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Kertas Asli/*Original Articles*

Prevalence of Food Addiction among People with Diabetes in an Urban Health Center

(Ketagihan Makanan di Kalangan Pesakit Diabetes di Klinik Kesihatan Kawasan Bandar)

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ABSTRACT

Food Addiction (FA) is a concept of dependence on substance related to the consumption of palatable foods high in fat, sugar, and salt. This dependence may influence dietary modification advice as dietary modification is an essential component in managing people with diabetes. The objective of this study is to determine the prevalence of FA among people with diabetes. A cross-sectional study was conducted between June and August 2021 at Klinik Primer, Pusat Perubatan Universiti Kebangsaan Malaysia (Cheras, Kuala Lumpur) involving 142 people with diabetes. FA was assessed using the validated Bahasa Melayu version of Yale Food Addiction Scale 2.0. The median age of participants was 58 years (IQR=10), and the majority (88%, n=125) of them were above the age of 45 years. A large majority) had central obesity (90.1%, n=128) and were overweight and obese (91%, n=129). The median duration of diabetes was 10 years (IQR=11) with more than two-thirds (63.4%, n=90) of them having diabetes for more than 5 years. Majority (73.9%, n=105) also had poor glucose control with median HbA1c level of 7.5% (IQR =2). Our study found that the prevalence of FA among people with T2DM was low (2.8%, n=4). This could be because the participants were mostly from the older age group with long standing disease. These two features may have influenced their eating behaviour, becoming more compliant and adapted to diabetic diet advice received over the long duration of the condition. A similar study among young diabetics and those with new onset disease may better reflect FA among this group of people.

Keywords: Food Addiction; Compulsive Eating; Diabetes, Diabetes Mellitus

ABSTRAK

Ketagihan Makanan (KM) ialah tabiat makan makanan yang sedap yang mengandungi kandungan gula, lemak dan garam yang tinggi. KM boleh mempengaruhi cara pemakanan individu. Memandangkan intervensi pemakanan dalah komponen penting dalam pengurusan penyakit diabetes, kajian ini bertujuan untuk menentukan prevalens KM di kalangan pesakit diabetes. Ini merupakan satu kajian keratan rentas yang telah dijalankan dari Jun hingga Ogos 2021 di Klinik Primer, Pusat Perubatan Universiti Kebangsaan Malaysia (Cheras, Kuala Lumpur). Seramai 142 pesakit telah mengambil bahagian dalam kajian ini. KM telah dinilai dengan menggunakan Yale Food Addiction Scale 2.0 versi Bahasa Melayu. Umur median peserta ialah 58 tahun (IQR=10), dan majoriti (88%, n=125) berumur lebih 45 tahun. Sejumlah besar (90.1%, n=128) diantara mereka mempunyai central obesity dan juga berat badan berlebihan dan obes (91%, n=129). Tempoh median diabetes ialah 10 tahun (IQR=11) dengan 63.4% daripada mereka, mempunyai penyakit diabetes lebih daripada tempoh 5 tahun. Majoriti (73.9%, n=105) juga mempunyai kawalan gula di paras tinggi (HbA1c >6.5%). Prevalens KM di kalangan pesakit diabetes dalam kajian ini adalah rendah (2.8%, n = 4). Ini mungkin kerana, peserta dalam kajian ini kebanyakannya terdiri daripada kumpulan umur yang lebih tua dan mempunyai tempoh penyakit yang lama. Kedua-dua ciri ini mungkin telah mempengaruhi cara pemakanan mereka yang lebih patuh kepada nasihat diet bersesuaian dengan penyakit diabetes yang diterima dalam tempoh mengalami penyakit ini. Kajian serupa ini di kalangan pesakit kencing manis yang muda dan yang mengalami penyakit ini pada tahap awal, mungkin dapat mencerminkan ketagihan makanan yang lebih tepat.

Kata kekunci: Diabetes, Diabetes Mellitus, Ketagihan Makanan, Makan Berlebihan

INTRODUCTION

The prevalence of Diabetes Mellitus (DM) in Malaysia has increased by 2.2 % from 7.2% in the year 2011 to 9.4% in 2019 and is responsible for the increase in health burden and expenditure (National Health and Morbidity Survey Malaysia NHMS 2019, Aris et al. 2014, Tee & Yap 2017). The rapid socio-economic growth in Malaysia and a shift towards a more "Westernised" energy-dense diet have partly contributed to this predicament (Jan Mohamed 2015). The prevalence of overweight and obesity in Malaysia has also increased over the last few years, further contributing to the increasing diabetes cases (Aris et al. 2014). Increased body mass index (BMI) is the most crucial risk factor for diabetes among Malaysians (Nawi A et al. 2019).

