International Journal of Public Health (2020) 65:893–903
https://doi.org/10.1007/s00038-020-01439-7

ORIGINAL ARTICLE

Effect of a nutritional education intervention on breakfast consumption among preparatory school students in Egypt

Omnia S. Elseifi[1] · Doaa M. Abdelrahman[2] · Eman M. Mortada[1,3]

Received: 6 March 2020 / Revised: 8 July 2020 / Accepted: 14 July 2020 / Published online: 28 July 2020

Abstract

Objectives The current study evaluates the effect of nutritional education based on Pender's health promotion model on breakfast consumption behavior among Egyptian school students.

Methods A pre-posttest intervention study through a nutritional education message based on Pender's health promotion model was carried on 244 preparatory school students. Data were collected using questionnaires and measuring weight, height and blood pressure before and after educational intervention was conducted to the intervention group.

Results The educational intervention was having a significant positive effect on all components of the model in the intervention group, the mean breakfast consumption, frequency of non-skipping and healthy breakfast per week ($p \leq 0.05$). Overweight and obesity and higher blood pressure were significantly present among breakfast skippers.

Conclusions The nutritional educational intervention based on Pender's health promotion model was effective in increasing the frequency of healthy breakfast among the school students. There is a need to develop evidence-based policies, community, family, and school-based interventions to promote healthy lifestyle and nutritional behavior among adolescents for a better quality of life.

Keywords Breakfast consumption · Students · Obesity · Nutrition education · Blood pressure · Pender's health promotion model

Introduction

Obesity is a growing epidemic in school children and adolescence, which has been increased significantly over the past decade, with high burden especially in the Eastern Mediterranean Region (NCD-RisC 2017; GBD 2015 Eastern Mediterranean Region Obesity Collaborators 2018). In Egypt, many studies demonstrate the prevalence of overweight and obesity 11–20% in adolescent school students (Talat and El Shahat 2016; Hamed et al. 2019). Obesity has multiple underlying factors from which unhealthy food is considered as the most important one (Baygi et al. 2013).

Breakfast has always been considered as the most important meal of the day and an indicator of a healthy lifestyle with its positive effect on physical and psychological wellbeing (Szajewska and Ruszczynski 2010).

Regular intake of healthy breakfast is associated with decreased risk of overweight and obesity, which consequently eliminates the risk of metabolic diseases as diabetes and cardiovascular diseases (CVDs), with fewer behavioral disorders. Also it improves cognition, learning and academic achievements among the school students (Cooper et al. 2011; Szajewska and Ruszczynski 2010; Adolphus et al. 2016).

Skipping breakfast is more common than other meals of the day especially in children and adolescents. The rate of

Electronic supplementary material The online version of this article (https://doi.org/10.1007/s00038-020-01439-7) contains supplementary material, which is available to authorized users.

✉ Omnia S. Elseifi
omnia2200@yahoo.com

[1] Community, Environmental and Occupational Medicine Department, Faculty of Medicine, Zagazig University, Zagazig City 44519, Egypt

[2] Department of Pediatrics, Zagazig University, Zagazig City 44519, Egypt

[3] Health Sciences Department, Health and Rehabilitation Sciences College, Princess Nourah Bint Abdulrahman University, Riyadh 11671, Saudi Arabia

skipping breakfast was ranging from 14 to 63.1% among school students in Australia, Korea and the United State of America (USA) (Smith et al. 2010; Kang and Park 2016; Demissie et al. 2018).

Previous studies reported a strong association between skipping breakfast and increasing body mass index (BMI) and abdominal adiposity (So et al. 2011; Nurul-Fadhilah et al. 2013). Other studies demonstrate the association between skipping breakfast and increasing blood pressure, fasting glucose level, LDL and total cholesterol level (Smith et al. 2010; Ho et al. 2015).

Female gender, dissatisfaction about body image, parent behavior, high perceived barriers and low perceived benefits of eating breakfast were the most important underlying factors to skipping breakfast among school students (Hallstrom et al. 2011).

Pender's Health Promotion Model (HPM) is one of the behavioral models which address the interaction between the individual, the interpersonal and the external environment (Pender et al. 2006). The model consists of three main domains; (a) personal characteristics and experiences (prior behaviors and personal factors), (b) behavior-cognitions, and affect (perceived benefits, perceived barriers, perceived self-efficacy, situational influences, interpersonal influences and activity-related affect), c) desirable health promotion behavior (commitment to a plan of action and immediate competing demands and preferences) (Pender et al. 2006).

To our knowledge, this research is the first one to explore the breakfast eating pattern and its effect on BMI and blood pressure level among the school students in Egypt and in using Pender's HPM to change the eating behavior of adolescents. In order to improve the wellbeing and academic achievements of Egyptian school students, the current study was designed as an attempt to evaluate the effect of nutritional education intervention based on Pender's health promotion model on changing breakfast consumption behavior among Egyptian school students.

Methods

Study design and setting

A pre-posttest intervention study through health education was carried out during a period of 6 months (from October 2017 until the end of March 2018) in a preparatory school in Zagazig District, Sharkia governorate, Egypt.

Study subjects

The study subjects were preparatory school students aged 12–14 years old, free from any chronic disease, "this was checked from the students' records in the school and also by asking the parents," and finally, the willingness of the students to participate in the study was confirmed after obtaining both written parental consent and assent from the students.

Sampling and sample size

Zagazig educational district was selected by simple random technique from the 16 educational localities in Sharkia governorate. From the two educational proveniences in Zagazig district, the East Zagazig educational provenience was selected randomly, then one mixed (male and female) preparatory school in EL Tahra Village was selected by simple random technique out of 13 mixed preparatory schools in the district.

