Interdisciplinary Research in Medical Sciences Specialty
ISSN: 3062-4401
2025, Volume 5, Issue 2, Page No: 55-63

Available online at: www.galaxypub.co/page/journals

Galaxy Publication

Galaxy Publication

Evaluating Educational Preparedness on Diabetes Mellitus Among Syrian Medical Students

Sibusiso Khumalo[1], Mandla Zulu[1], Bongani Mthembu[1]*

[1]Department of Public Health Sciences, Faculty of Health Sciences, University of KwaZulu Natal, Durban, South Africa.

***E-mail** ✉ bongani.mthembu.ph@outlook.com

Received: 09 May 2025; **Revised:** 27 September 2025; **Accepted:** 02 October 2025

ABSTRACT

Diabetes mellitus has emerged as the fastest-growing global health crisis of the 21st century, with the Middle East and North Africa region exhibiting the highest prevalence worldwide. As future healthcare professionals, medical students play a crucial role in addressing this challenge, making it essential to assess, update, and strengthen their knowledge of the disease. During the Syrian conflict, a cross-sectional survey was conducted at the Syrian Private University (SPU) in Damascus in November 2019, coinciding with World Diabetes Day. Participants completed self-administered questionnaires, and the resulting data were analyzed using SPSS version 25.0 (SPSS Inc., USA). Among the 275 participants, 74 (26.9%) were preclinical students and 201 (73%) were clinical students, with a mean age of 21.9 ± 3.7 years. Of these, 67 students (25.0%) were classified as overweight, and 26 (9.7%) as obese. Overall, students demonstrated good knowledge regarding the clinical features, risk factors, and complications of diabetes; however, gaps were observed in their understanding of general information and diagnostic criteria. Students in clinical years (4th–6th) exhibited significantly higher awareness compared to those in preclinical years (1st–3rd). Medical students exhibited certain gaps in their knowledge and awareness of diabetes mellitus. Comprehensive health education programs are needed to enhance their ability to recognize and manage the disease effectively, while also fostering the adoption of healthy lifestyle behaviors.

Keywords: Diabetes mellitus, Knowledge, Awareness, Syria, Medical student

How to Cite This Article: Khumalo S, Zulu M, Mthembu B. Evaluating Educational Preparedness on Diabetes Mellitus Among Syrian Medical Students. Interdiscip Res Med Sci Spec. 2025;5(2):55-63. https://doi.org/10.51847/lwVjYCZH6j

Introduction

Diabetes mellitus (DM) comprises a group of metabolic disorders marked by persistent hyperglycemia and is classified into three main subtypes: type 1 DM, type 2 DM—which accounts for approximately 90% of cases—and gestational DM [1]. DM has emerged as the fastest-growing global health crisis of the 21st century [1]. In 2019, the estimated global prevalence of DM among adults was 463 million (9.3%), projected to rise to 578 million (10.2%) by 2030 [1]. Notably, half of the affected population (50.1%) remain undiagnosed, with 84.3% of these cases occurring in low- and middle-income countries [1]. The Middle East and North Africa (MENA) region exhibits the highest global prevalence, with 12.2% of the population affected, projected to increase to 13.3% by 2030 (age-standardized) [1].

In 2019, DM and its complications caused approximately 4.2 million deaths among adults aged 20–79 years, equivalent to one death every eight seconds [1]. The World Health Organization (WHO) and United Nations (UN) have established global targets to improve DM care, reduce premature mortality, achieve universal health coverage, and ensure access to essential medications by 2030 [2]. These measures are critical to providing high-quality, affordable care and mitigating financial burdens for the projected 578 million individuals living with diabetes [1].

In Syria, the WHO profile for 2016 reported a DM prevalence of 11.9%, with 21.6% of the population classified as obese and 55% as overweight [3]. These figures surpass the global averages of 13% for obesity and 39% for overweight [4]. Additional risk factors contributing to DM include sedentary lifestyles, family history, smoking, and environmental influences [5]. As of 2016, Syria had no operational national policies for DM monitoring, prevention, or for controlling overweight, obesity, and physical inactivity [3].

The ongoing Syrian crisis, now in its tenth year, has significantly undermined the healthcare system. Hospitals and clinics have been damaged or destroyed, many healthcare professionals have fled the country, and the production and availability of medications have been drastically reduced. Alarmingly, 60% of insulin-dependent Syrians are at risk due to the damage and cessation of the country's sole insulin-producing facility [6]. Consequently, Syria's healthcare system is ill-equipped to manage DM and its associated risk factors. In the absence of national screening and prevention strategies, physicians and patient awareness remain the frontline defense against diabetes. Training healthcare professionals to promote community-based interventions, such as physical activity, healthy diets, and screening high-risk groups, can prevent or delay type 2 DM onset. Initiating such training during medical school is essential for shaping future clinical practice [7].

