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Impact of Preventive Diabetic Foot Nursing Intervention on Foot Status among Patients with Diabetes

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Abstract

Background and aim: Diabetic foot is an important cause of morbidity and mortality in patients with diabetes mellitus and many of which are preventable with early recognition and therapy. Aim**:** The aim of the current study was to assess impact of preventive diabetic foot nursing intervention on foot status among patients with diabetes. **Methods:** A quazi-experimental design was utilized to conduct the current study on a convenient sample of 67 patients who were assigned randomly to either the study group or control group. The subjects in the study group (33 patients) received the preventive diabetic foot care nursing intervention while, the subjects in the control group (34 patients) received the routine clinic care. The study was conducted at the outpatient clinic in El-Kasr El-Aini Hospital, Cairo University, Egypt. Four tools were applied for the study: Socio-demographic data sheet, Diabetic foot care knowledge test, Foot care behavior, and Lower extremity health status inventory. **Results:** The study results showed that both groups had low mean knowledge scores related to preventive diabetic foot care in the 1st visit, while in the 4th visit after implementation of the preventive diabetic foot care nursing intervention, the difference was statistically significant. In relation to foot care behavior, there was statistically significant difference between both groups in the 4th visit. Additionally, in relation to foot health status, there was statistically significant difference in the 3rd and 4th visits between both groups. **Conclusion:** The preventive diabetic foot nursing intervention was effective in improving knowledge, foot care behavior and foot health status scores among patients with diabetes.
Keywords: Diabetic patient, preventive foot care, nursing intervention, foot status.

1. Introduction:

Worldwide, Diabetes mellitus is one of the fastest growing health problem (Martinez, 2013). It is considered the greatest prevalent epidemic disease particularly in developing countries (Dikeukw & Omole, 2013). According to the World Health Organization (WHO), the prevalence of diabetes in Arab world is at an alarming level. This is as consequences of life-style, lacking of physical exercise, unhealthy diet, and a marked increase in obesity and overweight (Chew, Shariff-Ghazali & Fernandez, 2014). The six of Middle Eastern countries, including Bahrain, Kuwait, Saudi Arabia, the United Arab Emirates, Oman and Egypt take over the world top-ten league table for the highest percentage of diabetes in the population (Ahmed, Elsharief & Alsharief, 2011). According to statistics in Egypt, by 2030, there will be 8.6 million adults with diabetes (Beiranvand, Fayazi & Asadizaker, 2015). The steady increase is in type 2 diabetes, especially among obese persons. Because of the advance of new treatments which improve the longevity of the patients, the increasing of the occurrence of diabetes related complications will increase (Salehi, Shafiei, Amini & Abdeyazdan, 2014 and Saad, Elhadedy, Ramadan, Mohmady & Farid., 2013).

Diabetic foot problems are among the main complications that may face any patient with diabetes at any time of his or her life throughout the world. It is a major source of morbidity complications among patients with diabetes (Shaw, Sicree & Zimmet, 2010). Diabetic foot problems are the leading cause of hospitalization for patients with diabetes (O'Loughlin, McIntosh, Dinneen & O'Brien, 2010). The causal lesions that often result in chronic ulceration and amputation of the lower extremities have been termed the diabetic foot. This is defined as infection, ulceration and destruction of deep tissues, associated with neurological abnormalities (loss of pain sensation) and various degrees of peripheral vascular disease in the lower limb (Saad et al., 2013 and O'Loughlin, et al., 2010).

Globally, diabetic foot problems are resulting in disability among patients with diabetes (Ahamed et al., 2011). They are responsible for approximately 50% of all lower limb amputation (Viswanathan, 2010). An estimated 15% of patients with diabetes will develop a lower extremity ulcer during the course of their disease (Bagheri, et al., 2012). This can result in loss of lower extremities and even death (Dorresteijn, Kriegsman, Assendelft & Valk,

2010). The WHO estimates that every year more than one million limb amputations occur. It is estimated to precede 25% to 90% of a lower extremity amputation of people with diabetes that can result in marked physical disability and reduction of quality of life (Lobmann, 2011). Around 85 percent of those are believed to be avoidable if appropriate (inter-professional team approach) medical attention, nursing intervention and proper patient education had been given at an earlier stage. So, diabetic foot disease represents a real challenge to the health providers caring for these patients, health system in general and patients themselves in particular. Accordingly, preventive care practices include early identification of the high risk diabetic foot, early diagnosis of foot problems, early intervention to prevent further deterioration that may lead to amputation and patient education for proper care of the feet and footwear (Formosa, Gatt & Chockalingam, 2012).

