The Effect of Health Belief Model for Preventing and Controlling Cancer Risk Behaviors among School Age Children

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Abstract

Background: Cancer is a major cause of mortality in all over the world. The cancer problem in children and adolescents is large enough to be considered a warning of an impending worldwide. Educating children about cancer risks can improve awareness and introduce healthy lifestyle habits. Cancer prevention education must begin at an early age, because the foundation for more health-impacting risk behaviors later in life is forming at this age. **Aim:** The aim of this study was to assess the effectiveness of the health belief model for preventing and controlling cancer risk behaviors among school age children. **Materials and Methods**: A quasi-experimental study was performed on a purposive sample of 100 school age children was selected from two governmental schools affiliated to Beni-Suef city. The data gathering tools were two questionnaires including cancer knowledge questionnaire and health belief model constructs questionnaire which were used. It used to measure practices for preventing and controlling cancer risk behaviors. The Questionnaires were completed before, immediately, and three months later after the intervention. **Results**: The present study results indicated that immediately and three months later after the intervention, the knowledge of studied children improved significantly and the mean scores of the health belief model constructs (Perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and preventive cancer risks behaviors was increased than pre the program (P<0.001).**Conclusion:** The findings of the present study confirmed the practicability and effectiveness of the Health Belief Model based educational program in enhancing children's lifestyle behaviors about preventing and controlling cancer risks. Hence, these models can act as a framework for designing and implementing educational interventions for the cancer prevention at schools. **Recommendation:** The importance should be given to these classes in schools, try to increase children's perception of cancer risks, explain the benefits of protective behavior.

Key Words: Health Belief Model, Preventing, Controlling, School age children, Cancer Risk behaviors**.**

Introduction

Globally, cancer is among the leading causes of death, it is a primary health risk. Over the last years, the world has witnessed a steady increase in cancer incidence and cancer mortality among children and adolescents **(Mogensen et al., 2018).** According to a baseline analysis of pediatric oncology care in Egypt, cancer is second in terms of mortality, the rate of childhood cancer among children under the age of 18 is 166.6 per 100 000 people **(CAPMAS, 2018; Islami et al., 2021).**Overall, among children ages 0 to 14 years, the most common types of cancer leukemia, followed by brain and other central nervous system (CNS) tumors, lymphomas, neuroblastoma, kidney

tumors, and malignant bone tumors. Among adolescents' ages 15 to 19 years, the most common types of cancer are brain and other CNS tumors and lymphomas, followed by leukemia, thyroid cancer, testicular and ovarian germ cell tumors, and malignant bone tumors **(Siegel et al., 2021).**

Intensive medical researches have identified many causal risk factors for cancer that give a firm basis for prevention. Although there are many different types of cancer with different risk factors, several of the behavioral risk factors are common **(Schüz et al., 2019).** Evidence from numerous researches has shown that environmental exposures including smoking, radiation, pesticides, and sunshine, as well as elements of a child's lifestyle like what they eat and drink, are important determinants of human cancer. Although hereditary variables increase a person's risk of developing cancer, the researchers currently have no control over them.

With the help of voluntary behavioral modifications, lifestyle issues can be managed. The reduction of cancer-inducing products and changing our environment, can leading to elimination or controlling of carcinogens. Moreover, it is important to focus on child lifestyle development as it begins in childhood because it is evident that most of our health habits have their beginnings early in life **(Wild et al., 2019).**

Prevention is the most cost effective long term strategy for cancer control. About 4 in 10 cancer cases can be preventable. Smoking exposure, excessive body weight, lack of physical activity and unhealthy diet such as low fiber, high processed meat are the most preventable causes of cancer. Thus, cancer prevention and control can be explained through health behavior change and modification **(Brussels, 2021).**

Health education is one important activity that is commonly undertaken to promote health. It is the communication of information that enables people to make informed decisions about their health. Additionally, health education is a profession that educates people about their health, also health education defined as the principle by which individuals and groups of people learn to behave in a manner conducive to the promotion, maintenance or restoration of their health, the value of educational programs depends on their effectiveness, which depends mainly on the correct use of theories and models in health education (**Kokubo, 2014, McKenzie et al., 2009;Donatella, 2009;Sadeghi et al., 2019).** Thus, teaching preventive behaviors such as physical activity and correct nutrition as a simple and efficient method can help children prevent the disease and promote their health **(Chan, 2017; Darabi, 2017).** In line with such a purpose, identifying factors affecting behavior can make changes easier. Based on the Health Belief Model (HBM), people change their behavior when they understand that the disease is serious, otherwise they might not turn to healthy behaviors (**Turner, 2014).**

Health Belief Model is a psychological theory that is commonly used for prevention of human diseases by emphasizing individual perception. The HBM consists of four main constructs including perceived susceptibility, severity, benefits and

barrier and two additional constructs included self-efficacy and cues to action **(Almadi &Alghamdi, 2019),** which has been used for behavior prevention of different diseases such as osteoarthritis, low back pain, skin cancer and accident trauma in children **(Coulson et al, 2016; Tehrani, 2014).**The health belief model refers to one of the affective educational models in preventing chronic diseases and health promotion and acted as a practical framework for designing educational interventions and promoting preventive behaviors **(Sadeghi et al., 2019; Kudo et al., 2011).**This model is a comprehensive model that plays a significant role in disease prevention. According to this model, a person's decision and motivation to adopt a healthier behavior depends on three categories: personal perception, moderating behaviors, and the likelihood of doing that behavior **(Najarkolaeietal, 2019).**

