WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 5.990
Volume 4, Issue 12, 154-170. Research Article ISSN 2277– 7105

KNOWLEDGE OF DIABETES MELLITUS, RISK FACTORS AND COMPLICATIONS AMONG THE GENERAL PUBLIC IN KUALA LUMPUR

Muhammad Qamar[1*], Wai Hoong Lau[1], Amiruddin Ahmed[1], Faiz Ahmed[1], Jiyauddin Khan[2] Ahmad Mahmud[1]

[1]Faculty of Pharmacy, MAHSA University, Bandar Saujana Putra, 42610 Jenjarom, Kuala Langat, Selangor, Malaysia.

[2]School of Pharmacy, Management & Science University, Shah Alam, 40100 Selangor, Malaysia.

Article Received on
28 Sep 2015,

Revised on 21 Oct 2015,
Accepted on 12 Nov 2015

***Correspondence for Author**
Dr. Muhammad Qamar
Faculty of Pharmacy,
MAHSA University,
Bandar Saujana Putra,
42610 Jenjarom, Kuala
Langat, Selangor,
Malaysia.

ABSTRACT

Diabetes mellitus is a chronic, incurable and non-communicable disease associated with consequences that may leads to mortality and morbidity. It remains as the major health-related issue among the society nowadays. Despite a lot of efforts has been done by the ministry of health of Malaysia in managing the diabetes mellitus among the population, the prevalence rate of diabetes mellitus does not decreasing but showed a rapid increasing trend. The objective of this study is to evaluate the level of diabetes knowledge among the general public and to find the association between the social demographic factors with level of diabetes knowledge among the general public. A cross-sectional study was carried out by using pre-tested questionnaire which consisted of demographic factors, general knowledge, risk factors, symptoms and complications of diabetes mellitus in order to assess the diabetes knowledge among the general public. Out of 380 respondents, 51.8% were male with Chinese ethnicity (49.7%) with the age range between 18-27 years old (61.3%). Regarding the scores of diabetes knowledge, 53.9% of respondents managed to achieve good scores, while 41.3% moderate, whereas 4.7% of respondents managed to achieve poor score. The average percentages of correct responses on general knowledge, risk factors, symptoms and complications were 67.1%, 69.0%, 69.6% and 71.7% respectively. The lowest percentages of correct responses were related to the misconception that diabetes can be cured,

pregnancy as a risk factor and weight loss despite normal appetite as the symptoms of diabetes. Statistical significant were observed between the family history of diabetes and monthly income with the level of diabetes knowledge. The level of diabetes knowledge among the general public in Kuala Lumpur was reasonably good and well-informed regarding the basic general knowledge of diabetes except for a few deficiency areas.

KEYWORDS: Knowledge, Diabetes Mellitus, Risk Factor, Complications.

1. INTRODUCTION

In the 21th century, undeniably, diabetes mellitus is the biggest health concern-related disease among all the populations in all over the world. Worldwide, five Asian countries include both China and India expected to emerge as the leading countries in terms of amount of people who has diabetes mellitus among the ten leading countries by 2025 [1]. Diabetes mellitus is a chronic, incurable and non-communicable disease which causing significant morbidity and mortality throughout globally [2,3]. It raises the public health concern and emerged as the leading causes of death and disability among our society nowadays [4].

Several factors such as population growth rate, ageing population, age structures, urbanization, unhealthy diet habits, obesity, sedentary lifestyles, lack of physical activities, failure to access to healthcare facilities both in rural and urban area, economic and health transition of the country had contributed to the high incidence of diabetes mellitus [5,6]. Increased case of diabetes mellitus is also triggered by the positive family history of the disease.

Short term complications of diabetes include the occurrence of symptoms such as frequent urination, increased thirst, weight loss and increased hunger. Long term complications of diabetes include micro-vascular and macro-vascular complications. Micro-vascular complications include diabetic foot disorder such as infection, ulceration, Charcot's joint leads to leg amputation, neuropathy leads to impotence, nephropathy leads to renal disease and retinopathy leads to blindness.

