Filling childhood with health program: a fun strategy to encourage healthy habits in children

Enchendo a infância com o programa de saúde: uma estratégia divertida para incentivar hábitos saudáveis nas crianças

Programa llenando la infancia con salud: una divertida estrategia para fomentar hábitos saludables en los niños

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ABSTRACT
Sedentary lifestyle and inadequate diet are associated with 2.6 billion deaths each year. Health education could improve health habits in childhood. We investigated the effects of a health education program on physical activity (PA) level, eating habits, body composition, and cardiorespiratory fitness in schoolchildren. A total of 50 children from Brazilian public school were evaluated into a PA level and food consumption (questionnaire), cardiorespiratory fitness (PACER), and body composition (skinfolds), allocated to either an 8-week intervention at Fun Education Group (FEG, n=19, 8.2±0.5yr) or control group (CG, n=31, 8.1±0.5yr). FEG was exposed to an educative website (1h - TOODS KIDS), filled a sticker album according to habits (PA and eating) of each weekday, and families received instructions (leaflets and lecture) on how to improve their habits. The generalized linear models analysis revealed an improvement to FEG at cardiorespiratory fitness (6.4 laps, p=0.042; and 0.4 km/h, p=0.031), more fruits and vegetable consumption (1.4 unities, p=0.029) and body fat reduction (-1.5%, p=0.001), compared to CG. The participation at Program suggest that a short period of feasible intervention, with low-cost materials, aroused and motivated children to healthier habits with positive effects on cardiorespiratory fitness, body fat, and consumption of fruits and vegetable.

Keywords: physical activities, healthy eating, health education, children.

RESUMO
O estilo de vida sedentário e a dieta inadequada estão associados a 2,6 bilhões de mortes por ano. A educação sanitária poderia melhorar os hábitos de saúde na infância. Investigamos os efeitos de um programa de educação em saúde sobre o nível de atividade física (PA), hábitos alimentares, composição corporal e aptidão cardiorrespiratória em crianças em idade escolar. Um total de 50 crianças da escola pública brasileira foram avaliadas em nível de AF e consumo de alimentos (questionário), aptidão cardiorrespiratória (PACER) e composição corporal (pregas cutâneas), alocadas para uma intervenção de 8 semanas no Grupo Educação Divertida (FEG, n=19, 8,2±0,5 anos) ou grupo controle (CG, n=31, 8,1±0,5 anos). FEG foi exposto a um site educativo (1h - TOODS KIDS), preencheu um álbum de adesivos de acordo com os hábitos (PA e alimentação) de cada dia da semana, e as famílias receberam instruções (folhetos e palestras) sobre como melhorar seus hábitos. A análise dos modelos lineares generalizados revelou melhora da FEG na aptidão cardiorrespiratória (6,4 voltas, p=0,042; e 0,4 km/h, p=0,031), maior consumo de frutas e vegetais (1,4 unidades, p=0,029) e redução de gordura corporal (-1,5%, p=0,001), em comparação com a CG. A participação no Programa sugere que um curto período de intervenção viável, com materiais de baixo custo, estimulou e motivou crianças a hábitos mais saudáveis com efeitos positivos nos cardiorespiratórios aptidão física, gordura corporal e consumo de frutas e vegetais.

Palavras-chave: atividades físicas, alimentação saudável, educação em saúde, crianças.
RESUMEN
El sedentarismo y la dieta inadecuada se asocian con 2.600 millones de muertes cada año. La educación sanitaria podría mejorar los hábitos de salud en la infancia. Se investigaron los efectos de un programa de educación para la salud sobre el nivel de actividad física (AP), los hábitos alimentarios, la composición corporal y la aptitud cardiorrespiratoria en escolares. Un total de 50 niños de la escuela pública brasileña fueron evaluados en un nivel de AF y consumo de alimentos (cuestionario), aptitud cardiorrespiratoria (PACER) y composición corporal (pliegues cutáneos), asignados a una intervención de 8 semanas en el Grupo de Educación de la Diversión (FEG, n = 19, 8.2 ± 0.5 años) o grupo de control (CG, n = 31, 8.1 ± 0.5 años). FEG estuvo expuesto a un sitio web educativo (1h - TOODS KIDS), llenó un álbum de pegatinas de acuerdo a los hábitos (PA y alimentación) de cada día de la semana, y las familias recibieron instrucciones (folletos y conferencias) sobre cómo mejorar sus hábitos. El análisis de modelos lineales generalizados reveló una mejoría en el FEG en la aptitud cardiorrespiratoria (6.4 vueltas, p=0.042; y 0.4 km/h, p=0.031), más consumo de frutas y verduras (1.4 unidades, p=0.029) y reducción de grasa corporal (-1.5%, p=0.001), en comparación con el CG. La participación en el Programa sugiere que un corto período de intervención factible, con materiales de bajo costo, despertó y motivó a los niños a hábitos más saludables con efectos positivos en la aptitud cardiorrespiratoria, la grasa corporal y el consumo de frutas y verduras.

