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Preventing obesity among Brazilian adolescent girls: Six-month outcomes of the Healthy Habits, Healthy Girls–Brazil school-based randomized controlled trial

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ABSTRACT

Background. School-based trials to prevent and reduce prevalence of pediatric obesity in low-income countries are necessary. In Brazil, addressing adolescent obesity is a public health priority.

Objective. To evaluate the impact of a group randomized controlled trial involving a 6-month multicomponent school-based obesity prevention program targeting adolescent girls.

Methods. The Healthy Habits, Healthy Girls–Brazil program recruited participants ($n = 253$; 16.05 ± 0.05 years) from ten eligible public technical schools in São Paulo, Brazil. The program was adapted from an Australian intervention study, which is based on the Social Cognitive Theory. The primary outcome measure was body mass index (BMI), and secondary outcomes included BMI *z score*, waist circumference, and various sedentary and dietary health-related behaviours.

Results. Although changes in BMI were not statistically significant, differences favored the intervention group (adjusted mean difference, −0.26 kg/m^2,se SE = 0.018, $p = 0.076$). Statistically significant intervention effects were found for waist circumference (−2.28 cm; p =, $p = 0.01$), computer screen time on the weekends (0.63 h/day, p; p = 0.02), total sedentary activities on the weekends (−0.92 h/day, $p < 0.01$), and vegetable intake (1.16 servings/day, p = 0.01).

Conclusion. These findings provide some evidence for the benefit of a school-based intervention to prevent unhealthy weight gain in adolescent girls living in low-income communities.

Introduction

Recent decades have shown a substantial increase in the global prevalence of pediatric overweight and obesity (Ng et al., 2014). Brazilian youth are not impervious to this global public health crisis, with recent data showing high a prevalence of overweight (23.0%) and obesity (7.3%) among adolescents (Araújo et al., 2010). Specifically, the highest rates of obesity and overweight have been observed in the most developed region (Southeast) of Brazil (Araújo et al., 2010). This is a serious concern as unhealthy weight gain in youth can lead to a variety of adverse health outcomes (Tsiros et al., 2011) and the likelihood of pediatric obesity tracking into adulthood is high (Singh et al., 2008). There is clearly an urgent need for effective interventions that target weight-related health behaviors in population "at risk" of obesity (Olsen et al., 2012; WHO, 2012).

Schools are well placed to deliver health promotion interventions and address health inequalities in populations "at risk" of obesity (Hills et al., 2015).For instance, schools provide access to the majority of youth and already have the necessary provisions (i.e., facilities, resources, and trained staff) in place for the safe and supportive delivery of health promotion interventions (CDC, 2011). While numerous school-based obesity prevention interventions among youth have been evaluated, recent reviews of these studies have indicated several limitations and challenges that need to be addressed to advance the field (Waters et al., 2011).

The majority of youth studies have been conducted in high-income countries, predominantly in the United States. There is a lack of available evidence for effective strategies in developing countries, and quality randomized controlled studies using Brazilian adolescents are urgently needed (Guerra et al., 2014). Many studies have also revealed modest effects for interventions targeting adolescents, with greater success shown for programs designed for children (Brown and Summerbell, 2009). It has been suggested these modest effects of

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previous interventions may be explained by a lack of studies targeting the most vulnerable youth, and hence the need for programs and strategies to differentiate on the grounds of sex, cultural background, and socioeconomic position (Stamatakis et al., 2010). Research conducted in Brazil has demonstrated that girls consume more sugar and sweet food items (Levy et al., 2010), are less physically active (Hallal et al., 2010), and spend more time in small-screen recreation (Camelo et al., 2012), in comparison to boys. These findings highlight the importance of establishing effective strategies that target the health behaviors of this priority group to prevent unhealthy weight gain (Barbosa Filho et al., 2014). Therefore, the primary purpose of this study was to evaluate the effects of a culturally tailored school-based obesity prevention intervention in a sample of adolescent girls from low-income communities in the city of São Paulo, Brazil.

Methods

This study was registered in the ClinicalTrials.gov (NCT02228447) and reported according to the CONSORT checklist (Moher et al., 2010).

Study design

The design, methods, and baseline characteristics are described in details elsewhere (Leme and Philippi, 2015). In summary, The "Healthy Habits, Healthy Girls–Brazil (H3G-Brazil)" was a 6–month obesity prevention intervention evaluated using a cluster randomized controlled trial (March to September 2014). The intervention strategies were culturally adapted from "The Nutrition Enjoyable Activity for Teen Girls (NEAT Girls)" study (Dewar et al., 2013; Lubans et al., 2010, 2012). Approval was obtained from the Ethic Research Committee of the School of Public Health, University of São Paulo. Parents/caregivers, teachers, and school principals provided written informed consent. Adolescents also provided assent.

Sample size and randomization

The sample size was calculated to determine the necessary detectable post-intervention changes in the primary outcome, body mass index (BMI) (Lubans et al., 2010; Smith et al., 2014a). The power calculation was based on power of 80% and significance level of 5% ($p < 0.05$) and proportion of non-exposed and exposed to the outcome. Considering potential dropout of 20%, 266 participants were necessary to detect a between-group difference in BMI of 0.4 kg/m^2. Following baseline assessments, the 10 schools were match paired (i.e., 5 pairs of schools) based on their geographical location, size, and demographics. Schools within each pair were then randomized to either H3G-Brazil or control group by an individual not involved in the study.

