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Original Article

Effect of a School-based Nutrition Education Program on the Nutritional Status of Primary School Children

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ABSTRACT

Background and Objectives: Regarding the high prevalence of unhealthy food habits among Iranian children, we aimed to assess the effect of a school-based nutrition education program on nutritional status of primary school students in Shiraz.

Materials and Methods: This randomized educational controlled trial was carried out on 221 primary school age children selected by cluster sampling in the elementary schools of Shiraz-Iran. The intervention consisted of 6 nutrition education sessions carried out through one year for children, using active learning methods. Mothers' education was carried out in person in both lecture and question-answer sessions also via sending text messages and pamphlets. Weight, height and waist circumference (WC) of children were measured before and after the intervention. Also a 168-item food frequency questionnaire was completed. Two separate nutrition knowledge questionnaires were filled up by children and their mothers. Data were analyzed using SPSS version 16.

Results: 171 children (83 in the case and 88 in the control group), aged 9.5-10.5 years, completed the study. Anthropometric and nutritional knowledge of the participants in both the intervention and control groups was significantly increased. Weight, height, WC and nutritional knowledge increased significantly more in the intervention group compared to the controls. Consumption of fruits and vegetables decreased in the intervention group while plain sugar and fast foods intake increased among the controls. There were no significant differences between the changes in the intake of any of the food groups in the two groups.

Conclusions: In conclusion, the designed nutrition education program could increase students' nutritional knowledge, and lead to a non-significant change towards reducing the consumption of unhealthy foods such as fast foods, sweets and salty snacks.

Keywords: Nutrition education, Nutritional status, Children

Introduction

Increasing the prevalence of childhood overweight and obesity during the last decades has been a major concern both in the developed and developing counties (1). In a systematic analysis, Ng et al. reported that global prevalence of overweight and obesity in children and adults has increased dramatically in the developing countries including Iran during 1980–2013 (2). Obesity is one of the risk factors for non-communicable diseases such as diabetes, dyslipidemia, hypertension and cancers, which their prevalence is nowadays a global problem (3).

Nutrition transition and rapid changes in lifestyle and food choices have led to increased prevalence of overweight and various types of nutritional disorders worldwide (4). Despite the improvement in the

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general health status of Iranian children during the last decades, the prevalence of unhealthy food habits such as consumption of snacks and fast foods with low nutritional value is alarming (5). Results of a national study on students' dietary habits by Kelishadi and coworkers showed that Iranian students consumed a lot of sweets, salty snacks and fast foods, but their daily intakes of fruits, vegetables and dairy products were less than the recommendations which could endanger their health status (6).

Dietary habits are established in childhood (7, 8), and could last for whole life (8). When children have insufficient nutritional knowledge, they would choose their foods based on their preferences without scientific judgment (7). Dietary habits are influenced by several factors including nutritional knowledge (9). Schools are recognized as proper places for nutritional and behavioral interventions because children spend most of their time there (10). Results of nutrition education program in other countries have shown that it could improve nutrition knowledge and dietary habits among the children (11-13). Here, we decided to assess the effect of a school-based nutrition education program on the nutritional status of grade four primary school students in Shiraz, Iran.

Materials and Methods

Study population: This randomized educational controlled trial on nutrition education was carried out on 221 children selected by cluster sampling in the elementary schools of Shiraz-Iran. Two out of four educational districts were selected randomly; then eight schools and one class in each school were selected. Numbers were allocated to the girl and boy schools separately in each district, and then two numbers were selected randomly for each school. Between these two schools, the first randomly selected school was considered as the intervention group, and the second one as the control group. As a result, 4 schools (2 schools for girls and 2 for boys) were allocated as intervention and 4 other schools as the control.

Grade 4 students were chosen because this age group is a bit more independent in food choice decision making, and educational intervention in this age group could be more effective. Also following them would be easier in later years in case of long-term evaluations.

Grade 4 students and their parents participated in this school-based nutrition education intervention. Students with diagnosed chronic diseases such as diabetes, kidney diseases, hyper/hypothyroidism or using any drugs which affect basal metabolic rate, were not included in the study. Those students and parents who had no desire to participate or did not attend in more than one third of the nutrition education classes or did not answer more than 20% of the questionnaire items were excluded.

