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# School-based intervention to promote healthy nutrition in Sousse, Tunisia

## Abstract

**Introduction:** Obesity among children is a major risk factor for chronic diseases. School interventions programs can represent a mean to implement healthy nutrition attitudes at early ages. Our objective was to evaluate the effects of a school intervention program to promote healthy nutrition among adolescents, in terms of knowledge, behaviors and intention.

**Methods:** Quasi experimental study among urban students in Sousse, Tunisia with 2 groups, intervention and control. The intervention group had an interactive program integrated with school courses that promoted healthy nutrition habits. Both groups had a pre post evaluation.

**Results:** 2200 students aged from 12 to 16 participated to the pre post evaluation. In the intervention group, there were significant changes from pre to post test in knowledge, intentions, and behaviors. In the control group, almost no significant changes were observed.

**Conclusion:** School intervention programs can represent an interesting approach to promote healthy nutrition habits among adolescents.

**Keywords:** adolescents; nutrition; obesity; school intervention program.

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## Introduction

Throughout the world, children are becoming overweight and obese at progressively younger ages (1). In the US, the prevalence of obesity and overweight has doubled in the past 20 years. In fact, 15% of children aged 6–19 years are either at or above the 95th percentile (2). Middle and low

income countries are also concerned with this phenomenon. In Tunisia, a survey conducted in the city of Sousse showed that its population had a similar cardiovascular risk (CVR) profile to those of cities found in developing countries, namely, Quebec (3). This increase of obesity and overweight among children and adolescents is intimately correlated with a decline in their diet quality, which have deteriorated over the past 20 past years (4). Indeed, according to a recent study conducted among US youth on 2007, only 20.1% of teenagers had eaten the recommended servings of fruits and vegetables, and 16.2% had drunk 3 or more glasses of milk in the 7 days preceding the survey (5). Unhealthy eating habits also include skipping breakfast, replacing lunch meal with snack food, and increasing soft drink intake (6).

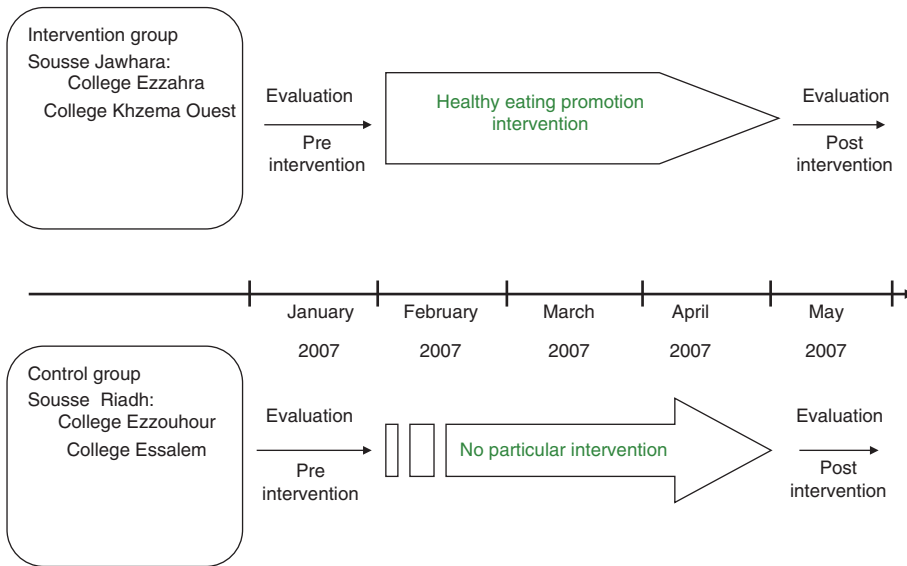
Obesity represents a real and public health problem by its magnitude and heavy consequences. In fact, obese children and adolescents have an increased risk for short- and long-term cardiovascular complications that include hemodynamic changes as well as structural and functional changes in the heart and blood vessels (7). Systematic review and meta analyses also assessed the strength of associations between body mass index and common cancers such as breast, endometrial, colon cancers and adenocarcinoma of the esophagus (8). Prevention is one the best remedies to this problem. Indeed, early management of obesity can abate or reverse almost all of the cardiovascular consequences of obesity (7).

Given that schools have been identified as major venues for health promotion programs (9), a survey among young adolescents in an academic setting was conducted. The purpose of the study was to evaluate the effects of a school intervention program towards the promotion of healthy nutrition among adolescents, in terms of knowledge, behaviors, and intention.

