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Health belief model for prevention of diabetic foot among elderly

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Abstract: **Diabetic foot problems in developing countries may consume as much as 40% of health care resources available for diabetes. This mean that programs aimed at early intervention and prevention of diabetic foot are importance for diabetic people. Aim: the study aimed to evaluate the effect of health belief model for prevention of diabetic foot among elderly. Study design: a quasi-experimental design was utilized to conduct this study. Setting: this study was conducted at the diabetes and endocrine outpatient clinic at Beni-suef university hospital. Subject: non-probability purposive sample of 70 diabetic elderly, admitted to the previously mentioned setting were recruited for conducting this study. Data collection tools: First tool structured interviewing questionnaire, it was composed of four parts, part one: Socio-demographic data, part two: Medical history of the elderly, part three: Elderly' knowledge regarding diabetes in general and diabetic foot specifically, part four: The therapeutic behaviors of the elderly. Second tool: The health belief model (HBM) constructs. Third tool: Foot self-care observational checklist. Results: There was significant difference between elderly' knowledge, health beliefs, compliance with diabetes therapeutic health behaviors and foot self-care practices pre-post and after two months of HBM based educational program. Conclusion: The HBM based education program is an effective and efficient manner in improving elderly' knowledge, health beliefs toward diabetes and diabetic foot and enhancing their compliance with diabetes therapeutic health behaviors and foot self- care practices. Recommendations: Conducting and disseminating HBM based educational programs at various settings to reach all targeted diabetic elderly to increase their positive behaviors towards diabetic care in general and foot care in specific, provide specialist educator nurse in the diabetes clinic to assess the needs and the education that the diabetic elderly needs, developing and disseminating medical posters or pamphlets to raise the health awareness among the elders. Further researches in the area of diabetic foot as well as diabetes prevention and care should be encouraged.**

Keywords: **Health belief model, Diabetic foot, Elderly, Education program.**

1. INTRODUCTION

Aging is a natural biological process which is associated with deterioration of health status of elderly people. As aging progress, an inevitable change in each of the body's organs contributes to the body's declining functions. It diminishes reserves in most body systems and increases vulnerability to most diseases and death. Elderly people constitutes a vulnerable group that needs special care. In Egypt retirement begins at the age of 60 years in governmental, public and private sector jobs. Some consider the geriatric age group as that group of people who passed the retirement age. Today, about two-thirds of all older people are living in the developing world; by 2025, it will be 75% ***(Abo el-Fetoh et al.,2017).***

Diabetes mellitus (DM) is a common chronic disease affecting older people, and it is becoming a global health concern. The International Diabetes Federation (IDF) reported that 425 million people diagnosed with diabetes mellitus in 2017, the number is projected to rise to 642 million by 2040 and the number of diabetic elderly is expected to increase to 252.8 million by 2035. The prevalence of diabetes is expected to increase exponentially in the next 20 years for developing countries. This has largely been attributed to unhealthy lifestyles, ageing, globalization and urbanization ***(Sharoni et al.,2017; IDF, 2017).***

High prevalence of DM is associated with increase in it's complications among diabetic elderly patients. Diabetic foot problems as one important complication of DM constitute an increasing public health problem and are a leading cause of hospital admission, amputation and mortality in diabetic patients, the peak prevalence being between 60 and 80 years of age. Worldwide, approximately 40-60% of all non-traumatic amputations of the lower extremities are performed in patients with diabetes ***(Marzouk et al.,2017).***

Health theories and models have been valued in the field of health education and promotion through behavior change. They are important in explaining health risk factors and changing behavior. Health belief model (HBM) was one of the earliest behavior change models to explain human health decision-making and subsequent behavior. The theory constructs helps to predict whether people will be taken action to prevent, screen for, and control illness. The HBM has been used extensively to determine the relationships between health beliefs and health behaviors ***(Abd El Aziz et al.,2016).***

The core assumption of the HBM is based on the idea that changing the health belief is the milestone for behavior change which contributes to improve health status. HBM composed of four main constructs. First, perceived susceptibility: to realize and believe that they are exposed to the risk. Second, perceived severity: to understand and belief that the disease is serious public health problem, and it can lead to serious complications. Third, perceived barriers: to identify physical, psychological or financial, barriers that can hinder healthy behaviors so that the person can overcome it to assume healthy behavior. Fourth, perceived benefits: it refers to the insight of the positive consequences that are caused by a specific act ***(Chanay & Anderson, 2016).***

