

## School Food Environment Promotion Program: Applying the Socio-ecological Approach

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### Abstract

#### Background

Despite of healthy nutrition recommendations have been offered in recent decades, researches show an increasing rate of unhealthy junk food consumption among primary school children. The aim of this study was to investigate the effects of health promotion intervention on the school food buffets and the changes in nutritional behaviors of the students.

**Materials and Methods:** In this Quasi-interventional study, eight schools agreed to participate in Tabriz city, Iran. The schools were randomly selected and divided into an intervention and a control group, and a pretest was given to both groups. A four weeks interventional program was conducted in eight randomly selected schools of the city based on the socio-ecological model. A check list was designed for the assessment of food items available at the schools' buffets, a 60-item semi-quantitative food frequency questionnaire (FFQ) was used to assess the rate of food consumption and energy intake. Results evaluation and practice were analyzed using the Wilcoxon, Mann Whitney-U and Chi-square tests.

**Results:** The findings revealed reduction in the intervention group between before and after intervention with regard the range of junk food consumption, except for the sweets consumption. The number of junk foods provided in the schools buffets reduced in the intervention group. After the intervention on the intervention group significant decreases were found in the intake of energy, fat and saturated fatty acids compared to the control group ( $p = 0.00$ ).

#### Conclusion

In order to design effective school food environment promotion programs, school healthcare providers should consider multifaceted approaches.

**Key Words:** Healthy eating, School Health, Students, Snacks.

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## 1- INTRODUCTION

Proper nutrition has been classified as one of the factors influencing on the growth and development of children/adolescents, that may reduce the risk of chronic diseases in adulthood (1). Although healthy nutrition recommendations (such as "five-a-day" for consumption of fruits and vegetable) have been offered in recent decades, researches show an increasing rate of unhealthy junk food consumption (snacks high in added sugar and/or saturated fat) among primary school children (2). In the last 30 years, the consumption of unhealthy snacks among American and European countries children has been increased (3). In a study conducted on students revealed that 38.6% of energy intake was provided from snacks (4). The consumption of junk food is likely to be contributed with developing many diseases (such as diabetes and hypertension) among children through decreasing appetite and, thus, skipping the main meals (5, 6). It may also result in overweight and obesity due to the higher intake of calories, fats and salt (1). School food environment is a point of strength for interventions considering the high amount of time that students spend in schools (7).

Also, the snacks provided at the buffets of schools are influential in the dietary choices of the students (8). Therefore, the school environment has a substantial role in the healthy nutrition of the school age children (9). A review on the literature shows that despite the importance of healthy nutrition among at the school age children, few studies have focused on the role of school food environment on nutritional status of the students (10). Also, previous researches have declared that many schools have not a standard and clear plan for control and monitoring the buffets (11). In the other hand, in order to create a supportive environment for children

health, school buffets should provide the children with healthier food choices (12). The junk foods sold to students in school buffets, may be considered as one of the main nutritional health issues among school aged children (9). Increasing the availability rate of fruits and vegetables in the school environment (13), restrictive policies for junk food provision (9), making competitive foods and beverages regulations (7), "five-a-day" recommendation for consumption of fruits and vegetables (14), are examples of nutritional health initiatives in different countries to provide the supportive environment for nutritional health among students.

Previous studies evaluating the food distribution in school buffets or the food markets around the schools in the developing countries are few in number. As an example, Jahanbani et al., in a study in Iran, showed that fruits and vegetables are not introduced in the most of Iranian school buffets. They also declared that due to the small space in the buffets even necessary equipment, such as refrigerators, do not exist to store the perishable foods like fruits and vegetables. As a result, these school buffets provide the students with the junk foods which contain a minimum level of nutritional values (e.g. puffed corns, salted snacks, soft drinks, and sausages/salami sandwiches) (15). In another research conducted in Iran, evaluating the school buffets, there was shown that among all the snacks purchased in the buffets, about 75.3% were bought cakes, and 33.2% were fruit juices (16). The snacking behaviors of students were investigated in a study in Argentina. The results showed that about 45.7% of the students consume chocolate most of the time. The students also reported always consumption of sausages (35.1%), and cookies (31.6%), soda water (28.1%), and candies (21%) (17).

