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### School-based dietary intervention to promote healthy eating habits and physical activity among adolescence in rural area

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#### Abstract

**Background:** Obesity and overweight are among the fastest growing health issues for children and adolescents, creating health problems later in life and producing an economic burden on the health systems. Unhealthy dietary habits and lifestyle among adolescents is considered as a risk factor for nutrition-related diseases in adulthood. Educational intervention for change in the behavioral for school adolescents can help to develop a better understanding and consumption of the proper food.

**Aim:** To examine the effectiveness of school-based dietary intervention on healthy eating habits and physical activity among adolescences in a rural area.

**Design:** A quasi experimental (pre/post-test) design was used.

**Setting:** The study was conducted at Tala City and Zenara Village at Menoufia Governorate, Egypt.

**Sample:** A convenience sample of 347 secondary school adolescent students was selected. The selected schools were located in the rural areas of Menoufia Governorate, Egypt.

**Tools:** Semi-structured Demographic Sheet; The Diet Self Efficacy Scale and Healthy Eating Active Living Youth Nutrition and Physical Activity Survey.

**Results:** There was a statistically significant difference in the mean score of the participants' dietary self-efficacy post intervention. While, there was no statistically significant difference in the participants' body mass index and healthy eating habits and physical efficiency post intervention compared to pre intervention.

**Recommendations:** The school authorities and government should pay more attention toward regulating food availability in schools, restricting access to sugary soft drinks and provide the needed actions against the consumption of such foods in schools and increasing the availability of healthy alternatives such as fresh fruit and vegetable options and involving parents in the school-based interventions to help adolescents improve their diet quality.

**Keywords:** obesity, adolescents, eating habits, school-based dietary intervention

#### Introduction

##### Background

Adolescence are critical periods for health and development as eating habits, lifestyle and behavior patterns are established during this period that may persist throughout adulthood [1]. Adolescent obesity is one of the most serious community health challenges of the 21st century [2]. Also, adolescent health is a public health concern because the high prevalence of sedentary lifestyle [3]. Sedentary lifestyle is associated with an increase in obesity, dyslipidemia, fasting hyperglycemia, sarcopenia, metabolic syndrome, [4] high blood pressure, [5] and some mental health problems, such as anxiety and depression [6].

Obesity and overweight are among the fastest growing health issues for children and adolescents, creating health problems later in life and producing an economic burden on

the health systems. Unhealthy dietary habits and lifestyle among adolescents is considered as a risk factor for nutrition-related diseases in adulthood [7]. Adolescent obesity is associated with co-morbidities such as hypertension, endothelial dysfunction, insulin resistance and Type II Diabetes Mellitus (TII DM) [8]. Obesity can increase the risk for asthma in adults by approximately 50% [9] and cause psychological problems such as depression and poor quality of life [10]. Therefore, the prevention and management of childhood and an adolescent obesity is so important.

Reducing childhood obesity requires effective lifestyle and behavioral interventions that target healthy eating and physical activity among the general child population [11, 12]. It was suggested that adoption of healthy eating habits, regular exercise (at least 30 min/day) and school education

on healthy eating are important [13, 14]. Healthy lifestyle habits, including healthy eating and physical activity can lower the risk of becoming obese and developing related diseases [15]. Dietary habits are one of the modifiable risk factors for nutrition related health problems during adolescence [16]. Dietary intervention and physical activity are important strategies that may help to reduce adolescent overweight and obesity [17]. A healthy diet can have a significant effect on maintaining a healthy weight, improving physical and intellectual performance, optimizing growth and improving skin health [18]. Proper nutrition facilitates the development of the body and mind among children and adolescents [19, 20]. The educational intervention about dietary habits and physical activities proved to be effective in encouraging adolescence to eat more healthily and to adopt an active lifestyle [21].

