ORIGINAL ARTICLE

School Health Education Program "Happy Life, Healthy Heart": A Randomized Clinical Trial

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Abstract

Background: School interventions based on playful activities have been shown to be good strategies for increasing children's knowledge about health, which may impact healthy habits.

Objective: To evaluate whether the school health education program entitled "Happy Life, Healthy Heart" increases health knowledge and causes a change in teachers' and students' lifestyles.

Method: Cluster randomized clinical trial including elementary school students and teachers from public schools in the city of Frederico Westphalen, Brazil. The intervention consisted of the training of teachers on topics of health, followed by classes on topics related to cardiovascular health given by these teachers to the students. The students were evaluated for nutritional status and health knowledge using the CARDIOKIDS and DAFA questionnaires, and teachers were assessed for physical activity. The Student's t-test, the chi-square test and the two-way ANOVA test were used for comparisons between groups, and McNemar-Bowker for intra-group comparisons. P values of <0.05 were considered statistically significant.

Results: A total of 473 children were included, 211 (44.6%) in the control group (CG) and 262 (55.4%) in the intervention group (IG), and 32 teachers (control = 14, intervention =18). There was no difference in health knowledge of the students after the intervention (CG 10.53 ± 0.11 vs. 11.19 ± 0.09 p = 0.061, IG 10.20 ± 0.12 vs. 11.09 ± 0, 09 p = 0.416), although 57.7% of the children of the IG reported having stopped eating pizza and drinking soft drinks (p <0.001), following the Brazilian Food Guide recommendations. Among teachers of the IG, an increase of 27.9% in physical activity level was observed.

Conclusions: The "Happy life, healthy heart" program was able to change students' eating habits and increase physical activity in teachers.

Keywords: Health, Knowledge, Atitudes, Practice; Health Personnel; Children; Teachers; School Health Education.

Introduction

The school is the place where children spend most of their time and recognized as an environment of health promotion and prevention of chronic non-communicable diseases. It can engage students, families, educators, and community members, and create a unique, sustainable environment, that strengthens this objective.[1]

Health-related knowledge is characterized by familiarization with cardiovascular risk factors and psychological and behavioral aspects that directly influence quality of life and the development of obesity.[2] Interventions based on practical, playful and recreational activities have been shown to be good strategies to increase knowledge, including about dietary practices.[1,3] For Duncan et al.,[4] the importance of practical and not only theoretical interventions is in the fact that they offer necessary tools for children to influence and bring benefits to the family environment. In addition, school age is critical for the development of long-lasting habits that will continue into adult life.

An observational study showed that teaching contents related to food, when done by teachers, promotes greater receptivity among students than when it is done by health professionals.[5] However, teachers demonstrate limited knowledge of health-related content and require training[6]

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and thus, most health intervention programs in Brazil have focused on actions promoted by health professionals or academic students rather than by teachers.[7,8]

Considering these aspects, the present study aimed to verify whether the school health education program "Happy Life, Healthy Heart," consisting of classroom interventions performed by qualified teachers and aimed at preventing cardiovascular health, increases health knowledge and causes behavioral changes in the lifestyle of teachers and students. This article was conducted according to the guidelines of the CONSORT Statement.[9]

Methods

Study Design

The study entitled "Happy Life, Healthy Heart" consisted of a (parallel) cluster randomized clinical trial (RCT), with two arms (control group [CG] and intervention group [IG]) and blind evaluation of outcomes. The study was conducted in the city of Frederico Westphalen, Rio Grande do Sul, Brazil, from March to December 2017. The randomization units were the schools, to avoid contamination of the results, and the observation units were the students.

Participants

Public schools located in the rural area of Frederico Westphalen were excluded because of cultural and dietary differences. Of the remaining 11 schools, one did not agree to participate, leaving ten schools for randomization. This was carried out by a health professional not involved in the study through the www.randomization.com website (retrieved in October 2016). Teachers of the first years of elementary school (1st to 5th) of participating schools were included, and those working in more than one school were excluded. We included children from six to 11 years of age, with the consent of parents or guardians, and children over nine years of age who were illiterate or had cognitive, neurological, or hearing and visual impairment, were excluded.

Ethical aspects

All children consented to participate, and their parents or guardians signed a term of consent. The study was approved by the ethics committee of the Institute of Cardiology, University Foundation of Cardiology, Porto Alegre, Brazil (approval number 5235/16) following the CNS 510/16 resolution, and registered and approved by the Brazilian Registry of Clinical Trials (REBEC): RBR-9sp5HX.