As diabetes is an intricate and demanding chronic disease from the perspective view of the patient. Accordingly, the American Diabetes Association (ADA), (2014) supported that diabetes is mostly self-managed with nearly 99% of the care becoming the charge of patients and those involved in the daily management. Additionally, Funnl, et al., (2012) added that the health status and well-being of patients with diabetes is strongly affected by the daily patient decisions and behaviors. Patient's knowledge and practices can contribute to prevent diabetic foot related health problems (Begum, Kong-in & Jaruwan, 2010). It is reported that enhancing the foot care behaviors of people with diabetes is one of the best effective approaches in reducing diabetic foot complications. So, the central target of preventive diabetic foot nursing intervention is to alternate behavior and motivate self-management of the patient (Kurniawan & Petpichetchian, 2011). Nurses have an effective role in the prevention of foot ulcers and lower limb amputation through learning intervention, and providing health care to patients with diabetes (American Diabetes Association, 2014). According to Peterman, (2010), it is essential for all patients with diabetes, exclusively who at risk for foot ulcers to be aware with the basics of foot care. Moreover, Welch, et al., (2010) reported that diabetic self-management education regarding dietary habits, control of blood glucose level, exercise regimen, as well as foot hygiene, toe-nails care, skin care, callus care, inspection of feet and legs and footwear, is a necessity for these patients to make better self-care decisions as well as improve quality of life.

According to studies conducted in Egypt by Saad et al., (2013); Abdo & Mohamed, (2010); Abd El-Raman & Abo Shousha, (2015) and Bahgat, (2008) on the diabetic foot concluded that education is effective for increasing knowledge of the diabetic patient, the prevention of diabetic foot ulceration, and improvement of health outcomes of the patient. As well, it is reported that the incidence of lower extremity amputation in patients with diabetes is decreasing particularly in response to implementation of improved diabetic foot care.

In the light of this review, it is necessary not only for diabetic patient but also for health care providers particularly nurses as a core of diabetic staff team to incorporate preventive diabetic foot nursing intervention into daily patient's care.

1.1 Significance of the study:

Diabetes is expected to become one of the world's leading disabler and killer within the next twenty-five years as its complications continue to rise. Egypt has been estimated to be the 9th country in the prevalence of diabetes (Abdo & Mohamed, 2010). Foot complications are mostly devastating, where they constitute as much as forty percent as a source of disability and mortality. Based on the National Institute for Health and Clinical Excellence Strategies, early effective management of foot complications can reduce the severity of complications such as, preventable amputations and possible mortality, and also can improve overall quality of life. In the Arab world, lack of education leads to unawareness of diabetic foot problems and their prevention (Woo, Vera Santos & Gamba 2013). Interestingly, a recent Egyptian study carried out by Saad et al., (2013) showed that 90% of screened diabetic patients had poor knowledge about their disease and 96.3% had poor awareness about its control. As The fundamental nursing intervention in patients with diabetes is education (Hunt, 2013). It is suggested that giving appropriate quantity and quality patient education in responsible centers and organizations, encouraging them to apply and empower a preventive diabetic foot nursing intervention, deserve particular consideration. Therefore, the aim of this research was to study the impact of preventive diabetic foot nursing intervention on foot status among patients with diabetes

1.2 Aim of the study:

The aim of the current research was to study the impact of preventive diabetic foot nursing intervention on foot status among patients with diabetes.

1.3 Research Hypotheses:

1. The foot care knowledge test mean scores will be significantly higher among the study group who will receive preventive diabetic foot nursing intervention than the control group who will receive the routine clinic care.

2. The foot care behavior mean scores will be significantly higher among the study group who will receive preventive diabetic foot nursing intervention than the control group who will receive the routine clinic care.

