Web Based Nutritional Health Education Intervention for Secondary Schools' Students

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Abstract:

Background: Nutrition promotion and education intervention using web sites are an accessible and effective tool in developing healthy nutrition-related practice and dietary habits in secondary school students. **Aim of the Study:** Was to examine the effect of web based nutritional health education intervention for secondary schools' students. **Design:** A Quasi-experimental research design was utilized. **Setting**: The study was conducted in 3 secondary schools affiliated to Benha Educational Administration. **Sampling:** A simple random sampling technique was used to select 130 students who were in second grade secondary. **Tools: I:** Structured Interview Questionnaire which divided into: **a:** Personal characteristics, measuring weight, height and BMI. **b**: students' knowledge. **c:** reported practices. **II:** Attitude of secondary school students regarding nutrition**. Results**: revealed that, 67.7% of the study group had poor level of total knowledge about nutrition at pre intervention. While, 87.7% had good level of total knowledge about nutrition at post intervention. 24.6% of the study group had satisfactory level of total reported practice regarding dietary habits at pre intervention, which increased to, 89.2% had satisfactory level of total reported practices regarding dietary habits at post intervention. 43.1% of the study group had positive attitude regarding healthy nutrition at pre intervention. While, 92.3% had positive attitude regarding healthy nutrition at post intervention. **Conclusion**: The web based nutritional health education intervention improved knowledge, practice and attitude for study group than control group. There was a high correlation between total students' knowledge, reported practices and attitude regarding healthy nutrition among the study group at pre- and post-intervention. **Recommendation:** Apply the web based interventions of nutrition on a large scale, large sample and students in other age groups.

Keyword: Education intervention, Nutritional health, Secondary schools' students& Web based

Introduction:

Adolescent and secondary school students need much attention as constitute one-fifth of the total population and about 84% of population lives in developing countries. Lifestyle choices among secondary school students are often guided by misleading information and adolescents' students may not appreciate the links between eating habits, physical activity levels and future health consequences. Therefore, it is prudent that health-promoting and education for adolescents must focus on the attainment of adequate knowledge, enhancement of the right attitudes towards desired health behaviors, and building of skills and self-efficacy to take appropriate diet **(Naidoo et al., 2019).**

Approximately 340 million children and adolescents aged 5–19 years had overweight or obesity globally in 2016. Almost 80% of

adolescents with obesity will have obesity as adults and the prevalence of morbid obesity in adults is higher among those who had obesity as adolescents. Obesity in childhood and adolescence is associated with an increased risk of Non-Communicable Diseases (NCDs) such as type 2 diabetes, cardiovascular disease, chronic obstructive lung disease and some forms of cancer. Adolescents with excess weight or obesity often have decreased self-esteem and may be subjected to bullying and discrimination, increasing the risk of poor psychological health and eating disorders **(World Health Orgnization, 2018).**

Unhealthy eating behaviors are presented between secondary school students such as skipping meals, high intake of energy-dense and nutrient-deficient foods such as wafers, chocolates and sweetened beverages, frequent consumption of fast foods and inadequate intake of protective foods such as fruits and vegetables. So, Secondary school students are susceptible to poor nutritional status if they don't meet their increased nutritional needs because of growth spurt, psychological and sexual maturity and cognitive development occurring during this period. Increased physical activity combined with poor eating habits contribute to poor nutritional status of this population **(Derry., 2021).**

Healthy eating habits found to be established in childhood and maintained during adolescence to prevent diet-related chronic diseases. Healthy eating habits in childhood not only help to prevent under nutrition, growth retardation and acute child nutrition problems, but also chronic, long-term health problems such as obesity, Chronic Heart Diseases (CHD), type 2 diabetes and stroke **(Moore et al., 2020).**

Nutritional habits may not only influence the present health but may also determine whether or not an individual develops diseases such as cancer and other chronic diseases later in life. It is perceived that these poor eating habits are as a result of peer pressure, parents' dietary habits, media exposure, the increase in fast food centers in urban cities and lack of knowledge of adolescents about the cumulative effects of their poor eating habits **(Perez-Rodrigo & Aranceta., 2021).**

Schools play an important role in promoting nutrition by providing access to children from a range of socioeconomic backgrounds. Secondary school students spend a considerable amount of time in school, so school-based intervention will reach many children in a relatively short period of time and, therefore, the school environment with the use of internet service is an ideal setting to acquire habits, skills, and knowledge related to healthy diets and physical activity **(Story et al., 2020).**

Web based education intervention seem to offer several advantages for the promotion of nutrition. Through its use, existing barriers can be overcome, such as cost, service availability, wait time, transportation, and stigma, thus reducing health care-related disparities. Besides, as school students are immersed in the digital world, internet can be effective and efficient tools to implement nutritional interventions for them. Nevertheless, there are few studies that assessed the effectiveness of web-based intervention to promote nutrition among school students. Although the first results have shown promise, there is a need for more controlled studies based on well-grounded models with long-term follow-ups **(Nicklas., 2022).**

As today's leading media, the internet offers great potential and wide reach for health promotion. Especially among younger target groups, it is already established as a

primary source of health information. Nevertheless, engagement with web-based interventions for health promotion is generally low. At the beginning of an intervention, three key stages are usually important: The user access to the website, to stay there, and to revisit it. The combination of digital and analogue study components or mixed intervention design can increase engagement with web-based interventions. Other intervention components that have been shown to have a positive impact on engagement include tailored prompts or reminders and regular updates **(Naidoo et al., 2019).**

Community and School health nurses have an essential role as a leader of the school's health services, screenings and referrals for a variety of health concerns, promotion of a healthy school environment, promotion of health through health education, leader in health policies and programs such as wellness programs, and as liaison between school personnel, family, health care providers, and the community. The recommendation also encourages the school nurse to act as the leader in the school's health services team such as physical therapists, occupational therapists, and speech language pathologists **(Clark et al., 2018).**

Significant of the study:

