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A Health at Every Size intervention improves intuitive eating and diet quality in Canadian women

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Abstract

Background and aims: Health at Every Size® (HAES®) interventions focus on healthy lifestyle by promoting behavioral changes related to diet and physical activity while emphasizing self-acceptance and well-being through an empowerment and intuitive approach. The purpose of this study was to investigate the effects of a HAES® program on intuitive eating and diet quality in women.

Methods: The HAES® intervention, offered by professionals from Health and Social Services Centers in Quebec (Canada), was composed of thirteen 3-hour weekly meetings and a 6-hour intensive day. For this study, 216 women (1.9% normal-weight, 21.1% overweight, 77.0% obese) who took part to the HAES program were compared to 110 women (3.9% normal-weight, 23.3% overweight, 72.8% obese) from a control group (waiting list). Intuitive eating was assessed using the Intuitive Eating Scale and diet quality was evaluated through the calculation of the Healthy Eating Index (HEI) from a validated web-based self-administrated food frequency questionnaire. Measurements were performed at baseline, post-intervention, and at one-year follow-up.

Results: Women who participated in the HAES® program significantly increased their intuitive eating score compared to women in the control group at post-intervention and at follow-up (group by time interaction, p=0.0002). A significant improvement in diet quality was also observed in the HAES® group in comparison with the control group at post-intervention (group by time interaction, p=0.0139). The intuitive eating score and the HEI score were positively associated in the HAES® group at post-intervention (r=0.20, p=0.0237) and one-year follow-up (r=0.22, p=0.0359), but no such associations were noted in the control group (post-intervention, r=0.04, p=0.70; one-year follow-up, r=-0.15, p=0.30).

Conclusions: The HAES® program seems effective in improving intuitive eating and also favours improvements in diet quality. However, the association between intuitive eating and diet quality remains unclear, being positive and significant only after the HAES® intervention.

Introduction

Over the last decades, the rising rates of overweight and obesity have been contrasting with the high prevalence of dieting and eating disorders. In response to the poor success rate of restrictive diets for sustainable weight loss and health improvement (1, 2), a new weight paradigm has emerged (3). This paradigm centers on healthy eating and physical activity as promising chronic disease-prevention strategies, without focusing on weight loss (4). One example is the Health at Every Size® (HAES®) approach, which advocates a holistic health-centered approach emphasizing self-acceptance and well-being, rather than weight loss (5) (Health at Every Size® and HAES® are registered trademarks of the Association for Size Diversity and Health). Such non-diet approaches have been found to improve eating behaviors, well-being, body image and psychological health (6).

With regards to the dietary and weight management components of HAES® interventions, they are based on intuitive eating principles (5). Eating intuitively is eating in response to hunger and satiety cues and respecting physical body signals to determine when, what and how much to eat (7). Intuitive eating principles aim at developing a healthy relationship between food, mind and body, and encourage the mindfulness of emotions and the pleasure derived from eating (7). During HAES® programs, nutrition topics are addressed through discussions, experimentations, and reflections on food intakes and eating behaviors rather than through nutrition education and suggestions about healthier food choices. It can be questioned whether or not such non-diet interventions can increase the quality of food intake. Given that the HAES® philosophy encompasses intuitive eating principles, it can be expected that such programs positively influence diet quality since intuitive eaters are expected to naturally lean towards foods that support their health and body functioning (7). As opposed to restrained eaters, who are likely to end up

transgressing their own dieting rules (8), not having such rules among intuitive eaters may prevent them from food cravings. However, as raised by Smith and Hawks (9), one could wonder if intuitive eaters, who eat in accordance with personal desires (7), may end up with a lower diet quality. Limited research exists on the effects of non-diet programs on diet quality. Such interventions seem to have positive impacts on diet quality in some studies (10, 11), whereas no association was observed in others (12, 13). These mixed results thus underline the need for further investigation.

The purpose of this study is to investigate the effects of a HAES® program on intuitive eating and diet quality in women. We hypothesized that the HAES® program increases intuitive eating and induces improvements in diet quality. We also hypothesized the presence of a positive association between intuitive eating and diet quality.

Material and Methods

Overview

A HAES® program, named "*Choisir de maigrir?*" ("What about losing weight?"), was created in the 1990s as an alternative approach for women struggling with weight-related problems. In 2006, the Quebec government launched an action plan to reduce the prevalence of obesity and of obesity-related health problems. This HAES® program was identified as one of the actions to put forward. The program has then been implemented in various Health and Social Services Centers (HSSC) of the province of Quebec (Canada) allowing the evaluation of its impacts in a community-based healthcare context. The present paper is part of a larger research project aiming at documenting the implementation process and at investigating the impacts of the HAES® program on women's

health in a natural setting. Data were thus collected among 326 women who were interested in taking part in the HAES® program offered in local HSSC in the province of Quebec. Twenty-five HSSC, from different regions of the province (urban and rural areas), were involved in the study during the fall (2010 and 2011) and winter (2010) sessions of the program, and HSSC's health professionals were in charge of the recruitment and data collection among participants. The HAES® program is freely offered to women wishing to improve their relationship with their body and eating behavior.