Intervention

The intervention consisted of two phases: 1) teacher training program and 2) theoretical-practical activities with students in the classroom. The training program took place between April and July 2017 and was held in four face-to-face and remote monthly meetings, totaling 32 class hours of theoretical-practical activities. A handout was specially developed for the program, containing seven topics divided into chapters with theoretical basis and suggestions for activities to be carried out in the classroom: 1) risk factors of cardiovascular diseases in childhood; 2) selection of healthy foods; 3) food labeling; 4) sodium, sugars and fats; 5) emotional health and quality of life; 6) physical activity (PA); and 7) healthy practices and changes in habits. The activities were created based on the themes to be worked on, age of children and intended goals. The CG did not participate in the training course and followed the school's political-pedagogical plan. At the end of the study, teacher of the CG were invited to participate in a seminar with lectures on the topics involved in the study, and they were also given a training program handout.

The intervention program with the students started after the teachers' training program. The program was first planned to be carried out in seven uninterrupted weeks (one theme per week). However, due to the occurrence of a teachers strike in state schools, the program was forced to be interrupted for 45 days at the end of its 5th week. After the strike ended, the teachers resumed the program from the point where they stopped.

Teachers of the GI were instructed to carry out at least one activity per week, and they had the liberty to add activities to the school curriculum or suggest them as a separate project. The activities were monitored by the number of activities performed per week/theme, registered by photos and videos sent to the researcher via message application. Guidance and assistance were offered by the researcher whenever needed.

Data collection

At baseline, sociodemographic data of the students by collected using a structured questionnaire that was administered to the parents. The children's level

of knowledge on health was assessed quantitatively, using the CARDIOKIDS questionnaire,[10] which divides knowledge into two factors: healthy habits (F1) and risk factors for cardiovascular disease (F2). The instrument consists of 12 questions, with three possible answers: "good for the heart", "bad for the heart" and "I don't know". Eating habits and PA were assessed by the DAFA-Typical Day of Physical Activity and Food[11]. This instrument includes measurement of PA level and 24-hour food recall, where the child reports the foods they had for breakfast and morning snacks, lunch, afternoon snacks and dinner.

For assessment of nutritional status of the children, height and weight measurements were obtained, and used to calculate body mass index (BMI) (body mass divided by height squared) and Z score using the Anthro Plus program.[12] After the intervention period, students from both groups were reevaluated. Data collection was performed by a previously trained team (academics and professionals in nutrition, psychology, pharmacy, physical education and nursing) and the evaluators were blinded to the school allocation group. The evaluation of teachers (baseline and after the training program) was done through a questionnaire with sociodemographic data, nutritional status (reported weight and height), PA and leisure. Outcomes were assessed by a blind examiner.

Sample size

Sample size calculation resulted in a total of 466 children, 233 in each group (IG and CG). A power of 95% and a significance level of 5% were assumed. An average health knowledge of 5.2 was expected at baseline, with an increase of 0.39 after the intervention.[7] Around 600 children were recruited, considering a 20% loss after the baseline assessment.

Statistical methods

Data analysis and processing were performed using the Statistical Package for the Social Sciences[13] for Windows version 20.0, and a significance level of 5% was adopted as statistical decision criterion.

To verify the normality of the variables, the Kolmogorov-Smirnov test with Lilliefors correction was used, indicating that all continuous variables had normal distribution. Continuous variables were expressed as mean and standard deviation. Categorical variables were presented as absolute and relative frequencies. Pearson's chi-square test was used to evaluate the association between categorical variables among the groups. In the comparison of continuous variables, the Student's t-test was used for independent samples, considering that all variables had a normal distribution. For comparison of continuous and categorical variables between pre- and post-intervention, the paired Student's t-test and the McNemar-Bowker test were used respectively.

In the study of evaluation of the instruments during follow-up (pre and post), two-way analysis of variance for repeated measures, with post-hoc Bonferroni test, was used. In within-group analysis, the impact of the intervention on the instruments was calculated by Cohen's d effect size estimate. To identify possible influencing factors in the differences between the pre- and post-intervention regarding the instruments' results, the generalized estimation equations were used, a technique that makes it possible to identify the influence of covariables on the behavior pattern identified in the pre-evaluations and post intervention in the total sample. All variations observed in the instruments administered to the children were analyzed by sex and education factors, which in the comparison between the groups, showed potential to discriminate the two groups.

