PUBLIC HEALTH RESEARCH

# Association of Diet Practice and Glycaemic Control among Type 2 Diabetes Mellitus Patients Attending Primary Care Clinic in Kuala Lumpur

***Hasimah Ismail*, Tahir Aris, Rashidah Ambak and Lim Kuang Kuay***

*Institute for Public Health, Ministry of Health, Jalan Bangsar, 56000 Kuala Lumpur*.

**For reprint and all correspondence: Hasimah Ismail, Institute for Public Health, Jalan Bangsar, 50590 Kuala Lumpur, Malaysia.*
*Email: hasimah.i@moh.gov.my*

## ABSTRACT

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**Introduction** Healthy dietary practice is important in preventing diabetes, managing existing diabetes, and preventing, or at least slowing the rate of diabetes complication development. It is, therefore, important at all levels of diabetes prevention. The objective of this study was to determine the association of dietary practice with glycaemic control among Type 2 diabetes mellitus (T2DM) patients, who received treatment from an urban Health Clinic in Kuala Lumpur.

**Methods** A total of 307 patients with T2DM aged 18 years and above participated in this study. A pre-tested structured questionnaire with guided interview was used to collect information on socio-demographic, clinical and dietary practice. Anthropometric and biological measurements were also taken. Descriptive statistics and Chi-square were used in the data analysis. Good glycaemic control was defined as HbA1c level less than 6.5%.

**Results** The prevalence of good glycaemic control was only 27% (n=83). The highest percentage of good glycaemic control were among male patients (29.1%), aged 60 and above (33.3%), educational level of primary school (35.4%) and those with monthly income group between RM1001 to RM1500 (32.0%). About three quarter of T2DM patient (n=224) had poor control of HbA1c (≥6.5%). Age (p=0.045) and working status (p=0.039) had significant relationship with the level of HbA1c. Dietary practice showed no significant relationship with the HbA1c level.

**Conclusions** Effective interventional health education strategies are needed, focussing on modification of dietary behaviour in order to achieve glycaemic control among diabetic patients.

**Keywords** Type 2 diabetes mellitus - diet practice – glycemic control – primary care clinic.

## INTRODUCTION

Diabetes is a global epidemic with an increasing trend and causes significant health and economic burden especially in the developing countries. It is an important public health problem because of its high prevalence and detrimental sequelae. Type 2 diabetes is now a common and serious global health problem, which, for most countries, has evolved in association with rapid cultural and social changes, ageing populations, increasing urbanization, dietary changes, reduced physical activity and other unhealthy lifestyle and behavioural patterns[1]. Control over these factors can reduce the risk of developing type 2 diabetes.

According to the International Diabetes Institute, Malaysia has been classified as the fourth highest Asian countries in terms of diabetes mellitus prevalence. It was estimated that about 1.5 million people suffered from diabetes mellitus in Malaysia in year 2006[2]. The National and Health Morbidity Survey in 2011 (NHMS, 2011) reported the national prevalence of diabetes in Malaysia as 15.2% (95% CI:14.3-16.1), an increase of 6.9% as compared to NHMS II in 1996, with prevalence of 8.3%[3,4]. The trend is believed to be contributed by multiple factors such as ageing population and urbanization that lead to unhealthy diet and lack of physical activities. Further, studies in Malaysia found that access to health educators, waist-hip ratio[5], ethnicity, age, duration of diabetes[6] have been associated with glycemic control.

Studies showed that diet control can improve the glycaemic control[7] and may reduce glycosylated haemoglobin (HbA1c) by 1.0% to 2.0%[8,9]. Carbohydrate amount, glycemic index, and fibre[10] are an important dietary practice in treating diabetes mellitus and may reduce the development of disease complications by improving risk factor profiles.

