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Effects of Tailored Health Education Program on Overweight Elementary School Students' Obesity-Related Lifestyle: A School-Based Interventional Study

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ABSTRACT

Objectives: Overweight and obesity are regarded as one of the most serious health and nutrition issues worldwide. This is immediately recognizable in both children and adolescents. In this study, we aimed to determine the effects of tailored education on lifestyle modification in elementary school students in Isfahan. ***Methods***: In a quasi-experimental study, two elementary schools in Isfahan District 3, Iran, were randomly selected to determine the intervention and comparison groups. Subsequently, 32 students from each school, 64 in total, were chosen arbitrarily and included in the study. They filled out the standardized questionnaire of physical activity and dietary behaviors before the intervention. Following one and four months' educational intervention, they were asked to complete the questionnaires once more. ***Results:*** The average general lifestyle score, one and four months after education, was significantly different between the groups ($p < 0.001$). However, this difference was not significant before the intervention ($p = 0.660$). Furthermore, the average lifestyle scores related to nutrition and physical activity one and four months after education showed a significant difference between the groups ($p < 0.001$). ***Conclusions:*** Providing overweight elementary school students with education about a healthy lifestyle improves their general lifestyle and reduces weight. Therefore, it is recommended that such interventions are applied to prevent complications associated with being overweight in children.

The World Health Organization (WHO) has declared overweight and obesity as a major factor in developing or exacerbating most diseases decreasing quality of life, and a serious health issue.[1] Metabolic factors including hormonal changes, as well as genetic factors, milieu, and nutrition all affect overweight.[2,3] According to studies performed in the field of epidemiology, obesity predisposes individuals to numerous diseases. Obese people are more likely to be afflicted with myocardial infarction, sudden death, metabolic disorders, insulin resistance and diabetes, high blood pressure, hyperlipidemia, coronary heart disease, and certain types of cancer.[4–6] Living a healthy lifestyle contributes to maintain and enhance people's health and wellbeing. People should adopt a healthy lifestyle and health habits during the embryonic stage. This will inhibit diseases, improve quality of life, increase life expectancy, and enhance physical and mental health.[7] According to statistics by the National Health and Nutrition Center of America, approximately 13% of children aged 6–12 years are overweight, which could be a consequence of unhealthy lifestyle habits.[8] Studies demonstrate that there is a close relationship between overweight in childhood and adulthood. Lifetime physical activity and dietary habits are formed during the very first years of life.[9] Poor habits could seriously endanger the health 6–12 year olds, regarded as a vulnerable age group, and expose countries to overweight and obesity epidemic over the next two decades.[8]

According to statistics by the WHO, the number of overweight and obese people worldwide is expected to reach one billion.[10] Research by Dorosty et al,[11] on Iranian children between the ages of two and five revealed that the prevalence of obesity using body mass index (BMI) was considerably higher than expected at 6.4% and 8% in 2–3 and 4–5 year olds, respectively. Results of the study by

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Ramezankhani et al,[12] on 360 adolescent boys and girls from Tehran demonstrated that the prevalence of overweight and obesity was 10.7% and 5.1% among boys, and 18.4% and 2.8% among girls, respectively. It was also indicated that the prevalence of overweight and obesity in the studied adolescents was equal to the prevalence reported about same-sex with Americans in the third National Health and Nutrition Examination Survey.[12] The prevalence of overweight and obesity observed in this study is more than the previous studies in Iran, which could be due to a real increase in the prevalence of overweight and obesity among adolescents or different cutoff points for the BMI.[12] Among major factors behind the increase in the prevalence of obesity among children and adolescents are increased intake of fatty food, decreased in physical activity, and increased sedentary activity. In addition to biological factors, cultural factors, such as knowledge, attitudes, and dietary behaviors, also play an important role in causing obesity.[13] It is much easier to shape and change behaviors in childhood than in adulthood.[14,15] Interventions focused on reducing obesity prevalence among young children and adolescents may be particularly important because the risk of adult obesity is increased markedly if one is obese during adolescence.[16]

