Awareness of Glycosylated Haemoglobin (HbA1c) Among Type 2 Diabetes Mellitus Patients in Hospital Putrajaya

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ABSTRACT

The glycosylated haemoglobin (HbA1c) test is the most widely accepted laboratory test for evaluating long term glycaemic control. Patient's understanding of HbA1c can lead to better glycaemic control. This study is aimed to determine the awareness and level of understanding of HbA1c among type 2 DM patients and its association with glycaemic control. A cross-sectional descriptive study among Type 2 DM patients undergoing routine follow up in an endocrine clinic of a tertiary centre in Malaysia. Patients were invited to answer a validated questionnaire which assessed their awareness and understanding of HbA1c. Their last HbA1c results were retrieved from the laboratory information system. A total of 92 participants were recruited. Fifty-six (60.9%) were aware of the term HbA1c. Fifty percent were categorised as having good HbA1c understanding, with age, monthly income and level of education being the factors associated with understanding. No significant association was noted between HbA1c understanding and glycaemic control, although more patients with good HbA1c understanding had achieved the target glycaemic control compared to those with poor understanding. The level of HbA1c awareness and understanding was acceptable. Factors associated with understanding were age, income and level of education. Continuing efforts however, must be made to improve patients understanding of their disease and clinical disease biomarkers.

Keywords: Biological markers; Diabetes Mellitus, Type 2; Haemoglobin A, Glycosylated

INTRODUCTION

The glycosylated haemoglobin (HbA1c) test has been the most widely accepted, reliable biomarker for evaluating long term glycaemic control in patients with diabetes mellitus (DM). Despite HbA1c being the most important indicator used by clinicians to manage diabetes, studies show that HbA1c results is either poorly recalled or understood among diabetic patients[1,2] despite recommendations that patients should know their target and actual HbA1c values.[3] There were however, studies which showed a high percentage of patients with HbA1c understanding including knowing their target HbA1c goals[4,5] and those who were able to recall their last HbA1c results correctly.[6] Those with better HbA1c understanding had achieved better glycaemic control with significantly lower HbA1c values.[2,5] Currently there are limited studies in Malaysia which evaluated HbA1c understanding among its diabetic patients. This study aimed to assess patients with type 2 DM on their awareness of HbA1c and the factors associated with their understanding of HbA1c.

MATERIALS AND METHODS

This cross-sectional descriptive study was conducted in the endocrine clinic of Hospital Putrajaya, Wilayah Persekutuan. Consecutive patients with type 2 diabetes age 18 years and above who came in for their scheduled follow up to the clinic in the month of July 2013 were invited to participate in the study. Informed written consent was taken from all the participants. Participants were asked to complete a validated questionnaire which consists of questions

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assessing participants understanding of HbA1c, their demographics and their diabetes history and complications. The questionnaire was evaluated by ten type 2 diabetes patients prior to being implemented in the current study with only minimal changes made. The first part of the questionnaire was on sociodemographics, their diabetes history as well as their perceived knowledge on diabetic complications. The second part of the questionnaire focuses on patient's understanding of HbA1c. The patients were first asked if they have heard or aware of the term HbA1c. Those who answered yes proceed to answering three other questions on HbA1c including what does the value of HbA1c indicate, their target HbA1c goals and whether they could correctly remember their last HbA1c results. Participants were categorised as having good HbA1c understanding if they could answer 3 out of 4 questions on HbA1c correctly. Participant's previous HbA1c results were retrieved from the laboratory information system. Statistical calculations were performed using the standard statistical software package, IBM SPSS Statistics for Windows, Version 21.0. Median with range was calculated for all non-normally distributed continuous variables. Chi-square test was used to determine the association between patients HbA1c understanding with factors such as sociodemographics, duration of diabetes, comorbidities and microvascular complications. In all statistical analyses, a p value of <0.05 (95% confidence interval) was considered to be statistically significant. This study was approved by the Medical Research Ethics Committee Ministry of Health Malaysia (NMRR-13-392-15394).

RESULTS

A total of 92 participants were recruited. Majority were male (n=53, 57.6%), Malays (n=60, 65.2%) and married (n=79, 85.9%). The median age was 53 (SD ± 10.91) years old. Most of the participants completed tertiary education (n=56, 60.9%) and earned more than RM5000 per month (n=27, 29.3%) (Table 1). The median duration of diabetes was 10 years (SD ± 7.2) and majority were on insulin (n=59, 64.1%) (Table 1). Almost all of the respondents had seen a diabetic nurse or physician (n= 91, 98.9%). Most participants claimed to have hypertension (n=56, 60.1%) and hypercholesterolemia (n=49, 53.3%). However, only 31 (33.7%) self-reported to have diabetic nephropathy, 48 (52.2%) retinopathy and 44 (47.8%) neuropathy.

