The Effect of a Nutrition Education Intervention on School-age Boys Attending a Sports Camp

Efeito de uma Intervenção de Educação Alimentar em Meninos em Idade Escolar a Frequentar um Campo Desportivo

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ABSTRACT

Introduction: Changes in dietary and lifestyle patterns worldwide have led to an increased prevalence of childhood obesity, becoming imperative to explore effective strategies to both prevent and treat this disease.

Objectives: This non-randomized controlled trial evaluated the effectiveness of a short-term nutrition education intervention (4 hours, distributed over 5 days) on improving the dietary knowledge, diet quality and Body Mass Index-for-age z-score of 26 school-age boys (6 to 11 years old) attending a holiday sports camp.

Methodology: Both intervention (n=26) and control (n=39) groups were evaluated immediately before and 6 weeks after the intervention (Body Mass Index and KIDMED were evaluated for both groups; while nutrition knowledge questionnaire was only for intervention group).

Results: In the intervention group, a significant decrease was observed in BMI z-score ($p<0.05$), but the overweight and obesity prevalence remained unchanged. No significant changes in knowledge and diet quality were found in both groups. In the control group, there were not significant changes for any variable.

Conclusions: Holiday sports camps with nutrition education interventions can be a promising strategy to combat childhood obesity.

KEYWORDS: Childhood obesity, Nutrition education, Nutrition knowledge , Dietary quality, Holiday sports camp

RESUMO

Introdução: Modificações nos padrões alimentares e nos estilos de vida a nível mundial estão a levar ao aumento da prevalência da obesidade infantil, tornando-se imperativo explorar estratégias eficazes para prevenir e tratar esta doença.

Objectivos: Este estudo não randomizado controlado avaliou a eficácia de uma intervenção de educação alimentar de curta duração (4 horas, distribuídas por 5 dias) na melhoria dos conhecimentos dietéticos, qualidade alimentar e z-score de IMC de 26 meninos em idade escolar (6 a 11 anos) a frequentar um campo de férias desportivo.

Metodologia: Tanto o grupo de intervenção (n=26) como o grupo controlo (n=39) foram avaliados imediatamente antes e 6 semanas após a intervenção (Índice de Massa Corporal e KIDMED foram avaliados em ambos os grupos; questionário de conhecimentos de nutrição foi aplicado apenas no grupo de intervenção).

Resultados: No grupo de intervenção, foi observada uma diminuição significativa no z-score de Índice de Massa Corporal ($p<0.05$), sem alterações significativas nos conhecimentos nem na qualidade alimentar. No grupo controlo, não se verificaram alterações significativas em nenhuma das variáveis.

Conclusões: Os campos de férias desportivos que integram intervenções de educação alimentar podem ser uma estratégia promissora no combate à obesidade infantil.

PALAVRAS-CHAVE: Obesidade infantil, Educação alimentar, Conhecimento nutricional, Qualidade alimentar, Campo de férias desportivo

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Recebido a 4 de Outubro de 2013
Aceite a 26 de Novembro de 2013

INTRODUCTION

Changes in dietary and lifestyle patterns worldwide have led to an increased prevalence of obesity (1). Childhood obesity, in particular, has risen dramatically in the past decades and, today, about 10% of the world's school-aged children have excessive body fat, with a quarter of these being obese (2). Portugal has followed the same trend and it is estimated that in boys between 6 and 10 years old the prevalence of overweight vary from 14.7 to 30.5% and of obesity vary from 5.3 to 13.2%, according to country region (3). Health consequences of obesity are multiple and serious. Short term morbidities include psychological or psychiatric problems, cardiovascular risk factors, such as high blood pressure, dyslipidaemia and impaired glucose tolerance, with deposition of fat in insulin-sensitive tissues such as muscle and liver, and asthma or worsening of pre-existing asthma (4, 5). Childhood obesity and its morbidities tend to persist in adulthood, predicting a risk of premature mortality (4).

