ORIGINAL ARTICLE

Knowledge of Diabetes Mellitus Among Undergraduate Clinical Students of Sindh Medical College

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ABSTRACT

Objective: To determine the knowledge of undergraduate students of Sindh Medical College regarding Diabetes Mellitus (DM)

Methodology: This cross sectional study was conducted at Sindh Medical College, Jinnah Sindh Medical University (SMC-JSMU). The participants were students of 3rd year, 4th year and 5th year M.B.B.S. The sample size was calculated to be 282, using open EPI software. The data was collected through a scientifically designed questionnaire which included questions about the over all knowledge, risk factors, complications, diagnosis, treatment, methods of prevention, and WHO criteria of Diabetes Mellitus. SPSS version 22.0 was used for data analysis.

Results: About 275 (98%) students had knowledge of the site of insulin production and 255 (90%) knew exactly how insulin produces its effects. Regarding the clinical presentation of DM, 262 (93%) of them agreed that hunger, thirst, and urination present as the major symptoms of this disease (p=0.005). Family history was considered as the prime risk factor by 93 (98%), 83 (95%) and 86 (86%) of final year, fourth, and third year students respectively (p=0.003). Furthermore, 254 (90%) selected retinopathy (p=0.00), 239 (85%) preferred nephropathy (p=0.003) and 224 (79%) considered neuropathy (p=0.024) as the most significant complication of DM. Moreover, the recall of the WHO diagnostic criteria for DM was comparatively lower in final year students (p=0.003).

Conclusion: The over all knowledge of undergraduate medical students of Sindh Medical College was found to be satisfactory. Most of the students considered medical education as an adequate source of knowledge in this regard. However, capability of diagnosing DM was found to be comparatively low among final year M.B.B.S. students.

Key words: Blood glucose levels, diagnostic criteria, diabetes mellitus, metabolic disease, medical students, neuropathy, nephropathy, retinopathy, undergraduates

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INTRODUCTION

Diabetes Mellitus (DM), according to World Health Organization (WHO), is a chronic metabolic disease characterized by elevated levels of blood glucose, which leads to serious damaging effects to the heart, blood vessels, eyes, kidneys, and nerves[1].

Increasing incidence of diabetes mellitus has proved to be worrisome for health care providers. Around 450 million people are suffering from diabetes mellitus worldwide with Asia being the highest contributor to the burden. Highest incidence of diabetes mellitus has been reported in China followed by India. About 12.13% population of Afghanistan is currently suffering from DM[2-4]. If these trends continue, the estimated frequency may rise to 629 million by the end of 2045. With 79,535 reported deaths, diabetes has acquired 7th position in the list of leading causes of death in the US. In Pakistan, currently 7.5 million people are suffering from this disorder which would more likely be increased to 16.1 million if preventive measures will not be taken[5,6]. Furthermore, the prevalence of DM in Pakistan is 11.77% with a distribution of 14.81% in urban and 10.34% in rural areas[7].

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DM has proved to be a massive economic burden globally due to its rapid spread[8,9]. In 2012, US spent $245 billion for this purpose. It is postulated that in Pakistan, for treating approximately 6.6 million diabetes patients, the estimated cost may increase up to 36.5 billion PKR per month[6,10,11].

Trend of urbanization, sedentary lifestyle, inactive routines, and stressful job conditions are important factors contributing to the increased frequency of this disorder[12]. The current WHO diagnostic criteria for diabetes is fasting plasma glucose = 7.0mmol/l (126mg/dl) or 2–h plasma glucose = 11.1mmol/l (200mg/dl)[13].

Since medical undergraduates are the future primary health care providers of the community, they should have optimal knowledge towards accurate diagnosis and management of DM. Early diagnosis of border line cases can prevent these patients from acquiring the disease in future. The current study was designed to determine the knowledge regarding aetiology, approach to diagnosis, and management of diabetes mellitus among undergraduate MBBS students of Jinnah Sindh Medical University.