Currently, there are approximately 1.8 billion adolescents in the world who will become the future workforce and parents; therefore, government investment in interventions within this age group has the potential to provide high economic yield. A focus on the social and environmental influences of eating behaviors has potential to enhance the understanding of how to improve health outcomes for young people **(Rose et al., 2021).**

Reports from different organizations like the World Bank documented that, adolescence who live in households deficient in clean healthy food are more likely to predispose to bad nutrition and health related problems than children from food secure households **(Srivastava et al., 2020)**. Globally, malnutrition among school age children is a major public health problem. More than 200 million school age children are stunted and underweight and if no action is done at this rate, about one billion school children will suffer from impaired physical and mental development by 2020 **(Hassan et al, 2018).**

In Egypt, school students represent more than 20% of total population. Malnutrition disorders affect more than 30% of them; this problem appears to be largely related to poor dietary quality and micronutrient deficiencies. The problem is affecting different age groups and socio-economic status. The 2014 EDHS found that one-quarter of girls and boys aged 5-19 years were overweight, 10 % and 11% of girls and boys respectively were obese **(El-Zanaty, 2019).**

Aim of the study:

The aim of this study is to examine the effect of web based nutritional health education intervention for secondary schools' students.

Research Hypothesis:

- The web based nutritional health education intervention will improve knowledge for study group than control group.
- The web based nutritional health education intervention will improve attitude for study group than control group.

- The web based nutritional health education intervention will improve practices for study group than control group.
- The web based nutritional health education intervention will improve BMI for study group than control group.

Subjects and Method

Research design:

A quasi experimental design (Pre-Posttest & Study control group) was utilized in conducting the study.

Setting:

A multi-stage random sampling technique was utilized for selecting total kalyobia Governorate which included 11 Educational Administration (at 10%: one Educational Administration: named Benha Administration) which were selected randomly. The total educational administration 22 secondary schools by 10% = 3 secondary schools named: El Ramla Secondary Schools, Damalo Secondary Schools, Om Elmoamnin Secondary Schools.

Sampling:

A simple random sampling technique was used to select students who were in second grade secondary. The total sample was 130 (65 for study group and 65 for control group). This number represented 10 % from the total number of students who were attending to the previous selected secondary schools.

Sample Inclusion Criteria:

-Both gender (male & female).

- Availability to use internet application.

Tools of data collection:

Tool I: An interviewing Questionnaire: that composed of three main parts to collect the following:

Part 1: A- It was designed to assess personal characteristics of secondary school students. It included 14 questions about (gender, age, number of family member, ranking, taking personal expenses, sufficient of expenses, buy food with expenses, buy food from inside the school cafeteria, smoking, sport, attending awareness seminars on nutrition & its type. Weight, height and BMI according to **Wohlfahrt-Veje et al., (2014).**

- Weight: - It was measured in kilograms (kg) using a weight scale. It was checked weekly with known calibration weights. The weight was approximated to nearest 0.1kg.

- Height: - It was measured by a tape measure. The height was approximated to nearest 0.1 cm on a Holtain portable anthropometrics.

- Body mass index (BMI): - Measurement of weight and height were used to estimate the body mass index (BMI) by dividing weight in kilograms by squared height in meters.

BMI	Weight Status
Below 18.5	Underweight
18.5 – 24.9	Healthy Weight
25.0 – 29.9	Overweight
30.0 and Above	Excessive Obesity

Classification of BMI according to **Wohlfahrt-Veje, et al., (2014).**

Part 1: B- To assess students' parent's data which included four question about (father education, father work, mother education and mother work).

Part 2: It was designed to assess students' knowledge toward healthy nutrition. It included 7 questions covering definition, benefits, component of food pyramid, component of healthy food and good source of protein, vitamins &carbohydrates and knowledge about unhealthy nutrition included 8 questions covering definition, causes, component of unhealthy nutrition, complication, unhealthy dietary behavior, factors affecting nutritional behavior and management of unhealthy diet.

Scoring system:

The questionnaire was contained of 14 questions, the total scores of the questionnaire were 28 score, the complete correct answer was scored as two points, the incomplete correct answer was scored as a one score and the wrong answer was scored as a zero score. These scores were summed and were converted into a percent score. It was classified into 3 categories:

- **Good level of knowledge if score ≥ 75%(≥ 21 scores).**
- **Average level of knowledge if score from 50-<75%(14-<21 scores).**
- **Poor level of knowledge if score from <50%(<14 scores).**

Part 3: It was designed to assess reported practices regarding dietary habits which consisted of 18 statements.

Scoring system:

The questionnaire of students' practices contained 18 statements; the total scores of the scale were 36 scores, always was scored as two **scores**, sometimes was scored as a one score and never was scored as a zero score. These scores were summed up and were converted into a percentage score. It was classified into 2 categories:

- **Satisfactory practices if score ≥ 60% (≥22 scores).**
- **Unsatisfactory practices if score from <60%(<22 scores).**

Tool II: Attitude of secondary school students regarding nutrition (adopted from **Wahlang & Baruah, 2020**) it was designed to assess attitude of secondary students, which included of 20 statements.

Scoring system:

The scale of students' attitude included 20 Items; the total scores of the scale were 40 scores, strongly agree was scored as two scores, agree was scored as a one score, and disagree was scored as a zero score. These scores were summed up and were converted into a percentage score. It was classified into 2 categories:

- Positive attitude if score ≥ 60%(≥24 scores).

- Negative attitude if score from <60%(<24 scores).

Content validity of the tools:

Content validity of the tools was done by three of Faculty's Staff Nursing experts from the Community Health Nursing Specialties at Faculty of Nursing Benha University who reviewed the tools for clarity, relevance, comprehensiveness, and applicability and give their opinion.

Reliability of the tools:

Reliability of the tool was applied by the researchers for testing the internal consistency of the tool, the reliability was done by Cronbach's Alpha coefficient test which revealed that each of the two tools consisted of relatively items as indicated by the moderate to high reliability of each tool. The student's knowledge toward healthy nutrition was 0.817 and student's reported practices regarding dietary habits was 0.822 and Attitude of secondary school students regarding nutrition cheek list was 0.842.

