

Title page

Evaluation of a theory-based intervention aimed at reducing intention to use restrictive dietary behaviors among adolescent female athletes

Research article

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Notes:

The Research Ethics Boards of Laval University reviewed and approved the protocol prior to its undertaking. The authors' responsibilities were as follows: BL and VD designed the research. CL coordinated the intervention, performed statistical analyses and wrote the manuscript. BL had primary responsibility for final content. All authors critically revised the manuscript and contributed intellectually to its development, provided final approval of the submitted manuscript, had full access to all of the data in the study, take responsibility for the integrity of the data and the accuracy of the data in the analysis, affirm that the article is an honest, accurate, and transparent account of the study being reported and that no important aspects of the study have been omitted. The study was funded by unrestricted grant from the Danone Institute, which had no role to play in designing the study, conduct of the study, or collection, management, analysis, or interpretation of the data or in the preparation or review of the manuscript and had no right to approve or disapprove of the submitted manuscript. Authors have no disclosures related to this research.

ABSTRACT

Objective: To evaluate the effectiveness of a theory-based intervention to reduce the intention to use restrictive dietary behaviors for losing weight among adolescent female athletes involved in aesthetic sports.

Design: Cluster randomized controlled trial.

Setting: Aesthetic sport teams of adolescent (age 12-17) female athletes.

Participants: Two teams (n=37 athletes) in the intervention group and 3 teams (n=33) in the comparison group.

Interventions: The 2 groups received nutrition education during 3 weekly 60-min sessions. The intervention group was further exposed to a theory-based intervention targeting the specific determinant of intention to use restrictive dietary behaviors for losing weight, namely attitude.

Main Outcome Measures: Difference over time between groups in intention to use restrictive dietary behaviors for losing weight and in nutrition knowledge.

Analysis: Mixed models for repeated measures.

Results: The theory-based intervention contributed to maintaining a low intention of using restrictive dietary behaviors for losing weight over time in the intervention group compared to the comparison group. Nutrition knowledge score increased equally in both groups.

Conclusion and implications: Complementing nutrition education with theory-based behavior change intervention may help maintain a low intention of using restrictive dietary behaviors for losing weight among high-school female athletes involved in aesthetic sports.

(197 words)

Key words: Adolescent; athletes; social theory; feeding and eating disorders; health education;

INTRODUCTION

Disordered eating (DE) refers to a wide spectrum of unhealthy eating behaviors often used in an attempt to lose weight and/or achieve a lean appearance.¹ The spectrum of DE ranges in severity from restrictive eating to abnormal eating behaviors such as bingeing and purging to frank clinical diagnosis of eating disorders.^{1,2} Epidemiological studies show that adolescence is a critical period for the onset of DE.³ Thin-ideal internalization, body dissatisfaction, overweight/obesity, and dieting have been shown to be key risk factors of DE.^{4,5} Pressure to lose weight within specific sports environments and some athletes' personality traits also amplify the risk of DE.^{6,7} Accordingly, DE has been shown to be more prevalent among female elite athletes than among female non-athletes. Among female elite athletes, those competing in aesthetic, endurance and weight-class sports where leanness is emphasized are at greater risk of DE than those competing in other sports where there is less focus on leanness.⁸ The prevalence of clinical eating disorders has been shown to be as high as 20% among adolescent female elite athletes who compete in sports that emphasize leanness.⁹ This represents an issue for athletes since DE can impair physical health, psychological health and sports performance.^{2,10}

Few studies have investigated the effectiveness of interventions designed to prevent unhealthy weight control behaviors in high-risk populations such as high school female athletes involved in aesthetic sports. The prevalence and psychosocial determinants of intention to use restrictive dietary behaviors for losing weight were recently examined among high school female athletes using the Theory of Planned Behavior (TPB) framework.^{11,12} Results showed that an important proportion of adolescent female athletes mostly involved in aesthetic sports expressed concerns regarding body weight (67%), wanted to be thinner than their perceived body size (38%), had attempted to lose weight within the last year (40%) and had "some

intention” to use restrictive dietary behaviors for losing weight (22%).¹² Attitude was the only significant predictor of this intention, accounting for 45% of its variance, with no apparent additional contribution of subjective norm and perceived behavioral control. Improvement in appearance was the most significant behavioral belief sustaining the favorable attitude towards the intent to use restrictive dietary behaviors in adolescent female athletes.¹² These data provided invaluable information for the development of an intervention based on these TPB psychosocial determinants.