3. The foot status, as measured by lower extremity health status inventory, will be significantly improved among the study group who will receive preventive diabetic foot nursing intervention than the control group who will receive the routine clinic care.

4. Methods:

2.1 Research Design:

A quasi-experimental design was utilized to study the impact of the independent variable (preventive diabetic foot nursing intervention) on the dependent variable (foot status). Polit, Beck & Hungler, (2014) reported that the strength of the quasi-experimental design is that it is practical and it is suitable for the nature of nursing research.

2.2 Study Setting:

The study was conducted at the outpatient clinic in El-Kasr El-Aini Hospital, Cairo University, Egypt.

2.3 Sample:

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 = z

e 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%. So, z-score was 1.28 and 10% expected drop out. The sample size was 67 male and female adult patients with inclusion criteria containing those who had been diagnosed with type II diabetes for less than one year, able to reach their feet and did not have vision problems which would interfere with feet self-inspection. While the exclusion criteria include patients had a foot ulcer and patients who had peripheral vascular disease, heart and liver disease. Patients were randomly assigned to either the study or control group, based on random number table, as follows: The researchers prepared a list of all participants eligible to participate in the study, after assessing the patients' records according to the inclusion criteria and considering exclusion criteria. Finally, the participants in the study group (33 patients) received the preventive diabetic foot nursing intervention during visits one, two and three. The participants in the control group (34 patients) received usual clinic care.

2.4 Tools of data collection:

Data was collected through a structured interview to complete the following four tools:

1. Socio-Demographic and Medical Data Sheet: Demographic data consisted of items seeking information about the background of the subject such as; age, gender, marital status, educational level, smoking history, and treatment modality for diabetes.

2. Diabetic Foot Care Knowledge Test: Developed by Martinez, (1992) to test the knowledge of the diabetic patient regarding diabetes and foot care. It consisted of 25 multiple choice questions with only one correct answer for each question, the scoring of the knowledge questions was as follows: A correct answer was given (1) and the incorrect one was given (0), with total possible scores of 0 – 25. The tool was translated into 2 ways from English to Arabic and from Arabic to English to ensure accuracy. Internal consistency of the foot care knowledge test was 0.80.

3. Foot Care Behavior: developed by Kraus, (1997) to assess behavior regarding diabetic foot care. It consisted of 10 items self-reported with a frequency rating scale which ranges from 1 to 5; whereas (1) for never, (2) for seldom (2 – 3 times per month), (3) for occasionally (4 – 8 times per month), (4) for often (3 – 6 times per week) and (5) for usually (daily or every time it comes up), with total possible scores of 10 to 50. The tool was translated into 2 ways from English to Arabic and from Arabic to English to ensure accuracy. The reliability determined using the alpha coefficient was 0.70.

4. Lower Extremity Health Status Inventory: Developed by Kraus, (1997) to assess the foot condition. There are 11 foot health status indicators on this instrument. Each one represents a category of health status of the foot which assess the areas of muscular status, vascular status, sensation and status of the skin (temperature, color, hydration, hygiene, condition). The status of the foot on each of the indicators is given a numerical value. A score of one indicated positive health status and a score of greater than one means negative health status. The range of total scores was 11 to 30. The lower the score, the better the foot health status. The reliability of this tool was 0.80.

2.5 Pilot study:

A pilot study was conducted to assess the feasibility and the time needed to fill in the questionnaires and to carry out nursing intervention. As well as the tools were applied in order to evaluate the translated content of the tools, ensure clarity, and suitability to the cultural background of the patients. Almost all items were clearly understood and the respondents found them appropriate. The pilot study was carried out on 7 diabetic patients in the clinic, who were later excluded from the main study sample. The findings of the pilot study revealed that all of the participants had poor scores regarding knowledge, behavior as well as foot status. The result of the pilot study confirmed that the study is feasible.

