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Diabetes knowledge of pharmacy students: A cross-sectional study

Zeynep Yesim AY[1*], Songul TEZCAN[2]

1 University of Health Sciences, Clinical Pharmacy Department, Faculty of Pharmacy, Istanbul, Türkiye
2 Marmara University, Clinical Pharmacy Department, Faculty of Pharmacy, Istanbul, Türkiye

ABSTRACT

The knowledge level of diabetes mellitus (DM) is considered as an important factor for disease control and quality of life. The aim of this study is to determine the diabetes knowledge level of undergraduate students in a pharmacy faculty in Türkiye. A cross-sectional study using online questionnaire was conducted from 2-16 January 2023 among the 4th and 5th year pharmacy students. For scoring, responses were assigned a value of 1 point when answered is "true", while it is "false" or "I don't know" responses were designated as 0 points. The mean knowledge score was found to be as 34.07 ± 4.13 (maximum score is 40). The subdomain scores were found to be as follows; diabetes risk factor 2.88 ± 0.37 (maximum score is 3), diabetes symptoms 2.70 ± 0.53 (maximum score is 3), diabetes diagnosis 3.46 ± 0.91. The Cronbach's alpha value of the scale was found to be 0.767. Students were found to have sufficient knowledge of the diagnosis of DM, symptoms, and risk factors. Nonetheless, participants exhibited notable knowledge gaps, particularly in domains such as diet in diabetes and treatment in gestational diabetes have been identified among participants.

Keywords: diabetes mellitus, knowledge level, pharmacy student, questionnaire, Türkiye

*Corresponding author: Zeynep Yesim AY
E-mail: zyesimcan@gmail.com
ORCIDs:
Zeynep Yesim AY: 0000-0002-1444-1355
Songul TEZCAN: 0000-0002-1147-6683
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INTRODUCTION

Diabetes mellitus (DM) is a global health problem[1]. According to the International Diabetes Federation (IDF), 537 million people had diabetes in 2021 and is predicted to be 784 million in 2045. In Türkiye, there are approximately 9 million diabetic patients between the ages of 20-79 in 2021 and its prevalence is 14.5%[2].

According to the American Diabetes Association (ADA), DM is "a chronic metabolic disease characterized by hyperglycemia caused by impairment in insulin secretion, insulin action, or both of these factors." Polyuria, polydipsia, weight loss, sometimes polyphagia and blurred vision are among the symptoms of hyperglycemia[3]. DM has microvascular (nephropathy, neuropathy, retinopathy) and macrovascular (atherosclerotic heart diseases, peripheral arterial disease, cerebrovascular diseases) complications[4]. As medication consultants and health advisors, pharmacists contribute to the management of many chronic diseases, including DM. With the pharmaceutical care education given by pharmacists providing primary health care services to individuals with diabetes, it is possible to prevent the development of these complications, increase adherence to treatment, increase quality of life and improve health outcomes[5-9]. Pharmacists are required to take on direct patient care roles through practice, provide comprehensive medication management and provide preventive care services. In this direction, the principles of pharmacy education have expanded from the traditional roles of preparing the prescription and presenting it to the patient, to the delivery of patient-oriented pharmacy services such as pharmaceutical care[10]. In our country, the concept of patient-oriented pharmacy education was introduced for the first time in the early 90s. Theoretical and practical training is given to students within the scope of clinical pharmacy courses in many pharmacy faculties. In this context, based on the concept of patient-centered pharmacy, students monitor patient treatment, evaluate patient-specific medical problems, drug therapy, therapeutic problems, and comprehensive drug treatment for these problems. Collaboration with patients, patient care providers and other health professionals is ensured[11].

There are studies in which the education given by pharmacy students to patients with diabetes significantly increases the patients' drug compliance, their knowledge about their diseases and complications is improved, and their problems such as coping with hypoglycemic crisis are improved[12]. In order to achieve these improvements, pharmacy students should have up-to-date and evidence-based information on diabetes. There are studies showing that pharmacy students need more knowledge to prevent diabetes and its compli-

cations[13,14]. It has been shown that the level of knowledge and confidence in presenting knowledge of pharmacy students who receive education on diabetes increases[15]. As far as we know, although there are studies investigating the knowledge and attitudes of students from different faculties (nursing, medicine, etc.) towards DM, more studies are needed regarding pharmacy students' knowledge and attitudes towards DM[16,17]. The primary objective of this research is to assess the diabetes knowledge level of undergraduate students in a pharmacy faculty in Türkiye.