The present study was undertaken to evaluate the effectiveness of a TPB-based intervention designed to reduce the intention to use restrictive dietary behaviors for losing weight among adolescent female athletes. The primary hypothesis was that combining nutrition education with a theory-based intervention targeting attitude and its underlying beliefs decreases the intention to adopt restrictive dietary behaviors compared to providing nutrition education only.

METHODS

Participants and Recruitment

Girls between 12 and 17 years of age were solicited within local competitive aesthetic sports communities, namely cheerleading, gymnastic, synchronized swimming, artistic skating, diving, circus and dance, through their coaches. Five coaches from 2 high schools and 1 sports club in Québec City expressed interest in having their athletes participate on a voluntary basis to the project. The study coordinator met the different groups within their sports setting to explain the purpose of the study and related procedures. Written consent from girls and their parents was obtained prior to the second visit for baseline data collection.

Twenty gift certificates at a local sports store were given at random among study participants. The Institution's Research Ethics Boards reviewed and approved the protocol prior to its undertaking.

Study Design

Using cluster randomization, teams of participants were randomly assigned to the comparison or intervention groups in this parallel arm study. Cluster randomization was considered ideal for implementation purposes as well as to eliminate the risk of contamination that occurs when participants from the same team are subjected to different interventions. The study flowchart is shown in Figure 1. A total of 70 athletes completed the baseline data collection. Participation rate among athletes in the intervention and comparison groups was 84% and 91% at week 3, and 73% and 36% after the 2-3 month follow-up, respectively.

The comparison group was subjected to 3 sessions of 60 minutes each, focusing on nutrition education. The following topics related to healthy eating and sports nutrition were discussed: (1) energy needs in athletes vs. sedentary individuals, (2) importance of considering hunger and satiety signals in achieving adequate energy intake, (3) importance of carbohydrates as a fuel, of proteins for muscle repair and function and of the right balance of lipids to maintain good health, (4) strategies to make nutritious food selection while eating out, (5) identifying the right foods before, during and after training, and (6) the importance of hydration in sports.

The intervention group was also subjected to 3 sessions of 60 minutes, which focused on behavior change in addition to providing nutrition education. The behavior change intervention, which used the TPB framework, was aimed specifically at reducing intention to use restrictive dietary behaviors for losing weight.

The framework was based on data from a previous study, which identified attitude as the main determinant of this intention in this population.¹² Specific behavior change strategies were therefore developed to modify attitude towards this intention (Table 1). Persuasive communication consisted in guiding girls towards adoption of an attitude by the use of arguments.¹³ This method was used to enhance the positive beliefs, weaken the negative beliefs and introduce new beliefs.¹⁴ Active learning was used during group discussion to stimulate people to cognitive elaboration.¹³ Observational modeling provided examples of athletes to emulate.¹³ Successful female Olympic athletes all involved in aesthetic sports but with various body sizes were used as models. The nutrition education activities in the intervention group were slightly shortened in each session to make time for the behavior change activities. For example, an activity aimed at classifying different beverages according to amounts of added sugar was replaced by a brainstorming activity discussing the pros and cons of low vs. high carbohydrate diets for weight management in sports setting.

The sessions in the intervention and comparison groups took place over a period of 3 weeks around the team's training time or during specific lecture periods. All sessions were developed and implemented by the same registered dietitian who had formal training in the management of disordered eating and had experience in working with adolescents. The TPB-based intervention was first pilot-tested using a group of adolescent girls of the same age, providing an opportunity for feedback. In response to comments received from participants and investigators, the intervention was modified to increase interaction with participants, to simplify explanations of various key concepts and to include more visual support. There was no change, however, in the content of the intervention following the pilot-test.

Measures

Data were collected at baseline, after the 3-week intervention as well as after a 2-3 month follow-up. All questionnaires were web-based. They were completed in most cases within the athletes' sports setting in

the presence of research staff, or at home when computers were not available at school or because of time constraints. Participants were asked to complete questionnaires individually without talking to their friends or relatives. Participants received up to 3 e-mails at each data collection time point as reminders to complete the questionnaires.