Considering the substantial role of healthy snacks in improving nutritional health status of the school age children, researches on food environment of the schools are necessary to further guide the school health care providers and nurses as well as the school health policy makers on providing a more supportive food environment for the school age children. Previous studies have shown the effectiveness of multifaceted interventions on obesity prevention among students (18), and the association of improving the nutritional choices of students with higher consumption of fruit and vegetables and lower consumption of soft drinks (19). Snack consumption is one of the behaviors that need to consider both at the individual level and the level of environmental (20).

The underlying idea is that interventions should include multilevel strategies focusing on behavioral and environmental factors. In the field of public health, ecological models describe people's interactions with their physical and socio-cultural surroundings (21). A central conclusion of ecological models is that it usually takes the combination of both individual-level and environmental level interventions to achieve substantial changes in health behaviors (22).

In Iranian schools, no main meal has been served for the students (23). Instead, they are provided with the snacks either being taken from home or being sold by the school buffets. Despite the concerns on the health aspects of this issue, no studies have been conducted to assess the effects of health promotion intervention on Iranian school food environments. The present study was conducted to investigate the effects of health promotion intervention on A) the school food buffets, and B) the changes in nutritional behaviors of the students.

## 2- MATERIALS AND METHODS

### 2-1. Method

This study was a Quasi-interventional with control group conducted in Tabriz, the North West of Iran, from February to May 2015. The protocol of study was approved by the ethics and research committee in Tabriz University of Medical Sciences (ID code: 4050/4/5). A four weeks interventional program was conducted in eight randomly selected schools of the city.

### 2-2. Participants and recruitment

The school site was considered as the unit of intervention. The schools were randomly selected in the Tabriz city, North West of Iran, applying a blocking procedure. Eight schools agreed to participate in the study based urban areas. Applying random sampling, 8 eligible schools were selected among ninety eight schools, and randomly allocated into the intervention and control groups. Then classes in schools were selected through random stratified sampling (**Figure.1**).

All the stakeholders in the schools including managers, teachers, buffets' authorities as well as the parents of students were informed about the aim and objectives of study and all signed written consent form. Also, the study objectives were verbally explained for the students in the presence of their parents. The students were assessed at baseline and 8-week after intervention, while the food items provided at the school buffets were controlled once a week during the study.

### 2-3. Procedures and intervention

The study procedure from enrollment to data collection and follow-up are presented in **Figure.1**. The inclusion criteria were the presence of signing informed consent form and the presence of a buffet for service delivery at the schools. Exclusion criteria were children in the first grade of education, and the

students intended to change their schools. Participants in the intervention schools were exposed to an eight weeks healthy nutrition program based on the socio-ecological model. The interventional program was performed in three levels: personal and inter-personal, social and environmental levels.

In the *personal level*, the strategies included the provision of an educational program to promote knowledge, attitude and behavior on healthy nutrition among the students, their parents and the stakeholders of the schools and the buffets. The strategies in the *inter-personal level* included providing healthy snacks the in school bags of the students by their parents/care providers, developing a friendly group of students to encourage and support each other for healthy snacks consumptions, and monitoring the snacks in the school bags of the students by teachers. In the *social level*, three strategies were used including social programs on healthy eating at schools (such as health break time, healthy tablecloth in schools), monitoring the students' snacks by teachers during break times, and encouraging students with healthy eating. As the students were asked to encourage and support their friends for healthy eating, the members of the groups were cheering each other up for the use of healthy foods.

In the *environmental level*, school buffet administrators were educated on the benefits of healthy snacks for children and were also invited and collaborated to supply and distribute healthy foods at the buffets of the schools.

During the implementation of the educational program also interventions were conducted for students, their parents and buffets environments. Interventions for students: the teachers checked the consumed foods of the students randomly once a week and the students with healthy food (having at least a healthy snack [like

one fruit] in the school bag) were received an incentive card. The students were gifted a small prize per having 5 cards. Buffets environments, and other school-appropriate spaces were used for installing posters, placards and the distribution of pamphlets among students.

*Interventions for parents:* parents were asked to provide healthy foods (such as bread and cheese or fruits) for their children to eat in the school. Also, a weekly healthy snack program was designed and provided for the parents as an action plan.

