

## FACTORS ASSOCIATED WITH HEALTH LITERACY AMONG TYPE 2 DIABETES MELLITUS PATIENTS ATTENDING A GOVERNMENT HEALTH CLINIC, 2016.

Azreena E.<sup>1</sup>, Suriani I.<sup>2\*</sup>, Muhamad Hanafiah Juni<sup>2</sup>, Fuziah P.<sup>3</sup>

<sup>1</sup>MPH Candidates, Department of Community Health, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia.

<sup>2</sup>Department of Community Health, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia.

<sup>3</sup>Hulu Langat District Health Office

\*Corresponding author: Dr. Suriani Ismail; Email: si\_suriani@upm.edu.my

### ABSTRACT

**Background:** Despite the numerous health education programmes provided to the type 2 diabetes patients worldwide, the outcome of the diabetic management remains a challenge globally. Health literacy plays an important role in determining the outcomes from the diabetes management.

**Materials and Methods:** This study was aimed to determine the level of health literacy and its associated factors among type 2 diabetes mellitus patients attending a government health clinic. This study also aimed to determine the association between the associated factors, such as sociodemographic, socioeconomic characteristics, type of treatment, diabetes duration, and knowledge on diabetes and the level of health literacy as well as the predictors of the level of health literacy. This was a cross-sectional study that was conducted from 1<sup>st</sup> February 2016 to 30<sup>th</sup> July 2016. A total of 360 participants were randomly selected from a government health clinic through a systematic random sampling method. A validated, self-administered questionnaire incorporating sociodemographic characteristics, socioeconomic characteristics, history of type 2 diabetes, diabetes knowledge and health literacy level was used in this study. Data was analysed using IBM Statistical Package for Social Science Version 22.0. Chi square test, Fisher's Exact test and simple logistic regression were used to measure the association between the associated factors and health literacy level. Multiple logistic regression analysis was used to analyse the predictors influencing health literacy level among type 2 diabetes mellitus patients.

**Result:** The response rate was 80%. Majority of the respondents have limited health literacy level (85.8%). There were significant association between ethnic group and health literacy level ( $\chi^2=6.317$ ,  $P=0.042$ ), level of education and health literacy level ( $\chi^2=6.304$ ,  $P=0.043$ ) and diabetes knowledge score and health literacy level [Odds Ratio (OR)=1.254, 95% Confidence Interval (CI) (1.063,1.479)]. Finally, the significant predictors for adequate health literacy level were the Chinese ethnic group [Adjusted OR (AOR)=4.441, 95% CI (1.472,13.392)] and diabetes knowledge score [AOR=1.238, 95% CI (1.031,1.488)].

**Conclusion:** In conclusion, level of health literacy among type 2 diabetes mellitus patients was significantly associated with the ethnic group, level of education and diabetes knowledge score. It can also be concluded that Chinese ethnic group and diabetes knowledge score were the significant predictors for adequate health literacy level among type 2 diabetes mellitus patients.

**Keywords:** Health literacy, type 2 diabetes, health literacy factors, diabetes education

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## 1.0 Introduction

Diabetes remains to be one of the most important public health challenges across the world. It is one of the most prevalence non-communicable diseases throughout the world as it is estimated that in 2014, the global prevalence of diabetes was 9% and 1.5 millions death were directly caused by diabetes in 2012 (World Health Organization [WHO], 2014). It is predicted that diabetes will be the 7<sup>th</sup> leading cause of death in 2030 (WHO, 2015). Type 2 diabetes itself accounts for 90% of all diabetic cases globally (WHO, 2015). In Malaysia, the burden of diabetes is increasing from year to year basis. This is shown by the increase in prevalence of diabetes from 15.2 % in 2011 (Ministry of Health Malaysia [MOH], 2013, p. 6) to 17.5 % in 2015 (MOH, 2015). A total of 99% of the registered diabetic patients in between 2009 to 2012 were diagnosed with type 2 diabetes mellitus (MOH, 2013).

