

Diabetic foot care: Knowledge and practice

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ABSTRACT

Background: The most common and serious diabetic complication involves foot ulcers. Such a complication is extremely burdensome for patients and for healthcare systems. **Objective:** To evaluate the understanding and practice of diabetic patients toward diabetic foot care. **Methodology:** Using a pretested online questionnaire data were collected prospectively from the general population descent from Hail region between November 2021 and April 2022 and analyzed by SPSS version 24.0. **Results:** A total of 423 diabetics participated in the study. More than three-quarters (76.8%) were from urban areas ($P=0.03$). Diabetic foot ulcer was found in 152 (35.9%) and it was lower most in the utmost educational groups ($P=0.003$) and highest in the older and those from urban areas, $P=0.007$ and $P=0.013$ respectively. A 79% knew that regular physical activity helps reduce blood sugar ($P=0.001$). Moreover, 70.4% were aware that before washing their feet, they should test the water's temperature ($P=0.001$). Awareness was affected by the presence of diabetic foot ulcer and education ($P=0.01$, and $P=0.001$ respectively). Foot care practice was reported among 42.6% ($P=0.313$). It was affected by the presence of diabetic foot ulcer and co-morbidity ($P=0.04$, and $P=0.002$ respectively). **Conclusion:** A low percentage of populations are aware of and practicing diabetic foot care. Emphasis should be placed on intensifying the role of education in diabetic foot care.

Keywords: Awareness, Diabetics, Diabetic Foot Care, Diabetic foot ulcer, Practice.

1. INTRODUCTION

Worldwide, diabetes mellitus (DM) poses a significant challenge to public health (Solan et al., 2017). Globally, there are 422 million people with DM and the disease causes 1.6 million deaths every year. Its prevalence increased over the course of the decades (Aldhafar et al., 2021; Solan et al., 2017). Different countries have different DM prevalence rates. The prevalence of DM was estimated to be 13.4% in Saudi Arabia among those who were greater or equal

to 15 years of their age and in Pakistan among males and females aged 15-25 of 12.1% and 9.8% respectively (Pourkazemi et al., 2020). Diabetes related foot problems are among the highly prevalent, worrying and distressing complications (Aldhafar et al., 2021; Goie and Naidoo, 2016; Solan et al., 2017). Diabetic patients have a 50% chance of developing foot ulcers as a consequence of neuropathy, which is in turn is responsible for around 80% of all amputations of the lower limb (Al-Jarallah et al., 2020; Solan et al., 2017).

In KSA, amputations of lower limbs are attributed mostly to diabetic patients (Aldawish et al., 2018; Alghamdi et al., 2022). There is a substantial economic impact on patients (Goie and Naidoo, 2016; Turkmen and Ozbaş, 2021), their families and society due to diabetic foot ulcers (DFU), which affect both high-income countries and low and middle-income countries (Goie and Naidoo, 2016). Poorly controlled DM leads to destructive changes in the nerves and vessels of the lower extremities, resulting in diabetic foot disorders. As a result, diabetic patients suffer diverse manifestations of diabetic foot disorders including wounds and ulcers, gangrene, etc., caused by sensory/motor neuropathy and reduced circulation to the lower extremities (Suhasini et al., 2020). Diabetic patients with uncontrolled DM, those with longer-term DM, those with a history of foot ulcers or amputations and those with chronic co-existing conditions could develop foot problems (Aldhafar et al., 2021). It is vital to educate patients about DFUs to reduce their incidence. In order to reduce the likelihood of foot problems, the primary foot care taker needs to understand and practice self-care (Aldhafar et al., 2021; Al-Jarallah et al., 2020; Muhammad-Lutfi et al., 2014). According to many studies, most people with DM are not only trained in foot care, but also ignore regular foot examinations (Chiwanga and Njelekela, 2015). In view of the absence of population studies investigating self-care practices among diabetics in the Hail region of Saudi Arabia, this study was undertaken to figure out the degree of perception, knowledge and trends associated with the practice of foot self-care among diabetics.

