PJN
ISSN 1680-5194

PAKISTAN JOURNAL OF NUTRITION

ANSInet
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
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E-mail: editorpjn@gmail.com

OPEN ACCESS Pakistan Journal of Nutrition

ISSN 1680-5194
DOI: 10.3923/pjn.2019.109.116

Research Article
Knowledge of Type 2 Diabetes Mellitus among Adults with and Without Diabetes in Universiti Kebangsaan Malaysia

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Abstract

Background and Objective: This study aimed to compare the level of knowledge on type 2 diabetes between adults with and without diabetes in Universiti Kebangsaan Malaysia (UKM), Bangi. **Materials and Methods:** The sample of this study included 202 UKM staff members including 101 diabetic respondents (DRs) and 101 non-diabetic respondents (NDRs) aged between 30 and 59 years. A questionnaire was used in this study to collect information on the respondents' sociodemographics and knowledge about type 2 diabetes. **Results:** The overall mean age for the respondents was 49.6±6.4 years. This study revealed that the mean score of knowledge for DRs and NDRs was comparable, with 80.4±14.0 and 76.7±14.3%, respectively ($p>0.05$), responding in the good category. The percentage of respondents for DRs that answered correctly on a few individual questions was significantly higher compared with NDRs ($p<0.05$), such as diabetes is a condition of insufficient insulin, complications include loss of sensation in the arms and legs, tablets and capsules are available for the control of diabetes and diabetics should carry sweets when they are out. The highest mean scores were obtained by DRs (95.0±14.6%) and NDRs (94.6±1.4%) in the monitoring sections ($p>0.05$), while the lowest scores were found for the general knowledge section, with a mean score of 69.1±23.0 and 65.7±20.0%, respectively ($p>0.05$). There was a significant difference in the mean score for the treatment and management of diabetes section between the DRs (80.5±18.8%) and NDRs (74.3±17.7%) ($p<0.05$). **Conclusion:** The level of knowledge on type 2 diabetes for both groups was good. The information gained could subsequently be helpful for the Health Center of the UKM and Health Ministry of Malaysia to design and initiate comprehensive programmes for the detection and control of diabetes and its complications with self-care and community support as its major components.

Key words: Type 2 diabetes, complication, knowledge of diabetes, control of diabetes, dietary habits

Received: April 07, 2018 Accepted: July 27, 2018 Published: January 15, 2019

Citation: Razalee Sedek and Saziatul Nazirah Saari, 2019. Knowledge of type 2 diabetes mellitus among adults with and without diabetes in Universiti Kebangsaan Malaysia. Pak. J. Nutr., 18: 109-116.

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Competing Interest: The author has declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Diabetes is one of the major health problems that is increasing worldwide. The number of diabetic patients is growing globally and is perceived to be on the rise to 35% in adults aged 20 years and above based on studies conducted from 1995-2005. Based on the World Health Organization (WHO), 300 million people are estimated to be diabetic[1]. The prevalence of diabetes in Malaysia for adults aged 18 years and above, as reported by the National Health Morbidity Survey III (NHMS III), increased from 11.6% in 2006 to 15.2% in 2011[2].

Type 2 diabetes is a type of diabetes that does not depend on insulin. Type 2 diabetes can be categorized as hyperglycaemia, which is high glucose content in the blood due to lack of secretion or effectiveness of insulin. Studies have shown that healthy eating habits, active lifestyles and intake of recommended medication can help in controlling or delaying the complications caused by type 2 diabetes[3].

Sufficient knowledge of this disease is the key to diabetes care[4]. Knowledge of care and sufficient health education is vital in moulding one's attitude and beliefs on life. This knowledge is also important in order to detect the presence of related symptoms and to help avoid the practice of risky lifestyles. The level of awareness and lack of knowledge about diabetes symptoms can lead to failure in detecting the presence of the disease in the early stages[5]. Chronic complications due to diabetes can be prevented or reduced effectively. However, many diabetes patients suffer due to these complications[6]. Generally, the decline of diabetes care is due to lack of importance regarding care by the patient or medical officer[7].

Based on the record of non-communicable disease patients among the staff at the Health Center of the Universiti Kebangsaan Malaysia (UKM) in 2013, 44.2% of the staff had control of diabetes and 55.8% were uncontrolled. Furthermore, the percentage of uncontrolled and controlled diabetic patients increased to 60.5 and 39.5%, respectively in 2014. In 2015, the percentages continued to increase by 63.5% for uncontrolled diabetics and was reduced by 36.5% for controlled diabetic patients[8].