To date, no studies have evaluated DM awareness among Syrian medical students, making this the first study conducted during the ongoing Syrian crisis. The primary aim of this study is to assess the knowledge and awareness of DM among medical students at the Syrian Private University (SPU). Specifically, the study seeks to evaluate students' understanding of risk factors, clinical features, diagnostic criteria, complications, prevention, and treatment, and to determine whether the clinical curriculum adequately equips them to identify at-risk individuals and intervene to delay disease progression.

Materials and Methods

Study design, setting, and participants

A cross-sectional survey was carried out at the Faculty of Medicine, Syrian Private University (SPU), Damascus, on November 14, 2019, coinciding with World Diabetes Day. A preliminary pilot study involving 30 students was conducted to evaluate the questionnaire's clarity, reliability, and relevance; responses from these participants were excluded from the main study to avoid bias. The main survey was distributed in paper format to students assembled in the faculty hall. Participation was entirely voluntary, responses were anonymous, students were not required to answer all questions, and they could withdraw at any stage.

The self-administered questionnaire, presented in English, was adapted from prior validated instruments [8, 9]. The first section collected socio-demographic data, including age, gender, body mass index (BMI), academic year, residence, marital status, mother's education, smoking and alcohol habits, and grade point average (GPA). The second section assessed diabetes-related knowledge through 45 items grouped into seven domains: general knowledge (4 items), risk factors (7 items), signs and symptoms (7 items), diagnosis (3 items), complications (8 items), prevention (6 items), and treatment (2 items). Ethical clearance was obtained from the Institutional Review Board (IRB) of the Faculty of Medicine, SPU.

Reliability analysis

To assess the internal consistency of the questionnaire, Cronbach's alpha test was performed. The Arabic version of the questionnaire yielded a Cronbach's alpha of 0.664, indicating an acceptable level of reliability for the included items [10].

Statistical analysis

All data were processed using SPSS version 25.0 (SPSS Inc., Chicago, IL, USA). Categorical variables were summarized as percentages and counts, while continuous variables were described using mean, median, and standard deviation values. To evaluate whether knowledge differed between students in preclinical and clinical years, comparisons were made across six domains—general knowledge, risk factors, clinical manifestations, diagnosis, complications, treatment, and dietary aspects—using the chi-square test. Differences were considered statistically significant at a threshold of $p < 0.05$.

Results and Discussion

Socio-demographic characteristics

A total of 275 undergraduate medical students completed the questionnaire, of whom 74 (26.9%) were in preclinical years and 201 (73%) were in clinical years, with a mean age of 21.9 ± 3.7 years (range: 18–30 years). Most students (±5 years) were aged 20–25 and 251 (91.3%) resided in urban areas. Regarding lifestyle factors, 96 students (34.9%) reported smoking, 28 (10.2%) consumed alcohol, and 144 (52.4%) engaged in regular physical activity. Body mass index (BMI) distribution showed that 164 (61.2%) were within the normal range (18.5–24.9), 67 (25.0%) were overweight (BMI 25–29.9), and 26 (9.7%) were classified as obese (BMI ≥30) **(Table 1)**.

Table 1 . Socio-demographic characteristics (n = 275).

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	Under 20	33	12.0
	20–25	228	82.9
	Above 25	14	5.1
Gender	Male	173	62.9
	Female	102	37.1
Social Status	Single	242	88.0
	In a relationship	26	9.5
	Married	7	2.5
Alcohol Use	Yes	28	10.2
	No	247	89.8
Smoking (Cigarette)	Yes	96	34.9
	No	179	65.1
Exercise ≥6.5 h per week	Yes	144	52.4
	No	131	47.6
Know someone with diabetes	Yes	250	90.9
	No	25	9.1
GPA	<2.0	35	12.7
	2.0–2.5	165	60.0
	2.5–3.0	57	20.7
	>3.0	18	6.5
Current Residence	Urban	251	91.3
	Rural	24	8.7
University Year	1	29	10.5
	2	9	3.3
	3	36	13.1
	4	49	17.8
	5th	87	31.6
	6th	65	23.6
BMI (kg/m²)	<18.5	11	4.1
	18.5–24.9	164	61.2
	25–29.9	67	25.0
	≥30	26	9.7

General information and risk factors regarding DM type 1 and 2

The findings indicated gaps in understanding the etiology of diabetes mellitus. Only 181 students (65.8%) correctly identified type 1 diabetes as insulin-dependent, while 180 students (65.5%) recognized type 2 diabetes as characterized by insulin resistance. No significant differences were observed between preclinical and clinical students in general knowledge regarding type 1 and type 2 diabetes **(Table 2)**.