The Ethics Board of Shiraz University of Medical Sciences, Shiraz, Iran, approved the study protocol (reference number: CT-P- 92-5022). The trial was registered at IRCT as IRCT2014021613080N2.

Sample Size: Sample size was estimated based on a similar study (α=0.05, β=0.2, d=1.9 and δ=2.5) (14). The study was conducted on 221 students but 171 children (83 in the case and 88 in the control group) with the age range of 9.5 to 10.5 years were eligible to be included in data analysis.

Data collection and measurements: After explaining the purpose of the study, written consent was obtained from all participants' parents. Anthropometric indices including weight, height and WC, were measured before and after the intervention. Body mass index (BMI) was calculated as Weight (kg)/Height $(m)^2$. Weight was measured to the nearest 100 gr in light clothing by a digital scale (Glamor, China). Using a non-stretch measuring tape, WC was measured at the narrowest part of the body between the breast and hip to the nearest 0.1 cm. Height was measured barefoot to the nearest 0.1 cm using a non-stretch tape measure.

Socioeconomic status was evaluated using a questionnaire that included parent's education and job, household income, family size, home ownership status and ethnicity.

Nutritional knowledge of children was assessed by a questionnaire consisting of 14 questions. In order to assess the content validity of the questionnaire, 7 experts reviewed the questionnaire to ensure necessity, relevance, clarity and simplicity of the items to calculate Content Validity Ratio (CVR) and Content Validity Index (CVI). CVR for total scale was computed according to Lawshe (15), and the relevance, clarity and simplicity of the items were assessed using Waltz & Bausell's (16) method. Also,

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as a pilot study, 20 students answered the questionnaire. Then the questionnaire's reliability was assessed using Cronbach's alfa ($\alpha = 0.76$).

To further analysis, nutritional knowledge was converted into an ordinal variable as follows: ≥11 suitable, 6-10 medium and ≤5 weak. Food intakes were evaluated by a validated 168-item semi-quantitative food frequency questionnaire (FFQ) (17). All data were gathered via face-to-face interview.

Intervention: Six nutrition education sessions for students and 4 sessions for mothers were held during one year in four intervention schools, using a similar method (Table 1). The content of nutrition education was based on the latest version of "Iranian Dietary Guidelines" and "American Dietary Guideline 2010". Strategies/techniques used in the sessions included, lecture, problem solving, goal setting, games, entertainment and competition, watching nutrition-related animations, making story and targeted snacks. Also, some posters related to the objectives of the nutrition education were hanged to the classes' wall.

Four short (5-10 minutes) animations with nutrition and physical activity content prepared by the National Nutrition and Food Technology Research Institute (NNFTRI) were presented to the students. Then they were asked to write story, draw painting or make wall newspaper about healthy eating, obesity and related topics so they could enroll in a competition. In addition, they were served with some healthy snacks like low salt puffed wheat and soy nuts, raisins, low fat milk, and cheese and cucumber sandwich in the nutrition education sessions. The schools' buffets were also checked, and some healthy food items were suggested to be available for the students use. No training was considered for the control group, except the routine school trainings.

Four nutrition education sessions (each about 2 hours) were considered for the parents. The purpose of these sessions was increasing the awareness of parents about the benefits of healthy eating and physical activity, making them familiar with the program, and convincing them to collaborate with the students at home. Pamphlets and booklets on children healthy eating were prepared for parents, and some nutritional messages were sent to them via text messaging.

Statistical analysis: Data were analyzed using the SPSS software (ver. 19). We assessed the normal distribution of variables using Kolmogorov-Smirnov's test, and nonparametric tests were used for analysis of the variables, which did not have normal distribution. Descriptive results were reported as mean ± standard deviation, percent or frequency. Within group changes of the dependent variables were analyzed by paired t-test. Between group comparisons were assessed using independent samples t-test. P values less than 0.05 were considered as significant.