Pilot study:

The pilot study was conducted on 10 % (13) student of the studied student to test the content, applicability and simplicity of the tools using the interviewing questionnaires. Based on the pilot study, the modification of the tools included rephrasing, rearrangements of some questions. The pilot study was carried in two weeks before starting the study and those who shared in the pilot study were included in the studied sample.

Procedure for data collection:

- **Study period:** Data was collected over 6 months from the beginning of June

2022 to end of November 2022.

- **Approval:** Before starting the study, a written letter was issued to the Dean of Benha Faculty of Nursing to obtain the approval for data collection, the objective and the nature of the study were explained and then it was possible to carry out the study. Interview was held between the investigator and students. The aim of the study was discussed with them, the time of data collection was also determined based on their view to gain their approval and cooperation.
- **Ethical considerations:** All ethical issues were assured; informed consent has been obtained from each student before conducting the interview and given them a brief orientation to the purpose of the study. students were also reassured that all information gathered would be confidentially and used only for the purpose of the study. The students had right to withdraw from the study at any time without giving any reasons.
- **Development of data collection tool:** data collection tools were based on reviewing current and past available national and international related literature and theoretical knowledge of various aspects of the study using text books, articles, magazine and internet search. This was necessary for the investigator to be acquainted with and oriented about aspect of the research problem as well as assist in the development of the data.
- **Assessed baseline data:** knowledge, attitude and practices of the studied students from the filled tools the researchers was identified himself to the students and take their phone numbers to create a new group on what's app application, the researchers did the pre- test.
- **Development of the web based nutritional intervention:** Based on the results obtained from the interviewing questionnaire and literature review which developed by researchers.
- **Important needs for target group:** The researchers identified the important needs for target group, set priorities of needs, goals and objectives were developed. Preparation of the study design and data collection tools was based on extensive review of the current and past available national and international references related literature about web based nutritional intervention by using a journal, textbooks and internet search to contrast the tools and the web based nutritional intervention. This was necessary for the researchers to be acquainted with and oriented about aspects of the research problem as well as to assist in the development of data collection tools. Also prepared booklets for studied students that included all items about web based nutritional intervention.
- **Web Based Nutritional Intervention:**

The study was conducted by the researchers for the studied sample in selected setting of secondary school in Benha administration and through web applications the researchers interviewed the secondary school students three days per week (Sunday – Monday and Wednesdays) from 9:00 am to 12:00 mid- day at schools or 10 p.m. online. The average time needed for the session was around 35/minutes.

The researchers implemented the web based nutritional intervention for the students at the suitable time for them. To ensure that they were exposed to the same learning experience. The researchers implemented the web based nutritional intervention through 6 sessions, 3 theoretical session & 3 practical session as a mix between face to face teaching and synchronize teaching and each session lasted 35 minutes including periods of discussion. And The total time used in web

based nutritional intervention is (3.30) hours. It was implemented immediately after pre-test. The researchers implemented the web based nutritional intervention.

First session: The researchers welcomed and introduced herself to the students, an orientation to the intervention and included web based nutritional intervention.

Second session: Covered the sources of protein, vitamins and carbohydrates., causes of unhealthy nutrition., List complications of unhealthy nutrition., factors affecting dietary choices among adolescents.

Third session: Covered the follow healthy nutritional behaviors.

Fourth session: Covered the components of balanced diet.

Fifth session: Covered Practices to improve healthy nutrition and prevent unhealthy nutrition.

Six session: use the internet to provide health care programs. Each session started by summary about the previous session and objectives of new topics. Direct reinforcement in the form, a copy of the intervention was given as a gift for each student to use it as future reference. All the participants were cooperative with the researchers. At the end of each session, student participated in a discussion to correct any misunderstanding.

- **Teaching aids:** Suitable teaching aids were specially prepared for intervention, as: What's app Application
- Sites.google.com.

http://sites.google.com/veiw/khadarezk

- **Data show**: Explain the content for the students in the secondary school on the Data show with also colored book about the content.

- **Post -test**: **Evaluation of the web based nutritional intervention:**

After implementation the web based nutritional intervention, the researchers applied the post-test three months after finishing the last session. Evaluation of the intervention was done by using the post-test questionnaire which was the same formats of pre - test in order to compare the change in the student's` knowledge, attitude and practices.

Statistical Analysis:

The collected data organized, tabulated and statistically analyzed using Statistical Package for Social Science (SPSS) version 25 for windows. Descriptive statistics were applied (numbers, percentages, mean and standard deviation). Test of significance, Chi-square test ($\chi 2$) this test used to compare for qualitative variables and correlation coefficient (r) were done for assessment of inter relationship among quantitative variables that were normally distributed or when one of the variables is qualitative, these tests were applied to test the study hypothesis. Reliability of the study tools was done using Cronbach's Alpha. A highly significant level value was considered p-value ≤ 0.001, significant level value was considered when p- value ≤ 0.05 and no statistical significance difference was considered when p- value > 0.05.

Results:

Table (1) shows that, the studied students' age ranged from 16 - 18 years. The mean ± SD age of the study and control groups was 17.3 ± 1.02 and 17.5 ± 1.19, respectively. Regarding to gender, 56.9% and 61.5% of the study and control group were female, respectively. Also, 66.1% and 67.7% of the study and control group have 4-5 family members, respectively. Moreover, 46.1% and 47.7% of the study and control group were the second child, respectively. Furthermore, 100.0 % of the study and control group take personal expenses, respectively. Also, 55.4% and 58.5% of the study and control group

have sufficient expense, respectively. Moreover, 84.6% and 89.2% of the study and control group buy food with expense, respectively. Furthermore, 60.0% and 53.9% of the study and control group buy food from inside the school cafeteria, respectively. Also 93.8% and 96.9% of the study and control group don't smoke, respectively. Moreover, 76.9% and 83.1% of the study and control group don't practice sport, respectively. Furthermore, 95.4% and 93.8% of the study and control group don't attend awareness seminars on nutrition, respectively. Likewise, there was no statistically significant differences were found in personal characteristics among the studied groups P >0.05.

