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308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorpjn@gmail.com

Effectiveness of Nutrition Education Intervention among High School Students in Tarqumia, Palestine

Farid A.W. Ghrayeb¹, Mohamed A. Rusli¹, Ayesha Al Rifai² and Mohd I. Ismail¹

¹Department of Community Medicine, School of Medical Sciences, Universiti Sains Malaysia, 16150 Kubang Kerian, Kelantan, Malaysia

²UNRWA, Ramallah, West-Bank, Palestine

Abstract: Few school-based interventions have been evaluated to assess health knowledge among high school students in rural southern areas of Palestine. This intervention study was to evaluate the impact of school-based nutrition education intervention on the knowledge of adolescents in a rural Palestinian community to nutrition health issues and to identify sources of nutrition knowledge. It compared adolescents in a two high schools (study group), which received health education on nutrition health with another two high school (control group), which did not receive any. The impact of the program was evaluated with a pre-test baseline knowledge and post-test gain in the knowledge 3 months later, using the same questionnaire. A total of 240 students selected by stratified sampling from each of the two randomly selected schools, a rural community in south Palestine participated in the program. The school-based intervention was effective in increasing health knowledge in the intervention as compared with the control group. The overall mean nutrition knowledge score increased by 1.91 in intervention group (baseline to follow-up: 4.59 to 6.50). The results showed that there was a significant difference ($p = 0.005$) between male and female students in the intervention group at post-test, whereas no significant differences for control group ($p = 0.726$). In contrast, there was no significant difference between scientific and non-scientific stream students in both the intervention and control groups ($p = 0.531$ and $p = 0.337$), respectively. School and media were the two most common sources of nutrition knowledge. Health knowledge of rural Palestinian adolescents can be improved through school-based nutrition education intervention. Further research needs to be conducted to determine the long-term impact.

Key words: Students, nutrition, high school, risk behavior, Palestine

INTRODUCTION

Overweight and obese children and adolescents have increased dramatically in both developed and developing countries (Adair, 2008; Ogden *et al.*, 2006). Rates of obesity have reached epidemic proportions. The potential impact of this epidemic is enormous, given that obesity has been identified as a risk factor for the development of the majority of chronic diseases later in life, such as type 2 diabetes mellitus, cardiovascular disease, certain cancers and psychosocial disturbances resulting from social stigmatization (Manson, 2003; Dietz, 1998). Obesity is listed as one of the ten most important health concerns in the Healthy People 2010 initiative (Hedley *et al.*, 2004).

Contributors to the development of obesity include lifestyle changes and nutritional habits, such as irregular meal patterns; mainly skipping breakfast, consumption of foods and beverages of low nutritional value and sub-optimal intake of dairy products, fruits and vegetables, intake of refined carbohydrates such as sugar-sweetened soft drinks influence the nutritional

patterns that are common to adolescents (Velazquez *et al.*, 2011; Bruening *et al.*, 2011; Deshmukh-Taskar *et al.*, 2010; Boumtje *et al.*, 2005; Frary *et al.*, 2004). Research has shown that poor nutrition or unhealthy dietary behaviors are often prevalent among adolescents, thus placing them at future risk for developing chronic diseases. Therefore, several studies recommend conducting nutrition interventions targeting adolescents to equip them with the necessary nutrition information that will help them develop appropriate nutritional habits (Prell *et al.*, 2005; Velazquez *et al.*, 2011). Adolescents need education about proper nutrition, including limiting fast food intake, adding fruits and salads to their diet. Many teens make their own food and beverage choices and often eat with friends who influence their decisions. Therefore, early education is vital to helping teenagers form healthy nutritional habits and nutrition education as a means of prevention, may offer some hope for combating obesity and thus mitigating the onset of many chronic diseases (Ball and Bindler, 2008).

Studies have provided information on how nutrition education focusing on youth may be most efficacious in advocating for the creation of healthy dietary patterns that will be followed throughout the life of a person (Robinson-O'Brien *et al.*, 2009). Schools have access to a large number of students, therefore, schools can be seen as a suitable place for the implementation of nutrition education and health promotion programs needed in order to promote health in general and specifically for the prevention of chronic diseases (Cohen *et al.*, 2012; Briggs *et al.*, 2003). Schools are a pivot part of the social environment that helps build eating patterns of children (Zenzen and Kridli, 2009).