Because nurses play a significant role in the health care system, they are essential in the early identification and prevention of cancer. Additionally, nurses must communicate knowledge about risk factors, the early detection of cancer and motivate individuals to perform cancer prevention practices regularly. Moreover, nurses generally play a major role in health education and promotion **(Ayres, 2009).**Therefore, nurses should provide up-to-date, pertinent information on all aspects of cancer with the aim of facilitating user knowledge and choice **(Oscarsson, et al., 2011).**

Significant of the study

Preventing cancer across the population, diagnosing it early, providing optimal care to patients and maximizing their quality of life is the main international cancer strategy worldwide. Cancer prevention is a cornerstone of this strategy as it offers the most cost-effective, long-term approach for cancer control**(National Institute for Healthcare and Excellence, 2015; Schüz et al., 2015).**Lifestyle risk factors are also associated with poor symptom awareness, delayed presentation and low uptake of services, including screening. The magnitude of the cancer problem in children and adolescents is large enough to be considered a warning of an impending worldwide. Behavior modification of children should be carried out on a large scale **(Sadeghi et al, 2019; Kudo et al, 2011).**

Based on researches and surveys **(American Cancer Society, 2019)** recommended that cancer prevention education should be included in the school curriculum. It is assumed that about two thirds of oncology diseases are attributable to the choice of a bad lifestyle. In this paper, we consider HFM education as a promising means to reduce cancer risk and encouraging children to follow preventive risk lifestyle. Therefore, the aim of this study was done to examine the effectiveness of the use of the health belief model in preventing and controlling cancer risk behavior among school age children.

Aim of the study

This study was conducted to determine the effectiveness of health belief model for preventing and controlling cancer risk behaviors among school age children, through:

- Assessing children's knowledge, beliefs, and practices regarding cancer risk.
- Design and implementation of a health education program based on HBM according to children's lifestyle risks.

- Evaluating the improvement of children' knowledge, healthy lifestyle practices to preventing and controlling cancer risk behaviors.

Research Hypothesis

1. Children who received a health educational program based on HBM are expected to have better knowledge, health beliefs, and health behaviors to prevent and control cancer risks
2. There is a significant relationship between knowledge and HBM constructs with children cancer risk preventive practices.

Subject and Methods

The research design

This study has incorporated quasi-experimental research design to fulfill the aim of this study (pretest posttest and follow up evaluations).

The research setting:

Two schools were selected randomly from the educational zone affiliated to Beni-Suef City. Each school consisted of three buildings, the 1st building for primary level classes, 2nd building for prep-classes and 3rd building for secondary level classes.

The Study subject

The samples were selected from two schools. A purposive sample of 100 children was included in the current study under the following inclusion and exclusion criteria:

Inclusion criteria

Accepted to participate in the study; Aging from 6-15 years; both gender; Healthy children (Not have cancer); Regardless of their social income.

Exclusion criteria

Children diagnosed with cancer were excluded.

Sample size

The sample of 100 children was selected out of 926 school age children who attended the selected schools and agreed to participate in the study. The sample size was calculated according to the following formula: n=N/[1+N(e)2(Yamane,1967).

Tools of data collection:

Two tools were used to collect the study data. These included the following:

First tool: Interviewing questionnaire was designated by the researchers in Arabic language after reviewing of the relevant literature **(Wild et al., 2019; American cancer society, 2019).** It comprises two main parts:

Part (1): Children' socio-demographic information, such as age, gender, educational stage, parents' education, previous family history of cancer, previous attendance of the health education program about cancer .

Part (2): Knowledge of the studied children regarding cancer definition, causes, risks, types, diagnosis, treatment, warning signs and symptoms, prognosis, complications and its prevention (10 open ended questions).

Scoring system of knowledge: Correct/complete responses were rated as '2'; incomplete responses rated as '1', and incorrect or unknown responses as '0'. Knowledge value was calculated by summing the points for correct answers. Possible total scores ranged from 0 to 20 and the mean and standard deviation

were calculated. This section was used as the (before/after and 3 months later) format.

Second tool: The Health Belief Model (HFM) was adapted from **(Orji et al., 2012; Skinner et al., 2015).** This model encompassed six main constructs including perceived susceptibility, perceived severity, perceived benefits, perceived barriers, preventive practices and cues to action **(Carico et al., 2020).** The modifications were done by the researchers on Arabic language. This tool composed of the perceived susceptibility to cancer such as the children's opinion about chances of getting cancer (9 Questions), perceived severity of cancer such as the children's opinion about complications due to cancer (7 Questions), perceived barriers of performing cancer prevention activities such as barriers facing child to doing physical exercise frequently (6 Questions), and perceived benefits of cancer prevention (7 Questions) and preventive Practices (9 Questions) for example, one of the questions was: do you exercise to prevent cancer.