Table 1. Educational sessions' topics for students and parents

Sessions	Students	Parents
1	Food groups based on food guide pyramid and my plate	Food groups based on food pyramid and my plate
2	Healthy breakfast and dairy products: their benefits, and discussion about barriers	Healthy breakfast and dairy products: their benefits and discussion about barriers
3	Fruits and vegetables, adequate intake, benefits and barriers	Fruits and vegetables, healthy snacks and beverages: benefits and barriers
4	Healthy snacks and beverages: benefits and barriers	Fast foods, obesity and related diseases, reading nutrition facts
5	Fast foods, obesity and related diseases	-
6	Physical activity: benefits and barriers	-

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Results

A total of 171 children (83 in the case and 88 in the control group) were eligible to be included in data analysis. Twenty seven participants in the intervention and 23 in the control group could not complete the study. Reasons of dropouts included changing school, being absent in more than 3 educational sessions, and not completing the questionnaires.

According to Table 3, the anthropometric and nutritional knowledge of participants in both intervention and control group was significantly increased after 1 year. Weight, height, WC and nutritional knowledge increased significantly more in the intervention group compared to the controls. As shown in Table 4, the percent of students in different categories of BMI before and after the intervention shows no difference between the cases and controls.

As illustrated in Table 5, consumption of fruits and vegetables decreased in intervention group also plain. Also intake of sugar and fast foods increased among the controls. There was no significant difference between the changes in the intake of any of the food groups in the two groups.

Table 2. Demographic and socioeconomic statuses of the under study primary school children

	Intervention group (83)			Control group (88)			
	Number (%)	Min-Max	Mean±SD	Number (%)	Min-Max	Mean±SD	P*
Gender							
Girl	42(50.6)			46(52.3)			0.87
Boy	41(49.4)			42(47.7)			
Mother's education (year)							
≤ 5	5 (6.6)			1(1.3)			
6-8	12(15.8)			7 (9.1)			0.08
9-12	23(30.3)			37(45.5)			
≥ 13	36(47.4)			34(44.2)			
Father's education (year)							
≤ 5	3(4.1)			3(4.1)			
6-8	6 (8.1)			4(5.4)			0.57
9-12	23(31.1)			17(23)			
≥ 13	42(56.8)			50(67.6)			
Mother's Occupation							
Housewife	54(65.9)			58(68.2)			
Worker	7(8.5)			3(3.5)			
Employee	17(20.7)			20(23.5)			0.65
Self-employment	2(2.4)			2(2.4)			
Doctor/Engineer	1(1.2)			2(2.4)			
Retired	1(1.2)			0			
Father's Occupation							
Worker	15(18.3)			14(16.7)			
Employee	35(42.7)			40(47.6)			0.40
Self-employment	18(21.8)			19(22.6)			
Doctor/Engineer	9(10.7)			8(9.5)			
Retired	5(6)			1(1.2)			
Family size		2-8	4.18±0.90		2-10	4.12±1.07	0.64
Birth order		1-6	2.12±0.81		1-7	2.15±1.05	0.67
Birth weight(kg)		2-5	3.31±0.61		2-6.25	3.49±0.66	0.21

Abbreviations; SD: standard deviation, Min: minimum, Max: maximum

*Obtained by independent samples t-test for numerical and Chi square test for categorical variables

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Table 3. Anthropometric indices and nutritional knowledge of the participants before and after the intervention

	Intervention group (n=83)				Control group (n=88)				P**
	Before	After	Changes	P*	Before	After	Changes	P*	
Weight (kg)	34.66±9.22	40.39±11.33	5.72±3.06	< 0.001	34.87±7.92	38.93±9.40	4.05±3.16	< 0.001	0.001
Height (cm)	138.57±6.29	144.65±6.96	6.10±1.79	< 0.001	139.02±5.98	144.16±6.28	5.14±1.94	< 0.001	0.001
BMI (kg/m2)	17.87±3.60	19.8±4.13	1.21±1.15	< 0.001	17.92±3.25	18.58±3.60	0.66±1.43	< 0.001	0.007
WC (cm)	67.89±9.64	71.97±9.96	4.08±4.37	< 0.001	65.91±9.34	69.42±9.95	3.50±4.21	< 0.001	0.41
Nutritional knowledge score	9.37±1.84	11.15±1.59	1.78±2.10	< 0.001	9.55±2.11	10.17±2.36	0.61±1.88	0.004	< 0.001

