Evaluation of a School Program Aimed at the Prevention of Obesity in High School Girl Students: A Theory Based Intervention Study

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Abstract: This paper describes the development, application and evaluation of a school based intervention to prevent obesity in high school girl students aged 13-14 years. In addition, the efficacy of three different behaviors which prevent obesity was assessed. Children aged 13-14 years (n 154) were recruited from four high schools in Shahr-e-kord city and randomly allocated to a control group or intervention group: Physical Activity, fruits & vegetables consumption and Sugar free-sweetened Beverages consumption. The setting for the interventions was schools. The intervention lasted for 12 weeks. Knowledge, Attitude and diet and physical activity were assessed at baseline and at the end of the intervention. Significant improvements in nutrition and physical activity knowledge were seen in all students (p < 0.001) between baseline and post-intervention, Overall, fruit and vegetable intake increased significantly (p < 0.001 and <0.001, respectively), also Sugar free-sweetened Beverages consumption increased significantly (p < 0.001). Physical activity in students increased significantly (p<0.001). This study has demonstrated that school may be a suitable setting for the promotion of healthy lifestyles in children and adolescents, but requires replication in other social settings. Future initiatives should be long-lasting, multi-faceted and sustainable, involving all children in a school and should goal the whole environment and be behaviorally focused. The final goal of any such program is to lead to positive behavior change which will have a useful effect on long-term health.

Key words: Education · Physical Activity · Fruits & vegetables consumption and Sugar free-sweetened Beverages consumption

INTRODUCTION

The prevalence of chronic or non-communicable disease is escalating much more speedily in developing countries than in industrialized countries. According to World Health Organization estimates, by the year 2020, non-communicable diseases will account for approximately three quarters of all deaths in the developing world [1]. Obesity is a major risk factor for chronic disease [1]. Evidence indicates that excessive weight gain in the first years of life can alter developing neural, metabolic and behavioral systems in ways that increase the risk for obesity and chronic disease later in life [2,3] Specifically, childhood and adolescent obesity is a precursor to type-2 diabetes, cardiovascular disease, hypertension, stroke, osteoarthritis, asthma and certain cancers [2,3] As such, many reports have projected that childhood-onset obesity will contribute significantly to
increased morbidity and mortality in adulthood [4]. In 2005 the American Medical Association (AMA), in collaboration with representatives from 15 national health care organizations, convened an expert committee to revise and develop updated recommendations for the evaluation and treatment of child and adolescent obesity. The purpose of the expert committee was to provide practical advice and guidance to clinicians and other health professionals in all areas of obesity prevention and treatment.

Key lifestyle behaviors the committee identified as being necessary for obesity prevention efforts included consuming no more than one sweetened beverage per day, consuming 5 servings of fruits and vegetables per day, engaging in at least 60 minutes of moderate to vigorous physical activity (MVPA) per day and limiting screen time activities to no more than 2 hours per day [6].

A potential emerging public health concern in developing countries is likely to be the increasing incidence of childhood overweight, which in the future is likely to create an enormous public health burden [7]. Despite the high and increasing prevalence of obesity in Iran, little attention has been paid to examination of the influential factors of obesity among students. In a Qualitative study by Farahmand and et al taste and food preferences, High cost of healthy foods and … have been reported as being associated with Lack of fruit and vegetable consumption and … [8]. In this study, constructs of the Health Belief Model (HBM), including perceived susceptibility of Obesity, perceived severity of Obesity, perceived benefits of consuming no more than one sweetened beverage per day, consuming 5 servings of fruits and vegetables per day, engaging in at least 60 minutes of moderate to vigorous physical activity (MVPA) per day and limiting screen time activities to no more than 2 hours per day, perceived cost (barriers) and self-efficacy, have been assessed. The HBM is one of the most widely used health behavior model that has been used extensively to organize theoretical predictors of preventive health actions. The HBM is a method used to evaluate and explain individual differences in preventative health behavior [9, 10].

The objective of the present study was to develop, implement and evaluate a school based intervention to prevent obesity in adolescents aged 13-14 years.

**MATERIALS AND METHODS**

**Subjects and Ethical Approval:** 154 students (aged 13-14 years) from four high schools in Shahr-e-kord were targeted in 2014.

**Inclusion Criteria:** School girls in the age range of 13 to 14 years.

**Exclusion Criteria:** School girls with over 15 year are old, suffering from chronic diseases, difficult diseases, disability and student's reluctance in continuing the participation in the study.

