ORIGINAL ARTICLE

Promoting fruit and vegetable consumption among students: a randomized controlled trial based on social cognitive theory

Arash Najimi,[1] Mohtasham Ghaffari[2]

Abstract

Objective: To assess the effectiveness of an educational intervention based on social cognitive theory on increasing consumption of fruit and vegetable among Grade 4 students.

Methods: The randomised study was conducted in Isfahan, Iran, during 2011 and comprised 138 students, who were randomly divided into intervention and control groups. Data was collected at the beginning and three months after the intervention. A self-administered questionnaire based on constructs of social cognitive theory and food consumption was used. Theory-based nutrition education was imparted on the intervention group. Data was analysed using SPSS 15 and appropriate statistical tests.

Results: The intervention group had 68 (49.27%) subjects, while there were 70 (50.72%) controls. After the intervention, mean scores of behavioural capability ($p<0.001$), self-efficacy in difficult situations ($p=0.04$), self-efficacy in selecting fruits and vegetables ($p=0.01$), social support ($p=0.03$), and observational learning ($p=0.002$) had significantly improved in the intervention group. Nutritional behaviour also showed significant improvement on mean daily intake of fruits and vegetables in the intervention group ($p<0.001$).

Conclusion: Intervention based on social cognitive theory led to increase in the consumption of fruits and vegetables among students, which confirmed the efficiency of social cognitive theory for such interventions.

Keywords: Fruit and vegetable consumption, Social cognitive theory, Education, Students. (JPMA 63: 1235; 2013)

Introduction

Fruits and vegetables (F&V) represent an important component of diet. Studies point to the crucial role of adequate F&V consumption in preventing chronic diseases such as cardiovascular diseases, cancers, diabetes and obesity. Global reports published in 2000 showed that 2.7 million deaths and 1.8% all diseases worldwide could be attributed to inadequate F&V intake.[1]

Regarding formation of nutritional habits in childhood and continuance of safe nutritional habits in adulthood, adequate F&V consumption in children's diet is vital.[2] Studies have shown that conducting interventions in children can influence their safe behaviour such as nutritional habits. Moreover, middle of childhood (7 to 12 years age) is the period when a child must receive nutrients for growing rapidly in adolescence. Thus, the importance of child's nutrition becomes more than ever.[3] Safe nutritional patterns in childhood cause enhancing well-being level and strength of mental activities. In addition, they prevent problems and complications such as anaemia, obesity, digestive disorders, and tooth decay in the short term, and chronic and dangerous diseases in the long term.[4] In spite of recommendations about F&V consumption in 6-11-year-old children, researches indicate low levels of F&V intake in this age group.[5] Different factors affect F&V consumption in children such as access, taste, parental control, F&V consumption by parents (one of the strong determinants), children's knowledge and belief about positive effects of F&V consumption, role modelling, and exposure to F&V types.[6]

Health behaviour theories can help in identifying main components of complicated health problems by determining influencing factors on behaviour and providing a context to understand these components and their functions. Social Cognitive Theory (SCT) is an interpersonal theory that is applied for surveying psychosocial effects on behaviour as well as changing behaviour.[7] The theory focuses on mutual interactions of persons, behaviour, and environment. Accordingly, access to F&V among children depends on personality characteristics (e.g. preferences) and external factors (e.g. availability). SCT emphasises that environmental and personal characteristics influence behaviour, and so, this theory is one of the efficient theories for interventions aimed at promoting F&V consumption.[8] There is no SCT-based intervention on record for increasing F&V consumption in Iran. The present study was performed to fill the void, using Grade 4 students as its subjects.

[1]Department of Health Education and health promotion, School of Health, Isfahan University of Medical Sciences, Isfahan, [2]Department of Public Health, Faculty of Health, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
Correspondence: Mohtasham Ghaffari. Email: mohtashamg@yahoo.com

Subjects and Methods

The randomised study was conducted in 2011, comprising Grade 4 students of Region 3 in Isfahan, which is the capital of Isfahan province, and is the third largest city after Tehran and Mashhad in Iran. The sample size was calculated using the formula: n= (Z1 + Z2)2 (S21 + S22) / d2. Therefore, 60 students were required in each of the two groups.

The subjects were recruited by multi-stage sampling method. Due to social, cultural and economic differences among the regions, only one of the five Isfahan instruction and education regions was randomly selected. Due to bureaucratic limitations about the participation of female students, 4 of the 12 boys schools were randomly selected and divided into intervention and control groups. All Grade 4 students of the selected schools participated in the study. All Grade 4 students with personal and parental consent were included. Those students and their parents who did not participate in one educational session were subsequently excluded. The study was approved by the Research Council and Ethics Committee of the Isfahan University of Medical Sciences. Written informed consent was obtained from the parents of all the participants.