School-based interventions have shown success in promoting appropriate dietary behaviors in children and adolescents. Previous studies have shown that an increased knowledge, intentions and self-efficacy had a constant impact on healthy choices for food (Abood *et al.*, 2008). In contrast, lack of knowledge about healthy lifestyle behaviors may lead adolescents to gain weight (Rimmer *et al.*, 2007). In addition, some adolescents may not be aware of the health risks associated with poor diet or lack of physical activity (Jobling, 2001). Demonstrated that there is a need for nutrition intervention with adolescents (Neumark-Sztainer *et al.*, 1998). They found that eating behaviors in adolescence might have a notable impact on immediate and long-term health outcomes. There are, however, some major challenges in working with youth to ensure adoption of proper eating habits.

Nutrition education may help increase student nutrition knowledge and develop accurate nutrition attitudes thus promoting change in the behavior of students to decrease the consumption of poor-nutrient high-calorie foods students have from home or that is purchased from available vending machines (Briefel *et al.*, 2009; O'Toole *et al.*, 2007). The nutrition knowledge and attitudes of the students may influence their personal decision to eat healthy foods. Prior to eating healthy foods students must believe that they have the knowledge to select a healthy diet. Unfortunately very little research regarding health disparities among adolescents in Palestinian rural areas has been conducted. The aim of the present study was to evaluate the effectiveness of this intervention to improve nutrition knowledge among high school students in Palestine.

Purpose of study: The purpose of this study was to assess the impact of a classroom-based nutrition education intervention program on the nutrition knowledge of high school students in Tarqumia, Palestine.

MATERIALS AND METHODS

This study took place in February 2012, a rural community in Tarqumia, south Palestine. There are four

secondary (high) schools. The majority of the adolescents are in school. This intervention study compared the intervention group, which received health education on nutrition health and a control group, which did not receive any. The study was done in three phases: (1) The pre-intervention phase, when a baseline study was done on both control and study groups using a questionnaire to assess their level of knowledge on nutrition health, (2) The intervention phase, when a 5 lessons classroom-based were organized by the researcher for the study group on nutrition, (3) The post-intervention phase, when the same questionnaire used earlier was used to evaluate their knowledge on the same subject 3 months after the intervention program. Permission for the study was obtained from the Palestinian Ministry of Education and the content of the health education discussed with them, as well as, with the local co-supervisor. The students were also assured of confidentiality and the teachers were not allowed into the venue of the test.

A G-power calculation was performed prior to the beginning of the study and indicated that at least 108 students in the intervention group and 108 in the control group is required with 92% power to detect a significant difference ($p < 0.05$) in nutrition knowledge between the two groups, the researcher enlarged the sample size to 240 to allow for loss of subjects. The final sample consisted of 240 students ($n = 120$ for intervention; $n = 120$ for control).

The researcher employed a stratified random sampling with grades, gender and stream of education track selected proportional to enrollment size and size of students in classes (proportional allocation), then simple random sampling without replacement was applied. All students in selected classes are eligible for participation and surveys can be administered during one regular class period. Questionnaires were completed in 4 public high schools with an overall response rate of 98%. Four questionnaires were excluded and discarded because they were incomplete. A pre-tested self-administered questionnaire consisting of three sections: (1) Demographic data, (2) their knowledge of nutrition health and (3) their source of health knowledge, was administered to the students. The data were analyzed using SPSS version 20 computer software. The independent *t*-test, two-way ANOVA and two-way repeated measures ANOVA were used to calculate difference in knowledge.

Intervention program: The intervention comprised nutritional value of whole versus processed foods and the types of nutrients and food sources including carbohydrates, protein, fats and cholesterol. These topics were taught in the context of healthy eating practices and the prevention of chronic diseases and over consumption of nutrients and its association with the risk of developing chronic diseases by using several

sources. The lessons were developed and delivered by the researcher and were reviewed by the thesis local co-supervisor in Palestine before being presented to the participants. Lesson structure delivered to participants followed the same format in all five lessons. The following is the format used: (1) Materials: Lesson plans, brochures, handouts, PowerPoint and visuals (fat, CHO, Protein, fruits and vegetables). (2) The lessons contained material on the contents and benefits of the food groups, MyPyramid Guidelines, health effects of low nutrient density foods; simple versus complex carbohydrates; saturated versus unsaturated fats; importance of eating fruits and vegetables.

Primary outcome-health knowledge: The primary outcome measure was health knowledge assessed using the "Health Knowledge Inventory (HKI)" health knowledge questionnaire. This questionnaire includes 25 items used for high school students; these items include a number of demographic to characterize students, nutrition knowledge and source of nutrition knowledge. The score on this questionnaire was expressed as percentage correct (e.g., the number of questions answered correctly out of 10 questions).

Secondary outcome measures: In addition to knowledge, we sought to identify the sources of nutritional knowledge among the students. They were asked to circle where they received their nutritional information from a list of choices that included father, mother, sister, brother, peer, relative, school, personal reading, media and internet.

