Effect of Health Belief Model on Lifestyle among Overweight Secondary School Female Students

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Abstract

Background: Overweight among school children become a significant public health concern in both developing and developed countries, as it is accompanied by numerous health problems. **The aim** of this study was to evaluate the effect of Health Belief Model on lifestyle among overweight secondary school female students. **Research design:** A quasi-experimental design was used. **Setting:** This study was carried out at governmental secondary schools at El Sharabia District in North Cairo Governorate. **Sampling:** A purposive sample of 82 overweight secondary school female students. **Two tools were used:** A self-administered questionnaire for the secondary school female students included; demographic characteristics, knowledge regarding overweight, and lifestyle aspects. The second tool was health belief model **Results:** This study revealed that there are highly statistically significant differences (p< 0.001) between total satisfactory knowledge, and total lifestyle aspects as dietary habits, food frequency consumption, physical activities, and sleeping pattern among overweight secondary school female students pre/post implementation of health belief model. There is a highly statistically significant difference between health belief model mean ± SD of subscales and total categories of health belief model pre/post implementation (p< 0.001). **Conclusion:** It can be concluded that, implementation of the health belief model for overweight secondary school female students led to significant improvements in their knowledge and lifestyle aspects. **Recommendation:** Apply a preventive program for school students to protect themselves from overweight and obesity.

Key words: Overweight, Lifestyle, Health Belief Model, Secondary school students.

Introduction

Overweight is an abnormal or excessive fat accumulation and a form of malnutrition that presents a risk to health. Overweight and obesity in children and adolescents are considered global epidemic **(WHO, 2019).** Overweight and obesity are categorized as follows for children aged between 5–19 years: Overweight > + 1SD (equivalent to BMI 25 kg/m^2 at 19 years). Obese > + 2SD (equivalent to BMI 30 kg/m^2 at 19 years) 79% of obese adolescents will become obese adults **(WHO, 2020).**

Over 340 million children and adolescents aged 5–19 years old were identified as overweight or obese in 2016, according to a WHO report. The global prevalence of overweight in children is increasing and there are about 155 million overweight children around the world **(WHO, 2021).**

Overweight among school children are affected by life style related behaviors include

Viewing of television, usage of computers and the internet, physical activity both within and outside of schools, and consumption of breakfast and sugary drinks are all factors.. In addition, changing sleeping pattern. Therefore, health assessments and interventions are greatly needed to combat the increasing rates of overweight among school children **(Kambondo & Sartorius 2018).**

Asthma, obstructive sleep apnea, joint issues, hypertension, hypercholesterolemia, low self-esteem, and depression are all major side effects of being overweight. Obese children are also 5 times more likely to become obese adults, resulting in long-term illness and mortality. **(O'Connor et al., 2017).** The impact of overweight on reproduction starts at a young age. Overweight girls frequently experience the onset of puberty at a younger age than their normal-weight peers. Overweight affects fertility throughout a woman's life, that lead to Polycystic Ovary Syndrome (PCOS) and can be attributed to

multiple endocrine mechanisms **(Armoon & Karimy, 2019).**

Lifestyle modification is the cornerstone for weight management. It includes behavioral techniques for correction of eating, physical activity and sleeping behaviors which leading to weight gain. Weight reduction is generally initiated with corrections in eating habits **(Kushner, 2018).** Understanding the characteristics that predict the occurrence of optimal weight loss behavior is critical for developing effective weight management programs for school students. The Health Belief Model (HBM) is a health-specific social cognition model that aims to explain and predict why people alter or retain certain health habits. **(Faghri et al., 2016).**

Health belief model (HBM) assumes that individual involvement in health-related behaviors is determined by understanding six following constructs: Perceived severity, Perceived susceptibility, Perceived benefit, Perceived barrier, Cue to action and Self-efficacy. These six constructs provide a conceptual framework for designing both long and short-term health behavior interventions for weight management **(Laranjo, 2016).**

Community health nurse can play an important role in obesity prevention through assessment, screening, weight maintenance, behavioral counseling, nutrition education, lifestyle intervention and help to put the management strategies for prevention and management of overweight through availability of information about overweight and its health consequence that will assist in setting goals and targets to reduce the prevalence of overweight **(Coyne, 2019).**

Significance of the study

Egypt is one of the Lower Middle-Income Countries (LMICs) where overweight and obesity among schoolchildren is becoming a serious problem, with rates rising from 6% to 15% between 1990 and 2010. **(Hadhood et al., 2017).** Prevalence of overweight and obesity in Egypt among schoolchildren from 2018-2020 was 21.8%. The prevalence is increasing day by day in both developed and developing countries that cause a variety of chronic diseases and risk of adult mortality **(El-Shafie et al., 2020).** So, the community-based intervention strategies based on behavior modification models are the most important way of overweight prevention.