Scoring system for the five constructs of HBM (Susceptibility, severity, benefits, and barriers and preventive practices) constructs were included 38 questions were measured using a five point Likert scale ranging from one (strongly disagree) to five (strongly agree). Subscale mean scores were obtained by summing and averaging the items. Each subscale was calculated separately, and therefore four different scores were obtained for each subject. The possible total score range was (38-190). The lesser perceived barriers indicated a more favorable attitude toward cancer preventive behavior. This section was used as (pre/post and three months later) format.

Additionally, Cues for action: it refers to anything that may heighten awareness or trigger interest in performing the necessary health related activity to prevent, control, treat or elevate the health problem. The cues to action questions were binary questions, yes or no. Such as their sources of information to get preventive practices to controlling cancer risk behavior such as family, mass media...etc. The details of the HFM questions are presented in **Table (1)**

Validity and Reliability

The validity of the questionnaire was evaluated and confirmed by the experts in pediatric nursing sciences. The tools were modified according to the Panel's judgment on the simplicity and content adequacy of the statements. Reliability was performed by Cronbach's alpha coefficient test, which revealed that each of the two tools was composed of relatively uniform elements, demonstrating the high reliability of each tool. The internal consistency of the knowledge questionnaire was 0.86, and the overall HBM major component was 0.80.

Field work:

Official permission was obtained from the Dean of the Faculty of Nursing, Beni-Suef University, and then the letter sent to the directors of the educational zone. Based on their approvals, permission was taken from the directors of the selected schools to collect the data. The researchers started by explaining the purpose of the study to children briefly. Children tested were informed that they had the right to discontinue the study at any time without giving a reason. Data were considered confidential and not be

used outside this study without the children's approval. The researcher phone number and all possible communicating methods (as whatsApp) were identified to the children to return at any time for any explanation**.**

Pilot study

A pilot study was carried out using 10% of the sample size to test the feasibility and applicability of the questionnaire's content as well as to determine how long it would take to gather the data, the necessary modifications were done. Those who shared in the pilot study were excluded from the study sample.

Ethical considerations:

The local ethics review committee of the Beni-Suef University approved the study Project # BSU-CP7-19016, Oral consent was taken from the children included in the study, they were informed that the data collected will be used for the research only, and confident manner is assured.

Procedure:

At the time of data collection, a verbal agreement was taken from every child in the study after clear and proper explanation of the study purpose and its importance for them. The study was carried out through three phases: assessment, implementation and evaluation phase. These phases were carried out from beginning of October 2021 to the end of June 2022. The previous mentioned settings were visited by the researchers three days/week from 9.00 am to 12.00 pm.

Assessment phase: After obtaining formal approval to conduct the study, the researchers approached and met the children under study at both schools, after which the children completed the questionnaires to assess knowledge regarding cancer definition, causes and risk prevention, and health belief model questions. Information obtained at this stage formed the basis for further comparisons to assess the impact of educational programs (Pretest).

Implementation phase: Depending on the needs identified during the assessment phase the researchers developed a cancer risk prevention and control sessions based on HBM constructs with simple Arabic language to suit children' level of understanding, which aimed to improve children' knowledge, modify their health beliefs, and empower them to make health decisions for cancer risks preventive behaviors.

It clarified the areas of common deficiency in children' knowledge related to cancer prevention, risks, and health food elements, control their exposures to smoking and chemical substances, benefits of controlling risks health beliefs and barriers to practice cancer preventive behaviors. The program was applied through five sessions, and each session lasted 45–60 min. Educational program brochures and booklets were distributed to each child. Teaching methods included group discussions, open discussion, and brain storming. After every session, additional time was offered for answering more questions. The program application lasted two months.

Evaluation phase: After the educational program implementation, its effect was assessed by posttest evaluation. The evaluation was done immediately and three months later (follow up) after the program using the same tools of pretest evaluation.

Data analysis

The collected data were coded and entered to Statistical Package for Social Sciences windows software, version 20.0. Categorical data were expressed in number (%) whereas continuous data were expressed as Mean±SD. The comparisons between categorical data were calculated using $\chi 2$-test, whereas comparisons between continuous data were calculated using paired t-test and the Analysis of Variance (ANOVA). Correlation between variables with continuous data was tested using the correlation coefficient test. Statistical significance was set at P less than 0.05, and a highly statistical significance was considered at P less than 0.001.

Results

Table (2): This table shows that, the mean age of the studied children was 8.6±4.26 years; 63.3% were female; 57.8 % were in primary level of education. As regards children' mothers and fathers' educational level, it is evident from this table that 48.9 % and 55.6 of them had a secondary schools educational level respectively. Also, 13.3 % of them had previous family cancer history.

Figure (1): This figure displays that 94.4% of the studied children didn't attended any previous program about cancer.

Table (3): Displays that there was highly significant difference between pre, post and follow up the program intervention in terms of knowledge items where p = 0.001, and no significant differences between post and follow up knowledge total scores p = 0 .311.