Anthropometry. At baseline, participants were measured and weighed without shoes with the same stadiometer (SECA model 217, SECA Corp., Hamburg, Germany, 2008) and electronic scale (SECA model 874, SECA Corp., Hamburg, Germany, 2009). Body mass index (BMI; kg/m^2) was calculated and classified according to the International Obesity Task Force age-and-sex specific BMI cutoff points.¹⁵

Nutrition knowledge. Participants completed a general and sports nutrition knowledge questionnaire comprising 37 true or false and multiple-choice questions that was developed for the purpose of a previous study.¹⁶ Upon development, the questionnaire was reviewed by 2 dietitians for content validation, pilot-tested in 6 adolescent girls to verify content clarity and pre-tested in 14 adolescent females. Questions were divided into 5 main subcategories: carbohydrates (8 questions, Cronbach's $\alpha=0.64$), proteins (9 questions, Cronbach's $\alpha=0.66$), lipids (8 questions, Cronbach's $\alpha=0.47$), general sports nutrition (7 questions, Cronbach's $\alpha=0.48$) and others (5 questions, Cronbach's $\alpha=0.27$). Questions on carbohydrates, proteins and lipids inquired about the nutrient content of different foods, the number of calories provided by each nutrient and their functions. Sports nutrition questions inquired about dietary recommendations, hydration and supplement use. The "other" category included questions on weight management, vitamins, publicity and Canada's Food Guide recommendations. Answers to all questions included a "don't know" option to minimize guessing. Correct answers were scored as 1, while incorrect and "don't know" answers were scored as 0. Subcategory scores and overall mean score were calculated as % of correct answers.

Psychosocial determinants. Intention, attitude, subjective norm and perceived behavioral control were assessed by the same questionnaire that had been used in a previous study on the same topic.¹² The target behavior was described as using restrictive dietary behaviors within the next 3 months to lose weight. The following restrictive dietary behaviors were considered: (1) avoiding dairy products, (2) skipping meals voluntarily, (3) avoiding meat products, (4) avoiding grain products, (5) skipping lunch, (6) avoiding fat, (7) avoiding sugary foods, (8) reducing serving size, and (9) avoiding restaurants. These specific behaviors were chosen based on available literature specific to this adolescent population. Overall intent was calculated as a mean score based on these nine specific behaviors measured on 6-point Likert scales, each ranging from totally disagree (1 point) to totally agree (6 points) (Cronbach's alpha=0.89). Having "some intention" to use restrictive dietary behavior to lose weight was arbitrarily defined as having an overall mean score > 3 points, which corresponds to the midway point of each of the 9 individual behaviors.¹² Attitude is defined as the subjective analysis of advantages or disadvantages related to a given behavior¹⁴ and was assessed using 4 items measured on 6-point differential semantic scale (Cronbach's alpha=0.98). For example, participants were asked, "For you, using restrictive dietary behaviors for losing weight in the next 3 months would be...". Adjectives to qualify attitude were: harmful/healthy, bad/good, unnecessary/useful and unacceptable/acceptable. Injunctive subjective norm refers to one's perception that important people would approve or disapprove the behavior.¹⁴ Injunctive subjective norm was assessed using 3 questions measured on 6-point Likert scales ranging from strongly disagree (1 point) to strongly agree (6 points) (Cronbach's alpha=0.87). For example, the following statement was used: "Persons that are important to you think you should use restrictive dietary behaviors for losing weight in the next 3 months." Perceived behavioral control is the perceived level of ease or difficulty with which participants may adopt the behavior.¹⁴ Perceived behavioral control was assessed using 3 questions measured on 6-point Likert scales ranging from strongly disagree (1 point) to strongly agree (6 points) (Cronbach's alpha=0.74). For example,

participants rated the degree of agreement/disagreement with the following item: “If you wanted to, you would be able to adopt restrictive dietary behaviors for losing weight in the next 3 months.”

Data Analysis

Sample size calculations indicated that a total of 150 athletes distributed equally in both groups would yield a power of 86% to detect a treatment difference ($P < 0.05$) between groups in intention to use restrictive dietary behaviors to lose weight, if the difference between groups was 10% or more, with a SD of the response variable of 20%. Statistical analyses were performed with SAS, version 9.2 (SAS Institute Inc., Cary, NC, 2009). Mean values and standard deviations for continuous variables and frequencies in percent for categorical variables were computed. Unpaired t-test and chi-square analyses were used to compare baseline characteristics between groups. Multivariate regression models were used to identify predictors of intention to use restrictive dietary behaviors for losing weight at each time point in the study. Mixed models for repeated measures with Tukey post-hoc tests were used to assess changes in outcome measures over time using time, group and their interaction as fixed effects and subject as random effects. Missing data were not imputed since a mixed model approach has been demonstrated to provide the most powerful and robust analysis when data are not missing at random, even in cases where there is a high percentage of missing values.¹⁷ Mixed models included baseline values of a given outcome as a covariate in all analyses. Differences between groups at baseline (age, competition level and/or type of school) were considered in all analyses, but were included only if their association with the dependent variable was significant in the final mixed model. Competition levels were combined in 3 categories for adjustment purposes (local-regional, provincial and national-international). The Akaike Information Criteria (AIC) was used in all mixed model analyses to compare covariance structures and to assess goodness of fit of the model to the data.