Aim of This Study

The aim of this study was to evaluate the effect of HBM on lifestyle among overweight secondary school female students through:

1. Assessing secondary school female students' knowledge regarding overweight.

2. Assessing secondary school female students' lifestyle.

3. Developing and implementing HBM for secondary school female students according to their lifestyle.

4. Evaluating the effect of the HBM on secondary school female students' knowledge and lifestyle regarding overweight.

Hypothesis

The HBM will improve secondary school female students' Knowledge and lifestyle regarding overweight.

Subjects and Methods

Research Design: A quasi-experimental design was adopted to carry out this study.

Setting:

The study was carried out at governmental secondary schools at El Sharabia District in North Cairo. From the Cairo Education Directorate records, the researchers selected El Sharabia District because it represents a popular zone with the highest number of governmental secondary female schools with different socio-cultural and economic characteristics. This district contains 7 secondary female schools, 50 % were taken from total schools representing four schools. The selection of the four schools was done by simple random sample technique through balling among the 7 secondary female schools; this was done to ensure randomization selection of schools.

Subjects: This study was carried out on a purposive sample of 90 (82 study sample +8 pilot study) overweight secondary school

female students according to the following criteria:

- Body mass index BMI ≥ 25.0 kg/m^2 - < 30.0 kg/m^2.
- Free from any chronic disease.
- The BMI was calculated by the researchers using a digital electronic scale to measure weight (Salter 9000WH3R). The scale was set to zero before the student was forced to stand on it, and it was double-checked to ensure that the student was dressed in minimal outerwear and wore no shoes.
- Height was measured with a tape measure permanently fixed to a wall or doorframe.
- According to the **WHO (2021)** BMI is calculated by weight in kilograms divided by the square of the child's height in meters (kg/m^2). BMI of 25.0 or more is considered overweight.

Tools of data collection:

Two tools were used for data collection (**Pre/post HBM implementation**).

First tool: A self-administrated questionnaire with closed ended questions was developed by the researchers based on literature review. It was written in simple, clear, Arabic language and consisted of three parts as the follows:

Part one: Designed to collect data about the demographic characteristics of secondary school female students which had 8 items including; age, birth order, pocket money, father's and mother's educational level, father's and mothers' occupation and family income.

Part two: Devoted to the secondary school female student's knowledge about overweight covering the following areas: meaning, weight classification, body mass index, predisposing factors, complications, methods of weight reduction and preventive methods of overweight (**Pre/post HBM implementation).**

Scoring system:

For knowledge items, the proper answers were decided based on a literature review, and a correct response was scored (2) while, an incorrect response was scored (1). For each item of knowledge, the scores of the items were summed–up and the total divided by the

number of the items. These scores were converted into a percent score.

The total score of secondary school female student's knowledge was 14 points, classified into:

- Satisfactory $\geq 50\%$ (7-14 points)
- Unsatisfactory <50% (0-<6 points).

Part three: Adopted from **Jezewska-Zychowicz et al. (2018),** it was designed to assess lifestyle aspects of the overweight secondary school female student as she reported (**Pre / post HBM implementation).** It covers the following three items:

a) Dietary habits, as eating three meals daily, eating meals at regular times, eating breakfast daily, eating outside home, take sandwiches to school, eat snacks between meals, eating fruits or leafy vegetables before meals, eating food from street vendors, eating processed meats in meals, eating fast food during the day, eating crispy chips during the day, drinking water in middle of meals, drinking soft drinks with meals, add extra salt to meals, add extra sugar to hot beverages, eating in front of the TV and sleep immediately after eating. It includes 17 closed ended questions. (**Pre/ post HBM implementation)**.

Scoring system:

The response of this part of the questions was designed as "always" "sometimes" and "never" and was analyzed as follows: A value of (3) was attributed to always, a value of (2) was attributed to sometimes and a value of (1) was attributed to never.

- The total score of dietary habits was 51 points, classified into:
- Good dietary habits $\geq 60\%$ (31-51 points).
- Bad dietary habits < 60% (0-30 points).

b) Food frequency consumption includes 12 items as whole meal (brown) bread, whole grain, red meat, white meat, fish, fried foods, tinned meats, pulses-based foods, fresh fruits, green vegetables, instant soups and sweetened carbonated drinks (**Pre/post HBM implementation).**

Scoring system:

The response of this part of the items was designed as a value of (0) was attributed to "never", a value of (1) was attributed to "1-3 times a month", a value of (2) was attributed to "once a week", a value of (3) was attributed to "several times a week", a value of (4) was attributed to "once a day", a value of (5) was attributed to "several times a day".