Community health nurses have an accountability to assist and support elderly people to recognize their health related experiences and to enhance their abilities to make informed choices. Nurses have an effective role in prevention of foot ulcers and lower limb amputation by educational interventions, screening high-risk people and providing health care, they can use HBM to clarify patients perceptions of risk; this enables nurses to apply strategies that influence them to make healthy lifestyle changes that plays a positive role in compliance with a therapeutic regimen and prevent further complications and consequences of diabetes ***(Waheida et al., 2015; Mahmoud et al.,2018).***

Significance of study

In Egypt, according to central agency for public mobilization and statistics, (CAPMS) the number of older persons reached 6.410 million in 2018, which constitute 6.7% of the total population, and this percentage expected to rise to 11.5% in 2031. Diabetes in older age is becoming a public health problem even in developing countries. In Egypt, diabetes is on the growth. The IDF has estimated the total cases of T2D among the Egyptian adults (20-79 years) in 2017 with more than 8 million patients and the number has been suggested to double in the next 2 decades. In Egypt, T2D is the sixth cause of mortality, responsible for 2.4% all years of life lost, and represents the sixth most important cause of disability burden ***(Hamdy et al.,2018; CAPMS, 2018).***

Aging is associated with a wide range of changes that increase the susceptibility to diabetes complications. One of the most disabling complications of DM is diabetic foot which affect 15-25% of diabetic patients and may lead to gangrene, infection and/or foot amputation. These complications can lead to severe adverse effects including a high financial burden, physical disability, low quality of life and high mortality. Since effective long term treatment of diabetic foot ulcers is difficult, costly and time consuming and since ulcers often reoccur even after healing ***(Abdelhamid et al.,2019)***

The alarming fact is that Egypt has more diabetics than any other country, and the incidence of diabetic foot problems and amputations among elderly remains very high, it is estimated from a recent study conducted among diabetics in Egypt, that (29.3%) of diabetics had foot ulcer; (63.3%) had vascular complications, and neuropathy was reported in (88.0%). This can be attributed to several practices prevalent in Egypt, such as barefoot walking, inappropriate footwear, illiteracy, low socioeconomic status, and lack of knowledge regarding diabetic foot problems. The latter is very pertinent to Egypt since more than 90% of the people having diabetes do not receive education on foot problems***(Abd-Allah et al.,2016;Moussa & Gida, 2017;Abdelsalam et al.,2017).***

Diabetic foot can be prevented through the proper foot education. The effectiveness of education depends on the appropriate use of behavioral science theories and models that have great potential for increasing the effectiveness of health education programs; so, it is very important to develop and run these programs based on theories ***(Goorabi et al., 2017).*** It is, therefore, essential to develop HBM based education program to encourage diabetic elderly to improve their knowledge, health beliefs,compliance with diabetes therapeutic regimen and practices toward foot care.

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Aim of the study

This study aimed to evaluate the effect of health belief model for prevention of diabetic foot among elderly through :

1-Assessing elderly' knowledge toward diabetes in general and diabetic foot specifically.

2- Assessing elderly' health beliefs toward diabetes and diabetic foot.

3-Assessing level of compliance of the elderly with diabetes therapeutic regimen.

4- Assessing elderly' practices toward foot self-care.

5-Designing and implementing program based on HBM for diabetic elderly, according to their needs.

6- Evaluating the effectiveness of HBM based program on elderly' knowledge, health beliefs toward diabetes and diabetic foot, compliance with diabetes therapeutic health behaviors and practices regarding foot self-care.

Research hypothesis:

Implementing health belief model based education program for diabetic elderly will expected to promote their level of knowledge, health beliefs toward diabetes and diabetic foot, and practices regarding foot self-care as well as their level of compliance toward diabetes therapeutic regimen.

2. SUBJECTS AND METHODS

I.Research design: A quasi-experimental design was utilized to meet the aim of the study (one group pre/post test and follow-up after two months).

II. Technical design:

A- Research Setting: The present study was conducted at the diabetes and endocrine outpatient clinic at Beni-suef university hospital.