METHODOLOGY

This was a cross-sectional study, conducted at Sindh Medical College, Jinnah Sindh Medical University (SMC-JSMU) from 2017 to 2018. The Institutional Review Board of JSMU approved this study by certifying it with IRB certificate No. JSMU/IRB/2018/107. All students from 3rd year to 5th year, M.B.B.S, were enrolled in the study. Those who did not consent, were excluded. The sample size of 300 was calculated using Select Statistics Software with the total population of SMC-JSMU to be as 1050 (350 students per batch). For sample size, following formula was applied:

$n = NxX / (X + N - 1)$,

where, $X = Z\alpha/22 *p*(1-p) / MOE2$, and $Z\alpha/2$ is the critical value of the Normal distribution at $\alpha/2$ (e.g. for a confidence level of 95%, α is 0.05 and the critical value is 1.96), MOE is the margin of error, p is the sample proportion, and N is the population size. Prevalence from previous study was 50%[14]. Note that a Finite Population Correction has been applied to the sample size formula. Ethical approval was obtained from the Institutional Review Board of Jinnah Sindh Medical University.

Data were collected using a structured questionnaire which was inspired by a previously published research[14]. The questionnaire was validated by endocrinologist and statisticians. It was a self-administered pro-forma which was sent to the participants via online portal using social media. The questions were written in very simple language, were easy to understand, and took only four to six minutes to answer. Total 19 questions were divided into four parts, including the following: I. The participant's knowledge regarding DM. II. The participant's knowledge regarding risk factors, complications, diagnosis, treatment and methods of prevention of diabetes mellitus.

SPSS version 22.0 was used for analyzing the data. Descriptive statistics were used to determine the mean, standard deviation, and diagnostic criteria of diabetes mellitus. Categorical variables were explained in frequency and percentages. Chi-square test of independence was applied to assess any statistical difference in the knowledge of clinical students regarding DM. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 282 students participated in this study with 100 (35.4%) students belonging to third year, 87 (30.8%) to fourth year and 95 (33.6%) to final year respectively. The mean age of participants was 21.5 ± 1.87 years and a range of 19-24 years.

Table 1 demonstrates the general knowledge, physiology, aetiology, and presentation of DM among clinical students. Accurate definition was known by 90 (95%) final year students, 82 (94%) and 85 (85%) fourth and third year students respectively ($p<0.005$). As many as 96 (96%) respondents from the third year, 86 (99%) from the fourth year, while 93 (98%) from final year batch claimed that insulin is produced by pancreas. Total 255 (90%) acknowledged that they know the mechanism of action of insulin. Regarding the clinical presentation of DM, majority of the students i.e. 262 (93%) of them reported that it manifests as hunger, thirst, and increased urination ($p=0.005$); 26 (26%) from the third year, 11 (13%) from the fourth year, and 17 (18%) from the final year recognized thirst, vision, and weight loss as presenting symptoms of diabetes ($p=0.065$).

Majority 258 (91%) of the students acknowledged class room teaching along with clinical rotations as the prime sources of knowledge regarding DM.

DISCUSSION

Diabetes Mellitus is a metabolic disorder affecting majority of the population of Pakistan.[15] Medical students being the care providers of tomorrow must possess optimal knowledge regarding this disorder,

Table 1: Knowledge of Medical Students Regarding Physiology, Pathology, Clinical Presentation, and Their Source of Education