## Materials and methods

### Design

This study adopted a pre-post quasi-experimental design with two groups, namely, intervention and control (Figure 1). Both groups



**Figure 1** Study design of a school based intervention to promote healthy nutrition in Sousse, Tunisia.

underwent initial evaluation. Only students from the intervention group received special courses and actions that promoted healthy nutrition. Then, a second evaluation was undertaken in both groups in order to compare the eventual effects of the intervention on knowledge, intentions, and behaviors.

## Population

The study concerned pupils of public schools in Sousse, Tunisia aged 12–16 years. Two districts from the city of Sousse (Sousse Jawhara and Sousse Riadh) served as the locations for the intervention and control groups, respectively. The intervention was implemented in two public schools (Ezzahra and Khzema Ouest) from which a total of 1965 participants were selected. Two control public schools were selected (Ezzouhour and Essalem) from which a total of 1737 participants were selected. The selection of schools was based on age and on socioeconomic and demographic characteristics. A stratified and proportional sampling was performed in each school to determine the minimal required number of students to answer the pre-post evaluations. This was based on the following parameters:  $\alpha=5\%$ ,  $\beta=20\%$ , and an expected increase of 10% in the knowledge of the schoolchildren after an intervention promoting healthy nutrition. The calculated minimal sample size was 958 students in each group.

We consciously monitored this number by considering the possible dropped out and the unequal repartition of students among classes. However, 2338 students participated to the first evaluation, intervention=1247 (39 classes) and control=1091 (37 classes). At the second evaluation conducted at the end of the school year, 138 students dropped out (intervention=58, control=80). Thus a final number of 2200 students participated in the pre-post evaluations.

## Variables and their measurements

A pre-tested self-administered questionnaire was used in the current study. Data collected by the questionnaire concerned sociodemographic variables (e.g., age, sex, parents' educational attainment, etc.), students' knowledge, behaviors, and intentions about healthy nutrition and dietary habits. The pre-assessment was conducted in January 2007 and the evaluation at the post-intervention was conducted at the end of the school year in May 2007.

## Statistical analysis

Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS). Data are presented as frequencies, means, and standard deviations. Statistical significance was at  $p<0.05$ .

## Description of the intervention

All schoolchildren in the intervention schools participated in the intervention, which lasted for 3 months (Figure 1).

Intervention consisted of interactive lessons and activities that were delivered by pre-formed teachers, in collaboration with doctors who were also members of the project. Each class in the intervention group received a visually supported course during (biological science hours), which provided the main information concerning healthy and unhealthy diet. The course had the following features:

- explanation of the principles of dietary pyramid;
- discussion of the ideal composition of principal meals;
- explanation of the importance of breakfast and its place in dietary balance;

- explanation of the difference between healthy and unhealthy food through examples;
- presentations on the effects of each kind of diet on health, with a focus on obesity complications and cardiovascular risk factors; and
- provision of suggestions for healthy eating habits and a balanced diet.

After this course, students were asked to prepare productions of their choice (drawings, posters, theatrical plays, etc.) concerning healthy/unhealthy food and its consequences. They were also encouraged to take part in different activities, such as those of local radio or biological science clubs, where additional discussions and presentations took place. Mural posters that promoted healthy nutrition were displayed on the school walls. Finally, during the ceremony of the end of the school year, students presented their productions with the presence of parents, teachers, team leaders, and other members of the community. The best presentations were rewarded.

## Ethical considerations

The study was conducted with the approval of the Farhat Hached Hospital Ethics Committee. Parents gave their consent for their children's participation, and the questionnaires were anonymous.

## Results

### Socio demographic characteristics

The population consisted of 2200 students, with 1189 in the intervention group and 1011 in the control group. Boys comprised 46.8% and 46.5% of the intervention and control groups, respectively. Students' ages ranged from 12 to 16 years, with mean ages of  $13.3 \pm 1.1$  and  $13.5 \pm 1.2$  years in the intervention and control group, respectively (Table 1).

### Pre-assessment comparison between the intervention and control groups

The comparison between the intervention and control groups at pre-intervention showed that the levels of their knowledge were similar. Nutrition behaviors were also similar concerning ideal breakfast intake ( $p=0.94$ ), snacking at the evening ( $p=0.19$ ), daily soft drink intake ( $p=0.73$ ), and fast-food intake at three times or more per week ( $p=0.34$ ). Daily breakfast, dairy products, and fruit and vegetable intake showed significant differences between the two groups. Intention to take breakfast daily in the future was similar in the two groups ( $p=0.25$ ), but intention to take fruits and vegetables daily was different.