In Malaysia, diabetes mellitus shows an increasing trend in prevalence rate which is similar with other countries. Initially, in the year of 1960s, the prevalence rate of diabetes was only 0.65%. However, it increased rapidly to approximately 2-4% in 1980s followed by shoot up to 8-12% by mid-1990s [7]. Nowadays, diabetes mellitus has become a growing concern

health issue and common disease among our society due to the health and economic impacts that it bring to our society.

As days passes by, it will exacerbate along with the complications attributable to mortality. It will lead to serious consequences which are detrimental to health, such as strokes, coronary heart disease, heart attacks, renal disease, blindness and leg amputations. If no appropriate actions are taken by related authorities and departments, then the nation or country have to spend extra costs in the health expenditures and loss of productivity [8].

There are a lot of on-going campaigns, event, and research on management of diabetes mellitus has been carried out among the public and societies by the governmental and non-governmental organizations nowadays in the urban areas. In addition, a huge amount of health expenditures has been spending by both the governmental and non-governmental organizations in this field. Despite that, the prevalence rate of diabetes mellitus and the number of diabetic patients are not decreasing but showed a rapid increasing and growing trend.

The objectives of this study are to evaluate the level of diabetes knowledge among the general public in Kuala Lumpur and to determine the association between the social demographic factors and level of diabetes knowledge among the general public.

2. MATERIAL AND METHODS

2.1 Research Design

A cross-sectional study with convenience sampling method had been used for this survey. This study used a pre validated questionnaire to obtain the data and information.

2.2 Population and Sample Size

The population selected was general public Kuala Lumpur. The areas involved were KL sentral, KL centrals' market and KLCC. These places were chosen based on criteria such as centre of attraction and have high population area. Sample size for this research is calculated by using Raosoft Software with confidence interval 95% and margin error of 5%. Estimated sample calculated was 380 respondents.

2.3 Inclusion and Exclusion Criteria

Participants with diabetes and those without diabetes were included in this study. The inclusion criteria were participants who aged 18 and above, no hearing or visual impairment regardless of their ethnicity. Participants who aged more than 67 years old, illiterate, pregnant woman and foreigner were excluded from the study.

2.4 Questionnaire Design

A pre-tested, self-administered, close-ended and structured questionnaire was distributed to the participants for the purpose of data collection. A diabetic knowledge questionnaire originated from the Wee, Ho, Li (2002) was adapted and used in this study. Permission and consent using this questionnaire had been granted and agreed by the author. This questionnaire comprised of five sections namely demographics, general knowledge of diabetes, risk factors, symptoms and complications. Each questions on every section consisted of three options which were "Yes", "No", and "Unsure" that required participants to put a tick on the specific selected column.

2.5 Informed Consent Process

Before filling the structured questionnaire, a written consent form was attached to the questionnaire to get the autonomy response from respondent. A signature by the respondent was required in order to agree and participate in this study. The confidentiality of data and information from the respondent was assured.

2.6 Data and Statistical Analysis

Only fully completed questionnaires were included for analysis. The numerical data was analysed by inferential data. A system of point allocation was incorporated in this study where one point was given to the correct response and none (zero) was given to the wrong or unsure response. The total maximum score for the sections of diabetic knowledge was 23. The pointer scored on each section was based on the highest score of that section as higher scores indicated a high knowledge in each sections and whole questionnaire as well. Data were analysed by using Statistical Package for the Social Science. Descriptive statistics was used to present the data in frequency and percentages. Fisher Exact Test was used to determine the association between the demographic variables and level of diabetes knowledge. The observed level of significance of test will be set at $p < 0.05$. The filled questionnaires were analysed as per the study objectives. A cut off value was used to further categorize each domain score. The domain score was categorized such that score within range

of 0 –7 was fall under poor category, score within range of 8 -15 was lied under moderate category while good category went to the score within the range of 16 – 23.

3. RESULTS

3.1 Demographic Data of Respondents

A total of 400 questionnaires were distributed to the general public in Kuala Lumpur. Among which 380 respondents answered and returned the completed questionnaires where 20 of the filled questionnaires were incomplete and met the exclusion criteria, hence excluded from this survey. Out of 380 respondents, there were 51.8% of males and 48.2% of females participated in this survey. As such, the figures of males were found to be higher than the females. The range of the age among the participants were located between 18 and 67 years old (Table 1).

