

Effect of school-based intervention on diet in high school students

Efetividade de uma intervenção de base escolar sobre as práticas alimentares em estudantes do ensino médio

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Abstract – Interventions during adolescence are important for modifying risk eating behavior that contribute to the early development of obesity and other non-transmissible chronic diseases, such as the consumption of high energy-dense and low nutrient-dense foods. The aim of this study was to assess the effect of a school-based intervention on the diet of high school students who study at night. Randomized controlled study conducted in 2006 in two Brazilian state capitals (Florianópolis and Recife). The intervention included multiple strategies for improving healthy eating and physical activity. Weekly frequency consumption of fruits, vegetables, dairy products, salty snacks, sweets and soft drinks, daily frequency consumption of fruits and vegetables and stages of change in fruit and vegetable consumption behavior were investigated using questionnaires. A total of 2155 students were included (mean age \pm SD = 18.4 years \pm 2.4) at baseline, 989 of whom remained in post-intervention. Bivariate analyses indicated greater frequency of vegetable consumption ($p=0.008$) and lower frequency of sweets ($p=0.032$) and soft drinks ($p=0.003$) in the intervention group compared to controls. The change in behavior was also favorable for the intervention group ($p=0.016$). Analysis regression showed positive effects of complying with vegetable intake recommendations (OR = 1.54 CI95% 1.19-1.97) and favorable changes in lower sweet consumption (OR = 1.21 CI95% 1.02-1.43) in the intervention group, compared to controls. We found positive effects on the eating habits of the students as a result of The Saude na Boa Project.

Key words: Eating Behavior; Adolescents; Intervention Studies; School Health.

Resumo – Intervenções durante a adolescência são importantes para modificar a exposição a condutas alimentares de risco que contribuem para o desenvolvimento precoce da obesidade e de outras doenças crônicas não transmissíveis, como o excessivo consumo de alimentos de alta densidade energética e baixa quantidade de micronutrientes. O objetivo desse estudo foi avaliar a efetividade de uma intervenção de base escolar nas práticas alimentares de estudantes do ensino médio noturno. Intervenção randomizada e controlada, realizada em 2006, em duas capitais brasileiras (Florianópolis e Recife). A intervenção envolveu estratégias múltiplas para melhorar a alimentação e promover a atividade física. A frequência de consumo semanal de frutas, hortaliças, laticínios, salgadinhos, doces e refrigerantes, a frequência de consumo diário de frutas e hortaliças e os estágios de mudança de comportamento para consumo de frutas e hortaliças foram investigados mediante aplicação de questionários. Foram incluídos 2155 estudantes (idade média \pm DP = 18,4 anos \pm 2,4) na linha de base, dos quais 989 completaram o estudo. Após a intervenção houve maior frequência de consumo de verduras ($p=0,008$) e menor frequência de consumo de doces ($p=0,032$) e refrigerantes ($p=0,003$) no grupo intervenção, comparado ao controle. A mudança nos estágios de comportamento foi também favorável ao grupo intervenção ($p=0,016$). As análises de regressão mostraram efeitos positivos no atendimento às recomendações de consumo de verduras (RO = 1,54 IC95% 1,19-1,97) e mudanças favoráveis na diminuição do consumo de doces (RO = 1,21 IC95% 1,02-1,43) no grupo intervenção, comparado ao controle. Foram verificados efeitos positivos nas práticas alimentares dos estudantes como resultado do Projeto Saúde na Boa.

Palavras-chave: Comportamento Alimentar; Adolescente; Estudos de Intervenção; Saúde Escolar.

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INTRODUCTION

Data from the 2009 National Student Health Survey showed that only 31% of Brazilian adolescents regularly consumed fresh fruits and vegetables (five or six times a week). However, regular consumption of high energy-dense and low nutrient-dense foods (sweets, salty cookies and soft drinks) was reported by more than 50% of participants¹. Inadequate food consumption behavior and low physical activity levels are associated with the increase in non-transmissible chronic diseases².

