# Diabetes Mellitus among Selected Malaysian Population: A Cross-Sectional Study

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## ABSTRACT

***Background:*** *About 387 million diabetic patients have been reported in 2014 globally. Two million and half of them in Malaysia. However, the prevalence of diabetes in Malaysia is very high but there is a lack of information in the management of diabetes.* ***Aims:*** *The aim of this study was to determine the knowledge and attitude to diabetes mellitus and the relevant associated factors among Malaysian population.* ***Materials and Methods:*** *A cross-sectional study was carried out among selected Malaysian population. Inclusion criteria were 'aged above 18 years old' and 'are able to understand Malay language'. Data was entered into SPSS version 22.0 and analysed and Independent t-test, ANOVA and Correlations was used. The level of statistical significant was set as p<0.05.* ***Results:*** *A total of 316 respondents participated in this study. The prevalence of diabetes mellitus was 10.8%. Majority of respondents was male (53.5%), Malay (85.8%), married (66.1%), had tertiary education (52.2%), and moderate socioeconomic status. There is a belief that traditional medicine is better than clinical treatment among the community. There were significant differences of knowledge between ethnicities (p=0.012) and marital status (p=0.011). Meanwhile there were significant mean differences of attitude score between ethnicities (p<0.001), and household incomes (p=0.03).* ***Conclusions:*** *There was a good score of knowledge, attitude, and practice towards diabetes mellitus. However, misconception on traditional medicine used need to be emphasised while consulting patients in primary health care facilities in the country.*

**Keywords:** Diabetes mellitus, knowledge, attitude, Malaysian population

## INTRODUCTION

About 387 million diabetic patients have been reported in 2014 globally [1]. Two million and half of them in Malaysia and the prevalence of diabetes in Malaysia was 16.6% [1]. Diabetes is connected with tuberculosis, with the risk of tuberculosis being three times higher in diabetic patients [2]. Modifiable risk factors such as blood pressure control, no tobacco use, no alcohol use, physically active, healthy diet, and maintain normal weight can reduce the morbidity and mortality of diabetes [3]. Because diabetes is a silent disease, some people are unaware that they have diabetes until they develop one of its life-threatening complications. Hence, it is crucial to have knowledge of diabetes mellitus at an early stage of life, facilitated by early detection [4]. For instance; a study in Malaysia reported that there is a lack of information in the management of diabetes [5].

Furthermore, a study from Pakistan [6], showed that there was a gap between knowledge and attitude among the diabetes patients. There is evidence that knowledge, attitude, and practice regarding diabetes and its complications amongst the general community are indeed lacking [7]. Research has shown that the diabetes-related complications can be reduced by improving glycaemic control which can be achieved by having knowledge about diabetes self-care [8]. About 68.6% patients do not come for earlier screening due to inadequate knowledge on diabetes [9].

Several socio-demographic factors play significant roles about knowledge, attitude and practice of diabetes. The most significant one is the income [10]. There is evidence showing that the neighbourhood-level income was one of the independent socioeconomic statuses which was a valid predictor of health results [10]. Race is also considered as one of the factors [11,12]. A study performed by Wong and Rahimah [11] found that Chinese and Malays recorded the highest diabetes cases (69% and 29%, respectively). Another contributing factor is gender [12]. According to Nailah [12], males have more knowledge about diabetes, compared to females (18% and 13%, respectively). In the same study, Nailah [12] showed also that individuals of younger age groups had higher knowledge regarding diabetes mellitus than the older ones. It is also important to note that most of the young participants (60%) knew that diabetes mellitus can be prevented by frequent exercise, as compared to the older age group (39%) [7]. as matter of fact, WHO reported that 20 min daily of moderate physical activity can lessen risk of diabetes (up to 27%) [13].

Because the information about knowledge, attitude and practice of diabetes mellitus in Asian countries, and in particular regarding Malaysian population is notable insufficient and fragmented, therefore, we undertook the present study in order to determine the knowledge, attitude and practice of diabetes mellitus and its associated factors among Malaysian population.