Figure (1) shows that, 38.5% of the study group have their information about nutrition from internet. Also, 36.9% of the control group have their information about nutrition from internet.

Figure (2) shows that, 67.7% of the study group have poor level of total knowledge about nutrition at pre intervention. While, 87.7% of them have good level of total knowledge about nutrition at post intervention.

Figure (3) displays that, 43.1% of the study group have positive attitude regarding healthy nutrition at pre intervention. While, 92.3% of them have positive attitude regarding healthy nutrition at post intervention.

Figure (4) shows that, 24.6% of the study group have satisfactory level of total reported practice regarding dietary habits at pre intervention. While, 89.2% of them have satisfactory level of total reported practice regarding dietary habits at post intervention.

Table (2) shows that, there is highly statistically significant relation between total reported practice of the study group at pre-intervention and their personal characteristics as BMI and practicing sport at P <0.001. Also, there is statistically significant relation with their gender, age, number of family members, buy food with expense and smoking status at P <0.05. While, there is no a statistically significant relation with their expense sufficient and buy food from inside the school cafeteria and attended awareness seminars on nutrition at P > 0.05. In addition, the results reveal that, there is statistically significant relation between total reported practice of the study group at post-intervention and their personal characteristics as number of family members, buy food with expense, smoking status, BMI and practicing sport at P <0.05. While, there is no a statistically significant relation with their gender, age, expense sufficient and buy food from inside the school cafeteria and attended awareness seminars on nutrition at P > 0.05.

Table (3) displays that, 53.9% and 50.8% of the study and control group have normal weight, respectively. Also, 60.0% and 61.5% of the study and control group have normal height, respectively. Moreover, 53.9% and 50.8% of the study and control group have normal body mass index, respectively. Likewise, there was no statistically significant differences were found in personal characteristics among the studied groups P >0.05.

Table (4) displays that, there is a high statistically significant positive correlation between total students' knowledge, reported practice and attitude regarding healthy nutrition among the study group at pre- and post-intervention $p \leq 0.001$.

Table (5) shows that, there is a high statistically significant positive correlation between total students' knowledge, reported practice and attitude regarding healthy nutrition among the control group at pre- and post-intervention $p \leq 0.001$.

Table (1): Distribution of personal characteristics according to study and control groups their personal characteristics. (n=130)

Personal characteristics	Study group (n=65)		Control group (n=65)		X^2	P-Value
	No.	%	No.	%		
Gender						
Male	28	43.1	25	38.5	**0.811**	**0.610**
Female	**37**	**56.9**	**40**	**61.5**		
Age						
16- < 17 years old	8	12.3	٧	10.8		
17-<18 years old	٥٠	**76.9**	٥٢	**80.0**	**1.096**	**0.357**
18 years and over	٧	10.8	٦	9.2		
Mean ± S.D	**17.3 ± 1.02**		**17.5 ± 1.19**		**T= 0.831**	**0.416**
Number of family members						
Less than 4 people	2	3.1	1	1.5		
From 4-5 people	**43**	**66.1**	**44**	**67.7**		
From 5 to 6 people	15	23.1	14	21.5	**0.955**	**0.463**
More than 6 people	5	7.7	6	9.2		
Ranking among siblings						
First	15	23.1	15	23.1		
Second	**30**	**46.1**	**31**	**47.7**	**1.018**	**0.428**
Third	12	18.5	14	21.5		
More than the third	8	12.3	5	7.7		
Take personal expenses						
Yes	**65**	**100.0**	**65**	**100.0**	**0**	**0**
No	0	0.0	0	0.0		
Is this expense sufficient						
Yes	**36**	**55.4**	**38**	**58.5**	**0.200**	**0.785**
No	29	44.6	27	41.5		
Buy food with expense						
Yes	**55**	**84.6**	**58**	**89.2**	**0.150**	**0.825**
No	10	15.4	7	10.8		
Buy food from inside the school cafeteria						
Yes	26	40.0	30	46.1	**0.598**	**0.429**
No	**39**	**60.0**	**35**	**53.9**		
Smoking						
Yes	4	6.2	2	3.1	**0.213**	**0.695**
No	**61**	**93.8**	**63**	**96.9**		
Practice sport						
Yes	15	23.1	11	16.9		
No	**50**	**76.9**	**54**	**83.1**	**0.195**	**0.863**
Attended awareness seminars on nutrition						
Yes	3	4.6	4	6.2		
No	**62**	**95.4**	**61**	**93.8**	**1.000**	**0.628**
If yes, what are those seminars	**(n=3)**		**(n=4)**			
Healthy nutrition	2	66.7	3	75.0	**0.081**	**1.000**
Unhealthy nutrition	1	33.3	1	25.0		

$X^{2:}$ Chi Square Test No Statistically significant at p >0.05.