The method of sampling was convenient sampling as follows: four high schools were selected from two educational areas of Shahr-e-kord, The participants were recruited randomly from these high schools; this means that Using Attendance List, Each student was given a code. Then, the samples were randomly selected from code.

After obtaining permission from the shahid Beheshti University of Medical Sciences and Presentation to the provincial education, the researcher entered the schools. The researcher presented information about the voluntary participation, the purpose of the study, the content of the questionnaire, and questionnaire data confidentiality. The students were permitted to leave if they were not interested in participating in this study.
Intervention: The intervention lasted for 7 weeks. Students were randomly allocated to one of two groups: three intervention groups or a control group. Each intervention group lesson was designed to last for a 40-60-min period, had an interactive approach and was behaviorally focused. The intervention program developed was based on Health Belief Model and incorporated the following elements:

- An individual’s assessment of his or her chances of getting the disease
- An individual’s judgment as to the severity of the disease
- An individual’s conclusion as to whether the new behavior is better than what he or she is already doing
- An individual’s opinion as to what will stop him or her from adopting the new behavior
- Personal belief in one’s own ability to do something
- A brief outline of the program per intervention and control group is given below.

Fruits and Vegetables Education: In the first term, children’s concepts of health were explored through their drawings and then a link was made to food contributing to health, provided a variety of food was eaten. In the second term, fruit and vegetables were promoted using tasting sessions. To students were taught that Low consumption of fruits and vegetables have been associated with poor diet quality and is considered one of the most common risk factors for the development of chronic diseases. Also to students were taught that:

- Identify four basic types of fruits.
- Identify five basic types of vegetables.
- Identify the amount of fruits and vegetables children should eat each day.
- Explain benefits of eating 5 servings of fruits and vegetables per day.
- Explain to parents and friends why eating 5 servings of fruits and vegetables per day is important.

Sugar Free-sweetened Beverages Education: In the first term, to students were taught that the consumption of added sugars has increased in recent decades among children and adolescents. Added sugar includes sugar and syrups that do not naturally occur in foods and are added during processing and preparation. The largest contributor to the intake of added sugars has been from sugar-sweetened beverages in the second term, to students were taught that:

- Define sugar-sweetened drinks
- List various examples of them.
- Define sugar-free drinks
- List various examples of them.
- Identify the food label on various drink containers
- Identify ‘Sugars’ on given food labels.
- Explain benefits of choosing sugar-free drinks and water instead of sugar-sweetened beverages.
- Explain to parents and friends why having sugar-free drinks and water instead of sugar-sweetened beverages is better.

Physical Activity Education: The physical activity program was designed to promote activity in daily life rather than the promotion of specific leisure pursuits, which would not be accessible to everyone. Using insects as a theme, the concepts of energy and activity were explored in the first term. The promotion of activity in the playground and a reduction in television viewing were specifically addressed in the second and third terms, using team games, fun physical activities and quizzes. Also, to students were taught that:

- Define physical activity.
- List various examples of physical activities.
- Identify the appropriate amount of physical activity children should engage in everyday (at least 60 minutes).
- Explain benefits of being physically active for at least 60 minutes per day.
- Explain to parents and friends why having at least 60 minutes of physical activity every day is important.

Control Group: For ethical reasons it was considered essential to provide the students in this group with an educational program. Students learnt about food in a non-nutrition sense. The topics covered were food traditions, food in different countries and food processing. On alternate weeks, students learnt about the human body, using an interactive CD and Booklet Training. Students had an activity book, which had a related homework.

Assessments: All assessments were made at the initial stage, post intervention and two month follow-up. The data gathering instrument was a four-part questionnaire; one part was used to obtain the demographic characteristics of the participants and two parts were self-made questionnaire health belief model based that included: knowledge (α=0.71), perceived threat (perceived susceptibility (α=0.71) and perceived severity (α=0.79)), benefits of Physical Activity (α=0.73), benefits of fruits &
vegetables consumption ($\alpha=0.69$), benefits of Sugar free-sweetened Beverages consumption ($\alpha=0.70$), barriers of Physical Activity ($\alpha=0.76$), barriers of fruits & vegetables consumption ($\alpha=0.81$), barriers of Sugar free-sweetened Beverages consumption ($\alpha=0.75$) and self-efficacy of Physical Activity ($\alpha=0.76$), self-efficacy of fruits & vegetables consumption ($\alpha=0.72$), self-efficacy of Sugar free-sweetened Beverages consumption ($\alpha=0.71$) and healthy behavior action for obesity prevention, three parts was FFQ questionnaire and four parts was physical activity questionnaire.