Table (4): Indicates that, highly statistically significant difference was found between pre , post and follow up the program intervention related to Perceived susceptibility, Perceived severity, Perceived benefits, perceived barriers and Preventive Practices (p <0.001). Whereas, the total mean score of HFM structures increased from 80.03±3.18 to 163±5.70 and 153±7.61 immediately and follow up the program, respectively. Meanwhile, no statistically significant difference was found between post and follow up the program intervention in all items of HBM Structures Score (p= .476).

Figure (2): This figure shows that, teachers (70.0%), family (65.0%), mass media (40.0%), and peers (15.0%) were the main sources of children's information related cancer risks prevention, respectively.

Table (5): Indicates that no significant relation between total mean score of knowledge, the model structures score of HBM and demographic variable of studied children related age, gender and parents education pre, immediately post and follow up the program intervention (p> 0.05). Meanwhile there was highly significant relation between total mean score of knowledge, the model structures score and studied children family past history of cancer pre ,post and follow up the program intervention (p < 0.001).

Table (6): Illustrates that, there was statistically significant correlation between mean of perceived susceptibility, perceived severity, perceived and perceived benefits with total mean of the preventive behavior pre

the program ($p < 0.05$). In addition , there was a positive highly statistically significant correlation between mean of perceived susceptibility , perceived severity , perceived barriers , and perceived benefits with total mean of the preventive behavior post and follow up the program intervention($p < 0.001$).

Table (7): This table demonstrates that, a highly statistically significant positive correlation was found among total knowledge scores and the total preventive practices scores pre, immediately post and follow up the health education program intervention $p < 0.001$.

Table (1) Health Belief Model constructs

Perceived susceptibility (9)
1. Do you think some day you will get cancer if you do not make good Lifestyle health behavior? 2. The children chances of getting cancer in these days are high because of pollution. 3. Family history puts children at risk for getting cancer 4. Parents working with toxic chemicals put children at risk for getting cancer. 5. The unhealthy food like Junk and fast puts children at risk for getting cancer. 6. Exposure to sun for long periods during the day puts you at risk for getting cancer. 7. Electromagnetic exposure for long periods puts children at risk for getting cancer. 8. Insecticide and pesticides exposure puts children at risk for getting cancer. **9.** Smoking positive or negative exposure puts children at risk for getting cancer**.**
Perceived severity (7)
10. Cancer may lead to death. 11. will miss more than two months of school or work 12. will have long-lasting effects 13. will be bed-ridden for a long time, 14. will have medical expenses; receive chemotherapy or radiotherapy treatment 15. My social relationships will suffer; **16.** I will hurt my family life**.**
Perceived barriers (6)
1. Inconvenient and under-resourced health services for prevention of child cancer 2. Inadequate education about cancer prevention in my family 3. It is too expensive to have regular check up for child cancer. 4. Lack of awareness about important of healthy food 5. Cultural beliefs neglect regular checkup for child cancer 6. Lack of time to make regular check up for cancer because my parent occupying **7.** I can't exercising regularly
Perceived benefits (7)
1. Avoiding exposing to cancer risk can prevent me to get cancer later 2. Prevention of cancer lead to reduce healthcare costs, save cost of delayed disease detection 3. Prevention of cancer lead to improve children's quality of life 4. Early detection of warning signs help to prevent cancer complications 5. Prevention of cancer lead to maintain child health 6. Health literacy about carcinogens is an effective primary prevention strategy for child cancer. **7.** Preventing cancer lead to normal social relation, and school achievement.
Preventive behaviors (9)
1. Importance of eating a healthy diet containing vitamins and essential elements as zinc, iron 2. Iam exercising frequently 3. I am avoid exposing to smoking 4. I am avoid exposing to pesticide 5. I am avoid exposing **to** sun light for long time, use sun screen 6. I am protect myself against solar radiation, mobile radition 7. I am avoiding exposing to chemicals at home and school. 8. I am avoid drinking beverage 9. I am avoiding junk food, packing food, high salt food and more sweets**.**

Table (2): Distribution of studied children according to their characteristics (n= 90)

Characteristics	Category	No.	%
Age in years	6 < 11	60	66.7
	11≤15	30	33.3
	Mean ± SD (8.6±4.26)		
Level of education	Primary	52	57.8
	Prep-school	38	42.2
Gender	Male	33	36.7
	Female	57	63.3
Birth order	First	12	13.3
	Second	28	31.1
	Third	33	36.7
	Fourth	7	7.8
Mother's education	Illiterate	26	28.9
	Read and write	5	5.6
	Secondary schools	44	48.9
	Higher education	15	16.7
Father's education	Illiterate	16	17.8
	Read and write	10	11.1
	Secondary schools	50	55.6
	Higher education	14	15.6
Previous family cancer history	Yes	12	13.3
	No	78	86.7