Sample size was calculated using Epi info 7 program depending on mean breakfast consumption in pre-intervention (3.5 ± 2.7) and post-intervention (4.9 ± 2.3) from the pilot study, 95% confidence interval, 80% power of the test and intervention to control ratio equals 1, resulting in 102 students, by adding 10% non-response rate, the total sample was 112 students. This number was doubled as using a multistage cluster sampling method, resulting in a total sample size equals 224 students divided into 112 students in each group. From the total school students "643 student," the participants were recruited using systematic random sampling technique, in which every third one from the students' records in each class was selected (643/224) and those who met the inclusion criteria were invited to the study with a response rate (80%), those who didn't match our inclusion criteria were excluded, and the next third student was invited to participate in the study.

Procedure of the study

Data collection

The data were collected by self-administrated pre-posttest questionnaires and through different measurements. The questionnaires were tested for validity by professional expertise and internal consistency for each domain and Cronbach's α coefficient was calculated.

(a) General characters and breakfast character questionnaire: it assess;

- *Sociodemographic characters of the students* age, gender, fathers' and mothers' occupation, and education.
- *Frequency of breakfast intake per week* the response varies from never eat to 7 days per week, the students were classified according to that into skippers (breakfast from 0 to 2 days/

week), semi-skippers (breakfast from 3 to 4 days/week) and non-skippers (breakfast from 5 to 7 days/week) (Ahadi et al. 2015).

- *The quality of the students' breakfast per week* it was categorized according to the consumption of 3 food groups; dairy products and proteins: milk, cheese, yogurt, eggs, cereals and legumes including whole grain bread, ready to eat cereals, beans, and fruit and or vegetables either as a whole or juice, into good quality (containing at least one food from each of the 3 groups); improvable quality (one of the groups is lacking); inadequate quality (two food items are lacking); poor quality (lacking of all three food items or taking fast food, sweets, and snacks). Students with breakfast of good quality or improvable quality $\geq$ 5 days per week were considered having "healthy breakfast," and those with an inadequate quality or poor quality were considered having "unhealthy breakfast" (Córdoba Caro et al. 2014). Cronbach's α coefficient for this part of the questionnaire was 0.83.

(b) Questionnaire for the Pender's Health Promotion Model (HPM) regarding Breakfast Consumption: A specific 58 item questionnaire to assess behavioral factors related to breakfast consumption was used; it was previously developed and tested in another study (Dehdari et al. 2014). The scale was classified into 11 domains including;

- *Prior related behavior* includes two categories, 5 questions each (total 10 items), asking about the attempts of regular breakfast intake in the past. The 10 items were answered on a 5 point Likert scale (1 = never; 5 = always), giving a domain rang of (10–50). Cronbach's α coefficient equal to 0.86.
- *Perceived benefits of eating breakfast* consists of 6 questions assessed by 5 points Likert scale (1 = strongly disagree; 5 = strongly agree), giving total range from (6–30). Cronbach's α coefficient was 0.81.
- *Perceived barriers to breakfast* through 8 questions answered on a 5 points Likert scale (1 = strongly disagree; 5 = strongly agree), with a total range of answers from 8 to 40. Cronbach's α coefficient equals 0.79.
- *Perceived self-efficacy* assessed through 8 statements to evaluate the confidence of the students in adopting the behavior; it was evaluated on 5 points Likert scale (1 = strongly unconfident; 5 = strongly confident), with a total range score of (8–40). Cronbach's α coefficient equals 0.80.
- *Positive affect* of eating breakfast through 2 items using the 5 points Likert scale (1 = strongly disagree; 5 = strongly agree), the total score was from 2 to 10. Cronbach's α coefficient was 0.85.
- *Negative affect* of eating breakfast through 2 items through 5 points Likert scale (1 = strongly disagree; 5 = strongly agree), the total score was from 2 to 10. Cronbach's α coefficient was 0.87.
- *Interpersonal influences* it includes 2 subcategories, with total of 10 questions, asking about the person who is expecting and encouraging the student to take his breakfast regularly. This was plotted on a 5-point scale (1 = never; 5 = always), giving a total score (10–50). Cronbach's α coefficient was 0.72.
- *Situational influences* three items asking about the different situation and settings which influence the students to eat breakfast were evaluated on a 5-point scale (1 = strongly disagree; 5 = strongly agree), giving a total score of (3–15). Cronbach's α coefficient was 0.77.
- *Immediate competing demands and preferences* four statements were used to assess the demands and preferences of the students that compete with their intake of healthy breakfast. The 4 assessment was on a 5-point scale (1 = never; 5 = always), with a total score ranging from (4–20). Cronbach's α coefficient was 0.80.
- *Commitment to planning for breakfast eating* through five questions and the answers were plotted on a 5-point scale (1 = not at all; 5 = very much), with total score ranging from (5–25). Cronbach's α coefficient was 0.82.

(c) Measurements

The BMI the weight and the height were measured by the researchers with assistance of the health visitor in the school clinic through a digital scale and elastic height measurement tap while the students were standing straight, wearing light clothes, without shoes with parallel feet and relaxed arms, the head was relaxed with looking forward in the Frankfurt plane. The measurements were taken twice, as the weight was calculated to the nearest 0.1 kg and the height to the nearest 0.5 cm, and the average was recorded. BMI was calculated from the equation weight divided by squared height in meter (kg/m^2), the BMI value of each participant was classified according to WHO percentiles into underweight (BMI $<$ 5th percentile), normal (BMI from 5th to $<$ 85th percentiles), overweight (BMI from 85 to $<$ 95th

percentile) and obese (BMI ≥ 95th percentile) (WHO 2018).