The scoring method of the questionnaire in the knowledge part was 1 score for each correct answer and 0 for each wrong answer, and in the perceptions part the score range of each question varied from 0 to 4, so that "completely disagree" scored 0, "disagree" 1, "I have no idea" 2, "agree" 3 and "completely agree" scored 4. The scale scores of knowledge, attitude and practice were calculated out of 100. Assessment of the validity of the above-mentioned questionnaire was conducted through face and content validity; thus, the questionnaire was provided given reliable articles and sources and for assessment of content validity was given five experienced professors in various areas (Health education and promotion, Nutrition, Statistics and Epidemiology) and was reviewed by the researchers and a number of the views and comments applied in the questionnaire. Reliability coefficient involved calculating (Cronbach's alpha) (was assessed on 30 students) and the desired score was =0.7, which indicates very good reliability.

### Statistical Analysis

Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS16). Data are presented as frequencies, means and standard deviations. Prior to statistical analysis, the normality of the data was tested using the Kolmogorov-Smirnov statistic. Between-group comparisons were made using analysis of variance (ANOVA). The independent sample t-test and paired t-test were used to investigate differences between baseline and final data. Repeated Measured ANOVA was used in two groups in pre, post and follow-up in each group (with the level of 95% confidence).

### RESULTS

A total of 154 students were randomly allocated to one of two intervention groups or the control group. Fruits & vegetables consumption and Sugar free-sweetened Beverages consumption knowledge scores improved in all students between baseline and final stage.

Most students walked to and from school but a sizeable proportion of students reported travelling by car (40-52%). At the final stage there were small increases in the number of students walking to and from school in all groups. An increase in activity in the playground at morning break was reported in intervention group and was higher, compared with the control group. Table 1 compares the 2 groups mean scores in knowledge and in the HBM domains of perceived susceptibility and perceived severity before, immediately after and two month after the intervention. Table 2 compares the 2 groups mean scores in perceived barriers, benefits and self-efficacy about Fruits & vegetables consumption before, immediately after and two month after the intervention.

Table 3 compares the 2 groups mean scores in perceived barriers, benefits and self-efficacy about Sugar free-sweetened Beverages consumption before, immediately after and two month after the intervention and Table 4 compares the 2 groups mean scores in perceived barriers, benefits and self-efficacy about
### Table 2: Comparison of means scorers of the students’ perceived benefits, barriers and self-efficacy about Fruits & vegetables consumption in the 2 groups studied pre, post and follow up intervention.

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Experimental group (N=77)</th>
<th>Control group (N=77)</th>
<th>R.M.ANOVA Test Results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-test Mean (SD)</td>
<td>Post-test Mean (SD)</td>
<td>Follow up Test Mean (SD)</td>
</tr>
<tr>
<td>Perceived benefits</td>
<td>45.06 (18.18)</td>
<td>80.00 (9.70)</td>
<td>79.92 (10.83)</td>
</tr>
<tr>
<td>Perceived barriers</td>
<td>37.79 (18.75)</td>
<td>70.26 (14.55)</td>
<td>68.91 (13.60)</td>
</tr>
<tr>
<td>Perceived self-efficacy</td>
<td>38.31 (19.74)</td>
<td>41.77 (18.56)</td>
<td>40.03 (13.60)</td>
</tr>
</tbody>
</table>

* = Repeated Measured ANOVA test result: significant difference between the groups.

### Table 3: Comparison of means scorers of the students’ perceived benefits, barriers and self-efficacy about Sugar free-sweetened Beverages consumption in the 2 groups studied pre, post and follow up intervention.