### Significance of the study

Children and adolescents obesity continued to rise globally and in low- and middle-income countries particularly in the last two decades [22]. It was reported that poor food choices and lack of nutritional knowledge has negative consequences on adolescents' school performance. Also, nutritional deficiencies during this critical period of brain development can cause a lasting impact on students' intellectual development.

Implementing a nutritional educational program among adolescent students could improve nutritional knowledge and therefore could improve the dietary behavior of adolescents. While schools are an ideal setting for reaching adolescents to promote physical activity and improve diet quality, there is not enough evidence for determining the effectiveness of school-based interventions, particularly among adolescents in a rural area. Recently, there have been significant changes in food culture and eating behavior particularly among the adolescents in rural area. Adolescents in the rural area have low knowledge of proper food and the majority of them are at risk of eating unhealthy food such as junk food outside the house. Hence, gaining knowledge of nutrition can be beneficial in improving the health and well-being of adolescents, educational intervention for change in the behavioral for school adolescents can help to develop a better understanding and consumption of proper food.

### Aim of the study

The aim of the current study was to examine the effectiveness of school-based dietary intervention on healthy eating habits and physical activity among adolescences in a rural area.

### Research hypotheses

1. Body Mass Index of adolescents who receive the school-based dietary intervention will be less than the BMI of adolescents who do not receive the intervention.
2. Dieting self-efficacy of adolescents who receive the school-based dietary intervention will increase more than those who do not receive the intervention.
3. Adolescents who receive the school-based dietary intervention have more healthy eating habits and physical efficacy than those who do not receive the

school-based dietary intervention.

### Theoretical framework

The current school-based intervention was guided by Self-Determination Theory (SDT) [27] and the Information-Motivation-Behavioral skills (IMB) model [28]. There are three basic needs were identified by the Self-Determination Theory that promote intrinsic motivation to drive behavior: competence (self-efficacy), autonomy (choice), and relatedness (social support). The Information-Motivation-Behavioral skills model indicates that making a positive change in behavior is increased when an individual has information, motivation, and behavioral skills for accomplishing the task. According to the model, self-efficacy, social support from others (e.g., parents, peers, and teachers), and motivation are related to healthy eating among adolescents.

### Methods

**Design:** A quasi experimental (pre/post-test) design was used.

**Setting:** This study was conducted at Tala City and Zenara Village at Menoufia Governorate, Egypt.

**Sample:** A convenience sample of 347 adolescent students, who attended to secondary school at Tala city and Zenara village at Menoufia Governorate, Egypt were selected. The selected schools were located in the rural areas of Menoufia Governorate, Egypt.

**Sample size calculation:** Sample size was calculated using AP info computerized system [29]. Based on previous studies, we expect that the change of the outcomes before and after the intervention will ranges from 50% to 75%. Accepting the Type I error is equal to 0.05% and expecting absolute precision is equal to 5% with a power of  $(1-\beta)$  80%, a sample size was calculated.

### Tools of data collection

1. **Semi-structured Demographic Sheet developed by the researcher to collect data including:** Age, gender, family history of obesity, Father' monthly income and place of residence. As well as, height and weight were measured to calculate the BMI. Height was measured to the nearest 0.1 cm barefooted using a wall-mounted stadiometer. Weight was measured to the nearest 0.1 kg using a digital weighing scale.
2. **The Diet Self Efficacy Scale (DSES):** Self-Efficacy was measured using the Diet Self Efficacy Scale (DSES) [30]. The scale consists of 11 questions answered by not at all confident, a little confident, moderately confident, quite confident and very confident, to assess three factors including: High Caloric Food temptations (HCF), four items; Social and Internal Factors (SIF), four items; Negative Emotional Events (NEE), three items. The scores ranged from 1 (not at all confident) to 5 (very confident). The internal consistency for the diet self-efficacy scale ranges from  $\alpha = 0.82$  to  $0.87$  in previous study [31]. The internal consistency values for the three subscales range from  $\alpha = 0.70$  to  $0.77$  for HCF,  $\alpha = 0.71$  to  $0.79$  for SIF,  $\alpha =$

0.75 to 0.79 for NEE. Test-retest reliability: Test-retest correlations for 2 to 3 weeks interval are  $r_{tt} = 0.83$  for the DIET-SE scale,  $r_{tt} = 0.75$  for the HCF,  $r_{tt} = 0.77$  for the SIF, and  $r_{tt} = 0.80$  for the NEE subscale.