## MATERIALS AND METHODS

### Subjects and setting

A cross-sectional study was carried out among the residents of Seksyen 17, Shah Alam, Selangor, Malaysia from 11th March 2016-26th March 2016. 'Inclusion criteria' were: 'Seksyen 17, Shah Alam residents', 'aged above 18 years old' 'able to understand Bahasa Malaysia', while 'exclusion criteria' were: 'non-Malaysian citizens', 'reside in Seksyen 17, Shah Alam for less than 6 months', 'aged less than 18 years old' and 'who were not able understand Bahasa Malaysia'.

### Sample size and data collection

The estimated population of Seksyen 17, Shah Alam is 12,000. By using the EpiInfo software with the prevalence of diabetes mellitus in Malaysia (according to a previous study at 22.6% 5) and by taking the confidence interval of 95%, we calculated the sample size; the sample size was to be estimated to be 263. Considering the defaulter rate of 20%, 53 more respondents were needed for the analysis and, thus, the final sample was 316 respondents. There were an estimated 1720 units of houses in Seksyen 17 that included terrace (1240) and flat houses (480) which comprised of 72% and 28% of the population, respectively. A proportionate sampling was done among the residents of Seksyen 17 by distributing 228 (72%) the questionnaires to the terrace houses and the remaining 88 (28%) to the flat houses. Simple random sampling was performed to choose the respondents' houses using a random number generator. One respondent was selected per house which made up a total of 316 respondents. If there were no eligible respondents in the selected house, the next house was chosen. If more than one eligible respondent were available in a house, simple random sampling was done by drawing papers. The individual who picked the marked paper was selected.

### Questionnaire design

We used a structured questionnaire which was constructed from previous studies and consisted of two parts. Part 1 was regarding socio-demographic details while part 2 was about knowledge, attitude and practice. There were 13 questions pertaining to knowledge, 9 questions for attitude and 20 questions regarding practice. The respondents required to response 'Yes' or 'No' for the knowledge section, 'Strongly agree', 'Agree', 'Don't know', 'Disagree' or 'Strongly disagree' for the attitude section and 'Never', 'Once in a while', '2-3 times a week' or 'Daily' for the practice section. The questionnaire was translated into Bahasa Malaysia. The suitability and clarity of the questionnaire was assessed by a small pilot study. A pilot study was done among 36 participants from Taman Prima Selayang, Batu Caves, Selangor, before the actual study was initiated to pre-test/validate the set of questions in the questionnaire. Ethical approval was obtained from the research ethics committee of the Research Management Institute of Universiti Teknologi MARA (UiTM). All participants of the study gave their informed consent to participate in the study.

### Statistical analysis

Data was entered into SPSS version 22.0 and analyzed. The overall score and subscale scores were converted into percentages. Independent t-test was used for comparison between categorical and numerical variables while ANOVA

was used if there were more than 2 categorical variables. Correlation test was used for comparison between numerical variables. The level of statistical significant was set as p<0.05.

## RESULTS

A total of 350 questionnaires were distributed to the residents of Seksyen 17, Shah Alam, Selangor. Total 316 respondents answered the questionnaires completely giving a response rate of 90.3%. Our study found that the prevalence of diabetes mellitus was 10.8%. The majority of our respondents was male (53.5%), Malay (85.8%), married (66.1%), had tertiary education (52.2%), and moderate socioeconomic status. Most of them had no past medical history of chronic illnesses and were non-smokers (Table 1). Our study found that there is a belief that traditional medicine is better than clinical treatment among the community (Table 2).