*Interventions for buffets environments:* at the same time, in collaboration with the administrators the schools buffets were organized to increase the variety of healthy food items (like bread and potatoes, bread and cheese, peanut, lentil soup, pasta, and soybeans), and eliminate the non-healthy snacks (like chocolate, commercial fruit juice, fizzy beverages, potato chips, and sausages/salami sandwiches).

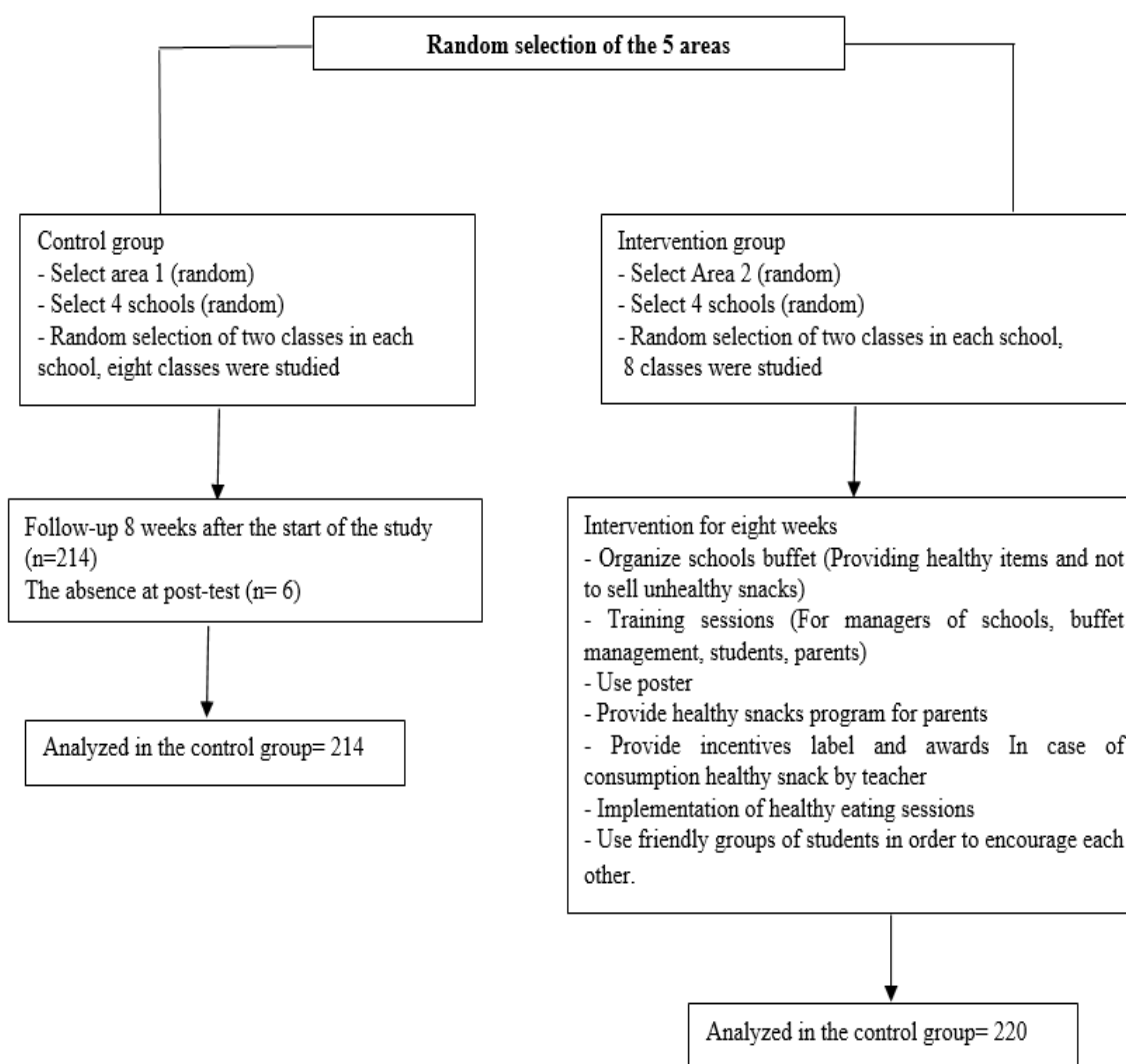
The primary outcomes examined were changes in the environment (provided items on the buffet), secondary outcomes included changes in feeding behavior in order to consumption healthy food.