Several studies have assessed the risk factors of obesity and the effectiveness of the interventions to prevent them.[17–19] The latest Cochrane revision evaluated the interventions for preventing obesity in children and concluded that there is enough evidence of the effectiveness of physical activity intervention in children from six to 12 years old to prevent obesity.[20] Schools are a potentially important channel of intervention because they offer access to large populations of students and provide the opportunity to institutionalize programs in communities; however, limited school-based research has focused on reducing obesity among adolescents. School-wide interventions among adolescents, in contrast, have not focused on reducing obesity but rather on reducing cardiovascular risk and have demonstrated little impact on obesity.[21] Moreover, due to regular and ongoing contact with children in educational environments and schools, one could have a more effective role in enhancing their health.[3] Although there are numerous obesity treatment methods, the best is prevention through an education healthy lifestyle and behavioral change programs.[22,23] It is through childhood that fixed behavior patterns are carried on to adulthood. It would be most effective to carry out educational interventions during this period to prevent high-risk behaviors and unhealthy life habits.[24,25] Considering the significance of preventing overweight and obesity among children, the importance of developing a healthy lifestyle and the potential of educational environments, it would be better to employ age-appropriate educational methods to achieve higher effectiveness. No previous education has used educational animations and role-plays sufficiently in this age group in Iran, our stude utilised these techniques. This study was conducted with the aim of determining the effectiveness of an educational intervention in modifying the lifestyle of overweight elementary schoolboys in Isfahan District 3.

METHODS

We conducted a quasi-experimental study interventional, in Iran from October to December 2015. The population included elementary school boys in Isfahan District 3. There were 10 similar schools for boys in the area. Stratified multistage random sampling was used and the 10 schools were considered different classes. Two schools were chosen randomly, of which one was randomly designated the intervention group, and the control group. Initial investigations indicated that there were sufficient subjects in both schools. A total of 64 overweight students in the fourth, fifth, and sixth grades were selected based on student's numbers using systematic random sampling. The sample size was at least 32 students in each group according to the following equation:

Comparing the mean of two groups

$$n = 2 [\{z_{(1-\alpha/2)} + z_{(1-\beta)}\} \sigma/\Delta]^2$$

n = sample size
α = type I error, usually 0.05–1.96
β = type II error, usually 0.20–0.841
σ = standard deviation pool
Δ = the smallest difference of variables between the two groups

Male students in the fourth, fifth, and sixth grades between the 85th and 95th weight percentile, following no particular diet, and suffering from

no diseases such as rheumatic heart disease, type 1 diabetes, or hypothyroidism, for which particular medications are prescribed by doctors and who both parents' and students' gave consent were included in the study. Students who were absent for one session, submitted an incomplete questionnaire, used specific medication such as steroids, became ill during the project causing the participant to not follow the recommendations were excluded from the study.

Data were collected using a questionnaire, consisting of two sections. The first section included demographic data and the second posed lifestyle questions pertaining to nutrition and physical activity. The questionnaire had 22 questions. It was designed according to a 5-point Likert-type scale ranging from "never" to "always." In each question, as well as the whole questionnaire, a higher score represented a higher lifestyle level. Depending on whether it was positive or negative, each question was scored between 0 and 4. The positive questions from "never" to "always" were respectively scored from 0 to 4. The negative questions from "always" to "never" were also respectively scored from 0 to 4. The total score was determined and the domains of nutrition and physical activity were scored from 0 to 100 using the change-of-variables technique. The questionnaire applied in this study was validated by Rahimi et al,[26] in Iran. The validity of the questionnaire was confirmed by applying the face validity and content validity methods, and after gathering feedback from 10 professors of nutritional sciences and pediatric nursing as well as carrying out necessary modifications. The reliability of the questionnaire was assured using the test-retest method and after performing a pilot study using 10 children ($r = 0.900$).[27]

The objectives of the study were explained to teachers, parents, and students in one session and informed consent of students' participation in the study was obtained. The students in the intervention andcomparison groups received and completed the questionnaires and their BMI was measured. A four session education (each lasting 60 minutes) over four consecutive weeks was provided for the intervention group by health education specialist with the aim of improving their physical activity and dietary behaviors [Tables 1 and 2].

Before the educational sessions, trainers were informed and educated about the content. Both groups were supplied with the questionnaires once more one- and four-months subsequent to the last session. Their BMI was measured four months after the educational intervention.[27] After the training sessions, all educational content expressed during a session for the control group. The collected questionnaires were entered into SPSS statistics

Table 1: Aims and strategies used in the educational sessions to improve dietary behaviors.