The program focuses on healthy lifestyle by promoting overall benefits of behavioral change related to diet and physical activity, with an emphasis on body acceptance and intuitive eating. The interventions are conducted in small groups (10 to 15 participants per group), and are divided in thirteen 3-hour weekly meetings and a 6-hour intensive day. Different topics are discussed with participants during the sessions, such as enjoyment of physical activity and healthy nutrition, identification of realistic objectives about body weight management, recognition of internal cues of hunger and satiety, influence of emotion on eating behavior, and acceptance of one's own and other's body image (see Table 1). Sessions are moderated by HAES® trained health professionals (usually a registered dietitian and a clinical psychologist or a social worker).

Participants

Following a quasi-experimental design, women who took part to the program (HAES® group; n=216) were compared to women who were on a waiting list for the program (control group; n=110). Participants in the HAES® group were from 21 different HSSC (mean: 10.3 participants per center, range: 3-21; 14% from rural areas), and participants from the control group were from 17 HSSC (mean: 6.5 participants per center, range: 1-16; 8% from rural areas). The flowchart in Figure 1 represents the number of participants who were excluded at different measurement times

due to various reasons (i.e. pregnancy, missing data, unrealistic intakes), drop-out of the study, and drop-out of the intervention (attended to less than 10 meetings). Written informed consent was obtained from all participants. This study was conducted according to the guidelines laid down in the Declaration of Helsinki. All procedures involving human participants were approved by the ethics committee of the Health and Social Services Agency of Montreal and ratified by each HSSC local ethics committee.

Questionnaires

Measurements were performed at baseline (T=0), post-intervention (T=4 months) and one-year (1-y) follow-up (T=16 months). At baseline, participants completed a socio-demographic questionnaire. At each measurement time, they were asked to complete a validated web-based self-administrated food frequency questionnaire (FFQ) (14), which measured the last month's dietary intakes.

The Intuitive Eating Scale (15) was also completed by participants at each measurement time. This scale measures a total intuitive eating score as well as three subscales: 1) Eating for physical rather than emotional reasons (*e.g.* "I find myself eating when I am lonely, even when I'm not physically hungry" (reverse-scored)), 2) Unconditional permission to eat when hungry and what food is desired (*e.g.* "I have forbidden foods that I don't allow myself to eat" (reverse-scored)), and 3) Reliance on internal hunger and satiety cues (*e.g.* "I trust my body to tell me when to eat."). Participants rated items on a 5-point Likert scale ranging from "strongly disagree" to "strongly agree". Mean scores were calculated for the total scale and each subscale, with higher scores representing more intuitive eaters. In the present study, the scale showed good internal reliability; Cronbach alpha coefficients were higher than 0.70 for the total and subscales scores.

Women's body mass index (BMI; kg/m^2) was calculated at each measurement time; self-reported height and weight were used for the control group at each time, and for the HAES® group at T=16, whereas health professionals from each HSSC measured height and weight in the HAES® group at T=0 and T=4. Except for the web-based FFQ, all questionnaires were pen-and-paper and given to participants by the health professionals in charge of the program within each HSSC (T=0 and 4 months in the HAES® group), or mailed-delivered (T=16 months in the HAES® group, and each measurement time in the control group).

Indicators of diet quality

Data from the FFQ were used to assess diet quality in three ways. First, energy and macronutrients daily intakes were calculated. Secondly, the high-fat/high-sugar foods intake was assessed by adding up daily portions of savoury and sweet foods (*i.e.* French fries, potato and corn chips, crackers, pizza, poutine, corndog, egg and imperial rolls, parmesan fondue, popcorn, pretzels, frozen yogurt and sorbet, ice cream, ice cream bars and sundae, chocolate, candies, cookies, cake and brownies, pie, doughnuts and other pastries). Thirdly, a Canadian adaptation of the Kennedy's Healthy Eating Index (HEI) (16) was used to determine the global quality of the diet. This index is considered sensitive enough to detect changes in eating habits (16). The score is composed of 10 components, each evaluated on 10 points; individuals receive 10 points if the criterion is met perfectly, no point if one fails to meet the criterion, and a proportional score if between the two extremes (see Table 2). According to Dubois's method (16), we grouped the fruits and vegetables servings, to adapt the criteria to the Canada's Food Guide recommendation (see Table 2). A maximum of 20 points is thus attributed for this group. Component scores are summed for a total score ranging between 0 and 100 (100 being the best score possible).