Blood pressure Blood pressure (BP) was measured using a stethoscope and a standardized mercury sphygmomanometer. The cuff of sphygmomanometer was placed 2 cm above the cubital fossa. The measurement was recorded after rest for 10 min in the sitting position with supporting the student's arm and the cuff at the level of the heart, the students were asked to be silent during measurement. Two measurements (at 2-min intervals) were performed, and the average systolic blood pressure (SBP) and diastolic blood pressure (DBP) values were recorded. BP was categorized based on sex, age, and height percentiles into three groups: normal blood pressure (< 90th percentile), pre-hypertension (≥ 90th percentile till < 95th percentile), and hypertension (≥ 95th percentile) (Flynn and Falkner 2017).

Intervention

Through month duration, both groups were initially pretested through the questionnaires, weight, height, and blood pressure measurement.

Over the next 5 weeks, a nutritional education message based on Pender's HPM was delivered to the intervention group "8 small groups, 14 students each" through 5 sessions (one session every week), each session takes 30 min.

The message in the first four sessions concentrates on the importance of eating breakfast and the health consequences of skipping that meal, the recommended frequency, the meaning and alternatives of healthy breakfast, the barriers of eating breakfast and how to deal with. The message was designed based on previous similar study (Dehdari et al. 2014), and the nutritional educational materials from the US Department of Agriculture (USDA) (USDA-a 2018). The message was delivered using PowerPoint presentation, group discussion as questions and answers; this was important in allowing the students to express their perceived barriers. Each student was asked to put his own plan to improve the frequency and quality of breakfast consumption, and this was discussed with the researchers. Also booklets were designed and distributed based on nutritional educational materials from USDA (USDA-b 2018). The last session of the intervention was a summary about all the information delivered during the previous sessions with emphasis on the social support, so the mothers of the students were invited to attend this session (participation rate 73%) in order to increase the family involvement. The response of the mothers was extremely positive represented in their engagement in the discussion and asking questions to the researchers, especially regarding unhealthy breakfast and the different alternatives of breakfast.

The posttest questionnaire was distributed to both groups after 2 months of the end of intervention; also measurement of weight, height, blood pressure was conducted for the students in both groups.

Pilot study a pilot study was performed on 22 students who were excluded from the study to evaluate the questionnaire before starting the study. Necessary modifications were conducted accordingly to make it simpler, short, clear and culturally accepted.

Outcomes Items of HPM and breakfast consumption habits.

Data analysis and management Data were coded and analyzed by SPSS (Statistical Package for the Social Sciences). Mean, standard deviation and percentages were used to represent the quantitative data and qualitative data, respectively. Comparing mean scores was performed using paired t test, independent t test, Wilcoxon rank test and the Man–Whitney U test. Chi-square, Fisher and McNemar exact tests were used to find the association between qualitative data categories. Linear regression was used to find the predictors for the weekly breakfast mean score. A significant difference was considered as p value ≤ 0.05.

Results

Table 1 shows that there was no statistically significant difference between the two studied groups regarding their general characters and health measures; the mean age was around 13 years old in both groups, girls represent 50.9% in the intervention group, while in the control group, boys represent 53.6%. Most of the fathers' and mothers' education was university or higher in both groups. Most of the fathers were employees, and most of the mothers were working in both groups. Most of the students were having normal BMI, only about 19.6% and 17.9% of students in the intervention and control groups, respectively, suffer from obesity. Most of the studied students were normotensive in pre- and posttest stages, and the minorities were in the pre-hypertensive state.

Table 2 shows that the mean breakfast consumption in both groups was higher among students of normal BMI, normal SBP and DPB. This was significantly different from the mean breakfast in overweight and obese students and those with pre-hypertension status, $p < 0.05$.

Regarding the comparison of the components of HPM, Table 3 demonstrates that the means of each component of the model were nearly the same between groups in the

Table 1 General characters and health-related measures of the participated students, Egypt, 2017–2018

Characters	Intervention group no. 112 (100.0%)	Control group no. 112 (100.0%)	*p value*
Age			
Mean ± SD	13.05 ± 0.63	13.00 ± 0.67	0.57
Gender			
Girls	57 (50.9)	52 (46.4)	0.50
Boys	55 (49.1)	60 (53.6)	
Father's education			
Pre-university	40 (35.7)	46 (41.1)	0.41
University or higher	72 (64.3)	66 (58.9)	
Mother's education			
Pre-university	44 (39.3)	50 (44.6)	0.41
University or higher	68 (60.7)	62 (55.4)	
Father's occupation			
Skilled worker	6 (5.3)	11 (9.8)	0.43
Employee	62 (55.4)	57 (50.9)	
Professional	44 (39.3)	44 (39.3)	
Mother's occupation			
Housewife	53 (47.3)	52 (46.4)	0.89
Working	59 (52.7)	60 (53.6)	
BMI: (mean ± SD)			
Pretest	20.73 ± 2.1	20.98 ± 2.46	0.41
Posttest	20.72 ± 2.1	21.73 ± 2.49	0.36
BMI categories			
Pretest			
Normal weight	69 (61.6)69 (61.6)	66 (58.9)	0.70
Overweight	21 (18.8)	26 (23.2)	
Obese	22 (19.6)	20 (17.9)	
Posttest			
Normal weight	69 (61.6)	65(58.0)	0.85
Overweight	24 (21.4)	27 (24.1)	
Obese	19 (17.0)	20 (17.9)	
SBP (mmHg): (mean ± SD)			
Pretest	99.22 ± 6.2	99.56 ± 4.8	0.64
Posttest	99.07 ± 6.0	100.1 ± 4.3	0.14
SBP categories			
Pretest			
Normal	108 (94.7)	108 (94.7)	1.00*
Pre-hypertensive	4 (3.6)	4 (3.6)	
Posttest			
Normal	109 (97.3)	108 (94.7)	1.00*
Pre-hypertensive	3 (2.7)	4 (3.6)	
DBP (mmHg): (mean ± SD)			
Pretest	58.92 ± 8.3	58.83 ± 2.6	0.91
Posttest	58.85 ± 2.3	59.11 ± 1.8	0.34
DBP categories			
Pretest			
Normal	109 (97.3)	109 (97.3)	1.00*
Pre-hypertensive	3 (2.7)	3 (2.7)	
Posttest			