**Table 1 Socio-demographic characteristics of the study respondents (N=316)**

| Variable | Categories | Number of respondents /Frequency (%) |
|---|---|---|
| Gender | Male | 169 (53.5) |
| | Female | 147 (46.5) |
| Race | Malay | 271 (85.8) |
| | Chinese | 7 (2.2) |
| | Indian | 29 (9.2) |
| | Others | 9 (2.8) |
| Marital status | Single | 94 (29.7) |
| | Married | 209 (66.1) |
| | Widowed | 13 (4.1) |
| Educational level | No formal education | 3 (0.9) |
| | Primary education | 24 (7.6) |
| | Secondary education | 124 (39.2) |
| | Tertiary education | 165 (52.2) |
| Employment status | Employed (government) | 58 (18.4) |
| | Employed (private) | 108 (34.2) |
| | Self-employed | 30 (9.5) |
| | Unemployed | 61(19.3) |
| | Retired | 34 (10.8) |
| | Student | 25 (7.9) |
| Monthly Household income (RM) | <2000 | 132 (41.8) |
| | 2000-4000 | 111 (35.1) |
| | 4001-6000 | 48 (15.2) |
| | >6000 | 25 (7.9) |
| **Medical history** | | |
| Diabetes mellitus | Yes | 34 (10.8) |
| | No | 282 (89.2) |
| Hypertension | Yes | 65 (20.6) |
| | No | 251 (79.4) |
| Dyslipidaemia | Yes | 47 (14.9) |
| | No | 269 (85.1) |
| Ischemic heart disease | Yes | 11 (3.5) |
| | No | 305 (96.5) |
| Smoking status | Non-smoker | 233 (73.7) |
| | Current smoker | 69 (21.8) |
| | Ex-smoker | 14 (4.4) |
| Family history of diabetes mellitus | Yes | 123 (38.9) |
| | No | 193 (61.1) |
| If yes, please specify | Mother | 64 (20.3) |
| | Father | 64 (20.3) |
| | Siblings | 25 (7.9) |

**Table 2 Knowledge of diabetes mellitus (N=316)**

| Knowledge | | Frequency (%) | |
|---|---|---|---|
| | | **True** | **False** |
| Knowledge of disease | Diabetes is a condition in which your blood sugar levels are higher than normal | 304 (96.2) | 12 (3.8) |
| | Diabetes is a syndrome or disease as a result of lack or loss of effectiveness of insulin | 239 (75.6) | 77 (24.4) |
| | There are 2 types of diabetes mellitus: Type 1 (insulin dependent) and Type 2 (non-insulin dependent) | 231 (73.1) | 85 (26.9) |
| Knowledge of symptoms | Frequent urination | 258 (81.6) | 58 (18.4) |
| | Increased thirst | 244 (77.2) | 72 (22.8) |
| | Loss of weight | 246 (77.8) | 70 (22.2) |
| | Wake up at night to urinate | 239 (75.8) | 77 (24.4) |
| | Fatigue (easily tired) | 272 (86.1) | 44 (13.9) |
| High blood pressure can worsen the diabetes | | 243 (76.9) | 73 (23.1) |
| Knowledge of complications | Renal failure | 258 (81.6) | 58 (18.4) |
| | Blindness/retinopathy | 256 (81.0) | 60 (19.0) |
| | Diabetic foot disease | 304 (96.2) | 12 (3.8) |
| | Nerve damage, especially in the legs | 273 (86.4) | 43 (13.6) |
| | Heart attack | 191 (60.4) | 125 (39.6) |
| | Stroke | 185 (58.5) | 131 (41.5) |
| Knowledge of prevention | Losing weight | 254 (80.4) | 62 (19.6) |
| | Practice a healthy and balanced diet | 303 (95.9) | 13 (4.1) |
| | Stay physically active | 298 (94.3) | 18 (5.7) |
| | Quit smoking | 251 (79.4) | 65 (20.6) |
| | Reduce stress | 243 (76.9) | 73 (23.1) |
| | Have a good and sufficient sleep | 255 (80.7) | 61 (19.3) |
| | Keeping blood pressure and cholesterol levels in the normal range | 277 (87.7) | 39 (12.3) |
| | Do a routine eye check-up once a year | 239 (75.6) | 77 (24.4) |
| Knowledge of treatment | Medication is less beneficial than diet and exercise to control my diabetes | 230 (72.8) | 86 (27.2) |
| | Once the sugar level is controlled drugs should be stopped | 217 (68.7) | 99 (31.3) |
| | Medication is less beneficial than diet and exercise to control my diabetes | 230 (72.8) | 86 (27.2) |
| | Once the sugar level is controlled drugs should be stopped | 217 (68.7) | 99 (31.3) |
| | Traditional medicine is less effective | 120 (38.0) | 196 (62.0) |
| | Regular treatment can delay diabetic retinopathy | 274 (86.7) | 42 (13.3) |

Half of the participants agreed that diabetes is preventable (50%). Furthermore, they believe that regular exercise helps controlling diabetes (54.4%) (Table 3).