Results

Ten schools were randomized into two independent groups, as shown in Figure 1. The results refer to a sample of 473 children, 262 (55.4%) in the IG and 211 (44.6%) in the CG, 32 teachers (14 [43.8%] in the CG (CGt) and 56.3% [n = 18] in the IG [IGp]). A loss to follow-up of 7.6% (n=20) in the IG and 10.9% (n=23) in the CG was observed, due to the transfer of students to other schools (n=17) or absence of the student on the day on which the second assessment was carried out (n=26).

Table 1 shows the sociodemographic characteristics of the students at the baseline assessment, showing that the groups were homogeneous in terms of gender, age and family income. Regarding children's schooling, there was a significative difference between the groups, with a greater concentration of 1st-grade children in the IG and 4th-grade children in the CG.

Teachers' sociodemographic data showed that the average age in the CGt was 39.2 ± 7.7 years and in the IGt 43.4 ± 9.6 years. Regarding marital status, most of teachers in both groups reported living in a common-law marriage (CGp 78.6% and IGp 77.8%). The background of 64.3% of the teachers of the CGt and 77.8% of the IGp was

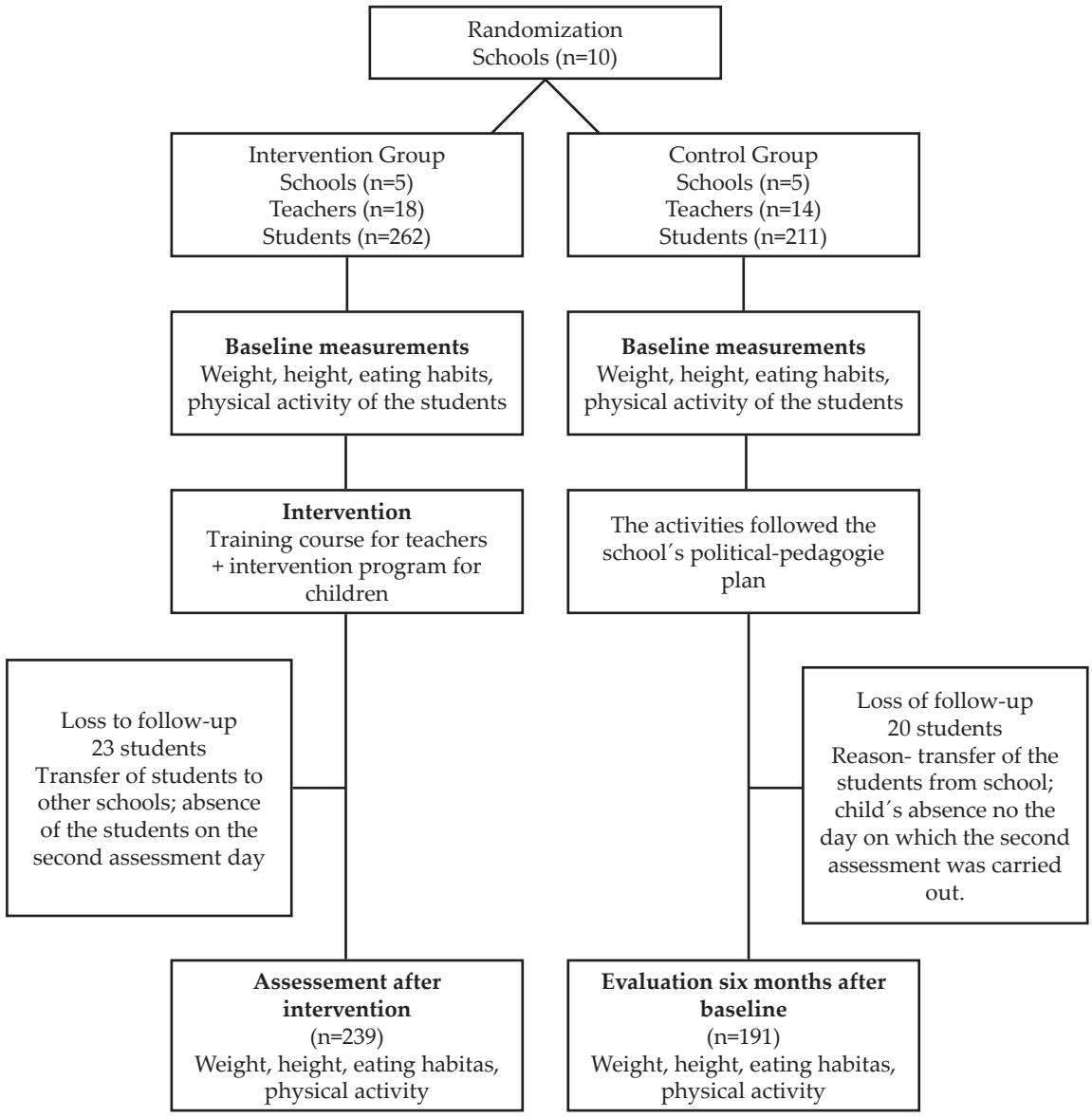

Figure 1 – Flowchart of the study.

pedagogy, and most had a specialization degree (CGp 78.6% and IGp 50%). The working day was generally 40 hours per week (CGt 71.4% and IGt 94.4%).

Results on students' health knowledge obtained through the CARDIOKIDS instrument (Table 2), considering the effect of time x group interaction (Size of achievement = 2.293; p = 0.131) showed that there was no difference between the two groups at the two evaluation times. The same behavior was repeated when considering each factor of the scale, with factor 1 (F1) evaluating "healthy habits" (F[1; 421] = 0.229; p=0.866) and Factor 2 (F2) evaluating "risk factors" (F[1, 421]; effect size = 0.456; p=0.473). The within-group analyses showed that there were statistically significant differences in both groups comparing baseline and post-intervention (CG [Pre: 10.53±0.11 vs. Post: 11.19±0.09; p<0.001] and IG [Pre: 10.20±0.12 vs. Post: 11.09±0.09 p<0.001]), i.e., there was evidence of a time effect, with an increase in CARDIOKIDS score in 6.27% of children in CG and 8.73% of children in IG. Regarding the knowledge factors (F1 and F2), the difference was maintained. Regarding the analysis of covariates, gender did not have a significant influence in the comparisons between groups, but a