Over the time, there are a number of health education strategies that were developed and implemented for the diabetic care in Malaysia. One of the strategies used by the MOH is the ongoing training programme in upgrading and updating the knowledge and skills among the doctors, para-medics and allied health staffs (MOH, 2008, p. 64). It is recommended for the diabetes education process to be carried out by various numbers of educators including the doctors, assistant medical officers, nurses, dietitian, pharmacist and other medical personnels (MOH, 2015, p. 10). The main objectives of the education are to reassure and lessen anxiety, to understand the disease, its management and complication as well as to promote compliance and self-care among the patients with type 2 diabetes mellitus (MOH, 2015, p. 10). However, how effective is the delivery and acceptance of the information remains questionable.

The effectiveness of the diabetes education and management is determined by many contributory factors. One of the most important determinants is the health literacy among the diabetic patients as it is the degree to which an individual can obtain, process, understand and communicate about health-related information in order to make informed health decision (Berkman, Davis, & McCormack, 2010). It is suggested that health literacy has a great influence on the health outcome including the acquirement of new disease-specific knowledge, self-efficacy improvement and adherence to self-care behaviours (Cavanaugh, 2011).

Health literacy among the diabetes mellitus patients is influenced by a number of contributing factors. Some of the contributing factors that were identified in relation to health literacy from previous studies are the sociodemographic and socioeconomic factors, duration of disease, treatment regimen and diabetes education status (Schillinger et al., 2002). Poor health literacy in type 2 diabetes mellitus patients is associated with poor outcomes on the diabetic management. A study in China found that low health literacy was associated with

uncontrolled diabetes which was indicated by high level of glycosylated haemoglobin (HbA1c) (Tang, Pang, Chan, Yeung & Yeung, 2008). There was an inverse relationship between health literacy and HbA1c level ( $r_s = - 0.32$ ,  $P < 0.001$ ) (Tang et al., 2008). Uncontrolled diabetes as a result of poor health literacy leads to diabetic complications. Patients with inadequate health literacy was found to be more likely to have poor glycemic control [AOR=2.03, 95% CI (1.11-3.73)  $P=0.02$ ] and higher rates of diabetes complication, retinopathy in particular [AOR= 2.33; 95% CI (1.19,4.57)  $P=0.01$ ] (Schillinger et al., 2002) . This explains that poor health literacy results in poor diabetic management outcomes, hence indirectly causing the increase of the disease burden.

In spite of advanced medical treatment available for the management of type 2 diabetes mellitus these days, there are still a high proportion of diabetic patients who have poorly controlled glucose level. In Malaysia, it was found that only 23.8% of type 2 diabetes mellitus patients achieved the Malaysian glycaemic control with HbA1c of less than 6.5% (MOH, 2013). A study conducted in Malaysia found that 74.5% from the type 2 diabetes mellitus patients have HbA1c level of 7% or more which indicated poor diabetic control (Mafauzy, Husein & Chan, 2011).

Even though in Malaysia there are a number of health education materials and methods established for the diabetic patients, including the presence of diabetes educators in most of the health clinics, the effectiveness of the means could be limited due to the different health literacy level among the patients. This was shown by a finding in a prospective observational study in Malaysia where the HbA1c level among the diabetic patients were higher at the end of the Diabetes Self Management Program despite all the education given (Al-Haddad et al., 2009). The difference of the health literacy level is associated with multiple factors including sociodemographic and socioeconomic background, history of the disease, knowledge on the disease as well as diabetes education status (Schillinger et al., 2002).

Thus, it is undeniably argued that health literacy is one of the most important factors to determine the outcomes of type 2 diabetes mellitus patients' management.

## 2.0 Materials and Methods

The objective of this study is to determine level of health literacy and the factors associated with it among type 2 diabetes mellitus patients attending government health clinic. It was also aimed to determine the association between the associated factors and the level of health literacy as well as the predictors of the level of health literacy. This study was carried out in one of the government health clinics in Selangor, Malaysia. This study has received ethical approval from the Medical Research and Ethics Committee of Ministry of Health as well as Ethics Committee For Research Involving Human Subjects Universiti Putra Malaysia.