METHODOLOGY

This cross-sectional study was conducted with 4th and 5th-grade pharmacy students at a university in Istanbul (Türkiye). Pharmacy education consists of 10 terms (5 years) in this pharmacy faculty. Fourth-grade students are introduced to pharmaceutical care and clinical pharmacy as follows; 2 hours theoretical and 2 hours practical per week- case studies. The clinic rotations of pharmacy students start in the 8th and 9th terms. At the time of the study, 4th-grade students had not yet started clinical rotation, while 5th-grader students completed their clinical rotation.

After obtaining the necessary permissions for the sample size for the questionnaire, 50% response distribution was predicted to give a 5% margin of error and 95% confidence interval, and it was determined that 139 pharmacy faculty students should be reached (http:/ /www.raosoft.com/samplesize.html, Accessed 12.12.2022). In this study, nonprobability sampling (purposive) was used.

After the participants were informed about the study, their informed consent was obtained via online. The sociodemographic characteristic of the students and the "Knowledge Level Questionnaire on Diabetes" questionnaire[16] were sent to the participants online via Google Forms. "Knowledge Level Questionnaire on Diabetes" questionnaire was developed by Al Sarayra and Khalidi[18] was performed. The validity process was not applied. After the translation from English to Turkish was made by 2 pharmacists, it was applied as a pretest to 10 pharmacy students and the adaptation was adjusted. The questionnaire consisted of 40 questions: General information about the definition of diabetes (8 items), information about the risk factor of diabetes (3 items), information about the symptoms of diabetes (3 items), information about the diagnosis of diabetes (4 items), information about the treatment of diabetes (10 items), information about the complications of diabetes (4 items) and information about the diabetes diet and exercise (5 items), about the control of

diabetes information (3 items). The answer choices were “true; false; or I do not know”. For scoring, responses were assigned a value of 1 point when answered correctly, while incorrect or “I don’t know” responses were designated as 0 points (“I don’t know” answer was evaluated as “false”).

The Statistical Package for Social Sciences (SPSS), Version 11.5 (SPSS Inc., Chicago, IL) was used for statistical analysis. The Kolmogorov-Smirnov test and Shapiro-Wilk test were used to test the normal distribution of data. The quantitative data of the binary groups were made with the Mann Whitney U test, and the comparison of the quantitative data of more than two groups was made with the Kruskal-Wallis H test. In case of significance in more than two groups, pairwise analyzes of the groups were made with the Mann Whitney U test. The median (interquartile range) values of the quantitative data that did not show normal distribution were calculated. A Chi-square test was applied to compare categorical data. Whether there is any relationship between the numerical data was analyzed with the Spearman correlation test. Data with $p<0.05$ at the 95% confidence interval were considered statistically significant.

RESULTS and DISCUSSION

One hundred and ninety-six students completed the questionnaires; 77% were female. The mean age and standard deviation were 23.57 ± 1.1 years. Regarding the study year of students, 49.5% of the students participating in the study were 5th grade students and 50.5% were 4th grade students. The demographic characteristics of students were summarized in Table 1.

Table 1. Demographic information of the students

Variable	4th year n (%)	5th year n (%)
Sex		
Male Female	26 (26.3) 73 (73.7)	19 (19.6) 78 (80.4)
Age (years) (IQR)	23.05 (22-24)	24.09 (22-24)
Rotation (day per year) (IQR)	0	7.35 (7-8)
Family history of diabetes Diabetic Not diabetic Unknown	 50 (50.5) 48 (48.5) 1 (1)	 35 (36.1) 61 (62.9) 1 (1)
Did you take part in the care of a patient diagnosed with diabetes? Yes No	 17 (17.2) 82 (82.8)	 64 (66) 33 (34)
Duration of community pharmacy internship (mean month for per student)	1.9	2.8
Duration of clinic rotation (mean month for per student)	0.4	0.9
Total	**99**	**97**

n: numbers of the students, IQR: Interquartile range

The diabetes information access sources used by the students are classified in Table 2.