The total score was 60 points, classified into:

- Healthy food frequency consumption ≥ 60% (36-60 points).
- Unhealthy food frequency consumption < 60% (0-35 points).

c) Physical/motor activities and sleeping pattern includes 9 closed- ended questions; as do exercises regularly, do exercises for an hour every day, regular participation in the school's sports' activities, always exercise without a specific time, don't spend more than two hours a day for watching TV or the Internet, measure body mass index at least once a week, don't find difficulty to sleep, get some rest during the day and number of hours of sleep ranges from 6-8 hours per day **(Pre/post HBM implementation).**

Scoring system:

The response of this part of the questions was designed as "always" "sometimes" and "never" and was analyzed as follows: A value of (3) was attributed to always, a value of (2) was attributed to sometimes and a value of (1) was attributed to never.

The total score was 27 points classified into:

- Satisfactory practices ≥ 60% (16-27 points).
- Unsatisfactory practices < 60% (0- 15 points).

Second tool: The health belief model (HBM) is adopted from **Park, (2011) and McArthur et al. (2018)**. The tool includes eighty-two statements represented in 7 perceptional and behavioral categories, as follows: Perceived severity consisting of 13 questions, perceived susceptibility consisting of 7 questions, perceived barriers consisting of 14 questions, perceived benefits consisting of 13 questions, cues to action consisting of 12 questions, self-efficacy consisting of 18 questions, and behavioral intention of weight management consisting of 5 questions.

Scoring system

All statements were rated using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Subscale mean scores were obtained by summing and averaging the items (range 1-5). Each subscale was calculated separately.

The total score range was (82-410), and a higher mean score indicated a more positive belief toward overweight preventive behaviors.

Content validity and reliability:

Tools of data collection were submitted to and reviewed by a panel of five experts in the fields of community health nursing and dietitian to test the content validity. Each of the experts was asked to examine tools for content coverage, clarity, wording, length, format, and overall appearance. Modifications were done according to the panel's judgment on the clarity of sentences and content appropriateness as rephrasing and cancelling for some questions.

Reliability was calculated using internal consistency (Cronbach's alpha). Alpha coefficients equal to or higher than 0.70 were considered satisfactory. The overall reliability of the tools based on the Cronbach's alpha, were 0.82 for knowledge, 0.74 for lifestyle aspects and 0.91 for health belief model HBM categories.

II – Operational Design:

Preparatory phase:

- During this phase, a review of the literature was done through reviewing the available national and international related literature to be oriented with various aspects of the research problem and to develop the study tools.

- **Ethical considerations:**

The rights of all female secondary school students were protected; informed consent was obtained from students who agreed to participate in the study, and each one was

informed about the study's expected outcomes. They were assured that all data would be kept private, that the information they provided would only be used for research purposes and for their benefit, and that each study subject would be given adequate time throughout the study. They were also told that they had the right to withdraw at any time and without giving a reason.

Pilot study:

After the development of tools of data collection, a pilot study was carried out on 10 % (8) secondary school female students. The purpose of the pilot study was to ascertain the relevance and content validity of tools, to estimate the time needed for data collection and detect any problem that might face the researchers and interfere with data collection. After conducting the pilot study, the necessary changes were performed; some questions were rephrased, others cancelled, the tools were reconstructed and made ready for use. The piloted sample was excluded from the main study sample.

Field work:
- The study field work was done throughout a period of 4 months from beginning of September 2021, till the end of December 2021.
- Data were collected by distributing the self-administered questionnaire sheet to the selected overweight female students during their free lessons.
- The questionnaire was administrated to students in the school classes under supervision of the researchers. Before the students filled in the questionnaire, the purposes of the study were explained to them.
- The self-administered questionnaire was completed within about 30 minutes.
- Preparation for assessment took one month (September, 2021) for developing the data collection tools, obtained from literature review.
- Data collection and filling in of the questionnaire took 3 months.

HBM development included 3 phases:

Phase 1: Preparation for assessment: (1 month): Based on the preparatory phase for developing the data collection tool obtained from the self-administered questionnaire, as well as literature review.

Phase II: Design and implementation: (3 months): The HBM was designed based on analysis of the actual secondary school female students' needs in pre assessment by using the pre constructed tool. The HBM model was developed through determining the general objective, contents, sessions, teaching methods and media.

The general objective of the model was to improve secondary school female students' knowledge and lifestyle regarding overweight.