Palabras clave: actividades físicas, alimentación saludable, educación para la salud, niños.

1 INTRODUCTION

Around 2.8 million people die every year due to complications related to overweight, mainly because of unhealthy eating and physical inactivity (WHO, 2018). The development of obesity prevention programs is a worldwide concern, the multifactorial origin results in the relentless search for effective interventions. Health education is considered an interesting approach because it places the subject as the central agent of his decisions according to his reality (Brener et al., 2019).

The best period and way to act in the prevention of obesity is in childhood through play. According to Vigotsky (2007) and Winniccot (1942) thus, children incorporate cultural habits, beliefs, and values. Kishimoto (2017) describes that children’s universe demands playfulness that
materializes like toys that allow them to expose their real learning through fiction and symbolism.

However, modern, sophisticated, and technological toys are taking the place of more active toys and play. The frequent use of electronic devices can have adverse effects on children's lives (Rosen et al., 2015), while a platform with challenges and avatars can provide more fun, influencing the levels of exercise, diet, and knowledge (Hieftje et al., 2013).

Nowadays, 88% of children and teenagers between the ages of 9 and 17 years old, with access to the internet, play every day or almost every day (CGI.br, 2019), increasing sedentarism. This inseparability between technology and pediatric daily life can be an ally in promoting awareness and healthy lifestyles through attractive and educational content (Pereira et al., 2017).

Interventions aimed at behavioral changes with a focus on healthy diets and promotion of physical activities can contribute to adherence to healthier lifestyles as proposed by the clinical guidelines for global health management (Brazil, 2014; NCD, 2017; WHO, 2014a, 2018b). Thereby, cognitive-behavioral therapy stands out for some strategies such as maintaining diet diaries to promote critical thinking and greater control of the diet (Mancini, 2017). However, to our knowledge, little scientific evidence is available regarding the application of this strategy combined with physical activities in children.

Placing importance on physical activity and fitness-based interventions can be provided also into the “paradox obesity”. McAuley (2012), Farrell et al. (2020), and Barry et al. (2014) presented strong evidence that the effects of cardiorespiratory fitness are much more important than fatness as a mortality risk indicator, which means that the risk factors of diseases have similarity to overweight and obese-fit individuals and weight-fit individuals (Barry et al., 2014).

Therefore, an intervention in Health Education entitled “Filling Childhood with Health” was developed, based on the theoretical assumptions exposed by Fisberg et al. (2016), which comprises awareness, motivation,
and protection of healthy habits, such as physical activity and healthy eating. Thus, the aim of the present study was to verify the effects of a health education program on the physical activity level, eating habits, body composition, and cardiorespiratory fitness in schoolchildren.

2 METHODS

2.1 STUDY DESIGN AND SAMPLE

This is a non-randomized, parallel, and controlled clinical study, developed to investigate the effects of the “Filling Childhood with Health” program. The study was carried out following Resolution 466/2012 of the National Health Council of Brazil, approved by the Research Ethics Committee.

One hundred and fifty-five children between 7 and 9 years old from the 3rd year of a public elementary school in the Federal District - Brazil were invited to participate in the study. According to the eligibility criteria, 50 children were considered for data analysis, allocated to the Fun Education Group (FEG) and the Control Group (CG) as shown in Figure 1. The experimental group was composed of children allocated to classes with a greater number of volunteers.