The most number of respondents who participated in this survey was laid within the age range of 18-27 (61.3%). In contrast, the lowest number of respondents who completed the questionnaire were the age range of 58-67 (5.0%). The second highest number of respondents who participated in this survey were located within the age range of 28-37 (16.8%). This was followed by the descending numbers and percentages of age ranges of 48-57 (8.7%) and 38-47 (8.2%) respectively. The breakdown of the ethnicity present in this study was: Chinese (49.7%), Malay (28.4%) and Indian (21.8%). Among all the ethnicity, the Chinese population had the majority participation in this study followed by the Malay population. Indian population appeared to be the least that participated in this study apparently.

In this study, it was found that the highest level of education were tertiary education (college/ university), followed by secondary and primary education with 20.8% and 0.3% respectively. Only 0.8% respondents did not want to disclose their level of education. Among the monthly incomes, 27.9% of respondents have monthly incomes more than RM 3000. This finding were followed by 8.7% of respondents having less than RM 1500 monthly income, 7.1% of respondents having RM 2000-RM 2499 monthly income, 6.3% of respondents having RM 1500-RM 1999 monthly income and 5.0% of respondents having RM 2500- RM 2999 monthly income which was the least among all monthly incomes respectively. On the other hand, 45.0% of respondents did not have any monthly income which was the highest among all the month incomes categories. 60.3% of respondents had positive family history of diabetes. On the other hand, only 39.7% of the respondents did not have any family history of diabetes. Surprisingly, the main sources of information regarding diabetes mellitus were

friends and relatives (33.9%). This finding was followed by internet (30.5%), medical staff (14.7%), journals and magazines (11.1%). The television and radio were the least identified sources of information regarding diabetes mellitus by respondents (9.7%) (Table 2).

Table 1: Demographic Characteristics of Study Participants (n=380 total)

Demographics		Number (%)
Gender	Male	197 (51.8)
	Female	183 (48.2)
Age	18-27	233 (61.3)
	28-37	64 (16.8)
	38-47	31 (8.2)
	48-57	33 (8.7)
	58-67	19 (5.0)
Ethnicity	Malay	108 (28.4)
	Chinese	189 (49.7)
	Indian	83 (21.8)
Level of Education	None	3 (0.8)
	Primary	1 (0.3)
	Secondary	79 (20.8)
	Tertiary	297 (78.2)
Monthly Income	None	171 (45.0)
	<RM 1500	33 (8.7)
	RM 1500-RM 1999	24 (6.3)
	RM 2000-RM 2499	27 (7.1)
	RM 2500-RM 2999	19 (5.0)
	>RM 3000	106 (27.9)
Family History of Diabetes	Yes	229 (60.3)
	No	151 (39.7)

Table 2: Source of Information

Sources of information	Number (%)
Friends and relatives	129 (33.9)
Journals and magazines	42 (11.1)
Internet	116 (30.5)
Television and radio	37 (9.7)
Medical staff	56 (14.7)

Table 3: General Knowledge of Diabetes Mellitus

General Knowledge of Diabetes Mellitus	Number (%)
Diabetes is a condition of high blood sugar.	357 (93.9)
Diabetes is a condition of insufficient insulin.	270 (71.1)
Diabetes is a condition of the body not responding to the insulin.	203 (53.4)
Diabetes is non-contagious.	209 (55.0)
Diabetes is not curable.	162 (42.6)
Insulin is a hormone.	209 (55.0)
Insulin controls blood sugar.	324 (85.3)
Insulin is required for some diabetic patient.	305 (80.3)

Table 4: Knowledge of Risk Factors of Diabetes Mellitus of Respondents

Risk factors of Diabetes Mellitus	Number (%)
Family history of diabetes	327 (86.1)
Age above 40-year old	254 (66.8)
Obesity	314 (82.6)
Pregnancy	153 (40.3)

Table 5: Complication/ Consequence of Diabetes Mellitus of Respondents

Complications/ Consequences of Diabetes Mellitus	Number (%)
Decaying limbs that require surgical removal	288 (75.8)
Eye problems	264 (69.5)
Kidney problems	295 (77.6)
High blood pressure	267 (70.3)
Loss of sensation in arms and legs	249 (65.5)

