UNIVERSITI PUTRA MALAYSIA

FACTORS ASSOCIATED WITH THE RISK OF TYPE 2 DIABETES AMONG CHILDBEARING AGE WOMEN IN UNIVERSITI PUTRA MALAYSIA, SERDANG

SITI NURSYUHADA BINTI BADRUDIN

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BY

SITI NURSYUHADA BINTI BADRUDIN

A project paper submitted as partial fulfillment of the requirement for the degree of Bachelor of Science (Dietetics) from the Faculty of Medicine and Health Science, Universiti Putra Malaysia.

This project entitled “Factors Associated With The Risk Of Type 2 Diabetes Among Childbearing Age Women In Universiti Putra Malaysia, Serdang” was prepared by Siti Nursyuhada binti Badrudin and submitted to the Faculty of Medicine and Health Sciences as a partially fulfilment of the requirements for the Degree of Bachelor of Science (Dietetics) from Faculty of Medicine and Health Science, Universiti Putra Malaysia.

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ABBREVIATIONS

DM	Diabetes Mellitus
NCD	Non-communicable Disease
T2DM	Type 2 Diabetes Mellitus
IDF	International Diabetes Federation
NHMS	National Health Morbidity Survey
GDM	Gestational Diabetes Mellitus
BMI	Body Mass Index
UKM	University Kebangsaan Malaysia
UPM	Universiti Putra Malaysia
FINDRISC	Finnish Diabetes Risk Score
IDRS	Indian Diabetes Risk Score
DRS	German Diabetes Risk Score
FPG	Fasting Plasma Glucose
HbA1C	Haemoglobin A1C
AUSDRISK	Australian Type 2 Diabetes Risk Assessment Tool
DRA	Diabetes Risk Assessment For Singapore
FFQ	Food Frequency Questionnaire
DKQ-24	Diabetes Knowledge Questionnaire
JKEUPM	Ethics Committee For Research Involving Human Subject Universiti Putra Malaysia
BMR	Basal Metabolic Rate

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ABSTRACT

FACTORS ASSOCIATED WITH THE RISK OF TYPE 2 DIABETES AMONG CHILDBEARING AGE WOMEN IN UNIVERSITI PUTRA MALAYSIA, SERDANG

SITI NURSYUHADA BINTI BADRUDIN

Childbearing aged women, 15-49 years old have a higher risk of developing type 2 diabetes mellitus (T2DM). From over 60 million women worldwide, two out from five women with diabetes are in childbearing aged. This study aimed to determine factors associated with the risk of T2DM among childbearing age women. This was a cross-sectional study involving 83 childbearing age women in Universiti Putra Malaysia (UPM). Socio-demographic characteristics, anthropometry data, and respondent history were obtained from self-administered questionnaire. Dietary intake and diabetes knowledge were assessed by using Food Frequency Questionnaire (FFQ) and Diabetes Knowledge Questionnaire (DKQ-24) respectively. Diabetes risk score were determined and classified into low risk and high risk by using Finnish Diabetes Risk Score (FINDRISC). The mean age of the respondents was 37.65 ± 5.7 years old and majority of the respondents (n=62; 74.7%) had poor diabetes knowledge scores. A total of 13.2% of them were classified as high risk of having T2DM. BMI (r=0.61, p=0.00), waist circumference (r=0.61, p=0.00) and weight (r=0.63, p=0.00) were positively associated with the higher risk of having T2DM. Besides, having family history of diabetes mellitus (X^2=14.31, p=0.00) and hyperglycemia (X^2=15.90, p=0.00) were also associated with a higher risk of T2DM development. Exceed the recommendation of energy intake (r=0.34, p=0.00), carbohydrate intake (r=0.25, p=0.02), protein intake (r=0.29, p=0.01) and fat intake (r=0.25, p=0.02) were found to be associated with the increasing risk of T2DM. The discovery of the factors should help the health care professionals to develop a proper management to reduce the prevalence of T2DM among childbearing age women.

ABSTRAK

FAKTOR-FAKTOR BERKAITAN DENGAN RISIKO DIABETES MELLITUS JENIS 2 DALAM KALANGAN WANITA USIA SUBUR DI UNIVERSITI PUTRA MALAYSIA, SERDANG

SITI NURSYUHADA BINTI BADRUDIN

Wanita usia subur, berumur 15-49 tahun mempunyai risiko yang lebih tinggi untuk menghidap diabetes mellitus jenis 2 (T2DM). Daripada 60 juta wanita dari seluruh negara, dua daripada lima menghidap diabetes adalah daripada kalangan wanita usia subur. Kajian ini bertujuan untuk menentukan faktor-faktor yang berkaitan dengan risiko T2DM pada wanita usia subur. Ini adalah kajian keratan rentas yang melibatkan 83 wanita usia subur di Universiti Putra Malaysia (UPM). Ciri-ciri sosio-demografik, data antropometri, dan sejarah responden diperolehi daripada borang soal selidik. Pengambilan makanan dan pengetahuan diabetes dinilai dengan menggunakan set soalan kadar pemakanan (FFQ) dan set soalan pengetahuan diabetes (DKQ-24). Skor risiko diabetes ditentukan dan dikelaskan kepada risiko rendah dan risiko tinggi dengan menggunakan set soalan risiko diabetes (FINDRISC). Kekerapan umur responden adalah 37.65 ± 5.7 tahun dan majoriti daripada responden (n = 62; 74.7%) mempunyai skor pengetahuan diabetes yang lemah. 13.2% daripada responden diklasifikasikan sebagai berisiko tinggi untuk menghidap T2DM. BMI (r=0.61, p=0.00), ukur lilit pinggang (r=0.61, p=0.00) dan berat (r=0.63, p=0.00) didapati mempunyai kaitan yang positif dengan peningkatan risiko untuk menghidap T2DM. Di samping itu, responden yang mempunyai sejarah keluarga menghidap diabetes (X^2=14.31, p=0.00) dan sejarah gula dalam darah yang tinggi (X^2=15.90, p=0.00) juga mempunyai kaitan dengan peningkatan risiko menghidapi T2DM. Pengambilan tenaga (r=0.34, p=0.00), karbohidrat (r=0.25, p=0.02), protein (r=0.29, p=0.01) dan lemak (r=0.25, p=0.02) yang melebihi rekomendasi turut dijumpai berkaitan dengan peningkatan risiko menghidapi T2DM. Penemuan faktor-faktor ini dapat membantu pegawai kesihatan professional untuk merangka pengurusan yang baik untuk mengurangkan kelaziman T2DM di kalangan wanita usia subur.

CHAPTER 1

INTRODUCTION

1.1 Study Background

Diabetes mellitus (DM) is a metabolic disorder which has been categorized as one of four most prevalent non-communicable diseases (NCDs) (WHO, 2018). DM develops when pancreas cannot produce adequate amount of insulin or the body is unable to use the insulin efficiently. Insulin is an important hormone that assist in regulating blood sugar level. Without proper regulation, blood sugar level becomes elevated, a condition called as hyperglycemia. Over time, it can damage the body system such as nerves and blood vessel (Goldenberg & Punthakee, 2013). Organ failure and dysfunction such as eyes, kidney and blood vessel might be the long-term effect of severe hyperglycemia (American Diabetes Association, 2014). International Diabetes Federation (IDF) reported that 415 million of people developed diabetes mellitus in 2015 and the number was estimated to increase over 642 million by 2040 (Tripathy et al., 2017). Type 2 diabetes mellitus (T2DM) is the main concern of diabetes epidemic as it contributed to 90-95% of diabetes cases in any country around the world (Sharifa Ezat, Azimatun, Amrizal, Rohaizan & Saperi, 2009).

Malaysia is one of Asian countries with diabetes as a main concern of public health. This is because the prevalence of T2DM among Malaysian adults have been increasing from 13.4% (2015) to 18.3% (2019). Despite effort in conducting diabetes prevention programs including health campaigns, the prevalence of T2DM still increased

4.9% over a four years period (2015-2019) which involved 3.9 billion of Malaysian adult (1 in 5 adults in Malaysia have diabetes) as reported by the National Health Morbidity Survey, 2019 (NHMS, 2019). Previous data from Ministry of Health reported in 2016 that from 422 million of people with diabetes aged 18 years and above, 47% of them were women. In addition, from the NHMS 2015 survey, more women was diagnosed with T2DM (18.3%) compared to males (16.7%). 81% of the women recruited in NHMS study categorized as childbearing age women (Institute for Public Health, 2015).

According to World Health Organization (WHO), childbearing age women defined as women in reproductive age from 15 to 49 years old (WHO, 2020). In addition, Department of Statistic Malaysia also defined childbearing age women same with WHO definition as a women within 15 to 49 years old (DOSM, 2014). However, Centers for Disease Control and Prevention (CDC) in the United States have different definition as they defined childbearing age women from 16 to 49 years old (CDC, 2017). Currently, there are about 199 million of women with diabetes and this is estimated to increase to 313 million of women. From over 60 million women worldwide, two out from five women with diabetes are in reproductive age (International Diabetes Federation, 2017).

A study conducted in Zuni Pueblo, New Mexico among Zuni Indians showed that the prevalence of diabetes among women with mean age of 26 years old was much more higher compared to men. They found that the higher prevalence of diabetes may be contributed by body weight as the prevalence of obesity among female Zuni Indians was significantly higher compared to male (Scavini et al., 2003).

Besides, women aged 35 years old and below with a history of gestational diabetes mellitus (GDM) has a significant risk for developing T2DM compared to women with normoglycaemia pregnancies, as women with GDM had a seven-fold higher risk to develop T2DM (Logakodie et al., 2017). A study in Sri Lanka conducted in 2017among 87 respondents found that more than 50% of women with mean age 29 years old with history of GDM developed diabetes; however less than 10% of them without a history of GDM also developed diabetes (Herath, Herath & Wickremasinghe, 2017). Thus, besides history of GDM there were several other risk factors that could increase the risk of developing T2DM among childbearing women. Dietary intake among women also played an important role in developing T2DM. Higher consumption of saturated fat, fast foods, and energy-dense food contributed to development of diabetes among childbearing age women. Besides, study among Asian women with mean age 25 years old especially Indians tend to have genotype that makes them more vulnerable to develop T2DM and it comorbidities (Cheekurthy, Rambabu & Kumar, 2016).