The high percentage of uncontrolled diabetes can lead to an increase in complications and increases in the cost of treating diabetic patients. As Malaysia is also a part of the phenomenon of the increasing prevalence of diabetes, this study was conducted to determine and compare the level of knowledge among diabetic and non-diabetic patients among UKM, Bangi staff. Furthermore, such a study has yet to be conducted at the UKM, Bangi campus. In addition, the relationship between knowledge and the sociodemographic factors of type 2 diabetes patients among UKM staff was also identified. The results of this study can assist in raising the level of awareness of diabetes among UKM staff and can be used as a reference by the UKM Health Centre in planning and implementing programs to prevent and control diabetes among UKM staff.

MATERIALS AND METHODS

Ethical approval: Prior to the study, approval from the Medical Research and Ethics Committee of Universiti Kebangsaan Malaysia (reference number: UKM 1.5.3/244/FST-2015-008) was obtained. An approval letter to conduct the study on diabetic staff was also obtained from the Health Center of UKM.

Selection of respondents and study location: This cross-sectional study was carried out between August and November 2015. Data collection was conducted through anthropometric measurements and questionnaires. This study focused on knowledge of type 2 diabetes. The respondents comprised UKM staff aged from 30-59 years. The respondents were divided into two groups: diabetic respondents (DRs) and non-diabetic respondents (NDRs). The data of the 122 DRs were derived from the registration files at the UKM Health Center. Respondents who were non-diabetic were chosen from the office of the UKM residential college and faculties by considering similar characteristics as the diabetic patients in terms of gender, age and level of education. In addition, exclusion criteria were determined for the respondents, such as pregnant and breastfeeding women, individuals who suffered a dangerous illness that required treatment and those with psychological problems. In addition, the respondents were also required to provide written consent to participate in this study. For DRs, the questionnaire was answered by the respondents in a comfortable environment at the outpatient room of the UKM Health Center. Of the 122 registered diabetic patients, only 101 diabetic patients were involved as respondents of the study. Some patients were excluded from the study due to the exclusion criteria and health factors. The number of DRs involved in this study was similar to the number of diabetics with 101 respondents.

Demographic information: A questionnaire was used to collect data on demographic information of the respondents, including gender, race, age, monthly income, educational level, marriage status and genetic factors.

Anthropometric measurements: The height of the respondents while not wearing shoes was measured to the nearest 0.1 cm using the SECA body meter (Model 208, Seca, Germany). Body weight was measured in light clothing and barefoot to the nearest 0.1 kg using the digital TANITA balance HD312 (Tanita Corp, Tokyo, Japan). The body mass index (BMI) was calculated as weight (kg) divided by height (m^2). The BMI categories based on the WHO[9] were used to classify the RMP personnel's weight status. Weight below 18.5 kg m^{-2} was classified as underweight, 18.5-24.9 kg m^{-2} was normal, 25.0-29.9 kg m^{-2} was overweight and >30 kg m^{-2} was classified as obese.

Knowledge questions on type 2 diabetes: The questionnaire consisted of sociodemographic information and questions on type 2 diabetes knowledge. There were a total of 41 questions on nutritional knowledge comprising five categories, namely, general knowledge on type 2 diabetes, risk factors for type 2 diabetes, symptoms and complications of type 2 diabetes, treatment and management of type 2 diabetes and monitoring of type 2 diabetes patients. The knowledge question was adapted based on a questionnaire by Wee *et al.*[8]. A pre-test on the knowledge level was conducted with thirty UKM staff members. This pre-test was conducted to obtain feedback on the suitability of the questions, the level of understanding of the subject, language and the duration of time required by the respondents to complete a set of questionnaires. The Cronbach's Alpha value for the questionnaire tested was 0.76. This indicated that knowledge questions were reliable in the range of acceptable categories, which is from 0.7-0.8. Three answer options were provided in this section: yes, no and not sure. The score for a correct option was one and zero score was given for an incorrect and uncertain answer option. A score of 50% and below was categorized as a low level of knowledge, 51-69% was categorized as a moderate level and 70% and above was categorized as having a good level of knowledge[10].