Contents:

Contents were designed to meet needs of overweight secondary school female students' and to fit into their interest and levels of understanding. {Teaching methods used in theoretical part were lectures presentation and group discussions, while in practical part they were conducted through demonstration and re-demonstration. Teaching aids included: laptop, posters and evidence-based booklet}.

Sessions: The sessions took place in an empty class chosen for the implementation of the HBM model, the total number of session hours was 8 (3 hours theoretical and 5 hours practical). Each session took about 30 minutes integrated with teaching points and the researchers before going on to a new topic used questions to check the school students' recall and understanding of the material already covered.

The sessions included the following parts:

Part 1: Knowledge about overweight: The researchers provided information about the meaning, predisposing factors, weight classification, body mass index, complications, methods of weight reduction and preventive methods of overweight.

By the end of each session, a summary was made, and time was allocated for questions and answers, and a plan for next session was presented. The researchers adjusted with the female school students a day for the next session according to their school free lessons.

Except for the last session, a termination of sessions through feedback was done.

Part 2: Lifestyle aspects for the overweight school students included: Reported dietary habits which lead to overweight, food frequency consumption, types of physical activities and how to perform them, sleeping pattern and methods to overcome insomnia and methods to calculate body mass index.

The school students were given an educational illustrated booklet, designed by the researchers, in Arabic language, to serve as a referral guideline for them. The educational booklet was evaluated for its content validity and clarity by a panel of experts, professors in the field of community health nursing and dietitian. In the light of their comments, the necessary modifications were carried out and the final form of the educational booklet was administered.

Phase III: Evaluation of the health belief model: Evaluation of the model was done by using the post-test questionnaire, which was the same format of pre-test in order to compare the changes in secondary school female students' knowledge, and lifestyle. It was assessed after one month from HBM implementation.

III. Administrative Design:

An official approval obtained from the Dean of the Faculty of Nursing, Ain Shams University was forwarded to the Directorate of Education in Cairo. Then, an agreement was issued from the Directorate of the Education to El Sharabia Educational Administration. Finally, permissions were obtained from the headmaster of the four selected schools to get their cooperation in conducting the research study.

IV. Statistical Design:

Data collected were coded and entered in a personal computer using the Statistical Package for Social Sciences (SPSS), version 28. Statistical methods were used and analysis of all these data was summarized into frequency tables. Cross tabulations were done to look for associations between independent and dependent variables, using the mean, standard deviation, paired t-test, Chi-square, Pearson correlation coefficient and analysis by r-test, using the mentioned SPSS. Statistically significant difference was considered at $P \leq 0.05$ and highly statistically significant difference at $P \leq 0.001$.

Results:

Table (1) represents that the age of the studied sample ranged from 16-18 years with a mean age of 16.52 ± 6.72 years. As regards pocket money, 80.6% of them spent on buying food.

According to the research hypothesis, it was justified as table (2) shows that there were highly statistically significant differences (p<0.001), in all items of knowledge regarding overweight pre/post HBM implementation.

According to the research hypothesis, it was also justified as figure (1) illustrates that there was a highly statistically significant improvement related to total knowledge score level regarding overweight pre/ post HBM implementation (P< 0.001).

Table (3); shows that there were highly statistically significant improvements in all total healthy lifestyle aspects pre/ post HBM implementation (p< 0.001).

According to the research hypothesis, it was also justified as figure (2) shows that, there was a highly statistically significant difference between total lifestyle score level of the studied sample pre/ post HBM implementation (p< 0.001).

Table (4) elaborates that, there were highly statistically significant differences between total mean score of health belief model subscales pre/ post implementation.

Table (5) represents highly statistically significant differences regarding total Mean and SD of health belief model categories pre/ post implementation (p< 0.001).

Figure (3) elaborates that total mean score of health belief model pre/ post implementation. Mean and SD was 32.35 ± 5.73 pre implementation compared to 45.39 ± 3.06 post implementation with a highly statistically significant differences (p< 0.001).

According to the research hypothesis, it was also justified as Table (6) Clarifies that, there were statistically significant correlation between total health belief model, total

knowledge score level and total healthy lifestyle of the studied sample.

Table (7): Clarifies that, there was a highly statistically significant correlation between total knowledge score level and total healthy lifestyle of the studied sample.

Table (1): Distribution of the Secondary School Female Students According to Their Demographic Characteristics (n = 82).