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Experimental group (N=77)</th>
<th>Control group (N=77)</th>
<th>R.M.ANOVA Test Results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-test Mean (SD)</td>
<td>Post-test Mean (SD)</td>
<td>Follow up Test Mean (SD)</td>
</tr>
<tr>
<td>Perceived benefits</td>
<td>45.94 (19.49)</td>
<td>84.82 (10.21)</td>
<td>82.92 (10.81)</td>
</tr>
<tr>
<td>Perceived barriers</td>
<td>46.18 (16.13)</td>
<td>65.50 (15.76)</td>
<td>64.91 (14.60)</td>
</tr>
<tr>
<td>Perceived self-efficacy</td>
<td>44.80 (22.06)</td>
<td>46.75 (16.39)</td>
<td>45.03 (15.60)</td>
</tr>
</tbody>
</table>

* = Repeated Measured ANOVA test result: significant difference between the groups.

### Table 4: Comparison of means scorers of the students’ perceived benefits, barriers and self-efficacy about physical activity in the 2 groups studied pre, post and follow up intervention.

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Experimental group (N=77)</th>
<th>Control group (N=77)</th>
<th>R.M.ANOVA Test Results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-test Mean (SD)</td>
<td>Post-test Mean (SD)</td>
<td>Follow up Test Mean (SD)</td>
</tr>
<tr>
<td>Perceived benefits</td>
<td>42.79 (19.97)</td>
<td>81.88 (7.86)</td>
<td>80.65 (9.45)</td>
</tr>
<tr>
<td>Perceived barriers</td>
<td>40.14 (16.83)</td>
<td>72.89 (1.17)</td>
<td>70.91 (11.60)</td>
</tr>
<tr>
<td>Perceived self-efficacy</td>
<td>36.93 (19.80)</td>
<td>35.53 (21.99)</td>
<td>35.03 (20.54)</td>
</tr>
</tbody>
</table>

* = Repeated Measured ANOVA test result: significant difference between the groups.

### Table 5: Comparison of the students’ Behaviors for obesity prevention in the groups studied during pre, post and follow up intervention.

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Pre-test Mean (SD)</th>
<th>Follow up Mean (SD)</th>
<th>Paired t-test P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruits consumption</td>
<td>1.37 (0.700)</td>
<td>1.70 (0.619)</td>
<td>0.000*</td>
</tr>
<tr>
<td>Control group</td>
<td>1.40 (0.584)</td>
<td>1.41 (0.581)</td>
<td>0.282</td>
</tr>
<tr>
<td>T-test</td>
<td>0.766</td>
<td>0.008*</td>
<td>0.000*</td>
</tr>
<tr>
<td>vegetables consumption</td>
<td>1.43(0.755)</td>
<td>1.75(0.659)</td>
<td>0.000*</td>
</tr>
<tr>
<td>Control group</td>
<td>1.50(0.836)</td>
<td>1.51(0.837)</td>
<td>0.277</td>
</tr>
<tr>
<td>T-test</td>
<td>0.576</td>
<td>0.038*</td>
<td>0.000*</td>
</tr>
<tr>
<td>Beverages consumption</td>
<td>2.20(0.752)</td>
<td>1.79(0.795)</td>
<td>0.000*</td>
</tr>
<tr>
<td>Control group</td>
<td>2.10(0.833)</td>
<td>2.09(0.805)</td>
<td>0.382</td>
</tr>
<tr>
<td>T-test</td>
<td>0.438</td>
<td>0.020*</td>
<td>0.000*</td>
</tr>
<tr>
<td>Physical activity</td>
<td>157.69 (80.18)</td>
<td>210.26 (79.91)</td>
<td>0.000*</td>
</tr>
<tr>
<td>Control group</td>
<td>158.22 (70.35)</td>
<td>157.25 (68.47)</td>
<td>0.443</td>
</tr>
<tr>
<td>T-test</td>
<td>0.965</td>
<td>0.000*</td>
<td>0.000*</td>
</tr>
</tbody>
</table>

*=significant difference between the groups
physical activity before, immediately after and two month after the intervention. The R.M.ANOVA test indicated that for each of the HBM domains the differences among the two groups were significant at before, immediately after and two month after (p<0.001). Tables 5-8 respectively shows the health action taken related to the Fruits consumption, vegetables consumption, Sugar free-sweetened Beverages consumption and physical activity of the 2 groups before and two month after the intervention.

**DISCUSSION**

The purpose of a study includes the assessment of feasibility, efficacy and acceptability, which in turn will lead to a decision on whether or not to pursue a particular approach. This is a valuable study for the Iran, which has used the school setting in an innovative way to promote diet and/or physical activity. Although a clear intervention program effect was not apparent as a result of this study, the potential of school as a suitable setting for the promotion of healthy lifestyles in students was demonstrated.

