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The Knowledge and Awareness Towards Diabetes Mellitus, Among Undergraduate Medical Students

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Abstract

The prevalence of diabetes mellitus in Malaysia has become a growing concern in recent years. A contributing factor to the rise in the number of diabetics would be the lack of knowledge and awareness of the population towards diabetes. Hence, we conducted a study aimed at assessing the knowledge and awareness towards diabetes mellitus amongst Malaysian undergraduate medical students. A cross-sectional study was conducted from June to July 2020 amongst students of the Malaysian campuses of MMMC, and purposive sampling was used to enrol them into our study. The data was collected using an online administered questionnaire comprised of open and close ended as well as multiple-choice questions. The questionnaire consisted of 3 parts: sociodemographic information, awareness, and knowledge towards diabetes. The data was then calculated using statistical tests such as ANOVA and unpaired T-test using the Epi Info software. 183 students of MMMC took part in this study. 33.88%, 58.47% and 7.56% of students displayed good, moderate and poor knowledge respectively. In the attitude assessment, the participants scored a mean of 25.6 out of 30, indicating positive attitudes toward diabetes. In our study, significant association was found between age groups and knowledge. Those aged 25-27 scored highest knowledge percentage mean, followed by those aged 22-24, while those aged 19-21 had the lowest knowledge percentage mean. The fact that older participants had a more refined level of understanding of the disease was found to be the most likely reason for this. However, there were no significant association between gender, ethnicity, family history of diabetes and knowledge about the disease. There was significant association between family history and attitude towards diabetes. Those with family history of diabetes scored higher attitude percentage mean compared to those without. There was significant association between knowledge of diabetes and the students' attitudes towards it. Those who had better knowledge demonstrated higher attitude scores whereas students who had poor knowledge displayed the lowest attitude scores. However, there was no association between age, gender, ethnicity and attitudes towards diabetes. In conclusion, majority of the students of MMMC displayed knowledge and awareness of diabetes.

Keywords

Diabetes Mellitus, Knowledge, Attitude, Cross-Sectional, Medical Students

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1. Introduction

Diabetes mellitus is a metabolic disorder characterised by impaired insulin secretion and varying severities of peripheral insulin resistance [1] This results in chronic hyperglycaemia, and is associated with dysfunction, long term damage, and eventual failure of multiple organs [2], specifically the eyes (diabetic retinopathy) [3], kidneys (diabetic nephropathy) [4], nerves (diabetic neuropathy) [5], heart (cardiovascular disease), and blood vessels (peripheral vascular disease, stroke, coronary artery disease) [6].

Diabetes mellitus is classified into 4 major types: type 1(T1DM), type 2 (T2DM), gestational diabetes (GDM), and the most critical state being diabetic hyperglycaemic crises. [1] Type 1 diabetes is an autoimmune illness that occurs due

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to destruction of B-cells of the pancreas, leading to an absolute deficiency of insulin. [7, 8] Triggers for this autoimmunity include genetic susceptibility, viral infection, toxins, and occasionally dietary factors. [9] Type 2 diabetes, the leading type of diabetes in South East Asia [10] is a progressive illness frequently associated with insulin resistance and is due to a gradual decline in adequate insulin secretion by B-cells. [7] In the past, T2DM was mostly prevalent in individuals over 45. However, currently there is an increasing number of adolescents and young adults being diagnosed with type 2 diabetes mellitus due to the rising proportion of obese individuals which can be attributed to a lack of physical activity and calorie rich diets. [9] Gestational diabetes mellitus is a common complication of pregnancy that typically presents itself during the second and third trimesters. [11] During a normal pregnancy, gradual insulin resistance develops in the second trimester, and is exacerbated in the third trimester due to the secretion of hormones and adipokines such as oestrogen, progesterone, cortisol as well as tumour necrosis factor (TNF)-α and human placental lactogen. [12] Diabetic hyperglycaemia crises include diabetic ketoacidosis (DKA) and hyperglycaemic hyperosmolar state (HHS). Both these conditions are life threatening medical emergencies, and they are a serious complication of poorly controlled type 1 and 2 diabetes. [13]

In the 21st century, diabetes mellitus proves to be a public health concern on the rise. The global diabetic population in 2009 was estimated to be 285 million [14], rising to 366 million in just 2 years by 2011 [15], and further increasing to 382 million, then to 415 million and to 425 million in 2013, 2015 and 2017 respectively. [16, 17, 18] In 2019, it was reported that there was an approximate total of 463 million diabetics, constituting 9.3% of the global population aged 20 to 79. [19] This figure is projected to escalate by 10.2% to an estimated 578 million in 2030, followed by an increase of 10.9%- putting the estimated global diabetic population at 700 million in 2045, if current trends continue. [20] A decade ago, the projected global diabetic population for 2025 was 438 million. In 2019 with little over five years to go, the current number of people living with diabetes has already exceeded this 2010 prediction by 25 million. [19]

In the developing nations of South East Asia, diabetes mellitus is a growing concern with an estimated diabetic population of 87.6 million adults aged 20 to 79 in 2019. [19] Currently, the Middle East and North Africa Region (MENA) comprises the highest global age-adjusted percentage of diabetics [21], but by 2025, South East Asia will possess the largest prevalence of diabetics, at 13.5% with 145 million individuals [22].

According to the National Health and Morbidity Survey (NHMS) Malaysia, the preponderance of diabetes-specifically type 2 diabetes mellitus, among Malaysians aged 18 and above has increased by 31% in only 5 years, from 11.6% in 2006 [23] to 15.2% in 2011 [24], to a staggering 17.5% in 2015 [25] and as of 2019 there are approximately 3.9 million diabetics residing in Malaysia [26]. Furthermore, the prevalence of undiagnosed diabetes has doubled in the span of 9 years, from 4.5% in 2006 [27] to 9.2% in 2015 [25]. This alarming trend will see almost 1 in 3 people suffering from diabetes in 2025, and has medical professionals as well as public policy makers concerned for its heavy economic burden on the healthcare system. [28]

As aforementioned, diabetes mellitus is a growing problem in Malaysia and had impacted lives of many citizens. As shown in a previous study conducted among Type 2 Diabetes Mellitus patients in Kuala Muda district, Malaysia, more than half of the participants were found to be just above the cut-off points for poor knowledge, attitude and practice. [29] Their attitude and knowledge on diabetes mellitus are found to be much associated with academic qualifications, followed by other factors such as age, occupation, monthly income, etc. [29] The Second National Health and Morbidity survey shows that in the year 2010, over 3.4 million citizens are diagnosed by diabetes and this takes up 11.8% of the total population [30]. Same study revealed that prevalence of diabetes is more common among the young Malaysians, attributable to their lack of knowledge and awareness towards diabetes mellitus. [30] The awareness on diabetes mellitus can play a critical role in someone's life. This may allow early diagnosis, the right treatment and can also prevent complications [30]. A similar study done in 2017, had a result of more than 48.1% of respondents scored 75% of total knowledge on diabetes and was affirmed to associate with low prevalence of diabetes mellitus among the population being studied. [31]