Table 1 – Sociodemographic data of children of intervention and control groups at baseline

Variables	Groups*				P
	Control (CG) (n = 211)		Intervention (IG) (n = 262)		
	N	%	n	%	
Gender					0.066§
Male	90	42.7	134	51.1	
Female	121	57.3	128	48.9	
Age (years)					€ 0.097
Average ±DP	8.8 ± 1.5		8.5 ± 1.6		
Schooling					<0.001§
1st grade	30	14.2	68	26.0	
2nd grade	35	16.6	37	14.1	
3rd grade	38	18.0	47	18	
4th grade	74	35.1	53	20.2	
5th grade	34	16.1	57	21.8	
Parents' marital status					0.932§
Married or living together	160	76.9	197	75.8	
Divorced	45	21.6	57	21.9	
Widow	3	1.4	6	2.3	
Family Income					0.670§
Up to 2 minimum wages	79	38	101	39	
From 3 to 5 minimum wages	87	41.8	114	44	
From 6 to 10 minimum wages	29	13.9	34	13.1	
11 or more minimum wages	13	6.2	10	3.9	

*Note: * Percentages obtained based on the total of each group; § Pearson's chi-square; €: Student's t-test for independent groups assuming heterogeneity of variances.*

significant effect of schooling on F2 [$F_{(1; 87)}$ = 12,941; p = 0.001; power = 0.876] was found. Thus, in the IG in the 1st, 2nd and 3rd grades, the average score in the post-intervention was significantly higher compared to the baseline. This result did not occur in the CG, or in the other school years investigated in this study (data not presented).

Anthropometric data are presented in Table 3. Mean z-score was not different between IG and CG, and a significant reduction of the mean was observed after the intervention in both CG and IG. However, this variation did not promote a change in the category and therefore, all children were classified as normal weight based on z-score.

Data of food consumption, evaluated by the DAFA instrument, are presented in Figure 2. A statistically significant difference was detected in the percentage of children who reported avoiding pizza/hamburger/French fries in the IG (p <0.001), following the Brazilian Food Guide recommendations.[14] In addition, there was an increase in the frequency of children who followed this recommendation after intervention, when compared to the baseline [57.7% (n=138) vs. 42.5% (n=111)]. A similar result was seen regarding the consumption of soft drinks (p < 0.001), with a significant increase in the percentage of children who stopped consuming sugary drinks in comparison to baseline [57.7% (n = 138) vs.