2. MATERIAL AND METHODS

Population and sample

A cross-sectional analysis had been carried out during the period between November 2021 and April 2022. All accessible diabetics aged more than 18 years from the general population of Hail region were invited to fill out the uploaded questionnaire consecutively till achieving the required sample size. A single inhabitance proportion specimen size estimation formula was used to calculate the sample size (Wanamo et al., 2021).

$$S = (Z\text{-score})^2 * p*(1-p) / (m)^2$$

S= Sample size, Z= 1.96 (confidence interval 95%), p= Std deviation= 50%=0.5, m= Margin of error=0.05.

Accordingly, S = 384.16. There were 423 participants in total after factoring in a contingency of 10% for non-respondents.

Data collection

The questionnaire was created by researchers following a comprehensive literature search and professional deliberation. Its information veracity was revised by a board of three proficient in DM, with play all adjustments. The data collection online form contains 27 questions, categorized in to three distinct sections. The initial division consists of 6 questions regarding the demographic characteristics of patients, such as age, gender, smoking status, weight and height. The second part is composed of 10 questions regarding DM status and bio-medical history. Whereas the third part contains 11 questions specified for knowledge, approach and practice of diabetic footcare.

Evaluation of data

After extraction of data, it was revised, coded and fed to statistical software IBM SPSS version 22.0 (SPSS, Inc. Chicago, IL). All statistical analysis was done using two-tailed tests. Results are evaluated at a 95% CI, while a P value less than 0.05 was considered statistically significant. Descriptive analysis based on the frequency and percent distribution was done for all variables including socio-demographic data, habits, bio-medical history, perception, as well as practice concerning diabetic foot and its care. Also, DM-related clinical data among diabetic patients were tabulated. Cross tabulation was used to compare groups for all factors, regarding DFU and their practice. Relations were tested using the Pearson chi-square test and exact probability test for small frequency distributions.

3. RESULTS

Demographic Characteristics

Table 1 shows the demographics of the study participants. A total of 423 diabetic patients responded appropriately to the study. The majority (53%) were aged more than 50 years (P=0.001) and 73.3% were married (P=0.001). More than three-quarters (76.8%) were from urban areas (P=0.03). The majority had intermediate level of education or less (71.7%), whereas the remainder 28.3% were university-educated or above (P=0.001). Their occupation varied, as housewife, employee and retired as seen 34.3%, 26.5% and 18.7% respectively (P=0.001). Additionally, the majority (73.1%) were overweight or obese (45.2% vs 27.9% respectively) (P=0.020).

Table 1 Demographics of study participants, Hail region, KSA

Diabetic patients	No	%	P value
Age in years			0.001*
< 30	43	10.2%	
30-40	62	14.7%	
41-50	94	22.2%	
> 50	224	53.0%	
Marital status			0.001*
Single	68	16.1%	
Married	310	73.3%	
Widow	45	10.6%	
Residence			0.03*
Urban	325	76.8%	
Rural	98	23.2%	
Education			0.001*
Illiterate	102	24.1%	
Primary	98	23.2%	
Intermediate	103	24.3%	
Graduate	111	26.2%	
Postgraduate	9	2.1%	
Occupation			0.001*
Student	33	7.8%	
Employee	112	26.5%	
Housewife	145	34.3%	
Retired	79	18.7%	
Other	54	12.8%	
Body mass index			0.020*
Normal weight	114	27.0%	
Overweight	191	45.2%	
Obese	118	27.9%	

P: Pearson X² test P < 0.05 (significant)*

Diabetes status

A total of 316 (74.7%) had type 2 DM while 201 (47.5%) were on oral hypoglycemics and 197 (46.6%) were on insulin therapy. A total of 395 (69.9%) had DM for more than 10 years and only 67 (15.9%) were diagnosed within less than 5 years. Currently, about 152 (35.9%) of the study participants had DFUs, whereas, about 56 (13.2%) had experienced DFUs during the disease process (Table 2). The commonness of DFUs was lowermost in the utmost educational groups (P=0.003). Conversely, it is frequency was highest in the older age groups and those of descent from urban areas, P=0.007 and P=0.013 respectively.