Medical students being the future pillars of our health care system, should also be well aware about diabetes mellitus. Concerning the fact that medical students are to be graduated as primary healthcare providers, they bear great responsibilities particularly to these diabetic patients. The awareness and knowledge in diabetes mellitus thus play an important role. Educating one's self with knowledge and multiple ways to manage Diabetes Mellitus can help prevent complications and also provide better management. A study carried out by Adichunchanagiri Institute of Medical Sciences (AIMS), in February 2017, showed that most of the final year students and interns were aware about the classical symptoms of diabetes (73.33% and 84% respectively) [32]. Interns (76%) had better knowledge regarding the fluid replacement in the management of Diabetic Ketoacidosis in compared to final year students (41.33%) [32]. Similar study conducted in Saudi Arabia, on the knowledge of diabetes

mellitus on medical students showed that 85.5% of medical students had knowledge on diabetes [21]. Regarding the awareness that diabetes is a condition of high blood sugar, 94.2% of the respondents knew that and knowledge was the same from medical (95.4%) and nonmedical students (92.9%) [21]. As what both studies had revealed, medical students show a satisfactory amount of knowledge about diabetes mellitus.

It is important to assess the awareness of people regarding diabetes and their practices about the disease so that a comprehensive education program may be designed to give awareness to the diabetic patient and contribute towards reduction of the complication of the disease. [33] Interventions at the level of pre-diabetic have a proven, cost effective value. However, these benefits can only be achieved if healthcare providers have adequate knowledge and evidence-based information for identification and management of pre-diabetes. [34] Prediabetes means your blood glucose levels are higher than normal, yet still lower than the blood glucose level to be called as diabetic. Whilst a supportive public health framework is desirable, individuals need to be engaged in promoting their own health. Family practitioners can provide information and advise that will improve individuals understanding of the consequences of poor lifestyle choices and help them to make health-enhancing decisions. [35] It is crucial to consider the role of preventive medicine because of the massive financial burden posed by chronic diseases such as diabetes for a developing country. Any intervention for pre-diabetes at the level of both the healthcare personnel and community requires an initial assessment to understand the magnitude of the problem. [34]

Therefore, this study is conducted mainly to assess and evaluate the attitude and knowledge of diabetes mellitus among undergraduate medical students of MMMC, in an expectation to contribute to raise awareness and improve their general knowledge on this disease. More specifically, we would aim to assess attitude of students on diabetes mellitus, including aspects like how would they react and handle the situations and also whether are they aware of what are the do's and don'ts in case of a diabetic. Apart from that, by conducting this study, we hope to improve the students' general knowledge on diabetes, particularly from the viewpoint as a medical undergraduate student. Rest assured, they bear a great responsibility and will contribute to the maintenance of good life quality of diabetic patients in the future especially when they graduate as healthcare workers in the future. With this being said, assessment of the students' general knowledge on diabetes mellitus is important as such to allow concerned parties to intervene and take proper initiatives whenever the outcome is less satisfactory, thus allowing adequate improvement at times. As the saying goes "Prevention is better than cure".

2. Methods

2.1. Study Design, Setting, Time and Population

A cross-sectional study was conducted from June 2020 to July 2020 in our college, Melaka Manipal Medical College (MMMC), Malaysia. Our college has two campuses; one is based in Muar, Johor and another based in Bukit Baru, Malacca, in which Muar campus offers Bachelor of Medicine and Surgery (MBBS) semester 6 and 7: whereas Malacca Campus offers semesters 8, 9 and 10 of similar course, MBBS, also offered in Malacca campus are Bachelor of Dental Surgery (BDS), dedicated for students from semester 6 to 10. The study was aimed to evaluate the knowledge and attitude of MMMC clinical years students (inclusive of both MBBS and BDS students) towards diabetes mellitus, and therefore a study population of 883 students from MMMC was selected.

2.2. Sample Size

Based on a previous study done in Chennai, India, [40] 75.5% of the whole population reported that they knew about the condition called Diabetes Mellitus. With the formula application software "Epi Info" version 7.2.3.1, the sample size (n) is calculated as below: -

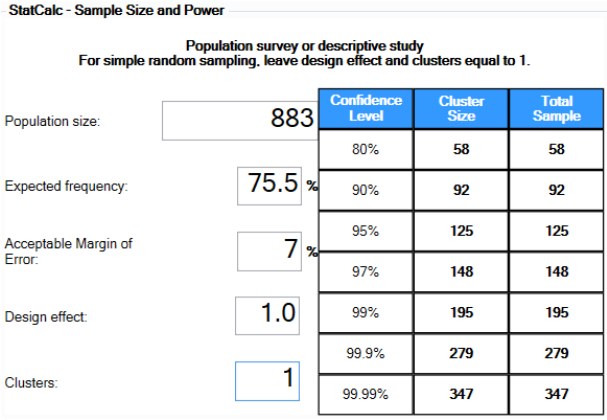

Figure 1. Sample Size Calculation.

The minimum sample size required was 125.

Upon further calculation of sample size (n) using the formula application software "Epi Info" version 7.2.3.1, we then chose to allow non-response of 30% and the calculation is as of below:

$$\text{n(final)} = \frac{\text{n(calculated)}}{1-(non-response)} = \frac{125}{1-0.3} = 178.6 = 179$$

Non-response = 30%

The final sample size obtained for this study was 179.

2.3. Sampling

Purposive sampling was used as the sampling method while conducting the study, which is a non-probability sampling method.

Inclusive criteria of this study were 1) MMMC clinical year undergraduate students from MBBS or BDS 2) voluntarily agreed to participate in this study and 3) the questionnaires must be completed to be considered valid for the research after they filled up the consent form. Meanwhile, exclusive criteria were 1) students who do not wish to participate in the study and 2) incomplete questionnaire.

2.4. Data Collection

The data was collected by the distribution of questionnaires via a Google form link to eligible undergraduate students in Melaka Manipal Medical College (MMMC). Students were advised to spend a duration of 15 to 20 minutes to read the participant information and voluntarily participate in the study and complete the informed consent and the questionnaire.

This study investigates the association between the independent and dependent variables. Independent variables of this study were age, gender, ethnicity knowledge of diabetes, family history of diabetes and knowledge of students on diabetes mellitus. Dependent variables were knowledge and attitude of students towards diabetes mellitus. Data were collected using an online-administered questionnaire, designed in English consisting of open-ended, close-ended and multiple-choice questions. The survey items were formulated based on previously published articles. [36-38]

The questionnaire was divided into 3 parts, namely 1) demographic profile, 2) attitude towards diabetes mellitus, and 3) knowledge of diabetes mellitus.

