Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity (2019) 24:107–119
https://doi.org/10.1007/s40519-018-0510-5

ORIGINAL ARTICLE

"Healthy Habits, Healthy Girls—Brazil": an obesity prevention program with added focus on eating disorders

Ana Carolina Barco Leme[1,2] · Sonia Tucunduva Philippi[2] · Debbe Thompson[1] · Theresa Nicklas[2] · Tom Baranowski[2]

Received: 6 March 2018 / Accepted: 24 April 2018 / Published online: 5 May 2018

Abstract

Purpose To evaluate the immediate post-intervention and 6-month post-intervention effects of a Brazilian school-based randomized controlled trial for girls targeting shared risk factors for obesity and disordered eating.

Methods Total of 253 girls, mean of 15.6 (0.05) years from 1st to 3rd grades of high school participated in this 6-month school-based cluster randomized controlled trial. "Healthy Habits, Healthy Girls—Brazil (H3G-Brazil)", originally developed in Australia, emphasized 10 key nutrition and physical activity (PA) messages delivered over 6 months. Disordered eating prevention procedures, i.e., prevention of weight-teasing, body satisfaction, and unhealthy weight control behavior, were added to the intervention. Body dissatisfaction, unhealthy weight control behaviors and social cognitive-related diet, and physical activity variables were assessed at baseline, immediate post-intervention, and 6-month post-intervention. Intervention effects were determined by one-way analysis of covariance or logistic regression, after checking for the clustering effects of school. The control group did not receive intervention prior to follow-up assessment. A conservative significance level was set at $p < 0.01$.

Results Beneficial effects were detected for PA social support ($F = 6.005$, $p = 0.01$), and healthy eating strategies ($F = 6.08$, $p = 0.01$) immediate post-intervention; and healthy eating social support ($F = 14.731$, $p = 0.00$) and healthy eating strategies ($F = 5.812$, $p = 0.01$) at 6-month post-intervention. Intervention group was more likely to report unhealthy weight control behaviors (OR = 1.92, 95% CI 1.15–3.21, $p = 0.01$) at 6-month post-intervention. No other significant immediate or 6-month post effects were detected.

Conclusion H3G-Brazil demonstrated positive 6-month effects on some social cognitive variables but an adverse effect on unhealthy weight control behaviors. Thus, this study was not able to achieve synergy by combining obesity and disordered eating prevention procedures in an intervention among low-income girls in Brazil.

Trial registration Level I: cluster randomized controlled trial

Keywords Adolescence · Girls · Eating disorders · Obesity · Prevention · Social cognitive theory

Abbreviations

BMI	Body mass index
CBT	Cognitive-based therapy
DBI	Dissonance-based intervention
H3G-Brazil	Healthy Habits, Healthy Girls—Brazil
HIC	High-income countries
LMIC	Low- and middle-income countries
PA	Physical activity
SCT	Social cognitive theory
WC	Waist circumference

Electronic supplementary material The online version of this article (https://doi.org/10.1007/s40519-018-0510-5) contains supplementary material, which is available to authorized users.

✉ Ana Carolina Barco Leme
acarol.leme@gmail.com

[1] Children's Nutrition Research Center, Baylor College of Medicine, Houston, USA

[2] Department of Nutrition, School of Public Health, University of São Paulo, São Paulo, Brazil

Introduction

Obesity affects one-quarter of adolescents in Brazil [1, 2] and almost one-third in the United States [1]. Pediatric obesity is associated with several metabolic risk factors and tracks into adulthood [2]. Mental and social health concerns among female and overweight individuals [3]

have been associated with eating disorders, the third most common chronic disease among adolescents after obesity and asthma [4].

Eating disorder is a psychiatric illness characterized by eating and body image disturbances, including Anorexia Nervosa, Bulimia Nervosa and Binge Eating Disorder [5]. Disordered eating, alternatively, is part of the eating disorder continuum including: thinking obsessively about food and calories, becoming angry when hungry, being unable to select what to eat, seeking food to compensate for psychological problems, eating until feeling sick, and presenting unreal beliefs about eating and weight [6]. Disordered eating is not limited to those diagnosed with eating disorders. Many individuals experience disordered eating habits, beliefs, and feelings toward food, but are unaware that they manifest "abnormal attitudes" [5–7].

Obesity prevention interventions with an added focus on eating disorders may help people attain healthier eating practices [8]. Adding an eating disorder focus to obesity prevention interventions may minimize the costs related to the development and delivery of two prevention programs, may be more cost-effective and may avoid confusing teens who receive conflicting messages from obesity-only and eating disorders-only prevention programs [9]. For instance, body image concerns are targeted in both strategies; however, the information is frequently inconsistent. In obesity-only programs, the primary aim is reducing body weight, so not being happy at being overweight or obese is acceptable. Thus, teens may be motivated to keep track and avoid certain foods (e.g., energy-dense nutrient poor foods), and control their calories consumed by tracking portion size. On the other hand, eating disorder-only programs, usually encourage self-acceptance of body size, lack of self-consciousness about dietary intake, and improving body self-esteem to reduce disordered eating behaviors [9].

Increased risk for disordered eating is associated with being female and overweight during the teen years due to social pressure toward thinness and weight stigma [10]. In addition, self-regulation of eating and physical activity practices are associated with weigh-related concerns in obese girls [11]. Ethnic minority status [10, 12] conferred increased risk for disordered eating, e.g., low-income Brazilian adolescents who are often ethnic minorities [13] are at higher risk for weight-loss targeted behaviors compared to their age counterparts. This vulnerability may result from higher levels of stress (due to minority status) which have been thought to contribute to disordered eating [10]. Young adolescents, particularly those coming from the South, Southeast and Northeast areas of Brazil, are often socially excluded, due to their poor living conditions (e.g., slums and governmental houses), poor education and lack of health services [10, 14, 15]. This could increase risk for engaging in unhealthy weight control behaviors as a means to modify appearance so as to be accepted in society.

Body dissatisfaction, i.e., negative subjective evaluation of the weight and shape of one's body, is a well-established risk factor for the development of weight-related problems [16]. Strong associations have been found among body dissatisfaction, dieting, disordered eating [17–19] and depressive and anxiety symptoms [20]. Weight status, sex [21] and ethnic background [16] have been important in the genesis of body dissatisfaction, likely due to current Western standards for attractiveness (i.e., thinness) and negative social experiences regarding appearance (e.g., weight-based teasing) [16]. Body dissatisfaction may lead to a cycle of disordered eating (e.g., dieting, fasting and food avoidance) to achieve beauty standards, which may be followed by binge eating because of long periods of restraint [22].

Weight-related concerns and behaviors were prevalent among US and Brazilian adolescents [14, 23]. Brazilian girls had a higher risk for developing disordered eating and eating disorders compared to the boys, and body dissatisfaction was positively associated with socio-economic level [15]. The mean (SD) score of eating disorder risk factors was 15.08 (± 11.18) for girls and 11.49 (± 11.46) for boys [15]. Approximately 41% of Brazilian female students reported an unhealthy weight control behavior of which dieting was the most prevalent [14]. Other studies found that up to 64% of girls had some type of disordered eating habit [10, 14, 24].

A recent meta-analysis and systematic review showed that weight-related prevention programs for teen girls were successful in improving body satisfaction and dieting (or other unhealthy weight control behaviors) [25]. The "Healthy Habits, Healthy Girls—Brazil" program targeted healthy weight [26] and improving risk factors for eating disorders.

Schools are well placed to deliver obesity and eating disorders prevention interventions and address health inequalities in populations "at risk" for weight-related problems [27]. No study has tested an integrated intervention among low-income adolescent girls in Brazil. Furthermore, a recent study suggested that rates of disordered eating behaviors were highest among youth with overweight/obesity, highlighting the need for interventions across weight statuses [12, 28]. Therefore, integrating eating disorder and healthy weight management into obesity prevention programs may reduce the incidence and prevalence of weight-related disorders among youth [28]. This study evaluated whether an integrated intervention influenced 6-month post-intervention social cognitive and disordered eating outcomes in a school-based program for Brazilian adolescent girls.