Table 1 (continued)

Characters	Intervention group no. 112 (100.0%)	Control group no. 112 (100.0%)	*p value*
Normal	111 (99.1)	109 (97.3)	0.62*
Pre-hypertensive	1 (0.9)	3 (2.7)	

SBP systolic blood pressure, *DBP* diastolic blood pressure, *BMI* Body Mass Index, *mmHg* millimeter of mercury Chi-square and Independent t test were computed between the intervention and control groups

*Fisher exact was calculated. $p \leq 0.05$ is significant

Table 2 Mean of breakfast consumption per week according to different health measures categories among students, Egypt, 2017–2018

Studied groups health measures	Intervention group no. 112 (mean ± SD)		*p* values			Control group no. 112 (mean ± SD)		*p* values		
	Pretest	Posttest	P1	P2[a]	P2[b]	Pretest	Posttest	P1	P2[a]	P2[b]
BMI										
Normal weight	4.69 ± 0.9	5.07 ± 1.1	< 0.001	< 0.001	< 0.001	4.03 ± 1.2	4.04 ± 1.0	0.68	< 0.001	< 0.001
Overweight	3.33 ± 0.6	4.95 ± 0.8	< 0.001			3.35 ± 0.7	3.40 ± 0.8	0.20		
Obese	2.52 ± 0.8	3.05 ± 0.7	< 0.001			2.88 ± 1.8	2.88 ± 1.8	–		
SBP (mmHg)										
Normal	4.66 ± 1.1	5.03 ± 0.9	< 0.001	< 0.001	0.001	4.50 ± 1.3	4.53 ± 1.5	0.12*	0.004	0.01**
Pre-hypertension	2.33 ± 0.5	3.33 ± 0.7	0.002			2.60 ± 1.0	2.62 ± 0.8	0.85		
DBP (mmHg)										
Normal	4.28 ± 1.0	5.00 ± 1.4	0.02	0.009	< 0.001	4.00 ± 1.3	4.10 ± 1.9	− 0.08	0.005	0.19**
Pre-hypertension	2.75 ± 0.6	3.41 ± 0.9	0.01			2.62 ± 0.7	± 0.7	0.81*		

SBP systolic blood pressure, *DBP* diastolic blood pressure, *BMI* Body Mass Index, *mmHg* millimeter mercury

P1: *p* value of paired t for the difference between pre- and posttest within the intervention and control groups, P2a,b: *p* value of independent t for the difference between BMI and blood pressure categories within the intervention and control groups

*Wilcoxon rank test was computed

**Mann–Whitney U test was computed. $p \leq 0.05$ is significant

pretest with no statistically significant difference ($p > 0.05$), but this was changed in the posttest as mean of each component of the HPM was significantly increased within the intervention group ($p = 0.00$) and between the posttest results of both studied groups ($p < 0.05$).

The pattern of breakfast intake per week was presented in Fig. 1; most of the students in the intervention group were skipper in the pretest (36.6%) and the least was non-skipper (28.6%), but this was significantly changed in posttest where the skippers decrease to 19.6% and non-skippers increase to 44.7% ($p < 0.05$). In the control group, most of the students were semi-skippers (42.0%) and the least were skippers (27.7%) in the pre- and posttest results. There was a significant difference between the posttest results in both intervention and control group ($p \leq 0.05$).

Figure 2 demonstrates the pretest and posttest quality of the student's breakfast per week; in the intervention group, 57.1% of the students were having healthy breakfast in the pretest that was increased to 68.6% in the posttest ($p = 0.000$). For the control group; 45.5% of the students consume healthy breakfast, in the pretest and posttest. The pre- and posttest results between the intervention and control groups differed significantly ($p < 0.05$).

The health education intervention, prior behavior, posttest Perceived benefits, posttest perceived barriers, and interpersonal influences were the significant predictors for breakfast consumption after the intervention using linear regression model as all variables were entered the model to found their effect on post-intervention breakfast intake. Table 4.