The children participating in the study could not be enrolled and attending any other regular physical activity program in the six months before the intervention and the parents have signed the informed consent. Children who did not participate in at least 70% of the intervention or had any physical, mental, or any other muscular, and osteoarticular pathology were excluded from participation in this study.
2.2 PROCEDURES

The children's sexual maturation was assessed according to the Tanner Scale (1962), and the socioeconomic level through the Brazilian Association of Advertisers / Brazilian Association of Market Institutes questionnaire adapted by Almeida and Wickerhauser (1991) and classified according to the Brazilian Association of Research Companies (ABEP, 2016).

The children's weight and height were measured according to the recommendations of the World Health Organization by using a 100g precision scale (Geratherm, Geschwenda, Germany), and a 0.1cm precision stadiometer (Sanny, Brazil). The Body Mass Index (BMI) in kg/m² was calculated for later...
assessment of nutritional status using the BMI percentile graphs according to age and sex (WHO, 2018).

The body fat percentage (%BF) was calculated using the equation of Slaughter et al. (1988) from the Tricipital (TR) and Subscapular (SS) skinfolds obtained with a Lange adipometer (Maryland, USA). The % BF classification was performed according to Lohman (1986) The Progressive Aerobic Cardiovascular Endurance Run (PACER) test was performed to assess cardiorespiratory fitness (VO₂max) following the procedures of Léger et al. (1988)

The Physical Activity Level (PA Level) and Sedentary Behavior (SB) were obtained by the Physical Activity Level and Sedentary Behavior Assessment Questionnaire (Militão et al. 2013). This questionnaire validated for children aged 10 to 13 years was used in the present study because in the pilot study children had no difficulty in answering it. In addition, the valid questionnaires (in the Portuguese language) that exist for this age group do not have an SB assessment, which is of great importance to assess because it has a significant impact on children's health, related to skeletal, biochemical, and metabolic.

The quality of the diet was assessed by a recall on the consumption of food in each meals using the Previous Day Food Questionnaire - QUADA-3 (Assis et al. 2009).

2.3 INTERVENTION

Initially, children in the FEG were exposed to the TODDS KIDS website (access link: <https://tododiadivertidos.wixsite.com/toddskids>) for one hour. Then they filled the stickers album according to the habits diary of Pereira et al. (2016) for eight weeks (Figure 2). The children were instructed to fill their album of figures with stickers representing the activities and food consumption of each weekday. The stickers associated with healthy habits were colored, while those associated with unhealthy habits were on grayscale. Children were asked to try to make their stickers album more colorful each day (Supplemental online material: <https://1drv.ms/b/s!ArRK63k37YDxgzMmN_Bt451v5bS_>
Meanwhile, the families of the FEG children received instructions on how to improve their habits through educational leaflets. The design of the leaflets was based on a one-hour lecture that used the focal group methodology. In this methodology, parents or legal guardians were invited to a discussion and were confronted about their perception related to health and what possibilities/actions can be taken to achieve the ideal described.

The Figure 3 summarizes the intervention for a better understanding.
2.4 DATA ANALYSIS

The normality of the continuous data of each group was verified by the Shapiro-Wilk test, z-score of Skewness, and Kurtosis (limits: -1.95 to +1.96). The data was described in mean ± standard deviation or median and percentile 25th and 75th, as appropriate. The independent t-test was used in the comparison of continuous sample characterization variables between the groups. While for categorical data, that was described in absolute frequency (n) and relative frequency (%), we used Pearson’s Chi-Squared test for the comparison of sample characterization variables between the groups. For the variables that presented cell count inferior to five, the exact Fischer test was applied.

The generalized linear model (GzLM) was used to verify the group effect on the cardiorespiratory fitness, body composition, PA Level, and SB variables. The probabilistic distribution model chosen for each variable was defined based on the goodness of fit and/or on the type of variable (continuous, counts, mix). For the cardiorespiratory fitness and body composition variables, we used the “linear” distribution. For the PA Level and SB, we used the “tweedie” distribution. In all the analysis of the GzLM, we included the post-intervention moment as a dependent variable and the pre-intervention moment as a co-variable.

The generalized estimating equation (GEE) model was used to verify the effect of the interaction group versus time of the food intake variables. Due to the variable characteristics, the “poisson” model was adopted for the probabilistic distribution. The comparison between pairs with Bonferroni correction was used to identify the punctual differences of the statistically significant GEE models. The models’ residues normality was verified by the Q-Q plot. The beta coefficient (β)
and its confidence intervals of 95% were used to estimate the model parameters. The descriptive data were described by the estimated marginal mean. The level of statistical significance adopted was p<0.05. We accomplished the statistical treatment by using the IBM® SPSS Statistics® software version 25.0.