Statistical analyses

The MIXED procedure for repeated measures was used to assess the main effect of group by time interaction on intuitive eating and diet quality. In all models, groups (*i.e.* HAES® and control group) and time (*i.e.* T=0, T=4 months, and T=16 months) were treated as fixed effects and participants as random effect. To ensure the most adequate statistical fit of the model, the structure of the covariance matrix for each outcome variable was taken into account in all analyses. When a significant main effect was found, Tukey-Kramer adjusted *p*-values were used to identify the precise location of differences. Stepwise linear regression procedures were used to identify which components were the main contributors to the changes in intuitive eating score and HEI score. Baseline characteristics between groups were compared using Student's *t*-tests. Pearson's correlation analyses were conducted in both groups to assess the association between the intuitive eating score and the HEI.

In order to consider under- and over-reporting, participants with implausible intakes were excluded (see Figure 1). Unrealistic food intakes are usually identified using formulas based on basal metabolism (17), but this method was not feasible given the study design. Another method is to use cutoffs for plausible energy intakes, with "less than 500 kcal/day" and "greater than 3,500 kcal/day" being frequently used to identify under- and over-reporters among women (18). However, this upper cutoff was too strict to be applied with a sample of mostly overweight and obese women who can be more likely to have higher caloric intakes. We thus decided to exclude outliers, using the Outlier Labeling Rule with a 2.2 inter-quartile range (IQR) multiplier (19). This technique uses the sample quartiles, Q1 and Q3, and labels as "outliers" any observations below Q1 - k(IQR) or above Q3 + k(IQR), with k=2.2. Outliers were identified at each measurement time for energy intake, as well as for each of the four groups of the Canada's Food Guide (*i.e.* Vegetable and fruit, Grain products, Milk and alternatives, and Meat and alternatives). After excluding

outliers based on the FFQ results, all variables were normally distributed, so no data transformation was needed. Statistical tests were two-sided and differences at $p<0.05$ were considered significant.

Effect sizes are presented, comparing means for the two groups. Values were calculated using Cohen's *d* formula: $ES = (M_1-M_2)/SD_{pooled}$, where $SD_{pooled} = \sqrt{[(SD_1^2+SD_2^2)/2]}$. A Cohen's *d* between 0.2 and 0.49 represents a small effect size, between 0.5 and 0.79 a moderate effect size, and ≥ 0.8 a large effect size. Participants who did not answer to more than 90% of the items of a questionnaire were excluded as "missing data" (see flowchart in Figure 1). All statistical analyses were performed using Statistical Analysis Software (SAS) version 9.4 (SAS Institute, Cary, NC, USA).

Results

Baseline characteristics of the sample are presented in Table 3. No difference was observed between the two groups at baseline according to age, BMI, ethnicity, education, family income, intuitive eating (total and subscales scores), and HEI (total and components scores). Results from the FFQ at baseline (energy intake and servings of each group of the Canada's Food Guide) are presented in Table 4. No statistically significant difference between the two groups was observed. No difference was observed between participants who dropped out and other participants as it pertains to ethnicity, family income, baseline intuitive eating score, and baseline HEI score (*p*s>0.05). Women who dropped out were however significantly younger (46.9±1.5 vs. 51.2±0.8 years, $p=0.0145$), and had a different education level distribution (chi-square, $p=0.0044$), with a higher percentage of women having only a high school degree.

Intuitive eating

A significant group by time interaction was observed for the total intuitive eating score ($F_{(2, 395)}$=8.66; p=0.0002; see Figure 2). More specifically, in the HAES® group, women's intuitive eating score at T=4 months and T=16 months were significantly higher than at T=0 (ps<0.0001). Also, whereas the intuitive eating score did not differ between the two groups at T=0 (HAES®, 2.77±0.52; Control, 2.69±0.57), it was significantly higher in the HAES® group compared to the control group at T=4 months (3.19±0.59 and 2.83±0.55, respectively; p<0.0001; Cohen's d= 0.63) and at T=16 months (3.04±0.57 and 2.79± 0.61; p=0.0207, Cohen's d= 0.42). The same pattern of group by time interaction was observed for each of the three intuitive eating subscales ("Eating for physical rather than emotional reasons" subscale, $F_{(2, 395)}$=5.87; p=0.0031; "Unconditional permission to eat" subscale, $F_{(2, 390)}$=2.96; p=0.0527; "Reliance on hunger and satiety cues" subscale, $F_{(2, 389)}$=5.10; p=0.0065; data not shown). A stepwise regression analysis identified the "Eating for physical rather than emotional reasons" subscale as being the main contributor to the change in total intuitive eating score across time in the HAES® group, explaining 56.0% of the variance between T=0 and T=4 months, and 55.7% of the variance between T=0 and T=16 months.