Table 2 DM-related data among study patients, Hail region, KSA

DM data	No	%
Type of DM		
Type1	107	25.3%
Type2	316	74.7%
Medication		
Dietary control	18	4.3%
Oral hypoglycemic	201	47.5%
Insulin	197	46.6%
Combined (Insulin and oral hypoglycemic)	7	1.7%
The extent of DM (Years)		
< 5	67	15.9%
6-10	60	14.2%
> 10	296	69.9%
Recent DFU		
Yes	152	35.9%
No	271	64.1%
History of DFU		
Yes	56	13.2%
No	94	62.7%

Bio-medical history

The majority had impaired visual acuity and hyperlipidemia as reported among 62.2% and 47.5% of the respondents. Compared to patients living in rural areas, patients with DM living in urban areas had a higher probability of impaired visual acuity (P=0.013) and hyperlipidemia (P=0.041). Chronic renal diseases were detected among 7.8% (P=0.623). About 13.9% of them had complained of chronic artery diseases (P=0.487). Smoking habits were found in 18.2% of the participants (P=0.413) (Figure 1).

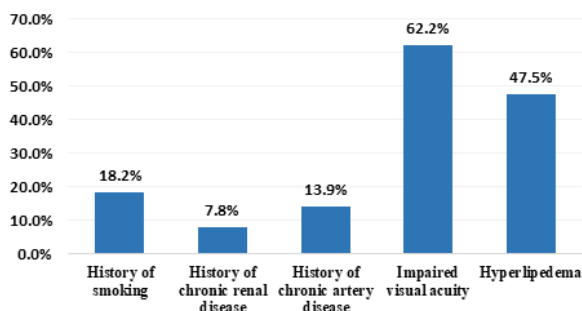


Figure 1 Bio-medical history among study participants, Hail region, KSA

The prevalence of chronic co-morbid diseases and hyperlipidemia are significantly linked to obesity (P<0.05). There is an inverse relationship between the presence of co-morbid diseases and the education level (P=0.004).

Awareness

A total of 27% of the participants had not been educated about diabetic foot self-care. The commonest source of their education in this era was doctors and nurses as seen in 31.2% and 29.3% respectively (P=0.001). A total of 88.7% of them knew that it is important to keep blood sugar levels within normal to prevent DFU (P=0.001). Moreover, 79% knew that routinely performing exercise could diminish the levels of high blood sugar (P=0.001). Smoking influences the development of DFU was reported among 77.5% of the participants (P=0.001). Additionally, 70.4% recognized that they must check the temperature of the water that they will use to wash their feet (P=.001) (Table 3). Their awareness was not affected by the duration & type of DM and the presence of co-morbid conditions (P>0.05). Whereas it is significantly affected by the presence of past or recent history of DFU and education level as P=0.008, P=0.01 and P=0.001 respectively.

Table 3 Diabetic foot awareness and care among study participants, Hail region, KSA

Awareness items	Diabetic patients		
	No	%	P value
Did you educate for diabetic foot self-care?			
No	114	27.0%	0.001*§
Doctor	132	31.2%	
Nurse	124	29.3%	
Relative	20	4.7%	
Friend	9	2.1%	
Internet	24	5.7%	
Is it important to keep blood sugar levels within normal to prevent DFU?			
True	375	88.7%	0.001*
False	48	11.3%	
Routinely performed exercise could diminish the levels of high blood sugar			
True	334	79.0%	0.001*
False	89	21.0%	
Smoking influences the development of DFU			
True	328	77.5%	0.001*
False	95	22.5%	
You must check the temperature of the water that you will use to wash your feet			
True	298	70.4%	0.001*
False	125	29.3%	

P: Pearson X² test §: Exact probability test* P < 0.05 (significant)

Practice

Foot care was reported among 42.6% (P=0.313). Although this may be harmful to their health, 87.2% of the participants reported eating a lot of sweets or foods rich in carbohydrates (P=0.001). Practicing regular physical activity was reported in 78.3% (P=0.001). Positively, a large number (64.1%) do check and monitor their blood sugar levels regularly (P = 0.001). About 59.6% of diabetics inspect their feet weekly or daily, while the minority inspects them more than once daily (P=0.001) (Table 4). Their diabetic foot care practice was not affected by their level of education, residency, age, occupation, duration of DM and its type (P>0.05). Whereas it is significantly affected by the presence of a past or recent history of DFU and the presence of co-morbid conditions, as P=0.02, P=0.04, and P=0.002 respectively.