Table 1. Sociodemographic characteristics of participants (N=92)

Characteristic	n (%)
Age (years)	
< 40	15 (16.3)
40 to 49	19 (20.7)
50 to 59	31 (33.7)
≥ 60	27 (29.3)
Race	
Malay	60 (65.2)
Chinese	14 (15.2)
Indian	15 (16.3)
Others	3 (3.3)
Gender	
Male	53 (57.6)
Female	39 (42.4)
Marital status	
Married	79 (85.9)
Not Married	13 (14.1)
Education level	
≤ Secondary education	36 (39.1)
Tertiary education	56 (60.9)

Monthly income (RM)	
<1000	12 (13.0)
1000-3000	22 (23.9)
3001-5000	16 (17.4)
>5000	27 (29.3)
Retired	15 (16.3)
Diabetic Duration (Years)	
< 5	29 (31.5)
5 to 10	26 (28.3)
11 to 15	20 (21.7)
≥ 16	17 (18.5)
Seen a diabetic nurse or doctor	
Yes	91 (98.9)
No	1 (1.1)
On Insulin	
Yes	59 (64.1)
No	33 (35.9)
Co-morbidities	
Hypertension	56 (60.1)
Hypercholesterolaemia	49 (53.3)
Microvascular complications	
Nephropathy	2 (2.2)
Retinopathy	8 (8.7)
Neuropathy	7 (7.6)
Nephropathy with retinopathy	3 (3.3)
Nephropathy with neuropathy	0 (0)
Retinopathy with neuropathy	11 (12)
Nephropathy, retinopathy and neuropathy	26 (28.3)
No complications	35 (38)

Out of total 92 participants, 56 (60.9%) participants were aware of the term HbA1c (Table 2). Out of those who were aware of the term HbA1c, 37 (66.1%) knew the correct indication for HbA1c measurement. Fifty one (91.1%) knew their HbA1c target goal out of which 30 (58.8%) had achieved this target. Most were also able to correctly report their last HbA1c result (n=46, 82.1%). Of those who reported their last HbA1c results incorrectly, 1 over-estimated their HbA1c, while 9 underestimated their HbA1c levels. The median HbA1c results was 7.6% (SD ± 1.8). Physicians (n=47, 83.9%) were the main source for their HbA1c information, followed by own self (n=17, 30.3 %), nurses (n=8, 14.2%) and others (n=2, 3.6%).

Table 2. Participant's awareness of HbA1c (N = 92)

Question	Yes n (%)	No n (%)
1. Reported they have heard of HbA1c test*	56/92 (60.9)	36/92 (39.1)
2. Knew the correct indication or use of HbA1c test	37/56 (66.1)	19/56 (33.9)
3. Knew their correct HbA1c target goal	51/56 (91.1)	5/56 (8.9)
4. Reported their last HbA1c correctly (within 0.5%)	46/56 (82.1)	10/56 (17.9)

*Only those answered yes to question 1 will proceed to answering questions 2-4.

Out of the 92 participants, 46 (50%) were found to have good level of understanding of HbA1c (Table 3). Sociodemographic factors that were significantly associated with HbA1c understanding were age (p=0.025), level of education (p=0.001) and monthly income (p=0.025) (Table 4). Those who were younger, had higher levels of education and monthly income had good HbA1c understanding. There was no significant association between duration of diabetes (p= 0.869), presence of hypertension (p=0.393), hypercholesterolaemia (p=0.834) and self-claimed diabetes microvascular complications (p=0.256) with HbA1c understanding.

Table 3. Participants level of understanding of HbA1c (N = 92)

Question	Yes n (%)	No n (%)
Good understanding of HbA1c	46 (50%)	46 (50%)

Table 4. Association between sociodemographic factors with level of HbA1c understanding

Characteristic	Understanding of HbA1c		Total	X^2	p-value
	Good n(%)	Poor n(%)			
Age					
Less than 40	10(66.7)	5(33.3)	15	7.601	0.025*
40 to 49	14(73.7)	5(26.3)	19		
50 to 59	12(38.7)	19(61.3)	31		
60 and above	10(37.0)	17(63.0)	27		
Race					
Malay	30(50.0)	30(50.0)	60	1.219	0.748
Chinese	6(42.9)	8(57.1)	14		
Indian	9(60.0)	6(40.0)	15		
Others	1(33.3)	2(66.7)	3		
Gender					
Male	30(56.6)	23(43.4)	53	2.181	0.140
Female	16(41.0)	23(59.0)	39		
Marital Status					
Married	40(50.6)	39(49.4)	79	0.090	0.765
Not Married	6(46.2)	7(53.8)	13		
Level Education					
≤ Secondary education	9(25.0)	27(75.0)	36	13.534	0.001*

Tertiary education	37(66.1)	19(33.9)	56		
Monthly Income					
<RM1000	4(33.3)	8(66.7)	12	11.177	0.025*
RM1000-RM3000	11(50.0)	11(50.0)	22		
RM3001-RM5000	8(50.0)	8(50.0)	16		
>RM5000	20(74.1)	7(25.9)	27		
No salary or retired	3(20.0)	12(80.0)	15		

Table 5 shows the associations between participant's glycaemic control and level of understanding of HbA1c. There was no statistically significant association between level of HbA1c understanding and their HbA1c test result (p=0.613).