**Table 1** Distribution of students in the intervention and control groups.

Sex	Intervention group		Control group	
	Age, years	Male n (%)	Female n (%)	Male n (%)
12	173 (47.0)	195 (53.0)	126 (48.1)	136 (51.9)
13	148 (46.4)	171 (53.6)	107 (42.5)	145 (57.5)
14	159 (49.7)	161 (50.3)	113 (43.8)	145 (56.2)
15	51 (39.5)	78 (60.5)	72 (51.8)	67 (48.2)
16	25 (47.2)	28 (52.8)	52 (52.0)	48 (48.0)
Total	556 (46.8)	633 (53.2)	470 (46.5)	541 (53.5)

## Effects of the intervention

### Intervention group

In our study, knowledge was assessed by the question: "Do you know what you should eat for breakfast?" The number of students who gave the right answer as to the composition of an "ideal breakfast" increased after the intervention (15.7%–40.8%  $p < 10^{-3}$ ). For intention, pupils were more likely to take breakfast, fruits, or vegetables every day in the future, which showed a significant difference from pre- to post-intervention ( $p < 10^{-3}$ ) (Table 2).

There were significant changes in behaviors as well between pre- and post-intervention in the intervention group. It concerned 6/10 items as follows: daily breakfast intake (58.2%–67.5%,  $p < 10^{-3}$ ); an "ideal" composition of breakfast that contains dairy products, slow-burning sugar product and a fruit (4.4%–10.5%,  $p < 10^{-3}$ ); dairy product intake every day (61.3%–74.4%,  $p < 10^{-3}$ ); decrease in snack intake in the evening (59.4%–52.1%  $p < 10^{-3}$ ); decrease in daily soft drink intake (22.6%–18.8%,  $p=0.003$ ); and decrease in the number of students who ate fast food products three or more times per week (42.5%–30.9%  $p < 10^{-3}$ ). There was an increase in the number of students who ate five or more fruits and vegetables a day, but it was not a significant one (Table 2).

### Control group

There were some differences in knowledge, intentions, and behaviors between pre- and post-evaluations in the control group. However, we observed significant improvement only in the number of students who took dairy products every day (51.6%–57.1%,  $p=0.001$ ), and those who expected to eat vegetables every day in the future (62%–67.1%,  $p=0.001$ ) (Table 3).

**Table 2** Comparison of knowledge, intentions, and behaviors before and after the intervention in the intervention group.

	Pre intervention		Post intervention		p-Value
	n	%	n	%	
Know the ideal composition of breakfast	170	15.7	443	40.8	<10 <sup>-3</sup>
“Ideal” breakfast intake	45	4.4	107	10.5	<10 <sup>-3</sup>
Daily breakfast intake	692	58.2	803	67.5	<10 <sup>-3</sup>
Daily dairy products intake	725	61.3	879	74.4	<10 <sup>-3</sup>
FVC of five or more times every day	58	29.3	62	31.1	0.683
Snacking at the evening	701	59.4	615	52.1	<10 <sup>-3</sup>
Soft drink intake every day	266	22.6	222	18.8	0.003
Fast food intake of three or more times per week	453	42.5	329	30.9	<10 <sup>-3</sup>
Intend to take breakfast every day	978	83.5	1076	91.9	<10 <sup>-3</sup>
Intend to take vegetables every day	628	53.2	861	72.9	<10 <sup>-3</sup>
Intend to take fruits every day	991	85.1	1092	93.8	<10 <sup>-3</sup>

### Comparison intervention and control group in post assessment

At the end of the study, the comparison between the intervention and control groups showed better nutrition knowledge, intentions, and behavior in the intervention group in majority of the tested variables. In fact, the proportion of schoolchildren who knew about the ideal composition of breakfast and who took ideal breakfast daily were significantly higher in the intervention group ( $p < 10^{-3}$ ). Only the variable concerning consumption of soft drinks daily was not different between the two groups ( $p = 0.32$ ). Schoolchildren who ate fast food products three times or more per week and who ate snacks at the evening were significantly less in intervention group ( $p < 10^{-3}$ ). Moreover, the intention of schoolchildren to take breakfast daily in the intervention group showed a significant improvement than in the control group at post-assessment.

## Discussion

The current study was an outcome evaluation of a school intervention program to promote healthy nutrition among teenagers in an urban environment in Tunisia. It is particular as it represents a pilot study in Tunisia and North Africa. The intervention consisted in different courses and activities provided to students of the intervention group, whereas no particular actions were carried out in the control group. Pre- and post-tests were conducted in both groups in order to assess the effects of the intervention in terms of changes in the students' knowledge, behavior, and intentions.

One of the limitations of this study is the absence of randomization of intervention and control groups. However, we verified the comparability between the two groups in the tested variables. In addition, we did not compare between the intervention and control groups at post-assessment when the variables were different at the pre-assessment. The other limit was the duration of the study. In fact, it lasted only for 6 months. However, even in such a short period, improvements in almost all tested variables were already observed. At this stage, we essentially tried to evaluate the feasibility of such intervention with this pilot study, which should be followed by a more durable project that will target a larger population.