4. DISCUSSION

Diabetes is on going diseases which burden some both to the patient and to the health sector in a country (Al-Jarallah et al., 2020). Rural populations form a smaller proportion of epidemiological studies, but in general they exhibit a subordinate prevalence of DM than urban inhabitants (Echouffo-Tcheugui et al., 2012; Hammamiri et al., 2012; Ploubidis et al., 2013). Rural and urban areas appear to be experiencing similar increases in DM risk factors such as body mass index, but Urban ambiances may have higher DM risk due to the sedentary mode of life and work, consumption of processed diets and less exercise, all of which potentially influencing DM risk (Braverman-Bronstein et al., 2021). In the current study, the prevalence of DM in urban dwellers was significantly higher than in rural inhabitants. Similar conclusions also were obtained in Taiwan (Tai et al., 2020), in Senegal (Seck et al., 2015) and in Myanmar (Aung et al., 2018). In this study, weight status is significantly correlated with DM this was in line with other studies in which obesity is associated with higher DM prevalence (Al Mansour, 2020; Alqubali et al., 2017).

Diabetic patients are more likely to suffer from other chronic co-morbid conditions that are associated with earnest complications (Alotaibi et al., 2017). Antecedent studies have debated a causative relevance between education level and the outcome of DM (Richards and Sacker, 2011). In the current study, there is a significant association between educational status and

diabetic outcome, as the poorest outcome was seen in a low educational level group. Some studies stated that low educational status is linked to poor health literacy, thus resulting in worse outcomes for patients. On the contrary, other studies show that diabetics with a higher education status have greater access to and ability to utilize health facilities, advice and protective factors (Sil et al., 2020).

Table 4 General & diabetic foot related Practice among study participants, Hail region, KSA

Practice	Diabetic patients		P value
	No	%	
Are you practicing foot care?			0.313
Yes	180	42.6%	
No	243	57.4%	
Do you eat lots of sweets or other foods rich in carbohydrates?			0.001*
Always	77	18.2%	
Sometimes	245	57.9%	
Rarely	47	11.1%	
Never	54	12.8%	
Do you have regular physical activity to achieve optimal blood sugar levels?			0.001*
rarely / never	92	21.7%	
Sometimes	183	43.3%	
Often	73	17.3%	
Always	75	17.7%	
Do you strictly follow the dietary recommendations given by your doctor?			-
rarely / never	84	26.6%	
Sometimes	137	43.4%	
Often	59	18.7%	
Always	36	11.4%	
Do you check and monitor your blood sugar levels regularly?			0.001*
rarely / never	152	35.9%	
Sometimes	178	42.1%	
Often	54	12.8%	
Always	39	9.2%	
How many times you inspect your foot condition?			0.001*§
once / week or less	248	59.6%	
4-6 times a week	83	20.0%	
once / day	66	15.9%	
more than once / day	19	4.6%	

P: Pearson X² test §: Exact probability test* P < 0.05 (significant)

Hospitalizations because of diabetic foot disease are common among diabetics and are caused mainly by infection, gangrene and amputation. Arab countries experience a higher incidence of the disease than western countries (Aldhafar et al., 2021). The incidence of DFUs is strongly correlated to the type of DM a patient has, with a higher rate in diabetics with type 1 DM (Tuglo et al., 2022). Comparable results have been attained in the current study, whereas this finding opposes the other studies that established an association between type 2 DM and the rate of DFUs (Mariam et al., 2017; Saad et al., 2013).

The current study investigated the degree of perception as well as the routine exercise of the diabetics in Hail region, toward diabetic foot care. Their level of awareness, attitude and routine exercise toward diabetic foot care is generally low. This was in accordance with previous reports from different regions and countries (Aldhafar et al., 2021; Al-Jarallah et al., 2020; Desalu et al., 2011; Hasnain and Sheikh, 2009; Muhammad-Lutfi et al., 2014; Solan et al., 2017). Furthermore, the current study found that diabetics with a previous history of DFU or/and those educated on diabetic foot care had an expressively higher level of knowledge, awareness and practice towards diabetic foot care. The study showed that the diabetics' practice towards diabetic foot care was influenced by their educational level, congruent with studies in Saudi Arabia (Aldhafar et al., 2021), Pakistan (Hasnain and Sheikh,

2009) and Nigeria (Saad et al., 2013). On the other hand, according to the Malaysian study, the education level of the diabetics did not correlate with their awareness and familiarity with diabetic foot care (Muhammad-Lutfi et al., 2014).