#### 2-4. Measures

A check list was designed for the assessment of food items available at the school buffets, and to count and record the number of healthy and unhealthy food items on the buffets. This assessment was conducted at baseline and then once a week during the intervention. The checklist contains three parts: how to manage buffet, how to prepare foods, and the type of food offered at the buffet. Check list of monitoring of food products in public places were used in current study, researcher was recorded all food items on the buffet weekly. A 60-item semi-quantitative food frequency questionnaire

(FFQ) (19), was used to assess the rate of food consumption and energy intake per week among the students which was administered to parents of all the students in the schools in both intervention and control groups. The FFQ is a valid and reliable instrument. Validity correlation coefficients ranged from 0.03 (liquid oil) to 0.77 (simple sugars) in men (median, 0.44), and from 0.12 (snacks) to 0.79 (simple sugars) in women (median, 0.37). (19). It was a 60-item check list, for example students mark consumption or not eating healthy/healthy food in the form of a table weekly.

Despite measure consumption snack each week, the exact amount of consumption of each item for each student was recorded by interview per day or week. The demographic characteristics of the students included age, gender, father's and mother's job, level of education as well as the number of family members. All study tools were completed fourth grade students and older using self-reported, but the students in the second and third-grade of education were interviewed privately.



**Fig1:** The process of implementing the study.

## 2-5. Statistical analysis

Data were summarized utilizing frequency (%), median (max, min) and mean (standard deviation [SD]) for categorical, and the abnormally and normally distributed numeric variables, respectively. Kolmogorov-Smirnov test was used to assess the normal distribution of data. Percent change was computed applying this formula:  $\frac{\text{Post-intervention} - \text{Before intervention}}{\text{before intervention}} \times 100$ .

To compare the demographic variables between the two groups, independent samples t-test, Mann Whitney U-test and Chi square test were used. Paired-samples t-test and Wilcoxon tests were used to compare the within group differences before and after intervention. Analysis of covariance (ANCOVA) was also exploited to compare the main outcomes between the two groups adjusting the effect of demographic variables. The amount consumption on any items was calculated in basis gram for each student, then entered into N4 software so that calculate amount of energy achieved, achieved protein and fat absorption by snacks.

Percentage change formula is the result of subtracting before intervention from after intervention, divided by before intervention ( $\frac{\text{Post-intervention} - \text{Before intervention}}{\text{before intervention}} \times 100$ ). All analyses were performed using N4 and the SPSS software (version 15.0). (SPSS Inc. IL. Chicago, USA). In all analyses,  $p < 0.05$  was considered as significant.

## 3- RESULT

The mean age of students was 9.6 (SD = 1.4 years). The level of education for 44% of the students' fathers was university for 42% of the students' mothers was diploma. The number of family members for the majority of students was four. Also, 63.8% of the fathers were self-employed, and 81.6% of the mothers were housewives. No significant difference was

found between the intervention and control groups in the demographic characteristics, except for the grade of education ( $p < 0.05$ ). Demographic characteristics of the students presented in **Table.1**. At baseline, difference in the number of healthy foods was checked out between the intervention and control groups. However, after intervention, differences in the number of healthy foods between the intervention and control groups were significant. The number of junk foods provided in the school buffets reduced by 46% in the intervention group (**Table.2**).

In the intervention group occurred significant increase only in consumption of healthy sandwiches (such as bread and cheese, bread and potatoes). Before intervention, there was no statistically significant difference in the consumption of junk food between the intervention and control groups, however, the range of junk food consumption decreased in the intervention group, after intervention, except for the sweets consumption (**Table.2**). The median consumption of chocolate ( $p = 0.00$ ), cake/biscuits and cookies ( $p=0.01$ ), commercial fruit juices ( $p = 0.01$ ), chips and snacks ( $p = 0.00$ ), and sausages/salami sandwiches ( $p = 0.00$ ) were significantly decreased in the intervention group, compared to the control group. As there is shown in **Table.3**, no significant difference was found in the frequency of healthy foods consumption before and after intervention (**Table.3**). As there is shown in **Table.4**, before the intervention, there was no significant differences in the intake of energy, micronutrients and macronutrients per day between the two groups; while after the intervention on the intervention group significant decreases were found in the intake of energy ( $p = 0.00$ ), fat ( $p = 0.00$ ), and saturated fatty acids ( $p = 0.00$ ), per day compared to the control group (**Table.4**).