Measurement of glycaemic proteins, primarily HbA1c, is widely used for routine monitoring of long-term glycaemic status in patients with diabetes mellitus. Achieving optimal glycaemic control among diabetic patients posed real challenge to health provider in the developing and developed countries. In Malaysia, a research conducted in government hospitals and health centers showed that from 828 respondents involved, only 18.5% had their diabetes controlled[11]. A similar study in Malaysia by Tan SL et al. in 2011, showed that only 16.4% of the respondents adhered to the dietary regimen provided by dietitians[12]. Studies in Mexico[13] and Thailand[14] showed non-compliance to diet control at 62.0% and 45.7% respectively. Therefore this study aims to determine the association of socio-demography and diet practice with the HbA1c control among type 2 diabetes mellitus (T2DM) patients who received treatment from an outpatient government clinic in Kuala Lumpur.

## METHODS

This cross-sectional study was conducted among T2DM patients attending a government diabetic outpatient health clinic in Kuala Lumpur. There were 1417 diabetic patients registered with the clinic. A total of 350 T2DM patients were included from the sampling frame, which were obtained from the clinic registry. Selections were based on all T2DM Malaysian citizens aged more than 18 years old and seeking treatment from July to December 2009. The patients should have been receiving treatment at the clinic for at least one year to ensure they have received two sessions of consultation on dietary control and exercise by the family health doctors. Patients with dementia and communication problem were excluded from the study.

Once the patients consented to join the study, they were interviewed by the researcher using a pre-tested structured questionnaire. The components of the questionnaire include patients' information on socio-demographic data such sex, age, race, marital status, level of education, occupation, biochemical data, history of diabetes, dietary practice and other medical information. Information gathered related to dietary practice was done based on the recommendation in the Clinical Practice Guidelines on Management of Type 2 Diabetes by Ministry of Health, Malaysia (2009) [10]. A questionnaire was constructed on frequency of taking fast food, eating outside, and consumption of fruits and vegetables in a week. It also covered issues on adherence to doctor's dietary advice, control of certain foods (sweet, fatty, oily) and sugary drink consumption. The questionnaire was pre-tested and piloted before commencement of data collection. Each interview session took approximately 45 minutes to 1 hour to complete.

Anthropometric measurements such as weight (kg), height (m), and measurement of blood pressure were taken by the clinic nurses before patients were interviewed. Blood investigation such as fasting blood sugar (FBS), random blood sugar, blood cholesterol and HbA1c were taken on the same day. For the purpose of this study, a good control of HbA1c was defined as having a level of HbA1c <6.5%, whereas a poor control of HbA1c was HbA1c $\geq$ 6.5% (HbA1c results within past 3 months), as recommended by Ministry of Health Clinical Practice Guidelines (CPG) for T2DM[10]. Ethical approvals were obtained from Ethical Committee Faculty of Medicine and Health Sciences, University Putra Malaysia and Medical Research Ethics Committee, Ministry of Health Malaysia.

Statistical analysis was carried out using Statistical Package for Social Sciences (SPSS, version 17). Descriptive statistics applied were mean, standard deviation and proportions wherever appropriate. Chi-square test was used to assess

statistical significance of the difference in the percentage of glycaemic control according to the categorical data of the independent variable. Multivariate analysis was carried out to determine the factors associated with the glycaemic control. A p value of less than 0.05 was considered statistically significant.

## RESULTS

A total of 350 patients diagnosed with T2DM aged 18 years and above who received treatment at the diabetic clinic was approached. However, only 307 respondents consented to participate in this study (89% response rate). Majority of the respondents were Malay women (62%). Most of the T2DM patients were from the following category: aged 50 years or above (78%), married (77%), attained secondary school education (50%), monthly household income of RM500 and below (36%) and not working/housewife (67%). Majority of respondents were diagnosed with T2DM for 5 years or less (54%), while only 7% of the respondents suffered T2DM for more than 15 years. The study also found that 62% of the respondents had close family member (parent or sibling) with diabetes (Table 1).