In Part 1, the participants were required to fill up their demographic information such as age, gender, ethnicity and batch of the participants.

In Part 2, the participants were enquired about their attitude towards diabetes mellitus. This part includes questions such as "I do not mind if others know that I have diabetes mellitus", "do you think you should be examined for diabetes mellitus?", "I have family members/ relatives who are diabetic", etc. The participants are to answer whether they strongly agree, agree, neutral, disagree, or strongly disagree to the statements given.

In Part 3, the questions were targeted towards the general knowledge of participants towards diabetes mellitus. This part consists a total of 20 statements and questions. Examples were "Diabetes mellitus is a medical condition caused by elevated blood glucose level beyond the normal range.", "Incidence of diabetes mellitus is increasing nowadays.", "Diabetes mellitus is a contagious medical disease.", "Diabetes mellitus can be cured." etc. For each of these statements, participants are given a choice of "True" or "False". "True" answer was given a score of 1, and for every "False" answer, a score of 0. Apart from that, some multiple-choice questions were also included, for example "Which of the following are the risk factors of diabetes mellitus?", "Which of the following are the symptoms of diabetes mellitus?", etc. These questions are designated as open-ended questions and participants are allowed to register more than one answers for these. Meanwhile, some questions such as "The most comments type of diabetes mellitus being encountered in clinics", "normal fasting blood glucose level", etc, participants are allowed to only choose one best single response for these questions. Apart from that, questions to assess the participants' awareness on general practice for a diabetic were also asked, such as things a diabetic should do and should not do. Participants are allowed to register multiple responses for these two questions.

Upon assessing the knowledge on diabetes mellitus among undergraduate students of Melaka Manipal Medical College, a scoring system was used, in which 1 point was granted for whichever correct response was registered; 0 for incorrect response. Therefore, a total of 45 points were allocated for knowledge part. Out of 45 points, the total scores obtained by each participant were converted into per 100 percentage then categorised into 3 categories, namely 'High', 'Moderate' and 'Low' based on total scoring percentage. On the other hand, attitude was assessed using 6 questions and scorings were done based on 5-Points Likert Scale. Therefore, a total maximum of 30 points and minimum of 6 points could be obtained.

2.5. Data Processing & Data Analysis

The data collected from our distributed Google Form was processed using Microsoft Excel. The obtained data was then statistically analysed using Epi Info version 7.2.3.1

In this study, qualitative data such as gender, ethnicity and batch were analysed to derive frequency and percentage. For quantitative data like age and questions about attitude and knowledge were analysed to derive mean, median and range. Standard deviation (SD) was then calculated from mean. The level of significance was set at $p = 0.05$.

Table 1. Statistical test used for data analysis.

Independent variable	Dependant variable	Statistical test
Age	Knowledge on Diabetes Mellitus	ANOVA
Gender	Knowledge on Diabetes Mellitus	Unpaired T test
Ethnicity	Knowledge on Diabetes Mellitus	ANOVA
Family History of diabetes mellitus	Knowledge on Diabetes Mellitus	Unpaired T test

Independent variable	Dependant variable	Statistical test
Age	Attitude towards diabetes mellitus	ANOVA
Gender	Attitude towards diabetes mellitus	Unpaired T test
Ethnicity	Attitude towards diabetes mellitus	ANOVA
Family History of Diabetes Mellitus	Attitude towards diabetes mellitus	Unpaired T test
Knowledge on Diabetes Mellitus	Attitude towards diabetes mellitus	ANOVA

2.6. Ethical Consideration

Participants were made aware that entering the research study was completely voluntary. Written informed consent was taken from each participant and we explained that they were able to withdraw from the study at any time without any given reason. All information obtained was kept anonymous and confidentiality was maintained. This research was approved by the Research Ethics Committee, Faculty of Medicine, Melaka-Manipal Medical College, Malaysia.

3. Results

Table 2. Sociodemographic profile of the undergraduate medical and dental students of Melaka Manipal Medical College. (n=183).

Variables	n (%)
Age	
19-21	46 (25.14%)
22-24	122 (66.67%)
25-27	15 (8.20%)
Mean (SD)	22.37 (1.47)
Minimum - Maximum	19.0 - 27.0
Gender	
Male	56 (30.60%)
Female	127 (69.40%)
Ethnicity	
Chinese	75 (40.98%)
Indian	56 (30.60%)
Malay	30 (16.39%)
Others	22 (12.02%)
Program	
MBBS	124 (67.76%)
BDS	59 (32.24%)
Family history of diabetes mellitus	
Yes	152 (83.06%)
No	31 (16.94%)

Table 2 shows the frequency and percentage of different variables such as age, gender, ethnicity, programmes, and presence of family history of diabetes mellitus among the undergraduate students of Melaka Manipal Medical College (MMMC). A questionnaire consisting of 27 questions were distributed to the students of MMMC and a total of 183 responses were collected. Out of the 183 responses, 122 (66.67%) of them were between the age of 22-24 years old, followed by 46 (25.14%) responses from participants between 19-21 years old and finally 15 (8.20%) participants from age group of 25-27. 127 (69.40%) of the responses were from females while the remaining 56 (30.60%) were from males.

The questionnaire was also distributed to many different ethnicities. We received the most responses from Chinese, 75 (40.98%). This was then followed by 56 (30.60%) responses from Indians, 30 (16.39%) responses from Malays, and finally 22 (12.02%) responses from other ethnic groups. We had also distributed the questionnaire to students from both medical (MBBS) and dental (BDS) courses in Melaka Manipal Medical College. Majority responses were collected from MBBS, which was a number of 124 (67.76%) responses and remaining from BDS, 59 (32.24%) responses. Out of the 183 participants, 152 (83.06%) of them reported presence of family history of diabetes mellitus while the remaining 31 (16.94%) denied it.

Table 3. Correct response about knowledge towards diabetes mellitus, among undergraduate medical students of Melaka Manipal Medical College.