Intervention programs aimed at promoting fruit and vegetable consumption, reducing salt, sugar and fat intake and encouraging participation in physical activity have become Brazilian public policies³. To reach the adolescence, schools are a favorable context for interventions aimed at promoting healthy lifestyles, since they facilitate joint actions in physical, social and educational settings. A few school-based intervention studies have investigated Brazilian adolescents in the morning and afternoon shifts, focusing on educational programs to reduce sweet beverage consumption⁴ or encourage healthy eating and physical activity⁵. Brazilian scientific journals contain no specific interventions with nighttime students at high school level.

The *Saude na Boa* Project⁶ was the first Brazilian study conducted to promote changes in the health behavior (physical activity and diet) of high school students who study at night. The aim of this article is to describe the effects of the *Saude na Boa* Project on the eating habits of nighttime public high school students in two Brazilian state capitals: Florianopolis and Recife (South and Northeast of Brazil, respectively).

METHODOLOGICAL PROCEDURES

The *Saude na Boa* Project was a randomized controlled intervention, carried out during the 2006 school year (March to December). The population consisted of nighttime public high school students, aged between 15 and 24 years, in Florianopolis and Recife, selected due to environmental and sociocultural contrasts at the time of the study. Earlier publications reported on the methods of the project, sampling⁶ and implementation process⁷, as well as reproducibility studies and questionnaire validity⁷.

The following components made up the intervention⁶ and measures to promote healthy eating habits with an emphasis on increased fruit and vegetable consumption: a) The food education and physical education component: food and vegetable posters, four newsletters for the entire school community and the project website; b) Environmental and organizational change component: weekly distribution of three types of seasonal fruit during school lunch; c) Personnel engagement and training: with school employees, emphasizing the choice of healthy foods, in addition to the purchase, cleaning and provision fruits during class breaks.

Data were collected using the *Saude na Boa* questionnaire, containing 43 questions on personal data, physical activity, food habits, weight control and

preventive behaviors⁶. The instrument was administered in a classroom by a trained team of undergraduate and graduate Physical Education students.

The present study used questions regarding the consumption of fruits, vegetables, beans, dairy products (markers of healthy eating habits), salty snacks, sweets and soft drinks (markers of unhealthy eating habits), and stages of behavior changes in the daily intake of fruits and vegetables. The weekly consumption of healthy and unhealthy foods was assessed with the following questions: “In a normal week how many days do you eat/drink “name of the food item?”, with eight response options (zero to seven days a week). To evaluate daily fruit and vegetable intake the following questions were used: “In the last 30 days, how many times a day do you usually eat fruits, such as bananas, oranges, apples, pineapple, watermelon, strawberries, etc.?”; “In the last 30 days, how many times a day do you usually eat vegetables (green salads, tomatoes, carrots, chayote, pumpkin, cauliflower, etc)?”, with seven response options ranging from “I did not eat fruits/vegetables in the last 30 days” to “five or six times a day”. For these questions subjects were classified according to compliance with the Brazilian Food Guide (GAPB) with respect to their consumption of fruit (three or more portions per day) and vegetables (two or more portions per day)⁸.

Stages of behavior change were assessed with the following question: “Daily intake of fruit and vegetables is considered healthy. In relation to your own eating habits, would you say that: “I have included fruits and vegetables daily in my diet for more than six months” (maintenance stage); “I have included fruits and vegetables in my diet for less than six months” (action stage); “I do not eat them at present, but I intend to include fruits and vegetables in my daily diet in the next 30 days” (preparation stage); “I do not eat them at present, but I intend to include fruits and vegetables in my daily diet in the next six months” (contemplation stage); “I do not eat them at present, and I do not intend to include fruits and vegetables in my daily diet in the next six months” (pre-contemplation stage)⁹.

Differences in the frequency of food consumption, percentage compliance of GAPB recommendations and stages of behavior change between the intervention (IG) and control (CG) groups, in the pre- and post-intervention phases were determined by the Mann-Whitney and chi squared tests. The Wilcoxon test for paired data as well as McNemar’s and Bhapkar’s tests were applied to assess intragroup changes between the pre- and post-intervention phases.