Diet quality

A significant group by time interaction was observed for the HEI score ($F_{(2, 333)}$=4.33; p=0.0139; see Figure 3), where women who participated in the HAES® program significantly increased their score at T=4 months (p=0.0030) whereas it remained stable in the control group. Accordingly, HEI scores were different between groups at T=4 months (HAES®, 76.82±11.61; Control, 72.12±11.37; p=0.0462; Cohen's d= 0.41), whereas no difference was observed at T=0 (HAES®, 73.25±12.67; Control, 73.73±10.21), and T=16 months (HAES®, 74.93±11.52; Control, 72.98±11.82). A stepwise regression analysis identified four components, namely changes in total fat, fruits and vegetables, variety, and cholesterol, as the main contributors to the change in total

HEI score between T=0 and T=4 months, accounting respectively for 49.3%, 16.7%, 10.8% and 9.8% of the variance. No significant group by time interaction was observed for energy ($F_{(2, 333)}$=0.29; p=0.75), protein ($F_{(2, 333)}$=0.45; p=0.64), carbohydrate ($F_{(2, 333)}$=0.22; p=0.81), and lipid intakes ($F_{(2, 333)}$=1.83; p=0.16). However, a significant interaction between groups and time was observed for the high-fat/high-sugar foods intake ($F_{(2, 333)}$=3.6; p=0.0283), where participants in the HAES® group decreased their daily consumption at T=4 months while no change was observed in the control group. Therefore, whereas there was no difference between the two groups at T=0 (HAES®, 3.80±3.31; Control, 3.53±2.94), a significant difference was observed at T=4 months (HAES®, 3.05±2.73; Control, 4.01±5.44; p=0.0325; Cohen's d= 0.23). The daily consumption of high-fat/high-sugar foods did not differ between the two groups at T=16 months (HAES®, 3.09±2.50; Control, 4.48±5.74).

Association between intuitive eating and diet quality

When looking at baseline data, no association was found between intuitive eating score and HEI score in the whole sample (see Table 5). At post-intervention and at 1-y follow-up, a significant positive association between intuitive eating score and HEI was observed among women in the HAES® group, whereas there was no association in the control group. The same pattern of associations was observed for the "Eating for physical rather than emotional reasons" subscale; no association with the HEI score was observed for the whole sample at baseline and for the control group at T=4 months and T=16 months, while significant and positive associations were observed for the HAES® group at post-intervention and 1-y follow-up. An inverse association between the "Unconditional permission to eat" subscale score and the HEI score was observed at baseline among the whole sample, whereas no associations were observed at T=4 months in the two groups. At T=16 months, the associations were not significant, but a trend towards a positive correlation

256 in the HAES® group, and for a negative correlation in the control group were observed. Finally,
257 no significant association was found for any group at any time between the "Reliance on hunger
258 and satiety cues" subscale score, and the HEI score, except for a positive correlation in the HAES®
259 group at T=4 months.

260

261 **Discussion**

262 In accordance with our hypothesis, the HAES® intervention was successful at increasing the
263 intuitive eating scores at short and long term. These results are concordant with others (13), where
264 a 10-week intuitive eating program induced a shift away from restrictive dieting and emotional
265 eating towards intuitive-eating lifestyle behavior. A partial regress in the changes by the 6-month
266 follow-up was although observed, which can be partly explained by the length of the intervention
267 (only ten 1-hour weekly meetings). In contrast, the intervention in the present study comprised
268 thirteen 3-hour weekly meetings and a 6-hour intensive day. Such intensity (length of the program
269 and duration of the meetings) could be part of the success in maintaining the increased intuitive
270 eating score up to 1-y post program. A non-dieting stress reduction program (ten 2-hour weekly
271 meetings and 8-month support phase) also induced an increase in intuitive eating behaviors at 12
272 months, but low internal reliability of the intuitive eating scale used decreased the strength of these
273 results (20). Two other studies reported increased intuitive eating among college students enrolled
274 in a HAES® general education course (21) or a "Body Image, Self-Esteem, and Healthy Weight
275 Management" course (22). Other interventions promoting eating by internal cues were associated
276 with increased interoceptive awareness (*i.e.* the ability to recognize and respond to internal states
277 such as emotions, hunger, and satiety) (1), decreased emotional and external eating (23), decreased
278 frequency of dieting behaviors (24), and increased overall non-diet lifestyle (25). Considering that

intuitive eating has been previously associated with various indicators of physical (26) and psychological health (15, 27), HAES® and other non-diet programs that promote intuitive eating behaviors could be considered as effective health promotion approaches.