Questions	Correct answer n (%)
Diabetes mellitus is a medical condition caused by elevated blood glucose level beyond the normal range (True)	178 (97.8%)
Incidence of diabetes mellitus is increasing nowadays. (True)	182 (99.5%)
Diabetes mellitus is contagious medical disease. (False)	179 (97.8%)
Diabetes mellitus can be cured. (False)	127 (69.4%)
Which of the following are the risk factors of diabetes mellitus?	
a) Obesity	183 (100%)
b) Family history of diabetes	181 (98.9%)
c) Excessive sugar intake	168 (91.8%)
d) Lack of physical exercises	162 (88.5%)
e) Age (>40y/o)	142 (77.6%)
f) Pregnancy	124 (67.8%)
Commonest type of diabetes mellitus encountered is: (Type 2 Diabetes Mellitus)	164 (90.1%)
Type 1 Diabetes Mellitus is caused by: (Insulin deficiency)	124 (68.9%)
Type 2 Diabetes Mellitus is caused by: (Insulin dysfunction)	126 (69.2%)
Which of the following are the symptoms of diabetes mellitus?	
a) Excessive thirst (polydipsia)	183 (100%)
b) Frequent urination (polyuria)	178 (97.3%)
c) Slow healing of cuts and wounds	155 (84.7%)
d) Tiredness and weakness	122 (66.7%)
e) Blurred vision	116 (63.4%)
f) Weight loss despite normal appetite	91 (49.7%)
Which of the following are the complications of diabetes mellitus?	
a) Decaying limbs (Necrotic limbs) that requires surgical removal (amputation)	165 (90.2%)
b) Eye problems	165 (90.2%)
c) Kidney problems	164 (89.6%)
d) Loss of sensation in arms and legs	140 (76.5%)
e) Heart problems	105 (57.4%)
f) High blood pressure	89 (48.6%)
g) Skin problems	85 (46.4%)
What is the normal random blood glucose level? (7.8 – 11.1 mmol/L)	76 (42%)
What is the normal fasting blood glucose level? (4.0 - 6.0 mmol/L)	141 (77.5%)
What is the normal post-prandial blood glucose level (after meal)? (4.4 – 8.5 mmol/L)	34 (18.8%)
Tablets and capsules are available for treatment of diabetes mellitus. (True)	153 (83.6%)
Insulin injection is a must for all cases of diabetes	160 (87.4%)

Questions	Correct answer n (%)
mellitus. (False)	
Diabetes mellitus can be controlled by diet restrictions. (True)	179 (97.8%)
Diabetes mellitus can be controlled by increasing physical activities or exercises. (True)	171 (93.4%)
Controlling of diabetes mellitus is by measurement of HBA_1C. (True)	156 (85.2%)
Which of the following should not be done by known diabetics?	
a) Skip meals	150 (82.4%)
b) Drinking alcohol	139 (76.4%)
c) Wear tight shoes	109 (59.9%)
Which of the following should be done by known diabetic?	
a) Regular Blood Sugar Profile (BSP) assessment	177 (96.7%)
b) Maintain good weight control	172 (94.0%)
c) Exercise regularly	170 (92.9%)
d) Perform regular body check-up	165 (90.2%)
e) Care for their foot and toes	153 (83.6%)
f) Perform regular eye check-up	142 (77.6%)
g) Carry sweets when they are out	120 (65.6%)
h) Low fat, high fibre diet	118 (64.5%)

Table 3 shows the correct responses for each question asked on assessing knowledge towards diabetes mellitus among the undergraduate students of Melaka Manipal Medical College. Also included are the frequencies of participants who had attempted correctly. There were 20 questions in this section, mainly consisting of multiple true-false and multiple-choice questions.

Majority of the students, 178 (97.8%) had agreed that Diabetes Mellitus is due to elevated glucose level beyond the normal range. For question on whether incidence of diabetes mellitus is increasing nowadays, 182 (99.5%) participants had attempted correctly. Next question was on whether diabetes mellitus is a contagious disease, 179 (97.8%) participants got it correct; similarly, when participants were asked if diabetes mellitus can be cured, 127 (69.4%) participants agreed that the statement was false. We included a question to assess if participants are aware of the risk factors of diabetes mellitus and participants were given multiple choices. 183 (100%) of the participants agreed that obesity is one of the risk factors, 181 (98.9%) for family history of diabetes mellitus, 168 (91.8%) for excessive sugar intake, 162 (88.5%) for lack of physical exercise, 142 (77.6%) for age more than 40 years and only 124 (67.8%) of them agreed that pregnancy could be a risk factor. For the commonest type of diabetes mellitus encountered, 164 (90.1%) made the correct attempt and chose Type 2 diabetes mellitus. For the cause of type I diabetes mellitus, 124 (68.9%) answered correctly where they had opted for 'Insulin deficiency'; for the cause of type II diabetes mellitus, 126 (69.2%) answered 'insulin dysfunction' correctly.

Another question was asked to assess if the participants were aware of the several symptoms of diabetes mellitus. Once again, participants were given a choice to pick more than one option. We received 183 (100%) response that excessive thirst is one of the symptoms, 178 (97.3%) for frequent urination, 155 (84.7%) for slow healing of wounds and cuts, 122 (66.7%) for tiredness and weakness, 116 (63.4%) for blurred vision and only 91 (49.7%) picked weight loss despite normal appetite as a symptom. Next, a question was given to assess if participants were aware of the possible complications of diabetes mellitus. Out of 183 responses, 165 (90.2%) participants knew that diabetes mellitus can complicate into decaying limbs (Necrotic limbs) that requires surgical removal (amputation). Similarly, 165 (90.2%) participants were aware that eye problems can occur as complication of diabetes mellitus. This is then followed by 164 (89.6%) participants ticked the option of 'Kidney problems' and 140 (76.5%) participants agreed that loss of sensations in arms and legs is one of the complications of diabetes mellitus. 89 (48.6%) participants knew that high blood pressure can occur due to diabetes mellitus and lastly only 85 (46.4%) participants were aware that diabetes mellitus can complicate into skin problems. For the normal random blood glucose level (7.8 – 11.1 mmol/L), 76 (42%) responded with the right answer. For normal fasting blood glucose level (4.0 - 6.0 mmol/L), 141 (77.5%) attempted correctly and only 34 (18.8%) participants answered correctly for the post prandial blood glucose level (4.4 - 8.5 mmol/L).

153 (83.6%) participants agreed that tablets and capsules are available for treatment of diabetes mellitus; 160 (87.4%) disagreed that insulin injection is a must for all cases of diabetes mellitus. Next question assessed on participants' knowledge whether diabetes mellitus can be controlled by diet restrictions, 179 (97.8%) agreed to the statement. 171 (93.4%) participants agreed on the next statement on diabetes mellitus can be controlled by increasing physical activities or exercises. Then the next question was on whether the controlling of diabetes mellitus is done by measurement of HBA_1C, 156 (85.2%) participants agreed to the statement. Additionally, participants were assessed using 2 multiple-choice questions whether they are aware of what should be and not be done by a diabetic. 150 (82.4%) participants were aware that known diabetics should not skip meals whereas 139 (76.4%) were aware that diabetics should not drink alcohol and only 109 (59.9%) of participants knew that diabetic patients should not be wearing tight shoes. Then they were asked on what a diabetic should do, 177 (96.7%) agreed that regular Blood Sugar Profile (BSP) assessment has to be done, 172 (94.0%) picked the option 'maintain good weight control', 170 (92.9%) agreed that diabetics should exercise regularly, 165 (90.2%) opted for performing regular body check-up, 153 (83.6%) thought diabetics should properly care for their foot and toes, 142 (77.6%) participants agreed that diabetics should perform regular eye check-up, 120 (65.6%) for carrying sweets when they are out, and 118 (64.5%) for low fat, high fibre diet.