T2DM commonly characterized by impaired fasting glucose and impaired glucose tolerance after a long term disruption in glucose metabolism during preclinical stage. Metabolic syndrome and other risk factors for vascular disease were usually detected in the early stage of diabetes. Effort on earlier detection of glucose metabolism disturbance would reduce the risk of morbidities and improve quality of life (Dugee et al., 2015).This effort helps to reduce the prevalence of diabetes in the country. To enhance early detection of T2DM, various T2DM risk scores have been created worldwide. Risk score helps in identifying people who have a higher risk of diabetes development and also help in identifying people with undiagnosed diabetes in cross-sectional setting (Dugee et al.,

2015). Diabetes risk scores have been developed as a screening tools for detecting high risk subjects for T2DM, determine their risk factors and help in raising awareness among the population to modify the risk factors and improve towards a healthier lifestyle (Saleem, Khan & Jan, 2017).

There were various factors identified in Malaysia that determined risk of T2DM among general Malaysian population. However there were still limited study available that addressed the risk factors associated with the risk of T2DM specifically among childbearing age women and their prevalence.

1.2 Problem Statement

Research had shown that the onset of diabetes occurred during childbearing age (Gregg et al., 2007). From over 60 million women worldwide, two out from five women with diabetes are in childbearing age (International Diabetes Federation, 2017).

Several risk factors for development of T2DM among childbearing age women had been discovered in Korea, including the maternal age, the level of glucose during pregnancy, family history of diabetes, body mass index (BMI) during pre-pregnancy and postpartum, dietary pattern, physical activity level and breastfeeding practice (Moon & Jang, 2017). Data from NHMS 2015 in Malaysia showed that sociodemographic factors associated with undiagnosed T2DM among Malaysian were increase in age, lower education level and the ethnicity. Malaysian Indian has the most significance number of

people who developed T2DM in Malaysia (Ismail et al., 2018). However, limited data available on the risk factors for developing T2DM specifically among childbearing age women in Malaysia.

Another study in California mentioned that postpartum weight gain also associated with the development of T2DM. More than 20% of women retained more than 4.5 kg weight after delivery especially during child-bearing years due to lack of physical activity and an increase in their food proportion as they followed the usual routine during their previous pregnancy. Weight gain of 4.5 kg increased twofold their risk of developing diabetes (Davis et al., 2017). A study among urban Malaysian women with average age 29.61±4.71 years old also support the study when they found that the mean weight retention of respondents was more than 5kg due to low physical activity level and higher energy and macronutrient intake (Fadzil et al., 2018).

Overweight and obesity were the two main factors of developing T2DM. This is because of modernization as well as nutrition transition to Western diet, along with lack of physical activity (Chivese et al., 2019). A study among childbearing age women in United States has also discovered that patients with T2DM were usually obese and higher prevalence of T2DM was reported among adults aged 20 years old and above (Eckel et al., 2011). Obese individuals were found to have a higher amount of nonesterified fatty acids, glycerol, and proinflammatory marker that lead to insulin resistance (Al-Goblan, Al-Alfi & Khan, 2014). Nonetheless, limited data available for nutritional status associated with development of T2DM among Malaysian childbearing age women.

In addition, lack of awareness and treatment contributed to the increased prevalence of diabetes among women. Good diabetes knowledge can help to identify the related symptoms of diabetes to prevent diabetes in the early stage. Furthermore, people who are more knowledgeable about diabetes risk tend to practice healthy lifestyle to avoid diabetes development. Study in UKM was conducted among adults with and without diabetes and showed that 80.2% of adults (30-59 y/o) with T2DM have low level of diabetes knowledge. Thus, low level of diabetes knowledge will increase the risk of developing T2DM (Sedek & Saari, 2019). However, limited study available on assessing the diabetes knowledge among childbearing age women in Malaysia.

Lack of awareness about the risk factors of T2DM among population should be mitigated to combat with the higher prevalence of diabetes in Malaysia. Thus, diabetes risk score is a simple, practical and informative scoring system that have been developed to promote awareness to the population about their future risk of developing T2DM (Key et al., 2018).

Diabetes risk score have been implemented in most countries in the world. Some of diabetes risk score used among Malaysian were Finnish Diabetes Risk Score (Lim, Chia & Koay, 2020) and Indian Diabetes Risk Score (Abdullah et al., 2018). However, limited studies have been conducted to assess diabetes risk especially for childbearing women.

Therefore this study was conducted to answer these research questions:

1. What are the socio-demographic characteristics, nutritional status and diabetes knowledge among childbearing age women in UPM Serdang?
2. What are the diabetes risk status among childbearing age women in UPM Serdang?
3. Are socio-demographic characteristics, nutritional status, and diabetes knowledge associated with the risk of type 2 diabetes among childbearing age women in UPM Serdang?

1.3 Significance of Study

This study provides more data to fill the research gap about the common risk factor for T2DM development for childbearing age women and provide baseline data on the risk factor associated with development of T2DM among childbearing age women in Malaysia.

The main findings of the study to provide new information for nutrition and health practitioners to identify the major factors of T2DM development suitable among childbearing age women in Malaysia. The discovered factors helps health care professional to implement and developed a proper management and strategies to avoid development of T2DM among Malaysian childbearing age women.

The data also include early screening on the risk future developing T2DM that can help to increase awareness among childbearing age women in Malaysia and thus may reduce prevalence of T2DM in Malaysia.

1.4 Objectives

1.4.1 General Objectives

To determine the factors associated with the risk of type 2 diabetes among childbearing age women in UPM Serdang.

1.4.2 Specific Objectives

1. To determine socio-demographic characteristics, nutritional status and diabetes knowledge among childbearing age women in UPM Serdang.
2. To assess type 2 diabetes risk status among childbearing age women in UPM Serdang.
3. To determine the association between socio-demographic characteristic, nutritional status and diabetes knowledge with the risk of type 2 diabetes among childbearing age women in UPM Serdang.

1.5 Null Hypothesis

1. There is no association of socio-demographic characteristics with the risk of type 2 diabetes mellitus among childbearing age women in UPM Serdang.
2. There is no association of nutritional status with the risk of type 2 diabetes mellitus among childbearing age women in UPM Serdang.
3. There is no association of diabetes knowledges with the risk of type 2 diabetes mellitus among childbearing women in UPM Serdang.

1.6 Conceptual Framework

Figure 1.1 shows the proposed conceptual framework that be investigated throughout the research. Socio-demographic characteristics, nutritional status and diabetes knowledge are studied in relation to the risk of type 2 diabetes among childbearing women in UPM Serdang. Socio-demographic characteristics, nutritional status and diabetes knowledge are the independent variables while the dependent variable is the risk on developing type 2 diabetes.

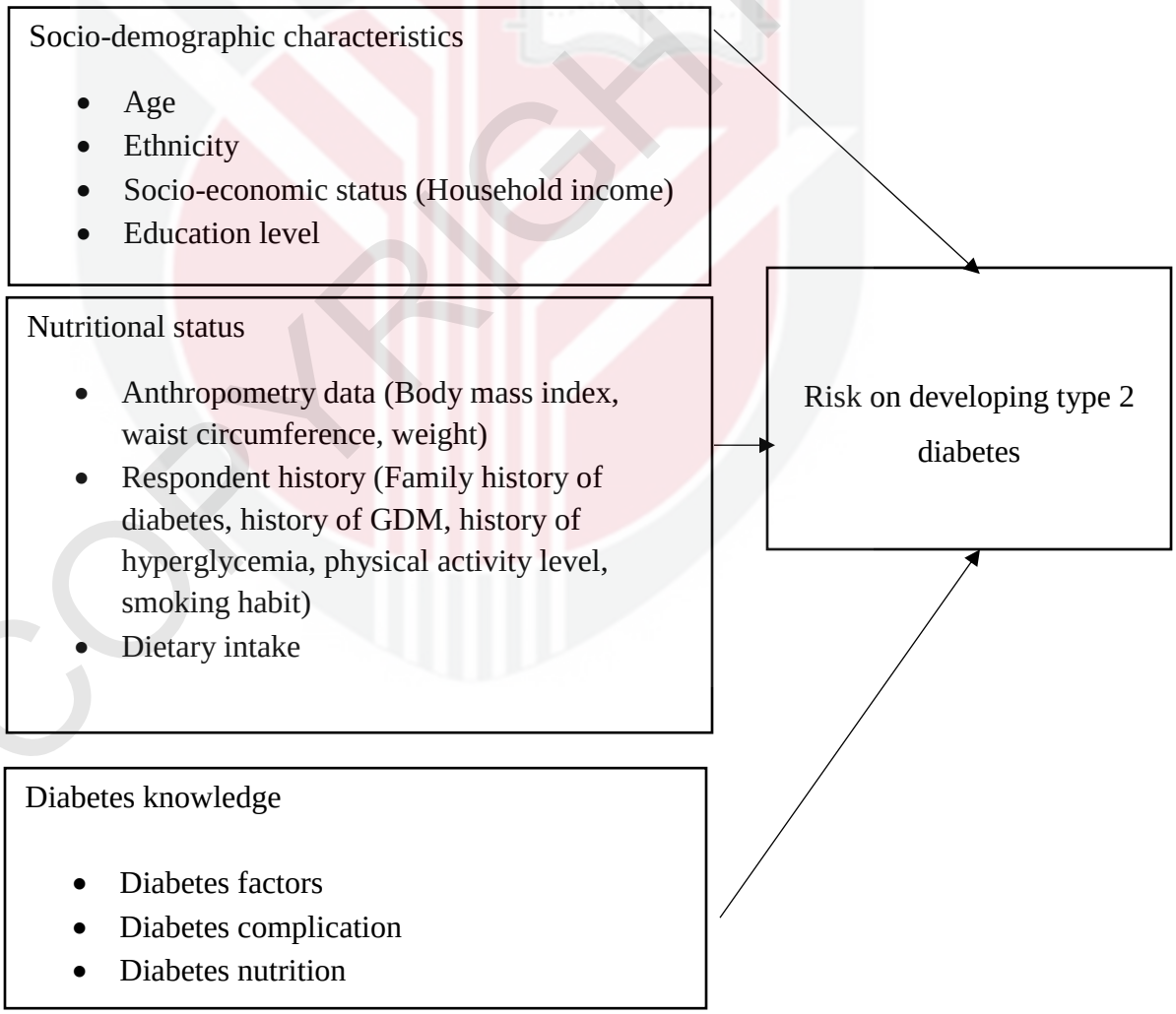


Figure 1.1: Conceptual framework for this study

CHAPTER 2

LITERATURE REVIEW

2.1 Type 2 Diabetes Screening by using Diabetes Risk Score

The prevalence of T2DM in Malaysia has been increasing rapidly since past decades (Hussein, Taher, Singh & Swee, 2015). The rising prevalence, in turn, increases the burden for country and also for the individual especially in treatment and managing the diabetes comorbidities. Earlier screening of prediabetes and T2DM will help to reduce the diabetes comorbidities in Malaysia (Franciosi et al., 2005). Diabetes risk score is a screening tools that will help in early detection of the risk of developing T2DM and to prevent its progression (Agarwal et al., 2019). Early screening might delay diabetes complications and help in improving the quality of life among the population (Acharya, Singh & Dhiman, 2017). Thus, implementing diabetes risk score can help to reduce diabetes prevalence in Malaysia. There was several risk scores which had been developed according to the suitable population, including Finnish Diabetes Risk Score (FINDRISC), Australian Type 2 Diabetes Risk Score (AUSDRISK), Indian Diabetes Risk Score (IDRS), Diabetes Risk Assessment (DRA) for Singaporeans and German Diabetes Risk Score (GDRS). However, Malaysia do not developed their own diabetes risk score yet. All risk factors of T2DM such as increasing age, obesity, family history of diabetes, low physical activity level, dietary intake and stressful environment were assessed by diabetes risk score for early detection of T2DM development (Nagalingam, Sundaramoorthy, Arumugam, 2016). The description for each Diabetes Risk Screening Tools and their components are summarized in the following Table 2.1 and Table 2.2 respectively.