This was a cross-sectional study. The study duration was from the 1<sup>st</sup> February 2016 to 30<sup>th</sup> July 2016. Data collection was carried out between 18<sup>th</sup> May 2016 to 29<sup>th</sup> May 2016. The study population for this study was all diabetes mellitus patients attending the government health clinic and the sampling population was type 2 diabetes mellitus patients attending the health clinic by appointment. The inclusion criteria was type 2 diabetes mellitus patients aged above 18 years old attending the health clinic during the study period. All type 1 , juvenile

diabetes patients, type 2 diabetes mellitus patients with any documented very poor vision, psychiatric illness, illiterate, unable to communicate in Malay language or English, learning disability or dementia were excluded from this study. Respondents were first assessed for eligibility to take part in this study. Written consent were collected from the eligible respondents, followed by questionnaire distribution. Respondents were guided for any hesitancy or doubt regarding the questionnaires. Questionnaires were returned on the same day after completeness were checked.

Data were collected using a validated, self-administered questionnaire incorporating sociodemographic characteristics, socioeconomic characteristics, history of type 2 diabetes, diabetes knowledge and health literacy level. For diabetes knowledge assessment, a validated Malaysian Version of 14-item Michigan Diabetes Knowledge Test (MDKT) was adopted. (Al-Qazaz et al., 2010). For health literacy assessment, a Malaysian Version of Newest Vital Signs was adopted (Institute of Health Behaviour Research (IHBR), 2011). This was based on the scoring of 0 to 1 correct answers indicated high likelihood of inadequate health literacy, 2 to 3 correct answers indicated possible limited literacy, and of 4 or more correct answers indicated adequate literacy (Shah, West, Bremmeyr & Savoy-Moore, 2010). These were then regrouped into 2 categories; limited health literacy (possible and high likelihood of inadequate health literacy) and adequate health literacy.

Data was analysed using IBM Statistical Package for Social Science Version 22.0. For descriptive analysis, mean (Standard Deviation [SD]) or median (Inter-Quartile Range [IQR]) were used to describe all continuous variables. For categorical variables, frequency and percentage (%) were used. Chi square test, Fisher's Exact test and simple logistic regression were used to measure the association between the associated factors and health literacy level. Multiple logistic regression analysis was used to analyse the predictors influencing health literacy level among type 2 diabetes mellitus patients attending Kajang Health Clinic. Level of significance was set at an alpha level of 0.05. Upon analyzing the predictors, selected variables from the bivariate analysis with *P*-value of less than 0.25 were included into the preliminary model (Hosmer & Lemeshaw, 2000).

### 3.0 Result

A total of 360 questionnaires were distributed to potential respondents based on the inclusion and exclusion criteria. Among the eligible, 288 respondents consented and completed the questionnaires. Thus making a response rate of 80%.

#### 3.1 Descriptive Analysis

##### 3.1.1 Sociodemographic and Socioeconomic Characteristics of the Respondents

The mean age of the respondents was  $53.42 \pm 9.87$ , with the youngest aged 27 while the oldest aged 76. 52.1% of the respondents were male while 47.9% were female. Majority of the respondents were Malay (68.8%), followed by Indian (23.3%) and Chinese (7.9%). In terms of level of education, majority of the respondents have secondary level of education (62.2%), followed by tertiary level of education (28.1%), primary level of education (8.7%) and no formal education (1.0%). For monthly household income, 23.3% of the respondents

earned between RM 2000 to RM 2999, followed by RM 1000 to RM 1999 (19.4 %), RM 5000 or more (18.1%), RM 3000 to RM 3999 (17%), RM 1000 and lesser (15.6%) and RM 4000 to RM 4999 (6.6%). For employment status, 31.3% of the respondents were private employees, followed by retirees (28.8%), others (25.0%) and government servants (14.9%).

### 3.1.2 Medical History of Type 2 Diabetes

Respondents' medical history of type 2 diabetes include the diabetes duration and the type of diabetes treatment. The median duration of diabetes of the respondents was 5 years (8) with the shortest duration of 1 year and the longest duration of 29 years. In terms of type of diabetes treatment, majority of the respondents were on oral hypoglycaemic agent (OHA) (64.6%), followed by OHA and insulin (24%), insulin only (6.3%) and OHA and alternative medicine (5.2%).

### 3.1.3 Knowledge on Diabetes

For the respondents' total diabetes knowledge score, the mean score was  $7.77 \pm 2.18$  with the lowest score was 2 and the highest score was 12.

### 3.1.4 Level of Health Literacy

Majority of the respondents (85.8%) have limited health literacy level while another 14.2% have adequate health literacy level. Table 1 showed the level of health literacy among the respondents.