B- Subjects:non probability purposive sample was used in the current study. The number of diabetics who visited the clinic was 436 (from registration record) through the year 2017. In 2018 the flow rate of cases per day in the clinic was 1-8 cases both type I and type II DM (either newly diagnosed or follow-up cases). The sample size was calculated using the following equation:

$$Sample\ Size = \frac{\frac{z^2 \times p(1-p)}{e^2}}{1+(\frac{z^2 \times p(1-p)}{e^2 N})}$$

Whereas: Population Size = N | Margin of error = e | z-score = ze is percentage, put into decimal form. The z-score is the number of standard deviations a given proportion is away from the mean. At 0.05, desired confidence interval was used at 80% power and 10% expected drop out. The sample size was 77 elderly both males, and females, patients with inclusion criteria containing those who are aged 60 years and above, free from foot ulcer, and other complications in their feet, willing to participate in the study and able to comprehend and communicate. 10% (7) of the subjects were excluded in a pilot study.

C-Tools for data collection:

Tool (1): Structured interviewing questionnaire was developed by the researcher based on HBM, it includes;

Part I: Socio-demographic characteristics of the elderly such as age, gender, marital status, occupation, monthly income, level of education, and residence.

Part II: Medical history of the elderly including age of onset of DM, duration of DM, associated comorbidity, current treatment and family history of diabetes disease.

Part III: Concerned with elderly' knowledge about diabetes in general and diabetic foot specifically (pre/post/follow- up).

Scoring system: Each correct answer was scored by one grade and each wrong or "don't know"answer was scored by Zero, a total of 50% and above were considered satisfactory and less than 50% were considered unsatisfactory.

Part IV: The therapeutic behaviors of the elderly include; compliance of elderly with diabetes therapeutic regimen (compliance with treatment regimen, dietary regimen, exercise, periodic check up, periodic laboratory tests for glucose in blood and urine and smoking cessation) (pre/post/follow-up). Answers were coded according to the following: Yes=3, Sometimes=2, No= 1.

Scoring system of elderly compliance with diabetes therapeutic regimen was calculated as following, participants who got 50% and more were considered good level of compliance, while participants who got less than 50% otherwise were considered poor level of compliance.

Tool (2):Health belief model scale (pre/post/follow-up). It was adapted from Sharifirad et al. (2007). Modification was done by the researcher on Arabic language. The scale composed of the main four HBM constructs: perceived susceptibility (9 items), perceived severity (9 items), perceived benefits (9 items), and perceived barriers (12 items).

Scoring system: The scale included 39 items on a three points likert scale for each variable. All statements were scored on a scale from 1-3. Elderly responses were scored as follows: agree =3, neither agree nor disagree = 2, while disagree = 1 for all parts of the scale except the part of the perceived barriers was coded as the following agree=1, neither agree nor disagree=2, disagree =3. The optimal total scores were 117 and subjects who reach 50% and more considered to have positive response and who got less than 50% otherwise considered to have negative response.

Tool (3): **Diabetic elderly' foot self-care practices observational checklist** (pre/ post/ follow-up). It was used to collect information regarding foot care practiced by the elderly.

Scoring system: It was composed of 18 items. The scores of each item ranged from 0-1, zero for not done and one for done. The total practical scores were divided into two categories, practices of 50% and more referred to good practice while practices less than 50% referred to poor practice.

III. Operational design:

The operational design includes: preparatory phase, validity, reliability, pilot study and fieldwork.

- **Preparatory phase:** It includes reviewing of literature and different studies related to HBM for prevention of diabetic foot by using books, articles, periodicals and internet, after reviewing of recent, current, national and international related literature in various aspects of the problems, the study tools were designed and translated into Arabic language. Outlining all areas to be included in HBM based education program were done and educational booklet through extensive review of the literature and other available resources.

- **Content validity:** To achieve the criteria of trustworthiness of the data collection tools in this study, tools were tested and evaluated for content validity. Content validity was tested by five experts in community health nursing and medicine specialties. They were from different academic categories, i.e., professor and assistant professor from faculty of nursing and medicine in Ain shams and Beni-Suef university. To ascertain relevance, clarity, applicability, and completeness of the tools. Based on experts comments and recommendations, minor modifications had been made such as rephrasing and rearrangements of some sentences.

- **Reliability:** Chronbach Alpha test was used to measure the internal consistency of the 3 tools used in the current study.