Methods

This is one of several papers from the "Healthy Habits, Healthy Girls—Brazil" project. It reports the immediate post-intervention and 6-month post-intervention outcomes in regard to the theoretical variables and the disordered eating outcomes. Other papers reported the study protocol and design [26], body composition outcomes at immediate [27] and 6-month post-intervention [29] and body dissatisfaction mediation effects on weight-teasing by family members and peers [30].

Study design

Details of the study design, protocol and participant characteristics at baseline have been reported [26]. "H3G-Brazil" was assessed using a two-group cluster randomized controlled trial, including ten public technical high schools (i.e., five intervention schools and five control schools) located in low-income communities in the city of São Paulo, Brazil. Recruitment and baseline assessments were conducted prior to randomization. The schools were pair matched based on their geographic location, size and demographics and randomized within matched pairs. Randomization was conducted by an individual not involved in the study, blinded to school characteristics picking slips of paper with group assignment out of a plastic bag, immediately after baseline data collection. Trained undergraduate and graduate students conducted follow-up assessments (baseline, immediate post-baseline and 6-month post-intervention) blinded to group allocation [26]. The control group did not receive any intervention until after follow-up assessments when the control girls received instructional materials (i.e., student handbooks, food and PA diaries and parents' newsletters).

School selection and participants

Technical high schools in Brazil are intended for adolescents (i.e., ages 14–18 years) from low-income backgrounds. They deliver both regular high school instruction and vocational training in technical subjects (e.g., chemistry, environmental science, visual communication, health and business and management). The adolescents spend full-time during weekdays at schools, i.e., part of the day at regular high school class and the other at locations learning specific technical vocational skills. Technical public schools that offered nutrition and dietetics training (13 of the 43 Technical high schools) in the city of São Paulo were selected for the current study to provide opportunities for partnership with accredited dietitian teachers and allowed the Nutrition and Dietetic students to work as research assistants. Of the 13 eligible schools, 10 agreed to participate. Teachers from these schools invited the female students to voluntarily participate. Girls were eligible to participate in the H3G-Brazil intervention if they were not enrolled in "Nutrition and Dietetics" or other health-related courses, and were attending 1st-to-3rd year high school, receiving training in building trades, business and management, chemistry, environmental sciences, or visual communication. At least two classes per school participated in the study to have the necessary number of girls per school. In Brazil, these schools generally have 30–35 total adolescents from both sexes per class, thereby requiring at least two classes per school to attain a sample of 25 girls per school. School and participant selection can be found in Fig. 1.

Ethics approval was obtained from the Institutional Review Board of the School of Public Health, University of São Paulo, Brazil. School principals, teachers, parents/caregivers and study participants provided written informed consent.

This study was registered in ClinicalTrials.gov (NCT02228447) and reported according to the CONSORT checklist [31].

Statistical power

Sample size calculation was based on change in Body Mass Index (BMI). To detect a between-group difference of 0.4 kg/m^2 complete data were required from 25 participants at immediate post-baseline from each of the 10 schools ($n = 250$) based on 80% power and 5% level of significance (two-tailed). Baseline assessments were conducted before randomization during February 2014. The immediate post-baseline assessments were completed during August 2014 and have been previously reported [27]. The 6-month post-intervention assessment was conducted in February 2015, for which the BMI, waist circumference and behavior change outcomes have been reported [29].

Intervention

H3G-Brazil was adapted from the Australian NEAT Girls study [32]. H3G-Brazil was a 6-month obesity prevention program with nutrition, physical activity (PA) and disordered eating components to help the girls achieve adequate food choices, promote healthy lifestyle and lifetime PA, and reduce screen-time activities (i.e., time spent on TV, computers and other recreational screens). H3G-Brazil was based on Social Cognitive Theory (SCT) [33], with strong peer and parent involvement to help the girls acquire diet, PA and disordered eating preventive behaviors. SCT proposes that health behavior change is influenced by environmental factors, personal factors, and attributes of the behavior itself. Self-efficacy is the main determinant of the

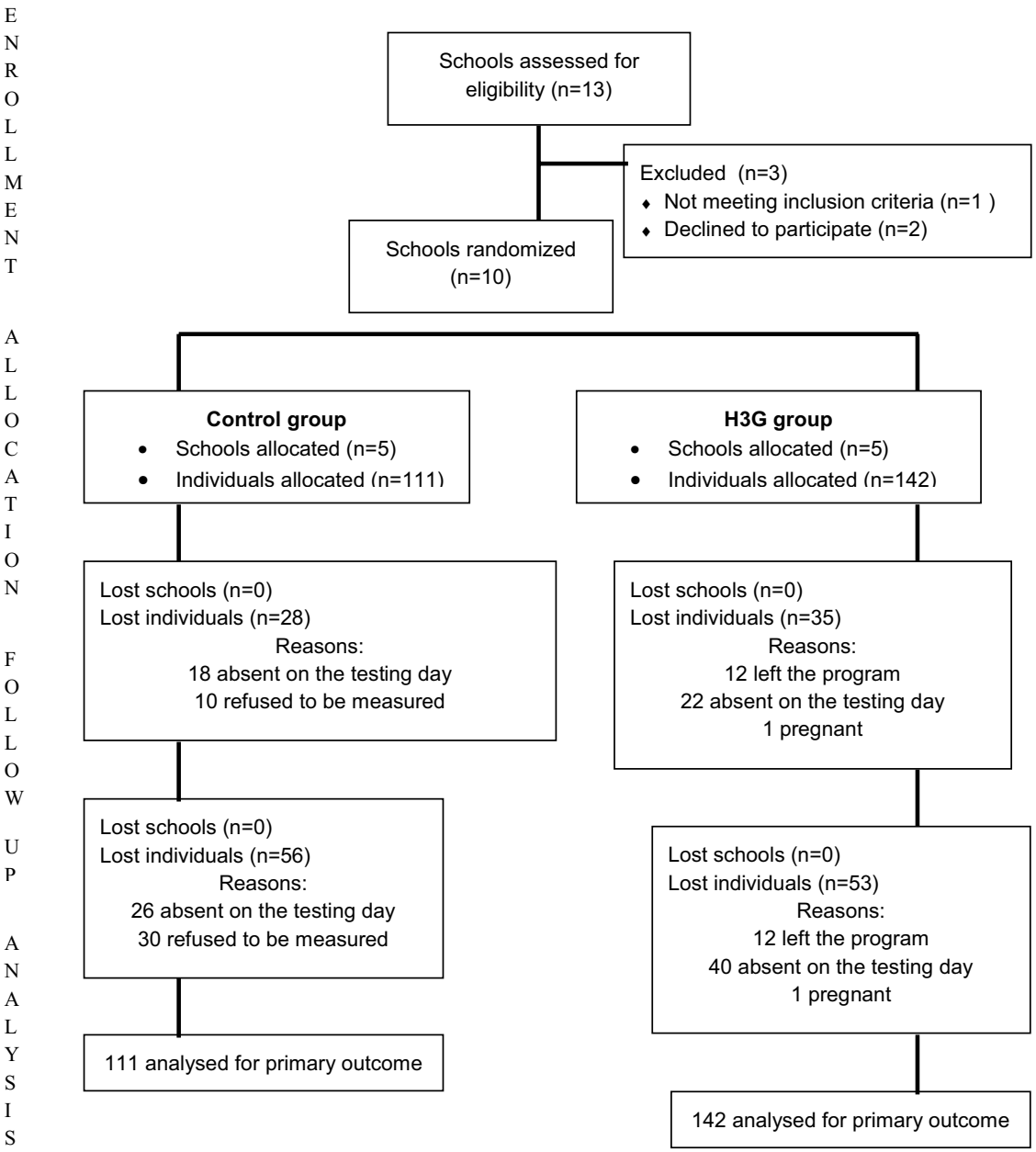

Fig. 1 Flowchart of the "Healthy Habits, Healthy Girls—Brazil"

behavior in the theory, and refers to an individual's belief in their ability to successfully perform a specific behavior [33]. The other determinants from this theory are: intentions, behavioral strategies, social support (e.g., friend and family), situations (home and school environment), and outcome expectations and expectancies. There were ten key-messages delivered twice a week and included the following activities: Physical Education classes, Physical Activity sessions, nutrition workshops, interactive seminars, weekly nutrition and PA messages delivered by teachers, WhatsApp® weekly messages, PA and Nutrition diaries and parents' newsletters. In all the components, topics related to body acceptance, unhealthy weight control practices and weight-related teasing were emphasized. The exposure to program was 3 h/week resulting in 18 h in the 6 months of program duration (Supplement Table 1).