Several studies demonstrated the positive effects of school intervention programs in improving knowledge concerning healthy nutrition habits among students of different ages. In our study, knowledge was assessed by the question, “Do you know what you should eat for breakfast?” The number of students who gave the right answer as to the proper composition of an “ideal breakfast” was computed. There was a significant improvement from the pre- to post-tests in the intervention group but not in the control group. A pilot study to examine the Michigan Model Nutrition Curriculum on nutrition knowledge, efficacy expectations, and eating behaviors in middle school students showed a positive change in nutrition knowledge (10). Meanwhile, a multicomponent nutrition education program among African American kindergarten and first-grade students attending an urban school also showed a high change of improved knowledge from pre to post in the experimental group (11).

With regards changes in eating behaviors observed in the current study, at post-test, students in the intervention group made significant improvements in several

**Table 3** Comparison of knowledge, behaviors, and expectations before and after the intervention in the control group.

Behaviors	Pre intervention		Post intervention		p-Value
	n	%	n	%	
Know the ideal composition of breakfast	157	16.5	173	18.2	0.28
“Ideal” breakfast intake	38	4.5	24	2.8	0.44
Daily breakfast intake	541	53.5	538	53.2	0.883
Daily dairy products intake	518	51.6	573	57.1	0.001
FVC of five or more times every day	50	25.3	68	34.3	0.38
Snaking at the evening	621	62.1	591	95.1	0.087
Soft drink intake every day					
Yes	221	22	206	20.5	0.319
Fast food intake of three or more times per week	369	40.5	375	41.2	0.765
Intend to take breakfast every day	820	81.6	850	84.6	0.23
Intend to take vegetables every day	626	62	677	67.1	0.001
Intend to take fruits every day	894	89.3	906	90.5	0.315

themes relative to schoolchildren in the control group and relative to their own pretest habits. Improving daily fruit and vegetable consumption (FVC) was one of the most important aims of our study and the majority of similar ones. In fact, recent studies suggested that increasing FVC as part of an overall healthful diet may reduce the risks for obesity, non-insulin-dependent diabetes mellitus, cancer, hypertension, hyperlipidemia, coronary heart disease, as well as other health problems in adults (12). According to meta and pooling analyses from seven studies, school-based interventions can successfully increase FVC among students (13). This purpose was not completely achieved in our study. Though we observed a moderate improvement in percentage of students who took at least five fruits and vegetables a day in the intervention group, this was not a significant one ( $p=0.683$ ). This can be partly attributed to the fact that our intervention did not contain a school lunch component, where an additional promotion of FVC could have been provided through tasting sessions or served meals, as it was the case in other studies.

As part of a healthy diet, reducing fast food consumption among young people was another important objective of our intervention. According to Bowman et al., children who ate fast food, compared with those who did not, consumed more total energy, energy per gram of food, total fat, total carbohydrate, added sugars, and sugar-sweetened beverages; they also consumed less fiber and milk as well as fewer fruits and nonstarchy vegetables (14). A study with white young adults found that eating fast food more than twice vs. less than once per

week was associated with 86% increased risk of becoming obese (15).

Healthy nutrition behaviors also include improving quality of beverage intake by increasing dairy product consumption and reducing carbonated sugary beverage, in order to prevent bone fractures (16), obesity (17), and tooth decay (18). In our study, daily consumption of dairy products improved significantly in both intervention and control group. A decrease in carbonated beverages intake was also observed in both groups, but this was significant only in the intervention group. In the fluids used effectively for living (FUEL) program (19), a decrease in sugary beverage intake was observed after a peer educator school-based nutrition education approach.

Our results concerning expectations for the future nutrition behavior showed significant improvement in the intervention group at post-test. This improvement indicates a degree of enthusiasm among students and reflects the impact of the provided actions on their minds. These findings, however, have to be confirmed by long-term studies.

## Conclusion

This was a school intervention program to improve nutrition knowledge, habits and expectations among urban teenagers. It also represented also a pilot study that aimed to evaluate the feasibility and acceptability of such an intervention. Positive effects were observed in several items in the intervention group. Our results mostly tallied

with those of similar studies, thereby supporting the concept that school intervention programs can play an important role in improving students' dietary intake. It seems necessary to broaden the scope of such interventions among young people, including school and extra

school activities, to ensure the acquisition and persistence of healthy habits.

Received May 28, 2013; accepted July 4, 2013; previously published online October 4, 2013

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