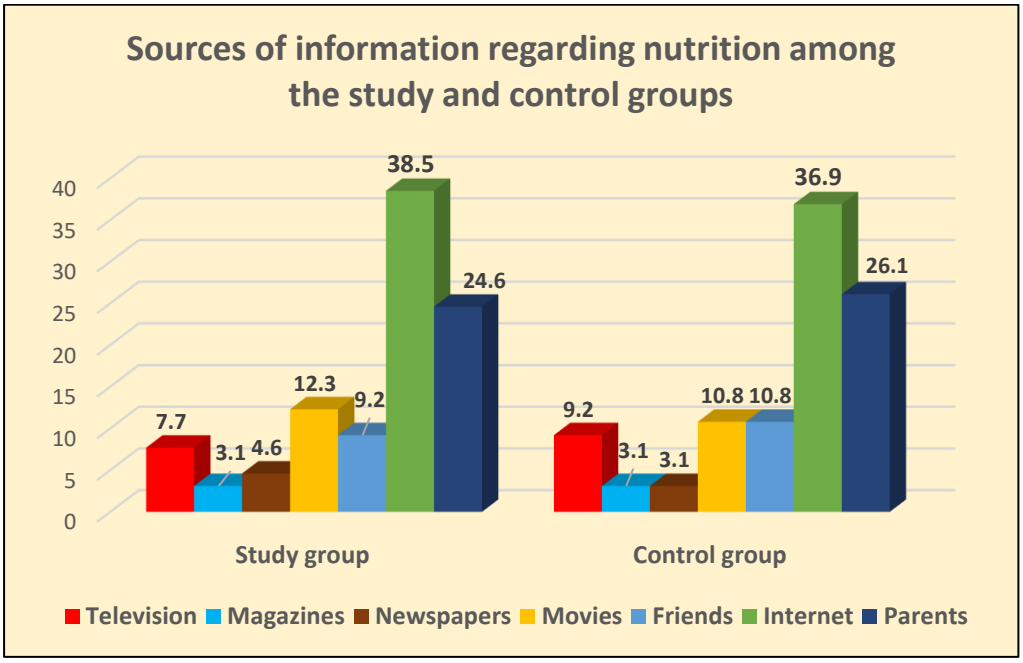

Figure (1): Percentage distribution of the study and control groups according to their sources of information regarding nutrition

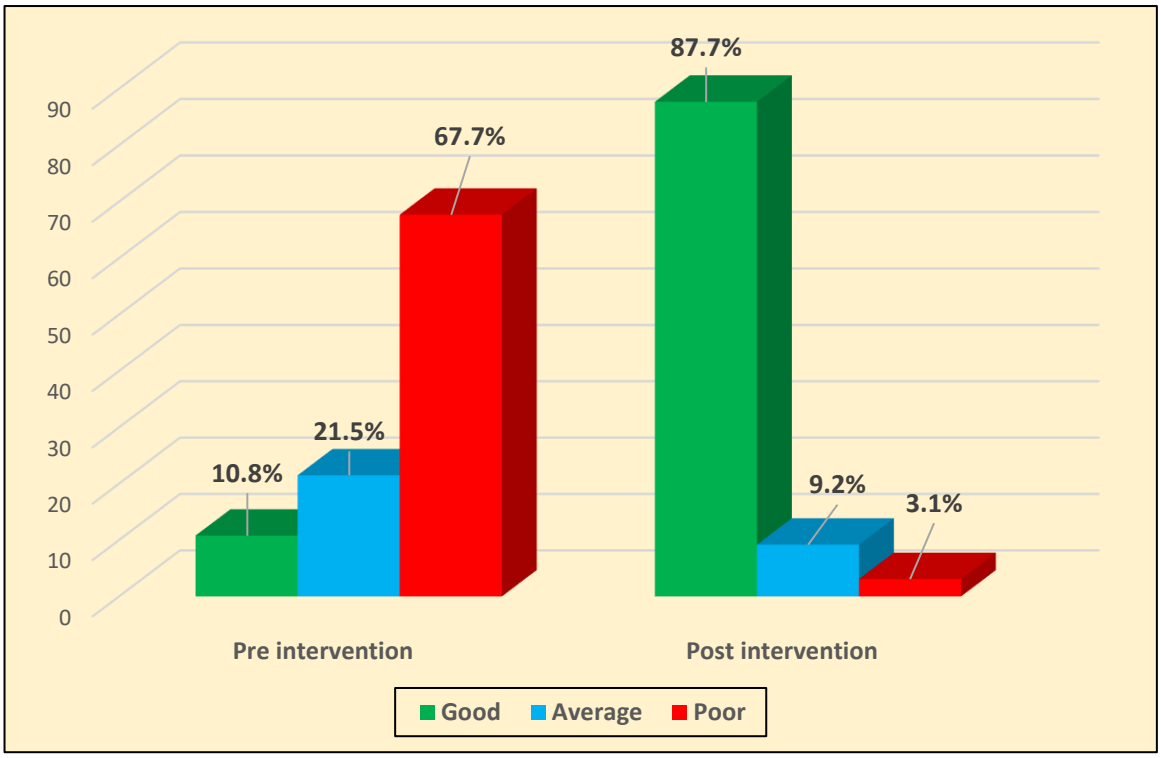

Figure (2): Percentage distribution of the study group according to their total knowledge regarding nutrition at pre- and post-intervention (n=65)

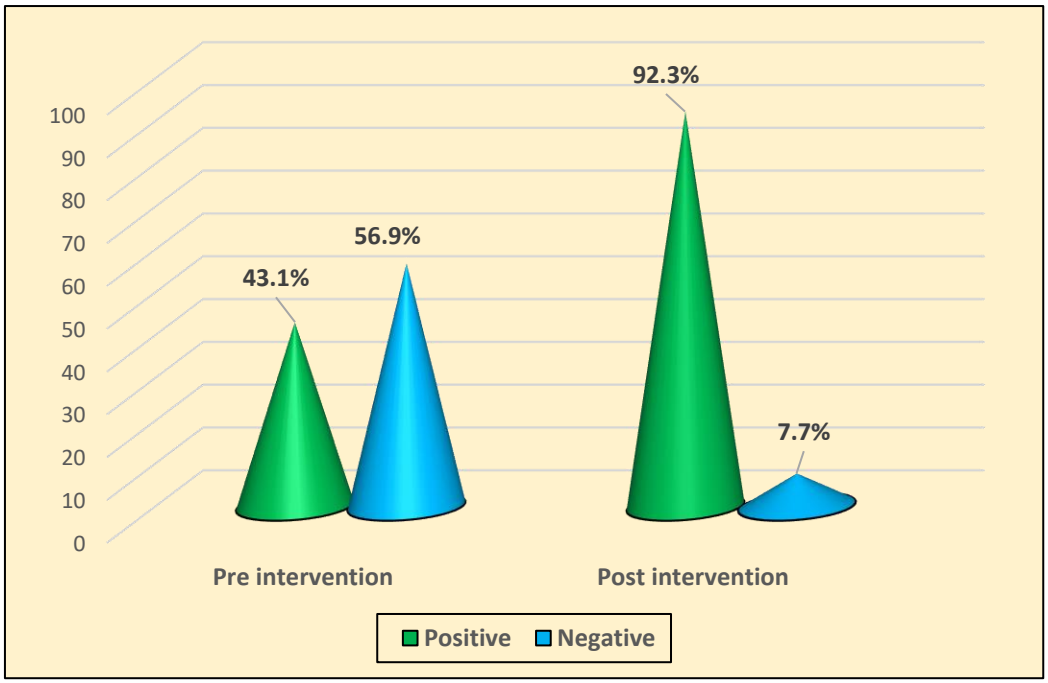

Figure (3): Percentage distribution of the study group according to their total attitude regarding healthy nutrition at pre- and post-intervention (n=65)