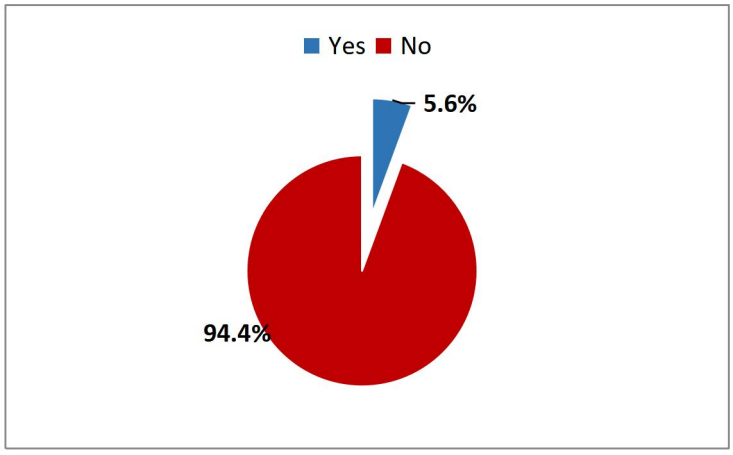

Figure (1) Percentage Distribution of the studied children According to their Attendance Previous Program about cancer

Table (3): Comparison of means scorers of the children' knowledge about cancer pre-, immediately and follow up the intervention (n= 90).

Cancer knowledge items	Pre - HFM	Post- HFM	Follow-up-HFM	P – value		
	Mean ± SD	Mean ± SD	Mean ± SD	P1	P2	P3
Cancer definition	0.491±0.507	1.634±0.041	1.525±.0381	.001**	.001**	.432
Caner Process	0.283±.0.452	1.325±0.391	1.16±-0.634	.001**	.001**	.121
Associated risk factor /causes	0.49±0.504	4.71± 0.346	6.859±0.634	.001**	.001**	.921
Methods of diagnosis	0.283±.0.452	1.913±.0.601	1.340±.312	.001**	.001**	.382
Treatment	1.63± 1.680	4.016±0.612	4.14±1.444	.001**	.001**	.531
Early signs and symptoms	0.491±0.507	1.716±0.452	1.950±0..218	.001**	.001**	.319
Complications	0.266±0.444	1.825±0.381	1.625±0.044	.001**	.001**	.642
Total knowledge score	5.311±0.420	14.670±2.139	13.90±3.133	.001**	.001**	.311

T- Test **highly significant <0.001 P1= comparing between pre and postP2= comparing between pre; follow up; P3= comparing between post and follow up

Table (4) Comparing components of HBM of participants at pre, post and the follow up of the study:

Items	Number of items	Obtainable score range	Pre - HFM	Post- HFM	Follow-up-HFM	P – value		
			Mean ± SD	Mean ± SD	Mean ± SD	P 1	P2	P3
Perceived susceptibility	9	9-45	11.38±2.34	31.82±1.72	32.22±1.92	.001**	.001*	.321
Perceived severity	7	7-35	17.12±1.71	22.42±5.12	21.20±2.11	.001**	.001**	.610
Perceived barriers	6	6-30	18.32±0.60	10.24±3.04	11.98±1.34	.001**	.001**	.476
Perceived benefits	7	7-35	21.62±1.10	26.61±4.58	28.24±3.04	.001**	.001**	.339
Preventive Practices	9	9-45	18.44±0.78	37.74±5.89	37.74±5.89	.001**	.001**	.204
Total	38	38-190	80.03±3.18	163±5.70	153±7.61	.001**	.001**	.476

T- Test **Highly significant <0.001; P1= comparing between pre and postP2= comparing between pre; follow up; P3= comparing between post and follow up

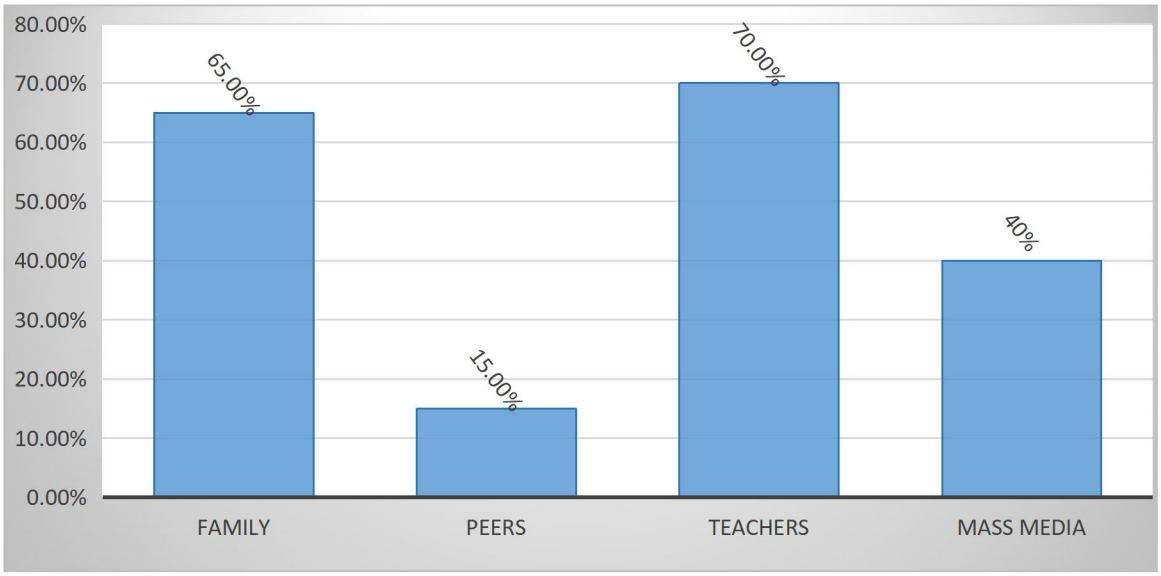

Figure (2): Distribution of the studied children according to their sources of information about cancer risk prevention (cues of action) (n=90).

