 0.04$) when compared with the control group. The change in the desire to eat noted in the HAES group was also different from the one observed in SS group ($p = 0.02$). Women from the HAES group experienced significant weight loss at 4 months (-1.6 ± 2.5 kg, $p < 0.0001$), which did not differ significantly from the SS and control groups ($p = 0.09$). An increase in flexible restraint was significantly related to a greater weight loss in both HAES and SS groups ($r = -0.39$, $p < 0.01$; and $r = -0.37$, $p < 0.05$, respectively). A decrease in habitual susceptibility to disinhibition was also associated with a greater weight loss in HAES and control groups ($r = 0.31$, $p < 0.05$; and $r = 0.44$, $p < 0.05$, respectively).

Discussion: These results suggest that a HAES intervention could have significant effects on eating behaviors and appetite ratings in premenopausal overweight women, when compared with an SS intervention or a control group.

Keys words: weight management, new weight paradigm, Three-Factor Eating Questionnaire, visual analogue scales, appetite

Introduction

Weight management is a critical issue in developed countries where the prevalence of obesity is constantly increasing (1,2). In an attempt to fight this obesity epidemic, weight loss programs, focusing on lowering energy intake (calorie-restricted diet) and increasing physical activity, have been developed (3). Even if hypocaloric diets successfully reduce body weight in the short term, only 20% to 30% of overweight/obese individuals are maintaining their weight loss after 1 to 3 years, and this percentage is even lower after 3 to 5 years (4,5).

Different factors have been identified to explain better why it may be difficult for most individuals to maintain weight loss. Behavioral factors such as disinhibited eating,

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*Institute of Nutraceuticals and Functional Foods, Department of Food Science and Nutrition, †School of Psychology, and ‡Division of Kinesiology, Department of Preventive and Social Medicine, Laval University, Montreal, Quebec, Canada; §Institut National de Santé Publique du Québec, Montreal, Quebec, Canada; and ‖Eating Disorders Treatment Program, CHUL, CHUQ, Laval University, Montreal, Quebec, Canada.
Address correspondence to Simone Lemieux, Institute of Nutraceuticals and Functional Foods, 2440, Hochelaga Blvd., Laval University, Québec, Québec, Canada, G1K 7P4.
E-mail: simone.lemieux@aln.ulaval.ca

hunger, binge eating, and eating in response to negative emotions and stress have been related to weight regain (6–9). It has also been suggested that restrictive diets could have negative effects on eating behaviors such as an increase in appetite (10) and an increase in frequency of obsessive thoughts about food and eating (11). These observations highlight the extent to which weight maintenance could be difficult to carry out successfully, since the main way to achieve weight loss (calorie-restricted diet) may also be related to factors enhancing weight regain in the long term.

Considering that weight loss is obviously difficult to maintain on a long-term basis (5), and considering the possible harmful effects of restrictive dieting (10–12), some researchers have suggested a shift from the traditional obesity treatment paradigm. Instead of considering weight loss as the main outcome, weight management is rather viewed from a health-centered approach, in which it is argued that health is related to behaviors independently of body weight status (13). This new weight paradigm, referred to as "Health-At-Every-Size" (HAES),[1] focuses on a healthy lifestyle by promoting overall health benefits of behavioral changes related to dietary habits and physical activity and emphasizes self-acceptance and well-being (14). Studies on the effects of a HAES approach have shown significant improvements in psychological variables (e.g., depression, body image, and self-esteem) and a decrease in disinhibition, susceptibility to hunger, and/or binge eating behaviors, even if no significant weight loss was observed (15–18). However, some inconsistent results with regard to the effects of HAES approach on restrained eating patterns have been observed in previous studies (15,18–20).

Even if recognition of hunger and satiety signals is an important issue in HAES approach, less is known about its observable effects on regulation of food intake. To our knowledge, no study has yet reported the impact of a HAES approach on appetite sensations measured after a standardized meal. Also, an important characteristic of most HAES interventions is that they have been conducted in a group setting (15–17). Thus, it is of relevance to take into account the effects of social support on changes observed in HAES studies, since social support could be a factor related to changes in health-related behaviors (9).