Table 2 – Comparison of the students' level of knowledge about health, according to CARDIOKIDS, at baseline and after intervention, in the intervention and control groups

Knowledge Level CARDIOKIDS	Bivariate					Multivariate - Effects		
	Groups				p between group	Time£	Group¥	Interaction£
	Control (CG)		Intervention (IG)					
	Mean	SD	Mean	SD				
Total								
Pre	10.53	0.11	10.20	0.12	0.061 ₸	<0.001	0.107	0.131
Post	11.19	0.09	11.09	0.09	0.416 ŧ			
*p intra- group**	<0.001		<0.001					
F1								
Pre	4.12	0.06	3.99	0.06	0.147 ₸	<0.001	0.101	0.866
Post	4.48	0.05	4.36	0.05	0.150 ŧ			
*p intra-group**	<0.001		<0.001					
F2								
Pre	6.41	0.07	6.22	0.07	0.078 ₸	<0.001	0.189	0.076
Post	6.71	0.05	6.73	0.04	0.871 ŧ			
*p intra-group**	<0.001		<0.001					

Note: Estimates obtained by analysis of variance for repeated measures (Two way); F1: Factor 1 = Healthy Habits; F2 = Factor 2 = Risk factors; £: Pre-post time effect (considering the sample as a whole); ¥: Group effect; £: Time X Group interaction effect.

37.9% (n = 99)]. Regarding the other food groups assessed (beans, cereals, meats, dairy products, fruits and sweets), there were no statistically significant differences between the groups.

Regarding the level of PA, also evaluated by the DAFA instrument, after the intervention, most children in the IG (n=87, 36.4%) were classified in the "Most Active" level, while in CG, most children (n=69, 36.1%) were classified as intermediate level of physical activity. However, it is noteworthy that mean PA level in the IG was already higher at baseline than the CG (IG:41.75±9.51 vs. CG: 37.49±17.96, p=0.014), which explains the lack of considerable difference between the groups (IG 35.82±16.18 vs. CG 33.41±14.51; p=0.105) after the intervention. The analysis of the covariates schooling and gender showed no significant difference.

Regarding the practice of PA of teachers, more teachers began to practice PA after the intervention, with an increase of 27.9% in the level of PA [IGp Pre 10 (55.6%) vs. Post 15 (83.5), CGp 7 (50%) vs. 5 (50%), p=0.014]. In addition, there was no difference between the groups regarding the number of times per week that teachers practiced PA. In the IGt, only four (22.2%) of the teachers practiced PA three times a week at baseline and after the intervention this number increased to nine (50%). On the other hand, in the CGt, 50% of the teachers did not practice any PA at baseline and remained so on the second evaluation (p= 0.007).

Discussion

This study examined the effect of the "Happy Life, Healthy Heart Program" that involved theoretical and playful activities conducted by teachers with students in the classrooms. The results showed that both intervention and control groups had an increase in health knowledge, however only the IG showed changes related to eating habits. The effects on teachers were demonstrated with the increase in the number of teachers who started to practice PA, which was observed in the IG only.

Table 3 – Anthropometric data of students at baseline and after intervention, in intervention and control groups

Anthropometry	Groups				
	Control (n=211)		Intervention (n=262)		P
	Mean	SD	Mean	Sd	
Z-score					
Pre-intervention	0.762	1.433	0.765	1.316	0.982*
Post-intervention	0.732	1.375	0.597	1.371	0.316*
p	<0.001†		<0.001†		
Difference	-0.006 ± 0.391		-0.155 ± 0.611		0.001*
Z-score - Classification – n (%)					
Pre-intervention					0.300¶
Obesity (z > 2)	44 (20.8)		47 (17.9)		
Overweight (z ≤ 2)	38 (18.0)		60 (22.9)		
Normal weight (z < 1)	129 (61.1)		155 (59.2)		
Post-intervention					0.372¶
Obesity (z > 2)	44 (20.9)		47 (17.9)		
Overweight (z ≤ 2)	37 (17.5)		53 (20.2)		
Normal weight (z ≤ 1)	130 (61.6)		162 (61.8)		
p‡	0.930		0.371		

**: Student's t-test for independent groups; †: Student t-test for paired data; ‡: McNemar Browker test; ¶: Pearson's Chi-square test; data expressed as mean and standard deviation (SD).*

The fact that the two groups had an increase in average knowledge can be explained by the improvement of existing skills or by learning by inference. When asked "if eating fatty foods is bad", the child activates pre-existing knowledge and skills and seeks to link new information to the existing ones.[15] Also, it is possible that the quality of the classes planned by the CG teachers was as high as that of the intervention program, suggesting that, in this community, the teachers have good knowledge and didactics about health when encouraged. Other studies[16,17] have shown similar results regarding a change in behavior not only in the IG but also in controls.