Table 3 Comparing the components of Pender's health promotion model from pre- to posttest between the intervention and control group, Egypt, 2017–2018

Characters	Phase	Intervention group no. 112 (mean ± SD)	Control group no. 112 (mean ± SD)	P1	P2[a]	P2[b]
Prior related behavior	Pretest	22.08 ± 3.12	22.36 ± 2.86	0.49	< 0.001	0.15
	Posttest	24.62 ± 3.12	22.38 ± 2.85	< 0.001		
Perceived benefits of eating breakfast	Pretest	11.24 ± 1.75	10.79 ± 1.32	0.03	< 0.001	0.48
	Posttest	14.92 ± 2.67	10.81 ± 1.34	< 0.001		
Perceived barriers to eating breakfast	Pretest	24.98 ± 2.26	23.94 ± 2.08	< 0.001	< 0.001	0.31
	Posttest	20.61 ± 2.74	23.91 ± 2.1	< 0.001		
Perceived self-efficacy	Pretest	13.08 ± 2.47	13.16 ± 2.32	0.78	< 0.001	0.22
	Posttest	16.02 ± 2.33	13.12 ± 2.38	< 0.001		
Positive affect	Pretest	6.16 ± 2.05	6.33 ± 2.06	0.56**	< 0.001*	0.47*
	Posttest	7. 46 ± 1.34	6.37 ± 2.01	< 0.001**		
Negative affect	Pretest	6.93 ± 1.00	7.13 ± 1.09	0.16	< 0.001	0.08
	Posttest	5.00 ± 0.99	7.12 ± 1.15	< 0.001		
Interpersonal influences	Pretest	20.95 ± 3.93	21.42 ± 3.21	0.32	< 0.001	0.56
	Posttest	23.35 ± 4.34	21.43 ± 3.23	< 0.001		
Situational influences	Pretest	7.75 ± 1.78	7.52 ± 2.09	0.39	< 0.001	0.15
	Posttest	8.31 ± 1.79	7.54 ± 2.07	0.00		
Immediate competing demands and preferences	Pretest	14.43 ± 2.00	15.51 ± 2.04	< 0.001	< 0.001	0.18
	Posttest	11.47 ± 1.88	15.49 ± 2.04	< 0.001		
Commitment to planning	Pretest	11.14 ± 2.26	11.61 ± 2.36	0.12	< 0.001	0.15
	Posttest	12.72 ± 2.19	11.63 ± 2.37	< 0.001		
Mean of breakfast consumption/week	Pretest	3.59 ± 1.02	3.63 ± 0.90	0.75	< 0.001	0.13
	Posttest	4.94 ± 1.22	3.65 ± 1.04	< 0.001		

$p \leq 0.05$ is significant. P1: p value of independent t test for the pretest and posttest between the groups. P2a and b: p value for paired sample t test within each group

*Wilcoxon rank test was computed

**Mann-Whitney U test was computed

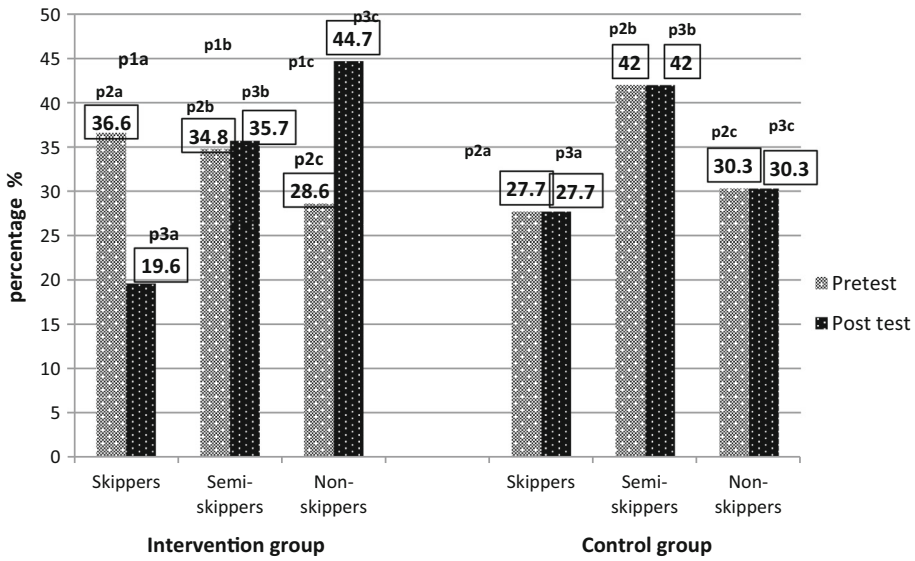

Fig. 1 Pattern of breakfast intake among the students per week, Egypt, 2017–2018. p 1 a, b values of Mc Nemar test for comparing unhealthy and healthypattern of breakfast within the intervention group $p < 0.001$ p2 *a, b* values of chi square comparing pretest analysis for unhealthy and healthy pattern of breakfast between the intervention and control group < 0.05 p3 a, b values of chi square comparing posttest analysis for unhealthy and healthy pattern of breakfast between the intervention and control group $p < 0.001$ $P \leq 0.05$ is significant