- **Pilot study:** A pilot study was carried out on 10% (7) of elderly to test the study tools for clarity, feasibility, applicability, and time required to fill out the questionnaires. The necessary modifications were done through omission of unneeded or repeated questions and improvements were made prior to data collection according to the pilot study results. The sample of the elderly who participated in the pilot study was excluded from the main study sample.

- **Field work:** The study was started and finished through the following phases:

A) Assessment phase (data collection(pre test):-

The researcher attended the diabetes and endocrine outpatient clinic two days per week, from 9.00 AM. to 1.00 PM. The data collection lasted over three months starting from the beginning of January to the end of March 2018. The researcher interviewed each elderly individually and briefly explained the nature and the purposes of the study, and asked for participation. All elderly were informed that participation is voluntary, after obtaining the acceptance of elderly to

participate in the present study. The elderly were interviewed to assess their socio-demographic data, and their knowledge, health beliefs regarding diabetes, diabetic foot, their compliance with diabetes therapeutic regimen as well as foot self-care practices (pre test). The average time needed to fill out the questionnaires was 25-30 minutes. A number of interviewed elderly per week ranged from 1-5. The program was designed by the researcher based on data obtained from pre assessment tools.

B) Program implementation:-

Based on the needs identified in the assessment phase and review of literatures the researcher applied a comprehensive HBM based education program with simple Arabic language to suit elderly' level of understanding, which aimed to improve elderly' knowledge, modify their health beliefs, and empower them to take health decisions for compliance with therapeutic health behaviors for prevention of diabetic foot. The education program was constructed based on HBM constructs (perceived susceptibility, perceived severity, perceived benefits and perceived barriers).

Program implementation based on conducting sessions plan using different educational methods, and media in addition to the use of guiding booklet, hand out, and illustrative pictures specifically designed and developed based on elderly assessment needs. Elderly who were assigned to group teaching were divided into 14 group between 4-5 in each group. Information and skills for each group by the end of the teaching experience were revised. Time was opened for attendance to ask questions and to receive the corresponding answers as well as to express their feedback toward the teaching session. This phase started from April 2018 to end of August 2018, takes five months.

Program sessions : The researcher visited the selected setting from 9.00AM to 11.00 AM 2 days/ week for program implementation. The program content and it's objectives were developed by researcher in the form of 7 sessions divided into 4 sessions for theory and 3 sessions for practices. The total time consumed for the sessions was 3:10 hr, varied in time from 20 minutes to 40 minutes for each session, according to the elderly understanding and span of attention. Teaching sessions were conducted in the clinic.

At the beginning of the first session, an orientation about the program and it's purposes were given. It was agreed at the time of the sessions with the elderly. From the second session and so on each session started by a summary about what was given through the previous session and objectives of the new one. By the end of each session a summary was made and time allocated for questions and answers, and plan for next session was made.

Each session of the program contains of general, and specific objectives, these objectives a chieved through several teaching methods and media as lecture, group discussion, brainstorming, posters, guidance booklet, illustrative pictures and hand out which includes instructions and information for elderly as a reference during, and after program implementation.

C) Evaluation phase:-

This phase aimed to evaluate the level of improvement in elderly' knowledge, health beliefs toward diabetes and diabetic foot, compliance with diabetes therapeutic regimen and foot self-care practices. Evaluation of outcome of the program was carried out by the researcher after two weeks of program implementation **(post test I)** then follow-up after two months of program implementation **(post test II)** by using the same study tools used in pre test.

IV. Administrative approval:-

Approval was obtained from the authorities of the faculty of nursing, Ain Shams University, then written official letters sent to the director of the Beni-Suief university hospital, include the aim of the study and steps of the program obtained to elderly in diabetes & endocrine outpatient clinic. Permission from chief of outpatient clinics in Beni- Suief university hospital to conduct the study was obtained as well as permission from head of medical and endocrinology department in the university hospital.

V. Statistical Design:

The collected data were organized, analyzed using appropriate statistical significant tests. The data were collected and coded using the Computer Statistical Package for Social Science (SPSS), version 20, and was also used to do the statistical analysis of data to evaluate the studied subject's changes throughout the study phases (pre, post & follow-up).

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Data were presented using descriptive statistics in the form of frequencies and percentages. Chi-square tests were used to compare frequencies and correlation between study variables. Degrees of significance of results were considered as follows: p-value > 0.05not significant, p-value ≤ 0.05 Significant, p-value ≤ 0.01 highly Significant.

