

Fruit and Vegetable Intakes among Elementary Schools' Pupils: Using Five-A-Day Educational Program

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Abstract

Background: Low fruit and vegetable intake is a major risk factor for cancer, coronary heart disease and stroke. The recommended intake of five portions per day would reduce death rates from these causes by 20%. In order to have reach fruit and vegetables in daily diet among students, this study examines a brief preventive intervention as for embedding schools action and students role for keeping and promoting fruit and vegetables consumption.

Methods: To promote increased fruit and vegetable consumption, this quasi-experimental study, was conducted among fourth and fifth grade students (228 students: Intervention and control groups) in Hamadan, Iran from October 2007 to February 2008. The intervention consisted of behavioral curriculum in classrooms, serving fruit in the school, and parental support plus involvement. 24-hour and 1-week food recalls measured food consumption.

Results: Compared with controls, the intervention group significantly increased their knowledge of the 5-a-day optimum ($P < 0.001$) and also it was found visible improvement for consumption of fruit and vegetables but it was not significant based on adjusted by the Holmes- Bonfereroni procedure.

Conclusion: School-based interventions can produce important changes in knowledge of and access to fruit and vegetables among students. However, educational programs need to advocacy for providing fruit and vegetables in each community.

Keywords: *Fruit, Vegetable, Nutrition, Healthy Diet, Iran*

Introduction

Diets rich in fruit and vegetables are associated with a lower risk of chronic diseases (1,2) and there is substantial evidence that low fruit and vegetable intake is a major risk factor for these and other non-communicable diseases. Fruit and vegetables have a significant protective effect against cancer of the bowel, stomach and breast (3). The risk of coronary heart disease (CHD) and stroke is also sharply reduced by a higher fruit and vegetable intake (4,5).

Based on the evidences, US health authorities recommend a minimum of 5 servings of

fruit and vegetables a day (6,7), and the World Health Organization (WHO) recommends a daily intake of at least 400 g fruit and vegetables (8,9), defined as at least five 80 g portions of a variety of fruit and vegetables(9).

Methods to monitor changes in the intake of fruit and vegetables related to the US 5 a Day Campaign have been suggested and discussed (10-12). The 5 a Day for Better Health Program was established in 1991 as a nutrition education campaign designed to increase awareness of the need to consume more vegetables and fruit, and to increase

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average vegetable and fruit consumption in the United States to 5 or more daily servings (13). The Norwegian Nutrition Council now recommends 5 servings of potatoes, vegetables, fruit, berries, and juices per day, corresponding to a total intake of 750 g/day, and a national campaign has been initiated to increase consumption (14).

During the 2004-05 school years, the Mississippi Department of Education Child Nutrition Program initiated the Mississippi Fresh Fruit and Vegetable Pilot Program. The program was designed to increase 1) knowledge of student about fresh fruit and vegetables, 2) the degree of student preference for fruit and vegetables, and 3) fruit and vegetable consumption. The results of this evaluation suggest that the distribution of fresh fruit at school free of charge to secondary school students might be an effective component of a comprehensive approach for improving students dietary behaviors; however, distribution of fresh vegetables might be more effective with changes in program implementation. One large study has found a 4% reduction in CHD risk and a 6% reduction in stroke risk with each one portion increase in fruit and vegetable consumption (15). Others have demonstrated a significant fall in blood pressure with rising fruit and vegetable intake (16, 17). Besides the decrease in mortality, increased fruit and vegetable consumption has been associated with improved control in long-term conditions such as asthma (18), chronic obstructive pulmonary disease (19), diabetes (20), reduction in obesity (21), and cataract development (22).

Overall, it has been estimated that eating five portions per day would reduce mortality from cancer, CHD and stroke by 20% (23). Indeed, in the case of cancer, the evidence indicates that increasing fruit and vegetable intake to five portions daily is the second most effective prevention strategy after smoking cessation (24).

A high fruit and vegetable intake will help to modify overall diet by increasing fiber and reducing fat and sugar intake, and will contribute towards weight reduction. Fruit and vegetables also contain a plethora of essential vitamins and minerals as well as non-nutritive bioactive constituents such as phyto-oestrogens and other phyto-chemicals. Many of these are also antioxidants, which may reduce the risk of cancer and other chronic diseases by destroying free radicals in the body (25).