**Table 1:** Level of health literacy (N=288).

Variable	n (%)
<b>Level of Health Literacy</b>	
Limited Literacy (0-3)	247 (85.8)
Adequate Literacy (4-6)	41 (14.2)

## 3.2 Bivariate Analysis

### 3.2.1 Association Between Sociodemographic and Socioeconomic Characteristics and Level of Health Literacy

Two variables were significantly associated with the level of health literacy which were the ethnic group ( $\chi^2=6.317$ ,  $df=1$ ,  $P=0.042$ ) and the level of education ( $\chi^2=6.304$ ,  $df=2$ ,  $P=0.043$ ). Among the Malays, a high proportion (88.4%) have limited health literacy level and only 11.6% have adequate health literacy level while 69.6% and 30.4% respectively among the Chinese and 83.6% and 16.4% respectively among the Indian. Among those with primary education and lower, there is a high proportion (92.9%) that have limited health literacy level while another 7.1% have adequate health literacy level. Among those with secondary education, 88.3% have limited health literacy level while 11.7% have adequate health literacy level while 77.8% and 22.2% respectively among those with tertiary education and higher.

Among those aged less than 53 years, there is a high proportion (82.4%) that have limited health literacy level while another 17.6% have adequate health literacy level while 88.8% and 11.2% respectively among those aged 53 years and above. A higher proportion (91.1%)

among those with monthly household income less than RM1000 have limited health literacy level and only 8.9% have adequate health literacy level while 88.8% and 11.2% respectively among those with monthly household income of RM1000 and above. Among those who were retired, there is a high proportion (92.8%) with limited health literacy level while another 7.2% have adequate health literacy level. Among those who were employed, 82.1% have limited health literacy level while 17.9% have adequate health literacy level while 85.0% and 15.0% respectively among those who were unemployed. However, these findings were not significant. Table 2 outlines the results for this analysis.

**Table 2:** Association between sociodemographic and socioeconomic characteristics of the type 2 diabetes mellitus patients and level of health literacy (N=288).

Variables	Limited Literacy n= 247 (%)	Adequate Literacy n=41 (%)	Test statistics		
			$\chi^2$	df	P-value
<b>Age Group</b>					
< 53 years	112 (82.4)	24 (17.6)	2.456	1	0.117
≥ 53 years	135 (88.8)	17 (11.2)			
<b>Gender</b>					
Male	133 (88.7)	17 (11.3)	2.160	1	0.142
Female	114 (82.6)	24 (17.4)			
<b>Ethnic Group</b>					
Malay	175 (88.4)	23 (11.6)	6.317	2	0.042*
Chinese	16 (69.6)	7 (30.4)			
Indian	56 (83.6)	11 (16.4)			
<b>Level of Education</b>					
Primary education and lower <sup>a</sup>	26 (92.9)	2 (7.1)	6.304	2	0.043*
Secondary education	158 (88.3)	21 (11.7)			
Tertiary education and higher	63 (77.8)	18 (22.2)			
<b>Monthly Household Income Group (RM)</b>					
< 1000	41 (91.1)	4 (8.9)	NA	1	0.355 <sup>b</sup>
≥ 1000	206 (84.8)	37 (15.2)			
<b>Employment status</b>					
Employed <sup>c</sup>	119 (82.1)	26 (17.9)	4.988	2	0.083
Unemployed <sup>d</sup>	51 (85.0)	9 (15.0)			
Retired	77 (92.8)	6 (7.2)			

<sup>a</sup>Primary education and lower include those who have no formal education and those with primary education.

<sup>b</sup>Fisher's Exact Test

<sup>c</sup>Employed include those who are government, private and self-employed.

<sup>d</sup>Unemployed include housewives.

NA : not available

\* Significant at  $P < 0.05$

### 3.2.2 Association Between Medical History of Type 2 Diabetic Patients and Level of Health Literacy

The proportion of respondents with diabetes duration less than 5 years with limited health literacy (85.1%) is quite similar with those with diabetes duration of 5 years and more (86.4%). Similarly, the proportion of respondents with limited health literacy level were quite similar across all types of treatment. However, these findings were not significant. Table 3 illustrates the result.

**Table 3:** Association between medical history (diabetes duration and type of diabetes treatment) of type 2 diabetes mellitus patients and level of health literacy (N=288).