3. RESULTS

Table (1): shows that; 84.3% of the elderly their ages ranged from 60 years to less than 65 years old with mean age 64.44 ± 3.65, 62.9% were females and 70% of them were married. As regards to monthly income, 61.4% didn't earn enough monthly income. Regarding occupation, 58.6% housewife. In relation to level of education, 48.6% were illiterate and 22.9% had university education. 74.3 % of elderly in the sample belonged to rural areas.

Table (2): illustrates distribution of the elderly according to their medical history; Regarding the age at which the patient was diagnosed as DM, 74.3% of them had DM at age from 41 to 60 years. As regards to duration of diabetes, 44.3 % had a duration of disease less than 5 years. 65.7% of the elderly had associated comorbidity with DM and 77.1% of them depending on oral tablets. Regarding family history, 51.4% had family history of DM.

Fig.(1): This figure shows that; only 25.7% of the elderly had satisfactory knowledge pre HBM based program, and this percentage increased to 67.1% and 55.7% during post program and follow-up respectively.

Fig.(2): This figure shows that; 55.7% of the elderly had poor compliance with diabetes therapeutic health behavior pre program, then this percentage decreased to 21.4% and 22.9% during post program and follow-up after two months respectively.

Table(3): This table shows that; there was significant (P=0.000) improvement of the mean value of HBM constructs (perceived susceptibility, severity, benefits and barriers) during post program and follow-up after two months compared to pre program.

Fig.(3): This figure denotes that, 40.0% of the elderly had good level of foot care practices pre program then this percentage improved to 84.3%, 77.1% during post program and follow- up after two months respectively.

Table (4) represents that, there was a positive highly statistically significant correlation between total health beliefs constructs, total therapeutic health behaviors and total foot self-care practices in pre/post and two months after program implementation.

Table (1): Distribuation of the elderly according to their socio- demographic characteristics (n=70).

Socio-demographic characteristics	N	%
Age		
60<65	59	84.3
65<75	8	11.4
>75	3	4.3
Mean ±SD	64.44 ± 3.65	
Gender		
Male	26	37.1
Female	44	62.9
Occupation		
Housewife	41	58.6
Retired	16	22.9
Working	13	18.6
Monthly income		
Enough	27	38.6
Not enough	43	61.4

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Level of education		
Illiterate	34	48.8
Basic and middle level education	20	28.9
University level	16	22.9
Residence		
Rural	52	74.3
Urban	18	25.7

Table (2): Distribuation of the elderly according to their medical history (n=70).

Medical history	N	%
Age of onset of DM		
20 – 30 years	2	2.9
31-40years	9	12.8
41-60years	52	74.3
Above 61years	7	10.0
Duration of diabetes		
< 5years	31	44.3
5-10years	18	25.7
> 10 years	21	30.0
Associated comorbidity		
Nothing	24	34.3
Yes	46	65.7
Current treatment		
Oral tablets only	54	77.1
Insulin Only	16	22.9
Family history of diabetes		
No family history	34	48.6
Yes	36	51.4

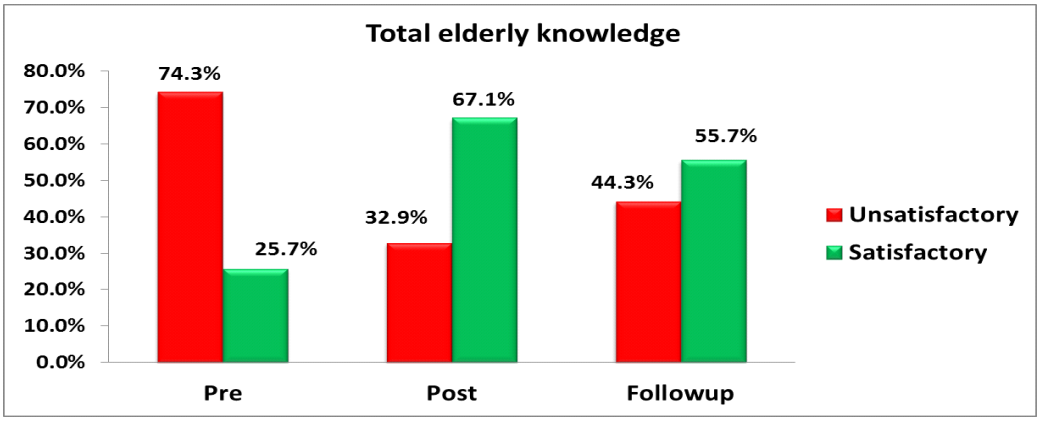

Fig (1): Percentage distribution of the elderly according to their total knowledge pre/post program and follow-up after two months (n=70).