Outcomes

Trained research assistants blinded to condition collected data at the schools. Self-reported questionnaires were completed after the physical assessments.

Social cognitive outcomes

Since the intervention was based on SCT principles, SCT variables were assessed in regard to diet and PA using adapted and validated questionnaires [34, 35]. Each questionnaire (diet and PA social cognitive variables) evaluated seven constructs: self-efficacy, intention, social support (i.e., family and peers), behavioral strategies, situation (i.e., environment), outcome expectations and expectancies. To ensure translation accuracy, two dietitians fluent both in English and in Portuguese independently translated the English version of the "social cognitive scales" into Portuguese. Next, another dietitian with similar characteristics back translated the translated version to English, which was compared with the original version. No discrepancies were found. A panel comprising nine experts in the areas of nutrition, PA, SCT, and/or scale cultural adaption were consulted to review and improve this version; their comments were used to modify the scale as needed. From the original questionnaire, the authors followed all mentioned steps, added some words and adaptations of some expressions [e.g., (1) original version—"choose water or diet drinks instead of soft drinks" vs. Brazilian version—"choose water, coconut water or 100% juices without added sugar"; (2) "feel more energetic" vs. "feel less tired during the day"] to obtain the final version of the Brazilian Social Cognitive Theory Questionnaire. Further, it included a box with the explanation of the meaning of different PA levels (in a way that teens could understand) and meaning of "what is portion size for fruits and vegetables", for better comprehension, usefulness and effectiveness of the scale. Moreover, an explanation was included [34] about healthy eating and smart choices. In summary, 17 changes in words were made. The revised scale was initially administered to 173 adolescents and again to a subgroup ($n=22$) 2 weeks later to assess test–retest reliability. Scale internal consistency ranged from acceptable to excellent ($\alpha=0.51$–0.94); and rank order repeatability was adequate to strong (ICC = 0.62–0.93).

Disordered eating behaviors

Since the intervention targeted disordered eating variables, disordered eating measures were selected. Disordered eating variables were measured using the primary items: "Indicate what you did in the past month to lose weight or to avoid gaining weight", which was followed by 16 items with "yes" or "no" answers. Principal components analyses (PCA) are reported in Table 1. A 4-factor solution best explained the correlations among items, including: (1) healthy weight control behaviors (HWCB): drink less sugar sweetened beverages, eat less fat, eat less sugar and sweets, pay attention to portion sizes, and practicing PA ($\alpha=0.67$); (2) unhealthy weight control behaviors (UWCB): Skip meals, eat little and fasting ($\alpha=0.64$); (3) extreme unhealthy weight control behaviors (EUWCB): diuretics and smoking ($\alpha=0.57$); and (4) other weight control behaviors (OWCB): use of other medications and meal replacements ($\alpha=0.51$). Since

Table 1 Rotated factor for the first three components from principal component analysis using weight control behaviors, "The Healthy Habits, Healthy Girls—Brazil"

Weight control behaviors				
Indicator[a]	PC1 (%expl. = 19.43)[b]	PC1 (%exp = 11.58)[b]	PC3 (%exp = 9.88)[b]	PC4 (%exp = 8.29)[b]
Soft drink intake	**0.69**[c]	−0.16	−0.03	0.05
Fat intake	**0.69**[c]	0.08	−0.10	−0.05
Pay attention	**0.67**[c]	0.21	0.03	0.02
Sugar and sweets intake	**0.66**[c]	0.13	0.05	0.14
FV intake	**0.56**[c]	0.07	−0.01	−0.17
Practice PA	**0.54**[c]	−0.02	0.21	0.08
Dieting	**0.37**[c]	**0.36**[c]	−0.12	0.21
Skip meals	−0.08	**0.74**[c]	0.15	0.15
Eat little	0.25	**0.74**[c]	0.09	0.17
Fasting	0.09	**0.70**[c]	−0.13	−0.18
Diuretics	0.07	−0.03	**0.84**[c]	0.14
Smoke cigarettes	−0.05	0.13	**0.84**[c]	−0.11
Use of other medications	0.11	0.01	0.13	**0.85**[c]
Meal replacements	0.01	0.22	−0.12	**0.71**[c]

FV fruits and vegetables, *PA* physical activity

[a]For details on indicators, see Methods section

[b]Proportion of the variance explained by each factor after orthogonal varimax rotation (Kaiser on)

[c]Items with a factor loading above or bellow have been highlighted using boldface

"dieting" loaded on two factors, it was deleted from both and used as a single item variable (Table 1).

Body satisfaction

Body satisfaction was assessed through a validated 10-item questionnaire with 7-point LIKERT scales ranging from very dissatisfied to very satisfied. This scale was adapted from the New Moves Study [36] and validated for use in a sample of Brazilian girls ($n = 159$) and had good internal-consistency ($\alpha = 0.88$) [37]. The body part items assessed were: height, weight, body shape, waist, hips, thighs, belly, face, arms and shoulders.

Binge eating

Binge eating was measured with the two questions: "In the past month, have you eaten so much food in a short period of time that you felt embarrassed about it (binge eating)?" and "During the time when you ate this way, did you feel you couldn't stop eating or control what or how much you were eating?" These items had adequate concurrent validity (positively associated with other measures of weight control behaviors and body dissatisfaction) and internal-consistency was acceptable ($\alpha = 0.638$).

Other eating disorder related measurements: weighing frequency and weight teasing

The frequency of self-weighing employed a 7-category LIKERT scale (never to ≥ 1×/day), which had demonstrated good test–retest reliability ($\alpha = 0.78$). Family and friends weight-teasing were assessed by a dichotomous response scale (i.e., yes and no). These measures showed adequate concurrent validity, i.e., were associated with body dissatisfaction, disordered eating and BMI.

Process evaluation

Several process measures were used to evaluate the program and included (1) attendance during the physical education classes, PA sessions, nutrition workshops, and seminars; (2) intervention fidelity (i.e., observational H3G-Brazil checklist by the lead researcher—AL); (3) engagement with WhatsApp® messages (i.e., number of girls who left the groups); (4) percentage of parents' newsletters received and read (i.e., girls self-reported if they saw their parents receiving/reading the letters); and (5) program satisfaction (rating scale, 1 = strongly disagree to 5 = strongly agree). Girls completed process evaluation questionnaires at the end of the study [27].