Table (5): Relation between total Mean score of knowledge, the total Model Structures Score of HBM and Demographic Variable of studied children (n.90)

Items	Demographic Variable									
	Age		Gender		Father Education		Father Education		Past- History	
	t	p	t	p	F	p	F	p	t	p
Total knowledge										
Pre-intervention	0.68	0.36	0.79	0.42	1.25	0.36	1.19	0.33	1.05	0.003*
Post intervention	0.72	0.19	0.53	0.22	1.74	0.49	1.87	0.31	2.96	0.001**
Follow-up intervention	0.54	0.52	0.64	0.40	1.18	0.33	1.13	0.36	3.14	0.001**
Total Model Structures Score										
Pre-intervention	0.82	0.56	0.74	0.42	1.05	0.89	1.56	0.82	2.04	0.005*
Post intervention	1.59	0.59	1.43	0.63	1.19	0.42	1.67	0.43	4.32	0.001**
Follow-up intervention	0.78	0.78	0.78	0.44	1.02	0.58	1.12	0.41	4.11	0.001**

(F)ANOVA test was used, (t) Chi-squared test was used*Significant at the 0.05 level , **Significant at the 0.01

Table (6): Correlation coefficient between HBM four main constructs and preventive practice of cancer risk among studied children pre, post and follow up the program intervention (n=90).

HFM Structures	Preventive Practice					
	Pre- HFM		Post- HFM		Follow-up HFM	
	r	P	r	P	r	P
Perceived susceptibility	0.195	0.017	0.790	0.001**	0.432	0.001**
Perceived severity	0.196	0.016	0.562	0.001**	0.521	0.001**
Perceived barriers	−0.143	0.025	0.647	0.001**	0.622	0.001**
Perceived benefits	0.183	0.030	0.819	0.001**	0.712	0.001**
Self-efficacy	0.199	0.041	0.635	0.001**	0.608	0.001**

*Significant at the 0.05 level, ** highly Significant at the 0.01

Table (7): Correlation between knowledge score and total score of preventive practices Score of the study sample pre post and follow up program:

Items	Total knowledge					
	Pre- HFM		Post- HFM		Follow-up HFM	
	r	P	r	P	r	P
Preventive Practices	0.304	0.001**	0.468	0.001**	0.544	0.001**

** Highly Significant at the 0.01

Discussion

According to the **National Cancer Institute, (2019)** and **American Cancer Society, (2021)**, health education focuses on building individual capacities through educational, motivational, skill-building and consciousness- encouraging and enhancing behavioral change. The role of health education in creating cancer awareness cannot be overemphasized. The quality health education programs delivered in schools can improve the well-being and health of students and improve their knowledge about dangerous diseases. Additionally, engaging in healthy behaviors has been linked to the reduction of chronic diseases like cancer.

Various research studies have been conducted globally, relying on the constructs of the HBM to determine how people's perception of diseases may impact its behaviors **Sadeghi et al., (2019) and Qian et al., (2020).** Therefore, this study sought to determine the effectiveness of the health belief model for preventing and controlling cancer risk behaviors among school age children.

The current study showed that approximately two third of the sample was in the age group between 6 to younger than 11 years. The researchers had chosen this age group to include in this study since it is the period in which children acquire the skills of understanding and interpreting knowledge. According to **Piko and Bak**

(2006) who emphasized that this age is considered as children's understanding of health and disease differs by age, cognitive development of children plays an important role in this change. Moreover, **Hockenberry and Wilson (2015)** stated that, according to Piaget's theory of cognitive development, ages 7 to 11 are the concrete operational stage, and from7 years of age and upwards, children can perform mental. During this stage child develop an understanding of relationships between things and ideas. The period of ages 12 and up is the formal operational stage. At this stage, children start to develop multi-directional, abstract, and analytical thinking like an adult.

According to the current study findings, the majority of studied children didn't attend any health education program about cancer. This finding attributed that health education program in schools about cancer prevention is limited. This finding confirmed with **(Mali, 2014)** who stated that the public health has made great effort in reducing the burden of cancer by promoting a healthy lifestyle, however, interventions that educate children and adolescents about cancer prevention are limited.

On investigating children' knowledge about cancer definition, causes, complications, prognosis, and treatment, our findings revealed that, pre the HFM program application the most of studied children didn't reported correct answer in relation to all items of cancer knowledge. These findings may be due to that most of them didn't attend any cancer educational program previously. These findings supported by studies done by **Denois et al., (2018) and Suppa et al., (2013)**which revealed that children's had inaccurate information or beliefs about cancer definition, causes, treatment and prognosis. In this regards **Knigting et al., (2011**) observed that children in the 7–11 age groups had difficulties in describing and drawing cancer during a narration and drawing practice and used definitions like "disease" and "medical illness" or "lump. On the other hand, these findings disagree with **Sarıkaya et al., (2021)** who studied the healthy children's knowledge and perception on cancer, and observed that the vast majority of the healthy children participating in his study had a detailed, scientific, realistic knowledge of the cancer disease.