Table 4. Attitudes towards diabetes mellitus (individual item) among undergraduate medical students of Melaka Manipal Medical College.

Items	Strongly agree n (%)	Agree n (%)	Neutral n (%)	Disagree n (%)	Strongly disagree n (%)
I do not mind if others know that I have diabetes mellitus.	50 (27.32%)	74 (40.44%)	41 (22.40%)	12 (6.56%)	6 (3.28%)
Do you think you should be examined/screened for diabetes mellitus?	74 (40.44%)	85 (46.45%)	19 (10.38%)	5 (2.73%)	0 (0.00%)
Do you think your family members should be examined/screened for diabetes mellitus?	111 (60.66%)	59 (32.24%)	10 (5.46%)	3 (1.64%)	0 (0.00%)
Do you think support from family and friends is important in helping a diabetic patient in dealing with diabetes mellitus?	131 (71.58%)	44 (24.04%)	7 (3.83%)	1 (0.55%)	0 (0.00%)
Do you think diabetes mellitus seriously affects daily activities?	46 (25.27%)	88 (48.35%)	34 (18.68%)	10 (5.49%)	4 (2.20%)
Do you think complications of diabetes mellitus can be prevented if blood glucose level is well controlled?	99 (54.10%)	74 (40.44%)	8 (4.37%)	2 (1.09%)	0 (0.00%)

Table 4 shows the data collected on the attitude towards diabetes mellitus among undergraduate students of Melaka Manipal Medical College. A 5-points Likert scale was given, ranging from strongly agree, agree, neutral, disagree to strongly disagree. The first statement was 'I do not mind if others know that I have diabetes mellitus.', 50 students with a percentage of 27.31% strongly agreed, 74 students with a percentage of 40.44% agreed, 41 students with a percentage of 22.40% feeling neutral towards the statement, 12 students with a percentage of 6.56% disagreed and 6 students with a percentage of 3.28% strongly disagreed to the statement.

When asked if they should be examined or screened for diabetes, 74 (40.44%) participants strongly agreed, 85 (46.45%) students agreed, 19 (10.38%) feeling neutral towards the statement, 5 (2.73%) students disagreed with the statement and none had strongly disagreed to the same. For the item 'Do you think your family members should be examined/screened for diabetes mellitus?', 111 students with a percentage of 60.66% strongly agreed, 59 students with a percentage of 32.24% agreed, 10 students with a percentage of 5.46% disagreed and also no one opted for 'strongly disagree'. Next statement was 'Do you think support from family and friends is important in helping a diabetic patient in dealing with diabetes mellitus?', 131 students with a percentage of 71.58% strongly agreed to the statement, 44 students with a percentage of 24.04% agreed, 7 students with a percentage of 3.83% opted neutral, only 1 student with a percentage of 0.55% disagree and none opted for 'strongly disagree'.

When asked on 'Do you think diabetes mellitus seriously affects daily activities?', 46 students with a percentage of 25.27% strongly agreed, 88 students with a percentage of 48.35% agreed, 34 students with a percentage of 18.68% were neutral, 10 students with a percentage of 5.49% disagreed and 4 students with a percentage of 2.20% strongly disagreed to this item. Next up was the item 'Do you think complications of diabetes mellitus can be prevented if blood glucose level is well controlled?', 99 students with a percentage of 54.10% strongly agreed, 74 students with a percentage of 40.44% agreed, 8 students with a percentage of 4.37% were neutral, 2 students with a percentage of 1.09% disagreed and again no one actually strongly disagreed to this item.

Table 5. Knowledge and attitudes towards diabetes mellitus among undergraduate medical students of Melaka Manipal Medical College.

Variables.	n (%)
Knowledge (0-100)	
Good (>80%)	62 (33.88%)
Moderate (60% - 80%)	107 (58.47%)
Poor (<60%)	14 (7.65%)
Mean (SD)	74.68
Minimum-Maximum	40.4 – 91.5
Attitudes (6-30)	
Mean (SD)	25.60
Minimum-Maximum	18.0 – 30.0

Table 5 shows the mean scores of knowledge and attitude towards diabetes mellitus among undergraduate students of Melaka Manipal Medical Collage. The knowledge percentage was scaled from 0% to 100%. The knowledge percentage was divided into 3 parts, good knowledge which is above 80%, moderate knowledge which is from 60% to 80% and poor knowledge below 60%. 62 students (33.88%) have obtained good knowledge percentage followed by 107 students (58.47%) scored moderate and 14 students (7.65%) obtained poor knowledge category when their general knowledge on diabetes mellitus were being assessed. A mean score of 74.68 was obtained, indicating that students of Melaka Manipal Medical Collage have an average of moderate knowledge towards diabetes mellitus. The attitude towards diabetes mellitus among the same group of students were also assessed, ranging from a lowest possible score of 6 to highest possible score of 30. The students of our study managed to obtain a minimum score of 18 and maximum score of 30, in which the mean score obtained was 25.60.

Table 6. Association between age, gender, ethnicity, family history and knowledge towards diabetes mellitus among undergraduate medical students of Melaka Manipal Medical College.

Independent Variables	Knowledge Percentage Mean (SD)	Mean Difference (95% CI)	P Value
Age			
19-21	69.94 (9.61)		
22-24	75.67 (9.28)	-	<0.001
25-27	81.13 (7.87)		
Gender			
Male	76.7 (9.3)	-2.9 (-5.9, 0.2)	0.065
Female	73.8 (9.8)		
Ethnicity			
Chinese	74.75 (10.07)		
Indian	74.51 (10.15)	-	0.642
Malay	73.26 (9.85)		
Others	76.79 (7.19)		
Family History of Diabetes Mellitus			
Yes	74.65 (9.54)	0.16 (-3.63, 3.96)	0.933
No	74.81 (10.79)		

Table 6 shows the association between age, gender, ethnicity, family history and knowledge toward diabetes mellitus. Those who are aged between 19-21 have a mean knowledge percentage of 69.94 (SD=9.61) which is the lowest among the 3 different classes of age group. Meanwhile those who are aged 22-24 has obtained a mean percentage of 75.67 (SD=9.28) and the highest mean percentage was obtained by those students who are aged between 25-27 with a mean score of 81.13% (SD=7.87). The calculated P value was <0.001 which indicates that there is significant association between age and mean knowledge score.