Data analyses

Linear Mixed Model procedures were conducted to address the clustering effects of schools, with girls as the unit of analysis (analyses available upon request). If the ICC (intra-class correlation) is small when quantifying the degree of clustering (< 5%), there is no meaningful difference among clusters and the data may be analyzed at the individual level [38, 39]. Since the social cognitive, weight teasing, self-weighting frequency and binge eating variables had an ICC ≥ 5%, we adjusted for clustering in these analyses. As clusters accounted for less than 5% of the variance in the body satisfaction and weight control behavior variables, we did not adjust for clustering in these analyses [38, 39]. Baseline differences between the intervention and control groups were tested with independent sample t or χ^2 tests as appropriate. Intention-to-treat analyses were considered for all outcome analyses. The effect of the intervention was determined using one-way analysis of covariance (ANCOVA) with the immediate post-intervention and 6-month post-intervention values as the dependent variables (continuous variables), baseline values of the outcomes as covariates and group (intervention vs. control) as the independent variable (fixed factor). ANCOVA is the preferred method of analysis in this situation, because it provides an unbiased estimate of treatment effect [40–42].

For categorical outcomes (i.e., weight-control behaviors) logistic generalized estimating equations (GEE) were employed. Significance level of the main analyses was set to $p < 0.01$ due to the large number of statistical tests. Data were analyzed using IBM SPSS Statistics v.21 (IBM Corp., New York, New York, USA).

Results

Characteristics of the study population

Details of the study sample were provided elsewhere [26, 27]. Most of the sample was born in São Paulo (84.8%) and their parents' education level was less than high school level (54.7%). Briefly, 50 and 37% of the control and intervention girls, respectively, dropped out of the study by 6-month post-intervention. Although the drop-out rate was high, of the 142 girls from the intervention group with baseline measurements, 130 girls received the 6-month intervention (91.5%). In general, attendance at the sessions was reasonable (up to 60%) and intervention fidelities were 53% for physical education classes, 60% for PA sessions and 80% for weekly behavioral key messages. Teens were content with the "Healthy Habits, Healthy Girls - Brazil"; workshops (i.e., cooking classes) were the most enjoyed session [27].

Participants lost to follow-up ($n = 109$) had significantly lower healthy eating intention (2.9 vs. 3.1 unit, $p = 0.01$) and outcome expectancies (3.4 vs. 3.5 unit, $p = 0.00$) than the retained sample ($n = 144$) at baseline. Significant differences were detected between intervention and control groups at baseline for healthy eating social support ($p = 0.00$), healthy eating strategies ($p = 0.01$) and friends

Table 2 Characteristics at baseline from the "Healthy Habits, Healthy Girls—Brazil" study intervention and control groups

	Control ($n = 111$) Mean (SD)	Intervention ($n = 142$)	p value
Physical activity self-efficacy[a]	3.05 (0.76)	3.09 (0.75)	0.85
Physical activity intention[a]	3.11 (0.85)	3.16 (0.86)	0.50
Physical activity social support[a]	2.36 (0.88)	2.23 (0.76)	0.17
Physical activity strategies[a]	2.61 (0.97)	2.47 (0.95)	0.86
Physical activity environment[a]	3.01 (0.79)	3.23 (0.78)	0.97
Physical activity outcome expectations[a]	5.09 (0.63)	5.07 (0.66)	0.79
Physical activity outcome expectancies[a]	2.97 (0.49)	3.09 (0.53)	0.21
Healthy eating self-efficacy[a]	3.60 (0.73)	3.48 (0.74)	0.22
Healthy eating intention[a]	2.94 (0.58)	3.06 (0.63)	0.14
Healthy eating social support[a]	3.86 (0.49)	3.58 (0.53)	**0.00**
Healthy eating strategies[a]	3.26 (0.62)	3.05 (0.67)	**0.01**
Healthy eating environment[a]	4.91 (0.81)	4.67 (0.88)	0.04
Healthy eating outcome expectations[a]	5.28 (0.48)	5.17 (0.56)	0.10
Healthy eating outcome expectancies[a]	3.44 (0.39)	3.49 (0.36)	0.35
Body satisfaction[a]	4.55 (1.12)	4.11 (1.25)	0.27
Weight frequency[a]	2.14 (1.22)	2.05 (1.13)	0.09
	n (%)	*n* (%)	p value
Family weight teasing[b]			
Yes	35 (33.0)	55 (43.0)	0.12
No	71 (67.0)	73 (57.0)	
Friends weight teasing[b]			
Yes	33 (31.1)	62 (48.4)	**0.01**
No	73 (68.9)	66 (51.6)	
Healthy weight control behaviors[b]			
Yes	69 (62.2)	68 (47.9)	0.02
No	42 (37.8)	74 (52.1)	
Unhealthy weight control behaviors[b]			
Yes	30 (27.0)	57 (40.1)	0.03
No	81 (73.0)	85 (59.9)	
Extreme unhealthy weight control behaviors[b]			
Yes	6 (5.4)	14 (9.9)	0.19
No	105 (94.6)	128 (90.1)	
Other weight control behaviors[b]			
Yes	7 (6.3)	15 (10.6)	0.23
No	104 (93.7)	127 (89.4)	

Sao Paulo, 2015

Significant values are in bold ($p \leq 0.01$)

[a]Differences between intervention and control were tested by student t-test

[b]Differences between intervention and control were test by chi-squared test

weight teasing ($p=0.01$) (Table 2). Analyses of covariance thereby adjusted for these effects [43].

Effects of the intervention on dietary social cognitive and DE outcomes

At immediate post-intervention, there were significant effects on PA social support ($F=1.88$, $p=0.01$, $d=0.50$) and healthy eating strategies ($F=6.08$, $p=0.01$, $d=0.37$) (Table 3).

At 6-month post-intervention, significant effects were detected for healthy eating social (i.e., parents and friends) support ($F=14.731$, $p=0.000$, $d=0.33$); healthy eating strategies ($F=5.812$, $p=0.01$, $d=0.38$); and healthy eating environment ($F=7.550$, $p=0.00$, $d=0.31$), but the intervention group was more likely to report unhealthy weight

Table 3 Effect of "Healthy Habits, Healthy Girls—Brazil" program outcome variables of adolescents in reference to baseline measurements