A number of studies had mentioned a considerable reduction in diabetic foot diseases and their consequences as a result of raising the awareness level of diabetic foot care among diabetics (Christie et al., 2009; Moreland et al., 2004). In the current study, scarce few of the respondents had received education concerning diabetic foot care, which may elucidate the apparent defect in their awareness and practice. Accordingly, it is imperative that clinicians are reminded of the significance of refining foot care practice among diabetics and encouraging their compliance.

5. CONCLUSION

Participants have inadequate awareness degrees as well as poor familiarity with diabetic foot care. Low self-care practices in addition to the inadequacy of knowledge hinder optimal patient care. Based on our study, we have discerned defects in their awareness and practice, which highlight the necessity for a patient-friendly education program. A DFU can be avoided and the quality of life of patients improved by diminishing the deficiency of awareness that patients have. Education about diabetic foot care may evolve their awareness and practice and encourage them to have a favorable approach concerning diabetic foot care. A regularly organized education platform or campaigns can be applied in communal places with the least utilization of resources. A well-adapted healthcare setting should provide diabetics with accurate knowledge and proficiencies on how to care for their feet.

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Author Contributions

Conceptualization, working idea and design: MA, AMAA, EMK, FFA, AAF, SHA, SAI; Data Collection: MA, EMK, FFA, SAI, SHA, AOA, KRA, RHA, AMA, SAA, NSA, BAA; Literature Review: MA, EMK, FFA, AT, AMAA, AAF, SAI; Analysis of data and its interpretation: MA, AMAA, SAI, AOA; Preparation of Manuscript: MA, AMAA, EMK, AAF, FFA, AOA, KRA, RHA, AMA, SAA, NSA, BAA, SAI; Final approval of manuscript: MA, AMAA, EMK, AAF, FFA, SHA, RHA, AMA, SAI.

Ethical considerations

This study has been approved by the research ethics committee (REC) at the University of Hail (No: H-2021-205). At the beginning of the questionnaire, participants were given a clear idea about the research and they only can proceed with the questionnaire after acceptance to participate in the research.

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Conflict of interest

The authors declare that there is no conflict of interests.

Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

REFERENCES AND NOTES

1. Al Mansour MA. The prevalence and risk factors of type 2 diabetes mellitus (DMT2) in a semi-urban Saudi population. *Int J Environ Res Public Health* 2020; 17(1):7. doi: 10.3390/ijerph17010007
2. Aldawish SN, Alsomali AH, Alkhars AA. Knowledge and awareness of diabetic foot complications in diabetic patients. *Egypt J Hosp Med* 2018; 72(10):5371-4. doi: 10.21608/ejhm.2018.11282
3. Aldhafar AS, Abdalla M, Althafar AK. Awareness of diabetic foot disease among patients with diabetes mellitus in Al-Ahsa Saudi Arabia. *Int Surg J* 2021; 8(12):3506-10. doi: 10.18203/2349-2902.isj20214738
4. Alghamdi AH, Agwa RH, Alherz SH, Alzahrani AA, Alghamdi MF, Alqahtani SM, Alghamdi SM, Alghamdi WM, Altaweel FI, Alghamdi RH. Extent of awareness of diabetic foot care in diabetic patients and their families at