The main objective of this study was to assess the effects of a HAES approach on eating behaviors and appetite sensations. More specifically, after an intervention period of 4 months, changes in eating behaviors and appetite sensations were compared among 3 groups: 1) HAES intervention group (HAES group), 2) social support (SS) intervention group, and 3) control group. Previous studies on the effects of HAES approaches have shown significant decreases in disinhibition and susceptibility to hunger, and these changes have been related to better weight management (9). Therefore, it could be hypothesized that, in comparison with SS and control groups, a more important decrease in disinhibition and susceptibility to hunger (and their related subscales) would be observed in the HAES group. Relationships between eating behaviors and appetite sensations as well as their associations with weight changes were also examined to further address if body weight changes could be associated with changes in eating behaviors and appetite sensations.

Research Methods and Procedures

Participants

This study was conducted among a sample of 144 premenopausal women (mean age, 42.3 ± 5.6 years), recruited through different media in the Quebec City metropolitan area. All women included in this study were overweight or obese (BMI, 25 to 35 kg/m^2), had a stable weight for at least 2 months (± 2.5 kg), were not currently dieting to lose weight, were not taking oral contraceptives, were not pregnant or lactating, were not presenting with metabolic or important psychological disorders, and were not under treatment for coronary heart disease, diabetes, dyslipidemia, depression, or endocrine disorders (except stable thyroid disease). Women were also characterized by a preoccupation about their weight and eating, following criteria defined by Grodner (21): 1) to show excessive concern with shape and weight, 2) to exhibit restriction over food choices for at least 2 years, and 3) to be unsuccessful in previous attempts to lose weight (for at least the past 2 years). Before her participation in the study, each woman signed an informed consent document, which was approved by the Laval University Research Ethics Committee.

Study Design

The present study is a randomized controlled trial in which participants were recruited during four equal phases of testing and intervention (September 2003, January 2004, September 2004, and January 2005). Randomization was performed within each phase, and women were then assigned to one of the 3 treatment conditions: HAES group (N = 48), SS group (N = 48), or control group (N = 48). Even though subjects were all randomized before baseline testing to optimize appointment scheduling, they learned their group assignment only after they did their baseline measurements to avoid potential bias. Women were tested during the follicular phase of their menstrual cycle to control for potential impact of hormonal variation on nutritional and psychological variables. However, there were exceptions; some women were tested at another point in their cycle mainly because they had an irregular cycle (N = 4).

[1] Nonstandard abbreviations: HAES, Health-At-Every-Size; SS, social support; TFEQ, Three-Factor Eating Questionnaire; PFC, prospective food consumption; AUC, area under the curve.

When these women were excluded from the present analyses, similar results were observed. All measurements were taken at baseline (T = 0) and at the end of the intervention period (T = 4 months) in the 3 treatment conditions (HAES group, SS group, and control group). Follow-up measurements will be completed at 6 months (T = 10 months) and 1 year (T = 16 months) post-intervention for all women under study.

Description of Treatment Conditions

The HAES intervention ($N = 48$) was conducted in small groups of 12 women, and 14 weekly sessions were scheduled (13 three-hour evening sessions and 1 intensive-day session of 6 hours). For each phase of the intervention, the same registered dietitian and clinical psychologist were in charge of the group. (They had previously received intensive training to provide the HAES approach tested; see http://www.equilibre.ca for more details.) This HAES intervention, named Choisir de Maigrir? ("What about losing weight?"), is focused on general well-being, as well as positive ways of having a healthy and satisfying lifestyle. Supported by lectures, guided self-reflection and observations, and group discussions, as well as practical exercises, this intervention is aimed at enhancing awareness and knowledge about biological, psychological, and sociocultural aspects of body weight. During sessions, different themes were presented, such as realistic objectives with regard to weight loss (according to energy intake and energy expenditure). A weekly food diary and group discussions were used to facilitate the recognition of internal cues of hunger and satiety (rated on a 3-point scale) and the identification of external influences on eating behaviors and energy intake. Enjoyment of physical activity and healthy nutrition and acceptance of their own and others' body image were also discussed. After the 14 intervention sessions, it is hoped that women will be able to make their own well-informed decision about losing weight or not, which is translated into the establishment of an individualized action plan to be pursued in the long term.