Table 6: Symptoms of Diabetes Mellitus of Respondents

Symptoms of Diabetes Mellitus	Number (%)
Constant feeling of thirst	244 (64.2)
Frequent urination	246 (64.7)
Weight loss despite normal appetite	222 (58.4)
Blurred vision	237 (62.4)
Slow healing of cuts and wounds	321 (84.5)
Tiredness and weakness	316 (83.2)

Table 7: Correct response of each attribute

Sections	Average Correct response (%)
General knowledge	67.1
Risk factors	69.0
Symptoms	69.6
Complications/ Consequences	71.7

Table 8: Level of Knowledge

Level of Knowledge	Total Score	Number (%)
Poor	0-7	18 (4.7)
Moderate	8-15	157 (41.3)
Good	16-23	205 (53.9)

Table 9: Cross tabulation between Demographics and level of level of knowledge

Demographics		Scores, Number (%)			*P* -Value*
		Poor (0-7)	Moderate (8-15)	Good (16-23)	
Gender	Male	12 (6.1%)	88 (44.7%)	97 (49.2%)	0.119
	Female	6 (3.3%)	69 (37.7%)	108 (59.0%)	
Age	18-27	11 (4.7%)	110 (47.2%)	112 (48.1%)	0.103
	28-37	4 (6.2%)	23 (35.9%)	37 (57.8%)	
	38-47	2 (6.5%)	9 (29.0%)	20 (64.5%)	
	48-57	-	10 (30.3%)	23 (69.7%)	
	58-67	1 (5.3%)	5 (26.3%)	13 (68.4%)	
Ethnicity	Malay	3 (2.8%)	51 (47.2%)	54 (50.0%)	0.538
	Chinese	10 (5.3%)	75 (39.7%)	104 (55.0%)	
	Indian	5 (6.0%)	31 (37.3%)	47 (56.6%)	
Level of Education	None	-	2 (66.7%)	1 (33.3%)	0.823
	Primary	-	1 (100.0%)	-	
	Secondary	3 (3.8%)	32 (40.5%)	44 (55.7%)	
	Tertiary	15 (5.1%)	122 (41.1%)	160 (53.9%)	
Monthly Income	None	8 (4.7%)	84 (49.1%)	79 (46.2%)	0.013
	<RM 1500	-	17 (51.5%)	16 (48.5%)	
	RM 1500-RM1999	3 (12.5%)	5 (20.8%)	16 (66.7%)	
	RM 2000-RM 2499	1 (3.7%)	13 (48.1%)	13 (48.1%)	
	RM 2500-RM 2999	-	7 (36.8%)	12 (63.2%)	
	>RM 3000	6 (5.7%)	31 (29.2%)	69 (65.1%)	
Family History of Diabetes	Yes	16 (7.0%)	99 (43.2%)	114 (49.8%)	0.010
	No	2 (1.3%)	58 (38.4%)	91 (60.3%)	
Sources of Information	Friends and relatives	8 (6.2%)	5 (42.6%)	66 (51.2%)	0.614
	Journals and magazines	3 (7.1%)	12 (28.6%)	27 (65.3%)	
	Internet	3 (2.6%)	48 (41.4%)	65 (56.0%)	
	Television and radio	2 (5.4%)	17 (45.9%)	18 (48.6%)	
	Medical staff	2 (3.6%)	25 (44.6%)	29 (51.8%)	

*p = Fisher's Exact

4. DISCUSSION

According to the results obtained from this study, the diabetes knowledge among the general public was reasonably good. However, there were certain areas of deficiency. The findings of this study revealed that the average score in numerous sections including general knowledge, risk factors, symptoms and complications were more than 60%. The precise percentages of each section were general knowledge (67.1%), risk factors (69.0%), symptoms (69.6%) and complications (71.7%) (Table 7). This result was consistent with the findings present in Saudi Arabia where it reported that the correct responses on general knowledge (71.1%), risk factors (71.1%) and symptoms (63.4%) respectively where the complication recorded the lowest score (47.7%) [9].

In this study, though the score of diabetes knowledge was more than 60%, however, the high diabetes knowledge score may be due to the large proportion of respondents with tertiary educations. This may be due to the high concentration of tertiary education people around the locations where survey had been conducted.