Table 2. General information and risk factors about DM type 1 and 2 (n = 275).

Question	Pre-clinical (n=74)	Clinical (n=201)	Overall	P-value
	Yes	No	Yes	No

Is type 1 DM insulin-dependent?	44 (59.5%)	30 (40.5%)	137 (68.2%)	64 (31.8%)
Is type 2 DM insulin-resistant?	50 (67.6%)	24 (32.4%)	130 (64.7%)	71 (35.3%)
Only type 1 DM presents with ketonuria?	48 (64.9%)	26 (35.1%)	87 (43.3%)	114 (56.7%)
Are autoantibodies present in type 1 DM?	39 (52.7%)	35 (47.3%)	144 (71.6%)	57 (28.4%)
Risk Factor	**Pre-clinical (n=74)**	**Clinical (n=201)**	**Overall**	**P-value**
	Yes	No	Do not know	Yes
Age >45 years	55 (74.3%)	7 (9.5%)	12 (16.2%)	166 (82.6%)
Obesity (BMI>30 kg/m²)	54 (73.0%)	3 (4.1%)	17 (23.0%)	187 (93.0%)
Positive family history	62 (83.8%)	3 (4.1%)	9 (12.2%)	196 (97.5%)
History of gestational diabetes	48 (64.9%)	4 (5.4%)	22 (29.7%)	153 (76.1%)
Hypertension	27 (36.5%)	18 (24.3%)	29 (39.2%)	98 (48.8%)
Carbohydrate-rich diet	49 (66.2%)	8 (10.8%)	17 (23.0%)	143 (71.1%)
Lack of physical activity	57 (77.0%)	5 (6.8%)	12 (16.2%)	159 (79.1%)

Most students, both clinical and preclinical, were able to correctly recognize key risk factors for diabetes mellitus. Specifically, obesity was identified by 93% of clinical students and 73% of preclinical students, while a positive family history was recognized by 97.5% and 83.3%, respectively. Similarly, lack of physical activity was acknowledged as a risk factor by 79.1% of clinical students and 77.0% of preclinical students. In contrast, fewer students were aware of hypertension as a risk factor, with only 45.5% of clinical and 36.5% of preclinical students responding correctly **(Table 2)**.

DM common clinical features

Students generally demonstrated strong recognition of diabetes mellitus symptoms. The most commonly identified clinical signs were excessive thirst (polydipsia) in 261 students (94.9%), dry mouth in 247 (89.8%), increased urination (polyuria) in 247 (89.8%), slow-healing wounds in 243 (88.4%), fatigue in 217 (78.9%), and frequent infections in 184 (66.9%). However, only 152 students (55.3%) correctly reported increased appetite (polyphagia) as a symptom. Across nearly all symptoms, clinical students exhibited significantly higher awareness compared to preclinical students, with statistical significance observed for polyuria and polydipsia ($p < 0.001$), dry mouth ($p = 0.014$), fatigue ($p = 0.005$), polyphagia ($p < 0.001$), delayed wound healing ($p < 0.001$), and recurrent infections ($p < 0.001$) **(Figure 1)**.