In this study, 154 high school female students from Shahr-e-kord fully cooperated with the researchers. The situation of experimental and control groups had been equal in their priority of the students in the family and their total number, the job and education of mother and father. In the first phase, there was no significant difference between two groups regarding: individual perceptions about susceptibility, severity, benefits and barriers of Obesity.

The results of present study showed that prior to intervention; all elements of HBM (perceived susceptibility, perceived severity, perceived benefits, perceived barriers and perceived self-efficacy) were below average in two groups. After intervention, participants in experimental group had significant improvement for behavior assessed; while students of control group showed a slight change, this supports our hypothesis that a health education program based on HBM can be effective in promoting the adoption of behaviors by adolescent girls to prevent Obesity.

Studies have identified several basic educational needs in participants, which increase their knowledge and change their intention to promoting preventive behaviors about obesity. Knowledge of individuals about obesity significantly increased after intervention in experimental group. The findings of this study are consistent with the researches’ results of Warren [11], Mauriello [12], Annesi [13], Bran scum & Kaye [14], Frenn [15], Wang [16], Ruyter [17], Kipping [18], Horne [19] and Simon [20].

Given the prevalence of obesity and the associated morbidity and mortality, it is important to increase Knowledge of obesity and encourage adoption of behaviors that help to prevent this condition, as opposed to waiting until the onset of the disease. The results of the study showed educational intervention focused on obesity prevention is ideally suited to reach these goals of increased Knowledge, perceived susceptibility, severity, barriers and benefits and adoption of prevention-oriented behavior.

The baseline level of fruit consumption was higher than that reported in the NDNS (National Diet and Nutrition Survey). The modest rise in fruit and vegetables consumption seen in the experimental group. This may also suggest that the change might not be the result of a seasonal effect. The food frequency data was collected in varying months for the different phases of recruitment: January-February for baseline data and March-April for final stage data. Other programs that have targeted an increase in fruit consumption have found similar levels of increase by Baranowski [21], Niklas [22] and Reynolds [23].

Based on findings about the performance of students related to Beverage consumption, decrease in sugar Beverage consumption seen in the intervention group. Beverage consumption behaviors were found to impact body weight status in children and adolescents and therefore they should become a goal for the prevention of childhood and adolescent's obesity. According to the accessible evidence, numerous interventions that aim for the adjustment of beverage consumption patterns seem to be hopeful in the treatment and prevention of childhood and adolescent's overweight and obesity. The replacement of sugar-containing soft drink by water or other no caloric beverages can be recommended as one behavioral target. Intervention measures should consider educational components together with environmental changes for a sustainable adjustment of children’s individual beverage consumption. School-based programs were shown to be effective in improving beverage consumption patterns in children and adolescents by increasing water consumption and reducing sugar-containing beverages. Thus, schools as well as other institutions for full-time care may become an important setting for beverage interventions to prevent obesity starting in early childhood and adolescents. Based on findings about the performance of students related to physical activity, rise in physical activity seen in the intervention group.
The results of the ultimate quiz, which all students in the relevant year groups undertook, showed that the program had been delivered and understood in an acceptable manner.

Limitations of and lessons from, the current study are outlined as follows: 1. the duration of the study was not adequate to see any significant anthropometric changes or changes in the trends of overweightness or obesity; 2. assessments of diet and physical activity may not have been sensitive enough; 3. For expediency the interventions were carried out in each of the four schools, which may have led to contamination between groups; and 4. The students recruited to this study were likely to be biased towards those from families of higher socio-economic classes and/or interested in health.

CONCLUSION

This study has demonstrated the potential of school as a suitable setting for the promotion of healthy lifestyles in students. The study resulted in knowledge improvements and meaningful rises in Physical Activity, fruits & vegetables consumption and Sugar free-sweetened Beverages consumption. This intervention, which involved the cooperation students, was feasible but not sustainable in the short-term.

Following a single and combined physical activity and nutrition approach is valuable. Any such initiative should emphasis on the whole school environment and be behaviorally focused, which is the viewpoint of the new and innovative Health Promoting Schools initiative. Perfectly, the broader community should also be targeted. The design of a future study should be randomization at a school level with cautious matching of schools, including schools with students from a broader range of ethnic and socio-economic families. Future studies of this type should be of adequate period to empower changes in anthropometry to be detected and long-term follow up is vital.

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