4.1 Sources of Information

There were numerous numbers of sources of information were identified from where the respondents obtained the information on diabetes. Majority of the respondents obtained their information on diabetes through the internet, friends and relatives (Table 2). Conversations, discussions, talks as well as sharing sessions were the common pathway of delivering the messages or information on diabetes among friends and relatives. It can be occurred anytime, anywhere and between any people. Therefore, the power of communication via "word of mouth" cannot be underestimated [10]. The education on diabetes hence benefited both patients and friends and relatives. Nowadays, internet access is becoming a common, useful, fast, convenient and efficient tool in searching data and information. As there were wide array of medical information available online, people can obtained their information needed easily by just clicking a button. The application of internet access is likely to become more famous and widely recognised according to the oversea studies [10]. Same trend was showed in this study whereby the respondents used it to access the information on diabetes wisely and properly. It was not surprising that the internet was utilized majorly as one of the sources of information in this study since there were large amount of respondents equipped with tertiary education. They can access to internet through computers, laptops, pads and even smartphones.

Unexpectedly, a low proportion of respondents obtained their sources of information on diabetes through medical staffs. This may be due to the daily heavy workloads of medical staff with insufficient time given to the respondents/ patients. On the other perspectives, it may be due to respondents seldom consulted their health practitioner in-charge as they were general healthy. The medical staffs including consultant physicians, general physicians, hospital pharmacists, community pharmacists and nurses are playing an important yet crucial role in educating the general public on diabetes mellitus. They should deliver accurate messages and information besides develop a good communication relationship among the patients. For instance, they should urge the high-risk patient to undergo screening test for diabetes, advice the public to take care of their lifestyle, diet and physical activity, advice the public to measure their blood glucose level regularly, distributing educational pamphlets on diabetes for each visits [10].

Similarly, the utilisation of the journals and magazines, television and radio were recorded at a low percentage by the respondents. This may be due to the insufficient, limitation and shortage of reading resources particularly journals and magazines. They may found that it was hard to get it. In addition, most of the respondents may neglect the use of television and radio as they were more towards the use of their electronic appliances such as smartphones, pads or laptops. This was because the electronic appliances being used nowadays had various functions including watching videos, movies, listening to music, messaging, voice talks and etc. They had the functions that television and radio did not have. Most of the respondents may prefer these electronic appliances than television and radio.

4.2 General Knowledge of Diabetes Mellitus

Based on the findings of general knowledge of diabetes in this study, majority of the respondents knew that diabetes is a condition of high level of blood sugar and also insulin function in controlling the blood sugar level in our body. Approximately half of the respondents did not know that insulin is a hormone and diabetes is non-contagious. This may be due to the lack of interest in diabetes-related issues and insufficient exposure on diabetes among the respondents led to the low score obtained [10]. Furthermore, nearly half of the respondents did not know that diabetes is a condition where the body not responding to insulin. This may be attributed to the lack of knowledge on pathophysiology of diabetes among the respondents [10]. In this study, nearly more than 60% of the respondents believed that diabetes is curable. This result was similar with the study done by Mohieldein *et al.* 2011

and Wee *et al.* 2002 in Saudi Arabia and Singapore respectively. It is very important to emphasis that diabetes is non-curable but manageable disease at the same time [2]. As such, general public may be less alert, aware and wary to taking preventive measures on diabetes due to the misconception.

4.3 Risk factors of Diabetes Mellitus

For the risk factors section, a fairly acceptable result was given by the respondents. It was informed that respondents were aware of the fact that both the family history of diabetes and obesity as the main risk factors of diabetes. The agreement of obesity as the main risk factor among the respondent is in concordance with the results and findings of a research study which carried out in Jordan [11]. About 30% of the respondents did not realise that age above 40 year-old was an important risk factor in causing diabetes. This may be due to the less health-concerned on diabetes disease among the respondents. Surprisingly, approximately 60% of the respondents had no idea that pregnancy could lead to diabetes, in other words gestational diabetes. A low score in this pregnancy part reflected the neglection of education on gestational diabetes among the general public. There is a strong relationship existed between gestational diabetes and the risk of diabetes in future offspring [12]. Hence, several efforts need to be carried out in order to increase the knowledge of this part. According to the American Diabetes Association, those with one or more risk factors of diabetes will be benefited from receiving the screening procedures for diabetes as routine medical care. Those high risk individuals are suggested to repeat the screening procedures within three year duration [13]. Risk perception within the community is the predominant key to behavioral changes among the community [14]. Development of diabetes can be prevented when people at high risk has the risk perception.