**Table 3 Attitude towards diabetes mellitus (N=316)**

| Attitude | Frequency (%) | | | | |
|---|---|---|---|---|---|
| | **Strongly disagree** | **Disagree** | **Do not know** | **Agree** | **Strongly agree** |
| Diabetes mellitus is preventable | 11 (3.5) | 9 (2.8) | 21 (6.6) | 158 (50.0) | 117 (37.0) |
| Diabetes mellitus is treatable | 8 (2.5) | 10 (3.2) | 25 (7.9) | 185 (58.5) | 88 (27.8) |
| Regular exercise helps controlling diabetes | 2 (0.6) | 15 (4.7) | 33 (10.4) | 172 (54.4) | 94 (29.7) |
| Following a controlled and planned diet will help in controlling progression of diabetes mellitus | 3 (0.9) | 4 (1.3) | 10 (3.2) | 178 (56.3) | 121 (38.3) |

| | | | | | |
|---|---|---|---|---|---|
| Regular checking of blood sugar level is important in diabetic patient | 2 (0.6) | 8 (2.5) | 13 (4.1) | 169 (53.5) | 124 (39.2) |
| Diabetic patients should keep in touch with their physician | 3 (0.9) | 9 (2.8) | 11 (3.5) | 173 (54.7) | 120 (38.0) |
| It is necessary for diabetic patient to take medication properly and regularly | 5 (1.6) | 2 (0.6) | 9 (2.8) | 172 (54.4) | 128 (40.5) |
| Missing doses of diabetic medication will have a negative effect on the disease control | 4 (1.3) | 10 (3.2) | 28 (8.9) | 172 (54.4) | 102 (32.3) |
| Smoking exacerbates vascular complications due to diabetes | 6 (1.9) | 12 (3.8) | 60 (19.0) | 147 (46.5) | 91 (28.8) |

For practice (Table 4) 82% consumes carbohydrates such as white rice, noodle, and bread. About 68% eat fast food like KFC three times a week and 48.7% drinks soft drinks 3 times a week.

**Table 4 Practice of check for diabetes mellitus (N=316)**

| Practice | Frequency (%) | | | |
|---|---|---|---|---|
| **Regular Check-Up** | **Never** | **Once in 2 years or more** | **Yearly** | **Once in a 6 month** |
| How often do you check your blood sugar levels? | 85 (26.9) | 54 (17.1) | 88 (27.8) | 89 (28.2) |
| How often do you check your cholesterol level? | 86 (27.2) | 53 (16.8) | 99 (31.3) | 78 (24.7) |
| How often do you do a urine test? | 91 (28.8) | 74 (23.4) | 96 (30.4) | 55 (17.4) |
| How often do you check your blood pressure? | 54 (17.1) | 61 (19.3) | 76 (24.1) | 125 (39.6) |
| **Exercise** | **Never** | **Less than 1 hour** | **1-3 hours** | **More than 3 hours** |
| Physical exercise such as swimming, jogging, aerobics, football, tennis, working out in the gym and etc. | 72 (22.8) | 121 (38.3) | 92 (29.1) | 31 (9.8) |
| Cycling, including cycling to work and free time | 158 (50.0) | 86 (27.2) | 56 (17.7) | 16 (5.1) |
| Walking, including walking to work, walking in the shopping mall and etc. | 17 (5.4) | 92 (29.1) | 126 (39.9) | 81 (25.6) |
| Household chores examples cleaning the house, taking care of children | 12 (3.8) | 72 (22.8) | 101 (32.0) | 131 (41.5) |
| Gardening | 145 (45.9) | 88 (27.8) | 65 (20.6) | 18 (5.7) |
| **Diet** | **Never** | **Sometimes** | **1-3times per week** | **Everyday** |
| Carbohydrate (White rice, noodle, bread, cereals) | 6 (1.9) | 23 (7.3) | 28 (8.9) | 259 (82.0) |
| Fiber & Fruits | 3 (0.9) | 47 (14.9) | 87 (27.5) | 179 (56.6) |
| Vegetables | 5 (1.6) | 35 (11.1) | 53 (16.8) | 223 (70.6) |
| Protein (chicken/meat/eggs) | 3 (0.9) | 36 (11.4) | 84 (26.6) | 193 (61.1) |
| Legumes (dhal, tempeh, green bean) | 16 (5.1) | 130 (41.1) | 111 (35.1) | 59 (18.7) |
| Milk and milk products | 14 (4.4) | 101 (32.0) | 84 (26.6) | 117 (37.0) |
| Fats, oil, sugar and salt | 177 (56.0) | 65 (20.6) | 65 (20.6) | 9 (2.8) |
| Fast food (KFC, McDonald's, etc.) | 4 (1.3) | 61 (19.3) | 215 (68.0) | 36 (11.4) |
| Carbonated drinks (Coca cola, Pepsi, 7up, etc.) | 6 (1.9) | 47 (14.9) | 175 (55.4) | 88 (27.8) |
| Sugary drinks/flavoured (syrup, Ribena, Lychee, etc.) | 51 (16.1) | 84 (26.6) | 154 (48.7) | 27 (8.5) |
| Salty food (salted fish, salted eggs) | 15 (4.7) | 81 (25.6) | 178 (56.3) | 42 (13.3) |

