Examining perceived and actual knowledge of diabetes among nursing students in Saudi Arabia: A cross-sectional study

JAZI SHAYDIED ALOTAIBI
Assistant Professor, Majmaah University, Saudi Arabia,
Correspondence to Dr. Jazi Shaydied Al Otaibi, Email: jalotaibi@mu.edu.sa., Phone: +966580559116

ABSTRACT

Background: The diabetes prevalence rate is high in Saudi Arabia (SA), rendering it a priority for the Saudi government and community. Nurses play a significant role in providing appropriate care for diabetes patients. Consequently, it is important to examine nursing students' knowledge of diabetes in SA.
Aim: To examine nursing students' perceived and actual knowledge of diabetes and its care & and management in SA.
Methods: This study employed a cross-sectional design including a convenience sample of 149 undergraduate nursing students at a newly established in SA to examine their perceived and actual knowledge of diabetes care and its management. The Diabetes Self-Report Tool was used to assess perceived knowledge, while the Diabetes Basic Knowledge Tool was used to assess actual knowledge.
Results: Nursing students in this study had a positive view of their diabetes knowledge, with a mean score (standard deviation (SD)) of 49.6 (5.9) (of a maximum 68); however, their mean score (SD) for actual knowledge was only 14.08 (5.78) (of a maximum 49). These results indicate a significant gap between perceived and actual knowledge as well as an inadequate level of actual knowledge regarding diabetes and its care and management. Nursing students aged 25 and older, those with five years or more of experience, those in their fourth rather than third academic year, and those with a diploma degree rather than a secondary school certificate had significantly higher actual diabetes knowledge.
Conclusion: The low level of actual knowledge regarding diabetes care and management demands attention from nursing schools. There is a need to increase content and improve the teaching method in nursing programmes with regard to diabetes care and its management.
Keywords: Diabetes, nursing students, knowledge

INTRODUCTION

Diabetes is a common health problem; there are currently 425 million people diagnosed with diabetes worldwide, and this is expected to reach 629 million by 2045[1]. In 2015, 30.3 million adults were suffering from diabetes in the US alone[2]. It is important that patients receive appropriate diabetes care and management to control the progression of the disease and to reduce its complications, such as cardiovascular disease, blindness, kidney failure, amputations of lower limbs, high morbidity and poor quality of life[3].

Diabetes self-management consists of multiple aspects of care, such as engaging in appropriate physical activities, adhering to dietary management, appropriate monitoring of blood glucose and screening and observing any long-term complications[4]. Among health care providers, nurses spend significant time with and play a considerable role in the provision of care for diabetes patients[5]. In addition, nursing staff play a significant role in educating diabetes patients, which is expected to improve patients' knowledge and to encourage them to be more diligent in adhering to the required self-management, in turn improving their health condition. Consequently, it is important that nurses have sufficient knowledge of all aspects of diabetes care, apply up-to-date knowledge related to diabetes and educate their patients regarding the management of diabetes and all its aspect[4]. Having appropriate knowledge of diabetes may be reflected positively in nurses' attitudes to diabetes management[6]. Determining areas of deficient knowledge of diabetes of nursing staff and nursing students is an important step towards implementation of appropriate educational programmes and may lead to improved care standards for patients with this significant disease.

Despite the importance of adequate knowledge of diabetes among nurses, many studies have revealed a deficit of such knowledge among nurses and nursing students[7–14]. More particularly, nurses have an inadequate level of knowledge regarding different areas of diabetes care and its management, including inadequate knowledge of diabetes pathology and symptoms of diabetes[6, 8,11] and medications for diabetes care[6–9,11,13], and a lack of knowledge and skills in blood glucose monitoring (BGM)[8,12,14]. In addition, many studies have shown that nurses have inadequate knowledge of various aspects of nutrition management[8,9,14,15].