- 3. Healthy Eating Active Living Youth Nutrition and Physical Activity Survey:** Developed by [32] and used to evaluate eating habits and physical activity. The survey consisted of 7 sections referred to: Section one, Nutrition habits, 14 questions, the total score being 56; Section two, School food, 11 questions, the total score being 66; physical activity, 12 questions, the total score being 36; physical activity at school 12 questions, the total score being 48, Opinion about nutrition, 11 questions, the total score being 44; physical activity in your community, 27 questions, the total score being 81; Information about you, 6 questions, the total score being 18.

Reliability of the Healthy Eating Active Living Youth Nutrition and Physical Activity Survey was estimated using survey of 107 adolescences students' age range from 15-18 years. The eating habits and physical activity were assessed to use dietary intervention program by [33]. Internal consistency was evaluated using Cronbach's alpha and was approximately 87% for the total questionnaire. In the present study, test-retest reliability of the survey was 0.84 at 35 students with a two weeks interval.

**Ethical considerations**

The Faculty of Nursing and the Ethics and Research Committee approved the study. School directors agreed to enroll in the study. The researchers explained the purpose of the study to the students and their parents to get their approval. The subjects were assured that their participation in the study is voluntary and that they can withdraw from the study at any time and can refuse to complete the study.

**Data collection procedure**

Data were collected from the beginning of February 2019 to the end of April 2019. The researcher explained the aim and the duration of the study to the school nurse. Also, the researcher discussed with the school nurse the most convenient time to meet with the students without disturbing the school schedule.

Students were interviewed in groups (5 to 10 students per group) three times per week for three months. Each session lasted for two hours. During the session the researcher help the students to read the designed booklet and answer any questions related to the booklet contents. The booklet contain information about the healthy foods and the foods they should avoid; simple way to calculate the calories in each food item, easy steps to increase their physical activity; how to train self to resist unhealthy habits and ways to promote healthy food choices.

**The dietary intervention**

The school-based dietary intervention in the current study was designed with the goal of reducing the daily calorie

intake by 20-30% to lose 10% of body weight in three months and including culturally specific foods to suite the residents of a rural area and being sensitive to the costs of foods to accommodate people with low socioeconomic level. Students were given health education about the dietary intervention included oral instruction supported by illustrated instruction booklet. The content of the dietary education included healthy eating habitués such as increasing consumption of fresh fruits and vegetables, fiber, water and reducing consumption of sweet snacks, junk foods and avoiding sugary drinks; causes of overweight and obesity such as sedentary lifestyle activities; health risks and consequences of overweight and obesity. The dietary intervention was coupled by 30 minutes physical activity daily, 2-3 sessions of intense physical exercises in the school field per week in addition to regular physical education classes twice per week about how to stay active throughout the day [34]. The students were instructed to engage in different physical activities to meet the daily 30 minutes physical activity target. The students were free to choose one from the suggested exercise types (e.g. fast walking, stair climbing, and jumping rope).

The rational for the three months duration of the weight loss program is that if the period is more than three moths the students will be exhausted and if less than three month the intervention will not be effective [35]. In addition, three months is the expected time to reach the target weight loss and achieve BMI reduction [36].

**Results**

**Characteristics of the sample**

Three hundred and fifty students were approached over a 3 month period from the beginning of February 2019 to the end of April 2019. Three students did not complete the post-test questionnaires. The final sample consisted of 347 students.