The current study findings indicated that there was a positive statistical significant difference between total knowledge score immediately and three months later after the program. This might be because of nursing educational program, as it provided the children with valuable information that can affect their knowledge level. These findings are in congruence with the study by **Asuquo, and Olajide, (2015)** who pointed out that breast cancer awareness program has a significant effect on the participants' knowledge of symptoms and risk factors associated with breast cancer disease. Also, this result matched with **Nejati et al., (2009)** who study the effectiveness of education on prevention of osteoporosis among high school female students and reported that, the knowledge scores in this group increased significantly after the HFM program intervention.

In our study the mean score of perceived susceptibility of children to cancer risk in was low pre the program intervention. This result may be due to

that their lack of knowledge about cancer before the program. These study findings supported the study by **Yossif and EL Sayed, (2014)** who reported that female college students do not perceive themselves to be at high risk for cervical cancer. While, immediately after and three months later the program intervention, the mean scores of perceived susceptibility increased among the study children. This might be because of, the nursing educational program might increase their knowledge score which influencing to their perception of risk. These results were in agreement with a study carried out in Iran by **Shojaeizadeh, (2012)** who revealed that education based on HBM was effective and improved the perceived susceptibility among study sample.

Perceived severity is defined as the feelings concerning the seriousness of acquiring a sickness. In this regards, before the program intervention, the studied children scored low mean of their perceived cancer severity. While, immediately after and three months later the program, the mean of perceived severity increased, there was significant increase in their level of perceived severity of cancer. This finding may be due to that, the effectiveness of HFM program applications. This finding was in line with **Farma et al., (2014)** they studied the effect of education based HBM on preventive behaviors of breast cancer in female teachers of Zahedan city, and indicated that the score of the perceived severity in the intervention group was meaningfully increased after the program.

Perceived barriers are found to be the most powerful dimension of HBM in the expression and prediction of health protective behaviors **Skinner et al., (2015).** In this context, our results documented that the mean of the perceived barriers after the educational intervention was decrease significantly different in the pre intervention phase. Likewise, other researchers found a significant decrease in the dimension of perceived barriers after HBM-based educational intervention in their studies on prostate cancer screening and nutritional behaviors associated with gastric cancer **Alidosti, et al., (2011) and ShouriBidgoli, (**2015). Moreover, **Karimy et al., (2012)** who had studied the effect of health education program based on HBM on the performance of Pap smear test among women. He reported a significant reduction in the average perceived barrier score within the intervention group before and after the intervention

In relation to perceived benefits of cancer risk prevention, the results of the present study revealed that, the mean of perceived benefits among the studied children was low pre program. This may be due to that children awareness regarding cancer risk and prevention was low before the program. Likewise, the present study results were consistent with those of the study conducted by **Amodeo et al., (2009) and Tehrani et al., (2014)** they reported that before the program intervention the study group showed a low mean scores about perceived benefits of preventive behavior.

Furthermore, the study results confirmed that, there was statistical significant difference between the pre, post and three months later of the program with respect to the mean score

of perceived benefits. Perceived benefits are focus on the effectiveness of healthy behavior in reducing the threat of the condition. This can be attributed to the program intervention was quite successful in promoting the perceived benefits of preventive cancer practice, in other words, after the program, most studied children believed they were at risk for cancer and understood the benefits of healthy behavior. Other researchers found similar results in examining the effect of HBM-based educational program on urinary tract infection and Acquired Immune Deficiency Syndrome preventive behaviors **Javaheri et al., (2013) and Pirzdeh and Sharifirad, (2012).**

Concerning the studied children means score of cancer preventive behavior practice, the present study results showed that, the mean of perceived healthy behavior is low pre the program. This finding may be due to that, children hadn't any information about cancer risk behaviors before the program.

On the other hand, we found out that the studied children total mean score in such protective behaviors increased significantly immediately and three months after the intervention. This finding may be due to that, children in the present study obtained high scores of perceived susceptibility and perceived severity, and these two structures were significant determinants to conduct the preventive behaviors against cancer. This attribution confirmed with various research studies have been conducted globally, relying on the constructs of the HBM to determine how people's perception of a disease susceptibility and severity may impact its actions for cancer prevention **ShouriBidgoli, (2015) and Aghamolaei et al., (2011).**These findings are in congruence with **Kang and Kim,(2011)** Emphasized that increased knowledge is associated with improved cervical cancer prevention behaviors and willingness to practice cervical cancer prevention behaviors

Cue or trigger is needed for motivating participation in health behaviors these cues to action are symptoms, strategies, or information sources that support implementation of a behavior .In the present study, based on the children' opinions family and teachers, and mass media were the main sources of information related to cancer risks prevention. Our findings were consistent with other studies indicating in a quantitative study by **Suppa et al., (2013)** demonstrated that children mostly get information about skin cancer from family and TV/media, but also from doctors and friends. In other studies, children's information sources on cancer were likewise listed as family members, health workers, TV/media and school **Bradbury et al., (2012).**