RESULTS

Table 2 presents the socio-demographic characteristics of participants. Athletes randomized to the intervention group were involved in synchronized swimming and dance whereas athletes randomized to the comparison group comprised gymnasts and cheerleaders. Athletes in the intervention group were on average 1 year older than athletes in the comparison group (14.1 ± 1.5 vs. 13.1 ± 1.2 years, $P=.003$). All athletes in the intervention group attended public schools while 63.6% of athletes in the comparison group were from private schools. Self-reported time devoted to sports practice was higher among athletes in the intervention group than in the comparison group (25.1 ± 5.3 vs. 11.2 ± 6.9 hours/week, $P<.0001$). More athletes of the intervention group competed at the national and international levels ($P<.0001$). There was no significant difference in baseline psychosocial variable scores between groups. Baseline socio-demographic characteristics of participants who dropped out at any point in the study were also similar to those of participants who remained in the study (data not shown).

Mean nutrition knowledge score at baseline was 60.8% in the intervention group and 51.4% in the comparison group ($P=.50$ after adjustment for age, type of school and competition level). Figure 2 depicts the changes in nutrition knowledge score over time. Participants in the intervention (+8.6%, $P<.001$) and comparison (+10.3%, $P<.01$) groups showed a significant increase in nutrition knowledge score from baseline after the 3-week intervention, and scores remained essentially unchanged at the 2-3 month follow-up. Changes in nutrition knowledge score over time were similar between the 2 groups (group*time interaction $P=.31$).

Multivariate regression analyses of baseline data indicated that among the primary constructs of the TPB, attitude was the only significant determinant of the intention to adopt restrictive dietary behaviors for losing

weight in both the intervention ($R^2=0.65$, $P<.0001$) and comparison groups ($R^2=0.54$, $P<.0001$). This was also the case at each time point of the study (data not shown).

At baseline, 16% of athletes in the intervention group and 18% of athletes in the comparison group reported having “some intention” to use restrictive dietary behavior to lose weight ($P=.67$ between groups). Figure 3 shows the changes in intention of using restrictive dietary behaviors for losing weight over time in each group based on the overall score of intention, which was calculated from 9 individual related behaviors. There was a significant group*time interaction for the change in intention to use restrictive dietary behavior to lose weight ($P=0.03$), suggesting significant difference between the intervention and comparison groups in intention over time. More specifically, the group*time interaction was significant for intention towards skipping meals voluntarily ($P=.02$), avoiding meat products ($P=.01$), avoiding grain products ($P=.006$), avoiding fat ($P=.02$) and avoiding restaurant ($P=.004$). However, none of the within-group changes achieved statistical significance.

Table 3 reports the change in psychosocial variables of the TPB framework over the study period. There was no significant group*time interaction for the changes in attitude, subjective norm and perceived behavior control scores. This indicates that there was no significant difference between the intervention and comparison groups in these variables over time, although scores for attitude (mean change -0.6 units, $P<.001$) and subjective norm (mean change -0.5 units, $P<.01$) were reduced significantly post-intervention compared with baseline scores in the intervention group only.

DISCUSSION

The aim of the present study was to evaluate the effectiveness of a TPB-based intervention designed to reduce the intention to use restrictive dietary behaviors for losing weight in adolescent female athletes. Despite the fact that young female athletes involved in aesthetic sports were investigated, the prevalence of having “some intention” to use restrictive dietary behaviors for losing weight was relatively low in the intervention and comparison groups (16% and 18%, respectively). These data are consistent, however, with data from a previous study of female athletes of the same age using the same arbitrary definition of the intention to use restrictive dietary behaviors for losing weight (22%).¹² Data further indicated that the TPB-based intervention along with nutrition education contributed to maintaining a low score of intention to use such behaviors over time in this at-risk population.

Results confirmed previous data¹² by showing that attitude was the only significant TPB determinant of intention to use restrictive dietary behaviors for losing weight in adolescent female athletes, with no apparent contribution of subjective norm and perceived behavioral control. This is consistent with results from a systematic literature review and meta-analysis, which identified attitude as the strongest determinant of intention for various nutrition-related behaviors in youth (mean $r=0.52$).¹⁸ A recent survey in Québec has shown that 41% of high-school girls expressed the desire to have a thinner body shape.¹⁹ The high prevalence of body dissatisfaction most likely contributes to sustain the rather favorable attitude towards dieting or using weight control behaviors in this population.²⁰