		Intervention ($n=142$) Mean (95% CI)	Control ($n=111$) Mean (95% CI)	F	p value	Cohen's d
Social cognitive constructs						
PA self-efficacy	Immediate post-intervention	3.19 (3.02–3.35)	2.98 (2.76–3.20)	2.180	0.14	0.37
	6-month post-intervention	3.05 (2.89–3.22)	2.94 (2.73–3.16)	0.603	0.43	0.26
PA intention	Immediate post-intervention	3.39 (3.22–3.55)	3.08 (2.87–3.30)	4.832	0.03	0.49
	6-month post-intervention	3.23 (3.08–3.36)	3.07 (2.87–3.27)	1.532	0.21	0.37
PA environment	Immediate post-intervention	3.37 (3.22–3.56)	3.07 (2.87–3.28)	4.976	0.03	0.93
	6-month post-intervention	3.39 (3.22–3.56)	3.13 (2.91–3.35)	3.263	0.07	0.74
PA social support	Immediate post-intervention	2.45 (2.28–2.62)	2.10 (1.88–2.33)	6.005	**0.01**	0.50
	6-month post-intervention	2.33 (2.17–2.49)	2.29 (2.08–2.50)	0.076	0.78	0.13
PA strategies	Immediate post-intervention	2.96 (2.76–3.17)	2.66 (2.39–2.93)	3.123	0.08	0.48
	6-month post-intervention	2.84 (2.63–3.05)	2.79 (2.51–3.07)	0.077	0.78	0.23
PA outcome expectations	Immediate post-intervention	5.23 (5.10–5.35)	5.09 (4.93–5.24)	1.946	0.16	0.21
	6-month post-intervention	5.20 (5.07–5.32)	5.17 (5.01–5.33)	0.803	0.80	0.09
PA outcome expectancies	Immediate post-intervention	3.20 (3.10–3.30)	3.07 (2.94–3.20)	2.416	0.12	0.51
	6-month post-intervention	3.12 (3.03–3.22)	3.17 (3.04–3.30)	0.323	0.57	0.36
Healthy eating self-efficacy	Immediate post-intervention	3.71 (3.86–3.85)	3.46 (3.64–3.29)	0.194	0.68	0.37
	6-month post-intervention	3.53 (3.35–3.72)	3.39 (3.20–3.58)	2.008	0.16	0.19
Healthy eating intentions	Immediate post-intervention	3.29 (3.18–3.40)	3.06 (3.24–3.88)	0.539	0.46	0.44
	6-month post-intervention	3.22 (3.35–3.09)	3.09 (2.91–3.22)	0.107	0.75	0.24
Healthy eating social support	Immediate post-intervention	3.75 (3.61–3.89)	3.73 (3.95–3.51)	3.052	0.08	0.03
	6-month post-intervention	3.83 (3.68–3.98)	3.61 (3.40–3.83)	14.731	**0.00**	0.33
Healthy eating strategies	Immediate post-intervention	3.54 (3.39–3.64)	3.31 (3.13–3.49)	6.084	**0.01**	0.37
	6-month post-intervention	3.58 (3.41–3.76)	3.30 (3.08–3.52)	5.812	**0.01**	0.38
Healthy eating environment	Immediate post-intervention	5.10 (4.91–5.28)	4.85 (4.57–5.12)	4.545	0.04	0.29
	6-month post-intervention	5.03 (4.83.6–5.21)	4.78 (4.52–5.04)	7.550	**0.00**	0.31
Healthy eating outcome expectations	Immediate post-intervention	5.41 (5.28–5.52)	5.28 (5.13–5.43)	2.299	0.13	0.27
	6-month post-intervention	5.42 (5.29–5.54)	5.33 (5.17–5.50)	0.584	0.45	0.16
Healthy eating outcome expectancies	Immediate post-intervention	3.63 (3.55–3.70)	3.46 (3.32–3.60)	4.744	0.03	0.43
	6-month post-intervention	3.57 (3.48–3.67)	3.51 (3.40–3.63)	0.162	0.69	0.15
Body satisfaction ($\alpha=0.88$)						
Body satisfaction	Immediate post-intervention	4.30 (1.20)	4.64 (1.20)	0.716	0.39	0.28
	6-month post-intervention	4.55 (1.26)	4.47 (1.49)	0.353	0.55	0.05
Weight frequency						
Weighing frequency	Immediate post-intervention	2.18 (1.27)	2.35 (1.18)	0.134	0.72	0.14
	6-month post-intervention	2.46 (1.27)	2.16 (1.16)	1.460	0.23	0.25

Sao Paulo, 2015

Intervention effects determined by analysis of covariance for baseline value

PA physical activity

Significant values are in bold ($p \leq 0.01$)

Table 4 Effect of "Healthy Habits, Healthy Girls—Brazil" program outcome variables of adolescents in reference to baseline measurements

Variable	Baseline		Immediate post-intervention		6-month post-intervention	
	OR (95% CI)	*p* value	OR (95% CI)	*p* value	OR (95% CI)	*p* value
HWCB	1.79 (1.08–2.96)	0.02	0.63 (0.36–1.11)	0.11	0.86 (0.46–1.60)	0.63
UWCB	0.55 (0.32–0.95)	0.03	1.06 (0.64–1.75)	0.83	1.92 (1.15–3.21)	**0.01**
EWCB	0.52 (0.19–1.41)	0.19	1.03 (0.58–1.83)	0.92	1.71 (1.03–2.83)	0.03
OWCB	0.57 (0.22–1.45)	0.24	0.92 (0.52–1.63)	0.78	1.66 (1.00–2.74)	0.04
Dieting	0.88 (0.45–1.73)	0.73	1.04 (0.50–2.16)	0.92	0.69 (0.31–1.51)	0.35
Binge eating	0.88 (0.48–1.61)	0.67	0.89 (0.44–1.79)	0.75	1.85 (0.81–4.26)	0.15
Family weight teasing	0.65 (0.38–1.12)	0.12	0.81 (0.43–1.53)	0.51	1.44 (0.67–3.09)	0.35
Friends weight teasing	0.48 (0.28–0.82)	**0.00**	0.60 (0.33–1.12)	0.11	0.31 (0.68–3.29)	0.31

Sao Paulo, 2015

HWCB healthy weight control behaviors, *UWCB* unhealthy weight control behaviors, *EWCB* extreme weight control behaviors, *OWCB* other weight control behaviors

Significant values are in bold ($p \leq 0.01$)

control behaviors (OR = 1.92, 95% CI 1.15–3.21, $p = 0.01$) (Tables 3 and 4).

Discussion

Since girls are more susceptible to influences by family and peers on their health behaviors [44] and are more likely to develop unhealthy weight control behaviors [45, 46], H3G-Brazil targeted adolescent girls from low-income communities living in São Paulo, Brazil. Previous analyses revealed H3G-Brazil did not change BMI, but obtained an improvement in waist circumference and in sedentary behaviors [29], fruit and vegetable intake immediately after intervention [27], but no improvements in dietary intake 6-month post-intervention [29]. H3G-Brazil aimed to improve dietary and PA social cognitive variables and prevent ED. The immediate post-intervention outcomes revealed improvements in PA social support and healthy eating strategies. The intervention group, however, increased unhealthy weight control behaviors at 6-month post-intervention (e.g., OR 1.92; 95% CI 1.15–3.21). Thus H3G-Brazil had desired shorter-term effects on several social cognitive eating variables, but not PA social cognitive variables and, had an adverse effect on a disordered eating variable (Tables 3 and 4).

Other similar interventions have reported mixed results in obesity and eating disorder prevention programs among adolescents [36, 47–51]. A multi-theory approach has been useful for explaining behavior within the dietary and PA domains [52, 53]. For example, SCT and Self Determination Theory constructs explained health behaviors in adolescents [54, 55]. A recent systematic-review and meta-analysis of randomized controlled trials for eating disorder prevention programs [24] showed that numerous programs had effects on most outcomes, which were maintained at up to 18-month follow-up, and found that Dissonance-Based interventions produced better results than other approaches [56]. Since H3G-Brazil was based on healthy weight approaches, but had an adverse effect on disordered eating behaviors, future interventions targeting Brazilian adolescent girls should use other theoretical foundations, e.g., Dissonance-Based intervention (DBI), Cognitive-Behavioral Therapy (CBT), or media literacy [57], combined with a healthy weight program.

The intervention group significantly increased unhealthy weight control behaviors at 6-month post-intervention. The seminars and workshops on health behaviors (including disordered eating behaviors, weight-teasing and body satisfaction) met three times in the semester for 1.5 h each session over the 24-week semester. The content of these activities was divided into topics, e.g., the first 10 min addressed the importance of eating more fruit and vegetables, followed by 10 min of weight control practices and then body acceptance. Given that unhealthy weight control behaviors predict excessive weight gain, extreme weight control behaviors and binge eating among adolescents [8, 23], the increase in unhealthy weight control behaviors may indicate these girls will experience more unhealthy weight gain and eating disorder symptoms in the future. This negative impact on the unhealthy weight control behaviors might be because of cultural norms, e.g., in Brazil there is a high concern for an ideal beauty standard [30, 58].

School settings tend to provide education that increases the eating disorder risk factors: unhealthy weight-control behaviors, lack of acceptance of differences in body size, and weight-teasing [59, 60]. Children and adolescents who are overweight and or obese impact the health of future generations and should be prevented through combating weight bias and obesity stigma [60]. Policies and practices on the prevention of obesity support the importance of

school-based health education as part of efforts to prevent unhealthy behaviors [59].