**Table 1:** The demographic characteristics of the studied sample

Items	The studied participants (N = 347)
<b>Age (years)</b>	
Mean ± SD	17.52 ± 0.93
Range	15-19
<b>Sex</b>	
Males	147 (42.4)
Females	200 (57.6)
<b>Economic status</b>	
Excellent	8 (2.3)
Average	336 (96.8)
Below Average	3 (0.9)
<b>Family history of obesity</b>	
Yes	22 (6.3)
No	325 (93.7)

Table (1) showed that the mean age of the participants' was  $17.52 \pm 0.93$ . Fifty seven percent of the participants were females and 42.4% were males. The majority of the participants had an average economic status and 96.8% of the participants have no family history of obesity.

**Table 2:** The effect of the dietary intervention on the body mass index (BMI) post intervention

Items	The studied participants (N = 347)		Paired t-test	P-value
	Pre Mean ± SD	Post Mean ± SD		
Weight (kg)	66.71 ± 11.39	66.40 ± 11.21	0.36	0.718
Range	46-100	46-100		
BMI (kg/m <sup>2</sup> )	24.70 ± 5.16	24.51 ± 5.09	0.49	0.625
Range	14.85 - 56.56	14.85 - 56.56		
Classification of BMI	No (%)	No (%)	χ <sup>2</sup>	0.438
Normal (< 25)	221 (63.7)	235 (67.7)	1.65	
Overweight (25- < 30)	97 (28.0)	90 (25.9)		
Obese (≥ 30)	29 (8.4)	22 (6.3)		

Table (2) revealed that there was no statistically significant difference in the participants’ body mass index post intervention compared to pre intervention. Although the decline in the BMI did not reach statistical significant, the number of participants who were classified as obese decreased from 8.4% pre intervention to 6.3% post

intervention. Also, there was a decline in the number of participants who were classified as overweight from 28% pre intervention to 25.9% post intervention. Although the decrease was not statistically significant it indicates that the intervention was effective.

**Table 3:** The effect of the dietary intervention on dietary self-efficacy post intervention

Items	The studied participants (N = 347)		Paired t-test	P-value
	Pre mean ± SD	Post mean ± SD		
Dietary Self-efficacy	22.12 ± 6.61	31.33 ± 8.26	18.39	<0.001

Table (3) showed that there was a statistically significant difference in the mean score of the participants’ dietary self-efficacy post intervention. The total mean score of the participants dietary self-efficacy was 31.33 ± 8.26 post

intervention compared to 22.12 ± 6.61pre intervention,  $P < 0.001$  which indicate that the intervention was effective in improving the participants dietary self-efficacy.

**Table 4:** The effect of the dietary intervention on healthy eating habits and physical efficiency post intervention

Items	The studied participants (N = 347)		Paired t = test	P-value
	Pre mean ± SD	Post mean ± SD		
Nutrition	76.94 ± 13.51	74.14 ± 9.78	4.28	<0.001
School food	56.16 ± 8.04	58.44 ± 5.96	5.88	<0.001
Physical activity	45.67 ± 10.90	51.44 ± 14.91	8.11	<0.001
Physical activity at school	22.42 ± 3.86	23.19 ± 4.08	3.26	0.001
Opinion about nutrition and physical activity in your community	66.71 ± 11.06	60.82 ± 10.27	9.63	<0.001
Information about you	14.81 ± 1.30	14.83 ± 1.26	0.64	0.525
Total Score	282.79 ± 21.32	282.84 ± 20.24	0.01	0.924

Table (4) illustrated that there was no statistically significant difference in healthy eating habits and physical efficiency post intervention compared to pre intervention. There were statistically significant difference in the mean score of nutrition, school food, physical activity and opinion about nutrition and physical activity in your community post intervention compared to pre intervention, while there were no statistically significant difference in Physical activity at school and Information about you.

**Discussion**

Promotion of health eating habitué is very importance in achieving effective results in the prevention of overweight and obesity. Schools are a suitable place for educational interventions to increase knowledge, attitudes, and behavior for health promotion among adolescents.