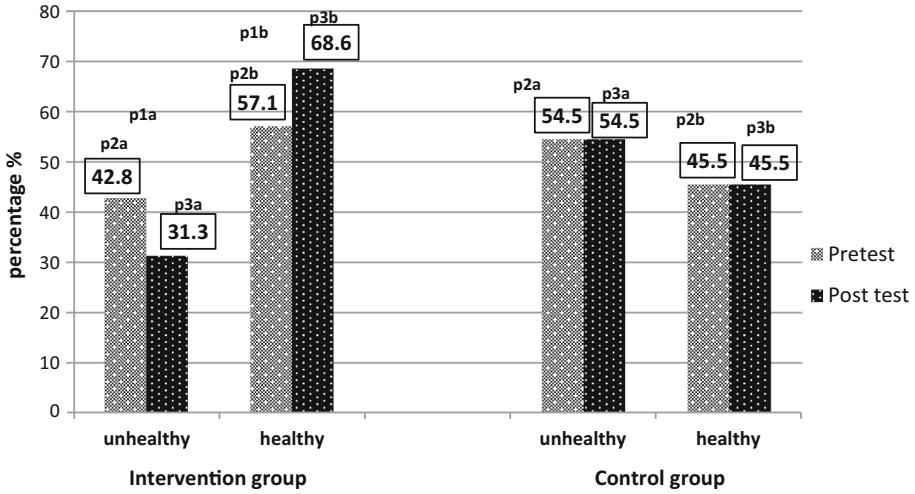

Fig. 2 Pretest and posttest quality of the student's breakfast per week, Egypt, 2017–2018. p 1 *a,b* values of Mc Nemar test for comparing unhealthy and healthypattern of breakfast within the intervention group $p < 0.001$ p2 *a,b* values of chi square comparing pretest analysis for unhealthy and healthy pattern of breakfast between the intervention and control group < 0.05p3 *a, b* values of chi square comparing posttest analysis for unhealthy and healthy pattern of breakfast between the intervention and control group $p < 0.001$. $p \leq 0.05$ is significant

Table 4 Regression analysis of factors that predict significantly the post-intervention breakfast intake among the studied groups Egypt, 2017–2018

Variable	*B*	SE	*β*	*t*	*p* value*	95.0% CI for B	
						Lower bound	Upper bound
Constant	6.183	3.078	–	2.009	0.041	0.077	12.288
Intervention	1.390	0.085	0.597	16.279	< 0.001	1.221	1.558
Prior related behavior	0.833	0.043	0.832	19.223	< 0.001	0.747	0.918
Posttest Perceived benefits	0.051	0.018	0.082	2.882	0.004	0.016	0.085
Posttest Perceived barriers	− 0.162	0.061	− 0.245	− 2.647	0.009	− 0.284	0.041
Interpersonal influences	2.114	0.154	0.500	4.231	< 0.001	1.129	3.100

B unstandardized beta "regression coefficient," *SE* standard error for the unstandardized beta. *β* = standardized beta. *t* t test

$p \leq 0.05$ is significant

Discussion

Nutrition education in schools in early life is one of the factors influencing the eating behavior of students (Salimi et al. 2018).

Our study shows that of the Pender's HPM's components were recorded with significantly higher scores in the posttest in the intervention group than the control group. This is in line with the result of a study conducted by Dehdari et al. (2014) using Pender's HPM on school students.

Following health education intervention, Perceived benefits, and Perceived self-efficacy, positive effects scores for eating breakfast were significantly increased and in the same time, the scores of perceived barriers and negative effect were significantly decreased within the intervention group, and as compared to the control group. These are in line with a similar study by Naserpoor et al. (2018).

In our opinion, the higher belief of the students about the benefits of breakfast and the lower perception of barriers lead to increase their self-efficacy regarding the ability in increasing the frequency of breakfast consumption. Studies conducted in the USA and Iran claimed that interventional researches in schools must focus on addressing the benefits and the barriers for the consumption of breakfast in order to improve self-efficacy of the students (Bruening et al. 2010; Mehrabbeik et al. 2017).

The Interpersonal influences score was significantly increased after the health education in the intervention group; this domain reflects the support to the students from the family members especially mothers who attend the last session of health education. From our point of view, this

was an important step for the success of our intervention. The role of the parents in encouraging the healthy breakfast intake and their important role model are well documented. Also the Pender's HPM is based on the fact that the individual can adopt a health-promoting behavior by the support of other surrounding persons especially family (ALBashtawy 2017; Stefani et al. 2018).

Regarding the situational influences; most of the participated students reported in the pretest that they preferred eating breakfast in the home in front of the TV, with increasing the chance of unhealthy food consumption (Ghobadi et al. 2018). This was changed in the posttest as most of the students in the intervention group preferred to eat breakfast either at home with family or at school with their colleagues. This change in behavior was significantly reflected on decreasing their competing demands preference of sleep over eating breakfast, and at the same time increasing their commitment to sleep early and prepare their schoolbag at night in order to have enough time for eating breakfast in the morning. This is the same as the result of the studies conducted in Iran and Jordan using Pender's HPM on school students (Dehdari et al. 2014; ALBashtawy 2017).

Our pretest results for the mean weekly breakfast consumption in the intervention and control groups were nearly the same (3.59 ± 1.02) and (3.63 ± 0.90), respectively. Only about 28.6% of the students in the intervention group and 30.3% in the control group were considered as non-skippers for breakfast (regular consumption 5-7 days/week), and the rest of the students were ranging from semi-skippers to skippers, which is nearly the same as the results of other previous similar studies (Dehdari et al. 2014; El-Qudah 2014; Mehrabbeik et al. 2017).

This was increased significantly to (4.94 ± 1.22) after the health education intervention in the intervention group, while it was nearly unchanged in the control group, with a significant difference between them. This indicates that conducting nutrition interventions especially those based on a theory is essential to improving the frequency and the quality of breakfast intake among students (Kothe et al. 2011; Naserpoor et al. 2018; Salimi et al. 2018).

Our results show that the prior related behavior increased significantly in the posttest. This is important as other studies indicate that the more times the individual has tried to adopt regular breakfast consumption in the past, the higher the probability to be committed to that behavior in the future, depending on the fact that, repeating of certain behavior leads to the gradual development of a habit (Pender et al. 2006; Dehdari et al. 2014).

The prevalence of overweight and obesity among the students in our study was nearly similar to the prevalence of in Cyprus, Peru and Egypt (Papoutsou et al. 2014; Menacho et al. 2014; Talat and El Shahat 2016; Hamed et al. 2019). Those students have lower breakfast consumption as compared to normal-weight students in both groups. Previous studies found BMI increases significantly among breakfast-skippers and semi-skippers (So et al. 2011; Nurul-Fadhilah et al. 2013; Papoutsou et al. 2014).