Similarly to the HAES group, the SS intervention ($N = 48$) was conducted in small groups of 12 women, and 14 weekly sessions were planned (14 two-hour evening sessions). To control for potential bias related to providers, the same registered dietitian and clinical psychologist involved in the HAES group were also in charge of the SS group for the 4 phases of intervention. Each HAES and SS session was videotaped, and tapes were reviewed by 2 investigators of the study (S.L., C.B.) to ensure that the interventions were appropriate. The main objective of the SS intervention was to reproduce a structural social support provided by the group itself. To achieve this purpose, each theme discussed in the HAES group was repeated in the SS group, following the same chronology. However, the registered dietitian and the clinical psychologist were not counselors (as in the HAES group) but were rather acting as facilitators in the group discussion (SS group). Therefore, no specific information, exercise, or counseling was provided to participants. Women joined together to discuss weight and health issues, as well as to offer their support to each other.

The control group ($N = 48$) was a waiting list control condition in which women were instructed to follow their usual lifestyle habits. Therefore, during the 4-month intervention period, these women did not receive any form of contact from the research team. At the end of the 4-month intervention period, women from the control group were invited for post-intervention testing, as performed in women from HAES and SS groups.

Measurements of Dependent Variables

Eating Behaviors. The Three Factor Eating Questionnaire (TFEQ) is a 51-item validated questionnaire (22–24), which assesses three factors that refer to cognitions and behaviors associated with eating: cognitive dietary restraint (conscious control of food intake with concerns about shape and weight), disinhibition (overconsumption of food in response to a variety of stimuli associated with a loss of control on food intake), and susceptibility to hunger (food intake in response to feelings and perceptions of hunger). More specific subscales can also be derived from these three general eating behaviors (25,26): rigid restraint (dichotomous, all-or-nothing approach to eating, dieting, and weight), flexible restraint (gradual approach to eating, dieting, and weight), habitual susceptibility to disinhibition (behaviors that may occur when circumstances predispose to recurrent disinhibition), emotional susceptibility to disinhibition (disinhibition associated with negative affective states), situational susceptibility to disinhibition (disinhibition initiated by specific environmental cues), internal hunger (hunger interpreted and regulated internally), and external hunger (hunger triggered by external cues).

Appetite Sensations. After a 12-hour overnight fast, each woman was invited to eat a standardized breakfast (601 kcal) and to rate her appetite sensations according to 4 visual analog scales (ranging from 0 to 150 mm): desire to eat, hunger, fullness, and prospective food consumption (PFC) (27). Appetite sensations were recorded before, immediately after, and at 10, 20, 30, 40, 50, and 60 minutes after the consumption of the standardized breakfast. Questions were asked as follows: How strong is your desire to eat? (Very weak to very strong); How hungry do you feel? (not hungry at all to as hungry as I ever felt); How full do you feel? (not full at all to very full); How much food do you think you could eat? (nothing at all to a large amount). One-hour post-meal area under the curve (AUC) in response to the standardized breakfast was calculated for each appetite sensation, according to the trapezoid method, as described by Doucet et al. (28).

Table 1. Eating behaviors at baseline (T = 0) and changes following the 4-month intervention in the HAES, SS, and Control groups

	HAES group		SS group		Control group		Difference between groups (p)
	Baseline* (N = 48)	Changes (N = 44)	Baseline (N = 46)†	Changes (N = 39)	Baseline (N = 46)	Changes (N = 38)	
Cognitive restraint	9.5 ± 3.6	0.8 ± 3.4	8.8 ± 4.2	−0.4 ± 2.5	8.0 ± 3.9	0.2 ± 3.2	0.20
Flexible restraint	3.0 ± 1.4	0.6 ± 1.7§	2.7 ± 1.6	0.3 ± 1.6	2.6 ± 1.6	0.1 ± 1.6	0.42
Rigid restraint	2.9 ± 1.6	0.1 ± 1.3	2.6 ± 1.7	−0.2 ± 1.0	2.5 ± 1.7	0.0 ± 1.3	0.59
Disinhibition	9.7 ± 3.1	−1.3 ± 2.8§	8.8 ± 2.7	−1.2 ± 2.6§	9.3 ± 3.0	−1.2 ± 1.9§	0.47
Habitual	2.3 ± 1.4	−0.5 ± 1.4§	1.9 ± 1.2	−0.2 ± 1.3	2.0 ± 1.5	−0.4 ± 1.0‡	0.31
Emotional	2.3 ± 1.1	−0.4 ± 1.2§	1.9 ± 1.2	−0.2 ± 1.2	2.2 ± 1.1	−0.2 ± 0.8	0.24
Situational	3.3 ± 1.5	−0.5 ± 1.4§	3.1 ± 1.4	−0.6 ± 1.5§	3.3 ± 1.4	−0.4 ± 1.1‡	0.41
Hunger	5.5 ± 3.9	−1.5 ± 2.9§	5.6 ± 3.3	−0.6 ± 2.4‖	5.6 ± 3.2	−0.3 ± 2.5‖	0.05
Internal	2.0 ± 2.2	−0.5 ± 1.6§	2.3 ± 2.0	−0.3 ± 1.6	2.0 ± 1.8	−0.1 ± 1.5	0.24
External	2.6 ± 1.7	−0.9 ± 1.7¶	2.5 ± 1.5	−0.4 ± 1.3‡	2.5 ± 1.4	−0.1 ± 1.4‖	0.02