Items	No	%
Age:		
16 – <17	45	54.9
17-18	37	45.1
Mean ± SD: 16.52±6.72		
Birth order:		
First	27	32.9
Second	18	22.0
Third	24	29.3
Fourth	13	15.8
Pocket money:		
Yes	67	81.7
No	15	18.3
Spend pocket money for (n=67)		
Buying food	54	80.6
Saving money	13	19.4
Mother's educational level:		
Not read or write	14	17.1
Read and write	31	37.8
Moderate education	33	40.2
High education	4	4.9
Mother's occupation:		
House wife	42	51.2
Private sector	15	18.3
Governmental sector	25	30.5
Father's educational level:		
Not read or write	17	20.7
Read and write	32	39
Moderate education	25	30.5
High education	8	9.8
Father's occupation:		
Hand crafts	30	36.6
Private sector	18	22
Governmental sector	27	32.9
Retirement	7	8.5
Family income		
Sufficient	57	69.5
Insufficient	25	30.5

Table (2): Secondary School Female Students' Total Satisfactory Knowledge Score Level Regarding Overweight Pre/ Post HBM Implementation (n = 82).

Items	Total satisfactory knowledge				X^2	P- value
	Pre-implementation		post-implementation			
	No	%	No	%		
Meaning of overweight	54	65.9	74	90.2	14.236	0.000
Weight classification	33	40.2	68	82.9	31.573	0.000
Body mass index	26	31.7	78	95.1	71.67	0.000
Predisposing factors of overweight	32	39.0	62	75.6	22.432	0.000
Complications of overweight	34	41.5	70	85.4	34.062	0.000
Methods of weight reduction	27	32.9	78	95.1	68.856	0.000
Preventive methods of overweight	24	29.3	75	91.5	66.288	0.000

Figure (1): Total Knowledge Score Level Regarding Overweight Pre/ Post HBM Implementation (n = 82).
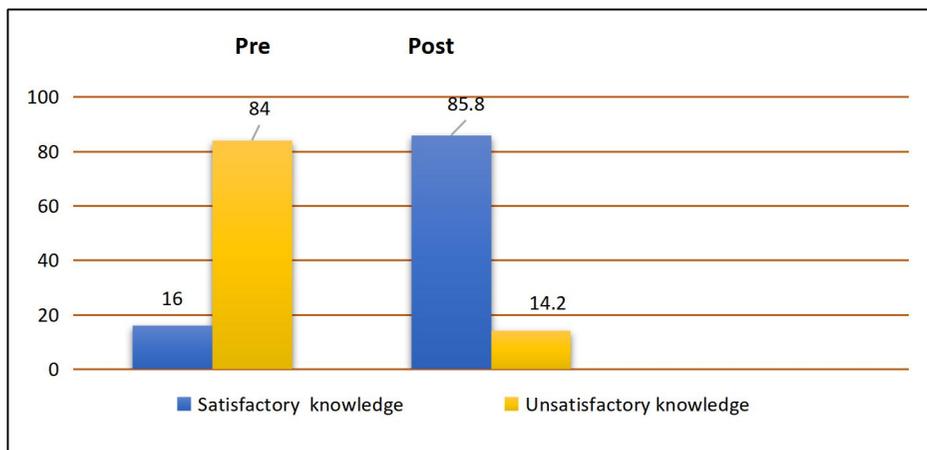
$X^2 = 79.256$ **P-value = 0.000**

Table (3): Secondary School Female Students Total Healthy Lifestyle Aspects Pre &Post HBM Implementation (n = 82).

Lifestyle Aspects	Total healthy lifestyle				X^2	p- value
	Pre-implementation		Post-implementation			
	No	%	No	%		
Dietary habits	14	17.1	73	89.1	85.219	0.000
Food frequency consumption	17	20.7	65	79.3	61.012	0.000
Physical and motor activities	24	29.3	56	68.3	24.990	0.000
Sleeping pattern	19	23.2	63	76.8	37.236	0.000