Table 2.1 The description table for each Diabetes Risk Screening Tools

Diabetes Risk Screening Tools	Author	Country	Component	Validation
Finnish Diabetes Risk Score (FINDRISC)	Finnish Diabetic Association	Finland	1. Duration (over 10 years) 2. Age 3. Body mass index 4. Waist circumference 5. Physical activity level 6. Dietary intake 7. Blood pressure level 8. Family history of diabetes 9. History of antihypertensive drug treatment	1. Validated in Greek population to identify unknown diabetes, metabolic syndrome and abnormal glucose homeostasis (Makrilakis et al., 2011). 2. Validated in United States population as a simple and non-invasive tools to identify risk of developing T2DM (Zang et al., 2014). 3. Validated in Spanish population as screening tools to identify dysglycaemia and undiagnosed T2DM (Salinero-Fort et al., 2016). 4. Validated in Malaysian population as reliable tool to determine risk of diabetes in Malaysia because of higher sensitivity, 86.4% (Lim. Chia & Koay et al., 2020).
Indian Diabetes Risk Score (IDRS)	Madras Diabetes Research Foundation	India	1. Age 2. Abdominal obesity (waist circumference) 3. Physical activity level 4. Family history of diabetes	1. Validated in Baloor population, India as a tools with higher degree of sensitivity, specificity and accuracy to identify undiagnosed diabetes in community (Adhikari, Pathak & Kotian, 2010). 2. Validated in Lucknow population, India as simple and cost-effective tools to screen risk of developing T2DM (Khan et al., 2017). 3. Validated in adults population of Central India, Jabalpur District as excellent tools for predicting undiagnosed T2DM in community (Bhadoria, Kasar & Toppo, 2015).

German Diabetes Risk Score (DRS)	German Institute of Human Nutrition	German	1. Duration (over 5 years) 2. Gender 3. Age 4. Blood pressure level 5. Height, 6. Waist circumference 7. Family history of diabetes 8. Duration of physical activity per week 9. Dietary intake 10. Smoking status	1. Validated in elderly population of the city of Halle (Saale) in eastern Germany as the research concluded DRS as a tool certainly capable of detecting the risk of T2DM development especially included HbA1c factor (Hartwig et al., 2013). 2. Validated in Germany population. DRS estimated 5-years probability of T2DM development based on several factors such as anthropometry, dietary pattern and lifestyle factors as risk of diabetes development (Schulze et al., 2007).
Australian type 2 diabetes risk assessment tool (AUSDRISK)	Baker Heart and Diabetes Institute Australia	Australia	1. Duration (over 5 years) 2. Age group 3. Gender 4. Ethnicity 5. Family history of diabetes 6. History of blood glucose level 7. Blood pressure level 8. Smoke status 9. Dietary intake 10. Duration of physical activity per week 11. Waist measurement	1. Validated in Australian adult as AUSDRISK provide a valid and reliable method to estimate the risk of T2D development and detect individual with undiagnosed diabetes in cross-sectional setting (Chen et al., 2010). 2. Validated in pharmacies setting of Queensland, Australian AUSDRISK was acceptable to assess risk of diabetes in community pharmacies (Kilkenny et al., 2014). 3. Validated among population in Illawarra region, Australian. AUSDRISK tools identify risk of developing T2DM among overweight or obese individuals (Martin, Neale & Tapsell, 2019)
Diabetes Risk Assessment (DRA)	Ministry of Health Singapore	Singapore	1. Age (18-39 years old) 2. Gender 3. Body mass index 4. Family history of diabetes 5. Blood pressure level 6. Duration of physical activity per week 7. Sugary beverage intake	1. Validated to Singaporean aged between 18 and 39 years old (Ministry of Health Singapore, 2018).

Table 2.2 The summary component from Table 2.1 for each Diabetes Risk Screening Tools

Component	FINDRISC	IDRS	DRS	AUSDRISK	DRA
Duration for the risk of developing T2DM	Next 10 years	Not stated	Next 5 years	Next 5 years	Not stated
Age	No specific age	No specific age	25-74 years old	25 years old and above	18-39 years old
BMI	✓				✓
Waist circumference	✓	✓	✓	✓	
Physical activity level	✓	✓	✓	✓	✓
Dietary intake	✓		✓	✓	✓
Blood pressure level	✓		✓	✓	✓
History of antihypertensive drug treatment	✓				
Family history of diabetes	✓	✓	✓	✓	✓
Gender			✓	✓	✓
Height			✓		
Smoking status			✓	✓	
Ethnicity				✓	
History of blood glucose level	✓				

Research in Finland shows that Finnish Diabetes Risk Score (FINDRISC) could be implemented among young Middle East population, aged 18 to 25 years old, to identify undiagnosed T2DM. From the risk score, glucose tolerance and metabolic syndrome could be assessed to identify the risk of developing T2DM (Al-Shudifat et al., 2017). Study in Mongolia showed the effectiveness of FINDRISC in earlier detection of undiagnosed diabetes among respondent within 15 to 64 years old. FINDRISC measures the risk factor distribution among undiagnosed diabetes including anthropometry measurement (such as body weight and waist circumference), physical activity, dietary intake and hypertension which were major risk of T2DM development (Dugee et al., 2015).

FINDRISC also had being used to determine the risk of developing T2DM among Asian population. A study among Malaysian aged 18 years old and above showed that FINDRISC was a reliable tool to determine risk of diabetes in Malaysia because of higher sensitivity of 86.4% (Lim. Chia & Koay et al., 2020). Another study among Omani population adult showed that FINDRISC was validated and reliable for their study as they found that Cronbach's alpha reliability was 0.84 showing good internal consistency (D'Souza et al., 2013). In addition, FINDRISC also proven to be reliable tools for identify the risk of developing T2DM among Pakistan population adult as they found that FINDRISC has the higher sensitivity (68%) and specificity (68%) for scoring (Ishaque et al., 2016). Thus, FINDRISC is a reliable tools that can be used to determine the risk of developing T2DM for the upcoming decades among Asian population.

In addition, another diabetes risk score used was IDRS. A study in Delhi with 54% of the respondents were women with mean aged 43 years old, showed that IDRS had been

a validated tool for early screening of T2DM development. IDRS showed more than 50% sensitivity and specificity on screening risk factors such as age, family history of diabetes, anthropometry data (waist circumference) and physical activity level, which could be easily measured at a very low cost (Acharya, Singh & Dhiman, 2017). A study in South Indian concluded that by using IDRS, they could estimate the majority of their adult population with mean age 41.5 years old and majority of women respondents were at medium and high risk of T2DM development. Based on the results, they could implement an intervention such as healthy lifestyle to delay the progression of T2DM. Thus, IDRS is an indicator as well as an early prevention tool for T2DM development. Although IDRS was used among Asian population, however they does not specify the estimated duration for developing T2DM for those with high risk of T2DM (Nagalingam, Sundaramoorthy, Arumugam, 2016).

On the other hand, DRS was identified as the better diabetes risk assessment tool for adult's women aged 18 to 65 years old. This is because from the gender analysis performance, women yield double higher specificity for diagnosing diabetes and intermediate hyperglycemia for fasting plasma glucose (FPG) and haemoglobin A1C (HbA1c). FPG resulted in 1.5 times higher sensitivity among women compared to men for undiagnosed T2DM while sensitivity for intermediate glycaemia was 2 times higher (Paprott, 2012). Although DRS is considered sensitive for women, but it could not be adopted in Asian countries due to different biological factors and different dietary pattern (Dugee et al., 2015).

Furthermore, AUSDRISK had been used to assess the risk of developing T2DM among Australian with no limitation of age. Patients can completed the screening tools by themselves or with the assistance of a health professional and practice nurses. Research in Australia among women with mean age 32 years old concluded that AUSDRISK provides a valid and reliable method to identify undiagnosed diabetes among Australian in cross-sectional settings based on the several factors such as age, sex, ethnicity, family history of diabetes, smoking, physical activity levels and waist circumference (Chen et al., 2010).

Asian country such as Singapore also develop their own DRA tools in September 2017 to assess the risk of developing diabetes among their population thus, will help in reducing the diabetes prevalence in their country. However, DRA only applicable for adults aged 18-39 years old while those 40 years old and above recommended to see the doctor for their health screening including diabetes (Ministry of Health Singapore, 2018). Nevertheless, there are no studies about application of diabetes risk score specific for childbearing women because most diabetes risk scores were developed for general adult population.

2.2 Socio-demographic characteristics

Socio-demographic characteristics was one of the major risk factor of type 2 diabetes mellitus (T2DM) development among childbearing women aged assessed by the diabetes risk score. This includes age, ethnicity, socioeconomic status (household income) and educational level. According to a meta-analysis of a total of 39 studies, the common

age for T2DM development among childbearing age women was between 15 and 54 years old. More than 10% T2DM prevalence was reported for group age 45-54 years old and 2% in group age 15-24. They concluded that the prevalence of T2DM development among childbearing women increased with the age (Chivese et al., 2019). This was also supported by a study using FINDRISC where more than 50% of young adult aged 18-25 years old scored less than 7 which indicated low risk of developing diabetes. The majority of respondents were women (54%) (Saleem, Khan & Jan, 2017).