Variables	Limited Literacy n=247 (%)	Adequate Literacy n=41 (%)	Test statistics		
			$\chi^2$	df	P-value
<b>Diabetes Duration (years)</b>					
< 5 years	120 (85.1)	21 (14.9)	0.098	1	0.754
≥ 5 years	127 (86.4)	20 (13.6)			
<b>Type of Treatment</b>					
Oral Hypoglycaemic Agent (OHA)	159 (85.5)	27 (14.5)	NA	NA	0.368 <sup>a</sup>
Insulin Only	15 (83.3)	3 (16.7)			
OHA and Insulin	62 (89.9)	7 (10.1)			
OHA and Alternative Medicine	11 (73.3)	4 (26.7)			

<sup>a</sup>Fisher's Exact Test

NA : not available

\* Significant at  $P < 0.05$

### 3.2.3 Association Between Diabetes Knowledge Score of The Type 2 Diabetes Mellitus Patients and Level of Health Literacy

Diabetes knowledge score is significantly associated with the level of health literacy among the type 2 diabetes mellitus patients. The odds of having adequate health literacy level is increased by 1.254 times with the increase in 0.226 of diabetes knowledge score [OR=1.254, 95% CI (1.063, 1.479),  $P=0.007$ ]. Table 4 illustrates the result for this analysis.

**Table 4:** Association between diabetes knowledge score of the type 2 diabetes mellitus patients and level of health literacy (N=288).

Variable	$\beta$	SE	Wald	Crude Odds Ratio	(95% CI)	P-value
Knowledge Score	0.226	0.084	7.23	1.254	(1.063, 1.479)	0.007*

\* Significant at  $P < 0.05$

### 3.3 Predictors of Adequate Health Literacy Level

Table 5 shows the results of the logistic regression for predicting the level of health literacy. The odds of having adequate health literacy among the Chinese were four times higher

compared to the Malay. In addition, the odds of having adequate health literacy is 1.238 times increase with the 0.214 increase in the diabetes knowledge score.

**Table 5:** Predictors of adequate health literacy level

Variable	$\beta$	SE	Wald	Adjusted Odds Ratio	(95% CI)	P- value
<b>Age Group</b>						
< 53 years	0.142	0.422	0.113	1.152	(0.504, 2.637)	0.737
[ $\geq$ 53 years ]				1.000		
<b>Gender</b>						
[ Female ]				1.000		
Male	-0.699	0.409	2.918	0.497	(0.223, 1.108)	0.088
<b>Ethnic Group</b>						
[ Malay ]				1.000		
Chinese	1.491	0.563	7.007	4.441	(1.472, 3.392)	0.008*
Indian	0.657	0.426	2.379	1.929	(0.837, 4.444)	0.123
<b>Level of Education</b>						
[ Primary education and lower <sup>a</sup> ]				1.000		
Secondary education	0.374	0.812	0.212	1.453	(0.296, 7.132)	0.645
Tertiary education and higher	0.922	0.891	1.070	2.515	(0.438,14.428)	0.301
<b>Employment status</b>						
[ Unemployed <sup>b</sup> ]				1.000		
Retired	-0.786	0.676	1.350	0.456	(0.121, 1.715)	0.245
Employed <sup>c</sup>	0.186	0.523	0.127	1.204	(0.432, 3.355)	0.722
<b>Diabetes Knowledge Score</b>	0.214	0.094	5.205	1.238	(1.031, 1.488)	0.023*
<b>Constant</b>	-4.075	1.055	14.928	0.017	- -	<0.001

[ ] Reference category

\* Significant at  $P < 0.05$

Nagelkerke  $R^2 = 0.155$

<sup>a</sup>Primary education and lower include those who have no formal education and those with primary education.

<sup>b</sup>Unemployed include housewives.

<sup>c</sup>Employed include those who are government, private and self-employed.

Therefore, it can be concluded that Chinese ethnicity and diabetes knowledge score are the significant predictors for adequate health literacy level in this study.

## 4.0 Discussion

Health literacy level has been found to be one of the important determinants of diabetes management outcomes. Despite medical discovery on the latest diabetic treatment and management, the diabetic outcomes can be limited due to poor health literacy among the type 2 diabetes mellitus patients (Schillinger et al., 2002). This study was aimed at exploring the level of health literacy and the various factors that contributed to the level of health literacy among type 2 diabetes mellitus patients attending a government health clinic.