- AL Baha city, Saudi Arabia. *Medical Science* 2022; 26:ms470e2520
5. Al-Jarallah MA, Alqahtani MA, Alshahrani ST, Alshahrani NA, Alshehri AA. Knowledge and practice of diabetic foot care among diabetic patients in Aseer region, Saudi Arabia. *Int J Med Dev Ctries* 2020; 4(1):095–100. doi: 10.24911/IJMD C.51-1571552077
 6. Alotaibi A, Perry L, Gholizadeh L, Al-Ganmi A. Incidence and prevalence rates of diabetes mellitus in Saudi Arabia: An overview. *J Epidemiol Glob Health* 2017; 7(4):211-8. doi: 10.1016/j.jegh.2017.10.001
 7. Alqubali HF, Albalawi KA, Alswat AE, Aljebreen AA, Alotaib KE, Aljehani HS, Almughamsi RA, Hussain AM, Albiek HF. Prevalence of type 2 diabetes mellitus and hypertension in overweight and obese people in Riyadh city, KSA 2017. *Egypt J Hosp Med* 2017; 69(6):2614-7. doi: 10.12816/0042237
 8. Aung WP, Htet AS, Bjertness E, Stigum H, Chongsuvivatwong V, Kjollesdal MK. Urban-rural differences in the prevalence of diabetes mellitus among 25-74 year old adults of the Yangon Region, Myanmar: Two cross-sectional studies. *BMJ open* 2018; 8(3):e020406. doi: 10.1136/bmjopen-2017-020406
 9. Braverman-Bronstein A, Hessel P, Gonzalez-Uribe C, Kroker MF, Diez-Canseco F, Langellier B, Lucumi DI, Osiac LR, Trotta A, Roux AV. Association of education level with diabetes prevalence in Latin American cities and its modification by city social environment. *J Epidemiol Community Health* 2021; 75(9):874-80. doi: 10.1136/jech-2020-216116
 10. Chiwanga FS, Njelekela MA. Diabetic foot: Prevalence, knowledge and foot self-care practices among diabetic patients in Dar es Salaam, Tanzania: A cross-sectional study. *J Foot Ankle Res* 2015; 8(1):1-7. doi: 10.1186/s13047-015-0080-y
 11. Christie D, Strange V, Allen E, Oliver S, Wong IC, Smith F, Cairns J, Thompson R, Hindmarsh P, O'Neill S, Bull C. Maximising engagement, motivation and long-term change in a Structured Intensive Education Programme in Diabetes for children, young people and their families: Child and Adolescent Structured Competencies Approach to Diabetes Education (CASCADE). *BMC Paediatr* 2009; 9(1):1-10. doi: 10.1186/1471-2431-9-57
 12. Desalu OO, Salawu FK, Jimoh AK, Adekoya AO, Busari OA, Olokoba AB. Diabetic foot care: Self reported knowledge and practice among patients attending three tertiary hospital in Nigeria. *Ghana Med J* 2011; 45(2):60-5. doi: 10.4314/gmj.v45i2.68930
 13. Echouffo-Tcheugui JB, Dzudie A, Epacka ME, Choukem SP, Doualla MS, Luma H, Kengne AP. Prevalence and determinants of undiagnosed diabetes in an urban sub-Saharan African population. *Prim Care Diabetes* 2012; 6(3):229-34. doi: 10.1016/j.pcd.2012.05.002
 14. Goie TT, Naidoo M. Awareness of diabetic foot disease amongst patients with type 2 diabetes mellitus attending the chronic outpatients department at a regional hospital in Durban, South Africa. *Afr J Prim Health Care Fam Med* 2016; 8(1):1-8. doi: 10.4102/phcfm.v8i1.1170
 15. Hammami S, Mehri S, Hajem S, Koubaa N, Souid H, Hammami M. Prevalence of diabetes mellitus among non institutionalized elderly in Monastir City. *BMC Endocr Disord* 2012; 12(1):1-7. doi: 10.1186/1472-6823-12-15
 16. Hasnain S, Sheikh NH. Knowledge and practices regarding foot care in diabetic patients visiting diabetic clinic in Jinnah Hospital, Lahore. *J Pak Med Assoc* 2009; 59(10):687.
 17. Mariam TG, Alemayehu A, Tesfaye E, Mequannt W, Temesgen K, Yetwale F, Limenih MA. Prevalence of diabetic foot ulcer and associated factors among adult diabetic patients who attend the diabetic follow-up Clinic at the University of Gondar referral hospital, North West Ethiopia, 2016: Institutional based cross-sectional study. *J Diabetes Res* 2017; 18:32-45. doi: 10.1155/2017/2879249
 18. Moreland ME, Kilbourne AM, Engelhardt JB. Diabetes preventive care and non-traumatic lower extremity amputation rates. *J Healthc Qual* 2004; 26(5):12-7. doi: 10.1111/j.1945-1474.2004.tb00515.x
 19. Muhammad-Lutfi AR, Zaraiyah MR, Anuar-Ramdhan IM. Knowledge and practice of diabetic foot care in an in-patient setting at a tertiary medical center. *Malays Orthop J* 2014; 8(3):22. doi: 10.5704/MOJ.1411.005
 20. Nandi M, Hazra A, Sarkar S, Mondal R, Ghosal MK. Stress and its risk factors in medical students: An observational study from a medical college in India. *Indian J Med Sci* 2012; 66(1-2):1-12.
 21. Ploubidis GB, Mathenge W, De Stavola B, Grundy E, Foster A, Kuper H. Socioeconomic position and later life prevalence of hypertension, diabetes and visual impairment in Nakuru, Kenya. *Int J Public Health* 2013; 58(1):133-41. doi: 10.1007/s00038-012-0389-2
 22. Pourkazemi A, Ghanbari A, Khojamli M, Balo H, Hemmati H, Jafaryparvar Z, Motamed B. Diabetic foot care: Knowledge and practice. *BMC Endocr Disord* 2020; 20(1):1-8. doi: 10.1186/s12902-020-0512-y
 23. Richards M, Sacker A. Is education causal? Yes. *Int J Epidemiol* 2011; 40(2):516-8. doi: 10.1093/ije/dyq166
 24. Saad N, Elhadedy K, Ramadan N, Mohmady O, Farid M. The prevalence and risk categorization of diabetic foot complications in cohort group in, Beni Suif, Egypt. *Life Sci J* 2013; 3:1-10.
 25. Seck SM, Dia DG, Doupa D, Diop-Dia A, Thiam I, Ndong M, Gueye L. Diabetes burden in urban and rural Senegalese