Besides, ethnicity was one of the risk factor for T2DM. Malaysia is composed of diverse ethnicities. Among them, Indians had highest prevalence of developing T2DM which was 24.9% compared to other ethnicities. This is because of the imbalance glycemic control that increased the level of haemoglobin A1C which led to a higher risk on T2DM development. Indians in Malaysia had the highest A1C level (8.5%) which could be contributed by the highest level of overweight and obesity (Hussein, Taher, Singh & Swee, 2015). A study in 2013 compared the prevalence of T2DM development among adults in Asians country where they found that the prevalence rate of Asian Indians was 14.2% which was the highest rate compared to other Asian regions such as Korea and Japan who have the lowest rate at 4.0% (Spanakis & Golden, 2013).

Furthermore, a cohort study had shown that the prevalence of diabetes among childbearing age women with higher level of education and income was inversely associated with the risk of T2DM development. They reported the biomarkers of the risk on developing T2DM such as HbA1C and triglyceride were relatively decreased with higher education and income (Lee et al., 2011). Another study also supported higher

education level and income reduced the risk of T2DM among women with mean age 38 years old. The Black Women's Health Study discovered that the risk ratio of T2DM for lower education was 1.28% compared to only 1.0% for higher education level while for household income, the ratio of T2DM development was 1.57% among women with low-income compared to women with higher income at 1.0% (Krishnan, Cozier, Rosenberg, & Palmer, 2010). However, study among Malaysian adult population with majority of respondents were women (53%), mean aged 42 years old showed that there was no significant association between educational level with undiagnosed T2DM in Malaysia (Ismail et al., 2018).

2.3 Nutritional status

Nutritional status include anthropometry data (body mass index, waist circumference, weight history), respondent history (family history of diabetes, history of gestational diabetes mellitus, history of hyperglycemia), dietary intake, and lifestyle factors, which were found to be associated with development of T2DM. In Malaysia, the increasing prevalence of T2DM was associated with overweight and obesity. 75% of Malaysian who developed T2DM were obese (Hussein, Taher, Singh & Swee, 2015). An increase in a unit $(1\ kg/m^2)$ of body mass index (BMI) resulted in the increment of 21% of diabetes risk in men and 15% in women (Feller, Boeing & Pischon, 2010).

A study in China among women with mean age 31 years old showed that the level of glycated haemoglobin (HbA1c) were significantly higher in overweight and obese

women compared to normal weight and underweight groups (Miao et al., 2017). Furthermore, European Prospective Investigation into Cancer and Nutrition (EPIC) Potsdam study also showed that an increase of 1 cm of waist circumference increased 8% relative risk of T2DM in both genders. They underlined the importance of determining both BMI and waist circumference to estimate the risk of type 2 diabetes (Feller, Boeing & Pischon, 2010). For childbearing mothers, they would gain more than 4.5 kg due to lack of physical activity and imbalance dietary intake. 4.5 kg weight gain was founded to increase the risk of developing diabetes by twofold (Davis et al., 2017).

Besides, family history of diabetes was significantly associated with T2DM development. A study discovered that if one family member had T2DM, the risk of developing T2DM increased about 2.5 fold. Increasing number of family members with T2DM, was parallel with the risk of developing T2DM (Scott et al., 2013). A study in India using IDRS showed, both genders who had family history of diabetes had a higher risk of T2DM development. Additionally, women age 18 years and above had higher risk at 68.8%, higher than male which was at 31.2%. The risk of developing T2DM was much higher if both parents had diabetes, the risk score reported was 81.9% (Ahmed & Amrutha, 2018).

Another risk factor of childbearing age women to develop T2DM was the history of gestational diabetes mellitus (GDM). GDM was common among pregnant women, especially women with higher BMI. GDM increased risk of T2DM development by sevenfold. A study had been done by Taibah University where they analysed 123 women with mean age 34 years old with previous history of GDM between 2011 and 2014. They

found out 67% of them developed T2DM based on medical record (Mahzari et al., 2018). Besides, in one study in Korea among 843 women with previous GDM, 12.5% of them developed diabetes two months postpartum, and the number still increased at the rate of 6.8% during 10 years follow-up (Kwak et al., 2013). Previous history of hyperglycemia during pregnancy also increased the risk of T2DM development. A study in Africa found about 50% of women with mean age 37 years old with previous history of hyperglycemia during pregnancy developed T2DM after 6 months postpartum (Chivese, Norris & Levitt, 2019).

Daily physical activity helped in reducing the risk of T2DM. 30 minutes of walking may help in reducing 50% of T2DM risk. In adult women age 18 years old and above, normal walking speed (3.2-4.8 km/h) could reduce about 30% risk of developing T2DM (Hamasaki, 2016). This was supported by another study among postpartum women with mean age 32 years old which found more than 30 minutes of walking every day was associated with prevention of weight gain after one year postpartum, which in turn may help to reduce the risk of developing T2DM (van der Pligt et al., 2016).

A study in Japan found that smoking was also associated with development of T2DM (Akter, Goto & Mizoue, 2017). This meta-analysis study concluded that the risk of T2DM increased by 40% among cigarette smokers compared to non-smokers. The prevalence of smokers with diabetes was 11.7% for men and 2.4% for women adults. Besides, higher risk of diabetes among smokers was usually caused by smoking cessation that increase about 5 kg weight gain after 1 year (Pan et al., 2015). A study done in Korea showed that after follow up for four years, the incidence of diabetes mellitus among heavy

smokers was higher by 2.9-fold compared to non-smokers. This is because ex-smokers and smokers had higher homeostatic model assessment for insulin resistance (HOMA-IR) and low homeostatic model assessment beta cell function (HOMA-ß) which increased the risk of T2DM by twofold (Cho et al., 2009). However, study among Malaysian adults showed there was no significant association between smoking with undiagnosed T2DM (Ismail et al., 2018).

Furthermore, dietary intake also may play a role in the development of T2DM among childbearing mothers. Excessive intake of fat and sugar-sweetened beverages were found to lead to obesity and increase the risk of T2DM (Hu, 2011). Childbearing age women tended to gain weight and increased their risk of developing T2DM. Most women would retain excess gestational weight gain after delivery, due to having difficulty in losing all the weight gained during pregnancy (Evenson, Brouwer & Østbye, 2013). A research from University of Texas conducted among postpartum women age 20-45 years old found that postpartum weight retention associated with higher intakes of soda and fried food especially during early postpartum period which could increase the risk of T2DM development (Davis et al., 2017).

2.4 Diabetes knowledge

T2DM is an economic burden to the country. Early prevention can help in reducing the risk of developing T2DM. Good diabetes knowledge especially knowing the risk of diabetes symptom and factors can help in earlier T2DM intervention. A study in Kimpese Hospital diabetic clinic in Democratic Republic of the Congo concluded that 72.3% of

overall diabetes patients in their clinic had poor diabetes knowledge. The mean percentage score for DM risk factors was 39.3%, and 20.5% and 35.6% respectively for complications and knowledge of diabetes causes (Ntontolo et al., 2017). Another study in Ethiopia with majority of women age 44 years old found less than 50% of adults with diabetes mellitus had good knowledge of diabetes and the knowledge was associated with the family history of diabetes. Higher scoring for diabetes knowledge was shown among respondents with family history of diabetes (Berhe, Gebru, Kahsay & Kahsay, 2014). In Northern Saudi Arabia, they found that majority of women age 40 years old and above (60%) had low knowledge on the causes of diabetes while only 33.2% of them was unsure with the symptoms of diabetes (Ahmed, Alateeq, Alharbi & Ahmed, 2018).

Diabetes Knowledge Questionnaire (DKQ-24) designed by Starr County Diabetes Education Study was one of the common diabetes knowledge questionnaires used among Asian population to determine the understanding of diabetes among respondents. It consisted 24 items that divided into three domains which were diabetes causes, diabetes complication, and diabetes nutrition (Bukhsh et al., 2019). A study in Pakistan showed that DKQ-24 was a valid and reliable tools with good internal consistency (Cronbach's alpha = 0.70) to determine diabetes knowledge among Pakistan population (Bukhsh et al., 2017). A local study also implement DKQ-24 to determine the risk of T2DM among Orang Asli. The found that DKQ-24 have good internal consistency (Cronbach's alpha= 0.81) and was suitable to assess diabetes knowledge among their population (Ahmad, Ramadas & Quek, 2010). Another study among Japanese population showed that DKQ-24 was suitable among Japanese population to assess general diabetes knowledge and for evaluated diabetes self-care education (Oba et al., 2019).

CHAPTER 3

METHODOLOGY

3.1 Study design and setting

This study was a cross sectional study examining the associations between socio-demographic characteristic (age, ethnicity, socio-economic status), nutritional status (anthropometry data, respondent history, dietary intake) and diabetes knowledge among childbearing age women in UPM Serdang. A cross sectional design was chosen because it can provide a snapshot of the health care needs of the population at a particular point in time. The duration of the study was six months.

3.2 Study location

This study was conducted in several faculties and institutes in Universiti Putra Malaysia (UPM), Serdang, Selangor. UPM was located approximately 21 km away from Malaysia's capital city of Kuala Lumpur. UPM Serdang campus has a total size of 1245.056 hectares consisting of 16 faculties and 10 institutes. The total number of students in UPM were 21,302 and the total number of academic staff is 1791 as reported in 2018 (Universiti Putra Malaysia, 2018).