About 40 to 60% of diabetics in Malaysia have poor glycaemic control (Reidpath et al. 2018 & Amsah et al. 2022). A qualitative study by Tong et al. in 2015, among diabetics on treatment with insulin and poor glycaemic control for one year (HbA1C ≥ 9), found that participants attributed the poor glycaemic control due to their food craving and eating habits. They described that "eating" and "food" was an essential part of Malaysians culture which is their way of life. The vast variety of food available and the temptation to eat delicious food, leads to overeating and loss of control over dietary restrictions (Tong et al. 2015).

Dietary control is an essential component in managing people with diabetes. However, poor adherence to dietary control especially increased consumption of carbohydrates and fats, interferes with dietary management strategies (Hussein et al. 2015). A local study in Kelantan which looked at compliance to dietary advice among people with type 2 diabetes mellitus, found that only 16.4% of them adhered to dietary advice. (Tan et al. 2011) Food plays a significant role in people's lives and has been seamlessly integrated into the Malaysian culture.

Eating habits have been extensively studied in the past, and some researchers suggest the existence of 'Food Addiction' (FA) concept (Ifland et al. 2009; Corsica & Pelchat 2010; Gordon et al. 2018). FA has been described as the dependence on substance related to the consumption of foods high in fat, sugar, and salt (Corsica & Pelchat 2010). A systematic review by Gordon et al. on evidence for FA, found that this is a unique concept which is consistent with the criteria for diagnosing other substance use disorder.

Researchers found that sweeteners and fats in processed foods have the highest addictive potential (Gordon et al. 2018). Following food consumption, people with FA display certain neuronal changes similar to those with drug addiction, suggesting a parallel commonality between the two concepts (Gearhardt et al. 2011). People who are genetically vulnerable, may develop poor control of food intake after repeated exposure to types of certain food (Volkow 2007). Hyperpalatable food high in fat, salt and sugar increases appetite and cause a craving for these foods (Yau & Potenza 2015). FA among people with diabetes in different parts of the world was noted to range between 8.6 to 29.3%. These group of people tend to have poor glycaemic control and higher psychological distress such as depression, anxiety and stress compared to those without FA (Yang et al. 2017, Nicolau J et al. 2020). Hence, food consumption, diabetes control and psychological distress appear to have a link. However, till date, data on the prevalence of FA among people with T2DM in Malaysia has not established. Hence, the objective of this study was to evaluate the prevalence of FA among people with diabetes.

MATERIALS AND METHODS

This is a cross-sectional study carried out at Klinik Primer, Pusat Perubatan Universiti Kebangsaan Malaysia (Cheras, Kuala Lumpur) between June and August 2021. Malaysians between ages 18 and 65 who were diagnosed with diabetes (diabetes mellitus type 2) for at least 1 year were selected using systematic random sampling. Those who were pregnant, breast feeding, unable to read and understand Bahasa Melayu (BM) which is the national language, on prolonged oral steroid treatment (≥2 weeks), with existing psychiatric illness or eating disorder and post-stroke patients on feeding tube were excluded. Eligible patients were approached and upon getting their consent, were given the questionnaire to be filled up manually. Ethical approval for this study was obtained from Universiti Kebangsaan Malaysia Ethics Committee (FF-2020-368), followed by and registered with with National Medical Research Registry (NMRR-20-1671-54928).

The sample size was calculated using a simple proportion formula based on finite population, Daniel formula with an estimated FA prevalence of 8.6% using confidence interval of 95%. (Yang et al. 2017)

$$n' = \frac{NZ^2P(1-P)}{d^2(N-1)+Z^2P(1-P)}$$

Sample size, n=5695x1.96^2 x0.086(1-0.086) / [0.05^2 (5695-1)] + [1.96^{2}x0.086(1-0.086)] =118

n'= sample size with finite population correction
N= population size
Z= Z statistic for a level of confidence. $Z_{1-\alpha} = Z_{0.95} = 1.96$ (from normal distribution table) This value of 1.96 is standard for Confidence Interval of 95%)
P= expected proportion (8.6%)
d = precision = 0.05 (5%)

An additional 20% was made to make up for any incomplete questionnaires. Hence the final sample size was 142. The data collection form consists of two sections. Section A, which consist of the demographic data of the participant such as the patients age, gender, duration of diabetes and co-morbidities such as dyslipidaemia or hypertension. Anthropometric measurements such as height and weight were measured by using a standard Secca scale. Body Mass Index (BMI) was calculated manually for each patient. The participants HbA1c level was documented in gram % while the BMI was measured in kg/m^2.