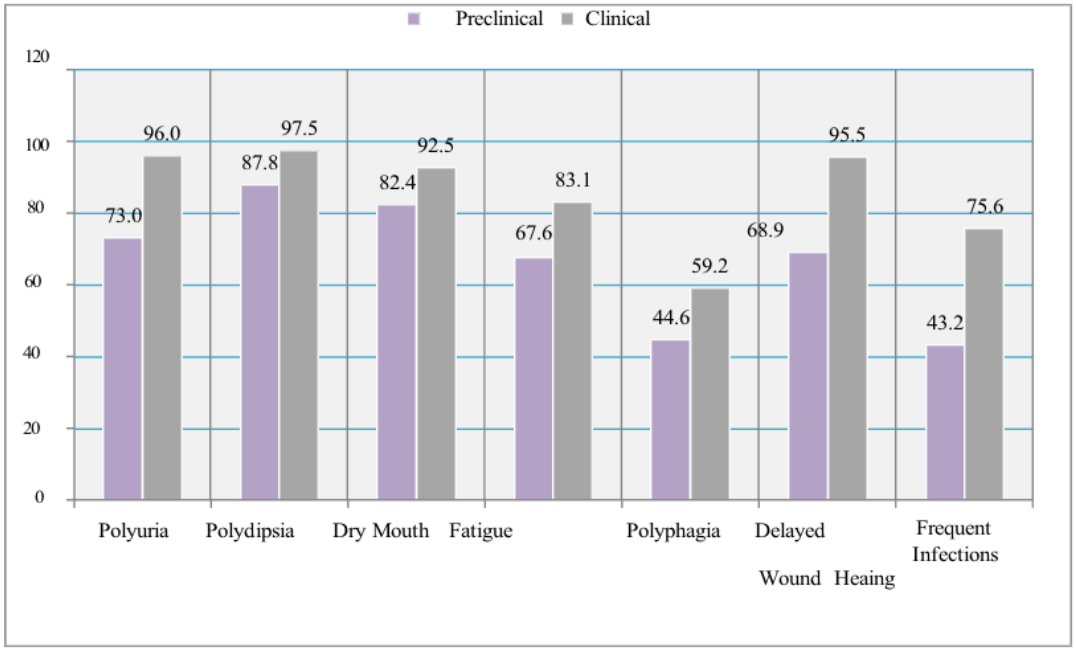

Figure 1. DM common signs and symptoms among preclinical and clinical medical students.

DM diagnosis

Regarding diabetes mellitus diagnosis, both preclinical and clinical students demonstrated considerable gaps in knowledge. Recognition of the diagnostic criteria was limited: a fasting plasma glucose level ≥126 mg/dL was correctly identified by 18 preclinical students (24.3%) and 86 clinical students (42.8%); an oral glucose tolerance test value ≥200 mg/dL after 2 hours was recognized by 20 preclinical students (27.0%) and 74 clinical students (36.8%); and an HbA1c ≥6.4% was reported by 30 preclinical students (40.5%) and 71 clinical students (35.3%) **(Table 3)**.

Table 3. Diagnosis.

Measurement	Category	Pre-clinical (n=74)	Clinical (n=201)	Total (Correct Answer)	T-test	P-value
Fasting Plasma Glucose (FPG)	70–100 mg/dl	34 (45.9%)	74 (36.8%)	108 (39.3%)	-3.017	0.003*
	100–125 mg/dl	18 (24.3%)	28 (13.9%)	46 (16.7%)		
	≥126 mg/dl	18 (24.3%)	86 (42.8%)	104 (37.8%)		
	≥140 mg/dl	4 (5.4%)	13 (6.5%)	17 (6.2%)		
Oral Glucose Challenge / Random Plasma Glucose (2 hours)	≤140 mg/dl	30 (40.5%)	76 (37.8%)	106 (38.5%)	-1.575	0.118
	140–199 mg/dl	22 (29.7%)	44 (21.9%)	66 (24.0%)		
	≥200 mg/dl	20 (27.0%)	74 (36.8%)	94 (34.2%)		
	>400 mg/dl	2 (2.7%)	7 (3.5%)	9 (3.3%)		
Hemoglobin A1c (HbA1c)	≤5.7%	10 (13.5%)	40 (19.9%)	50 (18.2%)	0.783	0.435
	5.7–6.4%	28 (37.8%)	69 (34.3%)	97 (35.3%)		
	≤6.4%	30 (40.5%)	71 (35.3%)	101 (36.7%)		
	>10%	6 (8.1%)	21 (10.4%)	27 (9.8%)		

DM complications

Students generally demonstrated strong awareness of diabetes mellitus complications. Most participants correctly identified retinopathy (254, 92.4%), limb gangrene (255, 92.7%), renal failure (248, 90.2%), hyperglycemia (238, 86.5%), peripheral neuropathy (233, 84.7%), and ketoacidosis (229, 83.3%) as potential complications. In contrast, fewer students recognized cataract (159, 57.8%) and hypoglycemia (167, 60.7%) as associated complications **(Table 4)**."

Table 4. DM complications.

Complication	Pre-clinical (n=74)	Clinical (n=201)	Overall Correct Answer	Chi-square	P-value
	Yes (%)	No (%)	Do not know (%)	Yes (%)	No (%)
Retinopathy	59 (79.7%)	5 (6.8%)	10 (13.5%)	195 (97.0%)	1 (0.5%)
Cataract	23 (31.1%)	13 (17.6%)	38 (51.4%)	136 (67.7%)	26 (12.9%)
Renal failure	60 (81.1%)	6 (8.1%)	8 (10.8%)	188 (93.5%)	4 (2.0%)
Peripheral neuropathy	45 (60.8%)	7 (9.5%)	22 (29.7%)	188 (93.5%)	5 (2.5%)
Ketoacidosis	48 (64.9%)	6 (8.1%)	20 (27.0%)	181 (90.0%)	4 (2.0%)
Hypoglycemia	38 (51.4%)	29 (39.2%)	7 (9.5%)	129 (64.2%)	45 (22.4%)
Hyperglycemia	66 (89.2%)	3 (4.1%)	5 (6.8%)	172 (85.6%)	9 (4.5%)
Limb gangrene	65 (87.8%)	1 (1.4%)	8 (10.8%)	190 (94.5%)	1 (0.5%)