3.3 Study respondents

Respondents for this study were selected from childbearing age women in Universiti Putra Malaysia. The respondent's selection were based on several inclusion and exclusion criteria. For inclusion criteria, the respondent must be Malaysian as this study want to know the risk factors of T2DM development in Malaysia population. Next, the respondent must be a married woman and already gave birth. Furthermore, the respondent must be between 18 until 49 years old because this was the average age for pregnancy mother in developing countries (WHO, 2018) (Table 3.1)

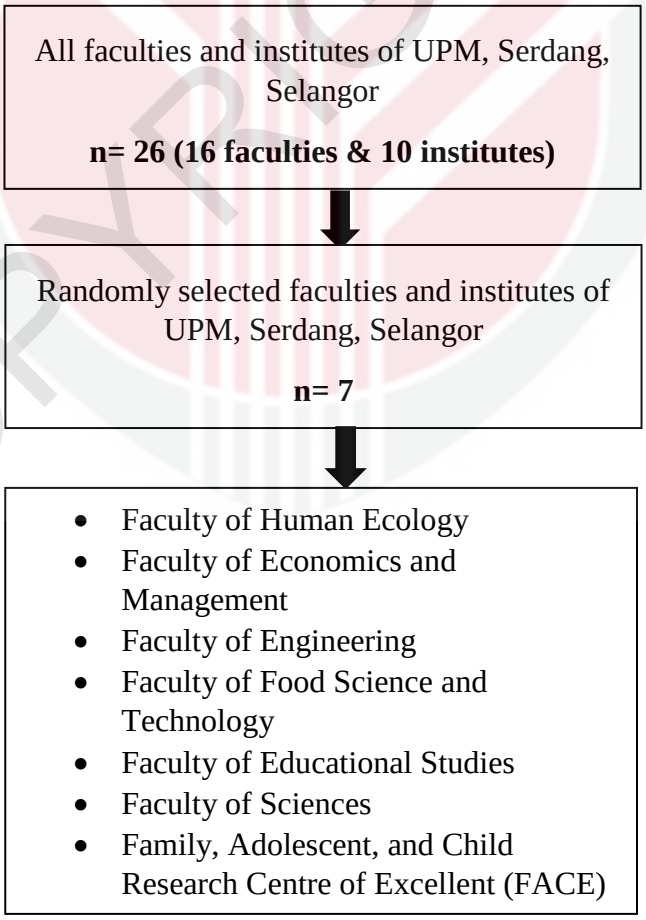
For exclusion criteria, pregnant women was excluded. This study also exclude women who have already been diagnosed with T1DM or T2DM because the study only want to assess the risk of T2DM development among healthy childbearing women. Table 3.1 shows the inclusion and exclusion criteria of the subject's selection.

Table 3.1: The inclusion and exclusion criteria of the subject's selection

Inclusion Criteria	**Exclusion Criteria**
18-49 years old	Pregnant women
Malaysian	Diagnosed with type 1 and type 2 diabetes mellitus
Married women	
Primiparous or multiparous mothers	

3.4 Sampling Method

Probability sampling was chosen to select sample from larger childbearing age women in UPM by using a method based on the theory of probability. Simple random sampling method which is one of the probability sampling was applied in this study where all women in UPM Serdang who meet the inclusion and exclusion criteria have an equal chances of getting selected. The faculties and institutes in UPM also randomly selected to involve in this study to avoid any bias. Simple random sampling was chosen because the method was easy to pick smaller sample size from larger population of childbearing age women in UPM and the results were represented as the summarized for the overall childbearing age women in UPM.



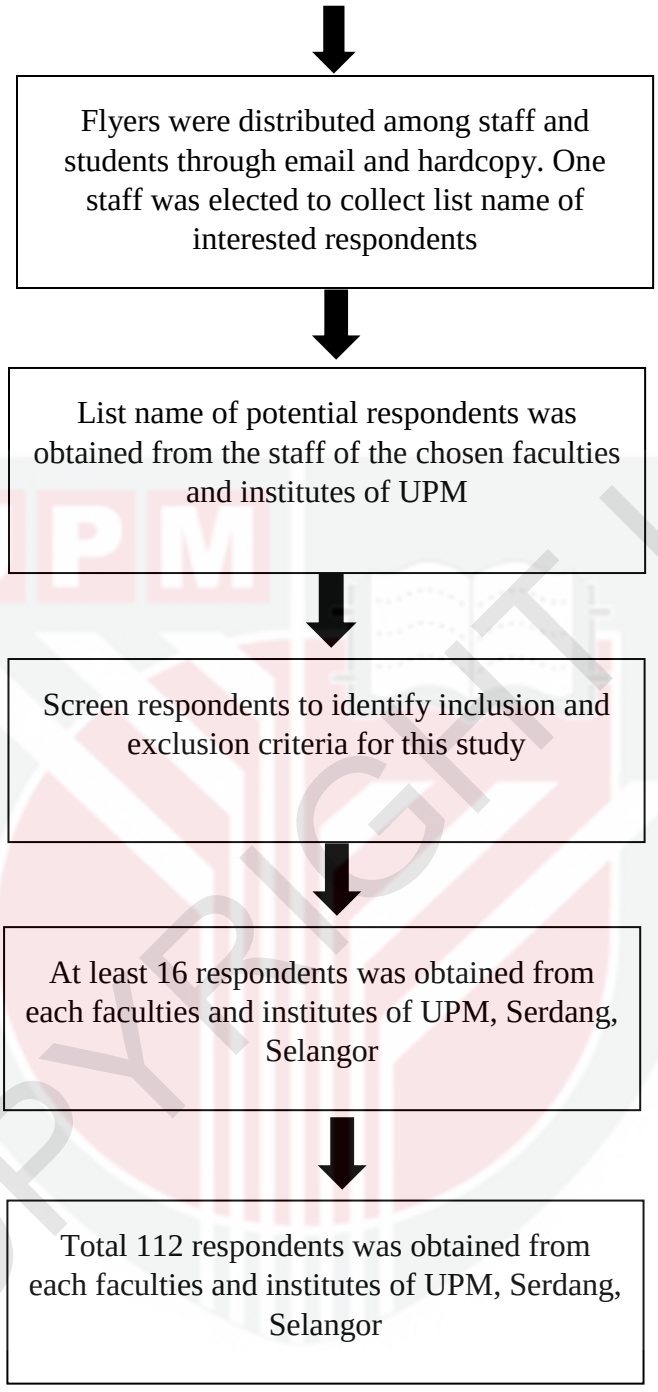


Figure 3.1: Simple Random Sampling for respondent recruitment

3.5 Sample size determination

In this study, the sample size was determined by using formula of sample size correlation studies (Cole, 1997). The following equation used to determine the sample size.

$$n = \frac{(z_{1-\alpha/2} + z_{1-\beta})^2}{r^2/(1-r^2)} + 5$$

(Cole, 1997)

Where

n= the calculated sample size

Z1-α/2= z score for level of significance a in two-sided test

Z1-β= z score for power of the test

r = correlation

Table 3.2 shows the sample size calculation by using Cole's formula above. The *r* values for the variable are obtained from similar studies which also determined the risk factors of T2DM among childbearing age women. The *r* values used is from other countries as there were no similar studies in Malaysia.

Table 3.2 Calculation of Sample Size (Cole, 1997)

Variables		**Correlation, r**	**Sample size, n**
Influence of obesity , parental history of diabetes , and genes in type 2 diabetes : A case-control study (Berumen et al., 2019)	Association between BMI trend and over the year with T2D	**0.890**	$n = \frac{(1.96 + 1.28)^2}{-0.89^2/(1-(-0.89^2)} + 5$ n = 8 + 20% = 10 respondents
	Association between waist circumference trend and over the year with T2D	**-0.740**	$n = \frac{(1.96 + 1.28)^2}{-0.89^2/(1-(-0.74^2)} + 5$ n = 13 + 20% = 16 respondents
The risk, perceived and actual, of developing type 2 diabetes mellitus for mothers of preschool children in urban China (Guo et al., 2019)	Association between family history of diabetes and risk of developing T2D	**0.328**	$n = \frac{(1.96 + 1.28)^2}{0.328^2/(1-(0.328^2)} + 5$ n = 92 + 20% = 110 respondents

Based on the Table 3.2, highest sample size calculated was 92 and after accounting for 20% of non-response rate, the minimum sample size needed in this study is **110 respondents**.

3.6 Instruments

Research instruments that being used for this study include self-administered questionnaires, food frequency questionnaire (FFQ), Finnish Diabetes Risk Score (FINDRISC) and Diabetes Knowledge questionnaire (DKQ-24) administered via face-to-face interview. Self-administered questionnaires was used to assess socio-demographic characteristic and anthropometry data. FFQ was used to assess dietary intake while FINDRISC was used for assessing the risk of T2DM among respondents. DKQ-24 was used to determine respondent diabetes knowledge. Bilingual (English and Malay) versions of all questionnaires were developed and respondents have to give their informed consent before answering the questionnaires.

3.6.1 Socio-demographic characteristics

Self-administered questionnaire was used to assess sociodemographic characteristic such as age, ethnicity, socio-economic status such as household income and education level.

3.6.2 Nutritional status

Anthropometry data includes body mass index (BMI) and waist circumference. Weight and height need to be measured to determine BMI of the respondent. TANITA Digital Weight Scale HD-319 was used to measured body weight (Tanita Health Equipment Ltd, Tokyo, Japan). Respondents were required to remove their shoes and

empty their pocket. Next, respondents will step on the middle of scale with both hands on the side of the body and facing forward (CDC, 2015).

The height of the respondents was measured by using SECA 206 Body Tape Measure (Vogel & Halke GmbH & Co., Germany). Body Mass Index (BMI) of the respondents was calculated as weight (kilogram) divided by the square of height (meter²) (CDC, 2014).

$$\text{BMI} = \frac{\text{Weight (kg)}}{\text{Height}^2\ (\text{m}^2)}$$

The classification of the BMI for adults and waist circumference for Asian female based on World Health Organization as shown in Table 3.3 and Table 3.4.

Table 3.3 Body mass index (BMI) classification for adults.

Body weight status	**BMI (kg/m^2)**
Underweight	< 18.5
Normal body weight	18.5 – 24.9
Overweight	25.0 – 29.9
Obese (Class I)	30.0 – 34.9
Obese (Class II)	35.0 – 39.9
Obese (Class III)	≥ 40

Source: World Health Organisation, 2016

Table 3.4 Waist circumference classification based on Asian cut-off for adult.

Gender	Waist circumference
Female	> 32 inches (>80 cm)

Source: World Health Organization Western Pacific Region, International Association for the Study of Obesity, & International Obesity Task Force, 2000

Weight history and history of gestational diabetes mellitus (GDM) was included in the self-administered questionnaire.

In addition, FINDRISC was used to assess family history of diabetes, history of hyperglycemia, and physical activity level. Smoking habit was assessed in self-administered questionnaire. For physical activity, FINDRISC assessed the average physical activity per week while for smoking, respondents being asked whether they were currently smoke cigarettes or any other tobacco products in their daily basis. The higher the score point assessed by FINDRISC, the higher risk for them to develop T2DM within 10 years (Table 3.7). Study among Omani adults in Oman, one of Western Asia country concluded that FINDRISC tool was validated and reliable and the Cronbach's alpha reliability of the tool was 0.84 which considered as good and valid (D'Souza et al., 2013).