Data analysis: All data from this study were analysed using the Statistical Package for Social Sciences (SPSS) version 23.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics, such as the frequency, mean, standard deviation and percentage, were used to describe sociodemographic characteristics, anthropometric profiles and the scores of the knowledge section. Independent t-tests were used to compare the differences in the anthropometric profiles and each score of the knowledge section according to diabetes status. Chi squared tests were used to evaluate the association between sociodemographic characteristics and the percentage of correct responses on individual knowledge questions with diabetes status. Statistical significance was set at $p<0.05$.

RESULTS AND DISCUSSION

Sociodemographic features of respondents: Table 1 illustrates the sociodemographic characteristics of the respondents according to the disease status. This study found that the majority of the respondents (67.8%), were males aged 50-59 years old (62.9%). There were more male than female respondents because the majority of diabetics registered at the UKM Health Center were male patients. A chi squared test was conducted to show a significant association between diabetes status and gender. However, the test showed no significant association between diabetes status and gender ($p>0.05$). Institut Kesihatan Umum (IKU)[2] reported a study conducted by NHMS III, which identified the number of male diabetes patients (11.9%) in Malaysia as being slightly higher than female patients (11.3%). Furthermore, the majority of the respondents were 50-59 years old (62.9%), followed by 40-49 years (22.3%) and 30-39 years (14.9%). The mean age of the respondents was 49.6±6.4 years. Although there was an increase in the percentage of respondents with diabetes that was parallel to the age increase, there was no significant association between diabetes status and age group ($p>0.05$). A study conducted by McDonald *et al.*[11] on 3590 respondents in Panama showed that the prevalence of diabetes increased in tandem with the age increase and individuals aged 50 and above were among those at high risk for diabetes. The majority of DRs and NDRs were married, at 89.1 and 96%, respectively. The DRs who were single at 6.9% were found to be diabetic compared to NBDs (0%) ($p<0.05$) with significant differences ($p<0.05$). The education level of the respondents was SPM/MCE at 41.1%, followed by university Degree (23.3%), STPM/Diploma (15.8%), SRP/PMR (10.9%) and 8.9% for primary school. For income level, 43.1% of the respondents had monthly incomes in the range of RM 2001-4000, followed by less than RM 2000 per month (29.7%) and RM 4001-6000 (18.8%). There was no significant association between diabetes status and education as well as income level ($p>0.05$). A total of 70.3% of DRs had a family history of diabetes compared to 42.6% for NDRs ($p<0.05$). According to Steyn *et al.*[12], genetic factors are one of the factors that can affect the prevalence of type 2 diabetes.

Anthropometric profiles: Table 2 shows the anthropometric profiles of the respondents by gender and diabetes status. The

Table 1: Sociodemographic characteristics according to diabetes status

	Diabetic patient (n = 101)		Non diabetic patient (n = 101)		Total (n = 202)			
Ciri-ciri	No.	Percentage	No.	Percentage	No.	Percentage	χ^2	p-value
Gender								
Male	69	68.3	68	67.3	137	67.8	0.023	0.881
Female	32	31.7	33	32.7	65	32.2		
Age (years)								
30-39	15	14.9	15	14.9	30	14.9	0.271	0.873
40-49	21	20.8	24	23.8	45	22.3		
50-59	65	64.4	62	61.4	127	62.9		
Ethnic								
Malay	98	97.1	100	99.0	198	98.0	1.020	0.312
Indian	3	2.9	1	1.0	4	2.0		
Marital status								
Single	7	6.9	0	0.0	7	3.5	7.262	0.026*
Married	90	89.1	97	96.0	187	92.6		
Widow	4	4.0	4	4.0	8	4.0		
Education level								
Primary school	10	9.9	8	7.9	18	8.9	0.381	0.984
SRP/PMR	11	10.9	11	10.9	22	10.9		
MCE/SPM	41	40.6	42	41.6	83	41.1		
STPM/Diploma	15	14.9	17	16.8	32	15.8		
Graduate	24	23.8	23	22.8	47	23.3		
Monthly income								
<RM2000	27	26.7	33	32.7	60	29.7	1.562	0.668
RM2001-RM4000	43	42.6	44	43.6	87	43.1		
RM4001-RM6000	21	20.8	17	16.8	38	18.8		
>RM6000	10	9.9	7	6.9	17	8.4		
Genetic factor								
Yes	71	70.3	43	42.6	114	56.4	15.786	0.000*
No	30	29.7	58	57.4	88	43.6		