DM prevention

Students exhibited strong awareness of key diabetes mellitus prevention strategies. The majority recognized the importance of a healthy diet (263, 95.6%), light physical activity (247, 89.8%), and maintaining a BMI within the normal range (18.5–24.9) (236, 85.8%). In contrast, fewer students identified vigorous exercise (141, 51.3%) and smoking cessation (168, 61.1%) as effective preventive measures **(Figure 2)**.

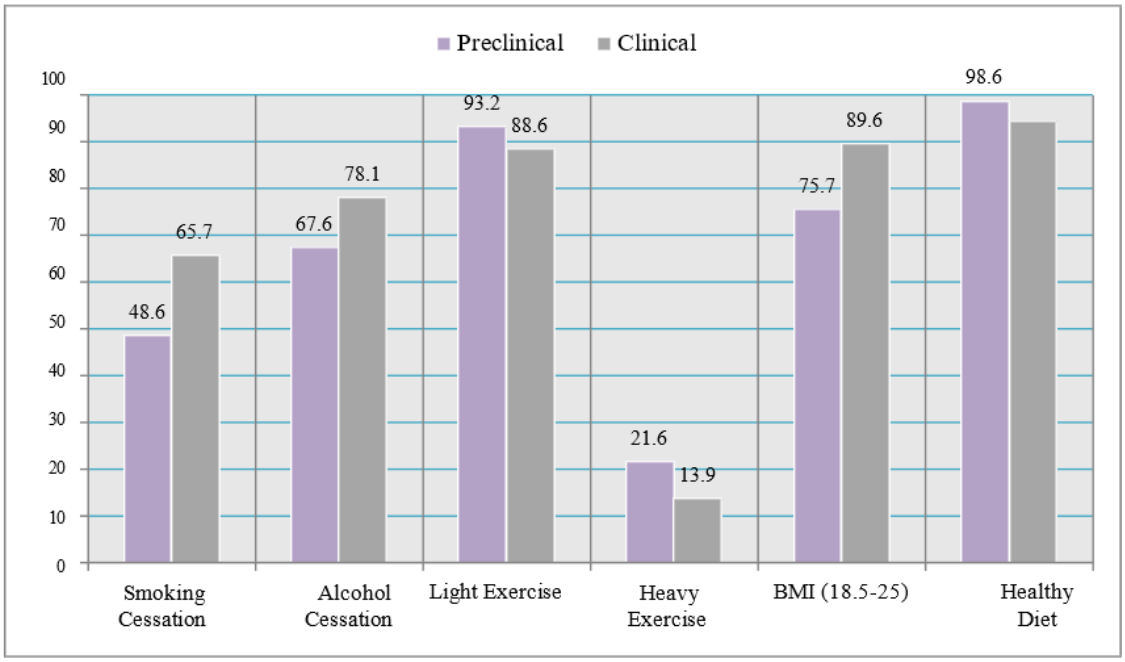

Figure 2. DM prevention factors among preclinical and clinical medical students.

DM treatment and diet

Clinical students demonstrated significantly greater knowledge than preclinical students regarding diabetes mellitus management and recommended dietary practices. For insulin administration, 148 clinical students (73.6%) correctly indicated its use, compared with 38 preclinical students (51.4%) (p = 0.001). Regarding the recommended diet for diabetic patients—comprising 35% carbohydrates, 50% fats, and 15% protein—only 45 students (16.4%) answered correctly (p = 0.003) **(Table 5)**."

Table 5. DM treatment and diet.

Topic	Category	Pre-clinical (n=74)	Clinical (n=201)	Overall (%)	Chi-square	P-value
Insulin is injected through:	Intravenous	22 (29.7%)	42 (20.9%)	64 (23.3%)	16.540	<0.001*
	Intramuscular	14 (18.9%)	11 (5.5%)	25 (9.1%)		
	Subcutaneous	38 (51.4%)	148 (73.6%)	186 (67.6%)		
Diabetic diet should include:	50% carbohydrate + 35% fats + 15% proteins	18 (24.3%)	27 (13.4%)	45 (16.4%)	9.818	0.007*
	35% carbohydrate + 50% fats + 15% proteins	17 (23.0%)	28 (13.9%)	45 (16.4%)		
	15% carbohydrate + 35% fats + 50% protein	39 (52.7%)	146 (72.6%)	185 (67.3%)		