X^2 26.660   P value 0.000

Figure (2): Secondary School Female Students Total Lifestyle Pre/ Post HBM Implementation (n = 82).
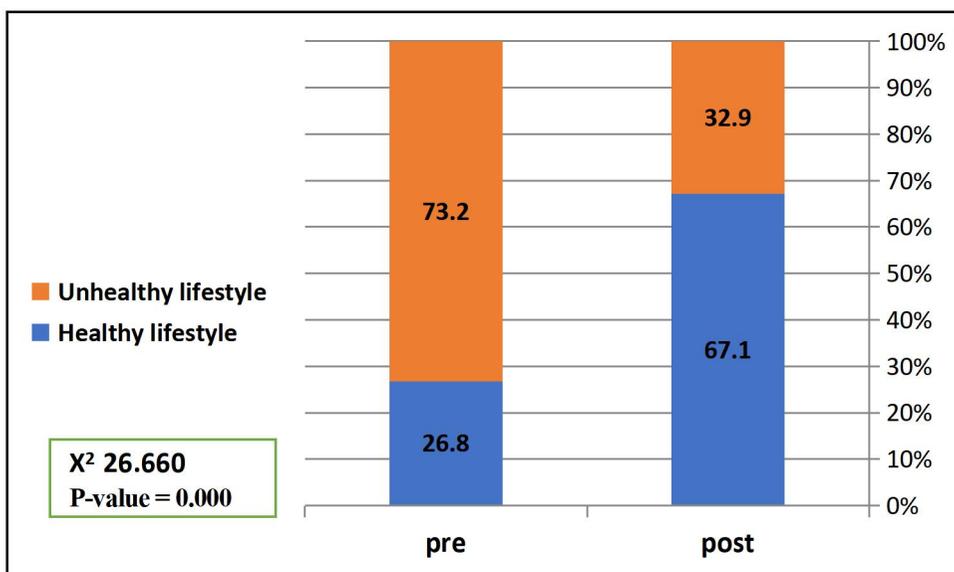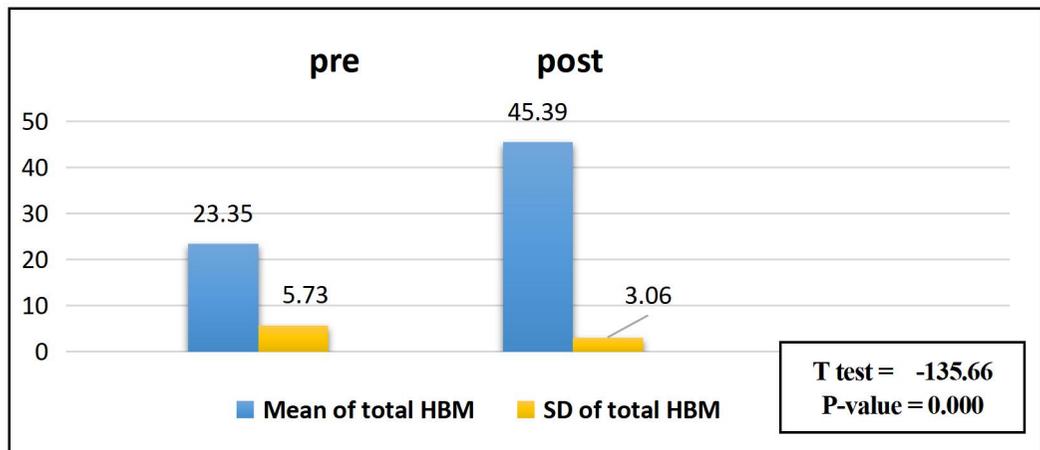
Table (4): Total Mean & SD Score of Health Belief Model Subscales among Secondary School Female Students Pre/ Post Implementation (n = 82).

Health Belief Model Subscales	pre- implementation		Post- implementation		Paired t- test	Sig
	Mean	±SD	Mean	±SD		
Perceived Severity						
- Emotional/mental health subscale	2.02	.867	4.44	.569	-25.772	0.000
- Physical health/fitness subscale	1.68	.683	4.39	.515	-35.342	0.000
- Social/professional subscale	1.76	.730	4.55	.501	-33.032	0.000
Perceived Susceptibility						
- Lifestyle subscale	1.29	.458	4.22	.567	-33.883	0.000
- Environmental subscale	1.29	.458	4.27	.545	-35.775	<.001
Perceived Barriers						
- Practical concerns subscale	1.46	.571	4.30	.581	-36.193	0.000
- Emotional/mental health subscale	1.29	.458	4.27	.545	-35.775	0.000
- Awareness subscale	2.18	.722	4.50	.503	-32.502	0.000
Perceived benefits						
- Emotional/mental health subscale	2.02	.769	4.30	.581	-25.639	0.000
- Physical health/fitness subscale	1.68	.664	4.40	.493	- 41.481	0.000
- Social/professional subscale	1.40	.493	4.22	.416	- 41.739	0.000
Perceived self-efficacy						
- In dieting	2.55	.570	3.02	.155	-7.537	<.001
- In exercise	2.26	.644	3.02	.221	-10.079	<.001
Cues to action						
- Internal cues	2.13	.491	2.98	.471	-12.329	<.001
- External cues	2.60	.606	3.07	.306	-5.687	<.001
Behavioral intention of weight management						
- Diet therapy subscale	2.52	.741	3.18	.611	-5.252	<.001
- Exercise therapy subscale	1.88	.329	2.70	.537	-12.106	<.001

Table (5): Total Mean Score of Health Belief Model Categories among Secondary School Female Students Pre/ Post Implementation (n = 82).