From this study, it was found that majority of respondents have the limited health literacy level (85.8%). This result showed higher percentage of the respondents that have limited



health literacy level compared to study conducted in the United States which showed 51.5% of the respondents have inadequate and marginal health literacy (Schillinger et al., 2002). This could be due to the higher proportion of the respondents who have lower level of education and lower diabetes knowledge score, leading to higher proportion of limited health literacy.

#### ***4.1 Association Between Sociodemographic and Socioeconomic Characteristics and Health Literacy Level Among Respondents***

From this study, it was found that only ethnicity group and level of education that were significantly associated with health literacy level.

From this study, it was found that there was a significant association between the ethnicity group and level of health literacy ( $P=0.042$ ). This is consistent with a study in United States done by Schillinger et al., that showed significant association between ethnicity groups and level of health literacy among type 2 diabetes mellitus patients (Schillinger et al., 2002). Among the Malays, 88.4% have limited literacy while 11.6% have adequate health literacy. Among the Chinese, 69.6% have limited health literacy while 30.4% have adequate health literacy. 83.6% of the Indians have limited health literacy while another 16.4% have adequate health literacy. The Chinese have higher percentage of having adequate health literacy level compared to the other ethnicity groups. This could be due to the selection of participants who were either Malay or English literate. Hence, increase the likelihood that the more educated Chinese were selected for this study. Therefore, a bigger study should be conducted to reduce the selection bias and Chinese version of questionnaire could be considered for future research.

This study also found that there was a significant association between level of education and health literacy level ( $P=0.043$ ). This is consistent with studies done in the United States by Schillinger et al., and another study done in Tokyo by Ishikawa et al., that found significant association between level of education and level of health literacy among type 2 diabetes mellitus patients (Schillinger et al., 2002 & Ishikawa et al., 2008). Among the group with primary education and lower, 92.9% have limited health literacy and 7.1% have adequate health literacy. 88.3% and 11.7% respectively among the group with secondary education and 77.8% and 22.2% respectively among the group with tertiary education and higher. This could be due to the group with higher education are more likely to have higher health seeking behaviour and critical thinking leading to them obtaining more information on health and better health literacy.

Level of health literacy may differ with age. In this study, it was found that 82.4% of those below 53 years old had limited health literacy level while another 17.6% had adequate health literacy. On the other hand, among those aged 53 years old or more, a higher percentage of 88.8% had limited health literacy level and 11.2% had adequate health literacy level. This is consistent with previous study in United States done by Schillinger et al., which showed higher mean age among the limited literacy group (Schillinger et al., 2002). This could be due to the higher possibility that the older age respondents have lower level of education compared to the younger respondents. However, it was not statistically significant ( $P=0.117$ ).

It was found that a higher proportion of males (88.7%) have limited health literacy level while 11.3% have adequate health literacy level compared to 82.6% and 17.4% respectively among the females. However, this finding was not significant ( $P=0.142$ ). This finding was consistent

with the MOH finding on Malaysian adults with adequate health literacy in which among the females, only 6.6% have adequate health literacy while among the males, only 6.5% have adequate health literacy (MOH, 2015). However, this was inconsistent with the finding by Schillinger et. al, which showed lower percentage of limited health literacy level (44%) among the males compared to (52%) among the females ( $P=0.01$ ) (Schillinger et al., 2002).

There was no significant association between the monthly household income group and level of health literacy among the respondents ( $P=0.355$ ). This is inconsistent with previous study by Schillinger et al., that found significant association between household income and level of health literacy among type 2 diabetes mellitus patients ( $P<0.001$ ) (Schillinger et al., 2002). Among the group with monthly household income less than RM 1000, 91.1% have limited health literacy level and 8.9% have adequate health literacy level and 84.8% and 15.2% respectively among the group with monthly household income of RM 1000 and more than RM 1000. This showed that higher proportion of those who came from below the poverty threshold have limited health literacy level which could be associated with lower level of education among this group. However, this finding was not statistically significant.