*Significant difference at p<0.05

Table 2: Anthropometric profile of respondents according to gender and diabetes status

	Mean±SD					
	Male (n = 137)			Female (n = 65)		
Characteristics	Diabetic patient	Non diabetic patient	p-value	Diabetic patient	Non diabetic patient	p-value
Body weight (kg)	80.6±16.3	74.7±14.1	0.026*	72.4±14.7	65.6±13.2	0.054
Height (m)	1.7±0.1	1.7±0.1	0.721	1.6±0.1	1.5±0.1	0.684
BMI (kg m^{-2})	29.0±5.1	26.8±4.2	0.768	29.7±4.6	27.3±4.3	0.947

*Significant difference at p<0.05

mean body weight of the male DRs was significantly higher (80.6±16.3 kg) compared to male NDRs (74.7±14.1 kg) (p<0.05). Meanwhile, female DRs had higher body weight (72.4±14.7 kg) in comparison to female NDRs (65.6±13.2 kg); however, there was no significant difference between these two groups (p>0.05). The results of the study also found that there was no significant difference in height and BMI between the two groups for both genders. Based on Fig. 1, the majority of the DRs were in the category of overweight at 39.6%, followed by 38.6% in the obese category, 20.8% were normal weight and 1% were underweight. The majority of RBPDs were overweight at 48.5%, followed by 30.7% in the normal weight category, 19.8% were obese and 1% were underweight. The respondents who were diabetic were identified as significantly higher in the obese category (38.6%) compared to non-diabetic patients (19.8%). The chi squared test showed a significant difference between BMI and diabetes status (p<0.05).

This study is consistent with the study by El-Hazmi and Warsy[13] on 14,660 DRs and NDRs in Saudi Arabia that showed a significant difference in the prevalence of overweight and obesity and weight between diabetic and non-diabetic respondents. Moy and Rahman[14] conducted a study at the University Malaya Health Center on 196 diabetes patients and found that 66.8% of the respondents were in the overweight category and 15.8% were obese. The results of

this study showed a much higher prevalence of obesity and underweight compared to the results of the study conducted by Moy and Rahman[14].

Knowledge level of type 2 diabetes: Figure 1 shows the level of knowledge for DRs and NDRs. The majority of the respondents for both groups were in the good category, with DRs having a higher percentage (80.2%) than NDRs (70.3%). The NDR group had a higher percentage in the moderate and low-level knowledge categories compared to DRs.

The results of this study showed that the respondents have a good level of knowledge about diabetes except for some of the questions, as previously discussed. The results of this study are consistent with Wee *et al.*[8], who reported that the level of knowledge of respondents in the study was generally in the good category. However, it is uncertain whether both diabetic and non-diabetic patients will apply the existing knowledge in everyday life to reduce the risk or control type 2 diabetes.

Mean score of knowledge based on each section: The questionnaire pertaining to knowledge of diabetes was divided into five sections, namely, general knowledge, risk factors, symptoms and complications, treatment and management and monitoring. Table 3 shows the mean knowledge score for DRs and NDRs for each section. Both groups had the highest mean score for the category of monitoring questions for diabetic patients with a mean score of 95.0±14.6 and 94.6±1.4% (p>0.05) for DRs and NDRs, respectively, while the lowest score was in the general knowledge category with a mean score of 69.1±23.0 and 65.7±20.0% (p>0.05). A study conducted by Wee *et al.*[8] on 1337 Singaporeans who were randomly selected also obtained the highest mean score in the monitoring section and the lowest category in the general knowledge section. The high mean score in the monitoring category may be due to the availability of information from conversations and hearsay on precautions to be taken when diagnosed with diabetes. On the other hand, the general knowledge category had the lowest score because it involved basic facts about diabetes. These facts are usually derived from reading sources such as books, newspapers or the Internet. In addition, lack of interest in diabetes is also perceived to contribute to the low score by the respondents.

The risk factor category of DRs and NDRs had a mean score of 79.2±27.0 and 77.2±27.5%, respectively and did not indicate any significance difference (p>0.05). By educating about diabetes risk factors, it is hoped that high-risk individuals will be eager to adapt to a healthy lifestyle and play an active role in the prevention of diabetes. Diabetes is a major cause of morbidity and mortality worldwide. Due to lack of awareness of diabetes, most diabetics will suffer from complications. The results showed that respondents of both groups had a good understanding of diabetic symptoms and complications with a mean score of about 80% but did not show significant differences (p>0.05). Early detection of diabetes symptoms can help in the prevention of the disease and allow for immediate treatment. Knowledge on the dangers of complications supports individuals taking the symptoms seriously and seeking immediate treatment. However, most respondents are not aware of the symptoms of diabetes such as high blood pressure and cardiac arrest. The DR group only showed a significantly higher mean score compared to NDRs in the treatment and management category (p<0.05). This may be due to the experience of DRs in the treatment and management of their disease, which furthermore may assist them in increasing their knowledge in this category compared to NDRs.