2.6 Procedure:

An official permission to carry out the study was granted from the head manager of the outpatient clinics and responsible authorities at Faculty of Nursing at University to proceed with the study. The researchers initiated data collection. Patients meeting the inclusion criteria were approached individually. Oral consent from patients who accepted to share in the study was taken. The researchers introduced themselves and explained the purpose of the study to the patients. Patients were enrolled as study participants during clinic visit one and then were followed up for four visits over three months. After obtaining informed consent, the participants were randomly assigned either to the study group or control group. The patients in the control group received usual clinic care which included some general educational brief advice on the foot care. While the patients in the study group received the preventive diabetic foot nursing intervention. During 1st, 2nd and 3rd clinic visits the nursing intervention was implemented for the study group by the researchers. For the 4th visit, the researchers completed the study tools for all the patients in both groups. The most common contents covered in the nursing intervention are procedures-based as application of emollients for skin lubrication, daily hygiene, toe nail trimming, managing corns and callus, foot wear, foot examination and foot exercises. In addition to, educational information about the symptoms of diabetes, importance of controlling diet, quitting smoking and achieving glycemic control as part of the prevention of diabetic foot development and consequential promotion of health status of lower extremities should be confirmed. Participants in the intervention group were divided into three sub-groups of 11 patients, to whom the procedures and materials related foot care were presented into three sessions. Each session takes 45–60 minutes based on patients' understanding. Each training session was repeated for each of the subgroup and a total of nine training sessions were organized for the entire intervention group. A video regarding foot hygiene and inspection was shown to those patients during the sessions. As well as, brochures were offered to them. Socio-demographic and medical data sheet was collected in the 1st visit.

Diabetic foot care knowledge and diabetic foot care behavior were measured for all of the subjects on the 1st and 4th study visits, foot status as measured by the lower extremity health status inventory was evaluated for all of the participants at every study visit (visits one through four). Data collection phase was conducted over a period of ten months starting from beginning of June 2013 and ended by the end of March, 2014. The time taken to complete data collection by the patients for all the tools was approximately from 25 to 30 minutes.

2.7 Ethical considerations:

Informed consent was obtained from each participant prior to enrollment in the research. Potential participants were invited to participate in a study to test ways of preventing foot problems in diabetes without any harmful effect that would result from participation. They were given information on the purpose of the study, frequency and number of clinic visits. The data collected from each study participant were identified by number only. Patients in the control group were provided with the practice nursing intervention following the completion of the data collection. Patients were informed that they are allowed to withdraw from the study at any time without jeopardizing the care they are usually provided in the diabetic clinic.

2.8 Statistical analysis:

Data were analyzed using the Statistical Package for Social Science (SPSS). Frequency and percentage distribution were used to describe the socio-demographic studied sample variables and chi–square was used to test the difference between the control and study groups regarding these variables (except for age). In addition, differences in diabetic foot care knowledge, diabetic foot care behavior, and foot status as measured by the lower extremity health status inventory were analyzed using t-test. The significance level was set at $P < 0.05$.

3. Results:

Findings of this study are presented in two sections: 1) Description of the study subjects' characteristics, and 2) Differences in mean scores of foot care knowledge test, foot care behavior, and foot status between the control and study groups along the study period.

N.B.: (N.S. means not significant).

3.1 Description of the study subjects' characteristics (table1 & figure1):

Table 1. Frequency distribution and percentage of socio-demographic variables among the control and study groups (n=67).

variables	**Control Group (n=34)**		**Study Group (n=33)**		**Chi–square**
	No.	%	No.	%	
Gender:					
Male	20	58.8	17	51.5	0.35
Female	14	41.2	16	48.5	N.S.
Marital status:					
Single	0	0	0	0	1.59
Married	29	85.3	24	72.7	N.S.
Divorced/widowed	5	14.7	9	27.3	
Educational level:					

Illiterate	12	35.3	11	33.3	0.79
Primary education	2	5.9	2	6.1	N.S.
Secondary education	17	50	18	54.5	
University/post graduate	3	8.8	2	6.1	
Currently smoking:					
Yes	7	20.6	3	10	1.69
No	27	79.4	30	90	N.S.