Changing health behaviors might be a challenge when targeting adolescent girls, due to their related negative experiences, e.g., weight-teasing [30]. Little is known about effective procedures for treating weight-related problems among individuals from low- and middle-income countries (LMIC) [30, 61].

The current study provided no real support for combining both obesity and eating disorders prevention in the same study. How best to design interventions targeting eating disorder risk factors in low- and middle-income countries are not well known. The majority of interventions on eating disorder risk factors have been conducted in high-income countries and found mixed results [46, 62, 63] and those with significant effects demonstrated reduced risk factors for eating disorders, such as dieting and body dissatisfaction [57]. An intervention study to promote reduced risk of eating disorders, which targeted three levels; societal, peer group and individual showed an improvement in body satisfaction and self-esteem, particularly among those with higher risk factors for eating disorders at baseline [63]. Although, this intervention was successful at the short-term, longer-term assessment should be considered to verify if the adolescents maintained what they accomplished.

The Brazilian New Moves Program [61] did not find significant results in the main outcome (body shape questionnaire—BSQ) or secondary outcomes (i.e., self-esteem, unhealthy weight control behaviors and body mass index). The prevention of eating disorders may require intensive interpersonal psychotherapy methods [64], not just an education type intervention.

Strengths of the current study included its theoretical foundation; use of a comparison group; and use of reliable measures of SCT, disordered eating and body satisfaction variables. However, limitations of this study include the sample was composed solely of adolescent girls, preventing generalization to adolescent boys and the dropout rate was higher than anticipated impairing statistical power. Future intervention studies in Brazil should develop no/low cost strategies to retain participations at the follow-up assessments [61, 65].

Conclusion

H3G-Brazil improved a smaller number of the diet related social cognitive variables, but girls from the intervention group reported higher unhealthy weight control behaviors at 6-month post-intervention. Thus, this study was not able to achieve synergy by combining obesity and disordered eating prevention procedures in an intervention among low-income girls in Brazil.

Acknowledgements The authors thank the participant schools and adolescent girls for the value contribution. We also thank FAPESP twice: for AL post-doctoral training in Brazil (process no. 2015/20852-7) and for the grant to conduct the research internship at Baylor College of Medicine, Children's Nutrition Research Center, Houston, Texas to AL (process no. 2016/21144-9).

Author contributions All authors truly contributed to the development of this study. AL: participated in study concept and design, acquisition of data, analysis and interpretation of data, drafting the manuscript, critical revision of the manuscript for intellectual content and statistical analysis. SP: senior research of this project, participated in study concept and design, acquisition of data, drafting the manuscript and critical revision of the manuscript for important intellectual content. DT: participated in drafting the manuscript, critical revision of the manuscript for intellectual content and statistical analysis. TN: participated in drafting the manuscript, critical revision of the manuscript for intellectual content and statistical analysis. TB: participated in analysis and interpretation of data, drafting the manuscript, critical revision of the manuscript for intellectual content and statistical analysis.

Funding No funding was received.

Compliance with ethical standards

Conflict of interest The authors do not have any particular conflict of interest. Author ACBL received a post-doctoral scholarship from the São Paulo Research Foundation (Fundação de Amparo à Pesquisa—FAPESP).

Ethics approval This research received ethical approval from the School of Public Health, University of São Paulo (FSP-USP) ethics committee under the protocol number 01658112.6.0000.5421.

Informed consent The parents/caregivers of the girls and the school principals provided written informed consent, as well as the girls provided assent forms for participation prior to data collection.

References

1. Ng M, Fleming T, Robinson M, Thomson B, Graetz N, Margono C, Mullany EC, Biryukov S, Abbafati C, Abera SF, Abraham JP, Abu-Rmeileh NME, Achoki T, AlBuhairan FS, Alemu ZA, Alfonso R, Ali MK, Ali R, Guzman NA, Ammar W, Anwari P, Banerjee A, Barquera S, Basu S, Bennett DA, Bhutta Z, Blore J, Cabral N, Nonato IC, Chang J-C, Chowdhury R, Courville KJ, Criqui MH, Cundiff DK, Dabhadkar KC, Dandona L, Davis A, Dayama A, Dharmaratne SD, Ding EL, Durrani AM, Esteghamati A, Farzadfar F, Fay DFJ, Feigin VL, Flaxman A, Forouzanfar MH, Goto A, Green MA, Gupta R, Hafezi-Nejad N, Hankey GJ, Harewood HC, Havmoeller R, Hay S, Hernandez L, Husseini A, Idrisov BT, Ikeda N, Islami F, Jahangir E, Jassal SK, Jee SH, Jeffreys M, Jonas JB, Kabagambe EK, Khalifa SEAH., Kengne AP, Khader YS, Khang Y-H, Kim D, Kimokoti RW, Kinge JM, Kokubo Y, Kosen S, Kwan G, Lai T, Leinsalu M, Li Y, Liang X, Liu S, Logroscino G, Lotufo PA, Lu Y, Ma J, Mainoo NK, Mensah GA, Merriman TR, Mokdad AH, Moschandreas J, Naghavi M, Naheed A, Nand D, Narayan KMV, Nelson EL, Neuhouser ML, Nisar MI, Ohkubo T, Oti SO, Pedroza A, Prabhakaran D, Roy N, Sampson U, Seo H, Sepanlou SG, Shibuya K, Shiri R, Shiue I, Singh GM, Singh JA, Skirbekk V, Stapelberg NJC, Sturua L, Sykes BL, Tobias M, Tran BX, Trasande L, Toyoshima H,

van de Vijver S, Vasankari TJ, Veerman JL, Velasquez-Melendez G, Vlassov VV, Vollset SE, Vos T, Wang C, Wang X, Weiderpass E, Werdecker A, Wright JL, Yang YC, Yatsuya H, Yoon J, Yoon S-J, Zhao Y, Zhou M, Zhu S, Lopez AD, Murray CJL, Gakidou E (2014) Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: a systematic analysis for the Global Burden of Disease Study 2013. Lancet 384(9945):766–781. https://doi.org/10.1016/s0140-6736(14)60460-8