As per gender variable is concerned, males obtained a mean score of 76.7% with a standard deviation of 9.3 while females obtained a mean of 73.8% with a standard deviation of 9.8. The mean difference of these two are -2.9 with 95% CI ranging from -5.9 to 0.2 and the calculated P value was 0.065, suggesting no significant association between gender and students' knowledge on diabetes mellitus. Apart from that, knowledge scores of the participants were also calculated with regards to their respective ethnicity. Highest among all, other ethnic groups obtained a mean score of 76.79% (SD 7.19), then Chinese generally obtained a mean score of 74.75% (SD 10.07), followed by Indians obtaining a mean of 74.51% with standard deviation of 10.15 and finally Malays with 73.26% (SD 9.85). The calculated P value was 0.642 which indicated no significant association between ethnicity and knowledge percentage score.

Finally, mean score knowledge on diabetes mellitus among the students were associated with the presence or absence of family history of diabetes. Those who have family history of diabetes mellitus obtained a mean knowledge score of 74.65% with standard deviation of 9.54; those who do not have family history of diabetes mellitus scored 74.81% with a standard deviation of 10.79. The mean difference was 0.16 with 95% CI ranging from -3.63 to 3.96. The P value of 0.933 indicating no significant association between family history of diabetes mellitus and knowledge percentage score about diabetes mellitus.

Table 7. Association between age, gender, ethnicity, family history, knowledge, and attitudes towards diabetes mellitus among undergraduate medical students of Melaka Manipal Medical College.

Independent Variables	Attitude Percentage Mean (SD)	Mean Difference (95% CI)	P Value
Age			
19-21	84.35 (6.51)		
22-24	85.41 (7.49)	-	0.318
25-27	87.56 (6.72)		
Gender			
Male	86.13 (6.44)	-1.17 (-3.45, 1.11)	0.313
Female	84.96 (7.51)		
Ethnicity			
Chinese	84.76 (7.93)		
Indian	84.46 (6.24)	-	0.207
Malay	86.56 (7.35)		
Others	87.73 (6.37)		
Family History of Diabetes Mellitus			
Yes	86.07 (6.74)	-4.46 (-7.19, -1.73)	0.002
No	81.61 (8.29)		
Knowledge Category			
Good	86.77 (6.72)		
Moderate	85.08 (7.08)	-	0.015
Poor	80.71 (8.49)		

Table 7 shows the association between age, gender, ethnicity, family history, knowledge, and attitude toward diabetes mellitus among undergraduate students of Melaka Manipal Medical College. Those who are aged between 25-27 scored the highest attitude percentage with a mean of 87.56% (SD=6.72), followed by a mean score of 85.41% (SD=7.49) obtained by those who are aged between 22-24 and finally the least attitude score was obtained by those who are aged between 19-21 which was 84.35% with a standard deviation of 6.51. The P value was 0.318 which indicated no significant association between age and attitude percentage score.

As per gender variable is concerned, males generally had obtained a mean score of 86.13% with a standard deviation of 6.44 while females obtained a mean of 84.96% with a standard deviation of 7.51. The mean difference of these two are -1.17 with 95% CI ranging from -3.45 to 1.11 and the calculated P value was 0.313 equivalent to no significant association between gender and attitude score. Chinese participants scored a mean score of 84.76% (SD 7.93), mean score for Indians was 84.46% with standard deviation of 6.24 then followed by Malays with 86.56% (SD 7.35) and participants from other ethnic groups scored a mean score of 87.73% (SD 6.37). The calculated P value was 0.207 which indicated no significant association between ethnicity and attitude percentage score.

From the aspect of family history of diabetes per se, those with family history of diabetes mellitus obtained an attitude score of 86.07% with a standard deviation of 6.74; meanwhile those

without family history of diabetes mellitus scored 81.61% with a standard deviation of 8.29. The mean difference was -4.46 with 95% CI ranging from -7.19 to -1.73. The P value of 0.002 which was less than 0.05 indicating there was significant association between family history of diabetes mellitus and attitude percentage score. Finally, those who have good knowledge on diabetes mellitus scored a mean score of 86.77% (SD=6.72) followed by moderate knowledge with a mean of 85.08% (SD=7.08) and poor knowledge 80.71% (SD=8.49). The P value of 0.015 which was less than 0.05 indicating there was significant association between knowledge and attitude towards diabetes mellitus.

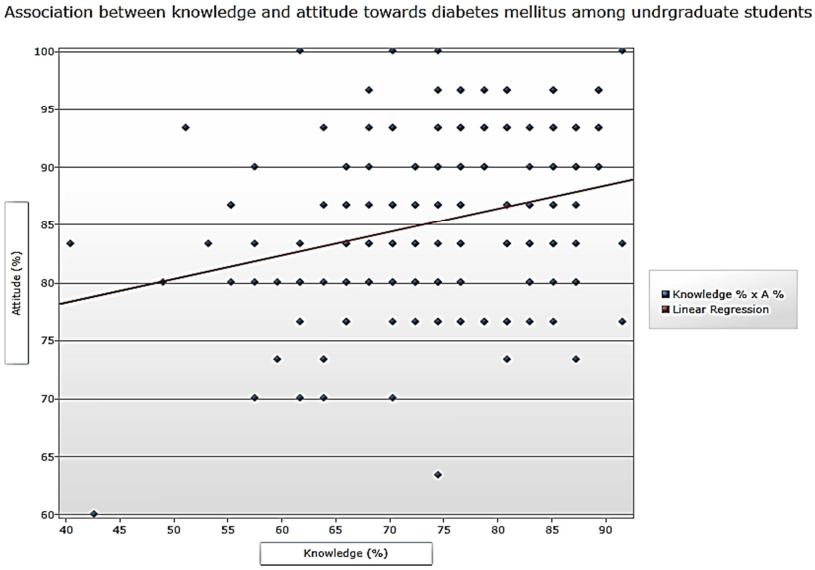

Figure 2. Association between knowledge and attitudes towards diabetes mellitus among undergraduate medical students of Melaka Manipal Medical College.

Coefficient regression = 0.21
Interpretation: 1% increase in knowledge scoring percentage is equivalent to 0.21% increase in attitude scoring percentage.
P-value = < 0.001

With this regard, there is positive association between knowledge and attitude scoring percentage. 1% increase in knowledge scoring percentage is equivalent to 0.21% increase in attitude scoring percentage. Since P-value = < 0.05, the association is statistically significant.

Table 8. Association between knowledge and attitudes towards diabetes mellitus among undergraduate medical students of MMMC.