The study conducted by Alotaibi et al[16] with 423 nurses at a major tertiary hospital in Saudi Arabia (SA) showed that the mean actual knowledge of diabetes was inadequate, with nurses scoring poorly in in knowledge of various aspects of diabetes care such as diabetes medication (45.7%), diabetes diet (41.1%) and pathology and symptoms (42.7%). Collectively, the above studies suggest that nurses in both developing and developed countries have suboptimal knowledge in different areas of diabetes care, in line with the integrative review presented by Alotaibi et al[17], who found that the studies in their review confirmed a lack of knowledge of diabetes care and its aspects among nurses in various settings.

Regarding nursing students, few studies in the literature have investigated their knowledge of diabetes. The cross-sectional study by Tawalbeh and Gharaibeh[18] in

Jordon of 134 nursing students found that their knowledge of diabetes was poor (M=46.1%, SD=14.4), and that there is a need for more focus on diabetes education programmes. Similarly, Shilpashree and Namitha's[19] study of 62 nursing students in India found that poor knowledge was interfering with provision of appropriate management of patients with diabetes; in particular, of these 62 students, only 17 correctly answered the questions related to the symptoms of diabetes, while only about half had correct knowledge of the complications of diabetes. A recent study by Požar et al. (20) of 80 nursing students in Subotica in Serbia found that the nursing students who participated in this study had low knowledge of nutrition therapy (58.75%), medium knowledge of controlling blood sugar (60%) and intermediate level of knowledge (63%) of chronic complications.

There has been no study that has investigated nursing students' knowledge of diabetes at Saudi universities. It is important that these students have sufficient knowledge related to diabetes care and management since the prevalence of this disease has increased in SA. Deficient knowledge attainment during undergraduate years could lead to unprepared and unskilled future nurses, who may provide insufficient interventions for diabetes care and management. Therefore, this study offers the first examination of nursing students' knowledge in relation to diabetes and it care and management in the setting of SA. This study has the potential to provide evidence-based information to support improving nursing curricula for undergraduate nursing programmes.

This study has the following aims: First, to examine nursing students' perceived knowledge of diabetes and its care and management and second to examine nursing students' actual knowledge of diabetes and its care and management. Finally, this study aimed to examine the relationships between nursing students' perceived diabetes knowledge and their actual diabetes knowledge to related socio-demographic data.

METHODOLOGY

This study employed a descriptive, cross-sectional design to examine actual and perceived diabetes knowledge among nursing students in SA.

Setting and sampling approach: This study was conducted at Majmaah University (MU), established in 2009, in the Riyadh region of SA. MU has an Applied Medical Sciences college that offers a bachelor's degree in different health specialties, including nursing. Convenience sampling was adopted to recruit 149 nursing students in the nursing programme at MU. The inclusion criterion was studying in their third or fourth year of a bachelor's degree, while non-nursing students and nursing students in their first year (university preparation), second year or internship year were the exclusion criteria.

Questionnaire: The questionnaire was composed of three parts. The first was a demographic profile sheet that included questions about gender, age, current academic year, educational qualifications, years of clinical experience (bridging students) and self-evaluations by nursing students regarding their knowledge of diabetes care and management. The second was the Diabetes Self-Report Tool (DSRT) developed by Drass et al[21] to examine nurses' perceived knowledge of diabetes care. The tool contains 15 questions addressing various diabetes-related content areas, with responses provided using a Likert-scale format where the answers range from 4 (strongly agree) to 1 (strongly disagree). Two questions were added to the original DSRT in the current study, as suggested by external reviewers, creating a total of 17 questions in this section. The third and final part of the questionnaire was adopted from the Diabetes Basic Knowledge Tool (DBKT), also developed by Drass et al[21]. The purpose of this tool is to assess actual nursing knowledge pertaining to diabetes care using 45 multiple-choice questions. The most recent study using this tool, conducted in SA by Alotaibi et al[16], modified the DBKT by adding four questions to further assess nurses' knowledge of diabetes complications. The current study uses this modified version of the DBKT[16], which consists of 49 questions in the five areas of diabetes content care: pathology and symptoms, BGM, diabetes nutrition, diabetes medication, and diabetes foot care and complications.