Table 5. Glycaemic control and understanding of HbA1c

HbA1c	Understanding of HbA1c		Total	X^2	p-value
	Good n(%)	Poor n(%)			
< 6.5%	11(55.0)	9 (45.0)	20	0.256	0.613
≥ 6.5%	35(48.6)	37 (51.4)	72		

DISCUSSION

Given the significance of HbA1c as part of diabetes management, patients should realise its importance in relation to glycaemic control to improve their clinical outcome. A total of 60.9% of the participants have heard of the term HbA1c. Unfortunately, the remainder did not despite it being written in their diabetes diary. It was reported that only 40.5% (45/111) of participants (both type 1 and 2 DM) attending a diabetic clinic in a hospital in UK have heard of the term HbA1c.[1] Out of this, only 13.3% (6/45) knew of the correct interpretation of a given HbA1c value in terms of its association with mean plasma glucose over the preceding 3 months.[1] In contrast, 66.1% of the participants in this current study knew what HbA1c indicates in association with their glycaemic control. An equivocal number of those with good and poor HbA1c understanding was obtained. A slightly higher percentage of those with good understanding (74%) was seen in a study involving 480 type 2 diabetes patients in a tertiary care centre in India.[5] Skiei *et al* 2001 also found that majority of participants had good understanding on HbA1c, although their participants were limited to type 1 diabetes patients only.[4] In contrast, Beard *et al* 2010, found a low percentage *i.e.* 26.5% of their 83 patients understood HbA1c.[2] They had recruited patients form seven diabetes outpatient clinics in UK. We had used similar criteria to the previous study to define those who had good understanding of HbA1c *i.e.* they have heard of HbA1c, knew the indication for HbA1c, could report their last HbA1c result within 0.5% and knew their HbA1c target goals.[2] 0.5% was chosen on the basis that a 1% reduction in HbA1c levels can significantly reduce the likelihood of developing diabetes complications.[7] Few other studies also reported poor understanding and awareness of HbA1c among their participants.[8-11] The difference of findings between the studies previously mentioned can be attributed to the settings of the clinic where the study was conducted and their current practice on diabetes education programme which include explanation on biomarkers such as HbA1c.

Factors associated with understanding of HbA1c

In this study, age (p=0.025), education level (p=0.001) and monthly income (p=0.025) were found to be significantly associated with participants understanding of HbA1c. Similarly, another study noted that HbA1c understanding was

greatest with increasing education level and those with higher income.[12] In contrast, Beard *et al* found that income was not a significant contributor to patients' good understanding of HbA1c. Beard et al reported that older diabetic patients had poor understanding and hence poorer glycaemic control.[2] Those who had good understanding had a mean age of 39.3 compared to those with poor understanding (52.28 years old). Our participants were slightly older with median age for those with good understanding at 49 years old compared to those with poor at 56 years old respectively. Gender or race was not found to be significantly associated with understanding of HbA1c.

Duration of diabetes was thought to be an important factor determining the level of understanding of HbA1c. However, this was not demonstrated in this study. Similarly, although Beard *et al* noted that that those who had good understanding had longer diabetes mean duration (18 years) compared to those with poor understanding (14.4 years), the findings was not statistically significant. The median duration of diagnosis in our study was even shorter (10 years).

Diabetes type was also a factor which affects understanding on HbA1c. Type 1 diabetes patients had significantly good understanding compared to type 2.[1,2] This finding is contributed mainly by the longer duration of diabetes and more intensive education programme in type 1.[1] Only type 2 type diabetes patients was recruited in this study thus unable to determine whether type of diabetes contributes to the understanding of HbA1c.

Association between participant's understanding of HbA1c on their glycaemic control

Unfortunately, there was no significant association between good understanding of HbA1c and better glycaemic control, although there was a higher percentage of those with good understanding achieved the target glycaemia control compared to those with poor understanding. This was in concordance with Iqbal *et al*. However, they noted that in those unaware of the term HbA1c, giving information on HbA1c to these patients resulted in significant improvement in HbA1c values and hence glycaemic control when followed up approximately 7 months later. Beard *et al* also reported that those with good understanding of HbA1c were significantly more likely to report better levels of self care in relation to their dietary regimes, self-efficacy for exercise, self monitoring of blood glucose and had better glycemic control, as indicated by their HbA1c levels. Thus, strategies to engage patients to know and interpret their HbA1c values should be encouraged within routine clinical practice.

LIMITATIONS

The study was performed in a tertiary hospital with specialization for endocrine and thus the findings may not apply to primary or secondary care centres. Furthermore, the diabetes complication were self- proclaimed by the participants and was not confirmed by any other means.

CONCLUSION

The level of HbA1c awareness and understanding among patients attending endocrine clinic in the centre was comparable with other centres. Age, education level and monthly income were important factors associated with understanding of HbA1c. It is hoped that patient's education programme on diabetes and their disease markers in particular HbA1c will be emphasized more to those with lower education and income level. Their understanding post education could also be assess to see whether this would lead to improvement in their glycaemic control.

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CONFLICTS OF INTEREST AND SOURCES OF FUNDING

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