In order to evaluate effectiveness of the intervention using logistic regression models, changes in eating habits were categorized as follows: a) for healthy foods, increasing or maintaining the frequency of consumption to five or more days per week; b) for unhealthy foods, reducing or maintaining frequency of consumption of up to two days per week; c) for the stages of behavioral change, advancing from a lower to higher stage or maintaining action and maintenance stages.

The effectiveness of the intervention was tested considering intention to treat (data inputted by maintaining the last observation) and participant data in the pre- and post-intervention stages (only collected data). As a

measure of the effect, odds ratio was used, applying logistic regression analyses for each dependent variable, adjusted for gender, age, employment status and municipality. For variables showing intergroup differences at baseline (Consumption of two or more portions/day of vegetables; Weekly frequency of vegetable and bean consumption), the initial condition was included to fit the regression model. Analyses were conducted using the MH program¹⁰ for the Bhapkar test and Stata version 12.0 (StataCorp, Texas, USA) for the other tests. The significance level was set to 5%.

RESULTS

A total of 2155 adolescents took part at baseline, 45.9% (n=989) of whom remained in the second data collection. Table 1 presents the characteristics of the CG and IG at baseline by municipality. In Florianopolis, the intervention group had higher mean age and fewer white and single individuals than the control group. In Recife, the IG contained more girls and fewer employed individuals than the CG.

Table 1. Sample characterization at baseline, according to city.

Variables	Florianopolis (n=1.156)			Recife (n=999)		
	Control	Intervention	P-value*	Control	Intervention	P-value*
Sex (% girls)	55.4	60.0	0.111	50.1	56.9	0.032
Age - mean (SD)	17.2 (2.0)	18.1 (2.4)	<0.001	19.0 (2.2)	18.8 (2.0)	0.080
Skin color (% white)	61.0	52.5	0.003	27.3	24.7	0.346
Employment status (% working)	52.3	53.1	0.797	43.8	36.2	0.015
Marital status (% single)	90.5	86.1	0.021	86.8	86.3	0.818
Overweight (%)	16.5	18.8	0.308	26.3	31.3	0.110

*t-test (age) and chi-squared test (remaining variables).

After nine months of intervention, loss to follow-up was similar in both groups (49.8% and 50.2% in the CG and IG, respectively). There were more losses in males (58.2% versus 50.7% in women; p=0.001) and mean age was higher among those who did not complete the study (18.4±2.2 years versus 18.1±2.4 in those that participated in both collections; p<0.001). There were no statistically significant differences in losses to follow-up for skin color, marital status, employment status, nutritional status or city investigated.

Table 2 shows the effect of intervention on eating habits, considering intention to treat. Differences between IG and CG at baseline were found only for weekly consumption of beans and weekly and daily vegetable intake. After the program, the IG consumed sweets and soft drinks less frequently and complied more with GAPB recommendations in terms of daily vegetable consumption than the CG. Moreover, the IG had more students that advanced from the pre-contemplation stage to consuming fruits and vegetables.

Table 2. Analysis of the effect, considering intention-to-treat of the Saude na Boa Project on food consumption indicators of public high school students of Florianopolis and Recife, 2006.