Table 2. Information resources that the students used

Resources	4th year n (%)	5th year n (%)
Lecture notes	98 (99)	97 (100)
International and national guidelines	67 (67.7)	95 (97.9)
Internet	84 (84.8)	87 (89.7)
Brochure	6 (6.1)	97 (100)
Text book	21 (21.2)	78 (80.4)

n: numbers of the students

The answers given by the students to the Knowledge Level Questionnaire on Diabetes are classified in Table 3.

Table 3. Knowledge of diabetes mellitus among pharmacy students

Questions	True n (%)	False n (%)	I don't know n (%)
Definition of diabetes (8 items)			
1. Definition: DM is an increased blood sugar above acceptable level (True)	**174 (88.78)**	20 (10.2)	2 (1.02)
2. Diabetes Mellitus is a chronic disease (True)	**188 (95.92)**	7 (3.57)	1 (0.51)
3. Commonest type of DM is type 2 (True)	**191 (97.45)**	1 (0.51)	4 (2.04)
4. DM may be present in pregnant women (True)	**195 (99.49)**	0 (0)	1 (0.51)
5. Insulin deficiency is found in type 1 DM (True)	**171 (87.24)**	24 (12.24)	1 (0.51)
6. Insulin dysfunction is found in type 2 DM (True)	**177 (90.31)**	17 (8.67)	2 (1.02)
7. Insulin deficiency is found in type 2 DM (False)	45 (22.96)	**149 (76.02)**	2 (1.02)
8. Type 2 DM can be found in adolescent (True)	135 (68.88)	46 (23.47)	15(7.65)
Risk factor of diabetes (3 items)			
9. Risk factors for DM is obesity (True)	**193 (98.47)**	2 (1.02)	1 (0.51)
10. Risk factors for DM is family history (True)	**195 (99.49)**	0 (0)	1 (0.51)
11. Risk factors for DM is excessive sugar intake (True)	**176 (89.8)**	11 (5.61)	9 (4.59)
Symptoms of diabetes (3 items)			
12. One of the DM symptoms is excessive thirst (True)	**192 (97.96)**	1 (0.51)	3 (1.53)
13. One of the DM symptoms is weight loss (True)	**149 (76.02)**	35 (17.86)	12(6.12)
14. One of the DM symptoms is excessive urination (True)	**189 (96.43)**	2 (1.02)	5 (2.55)
Diagnosis of diabetes (4 items)			
15. Cut-off point for DM diagnosis is fasting blood sugar of 200mg/dl (False)	31 (15.82)	**163 (83.16)**	2 (1.02)
16. Cut-off point for DM diagnosis is fasting blood sugar of 126mg/dl (True)	**177 (90.31)**	14 (7.14)	5 (2.55)
17. Cut-off point for DM diagnosis is fasting blood sugar of 90mg/dl (False)	21 (10.71)	**168 (85.71)**	7 (3.57)
18. Urine sugar cannot be used to diagnose DM (False)	20 (10.2)	**171 (87.24)**	5 (2.55)
Treatment of diabetes (10 items)			
19. Mode of treatment in type 1 DM is diet therapy and insulin (True)	**186 (94.9)**	7 (3.57)	3 (1.53)
20. Mode of treatment in type 1 DM is diet therapy and hypoglycemic drugs (False)	21 (10.71)	**168 (85.71)**	7 (3.57)
21. Mode of treatment in type 1 DM is oral hypoglycemic drugs (False)	28 (14.29)	**155 (79.08)**	13(6.63)
22. Mode of treatment in type 1 DM is insulin alone (False)	105 (53.57)	88 (44.9)	3 (1.53)