Dietary intake also being assessed by using food frequency questionnaire (FFQ) adapted from Malaysian Adult Nutrition Survey (MANS), 2014. FFQ from MANS assessed the respondent's food habit such as their frequent intake of food (cereals and cereals product, fast food, meat and meat product, fish and seafood, eggs, legumes and legumes product, milk and milk product, vegetables, fruits, drinks, alcoholic drinks,

confectionaries, bread spread, flavours, and sugar, salt and oil intake) either per day, weekly or monthly and also the size and total serving size of their food intake. All the frequency of energy, carbohydrate, protein, fat, and sugar intake recorded per day, per week, and per month in FFQ was calculated into per day consumption. According to RNI 2017, energy intake should be in range of 1610kcal to 2370kcal, carbohydrate intake should within 180g to 230g, protein intake should within 52g-53g and fat intake was within 51g to 63g (RNI, 2017).The ratio of energy intake (EI) with basal metabolic rate (BMR) was calculate to determine misreporting of energy intake. A ratio within (1.35 to 2.39) EI/BMR considered as normal range (Black, 2000).

Table 3.5 Conversion of food frequency to daily food intake

Frequency of intake	Frequency	Conversion factor
Per day	1 x	1
	2 x	2
	3 x	3
Per week	1 x	0.14 (1/7)
	2 x	0.29 (2/7)
	3 x	0.43 (3/7)
Per month	1 x	0.03 (1/30)
	2 x	0.07 (2/30)
	3 x	0.10 (3/30)

Source: Norimah et al., 2008

3.6.3 Diabetes knowledge Questionnaire (DKQ-24)

Diabetes knowledge questionnaire (DKQ-24) was used to assess diabetes knowledge include diabetes factors and complication. DKQ-24 consisted of 24-items with a "Yes", "No" or "I don't know" choices answer. The items were scored according to the correct and incorrect answer. Each correct item was summed to obtain total score. There were three domains for DKQ-24. First is "Diabetes Factors" (items number 1, 2, 3, 4, 7, 9, 11, 12, 21, 22). Second is "Diabetes Complication" (items number 5, 6, 8, 14, 15, 16, 17, 19, 20, 23). Third is "Diabetes Nutrition" (items number 10, 13, 18, 14) (Shams et al., 2016). The test basically took 30 minutes which not time consuming (Garcia et al., 2001). DKQ-24 also was a valid and reliable tools as study showed that it have good internal consistency in measuring level of diabetes-related knowledge (Cronbach's coefficient alpha =0.78)

Thus, DKQ-24 was reliable and valid tools that is easy to use to measure the general diabetes knowledge among the respondents. The components in DKQ-24 and the score points in percentage to determine level of diabetes knowledge showed in Table 3.6 and Table 3.7 respectively.

Table 3.6 Components in Diabetes Knowledges Questionnaire (DKQ-24)

24 items in diabetes knowledge (DKQ-24)	Correct answer
1. Eating too much sugar and other sweet foods is a cause of diabetes.	**No**
2. The usual cause of diabetes is lack of effective insulin in the body.	**Yes**
3. Diabetes is caused by failure of the kidneys to keep sugar out of the urine.	**No**
4. Kidneys produce insulin.	**No**
5. In untreated diabetes, the amount of sugar in the blood usually increases.	**Yes**
6. If I am diabetic, my children have a higher chance of being diabetic.	**Yes**
7. Diabetes can be cured	**No**
8. A fasting blood sugar level of 210 is too high.	**Yes**
9. The best way to check my diabetes is by testing my urine.	**No**
10. Regular exercise will increase the need for insulin or other diabetic medication.	**No**
11. There are two main types of diabetes: Type 1 (insulin dependent) and Type 2 (non-insulin-dependent).	**Yes**
12. An insulin reaction is caused by too much food.	**No**
13. Medication is more important than diet and exercise to control my diabetes.	**No**
14. Diabetes often causes poor circulation.	**Yes**
15. Cuts and abrasions on diabetes heal more slowly.	**Yes**
16. Diabetes should take extra care when cutting their toenails.	**Yes**
17. A person with diabetes should cleanse a cut with iodine and alcohol	**No**
18. The way I prepare my food is as important as the foods I eat.	**Yes**
19. Diabetes can damage my kidneys.	**Yes**
20. Diabetes can cause loss of feeling in my hands, fingers, and feet.	**Yes**
21. Shaking and sweating are sign of high blood sugar.	**No**
22. Frequent urination and thirst are signs of low blood sugar.	**No**
23. Tight elastic hose or socks are not bad for diabetics.	**No**
24. A diabetic diet consist mostly of special foods	**No**

Source: Diabetes Knowledge Questionnaire 24, adapted from the Starr County Diabetes Education Study.

Table 3.7 Score points in percentage to determine level of diabetes knowledge

Knowledge score	**%**
Poor knowledge	< 60%
Acceptable knowledge	60% - 80%
Good knowledge	> 80%

Source: Shams, Amjad, Seetlani, & Ahmed, 2016

3.6.4 Finnish Diabetes Risk Score (FINDRISC)

Risk of developing type 2 diabetes mellitus (T2DM) was assessed by using a diabetes risk score. Finnish Diabetes Risk Score (FINDRISC) consists of eight (8) components or factors associated with the risk of developing T2DM. FINDRISC was a validated and reliable screening tools (Cronbach's alpha =0.84) to detect risk of probability T2DM development within 10-year period. The components include age, family history of DM, waist circumference, BMI, physical activity, vegetable/fruit diet, past history of hypertension and blood glucose. All the components have their own score points and the total sum of the score indicated risk of developing T2DM within 10 years. The risk score was categorized as less than 7: low (estimated 1 in 100 would develop DM), 7–11: slightly elevated (estimated 1 in 25 would develop DM), 12–14: moderate (estimated 1 in 6 will develop DM), 15–20: high (estimated 1 in 3 would develop DM) and >20: very high (estimated 1 in 2 would develop DM) (Lindström & Tuomilehto, 2003). The most important aspect in the FINDRISC, this tool was not gender-based questionnaire which reduce bias among respondents and it also defined the duration of estimated develop T2DM in future. FINDRISC also was commonly used among Asian population and found to be reliable tools among Malaysian population (Lim. Chia & Koay et al., 2020). Thus, the FINDRISC tool appropriate to be used for this study (D'Souza et al., 2013). Table 3.8 showed the total score points of FINDRISC to determine risk developing T2DM.

Table 3.8 Score points of FINDRISC to determine risk developing T2DM

Risk developing type 2 diabetes	Score points
Low risk	**< 7**
Slightly elevated risk	**7-11**
Moderate risk	**12-14:**
High risk	**15-20:**
Very high risk	**> 20**

Source: Lindström J, Tuomilehto J. The Diabetes Risk Score: A practical tool to predict type 2 diabetes risk. Diabetes Care 2003; 26: 725-731.

3.7 Study procedure

Data collection was conducted after receiving approval from Ethic Committee for Research Involving Human Subject, Universiti Putra Malaysia (JKEUPM-2019-404) and permission letter from involved faculties and institutes around UPM Serdang. The respondents were given an information sheet that explain the purpose of the study and also a consent form. Respondents were required to answer the questionnaires provided regarding their socio-demographic characteristics, nutritional status and diabetes knowledge. FINDRISC was used to assess their risk of developing T2DM. The whole process taking approximately 40 minutes to complete.

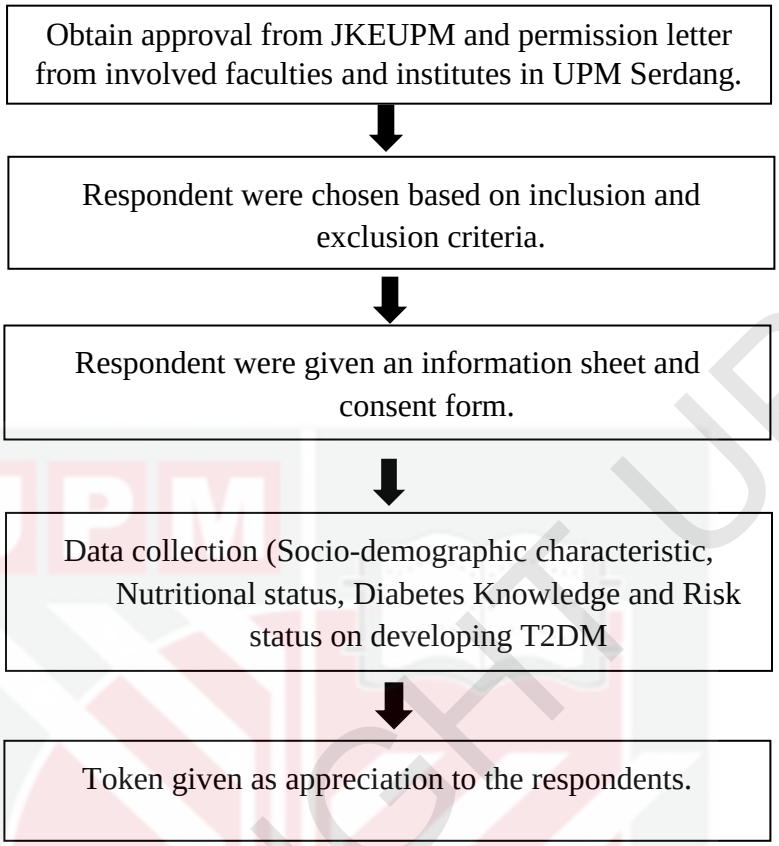


Figure 3.2: The flow of study procedures

3.8 Pre-test

Pre-testing for the questionnaire was conducted prior to actual data collection. Approximately five women with similar respondent characteristics needed for the study were chosen as a respondents. Their results were not be included in the actual data collection. Pre-testing was required to test the questionnaires in order to identify any potential problems before the actual data collection. Besides, pre-testing will provide an

overview off the procedure of the research so data collection process can run smoothly. Respondents had given their feedback and this helped the researcher to improve the questionnaires.

3.9 Data analysis

Statistical analysis was performed using IBM SPSS version 22 with statistically significant level set at $p<0.05$. Result for nominal and ordinal variables were presented in frequency and percentage. The association between two continuous variables (BMI, age, waist circumference, income, weight history, dietary intake, total score of diabetes risk score) were determined using Pearson's correlation. Besides, association between categorical and categorical variable (Type 2 diabetes risk score status and history of GDM, family history of T2DM, history of hyperglycemia, physical activity level and smoking habits) were determined by Chi-Squared test. Differences between three groups of ethnicity (Malay/Chinese/Indian) and Diabetes risk score were analysed by ANOVA test while difference between two groups (have family history of T2DM and do not have) and Diabetes risk score were analysed by Independent-T test.