The impact of schooling, in which students from the 1st to the 3rd grades had higher knowledge scores, can be understood by the fact that these students are in the age group between six and nine years old, at the highest point of the literacy process, considering the whole study group. This phase is considered a sensitive period in child development, since, according to Piaget,[18] children are in a transition period from the pre-operative to the concrete-operative phase. Another factor to be considered is that the CARDIOKIDS instrument proved to be more suitable for measuring the knowledge of younger children, considering its format and language, being less suitable for children aged over 10 years.

In relation to food consumption, the results showed that activities focused on health education can generate behavioral changes, reducing the intake of foods corresponding to an unhealthy diet. Many interventional studies conducted at schools[3,19,20] have shown that changes in eating habits produce positive effects on children's health, which reinforces the importance of developing health programs in these environments.[21] However, even with the increase

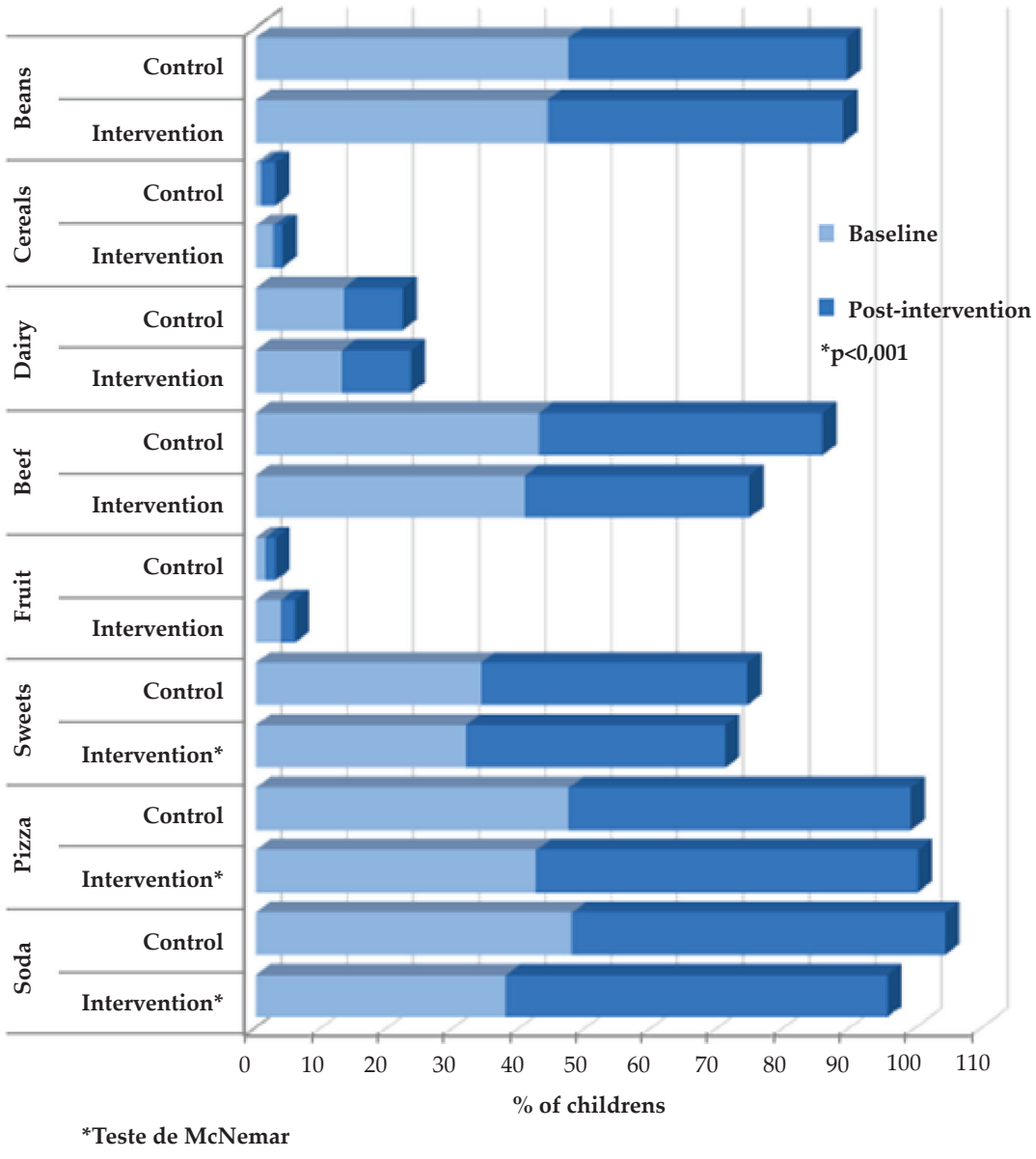

Figure 2 – Percentage of children who followed the Brazilian food guide recommendations in intervention and control and groups, before and after intervention

in the number of children in the IG following the recommendations of the Brazilian food guide, the consumption of pizza, French fries and soft drinks was significant, representing 42.3% of the children. These numbers are in line with the 2009 National School Health Survey,[22] which showed that 39% of adolescents reported drinking soft drinks at least five days a week. In this sense, over the last few years, public policies have been developed to change this reality and curb the consumption of ultra-processed foods.[23]

The significant reduction in the level of PA of children both in the CG and IG may be explained by two distinct situations, one related to the seasonal difference in assessments (baseline carried out in the end of summer, and post-intervention in spring, after winter) and the teachers' strike for 45 days between the 5th and 6th weeks of the intervention program, when the topics on PA and physical exercise were being worked on. The influence of seasons on the practice of PA in children was also reported in a similar study carried out in the capital of

Rio Grande do Sul state.[7] In addition, children who are at school participate in at least two periods per week of Physical Education classes, in addition to the school break that has been proven in many studies to facilitate and encourage the practice of PA.[24,25] Thus, it is believed that children who were not attending school due to the strike or in the winter months tended to take on more sedentary behaviors.

On the other hand, evaluation of PA of the teachers showed a different result, indicating a change in habits in the IGt. The practice of PA by teachers can be understood as a protective factor for physical and mental health[25,26] and an important target for different policies to promote healthy living.[27] According to the National Survey of School Health,[28] considering that teachers are models of good practices, the school can be a reference point of support and dissemination. The improvement in PA among teachers and the drop in PA level among children suggests that the latter group are more susceptible to factors such as strikes and seasonal effect.