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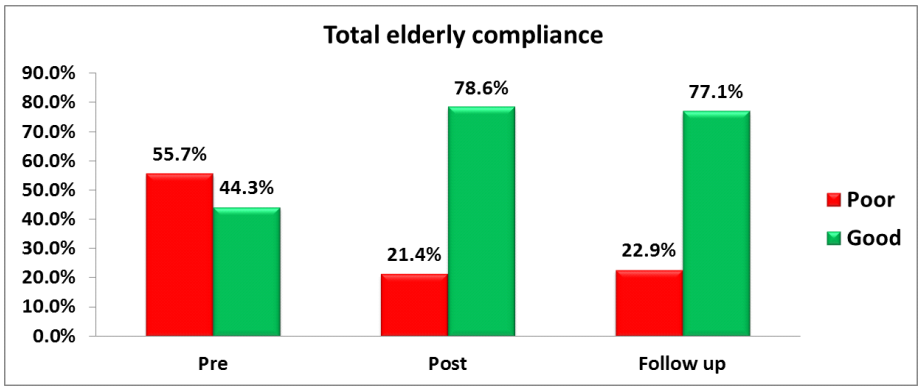

Fig (2): Percentage distribution of the elderly according to their total compliance pre/post program and follow-up after two months (n=70).

Table (3): Mean values of elderly' health beliefs (HBM constructs) pre/post program and follow-up after two months(n=70).

Health belief model (HBM)	Pre Mean ± SD	Post Mean ± SD	Follow- up Mean ± SD	F	P value
Perceived susceptibility	41.03±22.07	74.76±19.21	68.57±18.44	56.61	0.00
Perceived severity	40.16±23.29	74.76±22.75	72.94±23.70	49.10	0.00
Perceived benefits	49.37±23.28	78.49±19.79	79.44±20.25	45.69	0.00
Perceived barriers	42.38±17.64	72.14±14.86	69.35±15.69	69.90	0.00
Total HBM	43.35±19.84	74.82±17.58	72.33±17.56	63.56	0.00

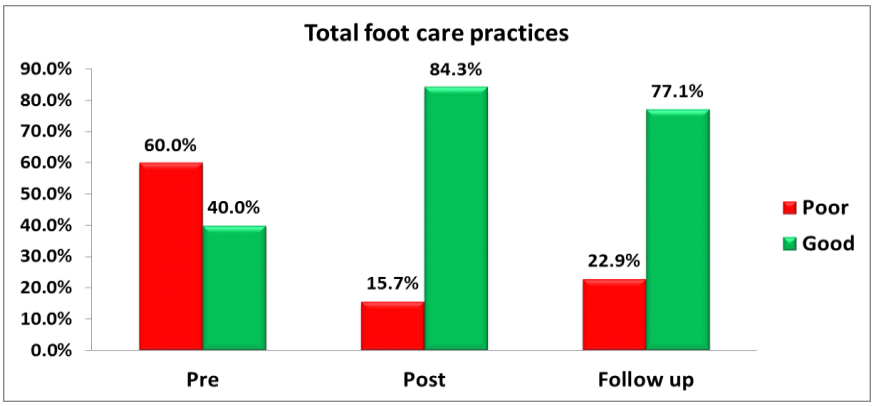

Fig (3): Percentage distribution of the elderly according to their total foot care practices pre/post program and follow-up after two months (n=70).

Table (4): Correlation between elderly' total health beliefs constructs, therapeutic health behavior and practice (n=70)

Items	Total health beliefs constructs					
	Pre		Post		Follow-up	
	R	P-value	R	P-value	R	P-value
Total therapeutic health behaviors	0.79	0.000	0.84	0.000	0.78	0.000**
Foot self- care practices	0.82	0.000	0.60	0.000	0.54	0.000**