23. Mode of treatment in type 2 DM is diet therapy and weight reduction (True)	**145 (73.98)**	48 (24.49)	3 (1.53)
24. Mode of treatment in type 2 DM is oral hypoglycemic drugs alone (False)	19 (9.69)	**171 (87.24)**	6 (3.06)
25. Mode of treatment in type 2 DM is insulin alone (False)	3 (1.53)	**190 (96.94)**	3 (1.53)
26. DM in pregnant can be treated by insulin and hypoglycemic drugs (False)	76 (38.78)	99 (50.51)	21(10.71)
27. DM in pregnant can be treated by insulin (True)	**163 (83.16)**	12 (6.12)	21(10.71)
28. DM in pregnant can be treated by oral hypoglycemic drugs alone (False)	41 (20.92)	133 (67.86)	22(11.22)
Complications of diabetes (4 items)			
29. Complications of DM may be seen in kidneys (True)	**191 (97.95)**	2 (1.03)	2 (1.03)
30. Complications of DM may be seen in eyes (True)	**189 (96.43)**	1 (0.51)	6 (3.06)
31. Complications of DM may be seen in nerves (True)	**184 (93.88)**	3 (1.53)	9 (4.59)
32. Complications of DM may be seen in lower limbs (as amputation) (True)	**182 (92.86)**	4 (2.04)	10 (5.1)
Diabetes diet and exercise (5 items)			
33. Diet therapy means 3 meals and 3 snacks (True)	115 (58.67)	31 (15.82)	50(25.51)
34. Diet therapy means 2 meals and 2 snacks (False)	34 (17.35)	108 (55.1)	54(27.55)
35. Diet therapy means not to eat carbohydrate (False)	12 (6.12)	**177 (90.31)**	7 (3.57)
36. Exercise in type 2 DM is recommended (True)	**193 (98.47)**	1 (0.51)	2 (1.02)
37. Exercise in type 1 DM is recommended (True)	**146 (74.49)**	26 (13.27)	24(12.24)
Control of diabetes information (3 items)			
38. Control of diabetes by measuring urine sugar (True)	**166 (84.69)**	19 (9.69)	11 (5.61)
39. Control of diabetes by measuring HbAc1 (True)	**185 (94.39)**	9 (4.59)	2 (1.02)
40. Control of diabetes by measuring daily blood sugar (True)	**189 (96.43)**	4 (2.04)	3 (1.53)

n: numbers of students DM: Diabetes Mellitus

The relationship between the education level and the answers given to the knowledge level questionnaire on diabetes is given in Table 4.

Table 4. Relationship between the education level and the answers given to the knowledge level questionnaire on DM

Subdomain	Questions	4th year n (%)		5th year n (%)		p value
		False	True	False	True	
Definition of diabetes	3. Commonest type of DM is type 2 (True)	0	99 (100)	5 (5.2)	92 (94.8)	0.022
Risk factor of diabetes	11. Risk factors for DM is excessive sugar intake (True)	4 (4)	95 (96)	16 (16.5)	81 (83.5)	0.004
Diagnosis of diabetes	18. Urine sugar cannot be used to diagnose DM (False)	7 (7.1)	92 (92.9)	18 (18.6)	79 (81.4)	0.016
Treatment of diabetes	21. Mode of treatment in type 1 DM is oral hypoglycemic drugs (False)	29 (29.3)	70 (70.7)	12 (12.4)	85 (87.6)	0.004
	22. Mode of treatment in type 1 DM is insulin alone (False)	46 (46.5)	53 (53.5)	62 (63.9)	35 (36.1)	0.014
	26. DM in pregnant can be treated by insulin and hypoglycemic drugs (False)	59 (59.6)	40 (40.4)	38 (39.2)	59 (60.8)	0.004
	27. DM in pregnant can be treated by insulin (True)	26 (26.3)	73 (73.7)	7 (7.2)	90 (92.8)	<0.001
	28. DM in pregnant can be treated by oral hypoglycemic drugs alone (False)	43 (43.4)	56 (56.6)	20 (20.6)	77 (79.4)	0.001
Complications of diabetes	31. Complications of DM may be seen in nerves (True)	2 (2)	97 (98)	10 (10.3)	87 (89.7)	0.016
Diabetes diet and exercise	33. Diet therapy means 3 meals and 3 snacks (True)	32 (32.3)	67 (67.7)	48 (49.5)	49 (50.5)	0.015
Control of diabetes	38. Control of diabetes by measuring urine sugar (True)	10 (10.1)	89 (89.9)	20 (20.6)	77 (79.4)	0.041

n: numbers of students DM: Diabetes Mellitus

There was not any significant relation between the sociodemographic characteristics of the participants, except for a family history of diabetes. 43.9% of those who answered the question 14 correctly had a family history of diabetes (p=0.002). Of those who answered question 15 correctly, 44.8% had a family history of diabetes (p=0.006). 66.7% of those who gave incorrect answers to questions 25 and 28 did not have a family history of diabetes (p<0.001), (p=0.007). Of those who answered the question 31 correctly, 45.7% had a family history of diabetes (p=0.002). Of those who answered the question 32 correctly, 44.5% had a family history of diabetes (p=0.039). 44.9% of those who answered the question correctly had a family history of diabetes (p=0.008).