Data-collection tools involved a self-designed questionnaire based on SCT: demographic characteristics (7 items), behavioural capability (17 items), outcome expectations (10 items), self-efficacy in difficult situations (10 items), self-efficacy in selecting F&V (4 items), access to F&V (4 items), social support (8 items), observational learning (6 items), and 2 open-ended items related to F&V preferences. The scoring method was: a) behavioural capability; 1 and 0 for true and false answers respectively, b) expectations, self-efficacy in difficult situations, and access to F&V; 1, 2, and 3 score for "I disagree", "I do not have idea", and "I agree" options respectively, c) self-efficacy in selecting F&V, social support, and observational learning; 1, 2, 3, and 4 scores were given to "never", "sometimes", "most times", and "always" respectively. The validity of the questionnaire was established by content and face validity methods. The questionnaire, based on credible sources and books, was sent to five experts. Their views were received for assessing content validity and some of them were incorporated in the questionnaire. In the next stage, the questionnaire was pilot-tested on 20 students who had similar characteristics, but were not part of the present study, for confirming face validity. Any expressed explanation, question and defect of the questionnaire were considered. Internal consistency was done for reliability of the questionnaire (α=0.86).

Besides, a 3-day food record questionnaire was used under parental supervision for assessing nutrition performance of students. For assessing the amount of F&V consumption, the gram of each kind of fruit and vegetable was converted to equivalent servings based on the Food Guide Pyramid.

Nutrition education was imparted on the intervention group: 4 sessions of 60 minutes each over a 4-week period for the students; and 2 sessions of 50 minutes each for parents and teachers. Regarding the presence of students in three different classes, each class received education separately. In order to ensure continuance of education, the content was compiled as a guidebook and distributed among the subjects. Theoretical basis of the educational intervention was SCT which relies on coordination between personality characteristics, behavioural factors and environmental effects (Table-1). The control group did not receive any specific nutritional education. Data of both the groups was collected 3 months after the educational intervention, and was analysed using SPSS 15. T-test was used to compare mean scores of variables between the groups and their mean changes. Paired t-test was used for assessing changes before and after the intervention in each group. In addition, for matching groups in terms of demographic variables, T-test and χ^2 tests were used. The significance level of α=0.05 was considered for all tests.

Results

Of the 138 participants, 130 (94%) completed the study; 63 (48.46%) in the intervention group and 67 (51.53%) in the control group. Four (2.9%), 1 (0.72%) and 3 (2.17%) students were excluded due to non-participation of parents, absence in educational sessions, and incomplete questionnaire respectively. The mean family size of the participants in intervention and control groups was 3.9±0.74 and 4.14±0.94 respectively (p=0.14). In both the groups, students' mothers were mostly housekeepers (n=35; 55.6% vs. n=41; 61.2% respectively) and most fathers were government employees (n=30; 47.6% vs. n=31; 46.3% respectively). The educational status of parents was similar mostly as academic graduates. The results for matching groups, showed no significant difference between them about variables of age, literacy level, and job status of parents (p >0.05).

In the intervention group, significant difference in mean scores of behavioural capability (p <0.001), self-efficacy in difficult situations (p <0.005), self-efficacy in selecting F&V (p <0.001), accessibility (p <0.03), social support (p <0.001), preferences (p <0.001), and observational learning (p <0.001) before and after education was found,

while there was no such difference in the control group. There was no significant difference after the intervention in the mean score of outcome expectation in the experimental group (p <0.12).

Mean changes in constructs of SCT revealed significant increase in the mean score of behavioural capability (p <0.001), self-efficacy in difficult situations (p <0.04), self-efficacy in selecting F&V (p <0.01), social support (p <0.03), and observational learning (p <0.002). About accessibility, significant difference between the groups was not found (Table-2). Before the intervention, F&V consumption was not different between the groups significantly. In the follow-up, mean servings of fruit intake increased in the intervention group (0.37±0.57 serving/day) and decreased in the control group (-0.11±0.95 serving/day). The difference of mean changes between the groups was significant (p <0.001). In the

Table-1: Social Cognitive Theory constructs.

Activity	Aims	Behavioural capability	Expectations	Self-efficacy in difficult situations	Self-efficacy in selecting F&V	Accessibility	Preferences	Social support	Observational learning
Class training of student	Increasing knowledge about consumption of fruit and vegetable	✓	✓						
	Convincing verbally about consumption of fruit and vegetable			✓	✓				
	Using peers' experiences			✓	✓			✓	✓
	Developing skill of preparing fruit and vegetable	✓		✓	✓	✓			
	Providing tastes list of newly used fruit and vegetable						✓		
Training parents and teachers	Emphasis on using fruit and vegetable by children							✓	
	Using social models		✓						✓
	Emphasis on using fruit and vegetable by parents							✓	✓
	Increasing students' access					✓			
	Receiving help of children for preparing fruit and vegetable	✓				✓			✓

Table-2: Social Cognitive Theory constructs at baseline and 3 months after educational intervention.