With the rising global burden of diabetes mellitus (DM) and its projected prevalence, equipping future physicians with a solid understanding of DM and its management is essential. This study represents the first assessment of DM awareness and knowledge among medical students during the ongoing conflict in Syria. Among the participants, 67 students (25.0%) were overweight, 26 (9.7%) were obese, and only 144 (52.4%) engaged in regular physical activity, highlighting a concerning level of inactivity. Compared with a study in China, where 59.7% of students were physically active, 55.1% had a normal BMI, and only 2.9% were overweight [11], the prevalence of overweight and obesity in our cohort is notably higher. This trend may reflect dietary shifts toward high-calorie, "Western-style" foods, reduced adherence to the traditional Mediterranean diet, and changes in domestic food production [12]. Overweight individuals and those with insufficient physical activity are at higher risk of developing type 2 DM and other chronic conditions, underscoring the importance of targeted obesity prevention strategies to promote healthier lifestyles and reduce future healthcare burdens [13].

Our findings indicate gaps in general DM knowledge. Understanding that type 1 DM results from insulin deficiency and type 2 DM from a combination of insulin resistance and relative deficiency is fundamental for diagnosis and management [1]. In our study, 181 students (65.8%) and 180 students (65.5%) correctly identified

type 1 and type 2 DM mechanisms, respectively, which is higher than reported in a Jordanian cohort [14]. However, many students failed to recognize ketonuria as a manifestation in insulin-dependent patients, indicating insufficient understanding of diabetic ketoacidosis (DKA) pathophysiology. While clinical students have completed relevant theoretical courses in physiology, pathology, and pharmacology and are exposed to patients with acute and chronic DM complications, this knowledge gap could place patients at risk and warrants additional educational interventions.

Students demonstrated strong awareness of major DM risk factors, with most correctly identifying advanced age, obesity, and a positive family history. These results surpass findings from studies conducted in Islamabad [8] and the United States [15]. However, knowledge regarding a carbohydrate-rich diet and sedentary lifestyle as risk factors was lower than reported in Southern Sri Lanka [16]. Awareness levels for most risk factors were similar between preclinical and clinical students, likely reflecting the widespread emphasis on DM in healthcare education and community health discussions [17].

Early recognition of clinical features is critical in preventing severe DM complications [18]. Classical symptoms such as polyuria, polydipsia, and fatigue were well recognized, with awareness exceeding that reported in Jordan [14], Saudi Arabia [19], Pakistan [20], and the United Arab Emirates (UAE) [21]. Recognition of delayed wound healing, which may be overlooked in clinical practice [22], was also higher among our students compared to studies in Pakistan [20] and the UAE [21]. Awareness of frequent infections, a consequence of DM-related immune dysfunction [23], was similarly higher than in UAE studies [21]. Clinical students consistently demonstrated superior knowledge relative to preclinical students, likely due to direct clinical exposure and the timing of the endocrinology curriculum in the fifth year.

Significant deficiencies were observed in knowledge of DM diagnostic criteria among both preclinical and clinical students. Although recognition of fasting plasma glucose, oral glucose tolerance testing, and HbA1c thresholds was higher than in Pakistan [8], it was lower than reported in South India [24]. This highlights a concerning knowledge gap, as timely and accurate diagnosis is crucial to initiate early interventions and prevent complications. Notably, type 2 DM may develop 4–7 years before clinical diagnosis, with delayed recognition often resulting from clinical inertia [25, 26].

Community-based DM prevention, through modifiable lifestyle changes, has been proven to reduce type 2 DM incidence [27, 28]. Smoking is a known contributor to microvascular complications [29]; in our cohort, 96 students (34.9%) smoked, and 168 (61.1%) recognized smoking cessation as a preventive strategy, consistent with findings from India [30] and UAE [21]. Physical activity was widely acknowledged as a preventive measure, aligning with studies from Pakistan [20], yet this awareness has not consistently translated into practice, as indicated by the low levels of exercise among students.

Knowledge of DM complications was generally high. Students were well aware of ocular microvascular complications, including retinopathy, cataracts, and glaucoma [31, 32], with awareness surpassing that reported in India and Ghana [30, 33] and comparable to Saudi Arabia [9]. Recognition of diabetic nephropathy, a precursor to chronic renal failure requiring dialysis [34], was higher than in India [30] but lower than in Saudi Arabia [9]. Peripheral neuropathy, which significantly impacts quality of life and life expectancy [35], was correctly identified by the majority, exceeding awareness reported in Saudi Arabia and Jordan [14, 19]. These findings emphasize the importance of DM knowledge in preventing the progression of debilitating complications.