The impact of non-diet interventions on the quality of dietary intake has not yet received much attention. In the present study, women who participated in the HAES® intervention made short-term improvements in diet quality, as shown by an increased HEI and a decreased consumption of high-fat/high-sugar foods after the intervention, despite no specific nutritional advice on healthier food choices. It is however difficult to isolate the component(s) of the HAES® intervention from which changes originate. We have already tried to isolate one core component of HAES® program, the social support (*e.g.* Leblanc et al. (12) and Provencher et al. (28)), and no difference in dietary intake was observed between the HAES® group and the social support group. To our knowledge, other components such as intuitive eating, have not been isolated. It is however noteworthy that improvements in diet were not maintained at 1-y follow-up. The HAES® program could benefit from the inclusion of follow-up group or individual meetings with a registered dietitian to help participants to pursue and maintain their diet improvements. Effective techniques that could help maintaining the behavior changes in a HAES® context are goal setting, action planning, self-monitoring, and social support (29). Hawley et al. (11) also observed increased diet quality scores after three different non-diet programs. In contrast to our intervention, their programs were effective in maintaining dietary improvements at 1-year and 2-year follow-up. This could be explained by their 8-month support phase, through group sessions or newsletters. In contrast with Timmerman and Brown (10), who observed a decrease in energy and fat intake after a mindful intervention, our HAES® program had no significant impact on energy and macronutrient intakes. It seems that our intervention had a positive impact on diet quality without modulating energy

intake. Yet, these results differ from our group and other's findings where no changes in eating patterns were observed in response to HAES® interventions (12, 13). Diet quality improvements among women in the HAES® group could be related to a change in their food-related mindset more than a change in nutrition knowledge, since nutritional choices were discussed in only one of the 14 meetings.

According to intuitive eating principles (7), individuals who eat intuitively have the ability to support health with gentle nutrition, *i.e.* they tend to make nutritious food choices that promote good body functioning (27). The significant correlations observed between the intuitive eating total score (as well as the "Eating for physical rather than emotional reasons" and "Reliance on hunger and satiety cues" subscales) and the HEI score at post-intervention and 1-y follow-up among women in the HAES® program corroborate with the gentle nutrition principle. Since correlations were not significant at any time in the control group, it is suggested that intuitive eaters have a better diet quality, but mostly when the principles of intuitive eating are made salient, as they were taught in the HAES® program. Among cross-sectional studies, intuitive eating has been associated with a slightly higher vegetable intake in mid-aged women (30) and with diversity in the diet in a college sample (9). No significant associations were although found between intuitive eating and junk food. It could be suggested that, without any intervention, intuitive eating is not related with diet quality in the general population, but neither is it associated with consumption of foods with low nutritional value.

Pertaining to the "Unconditional permission to eat" subscale, results suggest that this principle is generally related to eating foods that are nutritionally inferior, as shown by the correlations at baseline as well as at post-intervention and 1-y post-intervention in the control group. A trend towards a positive association between this subscale and the HEI score was however observed

among HAES® participants at 1-y follow-up. A non-diet intervention may thus induce a shift towards a different mindset regarding food, where giving oneself the unconditional permission to eat whatever food is desired is not related to unhealthy eating behaviors.

Recently, a revised Intuitive Eating Scale, the IES-2, has been developed and validated (27). This tool contains a new subscale, the Body-Food Choice Congruence, which relates to the *gentle nutrition* principle where intuitive eaters are expected to make food choices that match with their physiological needs, to support health and body functioning. In future studies, this new subscale will be helpful to address the extent to which one's food choices are made in order to reflect body needs.

Strengths and limitations

The originality of this study is based on its evaluation of a program offered in local health centers in the province of Québec. While the quasi-experimental design could be viewed as a limitation, this real-life community context increases the public health relevance of the results. Another strength is the comparison with a control group composed of women with the same characteristics than the program participants. The real-life context however brings its limitations, such as the fact that participants completed the questionnaires at home (or elsewhere), and the variability in program settings may have influenced the responses. The use of different methods to distribute questionnaires and to measure height and weight is another limitation. However, BMI was only used to describe the sample, therefore it is unlikely that our results be biased by the measurements. This study is also limited by the relatively high rates of drop-outs. Participants who dropped out were younger and had lowest level of education, which limits the generalizability of the results.

Also, our sample was almost exclusively Caucasian and the majority was from urban areas, again limiting the dissemination of the results to different populations.

Conclusion

This HAES® intervention showed its efficacy at improving intuitive eating total and subscales scores. Our study also revealed that women who participated to the HAES® intervention improved the quality of their food intakes at short but not long term, and that their diet quality was positively related to their intuitive eating score. Further studies are however needed to better understand the association between diet quality and intuitive eating among the general population.

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Statement of Authorship and conflict of Interest Statement

All authors have participated sufficiently in the work to take public responsibility for the content of the paper and have read and approved the final manuscript. Authors report no conflict of interest.