The DSRT and the DBKT were used in the current study because of their high levels of reliability and validity, as found in previous studies. Drass et al[21] found Cronbach's alpha coefficients for internal consistency were 0.91 and 0.79 for the DSRT and the DBKT, respectively. Several subsequent studies[9,10,16] also reported high reliability and validity. A recent study by Alotaibi et al[16] found that the content validity index of the overall their study questionnaires was 0.98. The test-retest of the questionnaires in Alotaibi et al.'s[16] study of 25 registered nurses found that the correlation value for the DSRT was r=0.835, p<0.01, and for the DBKT was r=0.727, p<0.01. To add support to the validity of these instruments, four content experts were engaged to review them in this current study; based on their recommendations, slight modifications of a few words of the instruments were made.

Data collection: The researchers collected data between March and June 2018, after the study was approved by the MU Research Centre Ethics Committee (MUREC) (approval no MUREC- May.I4 ICOM-20181/7). It should be noted that the primary researcher sought help from a female research assistant who was an expert on diabetes to collect data from the female section of the nursing department, in accordance with the non-mixed-gender teaching rule applied at Saudi universities. An invitation letter to participate in the study was placed on the walls outside the classrooms and other places where students usually meet. All necessary information, such as the aim of the study and its significance, the benefits of participation and the voluntary nature of participation, was included in the invitation letter. The researcher and the research assistant met the students in the lecture classroom, distributed the questionnaires and provided any further information, if required. The students who completed the survey were asked to return the questionnaires to locked boxes labelled 'completed questionnaires', located at different areas of the college for confidentiality purposes. Participant anonymity and research confidentiality were maintained throughout the process, and participants were free to withdraw at any time. Consent in this study was

implied, meaning that students volunteered to complete and return the questionnaire. The questionnaires were distributed to 217 nursing students at the college; 152 completed and returned them, giving a 70% response rate. Three of the returned questionnaires were incomplete and were therefore discarded, meaning that 149 completed surveys were used in the final analysis.

Data analysis: Data were analysed using IBM SPSS Version 25. Descriptive statistics (e.g. means, frequencies and percentages) were used to summarise the results and describe the data. As the data were normally distributed, the Pearson correlation coefficient and independent t-tests were used where needed. The p values were considered statistically significant if $p<0.05$.

RESULTS

Participant characteristics: The study participants (n = 149) were comprised of 61 female and 88 male nursing students (see Table 1). The majority (55.7%) were less than 25 years old. The largest group (60.4%) had a diploma degree as their highest qualification, while the remainder had a secondary school qualification. The majority of the participating students (67.8%) were enrolled in their fourth academic year of the Bachelor of Nursing programme. About 40% of the participants had work experience of more than five years. Finally, most of the participants (71.8%) rated themselves as having a good level of knowledge related to diabetes management.

Perceived diabetes knowledge among nursing students: The DSRT was employed to assess the perceived knowledge of diabetes and its care and management among nursing students. The respondents' scores in the current study for perceived knowledge of diabetes had a range of 33–68 with a mean (SD) of 49.6 (5.9) out of 68. This score represents an equivalent score of 72.9%, which indicates that nursing students had positive perceptions of their diabetes knowledge.

Actual diabetes knowledge among nursing students: Overall, scores for the actual knowledge of diabetes and its care and management among nursing students. It should be noted that of the 149 nursing students who participated in this study, none answered all 49 questions correctly. For the DBKT, if a participant answers a question correctly, he or she receives a score of 1 for that question; if not, he or she receives a score of 0. Thus, the possible range of scores for this construct is 0–49. Participants' scores for the

DBKT had a range of 1–34 with a mean (SD) value of 14.08 (5.78) in the study sample. The mean score of 14.08 out of 49 is equivalent to 28.7% correct responses, which indicates a low level of accurate knowledge of diabetes and its care and management among participating nursing students. In particular, nursing students' responses demonstrated low accuracy for questions related to pathology and symptoms (27.0%), BGM (31.8%), diabetes foot care and complications (31.4%), diet and nutrition (25.1%) and diabetes medications (29.1%).