**Table-1:** Demographic characteristics of the students in the intervention and control groups.

| Variables                      | Control group, number (%) | Intervention group, number (%) | P-value |
|--------------------------------|---------------------------|--------------------------------|---------|
| Age, Mean (SD) (years.)        | 9.13 (1.23)               | 10.19(1.45)                    | <0.001  |
| Gender                         |                           |                                |         |
| Female                         | 119(55.6)                 | 107(48.63)                     | 0.07    |
| Male                           | 95(44.39)                 | 113(51.36)                     |         |
| Level of education for fathers |                           |                                |         |
| Illiterate                     | 16(7.5)                   | 26(11.8)                       | 0.05    |
| High school                    | 35(16.4)                  | 37(16.8)                       |         |
| Diploma                        | 78(36.4)                  | 103(46.8)                      |         |
| University                     | 85(39.7)                  | 54(24.5)                       |         |
| Level of education for mothers |                           |                                |         |
| Illiterate                     | 13(6.1)                   | 22(10)                         | 0.05    |
| High school                    | 29(13.6)                  | 38(17.3)                       |         |
| Diploma                        | 65(30.4)                  | 77(35)                         |         |
| University                     | 107(50)                   | 83(37.7)                       |         |
| Mothers' Job                   |                           |                                |         |
| Housewives                     | 175(81.8)                 | 179(81.4)                      | 0.91    |
| Employee                       | 39(18.2)                  | 41(18.6)                       |         |
| Fathers' Job                   |                           |                                |         |
| Self-employed                  | 135(63.1)                 | 142(64.5)                      | 0.75    |
| Employee                       | 79(36.9)                  | 78(35.5)                       |         |
| Number of family members       |                           |                                |         |
| 3                              | 59(27.6)                  | 54(24.5)                       | 0.74    |
| 4                              | 116(54.2)                 | 122(55.5)                      |         |
| 5 and more                     | 39(18.2)                  | 44(20)                         |         |
| Birth rank                     |                           |                                |         |
| 1                              | 118(55.1)                 | 123(55.9)                      | 0.98    |
| 2                              | 73(34.1)                  | 74(33.6)                       |         |
| 3 and more                     | 23(10.7)                  | 23(10.5)                       |         |
| Grade of education             |                           |                                |         |
| 2                              | 78(36.4)                  | 18(8.2)                        | 0.00    |
| 3                              | 48(22.4)                  | 56(25.5)                       |         |
| 4                              | 62(29)                    | 64(29.1)                       |         |
| 5                              | 26(12.1)                  | 51(23.2)                       |         |
| 6                              | 0(0)                      | 31(14.1)                       |         |

**Table-2:** Snacks provided at the schools' stores in the intervention and control groups before and after intervention

| Snacks        | Sub-group    | Before intervention | After intervention |
|---------------|--------------|---------------------|--------------------|
|               |              | Frequency (%)       | Frequency (%)      |
| Junk foods    | Intervention | 49 (62)             | 23 (38)            |
|               | Control      | 36 (54)             | 30 (46)            |
| Healthy foods | Intervention | 14 (39)             | 22 (61)            |
|               | Control      | 9 (47.4)            | 10 (52.6)          |