4.4 Symptoms of Diabetes Mellitus

According to the results obtained regarding the symptoms of diabetes, a fairly good result was obtained by the respondents. Majority of the correct responses by respondents were seen which were more than 60%. It was encouraging that respondents did satisfactory in this section. About 40% of respondents believed that weight loss despite normal appetite was not the symptoms of diabetes. This may be due to the lack of pathways in obtaining diabetes-related information among the respondents. The diabetes knowledge on symptoms is important in assessing early diagnosis and treatment. Early recognizing the symptoms of diabetes renders the individuals to detect the disease and seek medical health care services or

treatment [15]. Those people who lacking this symptoms knowledge may find themselves suffered from the complications of diabetes eventually as they not seeking medical health care treatment in time [16].

4.5 Complications / Consequences of Diabetes Mellitus

For the complications section, the respondents responded best among all the sections where more than 60% of the respondents answered correctly in each complications of this section (Table 5). This showed that respondents were well-informed and understood regarding the complications of diabetes. Awareness and education on complications of diabetes are crucial in allowing disease diagnosis, disease prevention and disease control and adherence / compliance therapy to be carried out. Early recognition decreases the likelihood of losing vision and need for amputation. A study done in Singapore revealed that the implementation of public education regarding diabetes symptoms and complications will aid in lessen the burden of diabetes among the people as well as their friends and family followed by decrease the entire diabetes burden among the society[10].

4.6 Relationships between the Demographics and Scores (Level) of Diabetes Knowledge

There were several studies found evaluating the association/ relationship between gender and the level of diabetes knowledge. A few of the literature studies reported that gender was the predominant factor for diabetes knowledge [17,18] whereas others did not [19,20]. In this study, no statistical significant association between the gender and level of diabetes knowledge was observed (p = 0.119). Currently, both male and female have the same and equal opportunity, exposure and rights to receive education currently. This is the main reason that the Malaysian National Health Morbidity Survey 2011 reported that the prevalence of diabetes mellitus does not differ much between male and female [21].

Age is one of the factors in causing diabetes mellitus. No statistical significant were observed with cross tabulation between age (p = 0.103), ethnicity (p = 0.538) and level of education (p = 0.823) (Table 9). A few studies reported that education level was a determinant of the diabetes knowledge [22,23,24]. The result of this study was similar with the research study carried out in Latin which showed that higher levels of education attributed to the high level of diabetes knowledge [25].

While for cross tabulation between monthly income and diabetes knowledge, statistical significant association (p = 0.013) was observed (Table 9). This result was different

compared to others studies which showed people with high monthly income had better diabetes knowledge as this study results reported those respondents without monthly income contributed to high level of diabetes knowledge. This may be due to large proportion of respondents were within 18-27 years old where most of them were teenagers/ youngsters, students (college / university), fresh graduates and just start working. In addition, most of them were studying in tertiary education. This explained why the diabetes knowledge was high in this study.

There were several literature studies evaluating the association between family history of diabetes and level of diabetes knowledge. Some of the research studies found that positive family history did influence an individual's level of diabetes knowledge [26]. In this study, statistical significant association was observed (p = 0.010) between family history of diabetes and diabetes knowledge. This study's result was in agreement with the study done in Turkey and Tariai which showed that positive family history of diabetes did contribute to high level of diabetes knowledge among the respondents [19,26]. People who have positive medical history of diabetes may develop a personal sense of vulnerability that increases their awareness as shown in current study [27,28].

5. CONCLUSION

The result of this study demonstrated that the level of diabetes knowledge among the respondents was reasonably good except for a few deficiency areas. Majority of the respondents had a misconception that diabetes can be cured, did not realise that pregnancy could led to diabetes and did not know that weight loss despite normal appetite was the symptom of diabetes. Therefore, several efforts should be carrying out in order to further strengthening these specific deficiency areas.