Employment status was found to have no significant association with the level of health literacy ( $P=0.083$ ). Among the unemployed group, 85% have limited health literacy level while another 15% have adequate health literacy level. 92.8% among the retired group have limited health literacy level while another 7.2% have adequate health literacy level and 82.1% and 17.9% respectively among the employed group. This could be due to the mixture of educational background across the employment status group. This result is contrary to study in Marshall Island done by Bohanny et al., that found significant association between the employment status and level of health literacy among type 2 diabetes mellitus patients ( $P<0.01$ ) (Bohanny et al., 2013).

#### ***4.2 Association Between Medical History of Type 2 Diabetes and Health Literacy Level***

This study found no significant association between the medical history of type 2 diabetes and health literacy level. There was no significant association between diabetes duration and health literacy level ( $P=0.754$ ). Higher proportion of those with limited health literacy level were found in both with diabetes duration of less than 5 years (85.1%) and diabetes duration 5 years or more (86.4%). This finding was inconsistent with study by Schillinger et. al which found shorter mean diabetes duration among the adequate health literacy group ( $P<0.001$ ) (Schillinger et al., 2002). This could indicate that diabetes duration itself may not be the only independent influencing factor for health literacy level but it could be associated with other factor such as diabetes education. Therefore, more factor including diabetes education should be included in future research.

There was also no significant association between the type of diabetes treatment and the level of health literacy ( $P=0.368$ ). Majority of the respondents have limited health literacy level no matter they were on which type of treatment. This could be due to other factors, such as diabetes duration and level of education that can be associated with the level of health literacy instead of the type of diabetes treatment alone. This was consistent with previous study which found no significant association between the type of diabetes treatment and the health literacy level ( $P=0.1$ ) (Schillinger et al., 2002).

### **4.3 Association Between Diabetes Knowledge Score and Health Literacy Level**

From this study, it was found that the association between the diabetes knowledge score and the level of health literacy was statistically significant ( $P=0.007$ ). The odds of having adequate health literacy level is increased by 1.254 times with the increase in 0.226 of diabetes knowledge score [OR=1.254, 95% CI (1.063, 1.479),  $P=0.007$ ]. This could be due to the possibility that better health decision can be made with the increase in knowledge and information on the disease. This is consistent with finding by Powell et. al of significant association between diabetes knowledge and health literacy level in which those with lower diabetes knowledge score had lower health literacy level ( $P=0.004$ ) (Powell et al., 2007). This finding is also consistent with another study by Bains & Egede and a study by Mancuso that found significant correlation between diabetes knowledge and health literacy level (Bains & Egede, 2011 & Mancuso, 2010).

### **4.4 Predictors of Adequate Health Literacy Level Among Type 2 Diabetes Mellitus Patients**

Chinese ethnic group was one of the significant predictors of adequate health literacy in this study. The odds of Chinese ethnicity having adequate health literacy level is 4 times higher compared to the Malays. Thus, Chinese ethnic group predicts adequate health literacy level. Among the Chinese, 30.5% have adequate health literacy level while another 69.6% have limited health literacy level. This could be attributed by the large proportion among the Chinese who participated in this study were highly educated due to them being literate in English or Malay language. Therefore, this could be an effect from selection bias. However, this finding was consistent with previous findings by Schillinger et al., and DeWalt et al., which showed there was variation in health literacy across the ethnicity groups among type 2 diabetes mellitus patients ( $P<0.05$ ) (Schillinger et al., 2002 & DeWalt et al., 2007). Furthermore, a study on sociodemographic determinants of glycaemic control in young diabetic patients in Malaysia by Ismail et. al found the best diabetic control was obtained in Chinese patients compared with Malays patients (Ismail et al., 2000). This could indicate that the Chinese could have higher level of health literacy compared to the Malays which lead to better diabetic control among the Chinese. Nonetheless, little is known on association between health literacy level across ethnic groups in Malaysia. Therefore, more studies are needed to clarify on how the ethnic groups predict the level of health literacy among type 2 diabetes mellitus patients in Malaysia.