	Attitude (b)	P value
Knowledge	0.21	<0.001

b = Regression coefficient

Table 8 shows the association between knowledge and attitude towards diabetes mellitus among undergraduate medical students of Melaka Manipal Medical Collage. Mean attitude percentages were calculated to score a regression coefficient of 0.21 which means 1% increase in knowledge scoring percentage is equivalent to 0.21% increase in attitude scoring percentage. Since p value is < 0.001, the association is statistically significant.

4. Discussion

With the rising prevalence of diabetes mellitus in the Malaysian population [19], it is imperative for medical students as future luminaries of the Malaysian healthcare scene to be well educated and dutifully informed about this disease [32]. This cross-sectional study was conducted amongst the undergraduate medical and dental students in Melaka Manipal Medical College of the Malaysian campuses. The aim of this study was to evaluate the students' knowledge about diabetes mellitus, to assess their attitude toward this disease, as well as to contribute to refining their general knowledge on diabetes from the outlook of a medical undergraduate.

In this study, 33.88% of the students displayed good knowledge, 58.47% had moderate knowledge, and just 7.65% had poor knowledge. It was found that a vast majority of the students exhibited proficient basic knowledge about this disease, as 97.8% of students knew the definition of diabetes mellitus, 99.5% were aware of its escalating incidence, 97.8% knew that it was not contagious, and 69.4% were aware that it is incurable. Similarly, in a descriptive cross-sectional study conducted among medical students of a Saudi Arabian university, 85.5% of participants displayed good knowledge about diabetes mellitus [21]. Another descriptive cross-sectional study done among health science students of Saudi Arabia and Jordan showed that 79% of students knew the definition of DM, and 68% were aware that it is a chronic disease. However, only 25% of Saudi

students and 34% of Jordanian students understood that insulin dysfunction was found in type 2 diabetes [50]. In our study, the students of Melaka Manipal Medical College displayed adequate knowledge of risk factors and symptoms of diabetes mellitus, with the exception of 50.3% of students answering incorrectly that diabetes does not feature weight loss despite normal appetite. A similar descriptive cross-sectional study in India done by the Adichunchanagiri Institute of Medical Sciences (AIMS), posited that 73.33% of the final year students and 84% of interns were aware of the classical symptoms of diabetes [32]. In 2019, a study done in Pakistan at Ziauddin University, Karachi showed that 50% of students expressed that weight loss despite normal appetite was a feature of diabetes mellitus [51].

As for the knowledge of MMMC students about the complications of diabetes, only 48.6% and 46.4% answered correctly that diabetes causes increased blood pressure and skin manifestations, respectively. The descriptive cross-sectional study done among medical students in Albaha University, Saudi Arabia displayed that 100% of medical students agreed that kidney problems, peripheral gangrene and loss of sensation were the most common diabetic complications, however just 57.9% were aware that complications also included eye, lipid and cardiovascular problems [21]. Furthermore, as for the normal blood glucose level ranges, a large majority (77.5%) of the students of MMMC answered correctly that the normal fasting blood glucose ranged from 4.0- 6.0 mmol/L. In contrast to that, 58% of the students answered incorrectly for the normal random blood glucose level range, and only 18.8% answered correctly for the normal post-prandial blood glucose indices. This finding is consistent with that of another descriptive cross-sectional survey done among final year medical students in a medical college in the Al Hasa region of Saudi Arabia, students had poor knowledge of the normal blood glucose values [52].

In the attitude assessment portion of the survey distributed to the students of MMMC, they scored a mean of 25.6 out of a total score of 30, showing that a vast majority of the participants had a positive attitude toward diabetes mellitus. Most students agreed that they and/or their family members should be screened for diabetes mellitus, that familial support is important in dealing with this disease, and that its complications can be controlled with vigilant monitoring of blood glucose levels. A descriptive cross-sectional survey done among final year medical students in a medical college in the Al Hasa region of Saudi Arabia reported similar findings, with 50% of students agreeing that diabetic complications should not be a concern so long as blood glucose indices are kept under control [52]. A cross-sectional study among the public from Jordan stated that 46.3% of participants had positive attitudes toward diabetes mellitus. This study further specified that no significant association could be established between attitudes toward diabetes and gender or marital status. However, more positive attitudes were recorded in those with a higher education level in the medical field [53].

Among students of Melaka Manipal Medical College, those with a family history of diabetes mellitus had a more positive attitude toward the disease than those without family history). The association between the family history of diabetes mellitus and their attitude towards this disease is found to be statistically significant. In contrast to this, a cross-sectional study held among university students in Ajman, United Arab Emirates stated that despite a high prevalence of family history of diabetes, the participants displayed a poor attitude towards the disease [54]. Apart from this, the students of MMMC who exhibited good knowledge also had the highest attitude score whereas students who had poor knowledge demonstrated the lowest attitude score. Like the aforementioned association, this is also found to be statistically significant. This finding is reflective of that of a cross-sectional study done among the public in Jordan, which states that knowledge of the participants toward diabetes can be significantly correlated with attitude. This means that the higher level of knowledge and understanding of diabetes is closely related to favourable attitudes [53]. In our study, the oldest participants (aged 25-27) had the highest knowledge percentage mean, of 81.3. This may have been due to the fact that older participants have a more refined level of understanding of the diabetes mellitus. However, a descriptive cross-sectional study done among health science students of Saudi Arabia and Jordan posited that a higher level of health education had a more significant association than age with increased knowledge of diabetes [50]. Meanwhile, our study found that there was no significant association between gender, ethnicity, family history of diabetes mellitus and knowledge about diabetes mellitus. Our study also revealed no significant association between age, gender, ethnicity, and attitudes toward diabetes mellitus.

There were limitations encountered during our study. To name a few, this study was conducted over a short period of 6 weeks, and it did not allow us to observe our participants over a longer duration. Besides, our study was a cross-sectional study, hence we were only able to observe the participants at one point in time. Therefore, we were unable to observe the effect of time and further health education on the changes in the participants' future knowledge as well as attitudes toward diabetes mellitus. Apart from that, this study was only held in one private medical institution, which may not reflect the findings of a larger study population hence these findings may not be representative of other settings.

Among the students of Melaka Manipal Medical College, it

was observed that participants of the older age category scored better in the knowledge portion of the survey because they had received more education about diabetes mellitus. Therefore, more extensive theoretical knowledge should be integrated into the education programs of the younger students in our college. Although the curriculum at our institution already includes some education on this disease, there should be further incorporation of today's diabetes statistics in our nation to raise awareness of the rampancy of this illness and the plight it bears on Malaysian society to better improve the students' knowledge and attitude towards diabetes mellitus. With relation to this, it was found from our study that those with better knowledge of diabetes mellitus tend to practice better attitude in coping with the same. As such, it highlighted the importance for concerned parties to implement more programmes and launch more extensive initiatives in educating the undergraduate medical students as well as the public, thus promoting more positive attitude towards diabetes mellitus among the students or even the general population.

