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# Sustained impact of the "Healthy Habits, Healthy Girls – Brazil" school-based randomized controlled trial for adolescents living in low-income communities

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ABSTRACT

Pediatric obesity is a major public health concern in low- and middle-income countries, such as Brazil. There is an urgent need for preventive programs for adolescents and, the assessment of their sustained impact. This paper reports the longer-term (6-month post intervention) effects of the "H3G-Brazil" obesity prevention program on weight status and weight-related behaviors. A cluster randomized controlled trial starting with 10 public schools in the city of São Paulo, Brazil involved 253 adolescent girls [mean (se) age = 15.6 (0.87) years]. Body mass index (BMI), waist circumference (WC), dietary intake, physical activity (PA) and sedentary behaviors (SB) were assessed at baseline, immediate post-intervention and 6-month post-intervention (follow-up). ANCOVA was performed using intention to treat principles. There was no effect on BMI, the primary outcome. Although, meaningful increases occurred in waist circumference for both groups, the intervention group presented a lower increase ($F = 3.31$, $p = 0.04$). This effect size, however, was lower than the criterion for small ($d = 0.102$). Unfortunately, significant results favored the control group for time spent on TV/weekdays ($F = 5.13$, $p = 0.01$), TV/weekends ($F = 5.46$, $p = 0.01$) and sedentary behaviors/weekdays ($F = 5.32$, $p = 0.04$). No other significant results were found. This obesity prevention intervention among Brazilian adolescent girls did not have the desire effect on BMI. The significantly lower increase in waist circumference in the intervention groups is inconsistent with the adverse changes detected in sedentary time.

## 1. Introduction

Since treatment of obesity is difficult, costly and often unsuccessful (Selker et al., 2010), preventive interventions are necessary. Most research on prevention interventions were conducted in high-income countries (Baranowski, 2012) and targeted only obesity. Since obesity is more common among lower socioeconomic groups, interventions are needed for low- to middle-income (LMIC) countries, including Brazilian adolescents from low-income socioeconomic status (Araujo et al., 2017; Boff et al., 2017; WHO, 2012). Schools provide easy access to deliver prevention interventions among adolescents who are "at risk" of obesity and other weight-related problems (Hills et al., 2015; Kelishadi and Azizi-Soleiman, 2014). Obesity prevention interventions should target those most susceptible, such as adolescents of low-income backgrounds (Smith et al., 2014b). The global prevalence of obesity is higher among female compared with male youth (Ng et al., 2014). Evidence from a representative cross-sectional study showed that Brazilian adolescent girls were more likely to report inadequate dietary and physical activity patterns (Azeredo et al., 2016). They regularly ($\geq 5\times$/week) consumed foods considered to be unhealthy, e.g., savory snacks, deep-fried salty snacks, processed meats, sweets and cookies (Azeredo et al., 2014); and were less physically active (Hallal et al., 2010) compared to the boys. Furthermore, girls were more prone to engage in unhealthy weight control behaviors, such as fasting, dieting and using meal replacements in an attempt to reduce or maintain their weight. These can be harmful since they can lead to both obesity and eating disorders (ED) (Haines and Neumark-Sztainer, 2006; Neumark-Sztainer et al., 2002).

Studies in LMIC have not focused on adolescent girls living in low-income communities or on changing their weight related behaviors, which can combine in complex ways to exert a cumulative effect on weight status (Leme and Philippi, 2015). School-based obesity prevention interventions targeting multiple components seem to be more