Diabetes knowledge score was another significant predictor for having adequate health literacy level. The finding indicated that for every increase of 0.214 score in diabetes knowledge, the odds of having adequate health literacy increases 1.238 times. This is consistent with previous study in the United States done by Mancuso that found health literacy level increased as the diabetes knowledge increased ( $r_s=0.296$ ,  $P<0.01$ ) (Mancuso, 2010). Similar finding ( $r_s=0.446$ ,  $P<0.001$ ) was observed in another study by Bains & Egede (Bains & Egede, 2011). This showed that by improving diabetes knowledge, level of health literacy can also be improved. Therefore, efforts on educating the patients on diabetes should be enhanced. This is supported by finding by Kandula et al. and Wallace et al. where diabetes education significantly increased diabetes knowledge across all health literacy level among diabetes mellitus patients ( $P<0.001$ ) (Kandula et al., 2009 & Wallace et al., 2009). A Malaysian study by Tan et al., found a significant improvement in diabetes knowledge score among diabetic patients who received a brief structured education programme [2.78, 95% CI (2.39, 3.17)] compared to the control group [1.47, 95% CI (1.11, 1.83)] (Tan et al., 2011).

Similarly, a local study by Ahmad et al., found that a culturally tailored module of diabetes education significantly increased diabetes knowledge score which can be useful in helping diabetic patients in managing their diabetes (Ahmad, Ramadas, Fatt & Md Zain, 2014). This will subsequently lead to better health literacy level.

Furthermore, good diabetes knowledge among diabetes mellitus patients have also been found to be associated with good diabetic management outcomes. It is suggested by Eyuboglu & Schulz from a study in Turkey, that there is higher possibility of those with higher health literacy to have high level of patient empowerment and leading to good diabetic outcomes (Eyuboglu & Schulz, 2016). This could also be the result from good diabetes knowledge. However, the findings were not significant. A study in Malaysia by Al-Qazaz et al., found that there is a significant correlation ( $P<0.05$ ) between diabetes knowledge and medication adherence among type 2 diabetes mellitus patients (Al- Qazaz et al., 2011). This could also have resulted from better health literacy and leading to good diabetic control.

However, knowledge is only part of the influencing factors on health literacy level. Other factors including social and cultural aspects should also be considered in determining the health literacy level among type 2 diabetes mellitus patients.

## 5.0 Conclusion and recommendation

In conclusion, majority (85.8%) of the type 2 diabetes mellitus patients attending the government health clinic have limited health literacy level. It was found that the factors that were significantly associated with the level of health literacy among type 2 diabetes mellitus patients attending the government health clinic were the ethnic group, level of education and diabetes knowledge score. Chinese ethnicity and diabetes knowledge score were the significant predictors for adequate health literacy level among type 2 diabetes mellitus patients attending a government health clinic. Chinese were more likely to have adequate health literacy level compared to the Malays. Besides that, having higher diabetes knowledge score also predisposed to adequate health literacy level.

This study could provide a baseline data on factors associated with the level of health literacy among type 2 diabetes mellitus patients. However, as it was a cross-sectional study, findings from this study cannot be generalised to the whole population and causal relationship between the independent variables and the dependent variable were not able to be measured from this study. Besides that, this study was only able to generate results at a point of time. Another potential limitation in this study was bias in terms of selection of respondents as those who were either literate in English or Malay language only were selected in this study.

Therefore, it is recommended for future study to use other study design, such as intervention study. It is also recommended that other factors including diabetes education, family support and comorbidities to be included in future research to measure the association between these factors and health literacy level among type 2 diabetes mellitus patients. Thus, this will reduce the confounding effects from these factors and it will add more to the body knowledge in this field of research. Thirdly, it is also recommended that the questionnaire to be translated into Mandarin and Tamil versions as the Chinese and Indians are the other two majority ethnicity groups in this country. This can possibly reduce the selection bias so that all ethnicity groups

from different background level will be able to participate in the future research. Besides that, it is recommended that a larger sampling size and expanded study location to be considered in future research. This can improve the generalisation of the future study findings.

Although the results from this study cannot be generalised, potential efforts in improving health literacy level among type 2 diabetes mellitus patients in a government health clinic can be made by increasing diabetes knowledge among the vulnerable ethnic groups with limited health literacy which are the Malays and Indians.

## Acknowledgement

The authors would like to acknowledge the Ministry of Health, Selangor Health Office and Hulu Langat District Health Office for giving the permission for carrying out this study and the staffs of the government health clinic for their cooperation and support during data collection. We would also like to thank the Director General of Health Malaysia for his permission to publish this article.

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