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443 Table 1: Summary of the activities/intervention at each week during the HAES® program

444

Meeting theme	Examples of activities
1. Beginning my process	• Knowledge questionnaire (nutrition, obesity, weight loss)
2. Evaluating my food intake	• Food diary (with emotions, mood, hunger and satiety sensations)
3. Evaluating my eating habits	• Group discussion on previous experience pertaining to body weight and motivations to eat
4. Evaluating my energy needs	• Lectures on energy needs, energy balance and obesity
5. My body in motion	• Lecture on physical activity by a professional (kinesiologist, physiotherapist, or physical educator)
6. Listening to my body (intensive day)	• Exercises on hunger and satiety cues, and on external cues that makes one stop eating • Lecture and group discussion on the different dimensions of the act of eating
7. Realizing others' influence on me	• Exercise to identify supportive others and kill-joys
8. Exploring my body image	• Group exercise and discussion on body image and beauty standards around the world
9. Examining my motivation towards weight loss	• Lecture on physiological body resistance against weight loss
10. Choosing the direction of my approach	• Personal analysis of motivation towards weight loss
11. Feeding my body	• Lecture on the Canada's Food Guide
12. Being critical about diets	• Analysis and group discussion on weight loss products
13. Defining my action plan	• Presentation of the action plans of each participant
14. Evaluating my process	• Final group discussion on the program

445

446 Table 2 – Healthy Eating Index (HEI)

Components	Maximum score (daily servings)*	Score 0	Details
1. Grains	≤1600 kcal: 5 servings 1600-2200 kcal: 9 servings ≥2800 kcal: 12 servings	0 servings	Grain products group (*e.g.* breads, cereals, rice, pasta)
2-3. Fruits and vegetables	≤1600 kcal: 5 servings 1600-2200 kcal: 7 servings ≥2800 kcal: 10 servings	0 servings	Vegetable and fruit group (*e.g.* fruits, fruit juice, vegetables, vegetable juice)
4. Milk	2 servings	0 servings	Milk and alternatives group (*e.g.* milk, yoghurt, cheese, soy beverages)
5. Meat	≤1600 kcal: 2 servings 1600-2200 kcal: 2.5 servings ≥2800 kcal: 3 servings	0 servings	Meat and alternatives group (*e.g.* meat, poultry, fish, egg, legumes, nuts)
6. Total fat	≤30% energy from fat	≥45% energy from fat	Total fat
7. Saturated fatty acids	<10% energy from saturated fat	≥ 15% energy from saturated fat	Total saturated fatty acids
8. Dietary cholesterol	<300 mg	≥ 450 mg	Total dietary cholesterol
9. Sodium	< 2400 mg	≥ 4800 mg	Sodium

10.Variety	At least 1 serving of each food group	Not all food groups consumed	Number of servings in each food group

The HEI, as proposed by Dubois, Girard (16).

*The maximum score for each component is 10; components 2 and 3 have been combined so the maximum score is 20. The maximum total score is 100.

451 Table 3 – Baseline characteristics

	HAES® n=204	Control n=103	p^1
Age (y)	51.17 ± 11.43	49.44 ± 12.77	0.23
BMI (kg/m^2)	35.15 ± 5.95	34.40 ± 7.31	0.34
% Normal weight (BMI=18.5-24.9)	1.9 (4)	3.9 (4)	
% Overweight (BMI=25-29.9)	21.1 (43)	23.3 (24)	0.53
% Obesity (BMI≥30)	77.0 (157)	72.8 (75)	
Ethnicity			0.28
Caucasian	94.6 (193)	97.0 (100)	
African American	0.5 (1)	1 (1)	
Native American	0.5 (1)	0 (0)	
Latina	3.4 (7)	0 (0)	
Prefer not to answer	1 (2)	1.9 (2)	
Education			0.41
Elementary school	2.9 (6)	4.5 (5)	
High school	30.4 (62)	35.9 (37)	
College	29.9 (61)	31.1 (32)	
University	35.3 (72)	28.1 (29)	
Prefer not to answer	1.7 (3)	0 (0)	
Family income (CA$)			0.22
<20 0000	10.8 (22)	11.7 (12)	
20 000-39 999	30.4 (62)	26.2 (27)	

40 000-59 999	13.7 (28)	22.3 (23)	
60 000-79 999	10.8 (22)	13.6 (14)	
80 000-99 999	8.3 (17)	9.7 (10)	
≥100 000	14.2 (29)	7.8 (8)	
Prefer nor to answer	11.8 (24)	8.7 (9)	
Intuitive eating score	2.77 ± 0.52	2.69 ± 0.57	0.21
Eating for physical reasons subscale	2.45 ± 0.98	2.38 ± 1.09	0.58
Unconditional permission to eat subscale	2.77 ± 0.65	2.65 ± 0.62	0.11
Reliance on hunger and satiety cues subscale	3.07 ± 0.77	3.05 ± 0.85	0.84
HEI score	73.25 ± 12.67	73.73 ± 10.21	0.77
Grains score	5.09 ± 1.84	5.04 ± 1.77	0.84
Fruit and vegetable score	16.57 ± 4.38	16.86 ± 3.77	0.61
Milk score	8.84 ± 2.01	8.78 ± 2.10	0.83
Meat score	8.70 ± 1.72	8.29 ± 2.11	0.11
Total fat score	5.82 ± 3.13	6.20 ± 3.01	0.38
Saturated fatty acid score	5.53 ± 3.84	5.64 ± 3.60	0.83
Cholesterol score	7.53 ± 3.64	8.20 ± 3.25	0.17
Sodium score	6.05 ± 3.43	5.63 ± 3.78	0.39
Variety score	9.10 ± 2.87	8.88 ± 3.18	0.58

452 *Note:* Results are mean values ± standard deviations, or percentage (n).