General aims	Strategies
1. To define overweight and obesity.	Lectures, pamphlets, education packages, and question and answer sessions.
2. To name the complications of overweigh and obesity.	Lectures, pamphlets, posters, boards and markers, education packages, and question and answer sessions.
3. To explain the significance of a good diet.	Lectures, pamphlets, posters, boards and markers, education packages, question and answer sessions, and educational films (animations).
4. To discuss the body's requirement of the food groups.	Lectures, pamphlets, posters, demonstrations with real food samples, educational films (animations), scenarios and role-plays, education packages, and question and answer sessions.
5. To explain the ways of attaining fitness.	Lectures, pamphlets, posters, boards and markers, educational films (animations), education packages, and question and answer sessions.
6. To understand the concept of calorie.	Lectures, pamphlets, educational films (animations), education packages, and question and answer sessions.
7. To understand the significance of balance in energy intake and consumption.	Lectures, pamphlets, posters, educational films (animations), education packages, and question and answer sessions.
8. To discuss the body's requirement of the main food groups according to food shares.	Lectures, pamphlets, posters, demonstrations with real food samples, educational films (animations), scenarios and role-plays, education packages, and question and answe sessions.
9. To discuss benefits of fruits, vegetables, and dairy products.	Lectures, pamphlets, posters, demonstrations with real food samples, educational films (animations), scenarios and role-plays, education packages, and question and answer sessions.

Table 2: Aims and strategies used in the educational sessions to improve physical activity.

General aims	Strategies
1. To define overweight and obesity.	Lectures, pamphlets, posters, education packages, and question and answer sessions.
2. To name the complications of overweight and obesity.	Lectures, pamphlets, posters, boards and markers, education packages, and question and answer sessions.
3. To explain the significance of physical activity and exercise in a few lines.	Lectures, pamphlets, posters, educational films (animations), education packages, and question and answer sessions.
4. To mention the ways of improving health with exercise.	Lectures, pamphlets, posters, boards and markers, educational films (animations), education packages, and question and answer sessions.
5. To mention the ways of achieving exuberance and cheerfulness with exercise.	Lectures, pamphlets, posters, educational films (animations), education packages, and question and answer sessions.
6. To explain their personal exercise programs.	Lectures, posters, demonstrations, and question and answer sessions.
7. To imitate the exercise regimens properly.	Lectures, posters, demonstrations, and question and answer sessions.
8. To name five characteristics of a normal exercise program.	Lectures, pamphlets, posters, boards and markers, educational films (animations), education packages, and question and answer sessions.
9. To mention five benefits of taking exercise.	Lectures, pamphlets, posters, boards and markers, educational films (animations), education packages, and question and answer sessions.
10. To explain warm-up, workout, and cool-down as elements of an exercise program.	Lectures, pamphlets, posters, educational films (animations), demonstrations, education packages, and question and answer sessions.
11. To explain the exercise regimens.	Lectures, pamphlets, posters, educational films (animations), demonstrations, education packages, and question and answer sessions.

(SPSS Statistics IBM Corp., Armonk, NY) version 20.

In each group, the Mann-Whitney and chi-square tests were employed to determine the status of demographic variables and also the analysis of variance test, with repeated observations, was used to compare the averages of the scores of the variables on three occasions. The averages of the scores of the variables between the groups on three occasions were compared using the independent *t*-test.

This study was reviewed and approved by the Institutional Review Board of Isfahan University of Medical Sciences (IRB no: 393731). The principal investigator explained the purpose and the procedures of the study to the participants, and that they could withdraw from the study. Written informed consent was provided by all of the participants.

RESULTS

A total of 64 students were included in this study. The average age of the students in the intervention and comparison groups was 10.4±1 and 10.8±1 years, respectively. The independent *t*-test indicated that the average age between the two groups was not statistically significant ($p = 0.710$). Most parents were university educated. The majorty of fathers were employed, and mothers were mostly house wives. In general, there were no significant differences between the intervention and comparison groups in terms of parents' formal education and career [Table 3].

Education had a considerable influence on the average nutrition scores. The average scores in the intervention group increased from 60±14.8 before the intervention to 75.6±13.2 one month after the intervention and 75.2±12.9 four months after the intervention [Table 4]. Moreover, the results of physical activity demonstrated that the average score in the intervention group rose from 56.1±17.3 before the intervention to 74.5±11.4 one month after the intervention and 74.1±11.6 four months after the intervention.