Variables	3rd year n=100 (%)	4th year n=87 (%)	5th year n=95(%)	Total n=282(%)	p-value
Which of the following define diabetes mellitus?					
a. Insufficient production of insulin	3 (3)	1 (1.1)	0	4 (1.5)	
b. Improper action of insulin	1 (1)	0	2 (2.1)	3 (1)	*0.025
c. High blood glucose level	11 (11)	4 (4.6)	3 (3.1)	18 (6.5)	
d. Hyperglycemia resulting from defects in insulin secretion, insulin action or both	85 (85)	82(94.3)	90(94.8)	257 (91)	
In which of the following organ insulin is produced?					
a. stomach	1 (1)	0	0	1 (0.4)	
b. liver	3 (3)	1 (1.1)	2 (2.1)	6 (2.1)	0.515
c. pancreas	96 (96)	86(98.9)	93(97.8)	275(97.5)	
Which parts of the body are the prime target for insulin action?					
a. Adipose tissue, muscle and liver	89 (89)	81 (93)	85 (90)	255(90.4)	
b. Adipose tissue, muscle and brain	5 (5)	3 (3.5)	5 (5)	13 (4.6)	0.627
c. Adipose tissue, liver and kidneys	6 (6)	3 (3.5)	5 (5)	14 (5.0)	
Which gender is most affected by diabetes mellitus?					
a. male	44 (44)	12 (14)	23 (24)	79 (28)	
b. female	14 (14)	31 (36)	21 (22)	66 (23)	
c. both	33 (33)	38 (44)	43 (45)	114 (40)	
d. don't know	9 (9)	6 (7)	8 (8)	23 (8.2)	
What are the most common symptoms of diabetes mellitus?					
a. Feeling very hungry, feeling very thirsty and frequent urination	87 (87)	86 (99)	89 (94)	262 (93)	*0.005
b. Feeling very thirsty, decreased vision and weight loss	26 (26)	11 (13)	17 (!8)	54 (19)	0.065
c. Feeling very hungry, extreme fatigue and delayed wound healing	37 (37)	30 (34)	38 (40)	105 (37)	0.732
d. Weight loss, extreme fatigue and numbness	24 (24)	14 (16)	19 (20)	57 (20)	0.405
e. Usually asymptomatic	3 (3)	6 (7)	5 (5)	14 (5)	0.486
The chance of developing diabetes is more in which one of them?					
a. Educated	6 (6)	2 (2)	5 (5)	13 (5)	
b. Uneducated	21 (21)	29 (33)	22 (23)	72 (25)	
c. Both	73 (73)	56 (64)	68 (72)	197 (70)	
From where did you get to know about diabetes mellitus?					
a. Medical Education (class room teaching and clinical rotation)	88 (88)	79 (91)	91 (96)	258 (91)	
b. Research Articles	3 (3)	1 (1)	0 (0)	4 (1)	
c. CME Lectures	0 (0)	0 (0)	0 (0)	0 (0)	
d. Internet	2 (2)	3 (3)	3 (3)	8 (3)	
e. Others	7 (7)	4 (5)	1 (1)	12 (4)	
Do you have a family history of DM?	55 (55)	57 (66)	60 (63)	172 (61)	

* p-value is significant at <0.05

especially with regards to clinical presentation and investigation, in order to accurately diagnose the disease. Furthermore, the future doctors can also play an important role in the prevention of this highly prevalent syndrome.

The overall knowledge which included the correct definition, presentation, risk factors, complications, treatment, and management of DM was found to be adequate in the third, fourth and final year medical students. A study carried out on the Albaha University medical students showed a similar trend among undergraduate students[16].

In the current study, 98% of participants were aware that pancreas is the site of insulin production. Two studies conducted among final year students, one at a medical college in Northern Tamil Nadu and the other at Father Muller Medical College Hospital showed 90% and 98.75% respectively, had the correct response to the same question[17,18]. An outstanding percentage, i.e. 93% of medical students, were familiar with the presenting symptoms of the disease. This finding is supported by 91% accurate responses in one of the studies[17]. This shows similarity in the education standards among these universities.

Table 2: Knowledge of Risk Factors, Complications, Diagnosis and Preventive Measures Among Medical Students