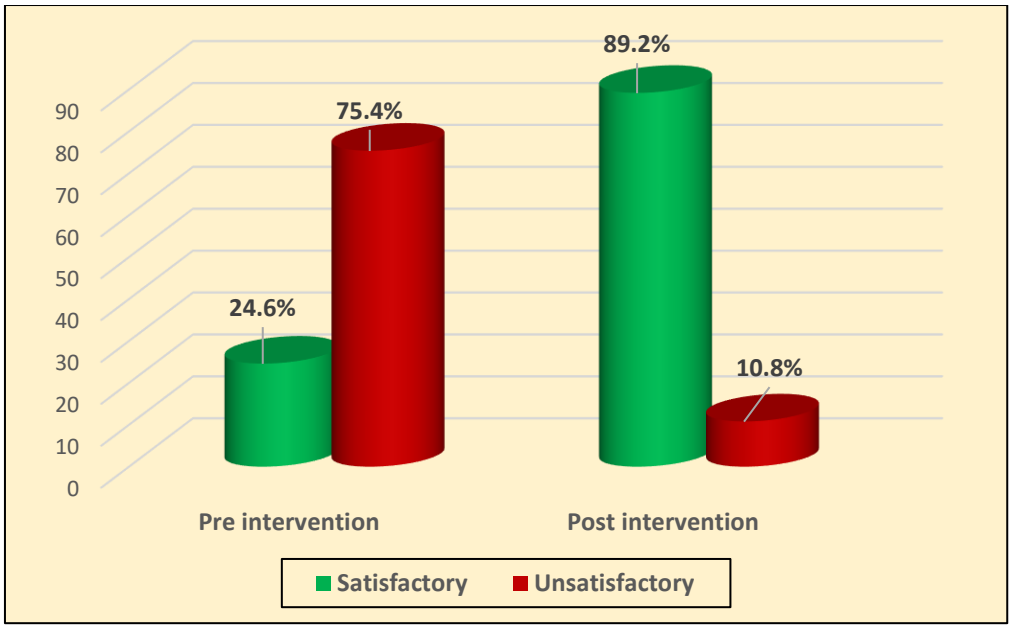

Figure (4): Percentage distribution of the study group according to their total reported practice regarding dietary habits at pre- and post-intervention (n=65)

Table (2): Relationship between personal characteristics of the studied students (study group) and their reported practice regarding dietary habits at pre- and post-intervention (n=65)

Personal characteristics		Levels of total reported practice pre-intervention				X^2	P-Value	Levels of total reported practice post- intervention				X^2	P-Value
		Satisfactory (n=16)		Unsatisfactory (n=49)				Satisfactory (n=58)		Unsatisfactory (n=7)			
		No.	%	No.	%			No.	%	No.	%		
Gender	Male	4	25.0	24	49.0	**9.552**	**0.025***	24	41.4	4	57.1	**3.055**	**0.121**
	Female	12	75.0	25	51.0			34	58.6	3	42.9		
Age (years)	16- < 17	0	0.0	8	16.3	**10.58**	**0.017***	3	5.2	5	71.4	**4.922**	**0.084**
	17-<18	9	56.3	41	83.7			48	82.7	2	28.6		
	≥ 18	7	43.7	0	0.0			7	12.1	0	0.0		
Number of family members	< 4	2	12.5	0	0.0	**8.504**	**0.044***	2	3.5	0	0.0	**13.96**	**0.010***
	4-5	11	68.8	32	65.3			43	74.1	0	0.0		
	5 - 6	3	18.7	12	24.5			13	22.4	2	28.6		
	> 6	0	0.0	5	10.2			0	0.0	5	71.4		
Expense sufficient	Yes	10	62.5	26	53.1	**5.221**	**0.067**	31	53.4	5	71.4	**4.955**	**0.099**
	No	6	37.5	23	46.9			27	46.6	2	28.6		
Buy food with expense	Yes	6	37.5	49	100	**10.88**	**0.025***	48	82.8	7	100	**11.85**	**0.019***
	No	10	62.5	0	0.0			10	17.2	0	0.0		
Buy food from inside the school cafeteria	Yes	11	68.8	15	30.6	**4.008**	**0.111**	24	41.4	2	28.6	**5.174**	**0.100**
	No	5	31.2	34	69.4			34	58.6	5	71.4		
Smoking	Yes	0	0.0	4	8.2	**11.99**	**0.015***	0	0.0	4	57.1	**13.51**	**0.011***
	No	16	100	45	91.8			58	100	3	42.9		
BMI	Subnormal	0	0.0	11	22.4	**19.74**	**0.000****	9	15.5	2	28.6	**9.047**	**0.031***
	Normal body mass	16	100	19	38.8			35	60.3	0	0.0		
	Above normal	0	0.0	19	38.8			14	24.2	5	71.4		
Practice sport	Yes	15	93.8	0	0.0	**21.44**	**0.000****	15	25.9	0	0.0	**10.45**	**0.024***
	No	1	6.2	49	100			43	74.1	7	100		
Attended awareness seminars on nutrition	Yes	3	18.7	0	0.0	**6.247**	**0.067**	3	5.2	0	0.0	**2.557**	**0.114**
	No	13	81.3	49	100			55	94.8	7	100		

$X^{2:}$ Chi Square Test. No significant at p >0.05. (*) Statistically significant at p<0.05. (**) Highly significant at p ‹ 0.001.