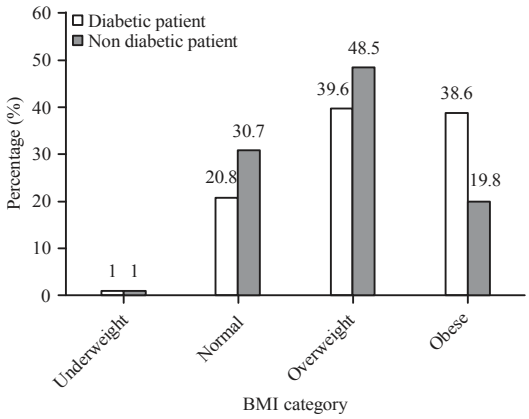

Fig. 1: Classification of BMI according to diabetes status of respondents
$\chi^2 = 8.952$, p<0.05

Table 3: Mean score of knowledge on diabetes type 2 for each section

Section	Diabetic patient (n = 101)	Non daibetic patient (n = 101)	p-value
General knowledge	69.1±23.0	65.7±20.0	0.272
Risk factors	79.2±27.0	77.2±27.5	0.606
Simptom and complication	83.3±19.0	80.7±20.7	0.362
Treatment and management	80.5±18.8	74.3±17.7	0.018*
Monitoring	95.0±14.6	94.6±1.4	0.821

*Significant difference at p<0.05

Analysis of knowledge questions on diabetes: Table 4-7 show the percentage of respondents who correctly responded to each question on general knowledge, risk factors, symptoms and complications, treatment and management and monitoring of diabetes according to the status of diabetes. The highest percentage obtained by DRs is in

Table 4: Percentage of correct response on general knowledge of diabetes

Questions	Yes/No	Percentage		χ^2	p-value
		Diabetic patient	Non diabetic patient		
Diabetes is a condition of high blood sugar	Yes	94.1	97.0		
	No	5.9	3.0		
Diabetes is a condition of insufficient insulin	Yes	70.3	56.4	4.180	0.041*
	No	29.7	43.6		
Diabetes is a condition of the body not responding to insulin	Yes	60.4	51.5	1.627	0.202
	No	39.6	48.5		
Diabetes is non-contagious	Yes	81.2	83.2	0.135	0.713
	No	18.8	16.8		
Diabetes is not curable	Yes	44.6	39.6	0.427	0.513
	No	55.4	60.4		
Insulin is a hormone	Yes	33.7	29.7	0.366	0.545
	No	66.3	70.3		
Insulin controls blood sugar	Yes	80.2	83.2	0.298	0.585
	No	19.8	16.8		
Insulin is required for some diabetic patients	Yes	88.1	85.1	0.385	0.535
	No	Tidak	11.9	14.900	

Table 5: Percentage of correct response on knowledge of risk factors, simptom and complications of diabetes

Question	Yes/No	Percentage		χ^2	p-value
		Diabetic patient	Non diabetic patient		
Risk factors					
Family history of diabetes	Yes	83.2	86.1	0.343	0.558
	No	16.8	13.9		
Age above 40 years old	Yes	74.3	64.4	2.037	0.153
	No	25.7	35.6		
Obesity	Yes	80.2	81.2	0.032	0.859
	No	19.8	18.8		
Simptom					
Constant feeling of thirst	Yes	84.2	73.3	3.575	0.059
	No	15.8	26.7		
Frequent urination	Yes	84.2	78.2	1.167	0.280
	No	15.8	21.8		
Weight loss	Yes	72.3	71.3	0.024	0.876
	No	27.7	28.7		
Blurred vision	Yes	92.1	91.1	0.064	0.800
	No	7.9	8.9		
Slow healing of cuts and wounds	Yes	89.1	93.1	0.976	0.323
	No	10.9	6.9		
Tiredness and weakness	Yes	97.0	94.1	1.047	0.306
	No	3.0	5.9		
Complications					
Decaying limbs that require surgical removal	Yes	80.2	93.1	7.225	0.007*
	No	19.8	6.9		
Eye problems	Yes	94.1	94.1	0.000	1.000
	No	5.9	5.9		
Kidney problems	Yes	83.2	77.2	1.122	0.289
	No	16.8	22.8		
High blood pressure	Yes	69.3	63.4	0.798	0.372
	No	30.7	36.6		
Heart attack	Yes	64.4	69.3	0.558	0.455
	No	34.4	30.7		
Loss of sensation in arms and legs	Yes	89.1	70.3	11.047	0.001*
	No	10.9	29.7		