Relationships between nursing students' knowledge of diabetes and socio-demographic data: Compared with nursing students aged less than 25 years old, nursing students aged 25 years or more had significantly higher perceived diabetes knowledge [t (−2.322), p=0.022] and actual diabetes knowledge [t (−3.260), p=0.02]. Participating nursing students with a Diploma in nursing scored significantly higher in actual diabetes knowledge compared with those with only secondary school qualifications [t (2.288), p=0.024]. Nurses in their fourth academic year had significantly higher actual diabetes knowledge than nursing students in their third year [t (2.293), p=0.023]. In relation to experience (bridging students), nursing students with five years or more of work experience had a significantly higher perceived knowledge of diabetes [t(−2.123), p=0.035] and actual knowledge [t(−3.327), p=0.001] than nursing students with less than five years of experience (see Tables 2 and 3).

Table 1: Nursing Students' Characteristics (n=149)

Variable	Number (%)
Age	
Up to 25 years	83 (55.7%)
More than 25 years	66 (44.3%)
Gender	
Male	88 (59.1%)
Female	61 (40.9%)
Highest qualification	
Secondary school qualification	59 (39.6%)
Diploma qualification	90 (60.45%)
Current academic year	
Third year	48 (32.2%)
Fourth year	101 (67.8%)
Clinical experience (bridging students)	
Less than five years' experience	89 (59.7%)
Five years' experience or more	60 (40.3%)

Table 2 Participants' perceived diabetes knowledge scores in relation to socio-demographic characteristics

Variables		Mean (SD)	Test values	df	p-value
Gender	Male (n = 88)	49.94 (5.88)	t (.479)	146	.632
	Female (n = 61)	49.48 (5.50)			
Age	Less than 25 years (n = 83)	48.79 (5.31)	t (-2.322)	146	.022
	25 years and above (n = 66)	50.95 (6.00)			
Qualification	Secondary school (n = 59)	48.78 (5.28)	t (-1.687)	146	.094
	Diploma (n = 90)	50.39 (5.92)			
Academic Year	Third year (n = 48)	49.72 (5.36)	t (-.048)	146	.962
	Fourth year (n = 101)	49.77 (5.90)			
Experience in years	Less than 5 years (n = 89)	48.94 (5.28)	t (-2.123)	146	.035
	5 years and above (n = 60)	50.95 (6.15)			

Table 3 Participants' actual diabetes knowledge scores in relation to socio-demographic characteristics

Variables		Mean (SD)	Test values	df	p-value
Gender	Male (n = 88)	14.23 (5.37)	t (1.650)	147	.101
	Female (n = 61)	12.67 (6.04)			
Age	Less than 25 years (n = 83)	12.22 (4.27)	t (-3.260)	147	.002
	25 years and above (n = 66)	15.32 (6.73)			
Qualification	Secondary school (n = 59)	12.41 (3.97)	t (-2.288)	147	.024
	Diploma (n = 90)	14.37 (6.48)			
Academic Year	Third year (n = 48)	12.06 (4.44)	t (-2.293)	147	.023
	Fourth year (n = 101)	14.32 (6.08)			
Experience in years	Less than 5 years (n = 89)	12.28 (4.61)	t (-3.327)	147	.001
	5 years and above (n = 60)	15.53 (6.56)			

DISCUSSION

This study offers the first examination of the level of diabetes knowledge held by nursing students in SA. The score for perceived knowledge in this study was 72.9%, whereas the corresponding score for actual knowledge was 28.7%, indicating a gap between nursing students' perceptions of their diabetes knowledge and their actual diabetes knowledge, and their insufficient level of actual knowledge of diabetes care and management. These concerning results concur with other studies conducted over the past two decades[7–11,13,14,16,18,19]. The lack of knowledge among nurses and nursing students of diabetes care is likely to have negative effects on the quality of nursing care to patients with diabetes. Nursing students are responsible for educating and providing health care instructions to patients, using up-to-date and accurate information. Consequently, they should have an appropriate standard of knowledge[22].