Variable	Group	Before intervention (Mean ± SD)	After intervention (Mean ± SD)	pvalue	Mean Differences (Mean ± SD)	pvalue
Behavioural capability	Intervention	0.76±0.15	0.82±0.15	<0.001	0.06±0.07	0.001
	Control	0.72±0.20	0.71±0.18	0.86	-0.01±0.08	
Expectations	Intervention	2.61±0.35	2.65±0.25	0.12	0.04±0.12	0.13
	Control	2.67±0.28	2.62±0.25	0.36	-0.03±0.41	
Self-efficacy in difficult situations	Intervention	2.33±0.54	2.61±0.41	0.005	0.27±0.75	0.04
	Control	2.27±0.61	2.26±0.55	0.92	-0.01±0.82	
Self-efficacy in selecting F&V	Intervention	2.25±0.62	2.36±0.55	<0.001	0.36±0.68	<0.001
	Control	2.36±0.55	2.41±0.47	0.59	0.04±0.75	
Accessibility	Intervention	2.44±0.48	2.55±0.33	0.03	0.11±0.43	0.24
	Control	2.48±0.52	2.50±0.36	0.64	0.02±0.45	
Preferences	Intervention	3.60±1.50	4.33±1.01	<0.001	0.73±1.15	0.02
	Control	3.17±1.48	3.37±1.15	0.28	0.19±1.46	
Social support	Intervention	3.29±0.75	3.68±0.34	0.001	0.39±0.88	0.03
	Control	3.23±0.72	3.26±0.59	0.78	0.03±0.98	
Observational learning	Intervention	2.89±0.61	3.43±0.37	<0.001	0.54±0.69	0.002
	Control	2.87±0.73	2.94±0.59	0.61	0.07±1.01	

F&V: Food and Vegetables.

Table-3: F&V consumption in groups at baseline and after intervention.

Variable	Group	Before intervention (Mean ± SD)	After intervention (Mean ± SD)	pvalue	Mean Differences (Mean ± SD)	pvalue
Fruit Serving/d))	Intervention	2.50±0.91	2.87±0.61	<0.001	0.37±0.54	0.001
	Control	2.65±0.82	2.54±0.69	0.38	-0.11±0.95	
	P	0.33	0.005			
Vegetable Servings/d))	Intervention	1.51±0.84	2.27±0.74	<0.001	0.75±0.78	<0.001
	Control	1.56±0.88	1.63±0.70	0.35	0.06±0.58	
	P	0.73	<0.001			

F&V: Food and Vegetables.

intervention group, vegetable intake increased significantly compared to the control group (0.75 ±0.78 vs. 0.06±0/58 serving/day; p <0.001) (Table-3).

Discussion

The study aimed at surveying the effect of SCT-based nutrition education on F&V consumption among Grade 4 students during a 12-week period. Behavioural capability had significant improvement in the intervention group compared to the control group after the intervention. Behavioural capability has been defined as required knowledge and skills for doing behaviour. For the success of health promotion programmes, Bandura deems paying attention to this construct as a crucial factor.[9] Converting complicated nutritional issues to comprehensible and applicable matters for students lead to improvement in their knowledge, skills, and consequently performance. Newell's study showed that educational intervention for increasing only behavioural capability can improve F&V consumption in students.[10] Powers et al, by pointing to strong correlation between nutritional behaviours and knowledge of students (r=0.097, p <0.001), emphased the effectiveness of applying SCT in nutrition education intervention for improving knowledge of students.[11] Blom-Hoffman et al have reported significant increase in knowledge level of 91 students after 5-week educational intervention based on SCT.[12] In the present research, outcome expectation was defined as students' expectations for achieving outcomes due to F&V consumption. Domel et al revealed that outcome expectation is one of the important factors determing F&V consumption.[13] In spite of group education and using peer education and working on subjective norms (involving parents and teachers in the programne), the results showed no significant difference in mean scores of outcome expectations in the intervention group before and after the education. Perhaps, there was the reason that the mean scores of outcome expectations were the highest among all constructs of SCT, and caused insignificant difference on account of nutrition education between the groups. Baranowski et al could change students' outcome expectations by wide scale use of media.[14] Although because of high cost, it was not possible for other studies to use such interventions, but perhaps more educational activities in this aspect could result in significant differences.