Our study revealed that there were significant differences of knowledge between ethnicities (p=0.012) and marital status (p=0.011). Malays (21.84 (4.79)) had a significantly higher mean knowledge score, compared to Non-Malays (19.91 (4.63)) and those, who were married (22.10 (4.86)) had a significantly higher mean knowledge score than those who were single (20.32 [4.58]) (Table 5).

**Table 5 Mean differences between 'Knowledge' score and socio-demographic characteristics**

| Variable | Categories | N | Mean SD | Mean difference (95% CI) | t-test (df) | p-value |
|---|---|---|---|---|---|---|
| Gender | Male | 169 | 21.10 (5.23) | -1.00 (-2.07, 0.06) | -1.85 (314) | 0.06 |
| | Female | 147 | 22.10 (4.24) | | | |
| Ethnicity | Malay | 169 | 21.84 (4.79) | -1.93 (0.419, 3.441) | 2.513 (314) | 0.012 |
| | Non-Malay | 147 | 19.91 (4.63) | | | |

| Variable | Categories | N | Mean SD | F-value (df) | p-value |
|----------|-----------|---|---------|--------------|---------|
| Marital status | Single | 94 | 20.32 (4.58) | 4.6 (2; 315) | 0.011 |
| | Married | 209 | 22.10 (4.86) | | |
| | Widowed | 13 | 22.00 (4.20) | | |
| Educational status | Primary | 27 | 22.15 (4.26) | 0.643 (2; 315) | 0.733 |
| | Secondary | 124 | 21.81 (5.08) | | |
| | Tertiary | 165 | 21.28 (4.70) | | |
| Employment status | Employed (government) | 58 | 21.93 (4.39) | 1.54 (5; 315) | 0.177 |
| | Employed (private) | 108 | 21.51 (5.19) | | |
| | Self-employed | 30 | 22.27 (4.39) | | |
| | Unemployed | 61 | 21.69 (4.63) | | |
| | Retired | 34 | 22.06 (5.55) | | |
| | Student | 25 | 19.16 (3.40) | | |
| Household income (RM) | <2000 | 132 | 21.11 (4.96) | 0.962 (3; 315) | 0.411 |
| | 2000-4000 | 111 | 21.62 (4.92) | | |
| | 4001-6000 | 48 | 22.31 (4.39) | | |
| | >6000 | 25 | 22.28 (4.26) | | |

For Attitude (Table 6), there were significant mean differences of Attitude score between ethnicities, ($p<0.001$), and between different household incomes ($p=0.03$). Malays (28.99 (4.48)) had a significantly higher mean practice score compared to non-Malays (25.82 (5.81)) and those with a household income of more than RM 6,000 had a significantly higher mean attitude score (29.92 (4.17)) than those with a household income of RM 2000-4000 (29.30 (4.31)) and a household income of less than RM2000 (27.70 (5.57)) (Table 6).