* Statistically significant ** Highly statistically significant

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4. DISCUSSION

Older diabetic clients' education on appropriate foot care has the potential to play a key role in preventing complications. Understanding the factors that contribute to sub-optimal behavioral outcomes in the foot care is important. Educating diabetic patients increase their knowledge of diabetic foot care and help bridge the gap between knowledge and integrated into daily activities. One of the significant theories of health education is the HBM, which considers behavior as a function of knowledge and attitude of individuals ***(Mohamed et al., 2016).***

Regarding socio-demographic characteristics of the elderly. Our study revealed that, majority of the elderly their ages ranged from 60 to less than 65 years old with mean age 64.44 ± 3.65 and more than three fifth of the elderly were females and less than three quarters of them were married. As regards monthly income and occupation, more than three fifth of the elderly didn't have enough monthly income and more than half of them were housewife, In relation to level of education, and residence, nearly half of the elderly were illiterate and less than three quarters of them belonged to rural areas **(Table 1).** This was in conformity with a previous study in Egypt by **Mohamed et al. (2016)** who studied the effect of diabetic foot care training program on elderly adults' outcome in El-Minia Governorate, Egypt, stated that, less than three quarters of the elderly their ages between 60 years to less than 75 years with a mean age ± SD 65±4.8, more than half could not read and write and the majority of the sample was married and live in rural areas.

According to medical history. Our study indicated that, less than three quarters of elderly had DM at age from 41 to 60 years and the highest percentage had a duration of disease less than 5 years, less than two-thirds of the elderly had associated comorbidity with DM, more than three quarters depending on oral tablets only and more than half of them have family history of diabetes **(Table 2).** This result in the same line with the study by **Mohamed et al. (2016)** in El-Minia Governorate, Egypt, stated that, less than half of the elderly had diabetes at age from 41 to 60 years and less than two-thirds had a duration of disease less than 5 years. Also, similar to study in Turkey by **Kaya and Kitiş (2018)** who examined elderly diabetes patients' health beliefs about care and treatment for diabetes, the study clarified that, more than three quarters were taking oral anti-diabetic medications, about half had a family member with DM and more than three quarters had a disease accompanying diabetes.

Regarding to elderly' knowledge about diabetes in general and diabetic foot in specific, the current study shows that, only about one quarter of the elderly had satisfactory knowledge before implementation of the HBM based educational program, while there was an increase of elderly' knowledge after implementation of the program as it was noticed that more than two- thirds of the elderly had satisfactory knowledge and this persists in follow- up after two months with minimal decline **(Figure 1).** This finding compatible with Iranian study conducted by **Mohammadi et al. (2018)** who investigated the impact of self-efficacy education based on the health belief model in patients with type 2DM, they showed that a significant increase in the mean score of knowledge among subjects who were educated on diabetes in the post intervention and follow- up phase compared with pre intervention. Increasing the knowledge in post test and follow-up we can be attributed to the planned HBM teaching program which was effective in increasing the knowledge of the elderly with diabetes. On the other hand, the present study finding was opposite to what was found in a study done by **Galal et al.(2016)** to assess if acquirement of knowledge prevent diabetes-related foot problems in Kuwait, they represented that, health education and a high level of knowledge on diabetes in the case and control groups not effective and appear to have little impact on HbA1c reduction.

Regarding to elderly' compliance with diabetes therapeutic health behaviors, the current study depicted that, more than half of the elderly had poor compliance before implementation of HBM based education program and this percentage decreased to less than one quarter had poor compliance in post program and follow-up phase after two months **(Figure 2).** Parallel to this finding study by **Jalilian et al. (2014)** entitled as "Effectiveness of self-management promotion educational program among diabetic patients based on health belief model in Iran" indicated that, a significant improvement in mean scores of diabetes self-management among patient's after implementing educational program. The finding of the present study could be explained by the researchers point of view as that HBM based educational program appeared to be a motivating factor in elderly's self-management of their condition through attain proper self-care practices and lifestyle modifications, because the education massage improves the perception constructs of HBM for adopting self-care behaviors. However, the current study contradicted with **Tavakoli et al.(2018)** who developed study to evaluate health belief model-based education through telegram instant messaging services on diabetic self-care. The study showed that, there was no statistically significant difference after intervention between the case and control groups regarding all the questions of self-care behaviors.