The Cohen’s d was used to determine the effect size of the mean difference. The magnitude of the effect size was evaluated qualitatively using the cut point established by Hopkins et al. (2009): < 0.2 (no effect), 0.2–0.5 (small), 0.6–1.1 (moderate), 1.2–1.9 (big), ≥ 2.0 (very big). The Cohen’s d was calculated through the G*Power software version 3.1.9.2 (Institute for Experimental Psychology in Dusseldorf, Germany).

3 RESULT

Nineteen children participated in the FEG, and thirty-one participated in the CG. Table 1 shows the results in mean and standard deviation of age, weight, height, body mass index, and results in absolute frequency (n) and relative frequency (%) of nutritional state, socioeconomic class, and sexual maturation.

<table>
<thead>
<tr>
<th>Table 1. Characteristics of study participants: Fun Education Group (FEG) and Control Group (CG)</th>
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<tbody>
<tr>
<td><strong>N</strong></td>
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<tr>
<td>Age (years)</td>
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<tr>
<td>Anthropometric measurements</td>
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<td>Weight (kg)</td>
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<td>Height (cm)</td>
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<td>Body Mass Index (kg/m(^2))</td>
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<td>Nutritional state, n (%)</td>
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<td>Eutrophic</td>
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<td>Overweight</td>
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<td>Socioeconomic class, n (%)</td>
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<td>A</td>
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<td>B</td>
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<td>C</td>
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<td>D-E</td>
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<td>Sexual maturation, n (%)</td>
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<tr>
<td>Pré-púbere</td>
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<td>Púbere</td>
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</table>

Source: Elaborated by the authors
Table 2 shows the results of cardiorespiratory fitness and body composition before and after participation in the health education program. Significant effect was observed in the number of turns ($p = 0.042; d_z = 0.62$; moderate effect) and in the speed ($p = 0.031; d_z = 0.68$; moderate effect) obtained in the PACER cardiorespiratory fitness test when comparing the groups, indicating improvement in the cardiorespiratory fitness of the FEG. Significant difference was also observed in body composition when FEG and CG were compared using TR ($p = 0.012; d_z = 0.71$; moderate effect), SS ($p = 0.004; d_z = 0.83$; moderate effect), $\sum$SF ($p = 0.001; d_z = 1.00$; moderate effect), and %BF ($p = 0.001; d_z = 1.00$; moderate effect). The CG significantly increased the percentage of fat while the FEG showed no change.
Table 2. Cardiorespiratory fitness and body composition before and after 8 weeks of the health education program for children: Fun Education Group (FEG) versus Control Group (CG)