Findings of this study documented that, there were significant differences of children' total score of knowledge about cancer and all HBM constructs after the program intervention. Our findings were consistent with other studies indicating the significant increase of the individuals' knowledge level about prostate cancer after the intervention. Also, similar findings were obtained in a study carried out on students in Faculties of Benha University by **Yossif and EL Sayed,(2014)** who found that, after implementation of self-learning package, there was a significant improvement in all HBM constructs. Also, **Bakhtariaghdam et al., (2012)** reached a similar result and suggested it could be

due to the fact that taking the pre-test had made the respondents sensitive and curious to the subject. In this regards, **Ghaffari et al., (2011)** believed that it resulted from the curiosity of the participants in the study group to evaluate and complete the questionnaire at the pre-test stage. Similarly, we can conclude that such increase lies in the curiosity of the children to find out more about the disease and increase their knowledge about it during the interval between pre-test and post-test phases which makes them sensitive to the subjects discussed in the questionnaire.

Our previous findings were similar to other college studies in terms of influence of educational program on their knowledge and beliefs likewise. These studies indicated that health education programs can contribute directly to one's ability to successfully adopt and practice behaviors that protect and promote health and reduce health risk. As wells as, maintained that health and well-being of people is not a matter of luck, chance or random event, it must be a planned outcome. They further explained that, this calls for well-designed, well-resourced and sustained health education in schools. Quality school health education provides the best opportunity to promote positive health behavior among students **Soni, (2007); Asuquo and Olajide, (2015).**

Moreover, this study reported that there was no significant relation between the total score of children knowledge, HFM structures with their socio-demographic characteristics except with their previous family history of cancer pre, post and follow up the program. These findings supported by **Wang, (2017)** who study of knowledge, attitudes, preventive practices and screening intention about colorectal cancer and the related factors among residents in Guangzhou, China and reported that, knowledge of women, those with a family history of colorectal cancer were higher than that of others in their knowledge regarding cancer.

The current study found significant correlations between children's perception of severity, susceptibility, barriers and perceived benefit with preventive cancer behaviors in studied children before, immediately and three months later the program intervention. This finding was due to that children's health beliefs significantly impact their health behaviors. These findings were in line with several similar studies **Kwok et al., (2020); Qian et al., (2020)** to assess the risk perception of COVID-19 in communities involved with this outbreak, the perceived susceptibility and perceived severity had a high correlation with the protective behaviors of COVID-19. Our findings were similar to other college studies in terms of influence of variables such as perceived severity and efficacy to eat healthy **Garcia and Mann, (2003) and Von Ah et al., (2004).**Along similar lines, **Sari et al.,(2018)** argue that, preventive behaviors of patients with Low Back Pain were directly and positively associated with perceived threat, perceived benefit and self-efficacy. It was indirectly associated with perceived susceptibility, perceived severity, and perceived barrier.

In addition to perceived severity, the strongest indirect correlation with preventive behaviors of cancer is perceived susceptibility. This might be because of the identification of the

severity and benefits. Moreover, the nursing educational program might increase the awareness and motivation of the children. According to **Coulson et al., (2016)** people will have high motivation to behave healthy if their perceived susceptibility is negative to certain disease. Our findings were similar to study by **Corrin and Papadopoulos, (2017)** who found that higher perceived susceptibility has stronger behaviors in terms of risk reduction.

The results of the current study indicated that, there was a positive highly statistically significant correlation between total knowledge and total health beliefs model constructs scores in studied children before, immediately and three months later after the program intervention. The increase in knowledge and other constructs can be due to that the participants' access to information as well as their participation in the training program held about diseases. The increase in knowledge score in the studied children is significant and deserves consideration. The findings were in line with the views of **Shojaezadeh, (2012)** they observed that the awareness of the benefits of healthy behavior could encourage people to practice it. Previous studies showed that an individual's decision to take a healthy behavior is influenced by the following factors: knowledge, attitudes and beliefs about the efficacy of alternative actions **Glanzet al., (2008).**

Conclusion

According to this study, a health education program based on the HBM was successful in modifying the behavior of school-aged children to predict their propensity for cancer prevention. In the guidelines for practice, most information had been received through training classes. Moreover, the findings of the present study confirmed the practicability and effectiveness of the Health Belief Model based educational program in enhancing children lifestyle behaviors about preventing and controlling cancer risks. Hence, these models can act as a framework for designing and implementing educational interventions for the cancer prevention at schools.

Recommendation

- The importance should be given to these classes in schools, try to increase children's perception to cancer risks, explain the benefits of protective behavior, and eliminate the barriers as much as possible.

- Propagation of educational programs based on HBM on cancer risks prevention to parents and teachers would help raise public awareness about cancer risks and take action for its prevention.

- Other studies should be replicated on large sample from children and adolescents in different schools settings in order to generalize the result.

Acknowledgment

The authors appreciate the help of the schools directors and teachers. We would also like to thank all the children who willingly participated in the study**.**

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