Such scenario requires the development of effective strategies to both prevent and treat childhood overweight and obesity, through the promotion of healthy lifestyles since infancy and the creation of healthy environments. Although there is not enough evidence, interventions that combine nutrition and physical activity seem to be promising in childhood obesity prevention and/or treatment (6), and more cost-effectiveness (7). The Mediterranean diet is associated with lower rates of chronic disease morbidity and higher life expectancy and has been considered one of the healthiest existing dietary patterns. It is also suggested that nutrition knowledge may play a small but pivotal role in the adoption of heal-

thier food habits (8) and this improvement on diet quality is inversely associated with body mass index (BMI) (9). It becomes essential to boost the involvement of other resources in society, such as sports clubs and associations, and explore the potentialities of nutrition education interventions in sporting environments per excellence.

Holiday sports camps can be a good environment to introduce nutrition education interventions, aiming to improve the lifestyle and health of participants.

OBJECTIVES

The present study aimed to evaluate the effectiveness of a short-term nutrition education intervention on improving the dietary knowledge, diet quality and BMI-for-age z-score of school-age boys attending a holiday sports camp.

METHODOLOGY

Participants

The study participants were a non-representative sample from the Dragon Force, a soccer school from FCPorto. Inclusion criteria were: 1) age between six and eleven years old; 2) male gender; and 3) registration in a Dragon Force school.

The intervention group (n=26) was formed from a convenient sample of the total range (n=56) of students who participated in the Easter holiday sports camp. The student recruitment for the intervention group was done on the first day of the holiday sports camp, before the beginning of any activity. The control group (n=39) was formed two days prior to holiday sports camp from the students registered as well in a Dragon Force school, but who did not attend the Easter holiday sports camp. We excluded the students who did not accomplish the inclusion criteria, and also those who did not accomplish all the procedures and measurements during the study period. The final sample consisted of 65 boys; 26 formed the intervention group. Verbal consent was obtained from parents, after being informed about the study procedures.

Study Design

The study was a non-randomized controlled trial, which used a repeated measures pre-post design and a comparison group. The intervention lasted for a period of 4 hours, distributed over 5 days.

Measurements

Nutritional and Dietary Knowledge

Nutritional and dietary knowledge was assessed only in the intervention group, through a non-validated questionnaire, designed by us according to nutrition topics included in the nutrition education intervention during the holiday sports camp. The questionnaire consisted of 15 multiple choice questions, each one with 3 possible options for choice; right answers were classified with +1 and the wrong ones were given 0, with a maximum of 15 points.

Dietary Quality

Dietary quality was measured by the adherence to a Mediterranean-style diet and assessed through the KIDMED, a quality index for children and youth developed by Serra-Majem and colleagues (10). The KIDMED combines the Mediterranean diet characteristics as well as the general dietary guidelines for children (9) in a total of 16 "yes-or-no" questions. For "yes" answers, questions denoting negative connotation are quoted with -1 and those denoting positive connotation are assigned with +1. "No" answers are given 0. The KIDMED score is calculated by summing the values attributed to each question and ranges from -4 to +12. The final score can be classified into three levels: a) ≥8, optimal Mediterranean diet; b) 4 – 7, improvement needed to adjust intake to Mediterranean patterns; c) ≤3, very low diet quality.

Anthropometry

Body weight and height were evaluated in training clothes and BMI was calculated (kg/m2). Weight was measured to the nearest 0.1 kg with a SECA® electronic weighting scale and height was measured to the nearest 0.1 cm with a SECA® stadiometer. To measure height, participants stayed upright on a horizontal surface with their heads in the Frankfort plane (11). BMI z-scores were then obtained, and for nutritional status classification, BMI was categorized using the Centers for Disease Control and Prevention (CDC) age- and gender-specific cut-off percentiles: BMI < 5th percentile (underweight); 5th percentile ≤ BMI < 85th percentile (healthy weight); 85th percentile ≤ BMI < 95th percentile (overweight); and BMI ≥ 95th percentile (obesity) (12).