FA ASSESSMENT

FA was assessed using the validated Bahasa Melayu version of the YFAS 2.0. self-administered questionnaire. (Nantha S et al. 2019) The Yale Food Addiction Scale (YFAS) 2.0 is the best available tool to evaluate FA based on DSM criteria for substance use disorder (Gordon et al., 2018, Gearhardt et al. 2016). The BM version of the YFAS with 26 questions (redacted version) has good validity (factor loading > 0.4) and reliability (Kuder-Richardson $\alpha > 0.8$). (Nantha et al. 2019) Participants were instructed to read each question and select a response which best describes the frequency of their experience over the last 12 months. Each question is followed by eight Likert scale answer options, ("never", "less than once a month", "once a month", 2 to 3 times a month, 'once a week", 2 to 3 times a week", "4 to 6 times a week" and "every day") from which the participants select one option. These 26 questions are classified to describe 12 symptom criteria (symptom criterias1 to 12). To meet the diagnosis of FA based on DSM V criteria for substance use disorder, a participant must experience clinical distress or impairment (symptom criteria number 12) with two or more of the other criteria (symptom criteria 1 to 11) for example, "Substance taken in larger amount and for longer period than intended", "Persistent desire or repeated unsuccessful attempts to quit", "Much time or activity to obtain, use and recover". Each of the criteria 1 to 11 was considered met if one or more of the relevant questions for each criterion had met the threshold. For participants who met the diagnosis of FA, they can be categorized into mild (2 or 3 symptom criteria), moderate (4 or 5 symptom criteria), or severe FA (6 or more symptom criteria) depending on the number of symptoms they experience. However, for the purpose of this study, the severity of FA was not evaluated as the BM validated version of the YFAS 2.0 was redacted; hence contained 26 items number in contrast to the original 35 items (Nantha et al. 2019).

DATA ANALYSIS

Data analysis was performed by using Statistical Program for Social Sciences (SPSS) version 23.0. For continuous variables with normally distributed data, the mean of variables was used. Median with interquartile range was used for data that were not normally distributed as evidenced by histogram and checked by Kolmogorov-Smirnov and Shapiro-Wilk test. A *p* value of 0.05 and less was considered significant.

RESULTS

A total of 148 from 176 participants who fulfilled the selection criteria, agreed to be recruited for this study (response rate 84%). Out of this, 6 entries were excluded due to incomplete data and 142 entries were subjected to analysis. The median age of the participants was 58 years (IQR=10). The youngest and oldest participants were 25 and 65 years old respectively. A large majority (88%, n=125) of the participants were above 45 years of age, and there was an equal male-female proportion (1:1). The median duration of diabetes was 10 years (IQR=11) while the shortest was 1 year and the longest duration was 31 years. More than two-thirds (63.4%, n=90) of them had long-standing diabetes (>5 years). Hypertension (75.4%, n=107) and dyslipidaemia 71.1% (n=101) were the two most common comorbidities. The median HbA1c level of the participants was 7.5% (IQR =2), with a large majority (73.9%, n=105) of them having poor glucose control (HbA1c of >6.5%).

Majority (73.2%, n=104) belong to the Malay ethnic group followed by Chinese (15.5%, n=22) and Indian (9.9%, n=14). The median BMI of participants was 28.8 kg/m^2 (IQR=7). A large majority (91%, n=129) had abnormal weight, where 59.8% (n=85) of them were obese

and 31% (n=44) were overweight. The mean waist circumference of the participants was 98.9cm (SD=11.9). A large majority (90.1%, n=128) of them had central obesity (waist circumference of ≥ 90 cm for males and ≥80cm for females). (Table 1).

TABLE 1. Participants' characteristics

Socio-demographic characteristics (n=142) #	% (n)
Age group (years)	
25 to 34	2.8 (4)
35 to 44	9.2 (13)
45 to 54	23.9 (34)
>55	64.1 (91)
Gender	
Male	50.7 (72)
Female	49.3 (70)
Ethnicity	
Malay	73.2 (104)
Chinese	15.5 (22)
Indian	9.9 (14)
Others	1.4 (2)
BMI (kg/m^2) categories	
< 18.5 (underweight)	0 (0)
18.5-22.9 (normal range)	9.2 (13)
23.0-27.4 (overweight)	31.0 (44)
>27.4 (obese)	59.8 (85)
Duration of Diabetes (years) (n=139)	
1-5	34.5 (49)
6-10	26.8 (38)
>10	36.6 (52)
Co-morbidities	
Hypertension	75.4 (107)
Dyslipidaemia	71.1 (101)
Hypertension +Dyslipidaemia	53.5 (76)
HbA1c level (%) (n 141)	
≤ 6.5%	25.4 (36)
> 6.5%	73.9 (105)