The results of the present study show that nursing students have a low level of knowledge regarding all areas of diabetes care. First, consistent with previous studies conducted in India (19), Pakistan[11] and SA[16], this study showed that these nursing students had a low level of knowledge regarding the pathology and symptoms of diabetes. Similarly, in Nigeria, Unadike and Etukumana[6] found that only a small percentage of the participants (about 12%) could recognise all symptoms of diabetes. A qualitative study conducted in Sweden by Olsen et al[8] revealed a lack of adequate knowledge regarding the symptoms of diabetes, as none of the 22 nurses who participated in the study could distinguish between the different types of diabetes. A possible explanation for these results is that the students' instructors may lack the experience to teach this significant area of diabetes care for nursing students.

Second, regarding BGM—a significant concern for nurses and nursing students and therefore requiring an appropriate level of knowledge—the current study found that only about one-third (31.8%) of participants had sufficient knowledge, consistent with previous studies[9,12,14]. These results are clinically significant, as high blood glucose levels can lead to diabetic ketoacidosis and other complications. Early detection and recognition of high blood glucose are crucial in the prevention and effective management of diabetes. However, in contrast, Alotaibi found different results[16], which indicated that BGM knowledge of nurses working in SA was adequate (71.4%); this may have been because the nurses were more familiar with practical skills such as BGM than with theoretical aspects of managing diabetes.

Third, an important aspect of diabetes care is diabetes medication, which plays a significant role in treating diabetes, and of which nurses and nursing students need to have a good education. Despite the importance of this factor, the present study showed that less than one-third of nursing students (29.1%) had a deficit in their knowledge regarding medication. These results are in agreement with those reported for U.S.A by Modic et al[13], for Jordon by Yacoub et al[9], for Pakistan by Ahmed et al[11], for Libya by Abduelkarem and El-Shareif[7]. Likewise, the study of Olsen et al. Granath[8] found that only three of 22 nurses had sufficient knowledge regarding oral hypoglycaemia agents.

Another important finding of this study is that knowledge regarding diabetes foot care and diabetes complication knowledge among nursing students was low (31.4%). This result is similar to findings from previous studies conducted in Nigeria[6], Australia[23] and New Zealand[24], all of which reported limited knowledge of diabetes complications such as nephropathy, neuropathy, nephropathy and cardiovascular and cerebrovascular diseases among their participants. Regarding diabetic foot care, much research concurs with the present study in finding that nurses have insufficient knowledge in this area[14,16,25]. However, the current study is inconsistent with some studies, such as those by Požar et al. (20) and Alotaibi et al[16], which found that nursing knowledge regarding foot care and complications was sufficient. Nurses' knowledge deficit regarding foot care is a critical concern, as patients need to be well informed on this topic to be able to manage their condition effectively and perform daily activities.

The final aspect of diabetes care is nutrition. In this study, many of the items related to this subject were answered incorrectly by most of the nursing students, indicating poor knowledge in this area, consistent with numerous prior studies[9,15,16,20]. Conversely, Al-Shwaiyat et al[26] showed that the mean correct-response rate for therapeutic nutritional knowledge related to diabetes was good (71.6%). Nutritional knowledge is significant for patients with diabetes, as they need information about appropriate diets to manage their disease.

Overall, the present study showed deficient knowledge of diabetes and its care among nursing students. Several factors may explain this lack of knowledge. A deficiency in nursing curricular content about diabetes may explain students' poor knowledge base. Another important factor is that the current teaching methods applied at most Saudi universities usually depend on the academic instructor,

who lectures students in the traditional manner, who then memorise information for examinations. Therefore, in many cases, because of the nature of short-term 'cramming' of information for exams, which doesn't allow for long-term memory storage and learning, students experience a loss of information related to diabetes. Finally, students may have a lack of practical diabetes care during their educational programme. Diabetes classes at most modern universities in SA usually take place either in the lab or in small hospitals, and these settings do not provide students with an appropriate teaching environment for this significant topic.