HAES, Health-At-Every-Size; SS, social support; TFEQ, Three-Factor Eating Questionnaire. Values are mean ± standard deviation.
* For each variable studied, no significant differences were observed between the groups at baseline.
† Some participants did not complete the TFEQ at baseline (SS group: N = 2; Control group: N = 2).
‡ $p < 0.05$; significant within-group change (T = 4 vs. T = 0).
§ $p < 0.01$; significant within-group change (T = 4 vs. T = 0).
¶ $p < 0.0001$; significant within-group change (T = 4 vs. T = 0).
‖ Significantly different from changes (T = 4 vs. T = 0) observed in the HAES group.

Anthropometric Profile

Height, body weight, and BMI were determined according to standardized procedures, as recommended at the Airlie Conference (29). Height was measured to the nearest millimeter with a stadiometer, and body weight was measured to the nearest 0.1 kg on a calibrated balance. Participants were asked to dress lightly and to remove their shoes for these measurements.

Statistical Analysis

Analyses were performed with all participants in the study for whom data were available at post-intervention testing (T = 4 months; N = 121). An ANOVA was performed to assess differences between groups for all variables measured at baseline. The MIXED procedure for repeated measurements was performed to determine differences among and between groups regarding short-term changes in eating behaviors, appetite sensations (fasting and 1-hour AUC), and body weight. One-tailed tests of significance are reported for disinhibition, susceptibility to hunger, and their related subscales because directional hypotheses were established for these variables. However, since prior studies did not report consistent results with regard to expected changes in cognitive dietary restraint and body weight (15–20), and since the effects of a HAES intervention on appetite sensations have not been yet reported, it was decided to use two-tailed tests for these variables. Pearson's correlation analyses were also conducted to quantify the univariate relationships between eating behaviors and appetite sensations (for baseline values and short-term changes) as well as their associations with short-term changes in body weight. For variables not normally distributed, a log-transformation was performed. The probability level for significance used for the interpretation of all statistical analyses was set at an α level of $p < 0.05$. All analyses were performed using SAS statistical software (SAS Institute, Cary, NC).

Results

For all variables measured in the present study, no differences were observed at baseline among the three groups. Women from the HAES, SS, and control groups had mean BMI of 30.1 ± 3.0 kg/m^2, 30.6 ± 3.1 kg/m^2, and 30.7 ± 3.1 kg/m^2, respectively. Women in the HAES group attended 11 ± 3 sessions, and women in the SS group attended 9 ± 5 sessions (p = 0.03). Attrition rates of 8.3%, 18.8%, and 20.8% were observed for the HAES, SS, and control groups, respectively.