Indicators	Baseline (BL)		Post-intervention (PI)		P-value			
	CG	IG	CG	IG	CG vs. IG	CG vs. IG	CG vs. CG	IG vs. IG
	Median (IQR)		Median (IQR)		(BL)	(PI)	(BL vs. PI)	(BL vs. PI)
Weekly consumption (days/week)								
Fruits	4 (2.5;7.0)	4 (2.0;7.0)	4 (2.0;6.0)	4 (3.0;6.0)	0.430	0.482	0.004	0.763
Vegetables	3 (1.0;6.0)	4 (2.0;7.0)	3 (1.0;6.0)	4 (2.0;6.0)	0.036	0.008	0.000	0.262
Dairy	5 (3.0;7.0)	5 (3.0;7.0)	5 (3.0;7.0)	5 (2.0;7.0)	0.473	0.090	0.145	0.001
Beans	6 (3.0;7.0)	6 (4.0;7.0)	6 (3.0;7.0)	6 (4.0;7.0)	<0.001	0.000	0.309	0.717
Salty snacks	3 (1.0;4.0)	3 (1.0;5.0)	3 (1.0;4.0)	2 (1.0;4.0)	0.978	0.172	0.000	0.001
Sweets	3 (2.0;5.0)	3 (2.0;5.0)	3 (2.0;5.0)	3 (1.0;4.0)	0.905	0.032	0.145	0.000
Soft drinks	3 (2.0;5.0)	3 (2.0;5.0)	3 (2.0;5.0)	3 (2.0;5.0)	0.275	0.003	0.509	0.000
Daily intake (portions/day)	n (%)	n (%)	n (%)	n (%)				
Fruits - 3 or + portions/day	255 (23.4)	265 (25.1)	341 (31.2)	354 (33.6)	0.345	0.249	0.000	0.000
Vegetables - 2 or + portions/day	343 (31.4)	385 (36.6)	304 (27.8)	386 (36.6)	0.012	0.015	0.002	0.936
Stages of change: Fruit and vegetable consumption	n (%)	n (%)	n (%)	n (%)				
					0.798	0.016	0.455	0.065
Maintenance	538 (50.9)	539 (51.9)	543 (50.2)	520 (49.7)				
Action	176 (16.4)	170 (16.4)	169 (15.6)	205 (19.6)				
Preparation	170 (15.8)	167 (16.1)	160 (14.8)	166 (15.9)				
Contemplation	118 (11.0)	103 (9.9)	126 (11.7)	102 (9.7)				
Pre-contemplation	72 (6.7)	60 (5.8)	83 (7.7)	54 (5.2)				

Abbreviations: CG – Control group; IG – Intervention group; IQR – Interquartile range; BL – Baseline; PI – Post-intervention

With respect to the intragroup difference in pre- and post-intervention, the CG exhibited a reduction in weekly consumption of fruits, salty snacks and daily vegetable intake, but increased daily fruit consumption. The IG showed an decrease in weekly consumption of dairy products, salty snacks, sweets and soft drinks as well as in the number of students who consumed three or more portions of fruit per day.

Few differences in intervention effectiveness were observed considering only the data collected. However, these data showed that after intervention the IG reported a lower weekly frequency of salty snack consumption compared to the CG ($p = 0.021$). Furthermore, the difference in weekly vegetable consumption between pre- and post-intervention in the CG was not significant ($p = 0.100$). (Table 3).

Table 4 shows the effect of intervention on the diet of students considering either intention-to-treat data or collected data only. In the first case, a positive effect was found in compliance with GAPB recommendations with respect to vegetable intake and changes in sweets consumption (decreasing or maintaining consumption at \leq twice a week). On the other hand, an inverse effect in dairy product intake was observed, with reduced consumption in the IG. Considering only collected data, the students that took part in the intervention were more likely to comply with vegetable consumption recommendations and increase weekly fruit intake (increasing or maintaining consumption at \geq five times/week and sweets consumption.

Table 3. Analysis of the effect, considering data collected in the *Saude na Boa* Project, on food consumption indicators of public high school students of Florianopolis and Recife, 2006.