2. Keating C, Backholer K, Peeters A (2014) Prevalence of overweight and obesity in children and adults. Lancet 384(9960):2107–2108. https://doi.org/10.1016/S0140-6736(14)62367-9
3. Moreno LA (2013) Obesity in children and adolescents. A critical review. Endocrinología y Nutrición 60:7–9. https://doi.org/10.1016/s1575-0922(13)70016-0
4. Cecon RS, Franceschini S, Peluzio M, Hermsdorff HHM, Priore SE (2017) Overweight and body image perception in adolescents with triage of eating disorders. Sci World J 2017:8257329. https://doi.org/10.1155/2017/8257329
5. APA (2017) Eating disorders. What are eating disorders? American Psychiatric Association. https://www.psychiatry.org/patients-families/eating-disorders/what-are-eating-disorders Accessed 9 Sep 2017
6. Ozier AD, Henry BW (2011) Position of the American dietetic association: nutrition intervention in the treatment of eating disorders. J Am Diet Assoc 111:1236–1241
7. Alvarenga Mde F, Scagliusi F, Philippi ST (2010) Development and validity of the Disordered Eating Attitude Scale (DEAS). Percept Motor Skills 2010 110:379–395
8. Neumark-Sztainer D (2005) Can we simultaneously work toward the prevention of obesity and eating disorders in children and adolescents? Int J Eat Disord 38(3):220–227. https://doi.org/10.1002/eat.20181
9. Irving LM, Neumark-Sztainer D (2002) Integrating the prevention of eating disorders and obesity: feasible or futile? Prev Med 34(3):299–309. https://doi.org/10.1006/pmed.2001.0997
10. Rodgers RF, Watts AW, Austin SB, Haines J, Neumark-Sztainer D (2017) Disordered eating in ethnic minority adolescents with overweight. Int J Eat Disord 50(6):665–671. https://doi.org/10.1002/eat.22652
11. Campos-Uscanga Y, Gutierrez-Ospina G, Morales-Romero J, Romo-Gonzalez T (2017) Self-regulation of eating and physical activity is lower in obese female college students as compared to their normal weight counterparts. Eat Weight Disord EWD 22(2):311–319. https://doi.org/10.1007/s40519-016-0338-9
12. Zullig KJ, Matthews-Ewald MR, Valois RF (2017) Relationship between disordered eating and self-identified sexual minority youth in a sample of public high school adolescents. Eat Weight Disord EWD. https://doi.org/10.1007/s40519-017-0389-6
13. Albuquerque IE (2003) O direito das minorias na constituição da república federativa do Brasil de 1988 e a situação dos índios enquanto minoria do Estado Brasileiro. Quaestio Iuris 6(2):11–32. https://doi.org/10.12957/rqi.2013.9311
14. Alvarenga Mdos S, Lourenco BH, Philippi ST, Scagliusi FB (2013) Disordered eating among Brazilian female college students. Cadernos de saude publica 29(5):879–888
15. Fortes Lde S, Cipriani FM, Ferreira ME (2013) Risk behaviors for eating disorder: factors associated in adolescent students. Trends Psychiatry Psychother 35(4):279–286. https://doi.org/10.1590/2237-6089-2012-0055
16. Bucchianeri MM, Fernandes N, Loth K, Hannan PJ, Eisenberg ME, Neumark-Sztainer D (2015) Body dissatisfaction: do associations with disordered eating and psychological well-being differ across race/ethnicity in adolescent girls and boys? Cult Divers Ethn Minority Psychol. https://doi.org/10.1037/cdp0000036
17. Balantekin KN, Birch LL, Savage JS (2015) Patterns of weight-control behavior among 15 year old girls. Int J Eat Disord 48(6):589–600. https://doi.org/10.1002/eat.22426
18. Stephen EM, Rose JS, Kenney L, Rosselli-Navarra F, Weissman RS (2014) Prevalence and correlates of unhealthy weight control behaviors: findings from the national longitudinal study of adolescent health. J Eat Disord 2:16. https://doi.org/10.1186/2050-2974-2-16
19. Gonsalves D, Hawk H, Goodenow C (2014) Unhealthy weight control behaviors and related risk factors in Massachusetts middle and high school students. Matern Child Health J 18(8):1803–1813. https://doi.org/10.1007/s10995-013-1424-5
20. Loth K, Wall M, Larson N, Neumark-Sztainer D (2015) Disordered eating and psychological well-being in overweight and nonoverweight adolescents: secular trends from 1999 to 2010. Int J Eat Disord 48(3):323–327. https://doi.org/10.1002/eat.22382
21. Goldschmidt AB, Wall MM, Loth KA, Neumark-Sztainer D (2015) Risk factors for disordered eating in overweight adolescents and young adults. J Pediatr Psychol 40(10):1048–1055. https://doi.org/10.1093/jpepsy/jsv053
22. Haines J, Neumark-Sztainer D (2006) Prevention of obesity and eating disorders: a consideration of shared risk factors. Health Educ Res 21(6):770–782. https://doi.org/10.1093/her/cyl094
23. Neumark-Sztainer D, Story M, Hannan PJ, Perry CL, Irving LM (2002) Weight-related concerns and behaviors among overweight and nonoverweight adolescents: implications for preventing weight-related disorders. Arch Pediatr Adolesc Med 156(2):171–178
24. Watson HJ, Joyce T, French E, Willan V, Kane RT, Tanner-Smith EE, McCormack J, Dawkins H, Hoiles KJ, Egan SJ (2016) Prevention of eating disorders: A systematic review of randomized, controlled trials. Int J Eat Disord 49(9):833–862. https://doi.org/10.1002/eat.22577
25. Le LK, Barendregt JJ, Hay P, Mihalopoulos C (2017) Prevention of eating disorders: a systematic review and meta-analysis. Clin Psychol Rev 53:46–58. https://doi.org/10.1016/j.cpr.2017.02.001
26. Leme AC, Philippi ST (2015) The "Healthy Habits, Healthy Girls" randomized controlled trial for girls: study design, protocol, and baseline results. Cad Saude Publica 31(7):1381–1394. https://doi.org/10.1590/0102-311X00136014
27. Leme AC, Lubans DR, Guerra PH, Dewar D, Toassa EC, Philippi ST (2016) Preventing obesity among Brazilian adolescent girls: Six-month outcomes of the Healthy Habits, Healthy Girls-Brazil school-based randomized controlled trial. Prev Med 86:77–83. https://doi.org/10.1016/j.ypmed.2016.01.020
28. Kass AE, Jones M, Kolko RP, Altman M, Fitzsimmons-Craft EE, Eichen DM, Balantekin KN, Trockel M, Taylor CB, Wilfley DE (2017) Universal prevention efforts should address eating disorder pathology across the weight spectrum: implications for screening and intervention on college campuses. Eat Behav 25:74–80. https://doi.org/10.1016/j.eatbeh.2016.03.019
29. Leme A, Baranowski T, Thompson D, Nicklas T, Philippi S (2018) Sustained impact and behavioral mediators of waist circumference in the "Healthy Habits, Healthy Girls—Brazil" school-based randomized controlled trial for adolescents living in low-income communities. Prev Med Rep **(in press)**
30. Philippi S, Leme A (2018) Weight-related teasing: body dissatisfaction mediates weight-control behaviors of Brazilian adolescent girls from low-income communities? Cadernos de Saúde Coletiva 35 **(in press)**
31. Moher D, Hopewell S, Schulz KF, Montori V, Gotzsche PC, Devereaux PJ, Elbourne D, Egger M, Altman DG (2010) CONSORT 2010 explanation and elaboration: updated guidelines for reporting parallel group randomised trials. BMJ 340:c869. https://doi.org/10.1136/bmj.c869