**Table 1** Relationship between socio-demographic characteristics with HbA1c control

| Socio-demographic characteristic | Glycaemic control | | $\chi 2$ | p-value |
|---|---|---|---|---|
| | HbA1c < 6.5% n=83 | HbA1c ≥6.5 % n=224 | | |
| Gender | | | 0.393 | 0.531 |
| Male | 34 (29.1%) | 83 (70.9%) | | |
| Female | 49 (25.8%) | 141 (74.2%) | | |
| Age | | | 8.059 | 0.045 |
| < 40 years | 1 (7.1%) | 13 (92.9%) | | |
| 40 - 49 years | 9 (17.0%) | 44 (83.7%) | | |
| 50 - 59 years | 31 (27.2%) | 83 (72.8%) | | |
| ≥ 60 years | 42 (33.3%) | 84 (66.7%) | | |
| Race | | | 0.108 | 0.742 |
| Malay | 67 (27.5%) | 177 (72.5%) | | |
| Non- Malay | 16 (25.4%) | 47 (74.6%) | | |
| Marital Status | | | 1.558 | 0.212 |
| Married | 60 (25.3%) | 177 (74.7%) | | |
| Single/ widow/ widower | 23 (32.9%) | 47(67.1%) | | |
| Education level | | | 6.561 | 0.087 |
| No formal education | 6 (24.0%) | 19 (76.0%) | | |
| Primary school | 40 (35.4%) | 73 (64.6%) | | |
| Secondary school | 34 (22.4%) | 118 (77.6%) | | |
| College / University | 3 (17.6%) | 14 (82.4%) | | |
| Family income | | | 3.130 | 0.536 |
| ≤RM 500 | 33 (30.3%) | 76 (69.7%) | | |
| RM 501-RM 1000 | 21 (25.0%) | 63 (75.0%) | | |
| RM 1001-RM 1500 | 16 (32.0%) | 34 (68.0%) | | |
| RM 1501-RM 2000 | 7 (17.9%) | 32 (82.1%) | | |
| ≥ RM 2001 | 6 (24.0%) | 19 (76.0%) | | |
| Working | | | 4.272 | 0.039* |
| Employed | 20 (19.6%) | 82 (80.4%) | | |
| Unemployed | 63 (30.7%) | 142 (69.3%) | | |

*Notes: * p<0.05 was considered statistically significant*

Only 27% (n=83) of the patients had good HbA1c control, while the rest had high glycaemic reading 73% (n=224). This study found that mean SBP of the respondents was 137.3±21.3 mmHg and mean DBP was 75.3±10.9 mmHg. The median cholesterol, HDLC and mean LDLC was 1.2 mmol/L (IQR: 0.4), and 3.3 + 1.0 mmol/L, respectively. For random blood sugar, the median value was 9.3 (IQR: 6.3) and Body Mass Index (BMI), 28.5 (IQR: 6.0). The study also showed that 84% of respondents suffered other chronic diseases other than diabetes. Majority of respondents were diagnosed as having high blood pressure (81%) and heart disease (10%).

About 80% of the respondents reported that they followed their doctor's advice on diet control (Table 2). However, our analysis showed no significant association of dietary practice with

the HbA1c control (p = 0.474). Further analysis also showed that some of common dietary practices such as weekly consumption of fast food ($\chi2$=4.007, p=0.135) and occasionally dining out (including take-away) ($\chi2$=6.287, p=0.098) were not significantly related to HbA1c control.

**Table 2** Relationship between dietary practice with HbA1c control

| Dietary practice of respondents | Glycaemic control | | $\chi2$ | p-value |
|---|---|---|---|---|
| | HbA1c<6.5% n(%) | HbA1c≥6.5% n(%) | | |
| Follow doctor's diet advice | | | 0.513 | 0.474 |
| Yes | 64 (26.1%) | 181 (73.9%) | | |
| No | 19(30.6%) | 43 (69.4%) | | |
| Frequency of taking fast food in a week | | | 4.007 | 0.135 |
| 1 time | 6 (16.7%) | 30 (83.3%) | | |
| ≥ 2 times | 1 (10.0%) | 9 (90.0%) | | |
| Never | 76 (29.1%) | 185 (70.9%) | | |
| Frequency of dining out (or take away food | | | 6.287 | 0.098 |
| Every meals/ at least once a day | 6 (18.8%) | 26 (81.3%) | | |
| 4 - 6 time a week | 11 (26.2%) | 31 (73.8%) | | |
| Rarely | 50 (25.5%) | 146(74.5%) | | |
| Never | 16 (43.2%) | 21 (56.8%) | | |