Indicators	Baseline (BL)		Post-intervention (PI)		P-value			
	CG	IG	CG	IG	CG vs. IG (BL)	CG vs. IG (PI)	CG vs. CG (BL vs. PI)	IG vs. IG (BL vs. PI)
	Median (IQR)		Median (IQR)					
Weekly consumption (days/week)								
Fruits	4 (2.5;7.0)	4 (2.0;7.0)	4 (2.0;6.0)	4 (3.0;5.0)	0.430	0.169	0.002	0.451
Vegetables	3 (1.0;6.0)	4 (2.0;7.0)	3 (1.0;6.0)	4 (2.0;5.0)	0.036	0.070	0.100	0.305
Dairy	5 (3.0;7.0)	5 (3.0;7.0)	5 (3.0;7.0)	4 (2.0;7.0)	0.473	0.158	0.157	0.001
Beans	6 (3.0;7.0)	6 (4.0;7.0)	6 (3.0;7.0)	6 (4.0;7.0)	<0.001	0.030	0.291	0.570
Salty snacks	3 (1.0;4.0)	3 (1.0;5.0)	3 (1.0;4.0)	2 (1.0;4.0)	0.978	0.021	0.023	0.000
Sweets	3 (2.0;5.0)	3 (2.0;5.0)	3 (2.0;5.0)	2 (1.0;4.0)	0.905	0.002	0.154	0.000
Soft drinks	3 (2.0;5.0)	3 (2.0;5.0)	3 (2.0;5.0)	3 (1.0;4.0)	0.275	0.003	0.548	0.000
Daily intake (portions/day)	n (%)	n (%)	n (%)	n (%)				
Fruits - 3 or + portions/day	255 (23.4)	265 (25.1)	208 (40.6)	190 (40.3)	0.345	0.927	0.000	0.000
Vegetables - 2 or + portions/day	343 (31.4)	385 (36.6)	128 (25.1)	152 (32.1)	0.012	0.000	0.002	0.936
Stages of change: Fruit and vegetable consumption	n (%)	n (%)	n (%)	n (%)				
					0.798	0.001	0.452	0.063
Maintenance	538 (50.9)	539 (51.9)	252 (49.5)	222 (47.7)				
Action	176 (16.4)	170 (16.4)	83 (16.3)	104 (22.4)				
Preparation	170 (15.8)	167 (16.1)	76 (14.9)	80 (17.2)				
Contemplation	118 (11.0)	103 (9.9)	53 (10.4)	44 (9.5)				
Pre-contemplation	72 (6.7)	60 (5.8)	45 (8.8)	15 (3.2)				

Abbreviations: CG – Control group; IG – Intervention group; IQR – Interquartile range; BL – Baseline; PI – Post-intervention

Table 4. Effect of the *Saude na Boa* Project on indicators of post-intervention food consumption in public high school students in Florianopolis and Recife, 2006.

Indicators	Effectiveness (intention-to-treat)			Effectiveness (data collected)		
	Control	Intervention	Adjusted OR ¹ (95% CI)	Control	Intervention	Adjusted OR ¹ (95%CI)
	n (%)	n (%)		n (%)	n (%)	
Compliance with recommendations						
Fruits: consumption of 3 or + portions/day	341 (31.2)	354 (33.6)	1.10 (0.92-1.32)	208 (40.6)	190 (40.3)	1.00 (0.77-1.29)
Vegetables: consumption of 2 or + portions/day	343 (31.4)	385 (36.6)	1.54 (1.19-1.97)	128 (25.1)	152 (32.1)	1.40 (1.04-1.88)
Changes favorable to food consumption						
Fruits	533 (48.8)	539 (51.1)	1.12 (0.94-1.33)	262 (51.4)	270 (57.5)	1.30 (1.00-1.67)
Vegetables				260 (51.1)	259 (55.6)	1.21 (0.93-1.56)
Dairy	649 (59.4)	581 (54.9)	0.79 (0.66-0.95)	316 (62.0)	276 (58.5)	0.82 (0.63-1.07)
Beans	749 (69.6)	785 (75.2)	1.07 (0.84-1.37)	383 (76.3)	361 (78.5)	1.06 (0.77-1.47)
Salty snacks				278 (55.4)	269 (57.2)	1.09 (0.84-1.41)
Sweets	512 (47.1)	544 (51.7)	1.21 (1.02-1.43)	265 (52.3)	282 (59.9)	1.38 (1.07-1.79)
Soft drinks	463 (42.4)	480 (45.5)	1.09 (0.92-1.30)	254 (50.1)	268 (57.0)	1.26 (0.98-1.63)
Favorable effect on the stage of behavioral change						
	777 (72.4)	782 (75.3)	1.15 (0.94-1.41)	362 (72.1)	344 (75.3)	1.20 (0.89-1.60)

¹Odds ratio (OR) and 95% confidence intervals (95%CI) adjusted for sex, age group, employment status and city. For variables exhibiting intergroup difference at baseline (consumption of 2 or + portions/day of vegetables; weekly bean consumption; weekly vegetable consumption), the initial condition was included in the model.