Table 1 shows differences observed in eating behaviors among the 3 groups. A significant increase in flexible restraint was observed in the HAES group, whereas disinhi-

Table 2. Appetite ratings at baseline (T = 0) and changes following the 4-month intervention in the HAES, SS, and Control Groups

	HAES group		SS group		Control group		Difference between groups (*p*)
	Baseline* (*N* = 46)†	Changes (*N* = 40)	Baseline (*N* = 43)	Changes (*N* = 37)	Baseline (*N* = 45)	Changes (*N* = 37)	
Appetite ratings in fasting state (mm)							
Desire to eat	88.2 ± 32.4	14.2 ± 41.6‡	89.8 ± 33.0	10.1 ± 40.0	87.2 ± 39.0	12.6 ± 49.5	0.92
Hunger	83.1 ± 37.4	17.7 ± 37.8§	91.7 ± 37.0	5.7 ± 49.3	84.2 ± 36.8	12.2 ± 35.6	0.46
Fullness	27.0 ± 23.5	−0.8 ± 30.1	26.7 ± 24.8	3.2 ± 34.3	31.4 ± 31.8	−1.0 ± 25.2	0.80
PFC	83.5 ± 32.5	9.0 ± 29.0	88.2 ± 27.8	−1.1 ± 41.8	82.6 ± 31.3	5.3 ± 29.5	0.44
1-hour AUC (mm × min)							
AUC desire to eat	1383 ± 1376	−451 ± 1321‡	1042 ± 1159	94 ± 1171¶	803 ± 871	321 ± 1079¶	0.02
AUC hunger	1419 ± 1389	−526 ± 1338§	1164 ± 1292	−64 ± 1202	894 ± 939	157 ± 828¶	0.04
AUC fullness	6160 ± 2038	114 ± 2157	6359 ± 2205	111 ± 1495	6521 ± 1918	16 ± 1696	0.97
AUC PFC	1826 ± 1593	−538 ± 1453	1433 ± 1567	18 ± 1215	1394 ± 1286	−26 ± 990	0.86

HAES, Health-At-Every-Size; SS, social support; PFC, prospective food consumption; AUC, area under the curve. Values are mean ± standard deviation.

* For each variable studied, no significant differences were observed between groups at baseline.

† Some participants did not complete the standardized breakfast test at baseline (HAES group: N = 2; SS group: N = 5; Control group: N = 3).

‡ $p < 0.05$; significant within-group change (T = 4 vs. T = 0).

§ $p < 0.01$; significant within-group change (T = 4 vs. T = 0).

¶ Significantly different from changes (T = 4 vs. T = 0) observed in the HAES group.

bition and susceptibility to hunger (and all their subscales) significantly decreased in this group. In the SS group, scores for disinhibition, situational susceptibility to disinhibition, and external hunger significantly decreased. In the control group, a significant reduction in disinhibition as well as in habitual and situational susceptibility to disinhibition was observed. Table 1 also shows that women from the HAES group had a significantly larger decrease in susceptibility to hunger when compared with women from the SS and control groups. The decrease observed for external hunger was also larger in women from the HAES group than in women from the control group.

Table 2 shows that women from the HAES group had higher desire to eat and hunger in the fasting state after the intervention, whereas no significant changes in response to the intervention were observed in the SS and control groups. However, 1-hour AUC for desire to eat and hunger significantly decreased at 4 months in the HAES group, and this decrease was also significantly different from slight increases observed in the SS and control groups for these appetite sensations.

Additional analyses were performed in which baseline values of dependent variables studied were added as covariates into statistical models. For eating behaviors, the inclusion of baseline values in the models did not have a significant effect on results obtained; i.e., between-group differences were still observed for susceptibility to hunger and external hunger. When baseline values were added into the statistical model for 1-hour AUC for desire to eat and hunger, differences observed between groups for changes in 1-hour AUC for desire to eat and hunger were not significant anymore. In addition, the impact of baseline values on changes in 1-hour AUC for desire to eat and hunger was not the same in the 3 groups, as reflected by a significant baseline 1-hour AUC for desire to eat-by-group interaction and also by a significant baseline 1-hour AUC for hunger-by-group interaction. To further address this issue, additional analyses were performed by stratifying the sample according to the median of baseline values (median for AUC of desire to eat = 612.5 mm × min and median for AUC of hunger = 775.0 mm × min). With this second set of analyses, significant between-group differences in

Table 3. Associations between eating behaviors and appetite sensations (fasting and 1-hour AUC) at baseline ($N = 139$)