All values are mean±SD, *Paired t-test,**Independent samples t-test
Nutritional knowledge score ≥11 suitable, 6-10 medium and ≤5 weak

Table 4. Prevalence of underweight, normal, overweight and obese students before and after the intervention

	Before			After		
	Intervention group (n=83)	Control group (n=88)	P*	Intervention group (n=83)	Control group (n=88)	P*
Underweight	6.3	3		7.1	6.7	
Normal	64	66.7	0.69	60.7	65.2	0.67
Overweight	17.1	13.1		17.9	12.4	
Obese	12.6	17.2		14.3	15.7	

All values are percent.
Underweight: BMI<5th persentile of CDC, normal: 5≤BMI<85 percentile of CDC, overweight: 85≤BMI<95 percentile of CDC, obese: BMI≥95th percentile of CDC
*Obtained by Chi square test

Table 5. Food intakes of the participants before and after the intervention

	Intervention group (n=83)				Control group (n=88)				P**
	Before	After	Changes	P*	Before	After	Changes	P*	
Fast foods (serving/week)	2.26±2.57	1.87±2.34	-0.05±0.48	0.28	2.96±3.12	2.00±2.67	-0.13±0.48	0.014	0.22
Sweets (serving/week)	6.25±7.51	5.77±7.36	-0.06±1.43	0.66	5.09±4.63	5.92±6.49	0.11±1.06	0.31	0.24
Plain sugar (serving/day)	2.05±1.77	1.96±1.68	-0.08±2.05	0.73	1.48±1.07	2.09±1.28	0.60±1.41	0.004	0.04
Salty snacks (serving/week)	2.61±2.85	1.95±2.55	-0.09±0.49	0.08	2.32±2.99	2.13±2.35	-0.02±0.52	0.63	0.17
Dairy products (serving/day)	2.18±1.06	2.03±1.11	-0.14±1.36	0.34	2.10±1.13	1.80±1.28	-0.29±1.39	0.05	0.46
Fruits and vegetables (serving/day)	3.41±2.19	2.63±1.61	-0.78±2.51	0.006	3.05±1.56	2.73±1.68	-0.32±1.87	0.12	0.18

All values are mean±SD. *Paired t-test,**Independent samples t-test

Discussion

Nowadays, unhealthy nutritional behaviors are increasing, and proper training using modern techniques could be effective in reducing chronic, nutrition-related diseases in the community. A few studies have used active learning techniques in the field of nutrition and health behaviors, which were successful in improving health behaviors (18, 19). Changing nutritional knowledge using active learning techniques was one of the primary goals of our study because knowledge increasing has important role in changing behavior and promoting nutritional knowledge. Active learning strategies have been used to improve learning and behaviors (18, 20).

At the end of the study, nutritional knowledge score was increased in both the intervention and control groups. But it was significant just in the intervention group, which could be the result of our nutrition education program. Increase of nutritional knowledge in the control group could be due to routine educational programs at schools. Other studies have shown that nutrition education interventions could increase nutritional knowledge (13, 21), which is a necessary but not sufficient factor for improving food behaviors (22). Some studies have reported that children's nutritional behaviors are not related to their nutritional knowledge. In Mirmiran et al.'s (23) study, 85% of the adolescents knew the relation between drinking soft beverages and overweight or obesity; however, only 4.5% of them did not drink soft beverages. Also 45% of them consumed crisps and corn balls snacks during their break time although 89% of them knew they are not healthy.