RESULTS

Subject characteristics: A total of 236 students participated both in the pre-test and post-test study. There were 60 females and 60 males in the control group, while the intervention group had 60 females and 56 males. Stream of education track distribution of participants by school were 44 (37.9%) scientific and 72 (62.1%) non-scientific in the intervention school; control school, 45 (37.5%) scientific and 75 (62.5%) non-scientific. The mean age of the students was 16.9 years (range 16-18 years), with both gender and stream of education track almost equally distributed.

Health knowledge: Table 1 shows the pre- and post-intervention respondents' knowledge about nutrition. Knowledge of nutrition health problems is defined in terms of the ability of the respondents to correctly answer the nutrition health issue in question.

Of the 240 students studied, 236 (98.3%) completed the self-administered health knowledge questionnaire both at baseline and post intervention. There was a significant ($p < 0.001$) improvement in the overall nutrition health knowledge of the students in the intervention schools after the intervention. Their mean score at baseline was 4.59 (95% CI: 4.30, 4.88) and it increased to 6.50 (95% CI: 6.14, 6.88) after the intervention (Table 2).

Significant difference ($p = 0.005$) by gender was detected in health knowledge as a result of the intervention in the intervention school, with 5.18 (4.80, 5.57) for male and 5.96 (5.57, 6.34) for female; whereas, there was no significant difference (0.726) by gender in the control group, with 4.65 (4.24, 5.07) for male and 4.76 (4.34, 5.18) for female (Table 3).

Table 1: Socio-demographic characteristics of the respondents (n = 236)

Characteristics	Intervention group (n = 116)		Control group (n = 120)	
	No. of students (n)	(%)	No. of students (n)	(%)
Age (years)				
16	35	30.2	36	30.0
17	63	54.3	64	53.3
18	18	15.5	20	16.7
Gender				
Male	56	48.3	60	50.0
Female	60	51.7	60	50.0
Stream of education track				
Scientific	44	37.9	45	37.5
Non-scientific	72	62.1	75	62.5
Grade in school				
11th	116	100.0	00.0	0.00
12th	00.0	0.00	120	100.0
Total	116	100.0	120	100.0

Table 2: Nutrition knowledge of high school students before and after the intervention^a

Health area	Intervention school (n = 116)			Control school (n = 120)		
	Pre-intervention	Post-intervention	p-value	Pre-intervention	Post-intervention	p-value
Nutrition ^b	4.59 (4.30, 4.88)	6.50 (6.14, 6.88)	<0.001	4.72 (4.42, 5.01)	4.62 (4.33, 4.92)	0.115

^aData are mean and confidence interval

^bSignificant difference in intervention vs. control school over time, $p < 0.05$

Table 3: Nutrition knowledge of high school students before and after the intervention based on gender and stream of education track

Health area	group	Intervention			Control		
		Mean (95%CI)	F statistic	p-value	Mean (95%CI)	F statistic	p-value
Based on Gender , intervention (n = 116, male 56 and female 60), control (n = 120, male 60 and female 60)							
Nutrition	Male	5.18 (4.80, 5.57)	8.05	0.005	4.65 (4.24, 5.07)	0.12	0.726
	Female	5.96 (5.57, 6.34)			4.76 (4.34, 5.18)		
Based on stream of education track , intervention (n = 116, 44 scientific, 72 non-scientific), control (n = 120, 45 scientific, 75 non-scientific)							
Nutrition	Scientific	5.66 (5.23, 6.08)	0.40	0.531	4.85 (4.38, 5.32)	0.93	0.337
	Non-scientific	5.48 (5.15, 5.82)			4.56 (4.20, 4.92)		

Table 4: Sources of Knowledge regarding nutrition for the respondents (N = 236; males = 116, females 120)

Source of health knowledge	Health area nutrition			Total
	Strongly agree	Agree		
Father	54 (22.9)	51 (21.6)		105 (44.5)
Mother	93 (39.4)	51 (21.6)		144 (61.0)
Brother	54 (22.9)	61 (25.8)		115 (48.7)
Sister	84 (35.6)	54 (22.9)		138 (58.5)
Peer	42 (17.8)	41 (17.4)		83 (35.2)
Relatives	36 (15.3)	28 (11.9)		64 (27.1)
School	69 (29.2)	84 (35.6)		153 (64.8)
Personal reading	69 (29.2)	65 (27.5)		134 (56.8)
Media	86 (36.4)	59 (25.0)		145 (61.4)
internet	82 (34.7)	42 (17.8)		124 (52.5)

For more explanation, further comparison was done based on stream of education. From test of within-group based on stream of education, there were no significant differences between scientific and non-scientific students in both the intervention ($p = 0.531$) and control ($p = 0.337$) groups (Table 3). Regarding source of nutrition knowledge, the results showed that, the most common sources of nutrition knowledge in rank order were father 96 (40.7%) and relative 94 (39.8%), while the least common sources were school 69 (29.2%) and personal reading 69 (29.2%) (Table 4).