Strengths and Limitations of the Study

As strengths of the present study, it is possible to mention its originality with respect to the objective of training teachers for health education. For this, the study proposed an intervention program using materials and resources developed specifically for the project. In addition, in Brazil, few studies have presented the teacher as the protagonist of transmission of health knowledge at school, which has been usually performed by health professionals instead. However, some aspects can be understood as limitations. Considering that the level of the students' knowledge about health at the baseline was high, possibly the knowledge evaluation instrument used may not have been sensitive to capture small differences in such a socially and economically homogeneous population. This does not exclude its use in other communities so that this hypothesis could be confirmed. The fact that the age range of children was wide and included different phases of cognitive development suggests different interpretations of the items of the instrument, especially when it comes to complex themes such as cardiovascular risk factors. In the year in which the study was conducted, there was a work stoppage of state teachers during the intervention period, which may have significantly affected the study, especially in the quantitative results related to the practice of PA, which, in turn, directly affects other data such as anthropometric measurements.

Conclusions

The "Happy Life, Healthy Heart" program reinforced the results of previous studies showing that an increase in health knowledge in children is not enough to change behaviors and lifestyle habits. Furthermore, the change in the practice of PA observed in the group of teachers corroborates the idea that education programs should be implemented, as they affect not only students, but all involved in the school environment.

Author contributions

Conception and design of the research: Mari MA, Pellanda LC. Analysis and interpretation of the data: Mari MA, Teixeira PP. Obtaiming financing: Mari MA. Writing of the manuscript: Mari MA, Teixeira PP, Pellanda LC. Data tabulation: Teixeira PP. Critical revision of the manuscript for intellectual content: Mari MA, Pellanda LC.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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Study Association

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Ethics approval and consent to participate

This study was approved by the Ethics Committee of the Institute of Cardiology, University Foundation of Cardiology, Porto Alegre, under the protocol number 5235/16. All the procedures in this study were in accordance with the 1975 Helsinki Declaration, updated in 2013. Informed consent was obtained from all participants included in the study.

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