5. Conclusion

Coming to a deduction, our study had revealed that the knowledge and attitude of the undergraduate medical and dental students of Melaka Manipal Medical College toward diabetes mellitus is found to be above satisfactory. The percentages of participants with good, moderate and poor knowledge were 33.88%, 58.47% and 7.65% respectively. The mean score for attitude towards diabetes mellitus among the samples was 25.6 out of a total 30. Significant correlation was found between a higher level of education and increased knowledge about diabetes. There appeared to be significant association between family history of diabetes with favourable attitude toward this disease. Also found was that students with a more refined level of knowledge and understanding about diabetes mellitus exhibited a positive attitude toward the disease. From this study it can be inferred that it is essential for medical students as future healthcare personnel to be well educated and wholly enlightened about the dire state of the prevalence of diabetes mellitus in Malaysia to curb the rise of this modern day plague to the society.

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Appendix

A Cross-sectional Study on The Knowledge and Awareness Towards Diabetes Mellitus, Among Undergraduate Medical Students of Melaka Manipal Medical College.

Principal investigator names:

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[1]MBBS students, Batch 41, Melaka Manipal Medical College

You are invited to take part in a research project which aims to determine the Knowledge and Attitude Towards Diabetes Mellitus Among Undergraduate Medical Students of Melaka Manipal Medical College. It will ask for basic information without breaking anonymity. It will ask you about knowledge and attitude towards Diabetes Mellitus without breaking anonymity. Data will be collected using a self-administered questionnaire and this will take about 15-20 minutes. Participation in this study is voluntary and you have the right to deny and/or withdraw from the study at any time, with no reason needed and this will not have a negative impact on you. *Any information you provide is anonymous*. Results of the study will be reported as a total picture and not individually.

Consent

I consent to participating in the study as titled above of my own free will. I further understand that I have the freedom to choose not to participate in the study. No reward or inducement has been offered to me to participate as a volunteer in the study.

Signature

Date
Thank you so much for your participation

Part I: Sociodemographic Information

1. Age (Years):

2. Gender:
   a. Male
   b. Female

3. Ethnicity:
   a. Malay
   b. Chinese
   c. Indian
   d. Others

4. Batch:
   a. BDS 7
   b. BDS 8
   c. BDS 9
   d. MBBS batch 37
   e. MBBS batch 38
   f. MBBS batch 39
   g. MBBS batch 40
   h. MBBS batch 41

5. I have family members / relatives who are diabetic.
   a. Yes
   b. No

Part 2: Awareness of Undergraduate Medical Students Towards Diabetes Mellitus

No	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	I do not mind if others know that I have diabetes mellitus.	1	2	3	4	5
2	Do you think you should be examined/screened for diabetes mellitus?	1	2	3	4	5
3	Do you think your family members should be examined/screened for diabetes mellitus?	1	2	3	4	5
4	Do you think support from family and friends is important in helping a diabetic patient in dealing with diabetes mellitus?	1	2	3	4	5
5	Do you think diabetes mellitus seriously affects daily activities?	1	2	3	4	5
6	Do you think complications of diabetes mellitus can be prevented if blood glucose level is well controlled?	1	2	3	4	5

Part 3: Knowledge of Undergraduate Medical Students Towards Diabetes Mellitus

1. Diabetes mellitus is a medical condition caused by elevated blood glucose level beyond the normal range → True / False

2. Incidence of diabetes mellitus is increasing nowadays. → True / False

3. Diabetes mellitus is contagious medical disease. → True / False

4. Diabetes mellitus can be cured → True / False

5. Which of the following are the risk factors of diabetes mellitus? (can choose more than one answer)
   a. Obesity
   b. Family history of diabetes
   c. Excessive sugar intake
   d. Age (> 40y/o)
   e. Mental stress
   f. Lack of physical exercises
   g. Pregnancy

6. Commonest type of diabetes mellitus encountered is:
   a. Type 1 diabetes mellitus
   b. Type 2 diabetes mellitus

7. Type 1 diabetes mellitus is caused by:
   a. Insulin deficiency
   b. Insulin dysfunction

8. Type 2 diabetes mellitus is caused by:
   a. Insulin deficiency
   b. Insulin dysfunction

9. Which of the following are the symptoms of diabetes mellitus? (can choose more than one answer)
   a. Excessive thirst (polydipsia)
   b. Weight loss despite normal appetite
   c. Frequent urination (polyuria)
   d. Blurred vision
   e. Headache
   f. Vertigo
   g. Slow healing of cuts and wounds
   h. Blood in urine (haematuria)
   i. Tiredness and weakness
   j. Flank pain

10. Which of the following are the complications of diabetes mellitus? (can choose more than one answer)
    a. Decaying limbs (necrotic limbs) that requires surgical removal (amputation)
    b. Eye problems
    c. Kidney problems
    d. Heart problems
    e. Skin problems
    f. Reproductive problems
    g. High blood pressure
    h. Loss of sensation in arms and legs

11. What is the normal random blood glucose level?
    a. 5.6 – 7.8 mmol/L
    b. 7.8 – 11.1 mmol/L
    c. 10.5 – 14.0 mmol/L

12. What is the normal fasting blood glucose level?
    a. 4.0 - 6.0 mmol/L
    b. 5.5 – 8.5 mmol/L
    c. 7.8 – 10.5 mmol/L

13. What is the normal post-prandial blood glucose level (after meal)?
    a. 7.8 – 11.1 mmol/L
    b. 4.4 – 8.5 mmol/L
    c. 6.5 – 10.5 mmol/L

14. Tablets and capsules are available for treatment of diabetes mellitus. → True / False

15. Insulin injection is a must for all cases of diabetes mellitus. → True / False

16. Diabetes mellitus can be controlled by diet restrictions. → True / False

17. Diabetes mellitus can be controlled by increasing physical activities or exercises. → True / False

18. Controlling of diabetes mellitus is by measurement of HBA_1C. → True / False

19. Which of the following should not be done by known diabetics? (Can choose more than one answer)
    a. Wear tight shoes
    b. Skip meals
    c. Blood donation
    d. Surgeries
    e. Drinking alcohol

20. Which of the following should be done by known diabetic? (Can choose more than one answer)
    a. Carry sweets when they are out
    b. Exercise regularly
    c. Self-prescribe insulin
    d. Low fat, high fibre diet
    e. Skip meals
    f. Care for their foot and toes
    g. Maintain good weight control
    h. Regular Blood Sugar Profile (BSP) assessment
    i. Perform regular eye check-up
    j. Perform regular body check-up

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