Although diets high in fruit and vegetables are associated with decreased risk for many chronic diseases (14), consumption of fruit and vegetables among children is below recommended levels (15). Despite the proven benefits of five a day program, UK consumption falls considerably short of the recommendation with only 13% of men and 15% of women achieving five a day. Average intake for men is 2.7 portions, and for women 2.9 portions. The average decreases significantly with age and the number achieving five a day approaches zero in adults aged 19–24. Consumption is also considerably lower in lower socio-economic groups (2.1 and 1.9 portions, respectively, in men and women on state benefits compared with 2.8 and 3.1 portions in those not on benefits) (26). It is not found any study about five a day consumption pattern in Iran. Many factors will combine to influence an individual's likelihood of achieving five a day. These include nutritional knowledge, awareness of the health impacts of different foods, attitudes to health promotion messages, skills and confidence in buying, preparing and serving fruit and vegetables, accessibility of shops selling good quality food, the perishability of fresh fruit and vegetables, and income (27).

Based on abovementioned background, a brief fruit and vegetable consumption educational intervention deployed in schools and among pupils to investigate whether a

school-based educational program would lead to a significant increase in the overall fruit and vegetable consumption among 5 grade children as an important factor for having healthy diet habits.

Materials and Methods

Participants and procedures

This quasi-experimental study was performed on elementary school students in Hamadan, southwest Iran in 2007 with approval from the relevant university research committee. For respecting ethical considerations, research group explained clearly process of research to director of educational area and then they permit to research group to perform project and coordinated all of process with students and their families. All participants were selected from 1st district area in the Hamadan. Eight schools were chosen based on randomized selection. These schools were then randomly assigned to an intervention group or a control group (four schools as intervention and four as control groups). The sample consisted of 228 students who participated in this study with the average age of 11. The age range of students was between 10 and 12 yr. The intervention was delivered in the fifth grade classes from October 2007 to February 2008. At first, diagnostic evaluation was performed and the designed questionnaires were completed by the pupils in their classrooms in the presence of a trained project worker who guided the pupils through the dietary assessment component (24 h recall and 1 wk) of the survey. Two months after "five a day" educational program in the intervention group, impact and outcome evaluation were done. Attrition rate for this study after outcome evaluation was calculated 15.1%.

Demographics

Background data collected in this research included age, gender, parents' job and liter-

acy, number of family members, and order of birth.

Students' knowledge of importance of fruit and vegetables

A structured questionnaire was developed by the researchers to measure knowledge about importance of fruit and vegetables. Pupils' knowledge was gauged about role of fruit and vegetables for prevention of disease ("e.g. dose eating five kinds of fruit and vegetables prevents cancer?") and about amount of fruit and vegetables consumption ("e.g. dose eating one apple or orange per day protect us against disease?"). In this questionnaire, twenty items were designed to assess the pupils' knowledge about importance of fruit and vegetables. Responses to items were yes/no and I do not know. The knowledge score was estimated by totaling the number of correct answers for all 20 items. A reliability coefficients was calculated for the knowledge scale ($\alpha = 0.78$) and these demonstrated high internal consistency.

Fruit and vegetable intake

A written 24-hour and 1-week fruit and vegetable recall were used to assess pupils' fruit and vegetable intake. The 24-hour and recall was read aloud to the pupils by a project worker. Fruit and vegetable intake in the previous day and week was recorded for school days (i.e. the survey was conducted on weekdays Tuesday through Friday). The pupils recalled the types of fruit and vegetables they ate at the different periods in household measures (e.g. 1 apple, 12 grapes) or in portions (e.g. one portion of mixed green salad). The household measures were coded into portions per day, and one portion was set at 80 g [ranging from 65 g (one carrot) to 105 g (one apple/one orange)]. more over repetition of fruit and vegetables consumption was gauged by using a written 1-week fruit and vegetable recall questionnaire.