This could be due to skipping breakfast leads to increase the appetite for the next meal and increasing consumption of unhealthy food and sweats; this will lead to weight gain as well as a hormonal and metabolic disturbance (Astbury et al. 2011).

The percentage of students who are in the pre-hypertensive stage for both SBP and DBP in our study was nearly 1–4%; this is nearly the same as the hypertension level among adolescent students in the study conducted in Peru (Menacho et al. 2014). Interestingly, the students having pre-hypertensive for SBP and DBP show infrequent intake of breakfast per week; this is the same result of the study conducted in Cyprus (Papoutsou et al. 2014).

This could be explained as the BMI among those students was high and increasing weight is strongly associated with the elevation of blood pressure in children. This must be taken seriously as according to previous studies; the probability of occurrence of adulthood cardiovascular diseases is greater in persons who begin to skipped breakfast in their childhood (Smith et al. 2010; Moraes et al. 2014).

The quality of food in all meals including breakfast is very important in achieving the required nutritional requirement of the school students; inadequate quality will lead to serious complications as nutritional deficiency, obesity and cardiometabolic diseases (Dehdari et al. 2012).

Our results demonstrate that only 57.1% of the students in the intervention group and 45.5% in the control group were having healthy breakfast in the pre-intervention stage, and the rest of the students were consuming unhealthy breakfast mainly sweets and snacks. This is in line with the results of another study by Musaiger and Kalam (2014) stated that higher percent of adolescent tend to consume less healthy breakfast.

The percentage of the students who consume healthy breakfast increased in the intervention group in the posttest; this result was the outcome of the study conducted in Spain, which emphasizes on the importance of conducting nutrition education for the school students to improve their practice regarding the healthy breakfast consumption (Córdoba Caro et al. 2014).

The interpersonal influence, prior related behavior, perceived barriers and benefits regarding breakfast as well as the specially designed nutritional educational intervention were the most important predictors for breakfast intake per week. This was similar to the results of other studies which demonstrated the role of the nutrition education and effective training based on Pender's HPM in promoting the healthy eating behaviors among the school students

(Dehdari et al. 2014; Khodaveisi et al. 2017; Mehrabbeik et al. 2017).

Limitations

Choosing the proper time for the intervention sessions through school days was not easy. Data collection was through self-reported questionnaires, so the actual behavior of the students was not observed, beside the presence of recall bias and expected confounders as sociodemographic variables and health measures. We tried to overcome them by selecting short recall period, randomization in selecting the participants and conducting the regression analysis.

Conclusion

Skipping breakfast was higher among students with overweight, obesity and increasing blood pressure. The educational intervention was effective in increasing the frequency of healthy breakfast, by changing the prior related behavior, perceived benefits and barriers and interpersonal influence of the students.

Further studies are needed to explore the breakfast consumption and the different cardiometabolic risks among students. This will help the Egyptian's Ministries of Education and health in the development of evidence-based policies and interventions to promote the nutritional behavior among adolescents for better quality of life.

Acknowledgements Sincere thanks to the school authorities, students and mothers for their cooperation in conducting this study.

Funding There was no external funding source.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval and informed consent All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Official permission was obtained before the study from Zagazig University Institutional Board (ZU-IRB# 5516/4-8-2017). Permission was obtained from the directors of the selected school; also written informed consent was obtained from the parents of the students.

References

Adolphus K, Lawton CL, Champ CL et al (2016) The effects of breakfast and breakfast composition on cognition in children and adolescents: a systematic review. Adv Nutr 7:590S–612S

Ahadi Z, Qorbani M, Kelishadi R et al (2015) Association between breakfast intake with anthropometric measurements, blood pressure and food consumption behaviors among Iranian children and adolescents: the CASPIAN-IV study. Public Health 129(6):740–747

ALBashtawy M (2017) Breakfast Eating Habits Among Schoolchildren. J Pediatr Nurs 36:118–123

Astbury NM, Taylor MA, Macdonald IA (2011) Breakfast consumption affects appetite, energy intake, and the metabolic and endocrine responses to foods consumed later in the day in male habitual breakfast eaters. J Nutr 141(7):1381–1389

Baygi F, Qorbani M, Dorosty AR et al (2013) Dietary predictors of childhood obesity in a representative sample of children in north east of Iran. Chin J Contemp Pediatr 15(7):501–508

Bruening M, Kubik MY, Kenyon D et al (2010) Perceived barriers mediate the association between self-efficacy and fruit and vegetable consumption among students attending alternative high schools. J Am Diet Assoc 10:1542–1546

Cooper SB, Bandelow S, Nevill ME (2011) Breakfast consumption and cognitive function in adolescent schoolchildren. Physiol Behav 103(5):431–439

Córdoba Caro LG, Luengo Pérez LM, García Preciado V (2014) Analysis of knowledge about healthy breakfast and its relation to life style habits and academic performance in compulsory secondary students. Endocrinol Nutr 61(5):242–251

Dehdari T, Khezeli M, Bakhtiyari M et al (2012) Health education interventions on student nutrition: a systematic review. J Health 3(3):62–72

Dehdari T, Rahimi T, Aryaeian N et al (2014) Effect of nutrition education intervention based on Pender's Health Promotion Model in improving the frequency and nutrient intake of breakfast consumption among female Iranian students. Public Health Nutr 17(3):657–666