<table>
<thead>
<tr>
<th></th>
<th>FEG</th>
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<tr>
<td></td>
<td>Pre</td>
<td>Post</td>
<td>EMM (CI 95%)</td>
<td>Pre</td>
<td>Pós</td>
<td>EMM (CI 95%)</td>
<td>β (CI 95%)</td>
<td>p*</td>
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<td>CF</td>
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<tr>
<td>Laps (n)</td>
<td>24.9 ± 14.6</td>
<td>33.5 ± 14.5</td>
<td>33.6 (28.8; 38.5)</td>
<td>25.4 ± 11.2</td>
<td>27.4 ± 12.5</td>
<td>27.3 (23.4; 31.1)</td>
<td>6.4 (0.2; 12.5)</td>
<td>&lt; .05</td>
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<tr>
<td>Speed (km/h)</td>
<td>9.9 ± 1.0</td>
<td>10.4 ± 0.9</td>
<td>10.4 (10.2; 10.7)</td>
<td>9.9 ± 0.7</td>
<td>10.0 ± 0.7</td>
<td>10.0 (9.8; 10.3)</td>
<td>0.4 (0.0; 0.7)</td>
<td>&lt; .05</td>
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<tr>
<td>VO\textsubscript{2}\text{max (ml/kg/min)}</td>
<td>47.1 ±3.5</td>
<td>49.3 ± 3.6</td>
<td>49.4 (48.0; 50.7)</td>
<td>47.2 ± 3.2</td>
<td>47.8 ± 3.6</td>
<td>47.8 (46.7; 48.9)</td>
<td>1.5 (-0.2; 3.3)</td>
<td>&gt; .05</td>
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<tr>
<td>Body Composition</td>
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<tr>
<td>TR (mm)</td>
<td>12.9 ± 5.0</td>
<td>13.3 ± 5.0</td>
<td>12.5 (11.8; 13.1)</td>
<td>11.6 ± 3.7</td>
<td>13.1 ± 3.6</td>
<td>13.5 (13.0; 14.0)</td>
<td>-1.0 (-1.9; -0.2)</td>
<td>&lt; .05</td>
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<tr>
<td>SS (mm)</td>
<td>7.9 ± 4.5</td>
<td>8.1 ± 4.7</td>
<td>7.6 (7.1; 8.0)</td>
<td>7.1 ± 4.2</td>
<td>8.1 ± 4.6</td>
<td>8.4 (8.1; 8.7)</td>
<td>-0.8 (-1.4; -0.3)</td>
<td>&lt; .05</td>
<td></td>
</tr>
<tr>
<td>∑SF (mm)</td>
<td>20.8 ± 9.3</td>
<td>21.4 ± 9.4</td>
<td>20.0 (19.1; 20.9)</td>
<td>18.7 ± 7.4</td>
<td>21.2 ± 7.9</td>
<td>22.0 (21.3; 22.7)</td>
<td>-1.9 (-3.1; -0.8)</td>
<td>&lt; .05</td>
<td></td>
</tr>
<tr>
<td>BF (%)</td>
<td>19.2 ± 7.4</td>
<td>19.6 ± 7.3</td>
<td>18.6 (17.9; 19.3)</td>
<td>17.5 ± 6.0</td>
<td>19.6 ± 5.9</td>
<td>20.2 (19.6; 20.7)</td>
<td>-1.5 (-2.5; -0.6)</td>
<td>&lt; .05</td>
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</tbody>
</table>

The data is expressed in mean ± standard deviation, estimated marginal mean (EMM) and confidence intervals of 95% (CI95%), and beta coefficient (β) and confidence interval of 95%.

*Difference between groups using a generalized linear model (GzLM) with adjustments to the baseline values.

Values highlighted in bold indicate significance (p < .05).

Abbreviations: CF: Cardiorespiratory fitness; TR: Triceps skinfold; SS: Subscapular skinfold; ∑SF: Sum of skinfolds; BF: Body Fat; VO\textsubscript{2}\text{max}: maximum estimated oxygen consumption.

Source: Elaborated by the authors
Table 3 shows the results of the PA Level and SB before and after the program. There was no difference observed between the groups regarding physical activity at moderate to vigorous intensity (PAMV), total PA Level, and SB (p > 0.05).

Table 3. Physical activity level (PA Level) and sedentary behavior (SB) before and after 8 weeks of health education program for children: Fun Education Group (FEG) versus Control Group (CG)

<table>
<thead>
<tr>
<th></th>
<th>FEG</th>
<th>CG</th>
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<th>p*</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Pre (P25; P75)</td>
<td>Post (P25; P75)</td>
<td>EMM (CI 95%)</td>
<td>Pre (P25; P75)</td>
</tr>
<tr>
<td>PAMV (min/week)</td>
<td>130.0 (20.0; 297.5)</td>
<td>140.0 (20.0; 305.0)</td>
<td>160.7 (83.4; 238.0)</td>
<td>70 (20.0; 282.5)</td>
</tr>
<tr>
<td>PA Level (METs/week)</td>
<td>520.0 (236.6; 1008.8)</td>
<td>493.0 (165.4; 848.6)</td>
<td>581.5 (331.3; 831.7)</td>
<td>769.5 (360.0; 1111.9)</td>
</tr>
<tr>
<td>SB (min/week)</td>
<td>540.0 (210.0; 1072.5)</td>
<td>585.0 (285.0; 1020.0)</td>
<td>775.6 (559.5; 1642.5)</td>
<td>1260.0 (450.0; 1020.0)</td>
</tr>
</tbody>
</table>

The data is expressed in median (Med) and percentiles 25th and 75th, estimated marginal means (EMM) and confidence interval of 95% (CI95%), and beta coefficient (β) and confidence interval of 95%.

*Results of the difference effect between groups using a generalized linear model (GzLM) with adjustments to the baseline values.