Finally, understanding DM management was limited. Only 186 students (67.6%) knew that insulin is administered via subcutaneous injections, highlighting a need for reinforced education. Addressing these gaps at multiple levels—within the undergraduate curriculum and through continuing medical education—is critical to ensure future physicians can effectively translate DM knowledge into patient care and preventive strategies.

Limitations

This study has several limitations related to its design and sampling methods. As a cross-sectional survey relying on self-reported data, responses—particularly regarding variables such as BMI and physical activity—may have been influenced by social desirability bias, potentially affecting the accuracy of the findings. Additionally, the sample may not be fully representative of the broader medical student population, limiting the generalizability of the results. Estimating sampling variability and potential biases also posed a challenge. Biochemical measures, such as random plasma glucose, were not assessed, preventing confirmation of students' glycemic profiles. Moreover, the survey did not include questions regarding medications used in DM management, which could have provided a more comprehensive understanding of student knowledge. Finally, limited published literature

evaluating medical students' knowledge of DM—particularly in the MENA region—makes it difficult to compare our findings with those from other contexts.

Conclusion

The findings of this study indicate that medical students at Syrian Private University possess generally good knowledge of diabetes mellitus, with clinical students demonstrating the highest level of awareness and preclinical students the lowest. However, gaps were observed in understanding general information and diagnostic criteria for DM. Enhancing medical education on screening, diagnosis, and management of diabetes is essential to strengthen future physicians' ability to address the growing DM burden in Syria. This could be achieved through curriculum updates, improved teaching strategies, and collaboration with the Syrian Ministry of Education.

Acknowledgments: We would like to thank the Syrian Private University for their support, Miss. Marrah Marrawi for her statistical contributions, and for all subjects who participated in this study.

Conflict of Interest: None

Financial Support: None

Ethics Statement: None

References

1. Federation. ID, IDF Diabetes Atlas, ninth ed., 2019.
2. Organization. WH, Global report on diabetes, 21 April 2016, p. 83.
3. Organization. WH, WHO diabetes country profiles, 2016. Explanatory Notes 2016. Available from: https://www.who.int/diabetes/country-profiles/diabetes_profiles_explanatory_notes.pdf?ua=10
4. Organization. WH, Obesity and overweight, 1 April 2020 [Available from: https:// www.who.int/news-room/fact-sheets/detail/obesity-and-overweight.
5. D. Asiimwe, G.O. Mauti, R. Kiconco, Prevalence and risk factors associated with type 2 diabetes in elderly patients aged 45-80 Years at Kanungu district, J. Diabetes Res. 2020 (2020) 5152146.
6. Organization. WH, WHO helps diabetes patients in Syria, 21 March 2016 [Available from: https://www.who.int/news-room/feature-stories/detail/who-helps-diabetes-patients-in-syria.
7. B. Hemmingsen, G. Gimenez-Perez, D. Mauricio, I.F.M. Roqu´e, M.I. Metzendorf, B. Richter, Diet, physical activity or both for prevention or delay of type 2 diabetes mellitus and its associated complications in people at increased risk of developing type 2 diabetes mellitus, Cochrane Database Syst. Rev. 12 (12) (2017), Cd003054.
8. N. Saeed, T. Jaffery, F.A. Ansari, B. Hamid, B.A. Khan, Knowledge and perceptions about Pre-diabetes amongst doctors, medical students, and patients in a tertiary care hospital of Islamabad, J. Pakistan Med. Assoc. 69 (4) (2019) 527–532.
9. A. Abukhelaif, A. Alghamdi, M. Alzahrani, T. Alghamdi, A. Alamri, F. Almalki, Diabetes mellitus knowledge and awareness among Albaha university students: an observational study, Int. J. Sci. Res. 8 (2017) 15284–15287.
10. G. Ursachi, I.A. Horodnic, A.J.P.E. Zait, Finance, How reliable are measurement scales? External factors with indirect influence on reliability estimators 20, 2015, pp. 679–686.
11. Y. Xu, D. Zhang, K. Liu, Y. Guo, Y. Yang, Self-reported knowledge on diabetes and its related factors among Chinese college students: a cross-sectional study, BMJ Open 6 (9) (2016), e011963.
12. M. Badran, I. Laher, Obesity in Arabic-speaking countries, J. Obes. 2011 (2011) 686430.
13. S.M. Haffner, Epidemiology of type 2 diabetes: risk factors, Diabetes Care 21 (Supplement 3) (1998) C3.
14. L. Al-Sarayra, R. Khalidi, Awareness and knowledge about diabetes mellitus among students at Al-Balqa' applied university, Pakistan J. Nutr. 11 (2012) 1023–1028.
15. T. Khan, G.D. Wozniak, K. Kirley, An assessment of medical students' knowledge of prediabetes and diabetes prevention, BMC Med. Educ. 19 (1) (2019) 285.