Health Belief Model Categories	Mean and SD		Paired t- test	Sig
	Pre- implementation	Post- implementation		
Perceived severity	4.15±1.046	5.84±0.367	-7.450	0.000
Perceived benefits	8.25±0.98	10.59±0.92	-17.652	0.000
Perceived Susceptibility	1.7378±.47288	3.6890±.32050	-27.764	<.001
Perceived barriers	6.88±1.20	9.72±0.96	-16.983	0.000
Perceived self-efficacy	2.4024±.41155	3.0244±.13385	-12.967	<.001
Cues to action	2.3659±.42345	3.0244±.29295	-11.330	<.001
Behavioral intention of weight management	2.2012±.42932	2.9390±.39589	-10.868	<.001

Figure (3): Mean and SD Score of Total Health Belief Model among Secondary School Female Students Pre/ Post Implementation (n = 82).

Table (6): Correlation among Total Health Belief Model, Total Satisfactory Knowledge Score Level and Total Healthy Lifestyle of Studied Secondary School Female Students Pre/ Post Implementation (n = 82).

Items	Total Health Belief Model			
	Pre- implementation		Post implementation	
	r	P- value	r	P-value
Total satisfactory knowledge	0.270*	0.018	0.246**	0.000
Total healthy lifestyle	0.125	0.443	0.344*	0.030

Table (7): Correlation between Total Knowledge Score Level and Total Healthy Lifestyle Score Level of Studied Secondary School Female Students Pre/ Post HBM Implementation (n = 82).

Items	Total knowledge			
	Pre- implementation		Post implementation	
	r	P- value	r	P- value
Total healthy lifestyle	0.332*	0.019	0.241**	0.001

Discussion

The health belief model was proved to be an effective framework by increasing healthy lifestyle amongst adolescents.

According to demographic characteristics of secondary school female students, it was clear that more than half were in age group 16 – <17 with a mean of 16.52±6.72 years. This finding is in agreement with that of a study carried out by **Salem and Said (2018),** who studied "The influence of health belief model based nutrition education on dietary habits of secondary school adolescent girls in Sharkia Governorate," they discovered that secondary school adolescent girls, ages 15 to 17, had a mean age of 15.77±0.7 years.

Concerning pocket money, the majority of studied sample are spending pocket money for buying food with more than two thirds had sufficient family income respectively. This finding agrees with the results of the study entitled "Overweight and obesity among adolescence children in Jordan: Prevalence and associated factors" by **Khader, et al. (2014),** who found that overweight was connected with daily pocket money as well as family monthly income.

From the researches point of view, pocket money encourages students to spend it for unhealthy foods or junk foods, leading to weight gain.

Comparing pre/post knowledge, there were statistically significant differences between pre and post HBM implementation showing improvement of knowledge regarding meaning of overweight, weight classification, body mass index, predisposing factors, complications, methods of weight reduction and preventive methods of overweight. As well as, the present study indicated that, there was a statistically significant improvement between pre/post HBM implementation related to the total knowledge score of the secondary school female students regarding overweight. these findings were in accordance with these of the study carried out by **Ismail (2021),** who in a very recent study entitled: "Primary prevention program of obesity among primary school children in Egypt", found that there were statistically significant differences regarding meaning, factors, diagnosis and prevention of obesity which affected the marked improvement of their general knowledge related to school students' obesity after implementation of program.

As well, This finding was congruent with that of the study carried out by **Rabiei et al. (2017),** who studied "health belief model on self-esteem and BMI of overweight and at risk of overweight adolescent girls, in Iran", and found that the mean score was significantly higher in the study group than the control group and those girls were able to correctly define obesity.

Similarly, this findings is in the same line with that of **Soliman et al. (2018)**, who studied "the application of health belief model among youth at high risk for obesity in West Bank Palestine", they found that, the total correct knowledge of nutritional habits among university students was 43.6 percent prior to the use of HBM, but it increased to 89.7 percent after the application with a highly statistically significant difference (P <0.001).

In the researches opinion, the students responded to improvement their knowledge because they interested to read educational booklet also attempted to control their weight for a better appearance.

The current study findings showed that, there was a statistically significant improvement between healthy lifestyle aspects

that reported by study sample as dietary habits, food frequency consumption, physical & motor activities and sleeping pattern. As well as, there was a statistically significant difference regarding total lifestyle score of the studied sample. Pre/post HBM implementation, the present study findings were in accordance with those of a very recent doctorate carried out by **Ismail (2021),** who found that, there was a statistically significant difference in post-program according to dietary habit and food consumption.