N.S. = Not significant

Table 1 shows that males are the dominant gender in both the control group (58.8 %) and the study group (51.5%). Regarding marital status, 85.3 % and 72.7 % were married in the control and study groups respectively. The educational level variable shows that 35.3% and 33.3% were illiterate in the control and study groups respectively. In addition, 50 % and 54.5% had secondary education among the control and the study groups respectively. Regarding smoking as a measure to decrease diabetic foot complication, 10% of the patients involved in the study group are smoking. There were no statistically significant differences between the control and study groups in all socio-demographic variables.

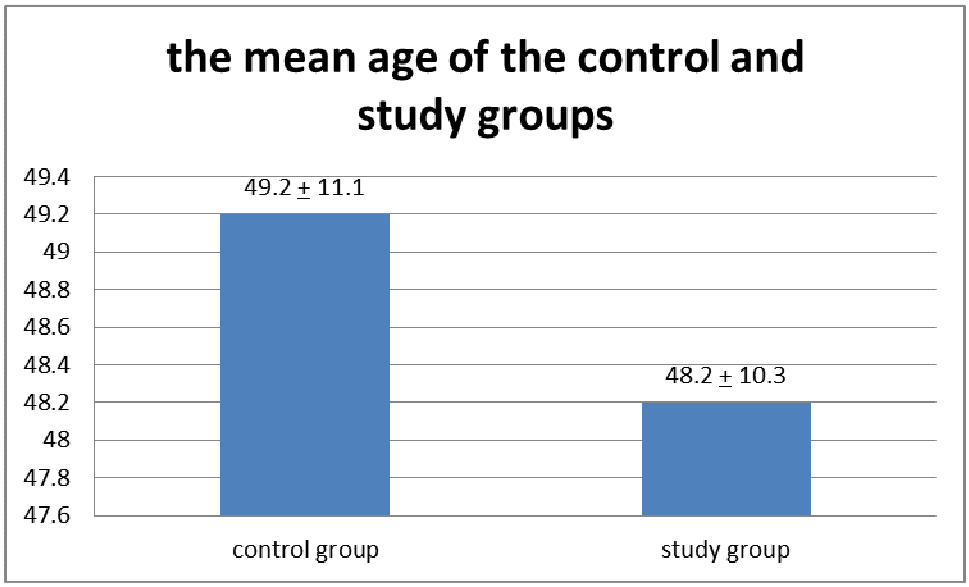

Figure 1. Mean age of the control and study groups.

Figure 1 shows that the mean age of the control and study groups were 49.2 ± 11.1 and 48.2 ± 10.3 respectively, with no statistically significant difference between both groups.

3.2 Differences in mean scores of foot care knowledge test, foot care behavior, and lower extremity health status (tables 2, 3 & 4):

Table 2. Comparison of mean scores between the control and study groups in relation to foot care knowledge test (n=67).

Visits	Control Group (n=34)	Study Group (n=33)	t-test	p-value
1st visit	11.7 ± 4.2	11.1 ± 5.9	0.46	0.6
4th visit	14.4 ± 4.9	20.9 ± 3.5	6.2	0.000*

Table 2 shows that there was no statistically significant difference between mean scores of the control group (11.7 ± 4.2) and study group (11.1 ± 5.9) in the first visit regarding knowledge test. However, in the 4th visit, there was a statistically significant difference between mean scores of the control group (14.4 ± 4.9) and study group (20.9 ± 3.5) with t-test= 6.2 at p-value = 0.000.

Table 3. Comparison of mean scores between the control and study groups regarding foot care behavior (n= 67).

Visits	Control Group (n: 34)	Study Group (n: 33)	t-test	p-value
1st visit	22.9 ± 3.2	23.4 ± 4.5	0.52	0.6
4th visit	25.9 ± 5.2	41.3 ± 3.7	14.01	0.000*

In relation to foot care behavior, the 1st visit revealed that there was no statistically significant difference between the control group (22.9 ± 3.2) and the study group (23.4 ± 4.5), with t-test = 0.52. However, the 4th visit showed a statistically significant difference between the control group mean score (25.9 ± 5.2) and that of the study group (41.3 ± 3.7), with t-test score =14.01 at p-value score = 0.000

Table 4. Comparison of mean scores of foot status as measured by lower extremity health status inventory between control and study groups (N: 67).