CHAPTER 4

RESULTS

4.1 Screening and recruitment of respondents

Staff were recruited from several faculties in UPM (Faculty of Human Ecology, Faculty of Economics and Management, Faculty of Engineering, Faculty of Food Science and Technology, Faculty of Educational Studies, Faculty of Sciences, Faculty of Modern Languages and Communication, Faculty of Environmental Studies) and one institute in UPM (Family, Adolescent, and Child Research Centre of Excellent, FACE).

Figure 4.1 shows the screening and recruitment procedure of the study. A total of 100 staff were screened for the study. 95 were eligible for this study based on inclusion and exclusion criteria. However, five respondents (n=5) were excluded from the study. Two of them already has been diagnosed with type 2 diabetes mellitus (T2DM) while another three were pregnant.

From 95 respondents enrolled in the study, only 83 of them had completed the questionnaire given. The overall response rate among respondents was about 87%. The 8 respondents were excluded for not completing the FFQ section. They were having difficulties to recall back their previous dietary intake and they complained that the questionnaire was too long and inconvenient. Hence, the final number of respondents for this study was 83. However, the total number of respondents did not achieved the desired

sample size (n=110). This is because of limited time for data collection due to current COVID-19 situation. Thus, the data collection need to be stop.

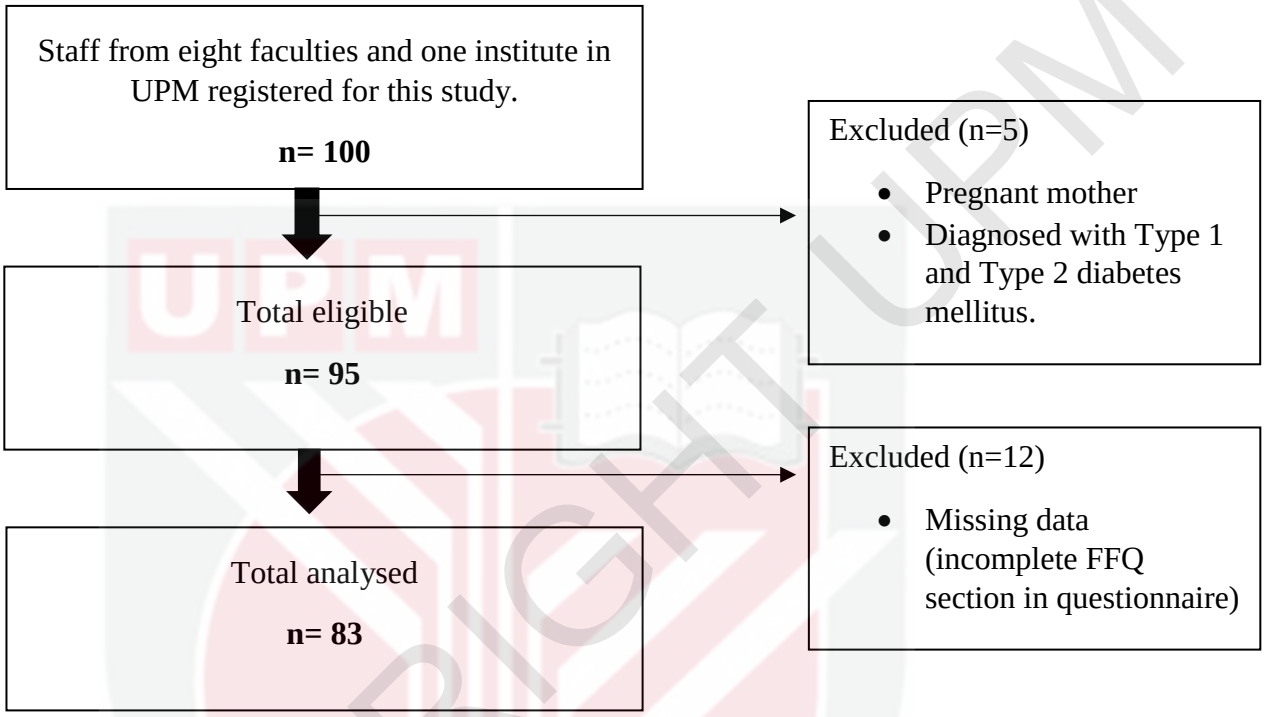


Figure 4.1: Screening and recruitment of respondents

4.2 Socio-demographic characteristics of the respondents

The mean age of the respondents was 37.65 ± 5.7 years old. The majority of the respondents were Malay, all of them works as officer in UPM and reported household income of RM 2001- RM 5000 per month (48%) which categorized as medium income. Besides, more than half of the respondents had completed their university educational

level (degree, master and PhD) (78.3%), followed by pre-university level (14.5%) and secondary educational level (7.2%) (Table 4.1).

Table 4.1 Socio-demographic characteristics of respondents (n=83)

Variables	n (%)	Mean ± SD
Age (years)		37.65 ± 5.7
Ethnicity		
Malay	82 (98.8%)	
Chinese	1 (1.2%)	
Indian	0 (0%)	
***Household income (RM)**		6515.25 ± 4144.9
≤ 2000	7 (8.4%)	
2001- 5000	40 (48.2%)	
5001- 10 000	26 (31.3%)	
> 10 000	10 (12.0%)	
Education level		
Secondary level	6 (7.2%)	
Pre-university	12 (14.5%)	
University	65 (78.3%)	

*Department of Statistics Malaysia (2019)

4.3 Nutritional status of the respondents

4.3.1 Anthropometry data

The mean body mass index of the respondents was 26.6 ± 6.0 kg/m^2 which indicated that respondents were overweight on average. Half of them (51.7%) exceeding normal range of BMI (Figure 4.2). The mean weight and height of respondents were 65.4

± 15.4 kg and 1.57 ± 0.5 m respectively. Moreover, the mean waist circumference of the respondents were 82.5 ± 12.2 cm which shows that on average they were abdominally obese (Table 4.2).

Table 4.2 Anthropometry data of respondents (n=83)

Variables	Mean ± SD
Anthropometry data (n=83)	
Body mass index (kg/m^2)	26.6 ± 6.0
Waist circumference (cm)	82.5 ± 12.2
Current weight (kg)	65.4 ± 15.4
Current height (m)	1.57 ± 0.5

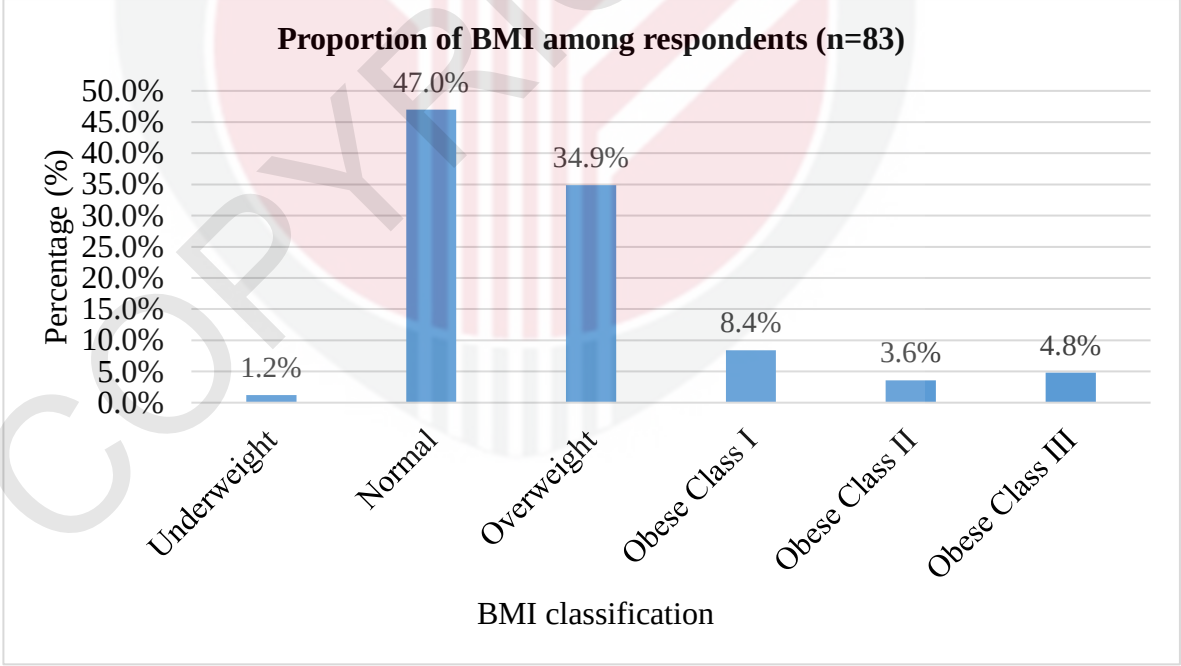


Figure 4.2: BMI classification of the respondents

4.3.2 Respondent history

More than half of the respondents reported that they had family history of diabetes (60%) and one third of them have history of hyperglycemia (21.7%) while small number of them had a history of gestational diabetes mellitus during their pregnancy (4.8%). More than half of them engaged in physical activity at least 30 minutes per day (56.6%), and the majority of them were non-smokers (96.4%) (Table 4.3).

Table 4.3 Respondent history of respondents (n=83)

Client history	**n (%)**
Family history of diabetes	
Yes	50 (60%)
No	33 (40%)
History of GDM	
Yes	4 (4.8%)
History of hyperglycaemia	
Yes	18 (21.7%)
No	65 (78.3%)
Physical activity (at least 30 minutes per day)	
Yes	47 (56.6%)
No	36 (43.4%)
Smoking habit	
Yes	3 (3.6%)
No	80 (96.4%)

4.3.3 Dietary intake

The mean daily energy intake per day of the respondents was 2138 ± 510 kcal/day. Then, the mean daily carbohydrate intake per day of respondents was 308.18 ± 94.93g (57% from total calories). Meanwhile, for protein and fat intake per day of the respondents

were 93.68 ± 30.40g (17% from total calories) and 58.33 ± 22.11g (24% from total calories) respectively. Sugar intake per day of the respondents was 9% from total calories (46.98 ± 28.24g) which was about 9 teaspoon per day. Thus, most of the respondents received an adequate amount of energy and macronutrient and the values were within the recommendation by Recommended Nutrient Intake 2017 (Ministry of Health Malaysia, 2017) (Table 4.4).