Intervention

School-based intervention research to promote fruit and vegetable intake has consisted largely of multicomponent interventions included a classroom behavioral curriculum component, and a food service environmental component that this study focused on classroom behavioral curriculum component for promoting fruit and vegetable consumption related behaviors. The classroom curriculum component typically focused on increasing students' knowledge, developing behavioral skills, and increasing motivation to choose fruit and vegetables. The curriculum was based on WHO recommendations, Iranian dietary habits, and pattern of consumption of fruit and vegetables. The curriculum was delivered in five sessions over a 2-month period. The pupils received an introduction to the health benefits of eating fruit and vegetables and recommendations regarding healthy levels of fruit and vegetable intake. In addition, each session started by having the pupils prepare fruit and vegetables for consumption during the sessions as snacks. A number of small-group activities included taste testing (preferences) and information concerning fruit and vegetables about quality, taste and availability in their local areas. During the events, various fruit and vegetable dishes were served for pupils.

Data analysis

All statistical analyses were performed using version 11.0 of the statistical software package SPSS (SPSS Inc., Chicago, Illinois, USA) and an alpha level of .05 for knowledge about importance of fruit and vegetables. The significance level for multiple comparisons was adjusted by the Holmes-Bonfereroni procedure (28).

Results

The sample was 101 students as intervention (44.6% female, and 55.4% male) and 117

students as control group (53% female and 47% male). Based rate results showed that it was not found significant difference for mean knowledge score about importance of vegetables and fruit for intervention group (\bar{x} :12.92, SD:2.48) in comparing control (\bar{x} :12.72, SD:2.79) before implementing interventional program (t :0.507, P = 0.612). Whereas, after intervention there was significant difference for knowledge score about importance of vegetables, (\bar{x} :19.95, SD:3.07) for intervention group versus (\bar{x} :12.89,SD:2.91) for control (t :9.969, P < 0.001).

As shown in the Table 1, there were no base rate differences for consumption of citrus, banana, vegetables, cucumber, tomato, carrot, cabbage, and lettuce for 1-week fruit and vegetable recall based on routine dietary intake of people who are living in the Hamadan's urban population before interventional program.

Changes in the consumption of fruit and vegetables from baseline to end-point and follow-up are shown in Table.2. However, it was found noticeable improvement for consumption of fruit vegetables but based on Holmes- Bonfereroni procedure it was not found significant difference in 1-week fruit and vegetable recall consumption for large part of fruit and vegetables. In general, there were large variations in baseline level of consumption of citrus, banana, natural fruit juice, vegetables, cucumber, tomato, carrot, cabbage, and lettuce after preventative five a day educational programs.

Table 1: Consumption of fruit and vegetables before intervention

consumption		Intervention group(n=101) n (%)	Control group(n=117) n(%)	X ²	d.f	Sig
Citrus	Never	9(8.9)	11(9.4)	0.607	3	0.645
	1-2 times	26(25.7)	35(29.9)			
	3-4 times	34(33/7)	35(29.9)			
	Every day	32(31/7)	36(30.8)			
Banana	Never	21(20.8)	25(21.4)	2.010	3	0.931
	1-2 times	47(46.5)	52(44.4)			
	3-4 times	25(24.8)	33(28.2)			
	Every day	8(7.9)	7(6)			
Vegetables	Never	19(18.8)	10(8.5)	3.675	3	0.081
	1-2 times	45(44.6)	53(45.3)			
	3-4 times	25(24.8)	34(29.1)			
	Every day	12(11.9)	20(17.1)			
Cucumber	Never	15(14.9)	15(12.8)	0.806	3	0.381
	1-2 times	39(38.6)	41(35)			
	3-4 times	30(29.7)	37(31.6)			
	Every day	17(16.8)	24(20.5)			
Tomato	Never	35(34.7)	33(28.2)	1.986	3	0.327
	1-2 times	42(41.6)	49(41.9)			
	3-4 times	15(14.9)	25(21.4)			
	Every day	9(8.9)	10(8.5)			
Carrot	Never	36(35.5)	41(35.6)	0.292	3	0.863
	1-2 times	41(40.6)	51(43.6)			
	3-4 times	15(14.9)	15(12.8)			
	Every day	9(8.9)	10(8.5)			
Lettuce	Never	33(32.7)	28(23.9)	2.96	3	0.371
	1-2 times	38(37.6)	54(46.2)			
	3-4 times	19(18.8)	19(16.2)			
	Every day	11(10.9)	16(13.7)			
Cabbage	Never	55(54.5)	59(54.5)	2.440	3	0.212
	1-2 times	36(35.4)	40(34.2)			
	3-4 times	7(6.9)	9(7.7)			
	Every day	3(3)	9(7.7)			