	Cognitive restraint	Disinhibition	Hunger
Appetite ratings in the fasting state (mm)			
Desire to eat	0.17*	0.02	0.21†
Hunger	0.10	0.02	0.18*
Fullness	0.02	−0.05	0.05
PFC	−0.05	0.17*	0.24†
1-hour AUC (mm × min)			
AUC desire to eat	−0.10	0.26†	0.43‡
AUC hunger	−0.16	0.28†	0.48‡
AUC fullness	0.17*	−0.11	−0.24†
AUC PFC	−0.20*	0.20*	0.35‡

AUC, area under the curve; PFC, prospective food consumption.
* Significant correlation: $p < 0.05$.
† Significant correlation: $p < 0.01$.
‡ Significant correlation: $p < 0.0001$.

changes in 1-hour AUC for desire to eat and hunger were observed in the subsample of women having 1-hour AUC at baseline above the median value, while between-group differences were not significant in the subsample of women with baseline 1-hour AUC values below the median.

Table 3 presents relationships between eating behaviors and appetite sensations at baseline. Cognitive dietary restraint was positively associated with desire to eat in the fasting state and with 1-hour AUC for fullness, while it was inversely associated with 1-hour AUC for PFC. Disinhibition was positively correlated with PFC in the fasting state and with AUC for desire to eat, fullness, and PFC. Susceptibility to hunger was positively correlated with fasting and 1-hour AUC values for desire to eat, hunger, and PFC. A negative association was observed between susceptibility to hunger and 1-hour AUC for fullness.

Since significant short-term changes in susceptibility to hunger and its subscales as well as in 1-hour AUC for desire to eat and hunger were observed in the HAES group, correlations were performed between changes in these variables. As observed in Figure 1, susceptibility to hunger and internal hunger were positively related to 1-hour AUC for hunger. Similar associations were observed with change in 1-hour AUC for desire to eat (data not shown).

A significant decrease in body weight was observed in the HAES group (−1.6 ± 2.5 kg; $p < 0.0001$ or 2.0% of the initial weight), while weight loss observed in the SS and control groups was not significant (SS group, −0.8 ± 2.2 kg; $p = 0.07$; and control group, −0.4 ± 3.0 kg; $p = 0.28$). However, no significant group differences were observed for changes in body weight ($p = 0.09$). To further address

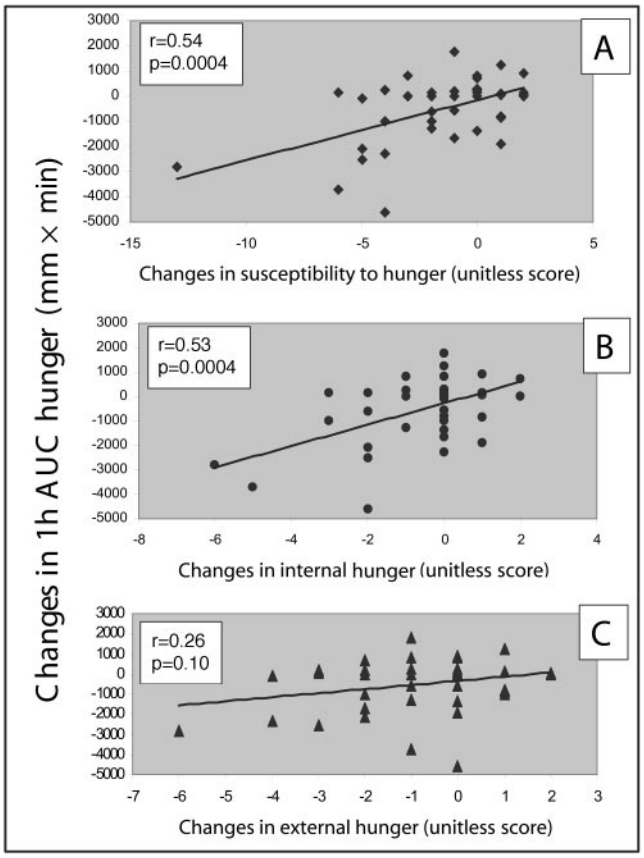

Figure 1: Associations between changes in 1-hour AUC for hunger and changes in susceptibility to hunger (A), internal hunger (B), and external hunger (C) in women from the HAES group ($N = 40$).