Variables	3rd year n=100 (%)	4th year n=87 (%)	5th year n=95(%)	Total n=282(%)	p-value
What are the risk factors for developing diabetes mellitus in view of your knowledge?					
a. Family history	86 (86)	83 (95)	93 (98)	262 (93)	0.003
b. Physical Inactivity	37 (37)	61 (70)	55 (58)	153 (54)	0.000
c. Others	5 (5)	7 (8)	3 (3)	15 (5)	0.379
What are the possible complications that are likely to occur in diabetes mellitus?					
a. Cardiovascular diseases	54 (54)	50 (57)	55 (58)	159 (56)	0.847
b. Retinopathy	81 (81)	84 (97)	89 (94)	254 (90)	0.000
c. Neuropathy	71 (71)	71 (82)	82 (86)	224 (79)	0.024
d. Nephropathy	75 (75)	77 (89)	87 (92)	239 (85)	0.003
e. Stroke	30 (30)	36 (41)	41 (43)	107 (38)	0.128
Can Glycated Hemoglobin (HbA1c) be used as the prime marker to diagnose diabetes?	83 (83)	71 (82)	82 (86)	236 (84)	0.683
Which of the following is the correct value of HbA1c to diagnose diabetes?					
a. >6.5%	78 (78)	75 (86)	67 (71)	220 (78)	
b. >5.0%	5 (5)	1 (1.1)	4 (4.2)	10 (3.5)	0.036
c. >7.0%	13 (13)	8 (9.1)	20 (21)	41(14.5)	
d. >6.0%	4 (4)	3 (3.4)	4 (4.2)	11 (4)	
Are you aware of the diagnostic criteria for diabetes mellitus set by the WHO?					
a. Yes	62 (62)	75 (86)	61 (64)	198 (70)	
b. No	19 (19)	5 (5.7)	15(15.7)	39 (24)	0.003
c. Maybe	19 (19)	7 (8)	19 (20)	5 (16)	
If yes, then which of the following is the correct criterion?					
a. Random plasma glucose > 200mg/dl plus classic symptoms of hyperglycemia	58 (58)	64 (74)	60 (63)	182 (64)	
b. Random plasma glucose > 150mg/dl plus classic symptoms of hyperglycemia	0	2 (2.4)	1 (1.0)	3 (1.0)	
c. Random plasma glucose > 180mg/dl plus classic symptoms of hyperglycemia	12 (12)	6 (7.3)	8 (8.4)	26 (9.2)	0.056
d. Random plasma glucose > 120mg/dl plus classic symptoms of hyperglycemia	10 (10)	8 (9.7)	5 (5.2)	23 (8.1)	
e. None of these	1 (1)	2 (2.4)	6 (6.3)	9 (3.1)	
Which of the following is used as the initial test in the evaluation of gestational diabetes mellitus?					
a. Glucose challenge test	14 (14)	19 (22)	28 (29)	61 (22)	
b. HbA1c	10 (10)	7 (8.0)	4 (4.2)	21 (7.5)	
c. Glucose tolerance test	36 (36)	29(33.3)	34(35.8)	99 (35)	0.031
d. Fasting plasma glucose	21 (21)	15(17.2)	14(14.7)	50(17.7)	
e. Random blood glucose	19 (19)	17 (19.5)	15(15.7)	51 (18)	
What minimal workup would you advise for the diagnosis of diabetes mellitus?					
a. FBS, RBS, HbA1c and OGTT	44 (44)	54 (62)	67 (71)	165 (58)	
b. FBS, RBS, HbA1c, urine test and OGTT	44 (44)	26 (29.8)	19 (20)	89 (31.5)	
c. CBC, ESR, FBS, RBS and HbA1c	4 (4)	2 (2.2)	3 (3.1)	9 (3.1)	0.001
d. CBC, ESR, Serum UCE, FBS, RBS, HbA1c and OGTT	7 (7)	5 (5.7)	5 (5.2)	17 (6.0)	
e. None of the above	1 (1)	0	(1.0)	2 (0.7)	

Do you think that your medical education has prepared you adequate enough to diagnose diabetes and other glucose abnormalities?					
a. Yes	39 (39)	52 (60)	59 (62)	150 (53)	
b. No	18 (18)	4 (4.5)	8 (8.4)	30 (10.6)	0.002
c. Maybe	43 (43)	31 (35.6)	28 (29.4)	102 (36.1)	
Do you think every diabetic should be treated with drugs?					
a. Yes	25 (25)	22 (25)	28 (29)	75 (26)	
b. No	60 (60)	49 (56.3)	61 (64)	170(60.3)	0.172
c. Maybe	15 (15)	16 (18.3)	6 (6.3)	37 (13)	
What measures can be taken to prevent diabetes or delay its onset?					
a. Healthy diet	81 (81)	76 (87)	85 (89)	242 (86)	0.205
b. Regular exercise	84 (84)	84 (97)	89 (94)	257 (91)	0.005
c. Weight loss	56 (56)	70 (80)	87 (92)	213 (75)	0.000
d. Quit smoking	39 (39)	52 (60)	56 (59)	147 (52)	0.004
Do you think that your medical education has prepared you sufficiently to optimize treatment of diabetes?					
a. Yes	36 (36)	40 (46)	41 (43)	117 (41)	
b. No	34 (34)	15 (17.2)	17 (17.8)	66 (23.4)	0.043
c. Maybe	30 (30)	32 (36.7)	37 (39)	99 (35.1)	

* p-value is significant at <0.05

Medical education including classroom lecture, tutorials and ward rotation was considered the prime source of knowledge by 91% participants of the present study. In comparison, a study conducted on the medical students of King Faisal University reported a surprisingly decreased number, 43.8%, of participants who considered medical education as the major source of information[19]. On the contrary, the majority, 75%, of participants of a study from the University of Ajman gave credit of their knowledge to friends, family, and relatives[20]. This difference can be attributed to the fact that this study was conducted on non-medical undergraduate students.