Table (3): Distribution of Bio-physiological measurements according to the study and control groups (n=130)

Bio-physiological measurements	Study group (n=65)		Control group (n=65)		X^2	P-Value
	No.	%	No.	%		
Weight						
Underweight	11	16.9	12	18.5	**1.006**	**0.328**
Normal weight	**35**	**53.9**	**33**	**50.8**		
Overweight	16	24.6	17	26.1		
Excessive obesity	3	4.6	3	4.6		
Height						
Tall	16	24.6	18	27.7	**1.801**	**0.310**
Normal height	**39**	**60.0**	**40**	**61.5**		
Short	10	15.4	7	10.8		
BMI						
Subnormal	11	16.9	12	18.4	**0.989**	**0.407**
Normal body mass	**35**	**53.9**	**33**	**50.8**		
Above normal	19	29.2	20	30.8		

$X^{2:}$ Chi Square Test No Statistically significant at p >0.05.

Table (4): Correlation between total students' knowledge, attitude and reported practice regarding healthy nutrition among the study group at pre- and post-intervention (n=65)

Variables	Total knowledge				Total attitude			
	Pre intervention		Post intervention		Pre intervention		Post intervention	
	r.	P- value	r.	P- value	r.	P- value	r.	P- value
Total knowledge					0.482	0.000**	0.513	0.000**
Total reported practice	0.519	0.000**	0.581	0.000**	0.475	0.000**	0.505	0.000**

r= Correlation coefficients test. **Highly significant Correlation at p ‹ 0.001.

Table (5): Correlation between total students' knowledge, attitude and reported practice regarding healthy nutrition among the control group at pre- and post-intervention (n=65)

Variables	Total knowledge				Total attitude			
	Pre intervention		Post intervention		Pre intervention		Post intervention	
	r.	P- value	r.	P- value	r.	P- value	r.	P- value
Total knowledge					0.476	0.000**	0.480	0.000**
Total reported practice	0.498	0.000**	0.501	0.000**	0.468	0.000**	0.472	0.000**

r= Correlation coefficients test. **Highly significant Correlation at p ‹ 0.001.

Discussion:

Nutrition is a major environmental influence on physical and mental growth and development in early life. Good nutrition contributes to improving the wellbeing of adolescent and their potential learning ability, thus contributing to better school performance. Adolescents learn healthy eating habits, are encouraged to be physically active, to avoid smoking and to learn to manage stress, have the potential for reduced impact of chronic diseases in adulthood. Nutrition education is a key element to promoting lifelong healthy eating and exercise behaviors and should start from the early stages of life **(Malan et al., 2020).** The aim of this study is to examine the effect of web based nutritional health education intervention for secondary schools' students.

Answer the first research hypothesis; the web based nutritional health education intervention will improve knowledge for study group than control group.

The current study showed that, more than one third of the study and control group have their information about nutrition from internet **(figure, 1).** The study was supported by **Alowais, & Selim, (2019)** who studied "Knowledge, attitude, and practices regarding dietary supplements in Saudi Arabia" A descriptive cross-sectional, online questionnaire-based study was conducted on 351 participants and results showed the internet was the most common source of information regarding nutrition among participants. Consumers can easily find information about dietary supplement over the internet and on sites of social network such as Twitter and Facebook, but its veracity is sometimes questionable. This is of concern because with the high prevalence of dietary supplement use and easy access to information on the internet, it is not surprising that many individuals may circumvent health professionals as a source of information and go directly to the web for help. From the researchers' point of view, this might be due to the availability of most information on the internet and the easy accessibility to such information from google engine and social media.

Concerning students' total knowledge regarding nutrition at pre- and post-

intervention, the current study showed that, more than two thirds of the study group had poor level of total knowledge about nutrition at pre intervention. While, the majority of them had good level of total knowledge about nutrition at post intervention **(figure, 2).** The study was congruent with **Samoggia, & Riedel, (2020)** who studied "Assessment of nutrition-focused mobile apps' influence on consumers' healthy food behavior and nutrition knowledge" conducted at Italy. Who illustrated that there was significant improvement of students' knowledge regarding healthy food post intervention application. In addition, the study was supported by **Salem, & Said, (2018)** who studied "Effect of health belief model-based nutrition education on dietary habits of secondary school adolescent girls in Sharkia governorate" aged between 15-17 years from one of female secondary governmental schools in Zagazig district at Sharkia Governorate, Egypt) who sound that after intervention there was an improvement in the mean of nutrition knowledge score. The mean knowledge on healthy and unhealthy lifestyle habits and foods was improved. The mean knowledge score on food safety was improved. Nutrition education based on HBM brought significant improvements in not only nutritional knowledge of adolescent but also translated some of them into action. HBM-based strategies can be recommended as effective communication channels to improve dietary habits of students. From the researchers' point of view, this could be related to the effect of educational intervention and the researchers ability to illustrate the importance of healthy nutrition in maintaining a good health especially during adolescence stage also, the effect of unhealthy nutrition on students' health condition.

Answer the second research hypothesis; the web based nutritional health education intervention will improve attitude for study group than control group

The results of the current study showed that, there was a marked improvement in total attitude regarding healthy nutrition among the study group at post intervention compared to pre intervention with a highly statistically significant difference. As evidence, less than half of the study group had positive attitude regarding healthy nutrition at pre intervention compare to most of them at post intervention **(fig 4).** The study was supported by **Salem, & Said, (2018)** who revealed that there was a highly significant increase in adolescent positive attitude toward healthy nutrition after intervention. The study was also congruent with **Hajivandi et al., (2021) who** revealed that, the participants, attitude about the nutritional behaviors more improved in the intervention group compared to the control group. Notably, attitude can affect behavioral intention and ultimately nutritional behaviors, it appeared that the use of educational strategies and emphasis on the role of healthy nutritional behaviors and the consequences of these behaviors in strengthen the positive beliefs on nutritional behaviors, and finally, the participants' attitude towards healthy nutritional. From the researchers point of view, this could be due to the effect of instructions and acquired students' behavior in changing their perception and attitude in the study group compared with control group who didn't receive any intervention.