453 [1] *p* values for differences between groups, as determined by the Student's *t*-tests for age, BMI, Intuitive
454 eating scores, and HEI score, and by chi-square tests for ethnicity, education, and family income.

455

456 Table 4 – Baseline food intakes

	HAES® n=204		Control n=103		p^1
	Mean	SD	Mean	SD	
Energy (kcal/day)	2349.26	785.29	2372.71	816.38	0.83
Vegetables and fruits[2]	8.02	3.69	8.37	3.97	0.50
Grain products[2]	4.92	2.06	4.98	2.21	0.85
Milk and alternatives[2]	2.74	1.51	2.95	1.75	0.33
Meat and alternatives[2]	2.82	1.23	2.62	1.18	0.23
High-fat/high-sugar food[2]	3.80	3.31	3.53	2.94	0.62

457 [1] *p* values for differences between groups, as determined by the Student's *t*-tests.

458 [2] Servings per day.

459

460

461 Table 5 – Pearson correlations between the Healthy Eating Index (HEI) and intuitive eating (total
462 and subscales score)

HEI score with	T=0	T=4		T=16	
		HAES®	Control	HAES®	Control
Intuitive eating total score	-.02	.20*	.05	.22*	-.16
Eating for physical rather than emotional reasons score	.12†	.24**	.13	.28*	-.02
Unconditional permission to eat score	-.20**	-.02	-.11	.19†	-.27†
Reliance on hunger and satiety cues score	.04	.21*	.09	-.01	-.05

463 † < .10, * $p < .05$, ** $p < .01$.

464

Figure 1 – Flow chart

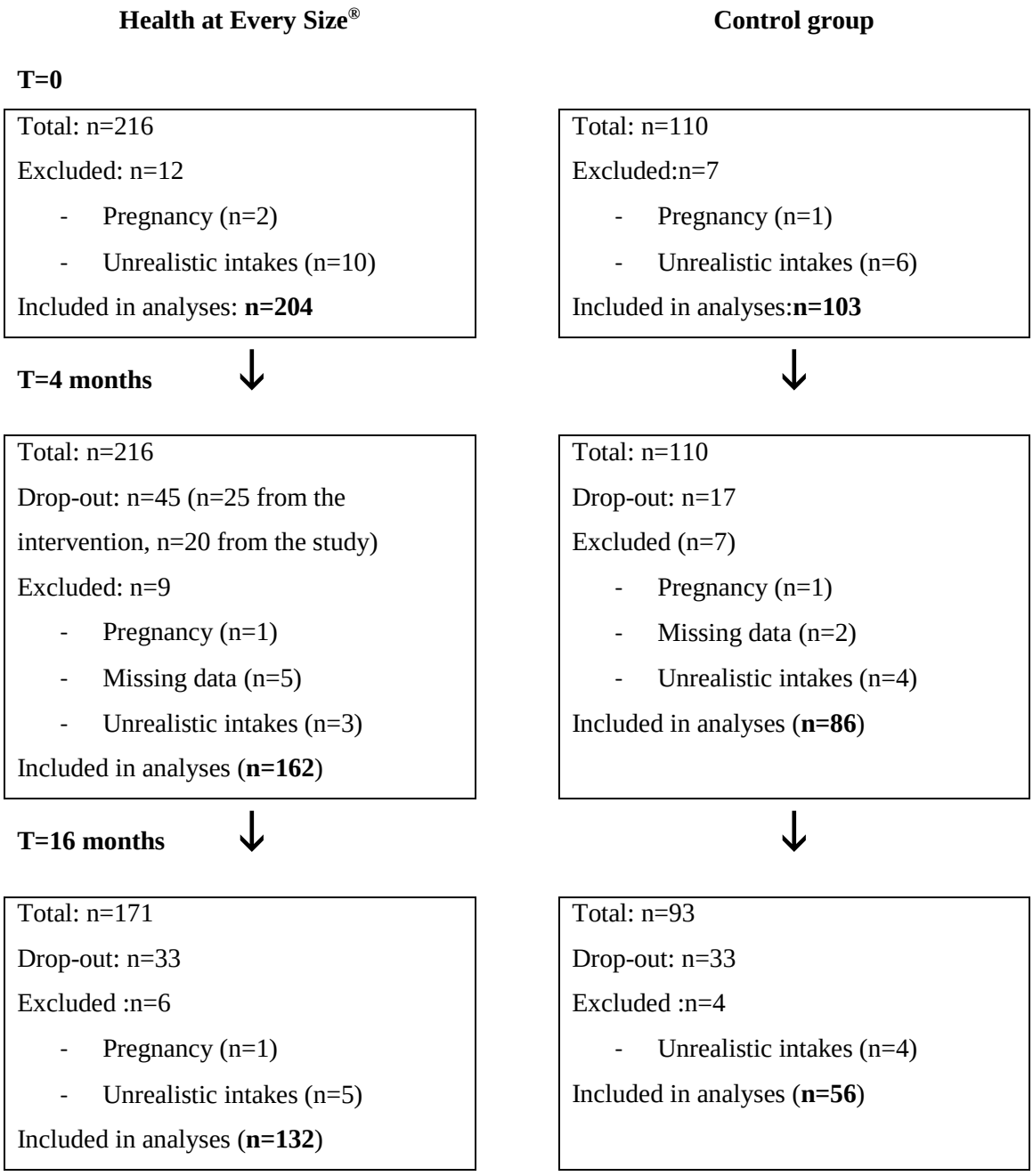
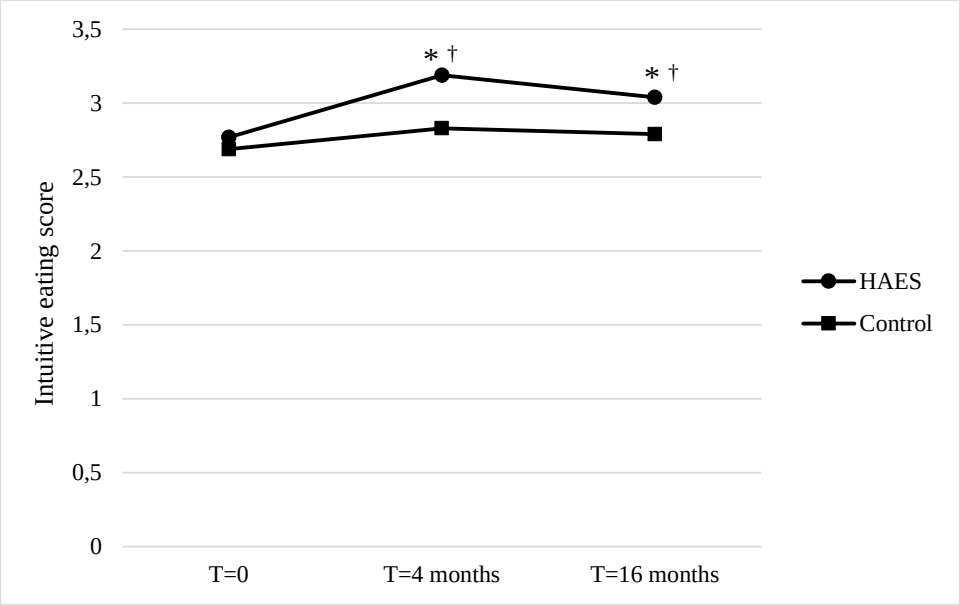