Self-efficacy shows person's ability to mould behaviour. In many studies, self-efficacy has been mentioned as one of the important factors regarding F&V consumption.[8] In addition, some researches have reported increased self-efficacy as reason of change in nutritional behaviours.[15] In a study conducted by Reynolds et al, self-efficacy has been nominated as one of important components of SCT in promoting consumption of fruit and vegetable.[16] In the present study, student self-efficacy was considered in two domains: self-efficacy in difficult situations, and self-efficacy for selecting F&V in the presence of other foodstuff such as confiture and fast food. Results after education showed that self-efficacy of students in these two domains improved significantly in the intervention group. It seems that activities such as role playing, developing skill of individuals for picking F&V, verbal persuasion, and using social models had positive effects on students' self-efficacy, and have enhanced students' belief in their ability to select F&V in difficult situations as well as ability to select F&V in presence of other foodstuffs. In Baranowski et al study, using F&V preparation skill development method among primary students improved self-efficacy.[17] Also, in Perry's study, self-efficacy of students in the intervention group increased after verbal persuasion and encouraging students to select F&V.[18] Enhanced self-efficacy has an important role in improving F&V consumption, as Luszczynska et al in their study reported that self-efficacy intervention had effects on F&V consumption as similar as combined intervention (self-efficacy and planned behaviour theory) during a 6-month intervention.[19]

Environmental factors, together with other components of SCT, have a main role in the effectiveness of interventions.[18] Lack of food services in schools had limited the present study about this area of environmental factors. Thus, home and social environments were considered as targets for promoting F&V consumption. Involving parents in the study was a social support source by guiding and educating them to buy and cook food, and to encourage children for preparing F&V. Studies have shown that involving parents leads to improve healthy behaviour among students.[20] Social support of parents along with involving teachers, peers and trainers as other important sources of social support increased significantly the social support level in the intervention group. Although Baranowski et al reported that social support is primarily one of the predictors of accessibility to vegetable at home,[21] but, based on present study findings, in spite of increase in social support, significant change in accessibility was not observed in the intervention group. It seems that the results shall be related to family factors such as cultural and economic.

Among other results, significant improvement was noted in observational learning level of the intervention group 3 months after intervention. The study used parent modelling as observational learning process and behaviour of parents and peers as a motive for similar behaviour in the child. Some studies have recommended that parents, as role models, can influence effectively on nutritional behaviours of children.[22] Pearson's systematic study indicated that encouraging parents can have influential and appropriate effect on children's nutritional behaviours.[23]

Frequency of preferences, as another important factor, increased significantly. Making children familiar with taste of F&V as well as encouraging parents are the main factors that influence students' preferences. Boynton-Jarrett et al showed that using appropriate methods for intended group had important role in changing people's preferences about F&V.[24] Also, a study by Wardle stressed the need to familiarise students with the taste of F&V as a leading factor in improving children's preferences.[25]

The other finding of the study was the significant increase in F&V consumption in the intervention group. Although many studies based on SCT are consistent with the present study in this aspect, but the increase was different in theses studies. Baranowski et al (2002) pointed to 0.8 servings/d increase in fruit group and 0.5 servings/d increase in vegetable group 8 weeks after SCT-based educational intervention among African-American boys.[26] In another SCT-based interventional research of Baranowski among Grade 4 students (2003), 0.52 servings/d increase in fruit consumption and 0.24 servings/d increase in vegetable consumption was reported five weeks after education.[27] Also, Perry et al reported 0.1 servings/d increase in F&V consumption among Grade 3 students of 26 elementary schools 2 years after nutritional intervention.[18] Reported increase in a SCT-based educational study that was done by Reynolds et al on Grade 4 students of 28 primary schools was 1-1.68 servings/d.[28] As it is clear, results of nutrition educational interventions based on SCT have been different. Some of the main reasons for such differences are difference in target groups, components used in SCT, intervention parametres, and duration. Another important factor is data-collection instrument (4-hour food recalls, food record, and food-frequency questionnaires) about the F&V consumption. Moreover, self-reporting method is also a factor that can cause difference in results. Even though in the present study, food record questionnaire was completed under the supervision of parents, but the need to use more objective methods in nutrition education interventions was felt.

This study had several limitations. Consumption of F&V increased in the intervention group, but considering the duration of intervention (12 weeks), evaluation of long-term behaviour change was difficult. However, applying the educational model and involving students' parents in the intervention might ensure the continuance of the results over a longer time. Limited number of participants and self-reporting method in data-collection were the other limitations.

Conclusion

SCT-based nutritional educational intervention led to increase in F&V consumption among the subjects. As such, designing, executing and evaluating of theory-based nutrition educational programmes by health educators and other related professionals is recommended in order to improve F&V consumption among children.

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