Demissie Z, Eaton DK, Lowry R et al (2018) Prevalence and correlates of missing meals among high school students-United States, 2010. Am J Health Promot 32(1):89–95

El-Qudah J (2014) Food habits and physical activity patterns among Jordanian adolescents aged 11–18 years. World Appl Sci J 10(29):1213–1219

Flynn JT, Falkner BE (2017) New clinical practice guideline for the management of high blood pressure in children and adolescents. Hypertension 70(4):683–686

GBD 2015 Eastern Mediterranean Region Obesity Collaborators (2015) Burden of obesity in the Eastern Mediterranean Region: findings from the Global Burden of Disease 2015 study. Int J Public Health 63:165–176

Ghobadi S, Totosy de Zepetnek JO, Hemmatdar Z et al (2018) Association between overweight/obesity and eating habits while watching television among primary-school children in the city of Shiraz, Iran. Public Health Nutr 21(3):571–579

Hallstrom L, Vereecken CA, Ruiz JR et al (2011) Breakfast habits and factors influencing food choices at breakfast in relation to socio-economic and family factors among European adolescents. The HELENA study. Appetite 56:649–657

Hamed A, Hassan A, Younis M et al (2019) Prevalence of obesity and overweight among primary schools children in Qena, Egypt. Egypt J Hosp Med 77(2):4899–4905

Ho CY, Huang YC, Lo YT et al (2015) Breakfast is associated with the metabolic syndrome and school performance among Taiwanese children. Res Dev Disabil 43–44:179–188

Kang YW, Park JH (2016) Does skipping breakfast and being overweight influence academic achievement among Korean adolescents? Osong Public Health Res Perspect 7(4):220–227

Khodaveisi M, Omidi A, Farokhi Sh et al (2017) The effect of pender's health promotion model in improving the nutritional

behavior of overweight and obese women. IJCBNM 5(2):165–174
Kothe EJ, Mullan BA, Amaratunga R (2011) Randomized controlled trial of a brief theory-based intervention promoting breakfast consumption. Appetite 56:148–155
Mehrabbeik A, Mahmoodabad SSM, Khosravi HM et al (2017) Breakfast consumption determinants among female high school students of Yazd Province based on Pender's Health Promotion Model. Electron Phys 9(8):5061–5067
Menacho AA, Campos RG, da Silva YM et al (2014) Nutritional status and blood pressure in adolescent students. Arch Argent Pediatr 112(4):302–307
Moraes LI, Nicola TC, Jesus JS et al (2014) High blood pressure in children and its correlation with three definitions of obesity in childhood. Arq Bras Cardiol 102(2):175–180
Musaiger A, Kalam F (2014) Dietary habits and lifestyle among adolescents in Damascus, Syria. Ann Agric Environ Med 21(2):416–419
Naserpoor F, Zamani-Alavijeh F, Shahri P et al (2018) Effect of education based on Pender's health promotion model on nutrition behavior of adolescent girls. J Res Health 8:394–402
NCD Risk Factor Collaboration (NCD-RisC) (2017) Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: a pooled analysis of 2416 population-based measurement studies in 128·9 million children, adolescents, and adults. Lancet 390(10113):2627–2642
Nurul-Fadhilah A, Teo PS, Huybrechts I et al (2013) Infrequent breakfast consumption is associated with higher body adiposity and abdominal obesity in Malaysian school-aged adolescents. PLoS ONE 8(3):e59297
Papoutsou S, Briassoulis G, Hadjigeorgiou C et al (2014) The combination of daily breakfast consumption and optimal breakfast choices in childhood is an important public health message. Int J Food Sci Nutr 65(3):273–279
Pender N, Murdaugh C, Parsons M (2006) Health promotion in nursing practices, 5th edn. Pearson & Prentice Hall, Upper Saddle River
Salimi N, Karimi-Shahanjarini A, Hazavehei SMM et al (2018) The effect of education on increase breakfast consumption among female students based on social cognitive theory (SCT). Health Scope 7(4):e61758
Smith KJ, Gall SL, McNaughton SA et al (2010) Skipping breakfast: longitudinal associations with cardio metabolic risk factors in the Childhood Determinants of Adult Health Study. Am J Clin Nutr 92(6):1316–1325
So H, Nelson E, Li AM et al (2011) Breakfast frequency inversely associated with BMI and body fatness in Hong Kong Chinese children aged 9–18 years. Br J Nutr 106(5):742–751
Stefani M, Harfika A, Anwar K et al (2018) An integrated healthy breakfast education for teachers, school children, and parents in west Java. ICCD 1(1):165–170
Szajewska H, Ruszczynski M (2010) Systematic review demonstrating that breakfast consumption influences body weight outcomes in children and adolescents in Europe. Crit Rev Food Sci Nutr 50:113–119
Talat MA, El Shahat E (2016) Prevalence of overweight and obesity among preparatory school adolescents in Urban Sharkia Governorate, Egypt Dietz WH. Overweight in childhood and adolescence. Gaz Egypt Paediatr Assoc 64:20–25
USDA-a: US Department of Agriculture. Food and nutritional services. Child Nutrition Programs. Nutrition Standards for School Meals. https://www.fns.usda.gov/school-meals/nutrition-standards-school-meals Accessed Nov 2018
USDA-b: US Department of Agriculture. Food and nutritional services. My Plate Guide To School Breakfast. https://fns-prod.azureedge.net/sites/default/files/tn/SB_Infographic_81216a.pdf. Accessed Nov 2018
WHO (2018) The World Health Organization growth references for 5–19 years. https://www.who.int/growthref/en/ Accessed 16 Dec 2018