Generally, respondents were well-informed regarding the basic general knowledge of diabetes. In conclusion, a presence of family history of diabetes is the predominant determinant factors that influence the level of diabetes knowledge. There was a statistically significant association between positive family history of diabetes and monthly income with the level of diabetes knowledge.

One of the limitations of this study was the results of this study cannot be generalised and represented the whole Malaysia because the study was done only in three different districts of Kuala Lumpur. Another limitation of this study was the unwillingness and uncooperativeness

of respondents in participating in this study. Our recommendation is such study should be done in a large population of Malaysia. We should conduct public seminar regarding the knowledge education on diabetes mellitus to give the awareness on diabetes general knowledge, risk factors and its complications.

Besides that, government and non-government organisation should often organise health campaign, seminars, and talks associated activities regarding diabetes. They should promote lifestyle modification, healthy diet consumption, and increased physical activities, minimise intake of sugar, modest weight reduction, measuring blood glucose level periodically and go for screening test for diabetes among the general public.

Moreover, health professionals including general physicians, pharmacists and nurses should cooperate together to enhance the health-related knowledge among the people by inculcating healthy lifestyle behaviour, practices as well as knowledge [29].

6. ACKNOWLEDGMENTS

The authors wish to thanks the general public for participating in this study.

7. COMPETING INTEREST

The authors declare no competing interest, in part or whole. No funding was received for this study.

8. AUTHORS CONTRIBUTION

MQ, AM and WHL carried out the literature review and draft the manuscript. MQ and WHL participated in collection of data and MQ, WHL, AM, JK, FA and AA arranged in tabular form. All authors read and approved the final manuscript.

REFERENCES

1. Roglic, G. & King, H. Diabetes in Asia, Hong Kong Medical Journal, 2000; 6: 10-11.
2. Ding, C.H., Teng, C.L.& Koh, C.N. 2006, Knowledge of diabetes mellitus among diabetic and non-diabetic patients in Klinik Kesihatan Seremban, Medical Journal of Malaysia, 2006; 61(4): 399-404.
3. Sagaran, R. & Srinivasan, S. Public awareness of diabetes mellitus in Klang district, Selangor, International Journal of Allied Medical Sciences and Clinical Research, 2014; 2(3): 186-195.

4. Gu, K., Cowie, C.C. & Harris, M.L. 1998, Mortality I adults with and without diabetes in a national cohort of the US population 1971-1993, Diabetes Care, 21(7): 1138-1145.
5. Mainous, A.G., Diaz, V.A. & Everett, C.J. Assessing risk for development of diabetes in young adults, Annals of Family Medicine, 2007; 5(5): 425-429.
6. Ramachandran, A., Snehalatha, C., Baskar, A.D., Mary, S., Kumar, C.K., Selvam, S., Catherine, S. & Vijay, V. Temporal changes in prevalence of diabetes and impaired glucose tolerance associated with lifestyle transition occurring in the rural population in India, Diabetologia, 2004; 47(5): 860-865.
7. Mustaffa, B.E. Diabetes Epidemic in Malaysia, Medical Journal of Malaysia, 2004; 59(3): 295-296.
8. Sabri, A.A., Qayyum, M.A., Saigol, N.U., Zafar, K. & Aslam, F. Comparing knowledge of diabetes mellitus among rural and urban diabetics, McGill Journal of Medicine, 2007; 10(2): 87-89.
9. Mohieldien A.H., Alohairy M.A. & Hasan M. Awareness of diabetes mellitus among Saudi non-diabetic population in Al Qassim region, Saudi Arabia, Journal of Diabetes and Endocrinology, 2011; 2(2): 14-19.
10. Wee, H.L., Ho, H.K. & Li, S.C. Public Awareness of Diabetes Mellitus in Singapore, Singapore Medical Journal, 2002; 43(3): 128-134.
11. Latifeh A.S. & Reem S.K. Awareness and knowledge about diabetes among students at Al-Balqa Applied University, Pakistan Journal of Nutrition, 2012; 11: 1023-1028.
12. American Diabetes Association. Gestational diabetes mellitus. Diabetes Care, 2003; 26(1): 103-105.
13. Diabetes Society of Singapore 2000.
14. Gianinazzi F., Bodenmann P., Izzo F., Voeffray Favre A.C., Rossi I. & Ruiz J. Risk perception and communications: from diabetes to cardiovascular disease, Rev Med Suisse, 2010; 6(252): 1182-1184, 1186-1187. French.
15. Lorga, T., Srithong, K., Manokulanan, P., Aung, T.N. N. & Aung, M.N. Public knowledge of diabetes in Karen Ethnic rural residents: a community-based questionnaires study in the far north-west of Thailand, International Journal of General Medicine, 2012; 5: 799-804.
16. Jackson D.M.A., Wills R., Davies J., Meadows K., Singh B.M. & Wise P.H. Public awareness of the symptoms of diabetes mellitus, Diabet Med., 1991; 8(10): 971-972.