The prevalence of FA in this study was 2.8% (n=4), out of which three were males and one female. Their age ranged from 49 to 64 years. All four were obese, with BMI ranging from 29.9 to 47.0 kg/m^2 and had central obesity (waist circumference ranging from 105 to130 cm). Participants 'duration of having diabetes, ranged from 2 to 10 years, with 2 of them having it for less than 5 years. Three of them had both hypertension and dyslipidaemia. Only one of the participants with FA had poor glycaemic control (HbA1c > 6.5%), while the remaining three had good control. Since the prevalence of FA in our study was small, the researchers did not proceed with further analysis. The most common symptoms criteria experienced by the respondents in this study were "Continued use despite

social or interpersonal problems" (21.1%), "Persistent desire or repeated unsuccessful attempts to quit" (19%) and "Substance taken in larger amount and for longer period than intended" (12.7%). (Table 2)

TABLE 2. Endorsement rates for Yale Food Addiction Scale symptom (in percentage)

Items	Symptom criteria	% (n)
1	Substance taken in larger amount and for longer period than intended	12.7 (18)
2	Persistent desire or repeated unsuccessful attempts to quit	19.0 (27)
3	Much time/activity to obtain, use, recover	9.2 (13)
4	Important social, occupational, or recreational activities given up or reduced	9.9 (14)
5	Use continues despite knowledge of adverse consequences (e.g., emotional problems, physical problems	9.2 (13)
6	Failure to fulfil major role obligation (e.g., work, school, home)	6.3 (9)
7	Characteristic withdrawal symptoms: substance taken to relieve withdrawal	5.6 (8)
8	Continued use despite social or interpersonal problems	21.1 (30)
9	Failure to fulfil major role obligation (e.g., work, school, home)	7.0 (10)
11	Craving, or a strong desire or urge to use	6.3 (8)
10	Characteristic withdrawal symptoms: substance taken to relieve withdrawal	3.5 (5)
12	Use causes clinically significant impairment or distress	3.5 (5)

DISCUSSION

Our study found that a large majority of participants with diabetes were above the age of 45 years and had it for more than five years. Most (90.8%) of them were either overweight or obese and had central obesity. More than two-thirds of them had other comorbidities. A large majority (73.9%) also had poor glucose control. All these features suggest that most of the people in this study population were older, had long-standing diabetes and had poor glycaemic control.

To the best of our knowledge, this is the first study examining the prevalence of FA among people with diabetes in Malaysia. Our study shows FA prevalence of 2.8% among people with diabetes. The prevalence of FA using YFAS among people with diabetes in other countries was higher, ranging from 6% in India, 8.6% in China, 39.1% in Turkey and 70.7% in Australia (Sivapriya et al. 2017; Yang et al. 2017; Baran & Türker 2021; Raymond & Lovell 2016). The age range of the participants with FA in these studies was younger, between 20 to 40 years and this could be the reason for the higher prevalence of FA. In the past, a wide variation in the prevalence of FA has been reported among different countries, ethnic groups, and characteristics of participants. There are numerous studies on FA among the general population from various countries, which found about 5.4 to 5.8% prevalence of FA. A much higher prevalence of FA, ranging between 41.5 to 57%, was noted among the specific population, e.g., overweight, obese, those with Binge Eating Disorder (BED) and those who sought treatment for obesity (Yang et al. 2017). However, there is a paucity of data for FA among people with diabetes for comparison.

Studies from other countries like China, Australia and Turkey found that the prevalence of FA was higher among the younger diabetic population (age between 20 to 40 years), showing a negative correlation between age and FA symptoms. (Yang et al. 2017; Pursey et al. 2014; Baran & Türker 2021) The study in China also showed a higher percentage of FA as their study population was among newly diagnosed diabetes. (Yang et al. 2017) The median age of participants in our study was 58 years with 63.4% of them having diabetes for more than five years. Also, our selection criteria were participants with diabetes for at least 1 year as the YFAS uses recall of eating habits over the past one year. This could explain the lower prevalence of FA in our study population. People with newly diagnosed diabetes would be younger and may have a higher prevalence of FA as those who are older and with long standing diabetes would have received multiple dietary interventions (diabetic diet plan advice) from the point of diagnosis as a part of their management as recommended in the guidelines (Nurul 2020). These participants may have already adopted healthy lifestyle modification pertaining to diet over the years, hence a large majority of people with diabetes in our study did not have the symptoms of FA.