**Table 6 Mean differences between 'Attitude' score and socio-demographic characteristics**

| Variable | Categories | N | Mean SD | Mean difference (95% CI) | t-test (df) | p-value |
|----------|-----------|---|---------|--------------------------|-------------|---------|
| Gender | Male | 169 | 28.41(5.37) | -0.26 | -0.48 | 0.63 |
| | Female | 147 | 28.67 (4.08) | (-1.33,0.81) | -314 | |
| Ethnicity | Malay | 169 | 28.99 (4.48) | 3.16 | 4.193 | <0.001 |
| | Non-Malay | 147 | 25.82 (5.81) | (1.68,4.65) | -314 | |

| Variable | Categories | N | Mean SD | F-value (df) | p-value |
|----------|-----------|---|---------|--------------|---------|
| Marital status | Single | 94 | 27.69 (5.72) | 2.998 (2; 315) | 0.051 |
| | Married | 209 | 29.00 (4.34) | | |
| | Widowed | 13 | 27.15 (4.02) | | |
| Educational status | Primary | 27 | 29.56 (3.46) | 1.387 (2; 315) | 0.251 |
| | Secondary | 124 | 28.05 (4.29) | | |
| | Tertiary | 165 | 28.73 (5.32) | | |
| Employment status | Employed (government) | 58 | 28.78 (3.70) | 2.595 (5; 315) | 0.026 |
| | Employed (private) | 108 | 29.27 (5.13) | | |
| | Self-employed | 30 | 27.40 (5.10) | | |
| | Unemployed | 61 | 28.38 (4.12) | | |
| | Retired | 34 | 29.06 (3.22) | | |
| | Student | 25 | 25.84 (7.32) | | |

| | | | | | |
|---|---|---|---|---|---|
| Household income (RM) | <2000 | 132 | 27.70 (5.57) | | |
| | 2000-4000 | 111 | 29.30 (4.31) | 3.019 (3; 315) | 0.03 |
| | 4001-6000 | 48 | 28.33 (3.42) | | |
| | >6000 | 25 | 29.92 (4.17) | | |

With respect to Practice (Table 7), there were mean differences of practice score between different marital status (p=0.001) and between different employment status (p=0.010). Those who are married had a significantly higher mean practice score (35.92 (6.55)) than those who are single (32.85 (7.08)), and those who are retired had a significantly higher mean practice score (36.56 (6.93)) compared to those who are employed in the private sector (35.81 (6.63)) and students (31.16 (5.9)) (Table 7).

**Table 7 Mean differences between 'Practice' score and socio-demographic characteristics**

| Variable | Categories | N | Mean SD | Mean difference (95% CI) | t-test (df) | p-value |
|---|---|---|---|---|---|---|
| Gender | Male | 169 | 34.99 (7.06) | 0.08 (-1.44, 1.59) | 0.10 (314) | 0.92 |
| | Female | 147 | 34.91 (6.57) | | | |
| Ethnicity | Malay | 169 | 34.90 (6.77) | -0.34 (-2.51, 1.82) | -0.309 (314) | 0.757 |
| | Non-Malay | 147 | 35.24 (7.20) | | | |

| Variable | Categories | N | Mean SD | F-value (df) | | p-value |
|---|---|---|---|---|---|---|
| Marital status | Single | 94 | 32.85 (7.08) | 6.841 (2; 315) | | 0.001 |
| | Married | 209 | 35.92 (6.55) | | | |
| | Widowed | 13 | 34.54 (6.33) | | | |
| Educational status | Primary | 27 | 35.81 (6.42) | 0.463 (2; 315) | | 0.63 |
| | Secondary | 124 | 35.19 (6.72) | | | |
| | Tertiary | 165 | 34.64 (6.99) | | | |
| Employment status | Employed (government) | 58 | 35.45 (6.55) | 3.095 (5 ;315) | | 0.01 |
| | Employed (private) | 108 | 35.81 (6.63) | | | |
| | Self-employed | 30 | 32.70 (8.47) | | | |
| | Unemployed | 61 | 34.72 (6.24) | | | |
| | Retired | 34 | 36.56 (6.93) | | | |
| | Student | 25 | 31.16 (5.9) | | | |
| Household income (RM) | <2000 | 132 | 33.71 (7.14) | 2.537 (3; 315) | | 0.057 |
| | 2000-4000 | 111 | 35.86 (6.69) | | | |
| | 4001-6000 | 48 | 35.85 (5.75) | | | |
| | >6000 | 25 | 35.72 (6.97) | | | |

Age is statistically weak and positively-correlated with score of knowledge. Age is statistically weak and positively-correlated with score of practice. Score of knowledge is statistically weak and positively-correlated with score of attitude. Score of knowledge is statistically weak and positively-correlated with score of practice (Tables 8-10).