The current study showed that; there was significant improvement (P= 0.000) of the mean value of HBM constructs (perceived susceptibility, severity, benefits and barriers) during post program and follow-up after two months compared to pre program **(Table 3).** This finding correlates with study developed by **Bayat et al. (2013)** about the effects of education based on extended HBM in type 2 diabetic patients, they reported that, the educational program had a positive and significant impact on extended health model belief constructs including; perceived susceptibility, perceived intensity, perceived benefits and perceived barriers in experimental group after the intervention. According to the researchers, point's of view, the current study result confirmed the efficiency of HBM based education in modifying elderly' beliefs about their susceptibility to diabetes complications including diabetic foot, and its severity as a result of increased their knowledge level about the disease. Moreover, the perceived barriers for engagement in the foot care preventive behaviors were improved with an associated increase in it's perceived benefits for performance of such preventive behaviors. On the other hand, these results disagreed with **Vahidi et al.(2015)** who evaluated educational program based on the HBM on self-efficacy among patients with type 2 diabetes, they showed that, the participants' mean perceived threat score was low in the intervention and control groups before the intervention, and after the intervention there was no significant difference between the two groups' regarding mean perceived threat scores, meaning that the educational program did not affect it.

Regarding foot self-care practices, the current study finding indicated that, only two fifth of the elderly had good level of practices before implementation of HBM based education program, while there was an improvement of practices after implementation of the program as it was noticed that the majority had good level of practices and minimal drop was observed in follow-up phase after two months **(Figure 3).** This finding agreed with study conducted by **Sharoni et al. (2017)** to evaluate the effect of self-efficacy education programme on foot self-care behaviour among older patients with diabetes, Malaysia, the study showed that foot self-efficacy scores improved after implementing the education programme as the respondents in this study reported being more confident in undertaking foot self-care behaviors after the education programme.

The success of the current HBM based education program in enhancing the elderly foot self-care practices could be explained by the researchers as when elderly knowledge about diabetes, diabetic foot, and their health beliefs improved post program this resulting in changing their health related behaviors and influence positively to engage with proper foot care practices. In contrast to the current finding study by **Gavgani et al.(2010)** about effectiveness of information-motivation and behavioral skill model in improving self-care behaviors and HbA1c measure in adults with type2DM in Iran, the authors reported no significant improvement in the foot care behavior among the intervention groups.

In the current study, there was a positive highly statistically significant correlation between total health beliefs constructs and total therapeutic health behaviors in pre-post and two months after program implementation **(Table 4).** This finding comes in harmony with other studies which showed that a good level of health beliefs have a positive effect on the self-care behaviors of individuals with diabetes **(Albargawi et al., 2016; Vedhara et al., 2014).**

In addition, there was a positive highly statistically significant correlation between total health beliefs constructs, and total foot self-care practice in pre-post and two months after program implementation **(Table 4).** This together with **Chin et al.(2013)** in Taiwan who found that in their study the four health belief factors (perceived severity, susceptibility, benefits, barriers) were associated with daily foot-exam practice. This could be explained by the researchers opinion as health beliefs are considered as a major unavoidable part in shaping persons' health behaviors thus it can greatly influence decision to engage in preventive health behaviors**.**

5. CONCLUSION

Diabetic elderly in the current study lacked appropriate knowledge and health beliefs regarding diabetes disease in general, diabetic foot, and foot care in the pre program phase and their compliance with diabetes therapeutic health behaviors and foot self-care practices were mostly unsatisfactory. After implementation of HBM based educational program, significant improvements were noticed in elderly' knowledge, health beliefs, compliance with diabetes therapeutic health behaviors and foot care practices. Therefore, the HBM based education program was successful in attaining it's aim and hypothesis of positively changing the knowledge, health beliefs and foot care practices of diabetic elderly.

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6. RECOMMENDATIONS

Conducting HBM based educational programs at different settings to reach all targeted diabetic elderly to increase their positive behaviors towards diabetic care in general and foot care in specific, developing booklet about diabetes and foot care based on HBM to improve elderly' knowledge, health beliefs, and screening practices should be available in diabetes clinics in Arabic versions and given to each elderly for free, the elderly diabetics need more intensive training and education in the health promoting behaviors of their diabetes. So, it's important to provide specialized health educator nurse in the diabetes clinic to assess the needs and the education that the elderly diabetics needs, developing and disseminating medical posters or pamphlets to raise the health awareness among the elderly, developing a health promoting behaviors program regarding the elderly diabetics, Future studies should follow the long-term effect of HBM based diabetic foot prevention program to reflect sustained change in the reduction of risk attitudes.

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