Another important observation is that data was collected during the second wave of COVID-19 when the pandemic was at its peak. During this period, a nationwide lock-down and movement restriction was implemented, which lasted for one and half years. This may have affected

the reporting of food addiction as people may have had financial problems, difficulties in making ends meet and limited social gatherings involving food feasts during this period. (As Malaysia entered MCO 2.0 Press release 08/02/21) This could have affected their reporting of food-related symptoms. Moreover, younger people with diabetes may have deferred clinic visits due to the pandemic and received their medication by post or delivery during this period as they are more internet savvy, hence were not captured during sampling.

Three out of four participants who had FA in our study were males. The effect of gender on FA in the general population has been inconclusive in the past, with some showing higher prevalence among females while some showed no difference between the genders. (Pursey et al. 2014; Eichen et al. 2013) Hence, a definite relationship between FA and gender is yet to be established. FA has been shown to be associated with mental health disorders as a metanalysis study showed a positive association between FA and binge eating, depression, and anxiety. (Burrows et al. 2018) An online survey demonstrated a high prevalence (70.7%) of FA among people with diabetes. However, in that study, participants with existing psychiatric illness and eating disorders were not excluded. (Raymond & Lovell 2016) In our study, those with existing psychiatric illness or eating disorders were excluded, which may be the reason for smaller prevalence of FA.

All four participants who fulfilled the diagnosis for FA in our study were obese with central obesity. This finding is consistent with the earlier study done in China, whereby BMI and waist circumference were significantly higher among diabetic individuals with FA (Yang et al. 2017). A study in Australia using an online survey involving participants with diabetes from all over the world also showed that participants with FA had higher BMI compared with those without (Raymond & Lovell 2015). This elicits the causal relationship between FA and obesity.

The most common symptoms endorsed by participants in this study were "Continued use despite social or interpersonal problems", "Substance taken in larger amount and for longer period than intended" and "Persistent desire or repeated unsuccessful attempts to quit". The last 2 symptoms were also the top symptoms reported by people with T2DM in China (Yang et al. 2017).

Our study has several limitations. The fact that the data collection was done during the COVID-19 pandemic could have limited the diversity of patients attending the clinic, hence may not represent the true prevalence of FA. Data was collected form a single clinic with pronounced urban density which may also affected the pattern of food addiction. The pandemic may have also affected the eating habits of the participants. During the movement control order, most of them were house bound hence may have consumed more home cooked food or whatever available food with limited access to food from outside. Food fests and social gatherings was also curbed due to the movement control order which may have affected eating habits in general. Hence, screening of FA post-pandemic, in a more diverse population will probably be more representative of the true relationship with food.

The list of food items in the redacted validated BM version YFAS 2.0 did not quite reflect the local food equivalence. Some common staple favourites such as *roti canai, nasi lemak, kuih*, *teh- tarik* (local delicacies and sweetened drinks) and fried noodles were not included. Instead, some uncommon food items such candy, steak, cheese, bacon, pretzel, sports beverages, energy drinks and lemonade (instead of *minuman manis*, *sirap*, *teh, teh tarik* or *kopi*) were stated as examples. Future studies should perhaps take this into consideration and make social and cultural adaptations for the food addiction scale. Due to the movement control order of the pandemic, it is possible that more of the older and those with longer duration of T2DM attended for follow up care to the clinic resulting in an unintentional bias. Future studies evaluating FA should include young diabetics and those with early disease as these populations may be struggling with food related issues and have higher prevalence of FA. Smoking and alcohol consumption status, which might affect the eating pattern, was not assessed in this study.

CONCLUSION

This is a preliminary study on food addiction (FA) among people with diabetes in Malaysia, which facilitates recognition of the FA concept and existence. The prevalence of FA among people with diabetes in this study was low (2.8%). This could be a true reflection of FA among this population or an underestimate as most of the participants were older and had long-standing diabetes. Hence, a larger study sampling a broader population of diabetes would be more representative of the true prevalence of FA. Generalised screening of FA among the younger population, including adolescents and children, maybe more meaningful for early intervention of FA in this age group. Future studies should also consider social and cultural adaptations for the food addiction scale. Good assessment and knowledge of FA may potentiate opportunity for treatment using addiction models rather than treating the consequences of FA, namely obesity and diabetes.

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