Procedures

The baseline BMI z-score, nutrition knowledge and dietary quality were assessed in the first day of the holiday sports camp in the intervention group.

In the control group, the baseline measurements of BMI z-score and dietary quality were assessed two days before the beginning of the holiday sports camp, following the same procedures of the intervention group, with the exception of the application of the knowledge questionnaire.

Nutrition education intervention in the intervention group was carried out throughout the week of holiday sports camp.

Six weeks after the end of the holiday sports camp, students of both groups were asked to repeat the same measurements and questionnaires performed before the intervention period.

Nutrition Education Intervention

The nutrition education intervention consisted of 4 sessions distributed over the 5-day holiday sports camp, totaling 4 hours of intervention. The sessions covered issues such as general healthy eating and healthy food choices, particularly upon carbohydrate-rich food and fruits and vegetables. Participants also took part in a "Nutrition Peddy Paper", whose enigmas asked for tasks that foster and exercise nutritional knowledge, providing an amusing and competitive learning.

Statistical Analysis

To analyze the data, the SPSS for Windows statistical software package version 17.0 was used. Descriptive analyses were carried out for the KIDMED and BMI percentiles categories for each group. Normality of the variables was tested with Kolmogorov-Smirnov Test. To assess differences between baseline and post-intervention data by group, paired samples t Test was used for normally distributed variables. When variables were not normally distributed, Wilcoxon Signed Ranks Test was used. To compare variables between groups, independent samples t Test was used. Sign Test was performed for dichotomous variables, using the binomial distribution. Differences were considered statistically significant when $p<0.05$.

RESULTS

At baseline, the intervention group did not differ significantly in age and anthropometric measures from the control group (Table 1). In the intervention group, 11.5% of the participants were overweight and 7.70% were obese at baseline, whereas in the control group 25.6% were overweight and 7.70 were obese.

There was a change in the desired direction of the dietary knowledge score in the intervention group (Table 2), 6 weeks after the holiday sports camp,

TABLE 1: Mean (SD) age and anthropometric parameters at baseline of intervention and control groups

	Intervention Group (n=26)	Control Group (n=39)	p value
	Baseline Mean (SD)	Baseline Mean (SD)	
Age (y)	8.38 (1.36)	8.97 (1.46)	0.106
Weight (kg)	32.0 (7.45)	35.9 (10.0)	0.075
Height (m)	1.37 (0.07)	1.40 (0.111)	0.264
BMI z-score	0.084 (1.07)	0.445 (0.926)	0.153

SD, Standard Deviation

TABLE 2: Dietary knowledge score of the intervention group immediately before and 6 weeks after the holiday sports camp

	Intervention Group (n=26)					
	Minimum	Percentile 25	Percentile 50	Percentile 75	Maximum	p value
Knowledge score						
Pre	2.00	5.00	7.00	8.00	10.0	0.070
Post	1.00	6.75	7.00	8.25	11.0	

TABLE 3: Dietary parameters of the of the knowledge questionnaire in the intervention group, immediately before and 6 weeks after the holiday sports camp

Dietary knowledge parameters of the questionnaire	Answers	Male (% to total of males)	Female (% to total of females)	*p*
1. Healthy diet and physical activity relation	3	3	20	1.00
2. Food wheel	6	4	16	0.754
3. Macronutrients	1	3	22	0.625
4. Food wheel groups high in carbohydrates	7	4	15	0.549
5. Carbohydrates functions	4	9	13	0.267
6. Healthy and unhealthy carbohydrates	1	7	18	0.0700
7. Simple carbohydrates	4	4	18	1.00
8. Healthy food option	1	7	18	0.0700
9. Daily fruit	3	3	20	1.00
10. Protein functions	2	3	1	1.00
11. Healthy lunch composition	2	3	1	1.00
12. Vitamins	3	5	18	0.727
13. Minerals	2	8	16	0.109
14. Fiber	3	2	21	1.00
15. Water	6	5	15	1.00

TABLE 5: KIDMED diet quality parameters immediately before and 6 weeks after the holiday sports camp by groups