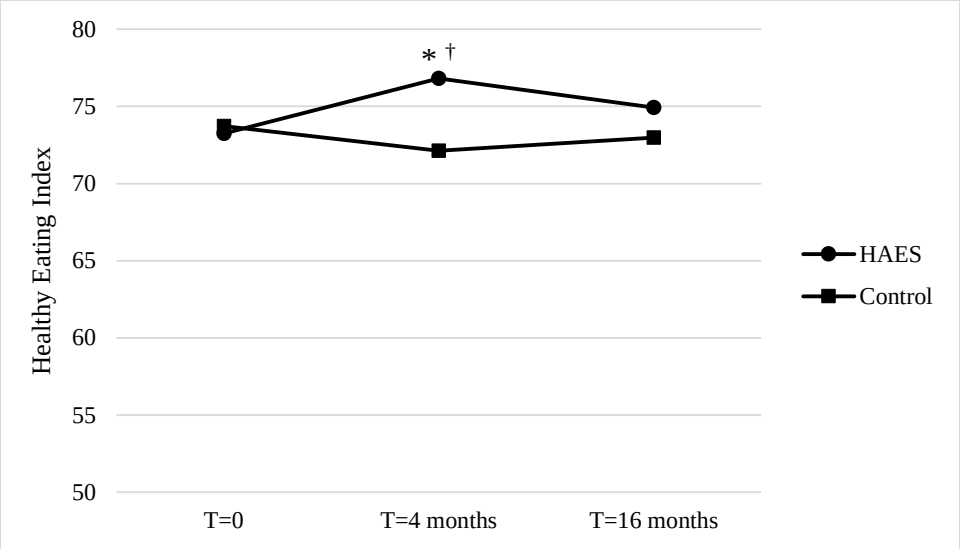
Figure 2 – Intuitive eating score



Group by time interaction (mixed model): p=0.0002.

* Different from baseline. † Different from the control group.

474 Figure 2 – Healthy Eating Index



475

476 Group by time interaction (mixed model): p=0.0139.

477 * Different from baseline. † Different from the control group.