The present study showed that there was a significant difference in the level of actual knowledge of diabetes based on the nursing students' years of experience. Nursing students in the bridging programme with five or more years' experience had higher scores than their peers with less than five years' experience; this is consistent with many previous studies that show a positive relationship between nurses' experience and their knowledge of diabetes[7,10,20]. In fact, it is expected that when nurses or nursing students have more experience, they will have more knowledge about diabetes because they have had more exposure to and communication with diabetic patients. Additionally, this study showed that as the age of the nursing students increased, their scores for knowledge regarding diabetes care also increased, which is consistent with earlier reported by[10]. Further, students with a secondary school qualification scored lower than those with a diploma degree, which corroborates research by Abduelkarem and El-Shareif[7], Yocoub, et al[9] who also found a positive relationship between nurses' qualifications and knowledge of diabetes and its management. However, Modic et al[13] found no differences in the level of knowledge of diabetes based on education level. Finally, similarly to (10), the present study did not identify any significant difference between males and females in terms of their perceived and actual knowledge of diabetes.

CONCLUSIONS AND RECOMMENDATIONS

This study showed that the actual knowledge of diabetes among nursing students in SA is insufficient in several areas of diabetes care. The results of this study have important implications for nursing practice, policy and education, and in response to these findings, it is recommended that strategies should be developed and operationalised to improve nursing students' knowledge of diabetes and its management.

Nursing schools in SA must provide a high quality of education related to diabetes to improve the knowledge of undergraduate nursing students in relation to this common yet dangerous disease. Nurse educator managers at SA universities should develop strategies to improve nurses' knowledge in all areas of diabetes care. Additionally, educators and administrators should consider developing a high-quality diabetes programme that provides frequent, regular, evidence-based and accessible education to these students; the content of these programmes should depend on students' needs and expected learning outcomes. The nursing programme curriculum needs to include relevant,

accurate and up-to-date knowledge and skills regarding diabetes.

In addition, nursing education managers at universities should provide undergraduate nursing students with opportunities to access specific diabetes education programmes that are well established in hospitals or other health care settings, which would improve their knowledge and skills related to diabetes. Nurse educators and administrators at hospitals should also provide continuous diabetes education classes for nursing students to improve their knowledge, which is imperative for nursing students to deliver effective treatment to diabetes patients. Further, commitment from managers of nursing colleges and nursing administrators at hospitals is needed to support a modern, up-to-date and comprehensive diabetes education curriculum and ongoing courses on diabetes while students are obtaining a bachelor's degree.

Although this study provides valuable information regarding nursing students' knowledge of diabetes, it has limitations. For example, to measure the perceived and actual diabetes knowledge of nursing students, a self-report tool was used, which is prone to report bias. Another limitation is the generalisability of the results, which should be taken into careful consideration. The sample in this study consisted of 149 nursing students from one university; as such, it is difficult to generalise the results to all nurses in SA. Future studies should re-perform this study among student nurses at other universities in SA.

REFERENCES

1. International Diabetes Federation. IDF diabetes atlas (9th ed.) 2009. [Online]. [cited 2019 November 1]. Available from: https://www.idf.org/aboutdiabetes/what-is-diabetes/facts-figures.html.
2. Centers for Disease Control and Prevention. National Diabetes Statistics Report, 2017. [online]. Atlanta, GA: Centers for Disease Control and Prevention, US Department of Health and Human Services; 2017. [cited 2019 August 3]. Available from: https://www.cdc.gov/diabetes/data/statistics/statistics-report.html
3. Word Health Organization. Diabetes: key facts [online]. 2018. [cited 2019 Dec 1]. Retrieved from: https://www.who.int/news-room/fact-sheets/detail/diabetes
4. deWit SC, Stromberg H, Dallred C. Medical-Surgical Nursing: Concepts & Practice 3rd edition, Elsevier Health Sciences; U.S.A. Philadelphia, 2016.
5. Vissarion B, Malliarou M, Theofilou P, Zyga S. Improvement of diabetic patients nursing care by the development of educational programs. Health Psychology Research 2014;2(1):13-5.
6. Unadike B, Etukumana E. Nurses' understanding about diabetes in a Nigerian tertiary hospital. Pakistan Journal of Medical Sciences. 2010;26(1):217-22.
7. Abduelkarem A, El-Shareif HJ. Assessment of diabetes-related knowledge among nursing staff in a hospital setting. Journal of Diabetes Nursing. 2013;17(6):207-18.
8. Olsen M, Granath A, Wharén P, Blom T, Leksell J. Perceived knowledge about diabetes among personnel in municipal care: a qualitative focus group interview study. Eur Diabetes Nursing. 2012;9(2):52-5.
9. Yacoub M, Demeh W, Darawad M, Barr J, Saleh A, Saleh M. An assessment of diabetes- related knowledge among registered nurses working in hospitals in Jordan. International Nursing Review. 2014;61(2):255-62.