**Table 8 Correlation between score of 'Knowledge' and scores of 'Attitude/Practice'**

| Variable | N | p-value | Null hypothesis | Pearson correlation coefficient, r | Correlation strength |
|---|---|---|---|---|---|
| Attitude | 316 | 0.00 | Rejected | 0.25 | Weak |
| Practice | 316 | 0.043 | Rejected | 0.114 | Weak |

**Table 9 Correlation between 'Age' and scores of 'knowledge/attitude/practice'**

| Variable | N | p-value | Null hypothesis | Pearson correlation coefficient, r | Correlation strength |
|---|---|---|---|---|---|
| Knowledge | 316 | 0.008 | Rejected | 0.149 | Weak |

| | | | | | |
|---|---|---|---|---|---|
| Attitude | 316 | 0.122 | Not rejected | 0.087 | - |
| Practice | 316 | 0.001 | Rejected | 0.192 | Weak |

**Table 10 Correlation between score of 'attitude' and score of 'practice'**

| Variable | N | p-value | Null hypothesis | Pearson correlation coefficient, r | Correlation strength |
|---|---|---|---|---|---|
| Practice | 316 | 0.04 | Rejected | 0.115 | Weak |

## DISCUSSION

Based on our study, out of 316 respondents, only 34 of them had diabetes mellitus which contributed to 10.8% of prevalence of diabetes mellitus among the community. This result can be explained by a study which concluded that communities with a good educational level and a good socioeconomic status had low prevalence of diabetes mellitus especially in the middle years of life [14]. However, our study showed that the prevalence of diabetes mellitus among the community is lower than the prevalence of diabetes mellitus in overall population which is 22.6% (IDF) in 2014 [1]. One possible explanation for this is there might be the study area was mostly resided by students and well-educated respondents. Besides that, the majority of our respondents practiced a healthy lifestyle including attending regular check-up every 6 months, exercising every day and practicing a balanced diet every week.

Regarding the Knowledge, in our study about 48.1% of respondents scored more than 75% of total knowledge score. Similarly, in our neighbour country, Singaporean study [15], showed that most respondents scored more than 75% of the total knowledge score. The level of education among the respondents could be a contributing factor to the high score whereby a large proportion of the respondents or about 55.2% of them completed their education until the tertiary level. The majority of our respondents had general knowledge about diabetes mellitus, symptoms, complications, prevention and treatment of the disease. However, they had a misconception about traditional medicine and also laser treatment for diabetic retinopathy. Interestingly, about 62% of respondents believed that traditional medicine is better than pharmacological treatment which suggested that our community still rely on traditional medicine which is probably due to the deeply-rooted practice of traditional medicine in the Chinese and Malay cultures [15].

Our study on the attitude towards diabetes mellitus reported that about 97.5% of respondents scored more than 50 percent of the total attitude score. Based on the results shown, we can conclude that a large proportion of respondents had positive attitude towards diabetes mellitus which is similar to two different studies conducted previously in Malaysia reported by Ranjini, et al. [16] and Ng, et al. [17]. This indicates the effectiveness of diabetes educational programs and continuous medical education provided by the government to the public. This is also proven by a study done in Universiti Sains Malaysia in 2009 which showed that patients' glycaemic control was significantly reduced in a structured diabetes educational program [18]. It is also supported by another study which stated that interventions were generally effective on behaviour change and patients' glycaemic control in the short term (≤ 9 months) [19].

Regarding the practice towards diabetes mellitus among the respondents, about 72.7% of respondents scored more than 50% of the total practice score. In our study, the majority of 35 respondents had frequent regular check-ups, practiced exercise more than 1 hour per week and applied healthy diet in their daily lives. Thus, our study is consistent with a study conducted in Malaysia reported by Ranjini, et al. [16], which suggested that the majority of respondents had good practice towards diabetes mellitus.