16. H.M.M. Herath, N.P. Weerasinghe, H. Dias, T.P. Weerarathna, Knowledge, attitude and practice related to diabetes mellitus among the general public in Galle district in Southern Sri Lanka: a pilot study, BMC Publ. Health 17 (1) (2017) 535.
17. (IDF). TIDF, Syrian diabetes association, 1973 [Available from: https://www.idf.o rg/our-network/regions-members/middle-east-and-north-africa/members/48-s yria.html?layout=details&mid=98.
18. A. Ramachandran, Know the signs and symptoms of diabetes, Indian J. Med. Res. 140 (5) (2014) 579–581.
19. A. Khamaiseh, M. Alshloul, Diabetes knowledge among health Sciences students in Saudi Arabia and Jordan, Jordan Med. J. 53 (2019) 37–48.
20. S. Mumtaz, T. Ashfaq, H. Siddiqui, Knowledge of medical students regarding diabetes mellitus at Ziauddin University, Karachi, J. Pakistan Med. Assoc. 59 (3) (2009) 163–166.
21. N. Khan, K.G. Gomathi, S.I. Shehnaz, J. Muttappallymyalil, Diabetes mellitus- related knowledge among university students in Ajman, United Arab Emirates, Sultan Qaboos Univ. Med. J. 12 (3) (2012) 306–314.
22. K. Christopherson, The impact of diabetes on wound healing: implications of microcirculatory changes, Br. J. Community Nurs. 8 (Sup6) (2003) S6–S13.
23. J. Casqueiro, J. Casqueiro, C. Alves, Infections in patients with diabetes mellitus: a review of pathogenesis, Indian J. Endocrinol. Metab. 16 (Suppl 1) (2012) S27–36 (Suppl1).
24. H. Singh, P. Thangaraju, S. Kumar, U. Aravindan, H. Balasubramanian, T. Selvan, Knowledge and awareness of diabetes and diabetic ketoacidosis (DKA) among medical students in a tertiary teaching hospital: an observational study, J. Clin. Diagn. Res. 8 (4) (2014) Hc04–6.
25. M.I. Harris, R. Klein, T.A. Welborn, M.W. Knuiman, Onset of NIDDM occurs at least 4-7 yr before clinical diagnosis, Diabetes Care 15 (7) (1992) 815–819.
26. L.A. Fraser, J. Twombly, M. Zhu, Q. Long, J.J. Hanfelt, K.M. Narayan, et al., Delay in diagnosis of diabetes is not the patient's fault, Diabetes Care 33 (1) (2010) e10.
27. A.L. Albright, E.W. Gregg, Preventing type 2 diabetes in communities across the U.S.: the national diabetes prevention program, Am. J. Prev. Med. 44 (4 Suppl 4) (2013) S346–S351.
28. B.Y. Shi, The importance and strategy of diabetes prevention, Chronic Dis. Trans. Med. 2 (4) (2016) 204–207.
29. S.A. Chang, Smoking and type 2 diabetes mellitus, Diabetes Metab. J 36 (6) (2012) 399–403.
30. R.M. Page, E. Stones, O. Taylor, K. Braudt, Awareness and perceptions of type 2 diabetes risk factors, preventability, and complications among college students in visakhapatnam, India, Int. Q Community Health Educ. 37 (1) (2016) 27–32.
31. J. Threatt, J.F. Williamson, K. Huynh, R.M. Davis, K. Hermayer, Ocular disease, knowledge and technology applications in patients with diabetes, Am. J. Med. Sci. 345 (4) (2013) 266–270.
32. N. Cheung, P. Mitchell, T.Y. Wong, Diabetic retinopathy, Lancet 376 (9735) (2010) 124–136.
33. M. Amankwah-Poku, A cross-sectional study of knowledge and awareness of type 2 diabetes mellitus in a student population in Ghana: do demographics and lifestyle make a difference, Health Psychol. Behav. Med. 7 (1) (2019) 234–252.
34. R.Z. Alicic, M.T. Rooney, K.R. Tuttle, Diabetic kidney disease: challenges, progress, and possibilities, Clin. J. Am. Soc. Nephrol. 12 (12) (2017) 2032–2045.
35. D. Selvarajah, D. Kar, K. Khunti, M.J. Davies, A.R. Scott, J. Walker, et al., Diabetic peripheral neuropathy: advances in diagnosis and strategies for screening and early intervention, Lancet Diab. Endocrinol. 7 (12) (2019) 938–948.