Table 4. Associations between changes in body weight and changes in eating behaviors in women from the HAES, SS, and Control groups

	Δ Body weight (kg)		
	HAES group (N = 44)	**SS group (N = 39)**	**Control group (N = 38)**
Δ Cognitive restraint	−0.26*	−0.29*	−0.39†
Δ Flexible restraint	−0.39‡	−0.37†	−0.17
Δ Rigid restraint	0.01	−0.08	−0.18
Δ Disinhibition	0.23	0.21	0.11
Δ Habitual	0.31†	0.28*	0.44†
Δ Emotional	0.09	0.11	−0.12
Δ Situational	0.16	0.11	0.02
Δ Hunger	0.29*	−0.30*	0.10
Δ Internal	0.17	0.28	−0.01
Δ External	0.25*	0.20	0.09

HAES, Health-At-Every-Size; SS, social support.
* Significant correlation: $p < 0.10$.
† Significant correlation: $p < 0.05$.
‡ Significant correlation: $p < 0.01$.

whether weight loss was related to changes in eating behaviors and appetite sensations, correlational analyses were conducted in the 3 groups, and results are presented in Table 4. A higher increase in flexible restraint was significantly related to a larger decrease in body weight in both the HAES and SS groups, while in the control group, weight loss was related to a higher increase in cognitive dietary restraint. A larger decrease in habitual susceptibility to disinhibition was also associated with a larger decrease in body weight in the HAES and control groups. No relationships were observed between changes in appetite sensations and changes in body weight.

Discussion

The aim of this study was to assess the effects of a HAES approach on eating behaviors and appetite sensations, in comparison to the SS and control groups. Although results showed significant changes in eating behaviors for the 3 groups studied, women from the HAES group presented larger decreases in susceptibility to hunger and external hunger compared with the control group and a larger decrease in susceptibility to hunger compared with the SS group. Changes in appetite ratings were also observed only in women from the HAES group, with a larger decrease in 1-hour AUC for desire to eat in comparison with women from the SS group and control group. These results suggest that a HAES approach could have beneficial effects on particular eating behaviors and appetite sensations, when compared with a social support intervention or a control group.

As previously observed in other studies (15,18,19), susceptibility to hunger significantly decreased in women from the HAES group, with a decrease in external hunger. Women from the HAES group also had significantly lower post-meal ratings for desire to eat and hunger than the control group and lower post-meal rating for desire to eat than the SS group, even though their ratings for these appetite sensations increased in the fasting state. In contrast, in a study conducted in weight-reduced subjects after a calorie-restricted diet, no changes were noted in subjects' postprandial ratings for desire to eat, hunger, and PFC after a standardized breakfast despite increases observed in fasting ratings for these appetite sensations (10). In addition, effects of the HAES approach seem to be more beneficial in women having higher postprandial ratings for desire to eat and hunger at baseline. Data on observable effects of a HAES approach on appetite sensations are new findings in this area of research, and it may be argued that these women developed a better ability to be conscious of their physical signals of hunger and satiety. These improvements could be explained by the emphasis on a better perception of hunger and satiety signals promoted in the HAES intervention compared with the other groups. For example, the food diary, which aimed at enhancing consciousness about level of hunger and satiety at each meal, may be one of the factors

that explains our findings. Thus, developing skills to differentiate real feelings of hunger from external stimuli may be an important aspect of HAES interventions, which could be translated into lower susceptibility to hunger and appetite sensations.

After a HAES intervention, a significant decrease in disinhibition has been reported (15,18,19), as observed in the present study. However, this beneficial effect does not seem to be distinctive to the HAES intervention, since a similar decrease in disinhibition also occurred in women in the SS and control groups. A similar decrease in disinhibition has also been shown in individuals who followed calorie-restricted diets to lose weight (15,18,19,30). Thus, different types of interventions seem to be effective in reducing disinhibition in the short term, suggesting that this eating behavior may be sensitive to several strategies toward its change, as has been previously observed for binge-eating disorder (31). Nevertheless, motives regarding the maintenance of these behavioral changes and improvements could be questionable, and it can be argued that true behavioral changes may be maintained in the long term only in those who really internalize new lifestyle behaviors (32). Long-term follow-up data will be of interest to assess if the HAES intervention will lead to a better maintenance of reduced disinhibition scores, since this approach is based on more internal ways to cope with disinhibition.