**Table-3:** Differences in the mean consumption of foods between the intervention and control groups before and after the intervention

| Food groups                |  | Groups       | Mean      |           | P-value | Percent change |
|----------------------------|--|--------------|-----------|-----------|---------|----------------|
|                            |  |              | Before    | After     |         |                |
| Healthy foods              | Bread/cheese/dates/nuts, bread/potatoes bread/eggs | Intervention | 4.08±2.09 | 4.83±2.40 | <0.001  | 20             |
|                            |  | Control      | 3.88±2.29 | 4.18±2.42 | 0.09    | 0.00           |
|                            | p. value   |              | 0.35      | 0.08      |         |                |
|                            | Fruits   | Intervention | 2.66±1.99 | 2.50±2.30 | 0.22    | 0.00           |
|                            |  | Control      | 2.41±1.88 | 2.31±2    | 0.46    | 0.00           |
|                            | p. value   |              | 0.21      | 0.56      | 0.56    |                |
|                            | Vegetables   | Intervention | 1.45±1.47 | 1.39±1.55 | 0.63    | 0.00           |
|                            |  | Control      | 1.67±1.65 | 1.50±1.71 | 0.03    | 0.00           |
|                            | p. value   |              | 0.28      | 0.13      |         |                |
|                            | Milk   | Intervention | 2±1.88    | 1.90±1.91 | 0.45    | -33.33         |
|                            |  | Control      | 2.07±2.03 | 2.21±2.01 | 0.59    | 100            |
|                            | p. value   |              | 0.66      | 0.26      |         |                |
|                            | Yogurt Drink                                       | Intervention | 0.76±1.34 | 0.87±1.40 | 0.2     | 0.00           |
|                            |  | Control      | 0.57±1.97 | 0.66±1.30 | 0.02    | 0.00           |
|                            | p. value   |              | 0.00      | 0.81      |         |                |
|                            | Ice cream  | Intervention | 0.03±0.35 | 0.30±0.95 | <0.001  | 0.00           |
|                            |  | Control      | 0.25±0.75 | 0.48±1.41 | <0.001  | 0.00           |
|                            | p. value   |              | 0.00      | 0.96      |         |                |
| Dried fruits               | Intervention                                       | 0.58±1.23    | 0.62±1.18 | 0.09      | 0.00    |                |
|                            | Control  | 0.40±0.91    | 0.57±1    | 0.01      | 0.00    |                |
| p. value                   |  | 0.15         | 0.37      |           |         |                |
| Nuts                       | Intervention                                       | 1.71±1.73    | 1.71±1.80 | 0.9       | 0.00    |                |
|                            | Control  | 1.55±1.77    | 1.37±1.44 | 0.2       | 0.00    |                |
| p. value                   |  | 0.12         | 0.32      |           |         |                |
| Soya                       | Intervention                                       | 0.16±0.56    | 0.22±0.6  | 0.16      | 0.00    |                |
|                            | Control  | 0.21±0.63    | 0.24±0.66 | 0.51      | 0.00    |                |
| p. value                   |  | 0.09         | 0.10      |           |         |                |
| Un-healthy foods           | Chocolate  | Intervention | 0.90±1.60 | 0.29±0.72 | <0.001  | 0.00           |
|                            |  | Control      | 0.58±1.28 | 0.59±1.30 | 0.84    | 0              |
|                            | p. value   |              | 0.01      | 0.00      |         |                |
|                            | Cake/biscuits/cookies                              | Intervention | 2.13±1.84 | 1.85±1.92 | 0.01    | -50            |
|                            |  | Control      | 2.43±2.01 | 2.26±2.10 | 0.37    | 0              |
|                            | p. value   |              | 0.19      | 0.14      |         |                |
|                            | Commercial juices                                  | Intervention | 0.92±1.49 | 0.61±1.11 | 0.01    | 0              |
|                            |  | Control      | 0.70±1.38 | 0.97±1.49 | <0.001  | 0              |
|                            | p. value   |              | 0.04      | 0.001     |         |                |
|                            | Chips and snacks                                   | Intervention | 0.27±0.79 | 0.03±0.17 | 0.00    | 0              |
|                            |  | Control      | 0.11±0.44 | 0.14±0.61 | 0.76    | 0              |
|                            | p. value   |              | 0.00      | 0.00      |         |                |
|                            | popcorn  | Intervention | 0.81±1.37 | 0.82±1.05 | 0.22    | ∞              |
|                            |  | Control      | 0.70±1.06 | 1.04±1.35 | <0.001  | ∞              |
|                            | p. value   |              | 0.99      | 0.13      |         |                |
| Sausages/salami sandwiches | Intervention                                       | 0.115±0.34   | 0.03±0.17 | <0.001    | 0       |                |
|                            | Control  | 0.07±0.34    | 0.10±0.49 | 0.48      | 0       |                |
| p. value                   |  | 0.03         | 0         |           |         |                |
| Sweetmeat                  | Intervention                                       | 0.21±0.49    | 0.21±0.51 | 0.7       | 0       |                |
|                            | Control  | 0.33±0.90    | 0.69±5.04 | 0.3       | 0       |                |
| p. value                   |  | 0.92         | 0.83      |           |         |                |