Another goal of the present study was improving healthy eating behaviors. Most of our training program was focused on increasing the consumption of fruits, vegetables and dairy products and reducing consumption of fast foods, sweets and salty snacks. After the intervention, consumption of fast foods, sweets, plain sugars, salty snacks and dairy decreased non-significantly in the intervention group. Intake of

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fruits and vegetables was also significantly reduced unexpectedly. In the control group, intake of healthy foods such as dairy products, and fruits and vegetables was reduced during one year, and that of plain sugar was increased significantly. Llargues et al. (14) found no changes in consumption of fruits, vegetables, dairy products, fast foods, legumes, sweets, rice, and nuts before and after 1-year intervention in primary school students. Similar to our study, they observed some positive trends in the healthy eating of the intervention group, which were not significant. Some other studies also did not observe any differences in healthy nutritional behaviors between the intervention and control groups after the nutrition education intervention (24-26). In previous studies, using behavioral changes models and theories resulted in acceptable changes in children, and their constructs can act as mediators to translate knowledge to behavior (27, 28). These models and constructs can be used in future studies in children to help them changing their behaviors more successfully.

Several factors such as socio-economic factors could affect food habits. Reduction in consumption of fruits, vegetables and dairy products in this study may be attributed to economic issues. In 2013, at the beginning of the study, the inflation rate was reported by the Central Bank of Iran equal to 30.5 percent. While in 2014 (after the intervention), the inflation rate was 34.7 percent (29). The consumer price index reported by the Central Bank of Iran showed that the price index of foods and beverages in 2014 as compared to 2013 had increased substantially to 41.7%. A closer look at food group price index has shown an increase of 24.4%, 49.1%, and 57.8% in the price index for all types of milk, fresh fruits and vegetables, respectively (30). Since the data collection was conducted in autumn and winter, and citrus fruits are the frequently consumed fruits of these seasons, increase in the price index for non-citrus and citrus fruits in 2014 was equal to 44.2% and 68.5%, respectively (30). So the reductions in fruits, vegetables, and dairy consumption after the intervention may be due to their increased price. It seems that despite using modern methods of education for children and parents, our efforts could not be significantly effective. However, we observed a reduction (although non-significant) in the consumption of unhealthy foods among the intervention group, and an increase in the controls, which could be more effective in longer interventions. Certainly, behavior change is a multi-factorial issue and to make appropriate nutritional change in the community, many organizations including agriculture and food industry sectors and the Ministry of Economy and Finance must have close cooperation to have an effective impact on the people's nutritional status. Allocating subsidy on healthy foods such as fruits, vegetables and dairy products during inflation could help achieving or maintaining healthy food habits in the community.

Compared to the beginning of the study, all anthropometric indices such as weight, height, BMI and WC increased after the intervention. Since there was a one year period interval between the two measurements, it seems that the significant increase in anthropometric parameters is due to the children's normal growth. Height, weight and BMI were significantly increased in the intervention group compared to the controls. WC, as an index of central obesity, was not significantly different between the two groups after the intervention. Results of similar studies on anthropometric status are inconsistence. Some studies were successful in improving anthropometric indices (31, 32) but Sichieri and colleagues (33) have shown that even good outcomes in dietary habits were not necessarily accompanied by significant weight changes. Also the results of a review study did not show a clear association between different aspects of children's and adolescents' diet and their weight status (34).

Given the prevalence of short stature in Iran, more increase in the height of children in the intervention group at the end of the study could be resulted from the appropriate food choices among them. In agreement with our findings, Llargues and colleagues (14) reported that educational intervention in primary students was not significantly effective in changing their eating habits but the height was increased more in the intervention group compared to the control group.

According to Warren et al.'s report, many studies have tried to improve eating behaviors among children and adolescents; however, even in the best

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situations, the results were modest (26). Our results also could not lead to considerable success in controlling weight or improving eating behaviors in the target children; this indicates that increasing knowledge alone could not be effective in this regard.

Focusing on more than one nutritional behavior is one of the strengths of this study so the students can choose behaviors that they are more willing to change. Parental involvement, which we considered in our study, is essential for any school based intervention. Using educational techniques and making discussions on behavior change barriers and problem solving in children's and also parents' education sessions are the other strengths of our study. On the other hand, short duration of the study is its main weakness. In conclusion, our trainings could increase nutritional knowledge in students. Despite the increasing rate of unhealthy eating habits in the community and appropriate trend towards reducing the consumption of unhealthy foods such as fast foods, sweets and salty snacks was observed in the intervention group.

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