Abbreviations: PAMV: Physical activity from moderate to vigorous intensity; PA Level: Physical activity Level; SB: Sedentary behavior.

Source: Elaborated by the authors

Table 4 shows the results of food consumption before and after the program. There was a significant effect in the interaction versus time group in the consumption of fruits and vegetables (FV) (p = 0.029) and the main effect in time (p =}
The post hoc analysis revealed that the consumption of FV increased only in the FEG ($p = 0.001; dz = 0.67; \text{moderate effect}$). There was no significant effect on the group versus time interaction in the other investigated foods ($p > 0.05$).

<table>
<thead>
<tr>
<th>Adequate (portion/day)</th>
<th>FEG</th>
<th>CG</th>
<th>$\beta$ (CI 95%)</th>
<th>$p^*$</th>
</tr>
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<tbody>
<tr>
<td>Med (P25; P75)</td>
<td>Med (P25; P75)</td>
<td>Med (P25; P75)</td>
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<tr>
<td><strong>Adequate (portion/day)</strong></td>
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<tr>
<td>Bean</td>
<td>1.0 (0.8; 2.0)</td>
<td>1.0 (0.8; 2.0)</td>
<td>1.0 (1.0; 2.0)</td>
<td>1.0 (1.0; 2.0)</td>
</tr>
<tr>
<td>Cereals</td>
<td>4.0 (3.0; 5.0)</td>
<td>3.0 (3.0; 4.0)</td>
<td>4.0 (3.0; 5.0)</td>
<td>4.0 (3.0; 5.0)</td>
</tr>
<tr>
<td>Dairy Products</td>
<td>1.5 (1.0; 2.0)</td>
<td>1.0 (0.0; 1.3)</td>
<td>1.0 (1.0; 2.0)</td>
<td>1.0 (0.0; 1.0)</td>
</tr>
<tr>
<td>FV</td>
<td>1.0 (0.0; 1.3)</td>
<td>2.0 (1.0; 4.5)**</td>
<td>1.0 (0.3; 2.0)</td>
<td>1.5 (0.3; 3.0)</td>
</tr>
<tr>
<td>Meat</td>
<td>1.5 (1.0; 2.0)</td>
<td>2.0 (1.0; 2.0)</td>
<td>2.0 (1.0; 2.0)</td>
<td>2.0 (1.0; 2.0)</td>
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<td><strong>Inadequate (portion/day)</strong></td>
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<td>Med (P25; P75)</td>
<td>Med (P25; P75)</td>
<td>Med (P25; P75)</td>
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<tr>
<td>Sweet</td>
<td>0.0 (0.0; 1.0)</td>
<td>0.0 (0.0; 1.0)</td>
<td>0.0 (0.0; 0.8)</td>
<td>0.0 (0.0; 0.0)</td>
</tr>
<tr>
<td>Pizza/French fries</td>
<td>0.0 (0.0; 0.3)</td>
<td>0.0 (0.0; 0.0)</td>
<td>0.0 (0.0; 0.0)</td>
<td>0.0 (0.0; 0.0)</td>
</tr>
<tr>
<td>Soda</td>
<td>1.0 (0.0; 2.0)</td>
<td>1.0 (0.0; 2.0)</td>
<td>1.0 (0.0; 1.0)</td>
<td>1.0 (0.0; 2.0)</td>
</tr>
</tbody>
</table>

The data is expressed in median (Med) and percentiles 25th and 75th, and beta coefficient ($\beta$) and confidence interval of 95%. 

*Results of the effect of group versus time interaction using a model of generalized estimating equation (GEE).

**$p = .001$ compared to the pre-intervention moment of the same group.

Value highlighted in bold indicate significance ($p < .05$).

Abbreviations: FV: fruits and vegetables.

Source: Elaborated by the authors
4 DISCUSSION

The present study demonstrates that children who completed at least 70% of the “Filling Childhood with Health” program showed improved performance in the cardiorespiratory fitness test, in the body fat percentage, and in the FV consumption. Any change in lifestyle is always a challenge, as it depends on both intrinsic and extrinsic factors (Tross et al., 2019). Therefore, this study obeyed the pillars: awareness, motivation, and protection (Fisberg et al., 2016), which resulted in a moderate effect (0.6 <dz <1.1) on health-related parameters.