The intervention based on the TPB framework was developed to modify attitude towards intention to use restrictive dietary behaviors using strategies such as persuasive communication, active learning and observational modeling. The study could not detect significant differences between groups in attitude

towards this intention in response to the intervention, although scores for attitude and subjective norm were reduced post-intervention in the intervention group only. Very few TPB-based dietary behavior interventions have been developed for adolescent populations²¹ and changes in targeted TPB constructs following interventions are rarely reported, making comparison with previous studies rather difficult.²² Nevertheless, a motivational-based TPB intervention aimed at increasing the intent to consume 5 servings of fruit and vegetable a day among youth did not have a significant effect on any of the TPB variables compared to the control group.²³ However, favorable changes in attitudes and subjective norms over time were observed in the motivational-based TPB intervention group and not in the control group,²³ which is consistent with data from the present study. Another intervention designed to increase fruit and vegetable consumption among young adults led to significant increases in attitude and subjective norm scores in the intervention group compared to the control group, while having no effect on intention, perceived behavioral control and the behavior *per se*.²⁴ Such mixed results reflect the complexity of investigating the determinants of behavior changes.

Several studies have emphasized the influential impact of sociocultural norms in modulating unhealthy weight control behaviors. The fact that subjective norm did not predict intention towards the use of restrictive dietary methods to lose weight among adolescent female athletes independently of the attitude construct appears as being inconsistent with previous data on this topic. Two different types of social norms have been described: descriptive norms (i.e., what others do) and injunctive norms (i.e., what others think one ought to do).²⁵ In the TPB framework, subjective norm relates primarily to the injunctive norm.¹⁴ Rivas et al. (2003) have shown that adding the descriptive norm to the original TPB framework may explain a greater percent of the variance in intention towards a given behavior.²⁵ Descriptive norm also correlates more strongly with intention among younger individuals than older individuals.²⁵ In support of this, peer modeling (e.g., "My friends are often on a diet") has been shown to be an important predictor of dieting behavior in

adolescent girls²⁶ while social reinforcement (e.g., “it is important for my friends that I am thin”) was not.²⁷ The fact that descriptive norm was not specifically assessed in this study may explain at least partly why the subjective norm construct of the TPB was not an independent predictor of intention to use restrictive dietary behaviors for losing weight among adolescent female athletes.

Strengths and Limitations

Strengths and limitations inherent to this study must be addressed. Strengths include the randomized design with an active control condition as well as a 2-3 month follow-up period post-intervention. The content of the TPB-based intervention targeted specific determinant of intention based on strong and highly relevant preliminary data. Behavior change methods were developed in light of existing literature. The cluster randomization, which was necessary to avoid potential contamination within sports teams, has generated significant differences in baseline socio-demographic characteristics between the intervention and comparison groups. This is a risk inherent to most studies using such randomization procedures. It is stressed, however, that there was no significant difference at baseline in primary outcome variables, namely TPB constructs and nutrition knowledge. Adjustment for differences in baseline characteristics also had no impact on the between-group comparisons. The internal consistency of the nutrition knowledge questionnaire was relatively low and this may have limited the capacity to observe differences between groups. However, as the nutrition education component of the sessions was comparable to a large extent in both groups, no difference in terms of nutrition knowledge was expected between intervention and comparison groups. The intention to use restrictive dietary behaviors for losing weight was not very prevalent in the intervention and comparison groups, which has limited the capacity to observe large effects with the TPB-intervention. Using tools such as the Restraint Scale to identify adolescent athletes at higher risk for using restrictive dietary behaviors might have increased the efficacy of the intervention. However, an

individual screening approach was impractical considering that participants were recruited within a team sports setting. Content fidelity was not monitored and intervention appreciation was not assessed. The sample size achieved was short of the calculated sample size, due to difficulties in recruitment. The drop out rate is also non-trivial, particularly in the comparison group at follow-up. Numbers, however, are consistent with drop out rates observed in previous DE prevention studies among adolescent athletes.^{28,29} Nevertheless, results must be interpreted with caution as the risk of a type 2 error exists. The use of self-report questionnaires may be seen as a limitation. However, even if social desirability response bias may be associated with lower self-reported body concerns and DE, it apparently has no influence on outcome measures over time in eating disorder prevention program designed for teenage girls.³⁰ Finally, the primary outcome was the intention of using restrictive dietary methods to lose weight, not this behavior *per se*. According to Webb et al., a medium-to-large size change in intention leads to a small-to-medium change in behavior.³¹

IMPLICATION FOR RESEARCH AND PRACTICE

Findings suggest that an intervention based on the TPB framework combined with nutrition education may help maintain a low intention of using restrictive dietary behaviors for losing weight in adolescent female athletes involved in aesthetic sports. The extent to which changes in attitude and social norms scores with the TBP intervention are responsible for this effect of the intervention remains unclear. Longer-term studies with larger samples sizes and with objective measures of restrictive eating are required to corroborate those results.