10. Modic MB, Albert NM, Nutter B, Coughlin R, Murray T, Spence J, et al. Diabetes teaching is not for the faint of heart: are cardiac nurses up to the challenge? The Journal of Cardiovascular Nursing. 2009;24(6):439-46.

11. Ahmed A, Jabbar A, Zuberi L, Islam M, Shamim K. Diabetes related knowledge among residents and nurses: a multicenter study in Karachi, Pakistan. BMC Endocrine Disorders. 2012;12(1):18.

12. Hargraves JD. Glycemic control in cardiac surgery: implementing an evidence-based insulin infusion protocol. American Journal of Critical Care. 2014;23(3):250-8.

13. Modic MB, Vanderbilt A, Siedlecki SL, Sauvey R, Kaser N, Yager C. Diabetes management unawareness: what do bedside nurses know? Applied Nursing Research. 2014;27(3):157-61.

14. Oyetunde MO, Famakinwa T. Nurses' knowledge of contents of diabetes patient education in Ondo-state, Nigeria. Journal of Nursing Education and Practice. 2014;4(4):91-8.

15. Mogre V, Ansah GA, Marfo DN, Garti HA. Assessing nurses' knowledge levels in the nutritional management of diabetes. International Journal of Africa Nursing Sciences. 2015; 3:40-3.

16. Alotaibi A, Gholizadeh L, Al-Ganmi A, Perry L. Examining perceived and actual diabetes knowledge among nurses working in a tertiary hospital. Applied Nursing Research. 2017; 35:24-9.

17. Alotaibi A, Al-Ganmi A, Gholizadeh L, Perry L. Diabetes knowledge of nurses in different countries: an integrative review. Applied Nursing Research. 2016; 39:32-49.

18. Tawalbeh L, Gharaibeh B. Diabetes knowledge among university nursing students in the north of Jordan. Pakistan Journal of Nutrition. 2014; 13:728-34.

19. Shilpashree YD, Namitha D. Assessment of diabetes knowledge amongst nursing students. International Journal of Applied Research. 2018;4(8):225-8.

20. Požar H, Paro NJ, Simin D. Diabetes and education – knowledge level about diabetes management in nurses' students. Nursing & Healthcare International Journal. 2019;3(1):1-9.

21. Drass JA, Muir-Nash J, Boykin PC, Turek JM, Baker KL. Perceived and actual level of knowledge of diabetes mellitus among nurses. Diabetes Care. 1989;12(5):351-6.

22. Chan MF, Zang YL. Nurses' perceived and actual level of diabetes mellitus knowledge: results of a cluster analysis. Journal of Clinical Nursing. 2007;16(7b):234-42.

23. Livingston R, Dunning T. Practice nurses' role and knowledge about diabetes management within rural and remote Australian general practices. European Diabetes Nursing. 2010;7(2):55-62.

24. Daly B, Arroll B, Sheridan N, Kenealy T, Scragg R. Diabetes knowledge of nurses providing community care for diabetes patients in Auckland, New Zealand. Primary Care Diabetes. 2014;8(3):215-23.

25. Bilal M, Haseeb A, Rehman A, Hussham Arshad M, Aslam A, Godil S, et al. Knowledge, attitudes, and practices among nurses in Pakistan towards diabetic foot. Cureus. 2018;10(7):1-13.

26. Al-Shwaiyat NM, Sinjillawi AB, Al-Rethaiaa AS, Fahmy A-EA, Al-Saraireh RM, Aqel MM, et al. Assessment of therapeutic nutritional knowledge of Jordanian nurses. International Journal of Nutrition and Food Sciences. 2013;2(3):142-8.