The study showed that the respondents had good overall knowledge, attitude and practice towards diabetes mellitus. In other countries, such as recent studies done in Western Nepal and Saudi Arabia, it was reported that the majority of respondents had a poor knowledge, attitude and practice score towards diabetes mellitus [20,21]. In opposition to that, a study done in a primary care centre in Malaysia reported that most of the respondents had good knowledge and a better attitude towards the care of their own disease which is also proven by our present research [16].

Knowledge is the greatest weapon in the fight against diabetes mellitus. In this group of people, knowledge of the disease was significantly associated with two key factors: ethnicity and marital status. According to McCaig [22], marriage can provide a positive and immediate support and may encourage a partner's healthy lifestyle [22]. Therefore, married individuals tend to commit more towards a healthy lifestyle as most of them are older and more prone to have diabetes. Another study done by Stewart [23], mentioned that a spouse can help maintain healthy habits and become a large force of influence in our own behaviour. This is compared to those who are single who

tend to be less cautious of this disease. However, our study is not in agreement with a study which showed that single patients had a higher mean KAP towards diabetes compared to the married ones [24]. This difference might have been affected by other socio-demographic characteristics: age, educational level, household income. There is also a study reported by Ding, et al. [25], which showed the opposite finding regarding ethnicity. On top of that, our study reported that gender, educational status, employment status and household income did not influence knowledge in our study population. This is in agreement with other study done in Kenya which showed no significant difference in knowledge level between genders [26].

In terms of attitude, our study established a relationship between attitude score and ethnicity. In our study, Malays showed a higher mean score compared to non-Malays. Nevertheless, in comparison to our finding, a study of diabetes knowledge and practice in Malaysian and the United Arab Emirates diabetic patients reported by Mahdi, et al. [27], showed that Chinese had the highest incidence of diabetes (52%) compared to the other races in Malaysia. Otherwise, gender, marital status, educational status, employment status and household income did not influence the attitude of our respondents. This is similar with another study reported by Islam, et al. [7], which showed that gender and educational status did not have any significant associations with attitude towards diabetes. This study which was performed in Nepal and Bangladesh [7], showed thus similar results as our study, suggesting that conservative thoughts might be a possible reason for not changing their attitudes.

Our study reported that marital and employment status had significant associations to the practice score towards diabetes. We found that married and retired people had better practice towards diabetes. According to an article by Crone [28], retired people pursued a more active lifestyle and spent more time indulging in their hobbies. Therefore, they are more prone to practicing a healthy lifestyle compared to an employed person. This strengthened our study as we found that retired people had better practice toward diabetes. In contrast to a study done in South Africa, the majority (97.7%) of their participants demonstrated poor practice towards diabetes. This might be due to poverty as it could limit accessibility and affordability to have a good practice [29]. Otherwise, ethnicity, educational status and household income did not influence the practice level of our respondents. Similar results reported in Northwest Ethiopia which showed that educational status did not influence the practice [29].

Our study demonstrated that there were correlations between the age of the respondents and knowledge and attitude levels. Age and knowledge level showed a weak, positive correlation of 0.149 (p=0.008). However, there were no studies found to strengthen our results. The significant weak and positive correlation of 0.192 (p=0.001) between age and practice level of the participants was also similar to study done by Niroomand, et al. [30], which showed a significant correlation between age of the participants and their practices (r=-0.179, p=0.012). Our study also showed that there was a significantly weak and positive correlation of 0.250 (p=0.000) between knowledge level and attitude level of participants. Similar findings reported by Okonta, et al. [31], which also showed a weak and positive correlation between knowledge and attitude toward diabetes. We also found that there was a significantly weak and positive correlation between knowledge and practice score (p=0.043) and a significantly weak and positive correlation between attitude and practice score (p=0.040). A similar finding was reported by a study showed a weak, but statistically-significant correlation between knowledge and practice as well as attitude and practice (p=0.001) [24].

## CONCLUSIONS

The study found that there was a good score of knowledge, attitude, and practice towards diabetes mellitus. However, the study found also that there is a belief that traditional medicine is better than clinical treatment among the community. This emphasizes the need for increasing diabetes knowledge and awareness such as through mass media campaigns, public lectures, and door-to-door campaigns on a massive scale to rectify the wrong belief.

## ACKNOWLEDGMENTS

## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest in this research.

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