Participants and selection

Technical schools in Brazil are government secondary schools (student ages range from 14 to 18 years). At these schools, part of the adolescents' school day is allocated to regular high school and the other to technical education in several different areas (e.g., mechanical, chemistry, health, and commerce). Government schools that offer nutrition and dietetic technical courses (13 of 43 schools) were selected for the current study because they provide (i) opportunities for partnership with accredited dietitian teachers and allow students to work as research assistants and (ii) infrastructure to deliver the nutrition activities (i.e., food science laboratory).

Girls reported their parents/caregivers school level of education and the neighborhood they live. In Brazil, parents' education level is considered an income proxy. In agreement with the social economic level of the city of São Paulo, the schools and neighborhoods are of high vulnerability (e.g., government housing and slums demonstrating areas of low socio economic position) (SãoPaulo, 2014). Once schools agreed to participate in the study, research assistants visited the study schools and provided a presentation to the students describing the proposed intervention and assessment procedures. Study participants were then asked to complete a questionnaire regarding PA and eating behaviors to identify girls "at risk" for obesity (Plotnikoff et al., 2009). Those who were considered "at risk" of obesity based on their PA and dietary behaviors were then eligible to participate in the intervention.

Intervention

The H3G-Brazil program was a 6-month multicomponent school-based intervention guided by the social cognitive theory (SCT) (Bandura, 1986). The intervention was based on ten nutrition and physical activity (PA) messages to support healthy eating and regular PA (Lubans et al., 2010). Additional program components were designed to reinforce healthy dietary and PA behaviors and included enhanced physical education (PE) sessions, school-break PA sessions, nutrition and PA handbooks, interactive seminars, nutrition workshops, weekly nutrition and PA key messages, parental newsletters, weekly health messages using WhatsApp®, and diet and PA diaries for self-monitoring.

H3G-Brazil was focused on promoting low-cost healthy dietary choices and lifelong and lifestyle physical activities. Lifelong physical activities are those that may be easily carried over into adulthood and generally require only one or two people to participate (e.g., yoga, dance, body weight resistance training) (Hulteen et al., 2015). Lifestyle activities are those performed as part of everyday life, such as walking for transport (Leme and Philippi, 2015; Lubans et al., 2010). Detailed description of intervention components and hypothesized mediators are reported in Supplementary Table 1.

Since the H3G-Brazil intervention was an adaptation of the Australian NEAT Girls program (Lubans et al., 2012), modifications were necessary to make it culturally appropriate to Brazilian girls: the enhanced PE classes focused on the girls' preferred activities (e.g., dance classes, walking around the school campus, and resistance training workouts). To promote enjoyment during sessions, the girls were invited to bring their preferred music (e.g., on cell phones). Further, the intervention's nutrition component was guided by the *Brazilian Food Guide Pyramid* and *Smart Food Choices* (Leme and Philippi, 2014; Philippi, 2014; Philippi and Leme, 2015), which promotes healthy, regional, and cost-effective food preparations including for example, tropical fruits (e.g., mangos and coconut), whole-wheat sandwiches and pasta, and cultural spices/herbs typically used in Brazilian cuisine (e.g., basil, bay leaves, black pepper, garlic and onion, nutmeg and mint).

Research assistants delivered the ten key health messages during school breaks. PE teachers conducted the enhanced PE classes and supervised the PA sessions during school breaks. Accredited dietitians delivered the nutrition workshops and the interactive seminars, and they were responsible for sending the WhatsApp® messages and newsletters. All teachers, dieticians, and research assistants previously took part in H3G-Brazil training workshops to ensure sufficient understanding and adequate delivery of program components. To prevent resentful demoralization, the control school received a condensed version of the program after follow-up assessments. This included professional learning workshops for control school teachers and the H3G-Brazil intervention materials (Leme and Philippi, 2015).

Assessments and measurements

All assessments were conducted by trained research assistants blinded to groups' allocation at both time points. Physical assessments were conducted in a sensitive manner (i.e., weight measured out of the view of other students), and questionnaires were completed after the physical assessments in exam-like conditions. Socio-demographic information was collected at baseline only.

Body mass index

Weight was measured by the nearest 0.1 kg using a portable digital scale. A portable stadiometer was used to obtain height measurements to the nearest 0.1 cm. Body mass index (BMI) was calculated using the standard formula (kg/m^2).

Body mass index z score

BMI *z* score was also calculated using the LMS method proposed by Cole (Cole, 1990). This method is used to build distribution curves of anthropometric outcomes such as weight and height (Hulteen et al., 2015). BMI percentile was used to classify weight status (i.e., underweight, normal weight, overweight, and obese) according to World Health Organization data (de Onis, 2007).

Waist circumference

Waist circumference was measured by the nearest 0.1 cm against the skin using extendible steel tape in line with the umbilicus (Pereira et al., 2015).

Leisure-time physical activity

PA was assessed using the an adapted and validated version of the Godin–Shephard Leisure-Time Physical Activity Questionnaire for use in the Brazilian