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Figures Legend

Figure 1. Study Flowchart

Figure 2. Changes (Mean±SEM) from Baseline in Nutrition Knowledge Score after the 3-week Intervention and at the 2-3 Month Follow-up in the Intervention and Comparison Groups of Adolescent Female Athletes. Based on mixed models for repeated measures with Tukey post-hoc tests; Model adjusted for baseline values and competitive level. **P<.01, ***P<.001

Figure 3. Changes (Mean±SEM) from Baseline in Intention of Using Restrictive Dietary Behaviors to Lose Weight after the 3-week Intervention and the 2-3 Month Follow-up in the Intervention and Comparison Groups of Adolescent Female Athletes. Based on mixed models for repeated measures with Tukey post-hoc tests; Model adjusted for baseline values and type of school (private vs. public).

Figure 1.

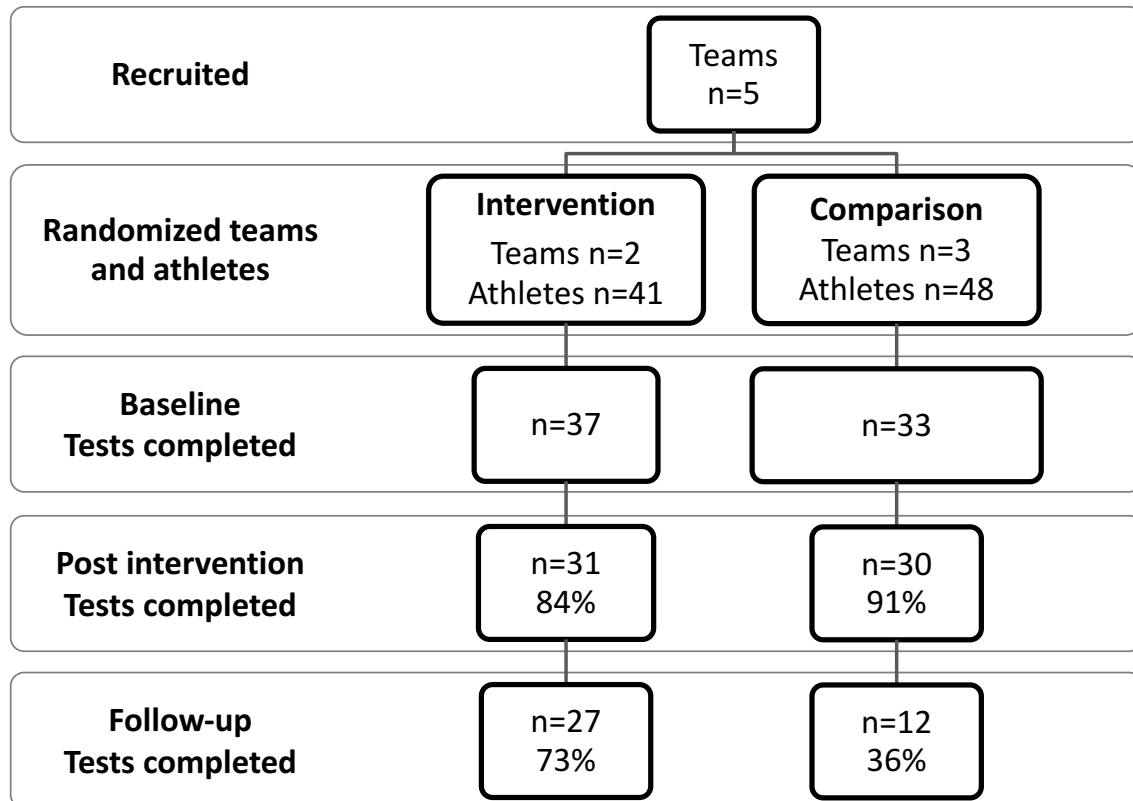


Figure 2.