The average general lifestyle score in the intervention group rose from 58.1±12.9 before the intervention to 75.1±10.4 one month after the intervention and 74.7±10.5 four months after the intervention [Table 4]. The averages of the scores did not changed significantly in any dimensions of

Table 3: Demographic results of the studied subjects.

Variables	Intervention group		Control group		*p*-value
	n	%	n	%	
Fathers' formal education					
Diploma	6	18.2	8	22.9	0.642*
University	27	81.8	27	77.1	
Mothers' formal education					
Elementary	0	0.0	1	2.9	0.325*
High school	0	0.0	1	2.9	
Diploma	9	27.3	11	31.4	
University	24	72.7	22	62.9	
Fathers' careers					
Unemployed	0	0.0	1	2.9	0.533**
Self-employed	16	58.5	14	40.0	
Employee	17	51.5	19	54.3	
Teacher	0	0.0	1	2.9	
Mothers' careers					
Housewife	21	63.6	22	62.9	0.371**
Employee	6	18.2	10	28.6	
Teacher	6	18.2	3	8.6	

**Mann-Whitney. **Chi-square.*

the lifestyle in the control group over time [Table 4]. The weight average in the intervention group increased from 55.2±9.8 before the intervention to 55.5±9.8 four months after the intervention. In the control group the average rose from 55.9±9.4 to 57.3±9.4 four months after the intervention. Consequently, after the intervention, the weight average in the intervention group was significantly less than the control group [Table 5]. The height average in the intervention group rose from 146.7±10.1 before the intervention to 147.9±10.2 four months after the intervention, and increased in the control group from 149.9±8.1 to 150.9±8.5 four months after the intervention. In fact, after the educational intervention, the height averages between the two groups had no considerable

Table 4: The comparison between the averages of the scores of the nutrition-related lifestyle, physical activity-related lifestyle, and general lifestyle in the intervention and control groups.

Lifestyle dimensions	Before the intervention (mean ± SD)	One month after the intervention (mean ± SD)	Four months after the intervention (mean ± SD)	*p*-value*
Nutrition-related lifestyle				
Intervention group	60 ± 14.8	75.6 ± 13.2	75.2 ± 12.9	< 0.001
Control group	61.2 ± 14.3	61.6 ± 14.4	61.3 ± 14.3	0.312
Independent *t*-test	0.723	< 0.001	< 0.001	-
Physical activity-related lifestyle				
Intervention group	56.1 ± 17.3	74.5 ± 11.4	74.1 ± 11.6	< 0.001
Control group	57.5 ± 14.5	58.0 ± 14.3	56.6 ± 14.3	0.175
Independent *t*-test	0.721	< 0.001	< 0.001	-
General lifestyle				
Intervention group	58.1 ± 12.9	75.1 ± 10.4	74.7 ± 10.5	< 0.001
Control group	59.4 ± 11.9	59.8 ± 11.84	58.9 ± 11.6	0.197
Independent *t*-test	0.664	< 0.001	< 0.001	-

**Analysis of variance with repeated observations (ANOVA). SD: standard deviation.*

Table 5: The status of the anthropometric indices before and after the educational intervention in the intervention and control groups.

Variables	Before the intervention (mean ± SD)	Four months after the intervention (mean ± SD)
Weight, kg		
Intervention group	55.2±9.8	55.5±9.8
Control group	55.9±9.4	57.3±9.4
p-value*	0.747	0.013
Height, cm		
Intervention group	146.7±10.1	147.9±10.2
Control group	149.9±8.1	150.9±8.5
p-value*	0.153	0.195
BMI, kg/m²		
Intervention group	25.51±2.9	25.23±2.9
Control group	24.73±2.4	25.04±2.3
p-value*	0.242	0.778

** Independent t-test. BMI: body mass index. SD: standard deviation.*

difference [Table 5]. The BMI average in the intervention group decreased from 25.51±2.9 before the intervention to 25.23±0.9 four months after the intervention and increased in the control group from 24.73±2.4 to 25.04±2.3 four months after the intervention. However, after the intervention, the BMI average decreased in the intervention group but increased in the control group. This difference was not statistically significant in any groups [Table 5].