The FEG showed a significant improvement in cardiorespiratory fitness when compared to the CG. Cardiorespiratory fitness is an important variable to be assessed in childhood since it is considered a good predictor of mortality from cardiovascular disease and all causes (Barry et al., 2014; Ortega et al., 2008). It is known that for each 1MET or 1 km/h increased in the PACER test, the risk of death from all causes is reduced by 13% and the risk of death from cardiovascular diseases by 15% (Harber et al., 2017; Kodama et al., 2009; Lee et al., 2010). The children from the FEG significantly increased the average speed by 0.5 km/h in the PACER after only 2 months of intervention, whereas the CG did not change this parameter.

Anthropometric data and body composition are also widely used in the assessment and diagnosis of people's health status. According to Rolland-Cachera, Akrout and Péneau (2019) the skinfolds measured in the trunk, such as subscapular skinfold, are associate with intra-abdominal fat, consequently cardiovascular disease risk, and the skinfolds measured in the body extremities, such as the tricipital skinfold, are more sensitive to changes in the diet. The skinfolds sum and the body fat percentage are related to obesity and associated diseases (WHO, 2018). The present study demonstrated the educational intervention contributed to a significant reduction in tricipital and subcapular skinfolds, in the sum of these skinfolds, and in the body fat percentage, while the same was not observed in the CG. These results demonstrate the program’s potential in preventing chronic diseases in childhood.
Although there were no significant changes in the consumption of other foods, the increase of 1 serving of FV per day in the FEG. This demonstrated a positive impact of this short educational intervention, also occurring in the diet of these children (Table 4), however, were not enough for them to reach the recommended consumption of 5 servings of daily FV. This recommendation is because there are essential micronutrients for the proper functioning of the organism that are only available in these foods. In addition, the benefits arising from these natural foods are due to the biochemical combination present in its matrix, making it impossible to obtain such benefits in industrialized products (Brazil, 2014).

Morris et al. (2013) applied a multifaceted intervention, the Great Activity Programme at the UK schoolchildren. Consisted of Physical Education lessons; participation in 3 highlight events involving dance, walking, and running; an interactive website for children, teachers, and parents; and vacation activity planners. Like this study, this Programme resulted in significant increases in cardiorespiratory fitness, and a reduction in the sum of skinfolds. But no effect on the dietary variables. Therefore, despite the favorable results for improving the diet, future interventions are also needed, including nutrition professionals at school as well as greater awareness raising work for the children's parents.

Physical education in elementary school usually promotes joy and pleasure for most children. The children who participated in the study attended a school where they did not have a physical education class with a physical education teacher. It is possible that if physical education was offered to its full potential to these children (Darido, 2013), the PA level could have been much higher both in the FEG and in the CG, which were classified respectively as sedentary and insufficiently active (Table 3). Although the SB did not present high values, it should be considered that avoiding bad habits is not enough for a healthy lifestyle, since insufficient physical activity can result in musculoskeletal, cardiometabolic disorders, among others.

This type of intervention is very important for all social classes, especially for the poorest social classes because they have less access to quality public
information and services. About 65% of the children who participated in the study were from socioeconomic classes C1 and C2 (Table 1), which means that the average family income was ≤ R$ 2,705 (~ US$ 470), and about 10% of the sample had family income average of R$ 768 (~ US$ 150). According to Falkenberg et al. (2014) health education for individuals in low-income is a public health issue and needs to be addressed.

The present study has some limitations such as the lack of sample calculation and randomization that may have interfered with the analysis of the results, since the children in the CG may have had access to the EGF material during the intervention; there may have been a measurement error or report of the diet by the children without substantial help from the parents (Livingstone, 2000), although the questionnaire applied has been shown to provide a valid measure of the previous day's food intake in this age group.

Despite the limitations, this study has an important practical application. The created instrument can be used in the school environment with the teacher, applying it with the other curricular contents and allocating part of the class to fill in the sticker's albums together, motivating the children for better health. This educational tool can be used by physical education teachers, parents, other educators, and infant nutritionists or other professionals health.

5 CONCLUSION

We concluded that the health education program entitled “Filling Childhood with Health” carried out with attractive, and low-cost materials, and applied for a short period of time, aroused, and motivated children to healthier habits with positive effects on cardiorespiratory fitness, body fat, and consumption of fruits and vegetables.
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