Chi-square analysis found no significant relationship between weekly consumption of fruit ($\chi2$= 1.249, p = 0.741) and weekly consumption of vegetable ($\chi2$= 1.949, p = 0.377) with HbA1c control (Table 3).

**Table 3** Relationship between food intake and food control in a week with HbA1c control

| Food intake and food control | Glycaemic Control | | $\chi2$ | p-value |
|---|---|---|---|---|
| | HbA1c<6.5% n (%) | HbA1c≥6.5% n (%) | | |
| Frequency of taking fruit and vegetables | | | | |
| Frequency of taking fruit | | | 1.249 | 0.741 |
| Every day | 25 (24.3%) | 78 (75.7%) | | |
| 1 – 2 times | 34 (30.4%) | 78 (69.6%) | | |
| 3 – 4 times | 21 (26.9%) | 57 (73.1%) | | |
| Never | 3 (21.4%) | 11 (78.6%) | | |
| Frequency of taking vegetable | | | 1.949 | 0.377 |
| Every day | 63 (25.7%) | 182 (74.3%) | | |
| 1 – 2 times | 9 (39.1%) | 14 (60.9%) | | |
| 3 -4 times | 11(28.2%) | 28 (71.8%) | | |
| Never | | | | |
| Type of foods controlled | | | | |
| Sweet food | | | 0.000 | 0.354 |
| Yes | 79 (27.5%) | 208 (72.5%) | | |
| No | 3 (50.0%) | 3 (50.0%) | | |

| | | | | |
|---|---|---|---|---|
| Fatty food | | | 1.553 | 0.213 |
| Yes | 72 (27.0%) | 195 (73.0%) | | |
| No | 10 (38.5%) | 16 (61.5%) | | |
| Oily food | | | 0.013 | 0.911 |
| Yes | 65 (28.1%) | 166 (71.9%) | | |
| No | 17 (27.4%) | 45 (72.6%) | | |
| Control all foods above | | | 0.000 | 0.992 |
| Yes | 63 (28.0%) | 162 (72.0%) | | |
| No | 19 (27.9%) | 49 (72.1%) | | |

The study also found no significant relationship between type of food control by the respondents and the HbA1c control: sweet foods ($\chi2$= 0.000, p = 0.354), fatty foods ($\chi2$= 1.553, p = 0.213), oily foods ($\chi2$= 0.013, p = 0.911), control of all of those foods ($\chi2$= 0.000, p = 0.992). Based on the multivariate analysis, there was no significant association found between the variables studied with the glycemic control.

## DISCUSSION

The prevalence of HbA1c control in our study was low (27%), compared to a study conducted in Kelantan by Tan, Juliana & Salinah in 2011 (33%)[12]. Lower prevalence of control in our study might be contributed by the high recruitment of respondents aged more than 60 years old (41%). Old age has been associated with reduced pancreatic islet function and increase in insulin resistance[15]. Furthermore, the elderly are not able to engage in strenuous physical activities compared to the younger diabetic patients. Hence, both factors contributed to high blood sugar and uncontrolled diabetes. In contrast, Haliza et al. in 2008 reported a lower prevalence of HbA1c control (19%), which was carried out at a government hospital and selected health centers[11].

Analysis showed that employment has a significant relationship with HbA1c control. This might be due to the difference in dietary pattern among the working and non-working respondents. Non-working respondents have more opportunity to prepare their own food and adhered to diabetic diet at home. The situation is different with the working respondents, where they would normally buy and eat food sold in stalls or restaurants. Normally foods sold outside has high glycaemic index, high in sugar, simple carbohydrate and less choice for a high fibre and low sugar diet.