In contrast to traditional weight-loss diets in which an increase in cognitive dietary restraint has been observed (30), studies regarding the effects of a HAES approach on eating behaviors usually document a decrease in restrained eating patterns (15,16,18,33–36). In the present study, scores in cognitive dietary restraint did not significantly decrease after 4 months in any of our study groups. It appears relevant to specify that various questionnaires have been used to assess changes in restraint following a HAES intervention, such as TFEQ, Restraint Scale, and Dutch Eating Behavior Questionnaire. Even if all these measurements of restraint have been shown to share common variance (24), it has been previously suggested that each scale may represent different aspects of the general construct of restraint (24,37), and questionnaires cannot be substituted for each other. Results from our study can be compared only with studies reporting results from the TFEQ: a decrease in cognitive dietary restraint was reported by Bacon et al. (15,18) and Sbrocco et al. (20), while cognitive dietary restraint increased slightly in the study of Rapoport et al. (19).

A significant increase in flexible restraint was observed in women from the HAES group, but this change did not differ from SS and control groups. This is somehow different from what was observed in the study of Bacon et al. in which a decrease in rigid restraint was noted (15). The assessment of flexible and rigid restraint was previously proposed by Westenhoefer et al. (25) to refine the definition of cognitive dietary restraint by representing its distinct aspects. Indeed, opposite effects of flexible and rigid restraint on anthropometric parameters have been observed in previous studies, with rigid restraint being related to a higher BMI (25,38). In addition, it has been proposed that flexible restraint is an eating behavior that should be enhanced for long-term weight management (7). Although increased flexible restraint was not a distinctive effect of the HAES intervention, results from the present study could support the idea that restraint is not a homogeneous concept and that specific aspects of restraint, such as flexible restraint, may have beneficial health effects (39).

While appetite ratings from visual analog scales have been previously related to energy intake (28,40,41), associations between eating behaviors and appetite sensations have been studied to a lesser extent. To our knowledge, only one study addressed this issue (40). In that study, eating behaviors were not significantly related to appetite ratings, which is not in line with results obtained in the present study. This could be explained by differences in characteristics of study samples (e.g., sex, number of subjects, baseline scores for eating behaviors, preoccupation about weight and food, history of dieting). This raises the relevance of assessing this issue in other populations. Significant associations were observed within the HAES group between decreases in susceptibility to hunger and reduced appetite ratings for desire to eat and hunger, suggesting that when an intervention following a HAES approach targets eating behavior changes, effects observed in the perceptions of the behavior could also be associated with observable feelings related to this behavior.

Significant changes in eating behaviors as measured by the TFEQ were observed in the SS group, which is in accordance with the literature underlying positive outcomes of social support interventions in weight management (42). Regardless of these changes, appetite ratings remained stable before and after the social support intervention. Thus, even though changes in eating behaviors occurred in a social support context, these improvements were not clearly translated into significant changes in appetite ratings, as was observed in the HAES group. These results suggest that social support may be effective in changing cognitions about food, without inducing active problem solving aimed at improving the perceptions of appetite sensations.

In comparison with previous studies in which weight loss was not systematically observed after a HAES intervention (15–18,33), the present study showed a small but significant decrease in body weight in the HAES group in the short term, although this change in body weight did not significantly differ from the one observed in SS and control groups. An increase in flexible restraint and a decrease in habitual susceptibility to disinhibition were related to weight loss in the HAES group, and similar relationships were also observed in SS and control groups. These changes

in eating behaviors have been previously related to successful weight loss and maintenance (9;43,44) as well as to lower energy intakes (25,45,46), which is in accordance with relationships observed in the present study. Associations observed between changes in body weight and flexible restraint may also partly explain why women from the HAES group, who increased their level of flexible restraint, also lost a significant amount of body weight. However, since the present results are derived from correlational analyses, the direction of causality cannot be established.

In summary, results from this study showed that a HAES approach could have beneficial effects on particular eating behaviors and appetite sensations, when compared with a social support intervention or a control group. More specifically, women from the HAES group showed a larger decrease in susceptibility to hunger and in 1-hour AUC for desire to eat when compared with women from the SS and control groups. Our results also suggest that a HAES approach may be efficient in the short term in improving eating behaviors and appetite sensations that might favor better food choices and regulation of energy balance. In the long term, it will be of interest to assess the maintenance of these changes as well as further improvement in global health status.

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