Major risk factor (family history) was correctly identified by most (93%) of the students in our study from all three years of education. Similarly, 94.4% medical students of Albaha University and 71% students of Ajman University selected family history as one of the major risk factors of diabetes mellitus[16,20]. The major complication recalled by a good number (85%) of our participants was renal diseases. However, a similar response by 100% participants of the Albaha University was reported[16]. This disagreement can be attributed to the difference in recalling capacity of participants at the time of filling the questionnaire.

Approximately 90%, 85%, 79%, and 56% of medical students from all batches had proper awareness about ophthalmic, renal, nervous and cardiovascular complications. However, in contrast a low frequency of knowledge 54%, 57%, 48%, and 40% was observed in a study from Ajman University[20]. Tabuk University students also observed a decreased knowledge, 45%, of the participants in identifying the major risk factors[21].

Both of the comparative studies were carried out on non-medical undergraduates. Even after extensive literature search, we could not find a comparative study on medical students addressing all risk factors similar to the current study.

Early detection of diabetic patients is not possible if the correct diagnostic criteria is not accurately known. In the current study, in comparison to 78% third year and 86% fourth year students respectively, only 76% of final year students were aware of the correct diagnostic value of HbA1c. Similar results were observed for WHO criteria for diagnosis of DM where fourth year students (74%) were found to be more knowledgeable compared to the final year (63%). A study conducted at Ziauddin Medical University Karachi recorded 55% of clinical students responding with the correct WHO criteria for HbA1c[14]. Our results are also strengthened by studies from Northern Tamil Nadu with 85.7% final year students and Al Balqa University with 42% fourth year students knowing the correct values for fasting blood sugar[17,22]. This variation in the recall knowledge among third, fourth and final year students may be because final year teaching schedules include less number of classroom lectures and more hospital rotation within various disciplines, where they may not frequently come across diabetic patients.

The initial diagnostic test for Gestational DM was known to only 29% of final year students in the current study. Another Father Muller Medical College study reported a slightly higher frequency 55% of final years admitting this knowledge[18]. A low number of medical students identifying the initial diagnostic test for Gestational DM can be explained by a decreased frequency of rotations of final year participants into the Obstetrics unit outpatient department of the teaching hospitals.

Majority of the students i.e. 84%, 97%, and 94% from third, fourth and final year respectively knew the preventive measures for DM (regular exercise). This is comparably higher than 64.1% medical students of Jordan who considered exercise to be a good preventive measure for DM[22].

Moreover, in the current study, knowledge of DM diagnostics among final year students was comparatively lower than the 3rd or 4th year participants. This variable clinical knowledge of students, especially final years, may be attributed to gaps in medical education as well as non-revision of clinical literature. The other possible cause could be only one rotation in the diabetic clinic for one-month duration within the span of three clinical years.

To the best of our knowledge, this study is the first effort in a public sector medical university of Karachi to identify undergraduate medical students' knowledge regarding DM. As future house officers or residents, these students will be the earliest caregivers in OPD and emergency units of hospitals. Their adequate knowledge in accurately assessing and managing DM patients will greatly contribute to decrease morbidity and mortality as well as in preventing Diabetes Mellitus.

CONCLUSION

We conclude that the overall knowledge of undergraduate medical students of Sindh Medical College regarding DM, site of insulin production, its risk factors, complications and prevention was found to be satisfactory. Most of the students considered Medical Education as an adequate source of their knowledge in this regard. However, capability of diagnosing DM was found to be comparatively low among final year M.B.B.S. students.

Recommendations

The knowledge of final year students regarding DM can be improved by revision of the class room course and practical implication of this knowledge by rotating the students more frequently in a diabetic care clinic.

Limitations

This was a uni-center analysis. Self-reported responses and questionnaire-based survey also are limitations of the current study.

Conflict of Interest: The authors declare that they have no conflict of interest.

Authors' Contribution: VK planned the study, did literature review and made questionnaire of the study, SR did analysis, wrote the manuscript and submitted the study, NJ was the Research Supervisor of this study and proofread the manuscript of the study, NA conducted the whole survey of the study, entered the data in SPSS and helped in analysis of the study. KA and MA proofread the manuscript and made minor changes in it.

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