Visits	Control Group (n = 34)	Study Group (n = 33)	t-test	p-value
1st visit	19.4 ± 2.7	20.1 ± 3.5	0.93	0.4
2nd visit	19.1 ± 2.9	18.6 ± 3.2	0.7	0.5
3rd visit	18.6 ± 3.2	16.9 ± 2.9	2.3	0.05*
4th visit	18 ± 4.1	15.3 ± 2.2	3.69	0.000*

Regarding foot status, there were no statistically significant differences between mean scores of the control and study groups in the 1st and 2nd visits (t-test=0.93 at p-value 0.4 and t-test 0.7 at p-value= 0.5 respectively). However, in the 3rd and 4th visits, there were statistically significant differences between both groups (t-test= 2.3 at p-value 0.05, and t-test 3.69 at p-value= 0.000).

1. Discussion:

Diabetic foot care has been neglected in health care research. Many studies were carried out to validate the complications and describe their extent. Foot ulcers are more likely to be of neuropathic origin, therefore eminently preventable. In developing countries, which will experience the greatest rise in the prevalence of diabetes in the next 20 years (Abd El-Rahaman & Abo Shousha, 2015). Health education is one of the treatment tools that has a great effect on enhancing the patients with diabetes own abilities to carry out self-care through providing adequate knowledge, changing their attitude, and empowering them with skills (Abdo & Mohamed, 2010). The current study findings revealed that the mean age of the total study sample was 48.5 $\pm$ 14.2, male was the dominant gender in both the control and study groups. About one third of them in both groups were illiterate. In addition, the majority of the patients are treated with oral hypoglycemic drugs.

The present study results showed that all patients in the control and study groups had low mean knowledge scores, whereas the mean scores were less than half of the total knowledge scores, which may indicate low mean knowledge scores regarding diabetic foot care. The study results were congruent with an Egyptian study done at Zagazig, Egypt, by Bahgat, (2008), who concluded that the study sample of diabetic patients had low level of knowledge regarding diabetes. Also, the current study results were consistent with an Iranian study done in Iran by Beiranvand, Fayazi and Asadizaker, (2015) who concluded that more than half of patients with diabetes (53.6%) had low level of the knowledge of foot care activities and methods. However, in separated studies by Abu-Qamar, (2014) and Jinadasa and Jeewantha, (2011), aimed to assess the level of knowledge and practice of patients with diabetes in order to prevent the occurrence of diabetic foot ulcer. They reported a high level of knowledge among participants.

In addition, the study results supported the first hypothesis as, findings denoted no statistically significant difference between mean knowledge scores of the control and study groups in the 1st visit. However, after application of the preventive diabetic foot nursing intervention, in the 4th visit, there was a statistically significant difference between mean knowledge scores of the control and study groups whereas the study group had higher mean knowledge scores than the control group. A study carried out by Abdo and Mohamed, (2010), on the effectiveness of health education program for type 2 diabetic patients, comes into the same line with the current study results and revealed that after application of the educational program, there was a significant improvement in knowledge level of the study group when compared to those of control group. Moreover, in a meta-analysis research study, by Hawthorne, Robles, Cannings-John & Edwards-Adrian, (2008), eleven researches showed improvement in knowledge of the intervention groups after application of educational programs.

Regarding foot care behavior, patients in both groups had low foot care behavior mean scores in the first visit with no statistically significant difference between both groups, while after application of the preventive diabetic foot nursing intervention, the study group had a statistically significant higher foot care behavior mean scores when compared to those of the control group as the study results justified the second research hypothesis. It was also found that the more knowdgable the patients are regarding the disease and self-care methods, the more likely they are to maintain foot care behavior. Three studies supported the results of the current study, the 1st one done by Borges and Ostwald, (2008) on 167 diabetic patients, found a significant increase on foot self-care behaviors in the study group who received 15 minute foot self-care intervention, when compared to the control group. The 2nd study carried out by Sun et al., (2009) on 302 patients with type 2 diabetes, the study group received group lectures while the control group received routine outpatient care. The study results revealed improvement in the study group regarding foot care behavior. The last one by Anselmo et al., (2010) on the effectiveness of educational practice in diabetic foot. They reported that training sessions held for patients with type 2 diabetes increased the participants' practice of foot care behavior.