**The effect of the dietary intervention on the body mass index**

The current study findings did not support the research hypothesis that BMI of adolescents who receive the school-based dietary intervention will be less than the BMI of adolescents who do not receive the intervention. The findings of the study revealed that participants’ body mass index did not decreased post intervention. The findings are similar to what was reported by [7] who assessed the effect of a school-based lifestyle intervention program on some nutritional and physical activity habits as well as weight change among the female students in the intermediate schools in Jazan, KSA and found that there was no significant change in the BMI.

However, findings of the current study are different from [37] findings that implementation of dietary intervention programs reversed weight trajectories and BMI in children with overweight/obesity in France. Also, similar findings have been reported by [38] who evaluated the feasibility, acceptability, and efficacy of a school- and home-based intervention to improve healthy eating, physical activity, and weight-related outcomes among adolescents. One possible explanation for the different results is that the current study intervention duration was shorter (three months only) than the previous study which lasted four years. This indicates that the short duration of the intervention could not capture the decline in the BMI.

### **The effect of the dietary intervention on dieting self-efficacy**

The current study hypothesized that Adolescents who receive the school-based dietary intervention have more dieting self-efficacy than those who do not receive the school-based dietary intervention. The current findings supported the study hypothesis and revealed that there was a difference in the mean score of the participants' dietary self-efficacy post intervention. Similar findings were reported by [40] who found that Self-efficacy for healthy eating increased for adolescents in the intervention group compared to control after 12 weeks of a school- and home-based intervention. Also, the current findings are similar to [39] who found that there were significant differences in knowledge and self-efficacy scores among 985 adolescents across three rural and three urban districts in India after Community-based interventions to improve the nutritional status of adolescents.

### **The effect of the dietary intervention on healthy eating habits and physical efficacy**

Healthy eating behaviors become less common as young people move through adolescence [18]. The current study findings did not support the study hypothesis that adolescents who receive the school-based dietary intervention have more healthy eating habits and physical efficacy than those who do not receive the school-based dietary intervention. The study findings illustrated that there was no difference in healthy eating habits and physical efficacy post intervention. Although the differences in the mean score of the total healthy eating active living youth nutrition and physical activity survey did not reach statistical significance, there were differences in the mean score of some components of the survey such as nutrition, school food, physical activity and opinion about nutrition and physical activity in your community post intervention. Similar findings were reported by [7] who investigated the effectiveness of a healthy lifestyle intervention including physical activity and eating habits among 565 female school students aged 12-15 years in Kingdom of Saudi Arabia and found that there was a significant increased physical activity measured by the number of students walking daily, the number of days walked, and the time spent on vigorous activities post intervention. They also reported that fast food consumption decreased post intervention. Additionally, the findings of the study are similar to [40] who examined the effect of 8 weeks school-focused nutrition and physical education intervention on the dietary practices among

adolescents in Kenya and found that students in the intervention group were more likely to consume less unhealthy foods and more healthy foods post intervention. However, [41] findings were different from the current study findings where they reported that there was no statistically significant improvement in the values of total nutrition, school food, physical activity and opinion about physical activity in your community after the dietary intervention.

### **Limitations of the study**

- Using questionnaires that are self-reported, possible reactivity in completing the questionnaires in a socially desirable direction can occur.
- The current study used BMI to assess obesity and BMI is known to be an imperfect measure of adiposity, because it is known that physical activity can increase lean muscle mass and decrease fat mass with no changes in BMI [42].

### **Recommendations**

1. The school authorities and government should pay more attention toward regulating food availability in schools, restricting access to sugary soft drinks and provide the needed actions against the consumption of such foods in schools and increasing the availability of healthy alternatives such as fresh fruit and vegetable options.
2. Although targeting schools is important for reaching adolescents it is recommending involving parents in the school-based interventions to help adolescents improve their diet quality.

### **Recommendations for future research**

Future research should be directed at determining sustainability of the intervention effects. Using a control group to determine whether the findings were based upon the intervention rather than a normal process of growth would be beneficial.

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