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# Multi-area foodborne outbreaks of enterohemorrhagic Escherichia coli and the risk factors in cooking meat

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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

## 1. 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.

## 2. 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 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).

## 3. 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.

## 4. 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.

## 5. 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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