The primary objective of this research is to assess the diabetes knowledge level of undergraduate students in a pharmacy faculty in Türkiye. In the literature, although there are many studies investigating the DM knowledge level of university students, there are not many studies investigating the DM knowledge level of pharmacy students. The percentage of female students in this study (77%) was found to be higher in contrast to similar studies (37%-64%)[17-20]. The percentage of the students with a family history of diabetes (43%) was found to be lower in contrast to other studies (67%)[17,19].

It was found that the students had sufficient knowledge about DM diagnosis with 3.46 points, symptoms with 2.7 points, and risk factors with 2.88 point. In a study conducted in Uganda, it was observed that 86% of university students had sufficient knowledge about the signs and symptoms of DM[21]. In a study conducted in Iraq, it was found that university students had an adequate level (a response of more than 50%)[22]. In a study conducted with university students studying in the field of health technicians in Türkiye, DM knowledge level of students was found to be limited[16]. However, in a study conducted in Poland, the knowledge level of medicine students was found to be insufficient[23].

Response rates of participants to questions regarding the knowledge level of DM ranged between 69% and 99%. This rate is quite high compared to studies conducted with other university students[24,25]. One of the reasons for this may be that it was conducted with pharmacy students. Because similar studies show that students studying in the field of health have a higher level of knowledge than students in other fields.

There are studies in which female students have a significantly better knowledge of DM general knowledge, risk factors, signs and symptoms, control and management, complications, and total knowledge scores[24-26]. Since the number of female students was much higher than male students in our study, it was not found statistically significant in our study ($p>0.05$).

Considering the participants with and without a family history of diabetes, there is a significant difference in the answers given to the following questions; One symptoms of DM is excessive urination, cut-off point for DM diagnosis is fasting blood sugar of 200 mg/dL, mode of treatment in type 2 DM is insulin alone, DM in pregnant can be treated by oral hypoglycemic drugs alone, complications of DM may be seen in nerves, complications of DM may be seen in lower limbs (as amputation) ($p<0.05$). In a similar study, the answers given to the questions such as risk factors for DM is family history and decreased physical activity, one symptom of DM is weight loss differed significantly depending on whether there was a family history of diabetes ($p<0.05$)[27]. In a study con-

ducted with university students, a significant relationship was found between the family history of DM and the knowledge and awareness of diabetes of those with no family history of diabetes. This may be due to caring for relatives of DM patients[24].

When the 4th and 5th-grade students were compared, it was found that the knowledge level of the 4th grade students was significantly higher in the correct answers to questions such as definition, risk factors, diagnosis, treatment, complications of DM ($p<0.05$). One of the reasons for this may be that the theoretical knowledge of 4th-grade students who have not yet started clinical rotation may be more up to date. Contrary to our study, in a study involving medical school students, clinical group had significantly better diabetes knowledge test results than preclinical group ($p<0.05$)[23].

All 4th and 5th grade students stated that they benefit from textbook notes as information sources about DM. In a study conducted with Saudi and Jordanian students, television was the highest source of information about DM, with 35% and 28%[28].

Students were found to have a sufficient foundational understanding regarding DM diagnosis, symptoms, and risk factors. Nonetheless, participants exhibited notable knowledge gaps, particularly in domains such as diet in diabetes and treatment in gestational diabetes have been identified among participants. This study will be helpful for future researchers who will investigate the knowledge level of DM among pharmacy students.

STATEMENT OF ETHICS

This study was granted ethical approval by the University of Health Sciences Hamidiye Scientific Research Ethics Committee, (Decision no: 28/9, Registration no: 22/634, Date: 30.12.2022), and was conducted in accordance with the ethical guidelines stipulated by the Declaration of Helsinki.

CONFLICT OF INTEREST STATEMENT

None of the authors has any conflict of interest to declare.

AUTHOR CONTRIBUTIONS

The authors contributed equally.

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