Diet quality parameters of the KIDMED	Group	Negative post - pre differences	Positive post - pre differences	*Ties*	p value
1. Fruit or fruit juice daily	I	1	4	21	0.375
	C	3	5	31	0.727
2. Second serving of fruit daily	I	5	3	18	0.727
	C	2	9	28	0.065
3. Fresh or cooked vegetables daily	I	5	0	21	0.063
	C	0	6	33	0.031*
4. Fresh or cooked vegetables >1/day	I	4	2	20	0.687
	C	4	7	28	0.549
5. Regular fish consumption (at least 2 – 3 /week)	I	4	3	19	1.00
	C	5	5	29	1.00
6. >1/week fast food (hamburger) restaurant	I	1	4	21	0.375
	C	4	7	28	0.549
7. Pulses >1/week	I	2	1	23	1.00
	C	4	7	28	0.549
8. Pasta or rice almost daily (≥ 5/week)	I	4	4	18	1.00
	C	4	3	32	1.00
9. Cereal or cereal products for breakfast	I	2	1	23	1.00
	C	1	1	37	1.00
10. Regular nut consumption (at least 2 – 3/week)	I	3	3	20	1.00
	C	3	3	33	1.00
11. Use of olive oil at home	I	3	1	22	0.625
	C	0	1	38	n.a.#
12. No breakfast	I	0	0	26	1.00
	C	1	1	37	1.00
13. Dairy product for breakfast	I	3	3	20	1.00
	C	1	2	36	1.00
14. Commercially baked goods or pastries for breakfast	I	2	0	24	0.500
	C	1	2	36	1.00
15. Two yoghurts and/or 40g cheese daily	I	3	2	21	1.00
	C	2	5	32	0.453
16. Sweets and candy several times a day	I	3	3	20	1.00
	C	3	3	33	1.00

I, Intervention Group; C, Control Group
*Statistically significant differences from pre to post intervention, p<0,05
#n.a., not applicable

TABLE 4: KIDMED scores and BMI z-scores before and 6 weeks after the education intervention of the holiday sports camp

	Intervention Group (n=26)			Control Group (n=39)		
	Mean	**SD**	**p value**	**Mean**	**SD**	**p value**
KIDMED score						
Pre	7.50	2.92	0.083	7.38	2.730	0.102
Post	6.92	2.86		7.95	2.339	
BMI z-score						
Pre	0.0842	1.064	0.049*	0.4446	0.92643	0.992
Post	-0.0019	1.158		0.4449	0.97574	

*Statistically significant differences from pre to post intervention, p<0,05.
SD, Standard Deviation

although not significant (p>0.05), obtaining the same results when we analyzed differences for each knowledge questionnaire question (Table 3).

In the intervention group, baseline KIDMED index was less than 4 (very low diet quality) for 7.70% of the group, from 4 to 7 (improvement needed to adjust intake to Mediterranean patterns) for 46.15% and higher than 7 (optimal Mediterranean diet) for 46.15%, whereas in the control group very low diet quality was found for 7.70%, intermediate diet quality for 41.0% and high index results were found in 51.3%. In both groups, however, the KIDMED total score showed no significant differences (p>0.05) after the intervention period (Table 4).

Analyzing the differences in answers of each KIDMED question by groups (Table 5), from pre to post intervention, differences were observed only for the daily intake of fresh or cooked vegetables (p<0.05), which increased in the control group. Intervention group had a decrease in the daily intake of fresh or cooked vegetables (p<0.1), which agrees with the slight non-significant impairment of the overall diet quality in this group (Tables 4 and 5). The opposite trend occurs in the control group for the daily intake of a second piece of fruit, in which it was possible to observe an increased consumption (p<0.1).

After the intervention, the overall BMI z-score of the intervention group decreased 0.086 (0.212) units (p<0.05), while in the control group there was no significant change in BMI z-score, as shown in Table 4. Even so, descriptive data showed that these differences did not reduce the overweight and obesity prevalence in the intervention group, which remained unchanged. In the control group, little variations in the BMI led to an increased prevalence of overweight from 25.6% to 28.2% and a decreased prevalence of obesity from 7.70% to 5.10%.