32. Lubans DR, Morgan PJ, Dewar D, Collins CE, Plotnikoff RC, Okely AD, Batterham MJ, Finn T, Callister R (2010) The nutrition and enjoyable activity for teen girls (NEAT girls) randomized controlled trial for adolescent girls from disadvantaged secondary schools: rationale, study protocol, and baseline results. BMC Public Health 10:652. https://doi.org/10.1186/1471-2458-10-652
33. Bandura A (1986) Social foundations of thought and action: a social cognitive theory. Prentice-Hall, Englewood Cliffs
34. Leme A, Philippi S (2014) Cultural adaptation and psychometric properties of social cognitive scales related to adolescent dietary behaviors. Cadernos de Saúde Coletiva 22(3):252–259
35. Philippi S, Leme A, Dewar D (2014) Cultural adaptation and psychometric evaluation of physical activity social cognitive scales for Brazilian adolescents. J Sport Sci 3(2):134–143. https://doi.org/10.17265/2332-7839/2014.03.003
36. Neumark-Sztainer DR, Friend SE, Flattum CF, Hannan PJ, Story MT, Bauer KW, Feldman SB, Petrich CA (2010) New moves-preventing weight-related problems in adolescent girls a group-randomized study. Am J Prev Med 39(5):421–432. https://doi.org/10.1016/j.amepre.2010.07.017
37. Leme AC, Philippi ST (2013) Teasing and weight-control behaviors in adolescent girls. Rev Paul Pediatr 31(4):431–436. https://doi.org/10.1590/S0103-05822013000400003
38. Heck R, Thomas S, Tabata L (2010) Multilevel and longitudinal modeling with IBM SPSS. Routledge, New York
39. Tabachnick BG, Fidell LS (2007) Multilevel linear modeling. Using multivariate statistics. Pearson Education Inc., Boston
40. Winkens B, van Breukelen GJ, Schouten HJ, Berger MP (2007) Randomized clinical trials with a pre- and a post-treatment measurement: repeated measures versus ANCOVA models. Contemp Clin Trials 28(6):713–719. https://doi.org/10.1016/j.cct.2007.04.002
41. de Boer MR, Waterlander WE, Kuijper LD, Steenhuis IH, Twisk JW (2015) Testing for baseline differences in randomized controlled trials: an unhealthy research behavior that is hard to eradicate. Int J Behav Nutr Phys Act 12:4. https://doi.org/10.1186/s12966-015-0162-z
42. Van Breukelen GJ (2006) ANCOVA versus change from baseline: more power in randomized studies, more bias in nonrandomized studies [corrected]. J Clin Epidemiol 59(9):920–925. https://doi.org/10.1016/j.jclinepi.2006.02.007
43. Torgerson DJ, Roberts C (1999) Understanding controlled trials. Randomisation methods: concealment. BMJ 319(7206):375–376
44. Leme AC, Philippi ST (2017) Home food availability, parents'/caregivers' support, and family meals influence on dietary servings of low-income urban adolescent girls from Brazil. BMC Nutrire. https://doi.org/10.1186/s41110-017-0053-y **(in press)**
45. Lopez-Guimera G, Neumark-Sztainer D, Hannan P, Fauquet J, Loth K, Sanchez-Carracedo D (2013) Unhealthy weight-control behaviours, dieting and weight status: a cross-cultural comparison between North American and Spanish adolescents. Eur Eat Disord Rev 21(4):276–283. https://doi.org/10.1002/erv.2206
46. Sanchez-Carracedo D, Neumark-Sztainer D, Lopez-Guimera G (2012) Integrated prevention of obesity and eating disorders: barriers, developments and opportunities. Public Health Nutr 15(12):2295–2309. https://doi.org/10.1017/S1368980012000705
47. Lubans DR, Morgan PJ, Okely AD, Dewar D, Collins CE, Batterham M, Callister R, Plotnikoff RC (2012) Preventing obesity among adolescent girls: one-year outcomes of the nutrition and enjoyable activity for teen girls (NEAT Girls) cluster randomized controlled trial. Arch Pediatr Adolesc Med 166(9):821–827. https://doi.org/10.1001/archpediatrics.2012.41
48. Dewar DL, Morgan PJ, Plotnikoff RC, Okely AD, Collins CE, Batterham M, Callister R, Lubans DR (2013) The nutrition and enjoyable activity for teen girls study: a cluster randomized controlled trial. Am J Prev Med 45(3):313–317. https://doi.org/10.1016/j.amepre.2013.04.014
49. Wilksch SM, Paxton SJ, Byrne SM, Austin SB, O'Shea A, Wade TD (2017) Outcomes of three universal eating disorder risk reduction programs by participants with higher and lower baseline shape and weight concern. Int J Eat Disord 50(1):66–75. https://doi.org/10.1002/eat.22642
50. Wade TD, Wilksch SM, Paxton SJ, Byrne SM, Austin SB (2017) Do universal media literacy programs have an effect on weight and shape concern by influencing media internalization? Int J Eat Disord 50(7):731–738. https://doi.org/10.1002/eat.22689
51. Tanofsky-Kraff M, Shomaker LB, Wilfley DE, Young JF, Sbrocco T, Stephens M, Brady SM, Galescu O, Demidowich A, Olsen CH, Kozlosky M, Reynolds JC, Yanovski JA (2017) Excess weight gain prevention in adolescents: three-year outcome following a randomized controlled trial. J Consult Clin Psychol 85(3):218–227. https://doi.org/10.1037/ccp0000153
52. Plotnikoff RC, Costigan SA, Karunamuni N, Lubans DR (2013) Social cognitive theories used to explain physical activity behavior in adolescents: a systematic review and meta-analysis. Prev Med 56(5):245–253. https://doi.org/10.1016/j.ypmed.2013.01.013
53. Tucunduva Philippi S, Guerra P, Leme AC (2016) Health behavioral theories used to explain dietary behaviors in adolescents: a systematic review. BMC Nutrire. https://doi.org/10.1186/s41110-016-0023-9
54. Smith JJ, Morgan PJ, Plotnikoff RC, Dally KA, Salmon J, Okely AD, Finn TL, Lubans DR (2014) Smart-phone obesity prevention trial for adolescent boys in low-income communities: the ATLAS RCT. Pediatrics 134(3):e723–e731. https://doi.org/10.1542/peds.2014-1012
55. Vaughan CA, Ghosh-Dastidar M, Dubowitz T (2017) Attitudes and barriers to healthy diet and physical activity: a latent profile analysis. Health Educ Behav. https://doi.org/10.1177/1090198117722818
56. Stice E, Marti CN, Spoor S, Presnell K, Shaw H (2008) Dissonance and healthy weight eating disorder prevention programs: long-term effects from a randomized efficacy trial. J Consult Clin Psychol 76(2):329–340. https://doi.org/10.1037/0022-006X.76.2.329
57. Stice E, Shaw H, Marti CN (2007) A meta-analytic review of eating disorder prevention programs: encouraging findings. Annu Rev Clin Psychol 3:207–231. https://doi.org/10.1146/annurev.clinpsy.3.022806.091447
58. Silva WRD, Santana MS, Maroco J, Maloa BFS, Campos J (2017) Body weight concerns: cross-national study and identification of factors related to eating disorders. PLoS One 12(7):e0180125. https://doi.org/10.1371/journal.pone.0180125
59. Larson N, Davey CS, Caspi CE, Kubik MY, Nanney MS (2017) School-based obesity-prevention policies and practices and weight-control behaviors among adolescents. J Acad Nutr Diet 117(2):204–213. https://doi.org/10.1016/j.jand.2016.09.030
60. Ramos Salas X, Forhan M, Caulfield T, Sharma AM, Raine K (2018) A critical analysis of obesity prevention policies and strategies. Can J Public Health Revue canadienne de sante publique 108(5–6):e598–e608. https://doi.org/10.17269/cjph.108.6044
61. Dunker KLL, Claudino AM (2017) Preventing weight-related problems among adolescent girls: a cluster randomized trial comparing the Brazilian 'New Moves' program versus observation. Obes Res Clin Pract. https://doi.org/10.1016/j.orcp.2017.07.004
62. Ciao AC, Loth K, Neumark-Sztainer D (2014) Preventing eating disorder pathology: common and unique features of successful eating disorders prevention programs. Curr Psychiatry Rep 16(7):453. https://doi.org/10.1007/s11920-014-0453-0
63. Lee GY, Park EJ, Kim YR, Kwag KH, Park JH, An SH, Lee JH, Sim JH, Treasure J (2017) Feasibility and acceptability of a prevention program for eating disorders (Me, You and Us) adapted

for young adolescents in Korea. Eat Weight Disord EWD. https://doi.org/10.1007/s40519-017-0436-3

64. Tanofsky-Kraff M, Shomaker LB, Wilfley DE, Young JF, Sbrocco T, Stephens M, Ranzenhofer LM, Elliott C, Brady S, Radin RM, Vannucci A, Bryant EJ, Osborn R, Berger SS, Olsen C, Kozlosky M, Reynolds JC, Yanovski JA (2014) Targeted prevention of excess weight gain and eating disorders in high-risk adolescent girls: a randomized controlled trial. Am J Clin Nutr 100(4):1010–1018. https://doi.org/10.3945/ajcn.114.092536
65. Lubans DR, Smith JJ, Plotnikoff RC, Dally KA, Okely AD, Salmon J, Morgan PJ (2016) Assessing the sustained impact of a school-based obesity prevention program for adolescent boys: the ATLAS cluster randomized controlled trial. Int J Behav Nutr Phys Act 13:92. https://doi.org/10.1186/s12966-016-0420-8