Answer the third research hypothesis; the web based nutritional health education intervention will improve practices for study group than control group.

Concerning the study and control group according to their total reported practice

regarding dietary habits at pre- and post-intervention, the results of the current study revealed that there was a marked improvement in total reported practice regarding dietary habits among the study group at post intervention compared to pre intervention with a highly statistically significant difference **(fig 3)**. The study was agreed with **Hajivandi et al., (2021)** who studied "Assessing the impact of an educational intervention based on the theory of planned behavior on the nutritional behaviors of adolescents and young adults with PCOS in Iran" and revealed that there was statistically significantly improved the lifestyle habits of respondents after the implementation of the educational intervention, the participants, intention for healthy nutritional behaviors more increased in the intervention group compared to the control group. This finding showed the effectiveness of the educational intervention on improving attitude, subjective norms, and perceived behavioral control in adolescents and young adults with PCOS that eventually led to the formation of intention for healthy nutritional behaviors. In the present study, after implementing the educational intervention, the participants, nutritional behavior more improved in the intervention group compared to the control group. From the researchers' point of view, this could be due to the effect of web based nutritional intervention on changing the unhealthy habits and following healthy diet also, might be due to the researchers ability to motivate the study group to decrease caloric intake, practicing exercise and losing weight.

The current study showed that, there was highly statistically significant relation between total reported practice of the study group at pre-intervention and their personal characteristics as BMI and practicing sport also, there is statistically significant relation with their gender, age, number of family members, buy food with expense and smoking status **(table 2).** The study was supported by **Zaki et al., (2019)** who revealed that there was significant relation between students' behavior and their body mass index, practicing sport, eating unhealthy snakes, smoking and age on both study and control group. Students' behavior might affect individuals' health status; therefore, intervention intended towards behavioral factor is important to achieve long-term positive effect. Behavioral improvement through reinforcement on nutrition education is a part of nutrition sensitive intervention towards adolescents' nutrition status correction. This could be due to the effect of educational and the illustrative booklet on students' practices and behavior regarding healthy nutrition by demonstrating healthy habits such as performing regular exercise, avoid smoking, avoid junk and fast food so that decreasing their body mass index BMI.

Conversely the study was disagreed with **Sharif Ishak et al., (2020)** who studied "Effectiveness of a school-based intervention on knowledge, attitude and practice on healthy lifestyle and body composition in Malaysian adolescents" ,who revealed non-significant relation between students' practices and in the outcome such as BMI, practicing sports, eating fried food and body weight change and this might be due to not only to the short duration of the intervention but also to the short follow-up period, which was not sufficient for meaningful changes in body composition to take place and thus be detectable. Also, adolescents may need more time to learn and apply what they have learned in the intervention. From the researchers' point of view, this could be due to students may acquire more information about healthy nutrition, practice sports and avoid smoking, post

intervention for study group than control group.

Answer the Fourth research hypothesis; The web based nutritional health education intervention will improve BMI for study group than control group: -

The result of the current study displayed that more than half of the study and control group had normal weight. Also, less than two thirds of the study and control group had normal height, Moreover, more than half of the study and control group had normal body mass index, **(table, 2 & 3)**. The study was agreed with **Archero et al., (2018)** who studied "Adherence to the Mediterranean diet among school children and adolescents living in northern Italy and unhealthy food behaviors associated to overweight" (questionnaire on 669 subjects (6–16 years) attending five schools of Novara at Italy) and revealed that, the majority of participants 81.2% had Normal body weight, height and BMI. This might be due to their need to control their body weight and improve their self-esteem and body image.

Correlation between total students' knowledge, reported practice and attitude regarding healthy nutrition at pre- and post-intervention:

Regarding the correlation between total students' knowledge, reported practice and attitude regarding healthy nutrition among the study and control group at pre- and post-intervention, the current study illustrated that there was a high statistically significant positive correlation between total students' knowledge, reported practice and attitude regarding healthy nutrition among the study control group at pre- and post-intervention **(table 4 &5).** The study was supported by **Hajivandi et al., (2021)** who revealed that there was statistically significant relation between total students' knowledge, attitude, subjective norms, the perceived behavioral control about nutritional behaviors, intention for healthy nutritional behaviors. From the researchers' point of view, this could be due to that increasing a students' knowledge can prompt a behavioral change and that high information will influence behavior

Conversely, the study was disagreed with **Sharif Ishak et al., (2020)** who reported that Although there were significant improvements in knowledge in the IG in this study, improvements in attitudes and practices were not statistically significantly different between the two groups of adolescents. There was a significant change in knowledge about nutrition, but there were no significant changes in nutrition practices or behaviors Even though nutritional knowledge on its own is not sufficient for behavioral change, an improvement in nutritional knowledge can be considered an important achievement, as it may play a small but crucial role in the adoption of healthier food habits. From the researchers' point of view, this could be due to change the attitudes and practices of the adolescents in order to increase students' personal efficacy, leading the adolescents towards healthier lifestyle practice and vice versa, when the students' knowledge regarding healthy nutrition is low, it will be negatively reflected on their attitude and practices.

Conclusions

Web Based nutritional intervention succeeded to improve knowledge, practice and attitude for study group than control group of secondary school students regarding nutritional health education. There was a high statistically significant positive correlation between total students' knowledge, reported practice and attitude regarding healthy nutrition among the study group at pre- and post-intervention. There is a high statistically significant positive

correlation between total students' knowledge, reported practice and attitude regarding healthy nutrition among the control group at pre- and post-intervention.

Recommendations:

- Apply the web based interventions of nutrition on a large scale, large sample and students in other age stages.
- Provide frequent assessment of student weight, length and BMI to determine the appropriate diet according their healthy status
- Use internet and social media as useful tool to educate student and improve their habits and behaviors regarding healthy nutrition.
- Replication of the study on a larger probability sample in other different setting is highly recommended to achieve generalize results.

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