Table 2: Consumption of fruit and vegetables after intervention

consumption		Intervention group(n=84) n(%)	Control group(n=101) n(%)	X ²	d.f	Sig
Citrus	Never	2(2.4)	16(16)	8.796	3	0.032
	1-2 times	38(45.2)	30(30)			
	3-4 times	12(14.3)	28(28)			
	Every day	32(38.1)	26(26)			
Banana	Never	6(7.1)	24(24)	3.021	3	0.082
	1-2 times	36(42.9)	32(32)			
	3-4 times	24(28.4)	34(34)			
	Every day	18(21.4)	10(10)			
Vegetables	Never	10(11.9)	10(10)	1.098	3	0.023

Table 2: Continued ...

	1-2 times	32(38.1)	22(22)			
	3-4 times	22(26.2)	30(30)			
	Every day	20(23.8)	16(16)			
Cucumber	Never	6(7.1)	22(22)	10.031	3	0.002
	1-2 times	28(33.3)	46(46)			
	3-4 times	34(40.5)	28(28)			
	Every day	16(19)	4(4)			
Tomato	Never	10(11.9)	26(26)	5.247	3	0.023
	1-2 times	38(45.2)	50(50)			
	3-4 times	20(23.8)	16(16)			
	Every day	16(19)	8(8)			
Carrot	Never	20(23.8)	46(46)	7.234	3	0.061
	1-2 times	28(33.3)	34(34)			
	3-4 times	14(16.7)	10(10)			
	Every day	22(26.2)	10(10)			
Lettuce	Never	6(7.1)	26(26)	7.355	3	0.007
	1-2 times	30(35.7)	44(44)			
	3-4 times	22(26.2)	20(20)			
	Every day	26(31)	10(10)			
Cabbage	Never	26(31)	44(44)	6.795	3	0.066
	1-2 times	24(28.6)	26(26)			
	3-4 times	14(16.7)	24(24)			
	Every	20(23.8)	6(6)			

Discussion

The results presented in this paper show that a school-based five a day interventional programs, was effective in increasing schoolchildren's knowledge and intake of fruit and vegetables. The results of this evaluation suggest that the fruit and vegetable educational program might have helped to increase the variety of fruit and vegetables ever eaten by students. The program also has increased the awareness of students about eating fruit and vegetables. Kearney et al. (29) state that the prescription for fruit and vegetables linked explicitly to key five a day messages could serve as a model for embedding public health action in primary care. In addition, they reported that a significant improvement in awareness about vegetables and fruit importance, which indicates five a day educational program, was implemented well. Indeed, the adjusted data show a significant association between message awareness and increased daily vegetable and fruit consumption (29). Other

research has shown that awareness and knowledge of dietary recommendations are significant predictors of change (30,31) and that parental knowledge as well as awareness of the need to consume more vegetable and fruit are independent predictors of children's fruit intake (32). Moreover the results for comparing children pre-post 1-week food recalls showed that the number of serving fruit and vegetables used per day increased specially for consumption of citrus, banana, natural fruit juice, vegetables, cucumber, tomato, carrot, cabbage, and lettuce after the intervention.

In conclusion, educational programs help to insight the importance of the fruit and vegetables consumption but there are environmental and economical factors can threat five a day programs. Based on this fact, it might be suggested that the distribution of fresh fruit at school free of charge to elementary school students by governments might be an effective component of a comprehensive approach for

improving student dietary behaviors especially among poor population with low intake of fruit and vegetables.

Study Limitations

One limitation of this study was that the findings were based on self-reported information obtained from a short vegetable and fruit screener questionnaire. Second, although the 24 h measure is the most appropriate method to collect information, the 1-week measure was used that could increase the probability of recall bias in this study.

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