Table 6: Percentage of correct response on knowledge of treatment and management of diabetes

Questions	Yes/No	Percentage		χ^2	p-value
		Diabetic patient	Non diabetic patient		
Insulin injections are available for the control of diabetes	Yes	93.1	91.1	0.272	0.602
	No	6.9	8.9		
Tablets and capsules are available for the control of diabetes	Yes	99.0	88.1	9.948	0.002*
	No	1.0	11.9		
Diabetics should carry sweets and jelly beans when they are out	Yes	73.3	52.5	9.352	0.002*
	No	92.7	47.5		
Diabetics should exercise regularly	Yes	89.1	80.2	3.087	0.079
	No	10.9	19.8		
Diabetics should have good weight control	Yes	92.1	92.1	0.000	1.000
	No	7.9	7.9		
Diabetics should go for regular eye check up	Yes	74.3	77.2	0.242	0.622
	No	25.7	22.8		
Diabetics should have a low fat and high fibre diet	Yes	86.1	79.2	1.693	0.193
	No	13.9	20.8		
Diabetics should care for their toes and feet	Yes	83.2	75.2	3.376	0.185
	No	16.8	24.8		
Diabetics should not consume alcohol	Yes	83.2	86.1	0.343	0.558
	No	16.8	13.9		
Diabetics should not donate blood	Yes	61.4	58.4	0.185	0.667
	No	38.6	41.6		
Diabetics should control the intake of fruits and vegetables	Yes	66.3	53.5	3.483	0.062
	No	33.7	46.5		
Diabetics should not smoke	Yes	82.2	74.3	1.860	0.173
	No	17.8	25.7		
Diabetics should not wear tight shoes	Yes	71.3	62.4	1.809	0.179
	No	28.7	37.6		
Diabetics should not skip meals when busy	Yes	71.3	70.3	0.024	0.877
	No	28.7	29.7		

Table 7: Percentage of correct response on knowledge of treatment and management of diabetes

Questions	Yes/No	Percentage		χ^2	p-value
		Diabetic patient	Non diabetic patient		
Diabetics should test for blood glucose	Yes	99.0	98.0	0.000	0.994
	No	1.0	2.0		
Diabetic should test for sugar in the urine	Yes	92.1	95.0	0.740	0.390
	No	7.9	5.0		
Diabetics should go for counseling session	Yes	93.1	89.1	0.976	0.323
	No	6.9	10.9		
Diabetics should go for regular medical check-ups	Yes	96.0	95.0	0.116	0.733
	No	4.0	5.0		

question 25 (capsules and pills can be used to control diabetes) and question 38 (diabetes patients need to carry out glucose tests in blood), at 99.0%. There was a significant difference for question No. 25 between both groups ($p<0.05$). The higher percentage of diabetic patients who answered both questions correctly is due to their experience and the ability to recognize the required medication for diabetes. The respondents of both groups indicated lower than 50% for question 5, with no significant difference ($p>0.05$). Furthermore, question 6 indicated the lowest percentage for DRs (33.7%) and NDRs (29.7%) ($p>0.05$). Both groups had a low percentage for the general knowledge questions of 'diabetes cannot be cured ′and 'insulin is a type of hormone'.

It is possible that the DRs and NDRs are less likely to read or are less thoroughly aware of type 2 diabetes. There was a significant difference for questions 2, 18, 23, 25 and 26 for respondents who answered correctly between DRs and NDRs ($p<0.05$). The DRs showed a significantly higher percentage for all questions except for question 18 on surgically removing limbs that are decayed. The DRs of the study may not have faced these problems due to diabetes; thus, they may lack awareness on the complications of diabetes. The DRs indicated a higher percentage of those questions compared to NDRs. This is because the former group had experience with the disease and received counseling from the UKM Health Centre, thus contributing to the higher level of knowledge.