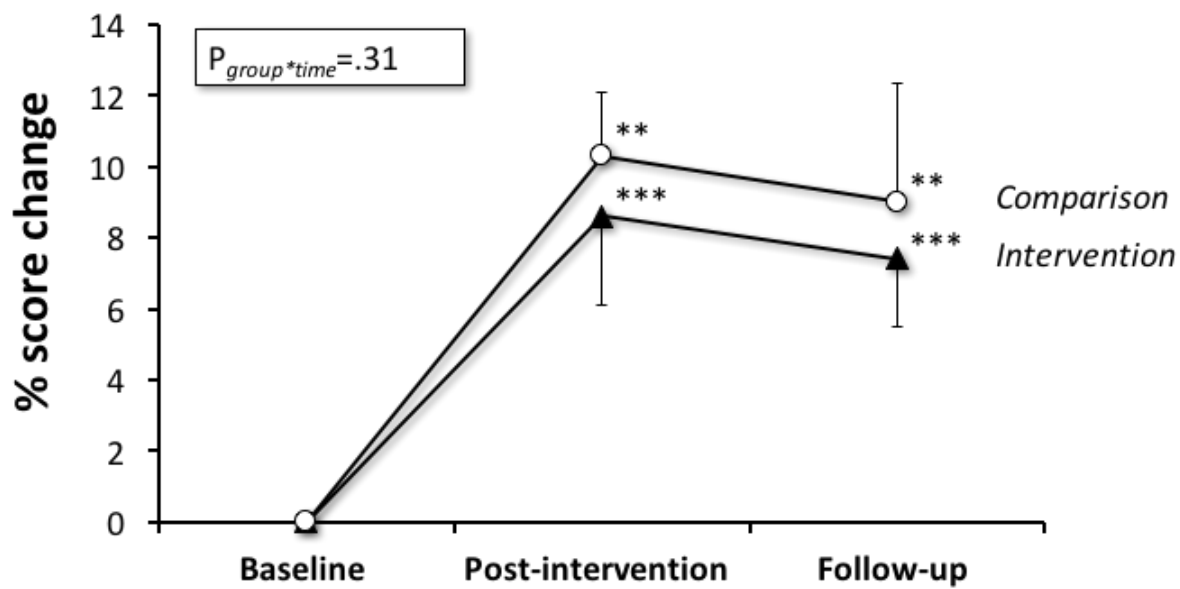


Figure 3.

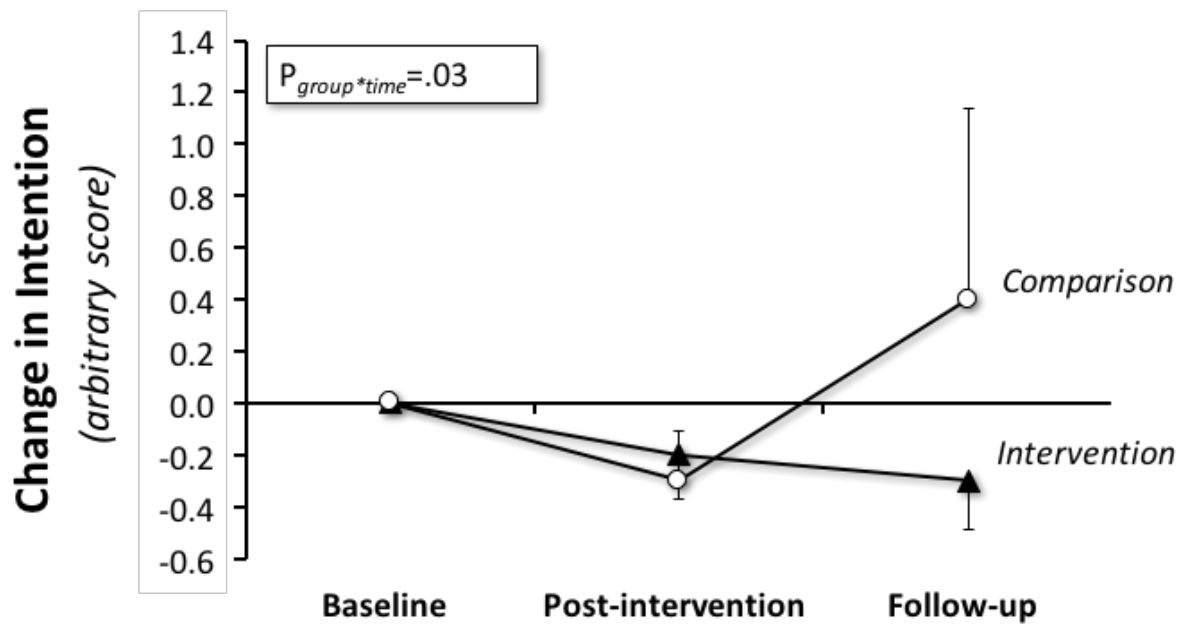


Table 1: Methods and Targeted Strategies Used to Modify Attitude Towards the Intent to Use Restrictive Dietary Methods Among Adolescent Female Athletes