DISCUSSION

In general, the results of the study showed that educating overweight children about a healthy lifestyle could have a significant effect on their lifestyle. The formal education of most of the students' parents was at the academic level. Most mothers (63.3%) were housewives and most fathers (52.9%) were employees.

The results of this research showed that education using age-appropriate methods, namely animations and role-play, improved the students' lifestyle. Moreover, the educators were familiar with education principles. As a result, the education had a considerable effect on the average of the lifestyle scores of the students in the intervention group. The results of a study exploring a school- and family-based intervention to prevent obesity in children aged 5–7, demonstrated that there was a significant increase in the intake of vegetables ($p < 0.050$) and fruits ($p < 0.010$) after the 20-week intervention.[27] According to the results of our research, the score of the lifestyle related to physical activity (after the education) changed for approximately 18 scores and was significantly modified (from 56 up to 74).

The score of the lifestyle concerning nutrition and physical activity (after the education) changed for 17 scores and was significantly modified (from 58 to 75). Manios and Kafatos performed a study aiming to educate school students about changing bad dietary behaviors, nutrient intake, and an increasing in physical activity.[28] The results of this study indicated that the students' average dietary function before and after the intervention and the average duration of physical activity (minutes/week) before and after the education were considerably modified.[28] School-based studies have emphasized that physical activity programs have a greater impact on fitness of children at risk.

One of the common resources for adolescents is their regular daily activities, particularly school-related activities, such as walking or cycling for school or classes for physical activity in school.[29] The results of this study showed that the average height had no significant change because changes in height occur over a long time. However, the weight average in both groups four months after the intervention, compared with the time before the intervention, increased and this increase was significant in the cotrol group ($p = 0.001$, 1.4 kg). However, the increase in the intervention group was not significant ($p = 0.670$). Approximately 300 g was added, but considering the growth age, this increase is appropriate. Ultimately, no significant difference was observed between the two groups in terms of BMI average after the education ($p = 0.770$) because the BMI is inversely related to height. As a result, a longer time (more than four months) is required to determine the change in the BMI. Nonetheless, upon controlling for BMI before the intervention, it was concluded that the increase in the change of the BMI after the educational intervention (education about nutrition and physical activity) between the two groups had a significant difference ($p = 0.010$).

The average BMI decreased in the intervention group and increased in the control one. A randomized school-based study, with the aim of reducing the body fat percentage, examined school

children for three consecutive years.[30] The results demonstrated no significant reduction in the body mass percentage although there was a considerable decrease in the percentage of energy from fat in the intervention schools.[30] Attempting to control obesity among children aged 5–7, revealed no significant change in the prevalence of obesity and overweight after the intervention; however, children's different education and function levels improved.[27] Furthermore, Gortmaker et al,[21] in the study concentrating on hours of watching TV, nutrition, and physical activity stated that the prevalence of obesity among girls in intervention schools reduced, with no differences found among boys. The results of their study are consistent with those in the present study and the BMI did not reduce significantly.

The limitations of this study included the fact that it was not possible to control all factors affecting the obesity-related lifestyle among adolescents, especially economic, cultural, and familial factors. The period for evaluating the consequences of the intervention could have been longer; however, due to human and financial limitations of the research, it was impossible. To improve the precision of data, it would have been better to monitor weight loss, changes in frequency of food intake, and the increase in physical activity through observational cases or reports by parents and friends, along with the measurement of the lifestyle affecting overweight and obesity through a self-reported and self-administered questionnaire.

CONCLUSION

Due to the growing prevalence of obesity among children and adolescents, it is recommended that necessary points concerning obesity-inducing factors, complications arising from obesity, and ways of preventing it should be integrated into school curriculum, particularly teachers and student groups through ongoing and regular programs. Meanwhile, in order for the continuity of education and promotion of a healthy lifestyle, should be offered age-appropriate programs in a detailed manner with the aim of improving physical activity and nutrition. The results of this research as a pilot study seem to provide the background to other studies, particularly of longer duration, and underscore the effectiveness of the educational interventions in improving and modifying the lifestyle related to overweight and obesity among students. In order to improve students' physical health and prevent obesity age-appropriate educational programs (e.g., animations and role-play) should be applied; and schools, parents, and the media should collaborate to change the unhealthy lifestyle and introduce healthy behaviors.

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