17. Murata, G.H., Shah, J.H., Adam, K.D., Wendel, C.S., Bokhari, S.U., Solvas, P.A., Hoffman, R.M. & Duckworth, W.C. Factors affecting diabetes knowledge in Type 2 diabetic veterans, Diabetologia, 2003; 46(8): 1170-1178.
18. Murugesan N., Snehalatha C., Shobhana R., Roglic G. & Ramachandran A. Awareness about diabetes and its complications in the general and diabetic population in a city in southern india, Diabetes Res Clin Pract, 2007; 77: 433-437.
19. Gunay, T., Ulusel, B., Velipasaoglu, S., Unal, B., Ucku, R. & Ozgener, N. Factors affecting adult knowledge of diabetes in Narlidere Health District, Turkey, Acta Diabetol, 2006; 43(4): 142-147.
20. Yun L.S., Hassan Y., Aziz N.A., Awaisu A. & Ghazali R. A comparison of knowledge of diabetes mellitus between patients with diabetes and healthy adults: a survey from north Malaysia, Patient Educ Couns, 2007; 69(1-3): 47-54.
21. Tahir A. & Noor A.A. 2013, Conference on Non-Communicable Diseases, National Health and Morbidity Survey 2011. Institute for Public Health, Ministry of Health Malaysia.
22. Caliskan D., Ozdemir O., Ocaktan E. & Idil A. Evaluation of awareness of diabetes mellitus and associated factors in four health center areas, Patient Educ Couns, 2006; 62: 142-147.
23. Kamel M., Badawy Y.A., El-Zeiny N.A. & Merdan I.A. Sociodemographic determinants of managements behavior of diabetic patients Part II. Diabetics knowledge of disease and their management behavior, Eastern Mediterranean Health J., 1999; 5: 974-983.
24. Powell C.K., Hill E.G. & Clancy D.E. The relationship between health literacy and diabetes knowledge and readiness to take health actions, Diab Educ, 2007; 33(1): 144-151.
25. Gonzalez H.M., Vega W.A., Rodrigue M.A., Tarraf M. & Sribney W.M. Diabetes awareness and knowledge among Latinos: Does a Usual Source of Healthcare Matter? J Gen Intern Med, 2009; 24(3): 528-533.
26. Ulvi O.S., Chaudhary R.Y., Ali T., Alvi R.A., Aman Khan M.F. & Khan M. Investigation the awareness level about Diabetes Mellitus and associated factors in Tarlai (Rural Islamabad), J Pak Med Assoc., 2009; 59(11): 798-801.
27. Al Shafaee M.A., Al Shukaili S., A Rizvi S.G., Al Farsi Y. & A Khan M.,S Ganguly S.,Afifi M. & Al Adawi S. Knowledge and perceptions of diabetes in a semi-urban Omani population. BMC Public Health, 2008; 8(249): 1-8.

28. Walter F.M., Emery J., Braithwaite D.& Marteau T.M. Lay understanding of familial risk of common chronic disease: a systematic review and synthesis of qualitative research, Ann Fam Med., 2004; 2(6): 583-594.
29. Khan, N., Gomanthi, K.G., Shehnaz, S.I. & Muttappallymyalil, J. Diabetes mellitus-related knowledge among university students in Ajman, United Arab Emirates, Sultan Qaboos University Medical Journal, 2012; 12(3): 306-314.