CONCLUSION

Generally, the UKM adults represented in the sample of this study, both the RBD and RBPD, had good knowledge of diabetes except for some general knowledge questions. Both groups showed the highest and lowest mean scores in the same sections, which were the monitoring and general knowledge sections. There were only significant differences in the treatment and management sections between the two groups. The information obtained in this study can help the UKM Health Centre to consider these factors in order to prevent and control diabetes and its complications.

SIGNIFICANCE STATEMENT

This study showed that the level of knowledge regarding type 2 diabetes mellitus among adults with and without diabetes in UKM can be of use to the UKM Health Centre, Health Ministry of Malaysia and health-related agencies as they identify specific areas of health education pertaining to type 2 diabetes to be developed for adults. This study will help researchers uncover the critical areas of type 2 diabetes issues faced by adults that many researchers were not able to explore. Thus, a new theory on the factors to prevent and control diabetes and its complications may be developed.

ACKNOWLEDGMENTS

The authors gratefully acknowledge all staff of the UKM who participated in this study. We are also grateful to the medical officer and staff of the Health Centre of UKM for their cooperation and assistance in collecting the data and to Universiti Kebangsaan Malaysia for their support.

REFERENCES

1. Cockram, C.S., 2000. Diabetes mellitus: Perspective from the Asia-Pacific region. Diabet. Res. Clin. Pract., 50: S3-S7.
2. IKU., 2011. National Health and Morbidity Survey 2011 (NHMS 2011): Non communicable disease. Institut Kesihatan Umum, IKU., Vol. 2, Kementerian Kesihatan Malaysia, Kuala Lumpur.
3. Centers for Disease Control and Prevention CDC, 2011. National diabetes fact sheet. National Estimates and General Information on Diabetes and Prediabetes in the United States.
4. Caliskan, D., O. Ozdemir, E. Ocaktan and A. Idil, 2006. Evaluation of awareness of diabetes mellitus and associated factors in four health center areas. Patient Educ. Couns., 62: 142-147.
5. Angeles-Llerenas, A., N. Carbajal-Sanchez, B. Allen, S. Zamora-Munoz and E. Lazcano-Ponce, 2005. Gender, body mass index and socio-demographic variables associated with knowledge about type 2 diabetes mellitus among 13 293 Mexican students. Acta Diabetol., 42: 36-45.
6. Gaede, P., P. Vedel, N. Larsen, G.V. Jensen, H.H. Parving and O. Pedersen, 2003. Multifactorial intervention and cardiovascular disease in patients with type 2 diabetes. N. Engl. J. Med., 348: 383-393.
7. Anderson, R.M., J.T. Fitzgerald and M. Oh, 1993. The relationship between diabetes-related attitudes and patients' self-reported adherence. Diabetes Edu., 19: 287-292.
8. Wee, H.L., H.K. Ho and S.C. Li, 2002. Public awareness of diabetes mellitus in Singapore. Singapore Med. J., 43: 128-134.
9. WHO., 2016. Global database on body mass index. World Health Organization. http://www.who.int/bmi/index.jsp?introPage=intro_3.html
10. Khan, Y.H., A. Sarriff, A.H. Khan and T.H. Mallhi, 2014. Knowledge, Attitude and Practice (KAP) survey of osteoporosis among students of a tertiary institution in Malaysia. Trop. J. Pharm. Res., 13: 155-162.
11. McDonald, P.A.J., G.J.A. Montenegro, G.C.E. Cruz, A.L.M. de Rivera and O.A. Cumbrera, 2013. Prevalence, sociodemographic distribution, treatment and control of diabetes mellitus in Panama. Diabetol. Metab. Syndrome, Vol. 5. 10.1186/1758-5996-5-69.
12. Steyn, N.P., J. Mann, P.H. Bennett, N. Temple and P. Zimmer *et al*., 2004. Diet, nutrition and the prevention of type 2 diabetes. Public Health Nutr., 7: 147-165.
13. El-Hazmi, M.A. and A.S. Warsy, 2000. Prevalence of overweight and obesity in diabetic and non-diabetic Saudis. East Mediterr. Health J., 6: 276-282.
14. Moy, F. and S. Rahman, 2002. Anthropometry and dietary intake of type 2 diabetes patients attending an outpatient clinic. Malays. J. Nutr., 8: 63-73.