In the researches' point of view, dietary habits, food frequency consumption, physical and motor activities, and sleeping pattern, showed that the likelihood of healthy eating was directly converted to total healthy life style.

Regarding total HBM pre/post implementation elaborated that, there were statistically significant improvements regarding all items' categories and subscales of HBM perceived severity, perceived susceptibility, perceived barriers, perceived benefits, perceived self-efficacy, cues to action and behavioral intention of weight management of the studied sample. These previous findings are in the same line with those of **Saghafi-Asl et al, (2020)** who studied "factors influencing weight management behavior among college students: An application of the HBM in Tabriz, Iran" and found that, following the application of HBM, the mean scores of the items perceived severity, susceptibility, perceived barriers to adopting healthy eating and physical activity habits, perceived barrier, perceived benefits to adopting healthy eating and physical activity habits, perceived cues to action for weight management, self-efficacy in dieting, and behavioral intention of weight management showed significant differences (P≤0.001).

As well, this finding was in accordance with these of **(Szabó and Pikó, 2019)**, who investigated "Likelihood of healthy eating among adolescents based on the HBM," which found that barriers, benefits, self-efficacy, and cues to action all influenced the likelihood of healthy eating.

This finding suggested that when adolescents can recognize the benefits of healthy eating and identify and overcome the barriers that prevent them from doing so, they are more likely to engage in healthy nutrition and control their overweight.

As well, the results of the present study were consistent with those of **Rabiei et al, (2017)** They discovered that the intervention group's mean score in knowledge, perceived susceptibility, perceived severity, perceived benefits, and, finally, self-esteem and BMI before and after the intervention differed significantly from the control group's (P<0.001).

As well, these findings were in agreement with those of the study carried out by **Keshani et al (2019)**, who studied "improving diet quality among adolescents, using health belief model in a collaborative learning context: A randomized field trial" study in Iran found that all HBM constructs, and diet quality score increased in the experimental group in comparison with the baseline levels, also reported that cues to action and knowledge had significant effects on different aspects of diet quality.

The researches view that this may be due to that the extent of the risk over time makes students' believe that whether the recommended behavior will reduce the risk or severity of impact with designing both long and short-term health behavior change.

This study finding clarified that, there were statistically significant correlation between total satisfactory knowledge and total healthy lifestyle of the studied sample pre/post HBM implementation. This finding is congruent with that of **Salem and Said (2018),** who found that nutrition education dramatically modified adolescent students' views about healthy eating habits, and the mean scores of HBM components, such as susceptibility, severity, advantages, barriers, self-efficacy, and signals to action, were statistically significantly improved after intervention (P< 0.001). As well, **Saghafi-Asl et al (2020)** highlighted that perceived threat; cues to action, and perceived self-efficacy were significantly associated with behavioral intention of weight reduction.

As well these findings were in agreement with these of the study carried out by **Keshani et al. (2019)**, who clarified the effectiveness of HBM-based nutrition education in improving the knowledge, attitude and practices.

This finding may be due to that students believed that after the implementation of the health belief model they would expect to improve their knowledge and lifestyle about overweight, this belief may have led them take action to protect their health.

In the current study there was a statistically significant correlation between total knowledge with total healthy lifestyle regarding pre/post implementation of the studied sample. The result of the present study was consistent with those of **Salem and Said.**

(2018), who discovered that after nutrition education, the percentage of students who followed the servings of healthy food groups and avoided unhealthy foods (fast, fried, canned foods), avoided also unhealthy beverages (carbonated and caffeinated drinks), decreased salt, and sugar/sweet intake increased significantly.

Also, the previous study findings were in accordance with those of the study carried out by **Talat and El Shahat (2016)**, who study prevalence of overweight and obesity among preparatory school adolescents in Sharkia Governorate, Egypt. they found that positive correlation as regards dietary knowledge and lifestyle of the preparatory school students, they were skipping breakfast which was associated with overweight/obesity in adolescents.

This finding could be explained, as being unaware about skipping breakfast leads to eating more energy-dense, less-nutritious snacks and fast foods later during the school hours to compensate this lost meal. So, nutrition education altered the eating patterns of adolescent girls dramatically.

Conclusion

Based on the results of the present study, and research hypothesis, it could be concluded that, overall, overweight secondary school female students' knowledge regarding overweight increased as well as lifestyle aspects improved from pre- to post HBM model implementation, with highly statistically significant improvements in knowledge and lifestyle aspects.

Recommendations

- Apply a preventive program for school students to protect themselves from overweight and obesity.
- Health education program to increase awareness of school students toward healthy lifestyle.
- Further researches, qualitative studies to address behavioral factors affecting lifestyle modification among overweight school students.

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