DISCUSSION

According to our knowledge, this is the first study that evaluates the effectiveness of school-based nutrition education in increasing health knowledge among adolescents in Palestine.

Overall, our intervention was effective in increasing the health knowledge of high school students and these findings suggest that the intervention was delivered successfully. The objective of this study was to assess reported nutrition knowledge of male and female students in the control and intervention group pre- and post-intervention. Participants in both, the control and the intervention groups, took that same test at baseline and both groups displayed similar results which were of a mean score of 46.4%. The finding of this study is consistent with the results from the previous study, in which student's nutritional knowledge was at 47.6% and showed no improvement throughout the students' schools years (Brook and Tepper, 1997).

After the conclusion of the nutrition education lessons from the *compelling the challenge* program, the

students in the intervention group had significantly higher ($p < 0.001$) nutrition mean knowledge score compared to control group. The students in the intervention group significantly ($p < 0.001$) increased their own nutrition knowledge from pre-test to post test.

In contrast, students in the control group failed to increase their own nutrition knowledge from pre-test to post-test, the results revealed that, there was no significant differences ($p = 0.259$) in nutrition knowledge within the control group on post-test.

Additional comparison revealed that, both male and female students participating in the nutrition education lessons from the *compelling the challenge* program increased their nutrition knowledge scores from pretest to post test, with significant differences ($p = 0.005$) between male and female students in the intervention group on post-test. For control group, both male and female students failed to improve their nutrition knowledge scores from pretest to post test. Therefore, there was no significant difference ($p = 0.726$) in nutrition knowledge between male and female in the control group on post-test.

Another comparison based on stream of education in high school revealed that, there was no significant differences ($p = 0.531$) in nutrition knowledge between scientific and non-scientific students in the intervention group on post-test. Also, no significant difference ($p = 0.337$) between scientific and non-scientific students in the control group was found on post-test.

The positive results obtained from this study can be attributed to the well-designed nutrition lessons that the participants were exposed to during the intervention. The participants were not only exposed to the materials, but

they were engaging in group discussion, given brochures and given materials to take with them and use as study tools and reference materials.

The results of current study are consistent with other previous studies. In an evaluation of a nutrition education intervention program in fourth through sixth graders Willeford *et al* found that all students had significant increases from pre- to post-intervention (Willeford *et al.*, 2000).

Other studies that randomized students into treatment and control groups, found a significant increase in nutrition knowledge in treatment groups compared to control groups (Powers *et al.*, 2005; Robertson and Zalles, 2005; Kelder *et al.*, 2005).

Based on this approach-compelling the challenge, it was possible to conclude that school-based nutrition education is effective in increasing the adolescents' knowledge, regardless of the intervention components. This result produces important scientific evidence for national and international school policies regarding poor nutrition knowledge management. All efforts to increase nutrition knowledge in children and adolescents must be considered because these issues prevent or reduce overweight and obesity, which decrease the risks of type II diabetes, cardiovascular diseases, certain cancers and other chronic diseases (Juonala *et al.*, 2011).

Recommendations: It is also important to have more interventions that focus on how to help adolescents so that their nutritional patterns can follow dietary guidelines. This study's results also demonstrate that schools play an important role when disseminating nutrition information to adolescents and therefore Ministry of Education should place more attention in the nutrition education students are receiving in order to cooperate with public health interventions that target adolescent nutrition.

Key points:

- Adolescents in the southern rural area of Palestine are at increased risk for overweight and obesity
- Health knowledge and dietary awareness is poor in these adolescents
- Simple interventions and partnerships between education and health systems can be beneficial in increasing school health
- Education interventions can be beneficial in increasing school students' health knowledge
- Comprehensive school-based interventions are needed for maximum effectiveness

Conflict of interest: The authors declare that they have no conflicts of interest.

Conclusion: Our intervention was effective in increasing the health knowledge of high school students. To

summarize, results found by this study suggested that reported nutrition knowledge appears to increase in male and female student participants after being exposed to a nutrition education intervention program. Value and interest of information presented and possibility of sharing information learned from the nutrition lessons with peers and family members were also found.

The school environment provides an excellent opportunity for intervention, given that most children will spend a significant portion of their time in the school setting. The result of this investigation showed that while small-scale interventions may provide some improvement in health knowledge, more comprehensive interventions are needed for maximum benefit. Information obtained during this investigation has now been used to help in the design of future school-based interventions in other rural areas of Palestine.

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