Determinant	Methods	Strategies
Attitude	Persuasive communication	<ul style="list-style-type: none"> Lecture on changes in shape that occur during adolescence in girls and the role of genetics in determining weight and body shape Dove's Evolution video showing manipulations of images used in commercials and media
	Active learning	<ul style="list-style-type: none"> Brainstorming on disadvantages of diets low in carbohydrates or very low in lipids for adolescent athletes Brainstorming on the social standards of beauty for women and female athletes, and on the pervasive value of thinness
	Observational modeling	<ul style="list-style-type: none"> Discussion based on pictures of high profile and successful Olympic aesthetic athletes with different body sizes and shapes

Table 2: Baseline Characteristics of Athletes in the Intervention (n=37) and Comparison (n=33) Groups

Characteristics	Intervention	Comparison	P
Age (years)	14.1 (1.5)	13.1 (1.2)	0.003
Height (cm)	160.4 (7.7)	157.2 (4.9)	0.05
Body weight (kg)	53.4 (10.0)	49.5 (8.5)	0.09
BMI categories (%)			
<i>Underweight</i>	8 (n=3)	12 (n=4)	
<i>Normal weight</i>	73 (n=27)	73 (n=24)	0.59
<i>Overweight</i>	19 (n=7)	12 (n=4)	
<i>Obese</i>	0 (n=0)	3 (n=1)	
Sports (%)			
<i>Synchronized swimming</i>	87 (n=32)	0 (n=0)	
<i>Gymnastic</i>	0 (n=0)	42 (n=14)	<0.0001
<i>Dance</i>	14 (n=5)	0 (n=0)	
<i>Cheerleading</i>	0 (n=0)	58 (n=19)	
Type of school (%)			
<i>Private</i>	0 (n=0)	64 (n=21)	<0.0001
<i>Public</i>	100 (n=37)	36 (n=12)	
Ethnicity (%)			
<i>White</i>	95 (35)	94 (n=31)	0.91
<i>Asian</i>	5 (n=2)	6 (n=2)	
Years in sport	6.8 (2.8)	5.4 (3.7)	0.08

Total physical activity (h/week)	25.1 (5.3)	11.2 (6.9)	<0.0001
Competitive level (%)			
<i>Local</i>	3 (n=1)	0 (n=0)	
<i>Regional</i>	5 (n=2)	25 (n=8)	
<i>Provincial</i>	24 (n=9)	66 (n=22)	<0.0001
<i>National</i>	51 (n=19)	9 (n=3)	
<i>International</i>	16 (n=6)	0 (n=0)	

BMI categories = body mass index categories based on the International Obesity Task

Force growth curves

P values are based on ANOVA and chi-square tests

Note: Values are means +/- SD (in parentheses) or % of group.

Table 3: Baseline Scores as well as Change after the 3-week Intervention and 8-12 Week Follow-up (Mean±SD) in Psychosocial Variables Related to the Intent to Use Restrictive Dietary Behaviors to Lose Weight in the Intervention and Comparison Groups of High-school Female Athletes

Variables	Intervention			Comparison			P group*time
	Baseline (n=37)	Change from baseline		Baseline (n=33)	Change from baseline		
		Post- intervention (n=31)	Follow-up (n=27)		Post- intervention (n=30)	Follow-up (n=12)	
Intention	1.9 (0.9)	-0.2 (0.9)	-0.3 (0.9)	2.0 (1.0)	-0.3 (0.9)	0.4 (2.1)	0.03
Attitude	3.1 (1.5)	-0.6 (0.9)***	-0.9 (0.8)***	3.0 (1.7)	-0.4 (0.8)	-0.6 (1.1)	0.62
Subjective norm	2.2 (1.3)	-0.5 (0.7)**	-0.5 (0.8)***	2.3 (1.5)	-0.08 (0.8)	-0.5 (1.0)*	0.46
Perceived behavioral control	4.0 (1.2)	-0.04 (1.2)	0.2 (0.9)	4.2 (1.5)	-0.5 (1.3)	-0.4 (1.1)	0.57

Significant change from baseline, *P<.05, **P<.01, ***P<.001

The group*time effect reflects the interaction between group (intervention vs. comparison) and time, as tested in mixed models for repeated measures.

All mixed models included baseline values as a covariate; Intention values are further adjusted for type of school (private vs. public); Attitude values are further adjusted for competitive level.

Note: All scores had a range from 1 to 6 and reflect the average score from a different number of questions for each item (intention: 9 items, Attitude: 4, Subjective norm: 3, Perceived behavioral control: 3). Higher score reflects a greater degree of intention to use dietary restrictive behaviors to lose weight, a favorable attitude (positive outcomes), a more favorable subjective norm (perceived pressure) and a greater perceived control (greater ease) towards this behavior.