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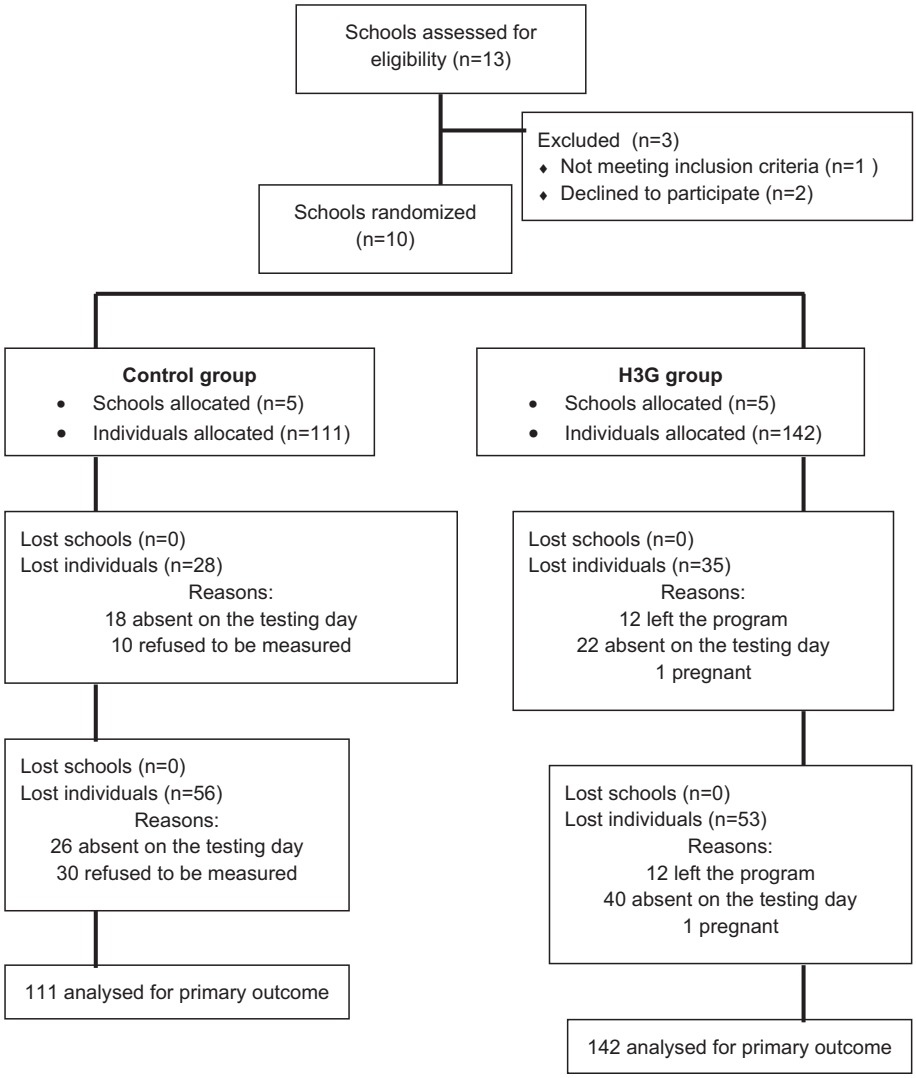


**Fig. 1.** Flowchart of the "Healthy Habits, Healthy Girls – Brazil" study.

successful than those that target either diet, physical activity or sedentary behaviors separately (Leme and Philippi, 2015). The "Nutrition and Enjoyable Activity for Teens Girls" (NEAT Girls) (Lubans et al., 2010) program was created to target school-based diet, physical activity and sedentary behaviors among girls in Australia. The "Healthy Habits, Healthy Girls -Brazil" (H3G-Brazil) adapted the NEAT Girls Study to the Brazilian context (Leme et al., 2016; Lubans et al., 2016a) and added a focus on eating disorders. H3G-Brazil refined NEAT for implementation in schools in São Paulo, Brazil using literature reviews from theory based trials (Leme and Philippi, 2015).

This paper reports the longer-term (6-month post intervention) effects of the "H3G-Brazil" obesity prevention program on weight status and weight-related behaviors. The primary goal of H3G-Brazil was to impact BMI and to teach students the skills to use healthy strategies for long-term changes, to be shared with family and friends (Leme and Philippi, 2015) and to reduce unhealthy weight control behaviors and weight stigma. The primary hypothesis was that H3G-Brazil would improve diet and physical activity behaviors and as a consequence prevent unhealthy weight gain in adolescents.

## 2. Methods

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

### 2.1. Study design

Details of the study design, protocol and participant characteristics at baseline were reported in detail elsewhere (Leme and Philippi, 2015). In summary, "H3G-Brazil" was assessed through a cluster randomized controlled trial design and included 10 public technical high schools (i.e., 5 intervention and 5 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 geographic location, size and demographics and randomized within pairs by an individual not involved in the research project. For instance, the numbers one or two were written on individual small papers then folded, and added to a plastic bag. Each number represented a school (e.g., number 1 was school A). Schools remained in their allocated group for the duration of the study. Trained undergraduate and graduate students conducted follow-up assessments blinded to group allocation (Leme and Philippi, 2015).

### 2.2. School selection and participants

Technical high schools in Brazil are intended for adolescents (i.e., 14 to 18 years old) from low-income backgrounds. These schools deliver regular high school education, along with vocational training in different areas (e.g., chemistry, environmental science, visual