**Table-4:** The mean intake of energy, macronutrients and micronutrients per day among the school children before and after the intervention

| Energy intake |              | Mean ( $P_{25}^* - P_{75}$ ) |                       | P-value | Percent change |
|---------------|--------------|------------------------------|-----------------------|---------|----------------|
| Variables     | Groups       | Before                       | After                 |         |                |
| Kilocalories  | Intervention | 479.5 (306.8-592.65)         | 347.03 (264.8-424.3)  | 0.00    | -22.97         |
|               | Control      | 452.1 (283.25-610.07)        | 385.2 (263.02-481.52) | 0.00    | -11.84         |
| p. value      |              | 0.45                         | 0.01                  |         |                |
| Carbohydrate  | Intervention | 79.02 (49.39-106.9)          | 58.69 (45.51-72)      | 0.00    | -15.36         |
|               | Control      | 74.29 (45.37-100.79)         | 64.55 (44.27-81.29)   | 0.01    | -14.85         |
| p. value      |              | 0.48                         | 0.04                  |         |                |
| Protein       | Intervention | 14.69 (9.08-19.42)           | 11.62 (8.57-14.62)    | 0.00    | -12.11         |
|               | Control      | 14.12 (9.1-19.33)            | 12.6 (8.35-16.26)     | 0.05    | -4.3           |
| p. value      |              | 0.68                         | 0.10                  |         |                |
| Fat           | Intervention | 12.71 (6.99-16.96)           | 7.95 (4.84-10.55)     | 0.00    | -35.31         |
|               | Control      | 11.6 (6.03-16.16)            | 9.36 (5.35-12.43)     | 0.00    | -15.97         |
| p. value      |              | 0.24                         | 0.00                  |         |                |
| Saturated fat | Intervention | 2.82 (0.94-3.88)             | 1.83 (0.82-2.35)      | 0.00    | -29.66         |
|               | Control      | 2.77 (0.80-4.94)             | 2.57 (0.88-4.4)       | 0.36    | -16.83         |
| p. value      |              | 0.93                         | 0.00                  |         |                |
| Monofat       | Intervention | 3.05 (1.37-4.13)             | 1.54 (0.65-2.2)       | 0.00    | -54.3          |
|               | Control      | 2.66 (1.02-3.47)             | 1.88 (0.79-2.74)      | 0.00    | -26.85         |
| p. value      |              | 0.01                         | 0.00                  |         |                |
| Polyfat       | Intervention | 3.04 (1.08-3.82)             | 1.62 (0.61-2.05)      | 0.00    | -33.18         |
|               | Control      | 2.56 (0.85-3.63)             | 2.11 (0.71-2.68)      | 0.00    | -12.98         |
| p. value      |              | 0.19                         | 0.00                  |         |                |
| Cholesterol   | Intervention | 18.80 (2.36-29.75)           | 18.03 (4.21-0.17)     | 0.56    | 0.00           |
|               | Control      | 24.97 (2.34-29.75)           | 24.49 (4.24-29.75)    | 0.32    | -22.39         |
| p. value      |              | 0.2                          | 0.85                  |         |                |

PC: percent change;  $P \leq 0.05$ ; \*percentile.