DISCUSSION AND CONCLUSION

In the present research, the effectiveness of a 5-day nutrition education intervention in the context of a holiday sports camp was evaluated. The results suggest that the short-term intervention originated a change in the desired direction of participant's nutrition and dietary knowledge, although not statistically significant. This outcome was followed by an overall decrease in BMI z-score; however, this reduction did not influence the prevalence of overweight and obesity in the intervention group.

Some residential weight-loss camps interventions on nutrition education and physical activity also led to significant improvements in BMI z-score (13-15), but the differences were stronger. However, these studies were conducted among older children, who attended residential camps, for longer periods and had other type of interventions not performed in our study, such as controlled ingested energy. On the other hand, the intervention samples of these studies were overweight or obese children only and also included girls. We found that, in the control group, the percentage of obese children decreased, but that possibly happened because the small variations affected values near or over the cut-offs.

The association between nutrition knowledge and dietary intake has been more explored in intervention programs in the school context. Two recent studies (16, 17) upon nutrition education and physical activity among primary-school children showed significant improvements in knowledge and dietary intakes of intervention groups after an intervention period of 1 to 2 months. In our study, such results were not found, probably because of the very short period of the intervention (5 days). The School Health Education Evaluation study found that 15 hours of nutrition education could be expected to produce changes in knowledge, whereas for changes in attitudes and behaviors it would be necessary about 50 hours (18). Moreover, it appears that girls tend to respond better to educational components grounded in social learning, while boys may be more influenced by structural and environmental changes facilitating increased physical activity and improved dietary intake (19).

This raises a major methodological issue of this study, because there may have been differences in physical activity between both groups, during the holiday sports camp period, which could have also contributed for the differences observed in BMI z-score. On the other hand, we have to consider that younger children may have difficulty in conceptualizing their real dietary intake, whereas older children may respond under the influence of some social desirability. Recently, Kelly et al. (20) emphasized the importance of programs such as weight loss camps in childhood obesity treatment, especially those that withdraw children from their obesogenic environment and place them in an active, recreational and educational environment for extended periods of time. This holiday sports camp was not exclusively for obese children, but provided a healthy environment and nutrition education that may influence future participant's behavior and, thus, acting, not only as a treatment strategy for childhood obesity, but also as a prevention strategy.

Even so, this study has some limitations that have to be considered. The short duration of the holiday sports camp was a drawback that induces the very short intervention period, which proved insufficient, as we have seen, to produce more consistent nutritional and dietary knowledge and, mainly, improved dietary habits. On the other hand, the questionnaire applied to evaluate the participants knowledge was not validated for this population, which may interfere with the outcomes. A major limitation of this research is the study design and the very small sample size. This was not a randomized controlled trial, given the financial, timing and organizational constraints of the camp (we could not control the registration of the boys in the holiday sports camp). The small sample size of both intervention and control groups may also have resulted in larger estimation errors. A question that remains unclear is the possible impact of physical activity on BMI z-score in the intervention group. This variable was not measured and compared between both groups, which limit the conclusions. Finally, the outcomes observed in this research may not be reproduced in other holiday sports camps, because of the non-representativeness of the sample and due to the presence of differences in participant backgrounds and in structure, contents and environment offered by the camps that may affect the final results.

Additional studies are needed on the effectiveness of nutrition education strategies implemented in sports camps on improving participant's health and in prevention/treatment of childhood obesity.

In conclusion, this research showed that short-term nutrition education interventions may have an impact in the desired direction on dietary quality and nutritional knowledge but, in spite of the absence of stronger results, it also gave some tracks for future interventions, showing that holiday sports camps with nutrition education interventions can be a promising strategy to improve child health and to combat childhood obesity. Better results can be expected in longer interventions with structural and environmental changes and a subsequent follow-up extended in time.

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