Regarding foot status, the current study showed that there was no statistically significant difference between the control and study groups, in the 1st and 2nd visits. However, in the 3rd and 4th visits, there was a statistically significant difference between both groups ($p< 0.000$), whereas, the third research hypothesis was supported by the research results. This is consistent with previous scattered studies done by: Dorresteijn, et al., (2010); Yazdanpanah, Nasiri, & Adarvishi, (2015); Abdullah, (2010); Chia et al., (2013); Natalia et al., (2014) and Fujiwara et al., (2011) who concluded from their studies about the effect of preventive diabetic educational interventions on the occurrence of foot lesions or amputation, that the education is effective for the prevention of diabetic foot ulceration and amputation particularly educational interventions in high risk patients. Another study done by Viswanathan, Madhavan, Rajasekar, Chamukuttan, and Ambady, (2005) on a very big sample of diabetic patients (4872), whereas patients were divided into three groups, group 1 received help in choosing appropriate footwear and had routine treatment, while groups 2 and 3 were given custom orthoses. The results

showed that 26% of patients who did not follow educational advice developed new problems, while 5% of participants, who adhered to the educational advice developed new problems.

However, the study done by Lincoln, Radford, Game and Jeffcoate, (2008) who recruited 172 patients with newly healed foot ulcers contradicted the current study results, the outcome measures were occurrence of ulcer within 1 year and occurrence of lower extremity amputation (LEA) within 6 months, and concluded that foot education had no effect on the LEA rate as well as ulcer incidence between the two groups. Interestingly, a study was conducted by Formosa and Vella, (2012), to investigate the relationship between diabetes-related knowledge and foot ulceration among people with type 2 diabetes. They assessed diabetes knowledge in groups with and without foot ulceration. They concluded that there was no significant difference in diabetes-related knowledge between the two groups.

2. Conclusion:

The study findings supported the three research hypotheses as, it concluded that the implementation of the preventive diabetic foot nursing intervention was effective in improving preventive foot care knowledge, preventive foot care behavior, and foot status in the study group who received the nursing intervention when compared to control group who received the routine clinic care.

Recommendations:

Based upon the findings of the study, the following recommendations are concluded:

1- Incorporating foot care into self-management programs to reinforce the importance of foot care to people with diabetes.
2- The presence of a diabetes educator at every primary care clinic would facilitate the behavioral and lifestyle interventions required.
3- Applying the preventive diabetic foot nursing intervention in the diabetes clinics and centers that provide care for patients with diabetes.
4- Teaching the diabetic patients the preventive nursing intervention in the early course of disease should be imperative in order to reduce the occurrence of the diabetic foot related complications.
5- .Training and empowering health care providers, working in outpatient diabetes clinic, skills of preventive diabetic foot care.
6- Further studies may be needed to determine effective factors on the behavior changes of patients with diabetes that could be the basis of developing preventive nursing intervention to improve the foot care.
7- Further studies may be needed to determine the stability of the effect of the preventive diabetic foot nursing intervention on the improvement of the foot status.
8- Further studies may be needed to determine the psychological state of the participants that could affect their compliance and responses.

Nursing implications

Regarding implications for research, implementation of the preventive diabetic foot nursing intervention in other clinical settings and with different patient populations would provide additional evidence of its effectiveness. Clinical settings that may use the nursing interventions are diabetes clinics in non-academic settings, clinics or centers that provide care to persons with diabetes but do not have diabetes care as the primary focus as geriatric centers.

Considering implications for practice, there is growing emphasis on the role of the nurse in implementing interventions that focus on reduction of risk of long term complications of chronic illnesses as diabetes. Therefore, the nurse would have a pivotal role in implementation of the preventive diabetic foot nursing intervention in order to reduce the risk of complications.

As for implications for nursing education, the preventive diabetic foot nursing intervention would provide a framework and content to be taught in basic and continuing education programs as a primary preventive practice for the health professionals regarding the preventive care of diabetic foot. The key nursing intervention for patients with diabetes is education.

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Conflicts of interest disclosure:

The authors declare that there is no conflict of interest statement.

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