#### 4- DISCUSSION

The aim of this study was to determine the effect of a school food environment promotion program on the nutritional status of elementary school students in Tabriz, Iran. The results showed a significant decrease (53%) in the provision of unhealthy food choices of the school buffets in the intervention group. This difference in the control group was 16%. These findings were similar to those reported by Esfarjani et al. (24) and Zamani et al. (25). In line with our findings, Briefel et al. also in a study in the United States, reported that school food environment reduced the consumption of sugary and energy drinks, snacks, cakes, ice creams, and snacks (26). In this study,

the 50% reduction in the provision of unhealthy food items in the school buffets resulted in the consumption of like candies, cakes, cookies and biscuits, juice industry, chips, sandwiches, and sausages in the intervention group. This decline was significantly higher compared to those in the control group (16.66%) which may be due to the baseline checklist filled out at the beginning of the study. Despite the executive regulations of the Ministry of Education in Iran emphasizing the prohibition of selling some unhealthy foods such as snacks and soft drinks at the school buffet, there were lots of such items in the buffets. It is likely that buffet administrators in the control group had eliminated such items from their list of

items. Also, there is a possibility that the teachers and buffet administrators in the intervention group have had relations with the school teachers and buffet administrators in the control group.

The results of our study showed that the frequency of healthy food was significantly increased from 14 items to 22 in the intervention group after the intervention. This frequency in the control group at baseline was 9 items which increased only to 10 items.

Considering to the obligation of the Ministry of Education to eliminate unhealthy snacks, using pressure from authorities on the buffet administrators to remove such snacks from their stores is not too difficult. But, due to the lack of regulations, the change in raising the healthy items was almost impossible (27). The results of our study showed that it may not be so impossible in the case of conducting nutrition health promotion programs in the schools by school health care providers and school nurses.

Lack of proper equipment for maintaining and washing fruits and vegetables in the school buffets, and the belief of the school buffets administrators from the lack of cost-effectiveness may be reasons for the low level of fruits and vegetables provisions in the school buffets. Perry et al. revealed that fruits and vegetables may be made available of students (28). Cauwenberghe et al., in a systematic review showed strong evidences for the effectiveness of interventions on increasing the consumption of fruits and vegetables among school age children (1).

In the present study, the consumption of junk food and healthy snacks were significantly decreased and increased, respectively, after intervention in the intervention group. These differences were not significant in the control group.

In line with the results of our study, Terry et al., reported that fruit and vegetable

consumption in the schools with unrestricted access to junk food is lower than the schools that have restriction on access to such foods (13). They concluded that if students do not have access to unhealthy foods, they will tend to use healthy foods. In the current study, after intervention the mean intakes of energy, fat, saturated fatty acids were significantly decreased in the intervention group compared to the control group. These findings are consistent with those reported by Hoppu et al., and (19) Haerens et al. (29), and Mohammadi et al. (30). The lower level of energy intake in the intervention group of the present study may be due to the reduction happened in the consumption of junk foods.

Similar with those reported by Cullen et al., (2004), in the present study little effect was found on improving the schools' buffets in terms of healthy food preparation. They also showed that students, who bought their own snack from schools' buffets, ate higher rates of unhealthy foods (12). In another study, it was shown that fruits and vegetables consumption in schools with a buffet were higher compared to the schools without buffet (31), which reflects the detrimental role of school food environment on nutritional status of the students. Therefore, policymaking on schools' buffets reforms is recommended.

#### **4-1. Limitations of the study**

Firstly, the duration of intervention was short, which was due to the time limitation of the researchers. Secondly, collecting data from the students in the lower school grades was difficult. It is suggested to apply the objective tools and means (such as observational tools) for data collection on snacks consumption. Thirdly, the lack of equipment such as refrigerators, washing and disinfecting equipment for food storage and preparation was another limitation not only for buffets in the

present study, but also for the most of schools' buffets throughout the country. Finally, although a previous study suggested the improvement of school policies to promote healthy food provision at the buffets (32), the organizational and political supports were not considered in the program of present study. A major strength of the present study was the application of socio-ecological approach as the theoretical framework, which helped the researchers in the organizing the strategies in clear levels.

## 5- CONCLUSION

Considering decrease of the junk food consumption, the number of junk foods provided, the intake of energy, fat and saturated fatty acids except the frequency of healthy foods consumption in intervention group significantly, it seem that many factors (such as economic problems, TV advertisements) have an impact on healthy foods consumption in addition to the implemented interventions in current study. Therefore, more research must be done to incorporate these factors into Socio-ecological model.

## 6- CONFLICT OF INTEREST

No Conflict of interest has been declared by the authors.

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