Several studies proved that risk factors such as family history, body fat distribution, age, gender, smoking and physical activity has a strong relationship with T2DM[16,17]. Significant relationship was seen between age and HbA1c level, where, as the age increased more respondents had poorer glycaemic control. The finding is in agreement with a study by Nor Shazwani et al. (2010) in another government health clinic in Cheras[18]. Their respondents (mean age 51.9±5.8 years) also showed a poor glycaemic control and this was associated with physical inactivity[18]. Our finding on poor glycaemic control might be explained by declination in physical activity with increased age[18, 19, 20]. Lacked of physical strength[18] and perception of physical disabilities among older diabetic patients[20]. Studies conducted by Suhaiza et al. (2004)[21], and Eid et al. (2003)[5] locally and Haney and Yue-Fang (2007)[22] in United State also found that increase in age is significantly correlated with poor HbA1c control[19,20,21]. On the other hand, Rothenbacher et al. (2003) presented that older respondents scored good glycaemic control compared to their younger counterparts. We might postulate that the older respondents are more motivated to control their diabetes, adhere to medication and control their diet since they stay at home most of the time compared to their younger counterpart[23].

Our study also found that variables such as gender, race, marital status, education, income and duration of diagnosis did not have a significant relationship with the level of HbA1c control. This concurred with the findings of Suhaiza et al. (2004) where gender, level of education, income, body mass index and duration of diagnosis were not significantly related to HbA1c control[21].

Studies conducted by Ismail et al. (2000) also found no significant relationship with socioeconomic status with HbA1c control[6]. Similarly, a study conducted by Hartz et al. (2006), found that gender, duration of diabetes diagnosed and body mass index did not have a significant relationship with HbA1c control[24].

Adhering to diet control and healthy eating habits are essential self-care management in order to achieve a good level of glycaemic control among patients with T2DM. This study showed that respondents' self-reported compliance to diet as recommended by doctors is high (80%). However, this is in contrast to a study conducted in Saudi Arabia which it reported that only 40% of diabetic patients had good compliance with their diet[25]. However, there was no significant relationship between dietary compliance with HbA1c control. Respondents claimed to follow the doctors' advice on diabetic control. This probably

shows an over reporting to suit the socially desirable expectation where they might want to present a good image of themselves during commencement of the study, comply to an acceptable values and answer to what they think the researcher expects[26].

The study showed no significant relationship between the frequency of fast food intake (p=0.135) and frequency of dining out in a week including take away with HbA1c control (p=0.098). In contrast, Pereire et al. (2005) showed that diabetics who frequently visited fast-food restaurant (more than twice a week) had a two-fold greater increase in insulin resistance[27]. For fruit and vegetable intake, the study found no significant relation between the frequency of fruit and vegetable intake to the HbA1c control. These findings are almost similar to a study conducted by Tan, Juliana & Salinah (2011), who found that self-behaviour dietary control related with eating five or more servings of fruit and vegetable showed no relationship with HbA1c control[12]. Finding in this study also showed that the intake of sugary, fatty and oily foods did not have a significant relationship with HbA1c control. This is also similar to the study by Tan, Juliana & Salinah (2011) which found that self-behavior dietary control related with eating fewer sweet foods had no significant relationship with HbA1c control[12].

Findings showed that a larger sample size of respondents is needed to get a more constructive result. This study examined the outcome of doctor's treatment related to diet control among T2DM patients in the clinic. A more comprehensive study is needed to determine the HbA1c control among T2DM patients treated specifically by a dietitian for a more concrete finding.

## CONCLUSIONS

The prevalence of controlled type 2 diabetes found in this study was low. Although the study showed that dieting is closely related to effective food taking and control, however the percentage of patients with glycaemic control is still low. Findings from this study showed that the dietary practices of respondents with diabetes are inadequate and need improvement. Dietitians should be placed at all health clinics to meet the demand for health promotion, dietary education and sustain lifestyle changes in the growing number of diabetic patients.

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