- populations: A cross-sectional study in 2012. *Int J Endocrinol* 2015; 2015. doi: 10.1155/2015/163641
26. Sil K, Das BK, Pal S, Mandal L. A Study on Impact of Education on Diabetic Control and Complications. *Nat J Med Res* 2020; 10(1):26-9.
27. Solan YM, Kheir HM, Mahfouz MS, Al-Faify AA, Hakami DT, Al Faifi MA, Hakami AW, Hakami AH, Sharif HH. Diabetic foot care: Knowledge and practice. *J Endocr Metabol* 2017; 6(6):172-7. doi: 10.14740/jem388e
28. Suhasini KA, Manjunatha S, Santosh B, Chandrakala C. Awareness of Diabetic Foot Disease and Practice of Foot Care among Patients with Diabetes Mellitus in Tertiary Healthcare Centers. *J Med Sci* 2020; 6(2):36-39. doi: 10045-00149
29. Tai SY, He JS, Kuo CT, Kawachi I. Urban-Rural Disparities in the Incidence of Diabetes-Related Complications in Taiwan: A Propensity Score Matching Analysis. *J Clin Med* 2020; 9(9):3012. doi: 10.3390/jcm9093012
30. Tuglo LS, Nyande FK, Agordoh PD, Nartey EB, Pan Z, Logosu L, Dei-Hlorlewu AE, Haligah DK, Osafo L, Taful S, Chu M. Knowledge and practice of diabetic foot care and the prevalence of diabetic foot ulcers among diabetic patients of selected hospitals in the Volta Region, Ghana. *Int Wound J* 2022; 19(3):601-14. doi: 10.1111/iwj.13656
31. Turkmen A ES, Ozbaş A. Research of Knowledge and Attitudes of Patients with Diabetic Foot Ulcer Regarding Foot Care. *Int J Diabetes Clin Res* 2021; 8:144. doi: 10.23937/2377-3634/1410144
32. Wanamo ET, Kedir H, Ahmed K, Abdulkadir A, Lette A. Knowledge and Practice of Breast Self-Examination and associated Factors among women Students in west Arsi Zone. *Southeast Ethiop J Health Sci* 2021; 15(10). doi: 10.35248/2167-0420.21.10.542
33. Wong MD, Strom D, Guerrero LR, Chung PJ, Lopez D, Arellano K, Dudovitz RN. The Role of Social Emotional and Social Network Factors in the Relationship Between Academic Achievement and Risky Behaviors. *Acad Pediatr* 2017; 17(6):633-641. doi: 10.1016/j.acap.2017.04.009