DISCUSSION

This study presents the results of a randomized controlled school-based intervention, with a focus on the eating habits of nighttime high school students in two Brazilian state capitals with different socioeconomic conditions. The measures promoted fruit and vegetable consumption, showing the beneficial effects of these food groups and the reduced frequency of salty snack, sweets and soft drink consumption.

The results demonstrated that, compared to basal data, the intervention produced favorable changes in the daily and weekly frequency of fruit consumption. However, the CG also showed improvements (33% increase over basal values) in the number of students who complied with recommended daily fruit intake (\geq three portions per day), demonstrating a lack of association in adjusted analysis. It is unlikely that respondent bias explains the improvement observed in the CG, given that the same finding would have been expected for the other outcomes. Contamination of the CG is also highly unlikely, considering the type of intervention used, as well as the little contact expected between the groups due to the profile of the population investigated. It is also unlikely that co-interventions (whether local or national) explain the improvement observed, not only because of the short time period in which these changes occurred (nine months), but also because the data is not compatible with literature findings. A study conducted by the Telephone-based System for the Surveillance of Risk and Protective Factors for Chronic Diseases (VIGITEL) showed that between 2008 and 2010 the number of individuals aged 18 years or older that consumed five or more portions of fruits and vegetables daily remained relatively stable (22-25% in Florianopolis and 17-18% in Recife)^{11,12}. In the present study the corresponding percentage was 15% in the two cities at baseline, increasing to 23% in Florianopolis and 17% in Recife after intervention, with no statistically significant difference between the IG and CG (data not presented).

Evidence of improved fruit and vegetable consumption is consistent with the data reported in a systematic review showing that 83% of similar intervention studies (school-based using multiple intervention strategies) caused an increase in fruit and vegetable intake in children and adolescents, and enhanced nutritional status¹³. No similar Brazilian study was found to compare with the present investigation.

In relation to the effect on reducing the consumption of sweets, salty snacks and soft drinks, Brazilian studies have corroborated the promising findings obtained here, albeit in younger adolescents. Sichieri et al. found a reduction in sugary drinks using educational strategies that promoted water intake in students aged nine to twelve years⁴. Another intervention, including educational material and measures for parents, observed a reduction in soft drink and cookie consumption among adolescents with a mean age of 11 years¹⁴.

A systematic review found that socioeconomic condition, food preferences, fruit and vegetable consumption by parents and household avail-

ability are the main determinants of consumption for these food items in children and adolescents, in addition to sex and age¹⁵. On the other hand, barriers to fruit and vegetable intake in qualitative studies show a greater diversity of factors, including the sensory and physical attributes of fruits and vegetables, satiety value, knowledge, peer influences, television and the media, price and accessibility¹⁶.

In the present study, loss to follow-up of students during the collection week was an important limitation. High school students in Brazil exhibited high dropout rates compared to their elementary counterparts. Moreover, we found a number of differences in CG and IG characteristics at baseline, duly fit to the regression models. However, losses to follow-up were similar for most variables, except sex and employment status. Intention-to-treat analyses showed similar results, suggesting that losses to follow-up did not bias the findings of the study. Another possible limitation is the use of a food frequency questionnaire to assess food intake, given that this method depends on the subjects' memory.

With the purpose of promoting healthy foods at school, the Brazilian government included the National School Food Program in the high school curriculum, thereby ensuring a minimum frequency of three weekly portions of fruits and vegetables (200g/student/week)¹⁷. Similarly, the Strategic Action Plan for Combatting Chronic Non-transmissible Diseases proposes combining measures recommended by the School Health Program and the Ministry of Education and Culture in order to stimulate healthy eating and promote sports activities³. The measures employed by the present intervention showed positive results in very different settings, suggesting that relatively simple actions can be effective in improving the eating habits of Brazilian adolescents.

CONCLUSIONS

The present investigation exhibited the promising results of a school-based intervention aimed at improving the food habits of nighttime high school students. The positive effect on healthy (fruits and vegetables) and unhealthy (salty snacks, sweets and soft drinks) food consumption suggests that relatively simple interventions can promote important behavioral changes. Assessment of the large-scale sustainability of these types of interventions, as well as the study of their effectiveness for longer periods may contribute to the implementation and consolidation of measures directed at promoting healthy eating habits in this population.

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