Table 4.4 Total energy, macronutrient and sugar intake of respondents using Food Frequency Questionnaire (n=83)

Dietary intake	**Mean ± SD**	***Recommended intake**
Energy intake (kcal)/day	2138 ± 510	(1610-2370) kcal
Carbohydrate (g/day)	308.2 ± 94.93	(180-230) g
Percent (%)	57.0 ± 9.8	(50-65) %
Protein (g/day)	93.7 ± 30.40	(52-53) g
Percent (%)	17.5 ± 4.4	(10-20) %
Fat (g/day)	58.3 ± 22.11	(51-63) g
Percent (%)	24.4 ± 6.4	(25-30) %
Sugar (g/day)	47.0 ± 28.24	(16-40) g
Percent (%)	8.8 ± 5.0	10 %
	1.67 ± 0.361.	1.35-2.39

**Ratio of EI with BMR (EI/BMR)

- Under-reporting = 10.8%
- Over-reporting = 2.4%

*Recommended intake based on Recommended Nutrient Intake 2017 (RNI 2017) for Female adult.

** Categorization of normal EI/BMR range according to Goldberg cut-off point (Black, 2000).

The mean of EI:BMR ratio for all respondents was 1.67 ± 0.361. Based on the cut-off point, 10.8% under-reporters while 2.4% over-reporters of energy intake. However, misreporting of energy intake were not excluded as this study aimed to determine the energy and macronutrient intake for all respondents.

4.4 Diabetes knowledge of the respondents

Among the three type of domains in diabetes knowledge questionnaire, the domain with most correctly answered questions (≥ 60%) were diabetes complication (62.3%), followed with diabetes nutrition (54.5%) and the least correctly answered question was domain diabetes factor (29.9%) (Table 4.5.1). The questions with most correctly answered (≥ 60%) were about the usual causes of diabetes (85.5%), higher blood sugar level in untreated diabetes (90.4%), the inheritance of diabetes among family members (83.1%), role of diet and exercise to control diabetes (83.1%), the slower heal of cuts in patient with diabetes (96.4%), care while cutting toenails (75.9%), importance of self-prepared food (90.4%), and consequences of diabetes 74.7% for kidney damages and 78.3% for numbness of hands, fingers and feet. 9 out of 24 in the questions (37.5%) were correctly answered by more than 60% respondents while another 15 questions (62.5%) scored the least number of correct answers (Figure 4.3).

Table 4.5 Proportion of respondents correctly answered for diabetes knowledge question (DKQ-24) (n=83)

24 items in diabetes knowledge (DKQ-24)	**Correctly answered n (%)**
Eating too much sugar and other sweet foods is a cause of diabetes.	0 (0%)
The usual cause of diabetes is lack of effective insulin in the body.	71 (85.5%)
Diabetes is caused by failure of the kidneys to keep sugar out of the urine.	15 (18.1%)
Kidneys produce insulin.	21 (25.3%)
In untreated diabetes, the amount of sugar in the blood usually increases.	75 (90.4%)
If I am diabetic, my children have a higher chance of being diabetic.	69 (83.1%)
Diabetes can be cured	20 (24.1%)
A fasting blood sugar level of 210 is too high.	28 (33.7%)
The best way to check my diabetes is by testing my urine.	33 (39.8%)
Regular exercise will increase the need for insulin or other diabetic medication.	19 (22.9%)
There are two main types of diabetes: Type 1 (insulin dependent) and Type 2 (non-insulin-dependent).	39 (47.0%)
An insulin reaction is caused by too much food.	17 (20.5%)
Medication is more important than diet and exercise to control my diabetes.	69 (83.1%)
Diabetes often causes poor circulation.	46 (55.4%)
Cuts and abrasions on diabetes heal more slowly.	80 (96.4%)
Diabetes should take extra care when cutting their toenails.	63 (75.9%)
A person with diabetes should cleanse a cut with iodine and alcohol	6 (7.2%)
The way I prepare my food is as important as the foods I eat.	75 (90.4%)
Diabetes can damage my kidneys.	62 (74.7%)
Diabetes can cause loss of feeling in my hands, fingers, and feet.	65 (78.3%)
Shaking and sweating are sign of high blood sugar.	11 (13.3%)
Frequent urination and thirst are signs of low blood sugar.	22 (26.5%)
Tight elastic hose or socks are not bad for diabetics.	21 (25.3%)
A diabetic diet consist mostly of special foods	18 (21.7%)

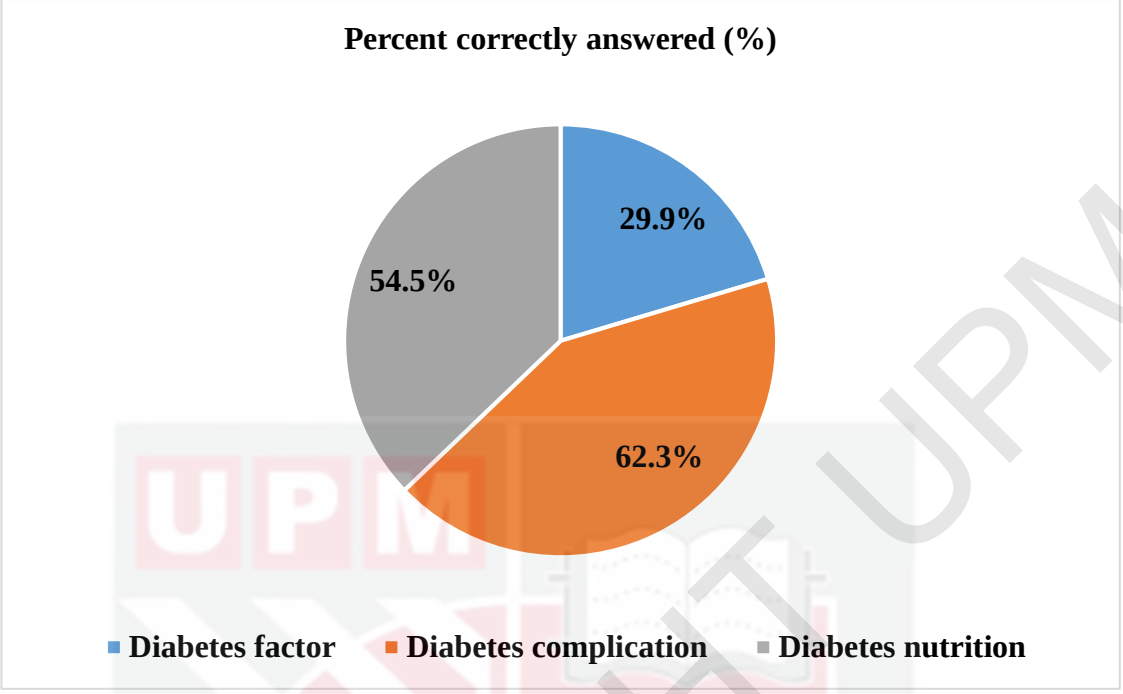


Figure 4.3: Overall domain correctly answered for diabetes knowledge question (n=83)

The majority of the respondents (n=62; 74.7%) had poor knowledge score which was less than 60% for diabetes knowledge questionnaire and followed by acceptable knowledge score (n=21; 25.3%). None of the respondents had good knowledge score for diabetes knowledge questionnaire (Table 4.6).

Table 4.6 Knowledge score of the respondents (n=83)

Knowledge score	**Correctly answered n (%)**
Poor knowledge (<60%)	62 (74.7%)
Acceptable knowledge (60% - 80%)	21 (25.3%)
Good knowledge (>80%)	0 (0.0%)

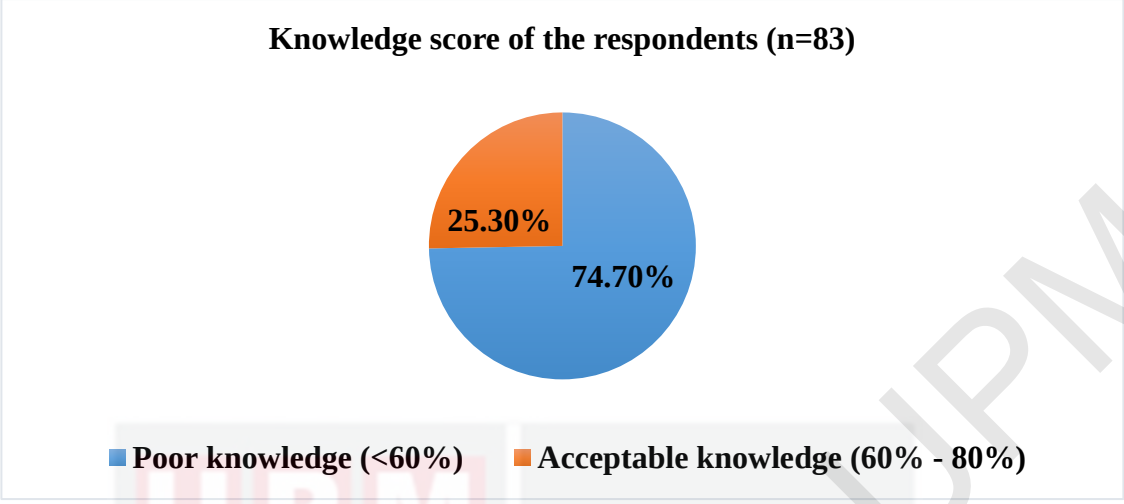


Figure 4.4: Overall knowledge score for all respondents (n=83)

4.5 Risk of developing type 2 diabetes of the respondents using FINDRISC diabetes risk score.

More than half of the respondents (66.2%) have a risk on developing T2DM in 10 years later. About 13.2% of the respondents had a very high risk of diabetes, while 86.7% of the respondents were categorized as low risk by FINDRISC indicator (Table 4.7).

Table 4.7 Overall diabetes risk score of the respondents (n=83)

Risk developing type 2 diabetes	Score points	n (%)
Low risk		**72 (86.7%)**
Low risk	**< 7**	28 (33.7%)
Slightly elevated risk	**7-11**	34 (41.0%)
Moderate risk	**12-14:**	10 (12.0%)
High risk		**11 (13.2%)**
High risk	**15-20:**	9 (10.8%)
Very high risk	**> 20**	2 (2.4%)

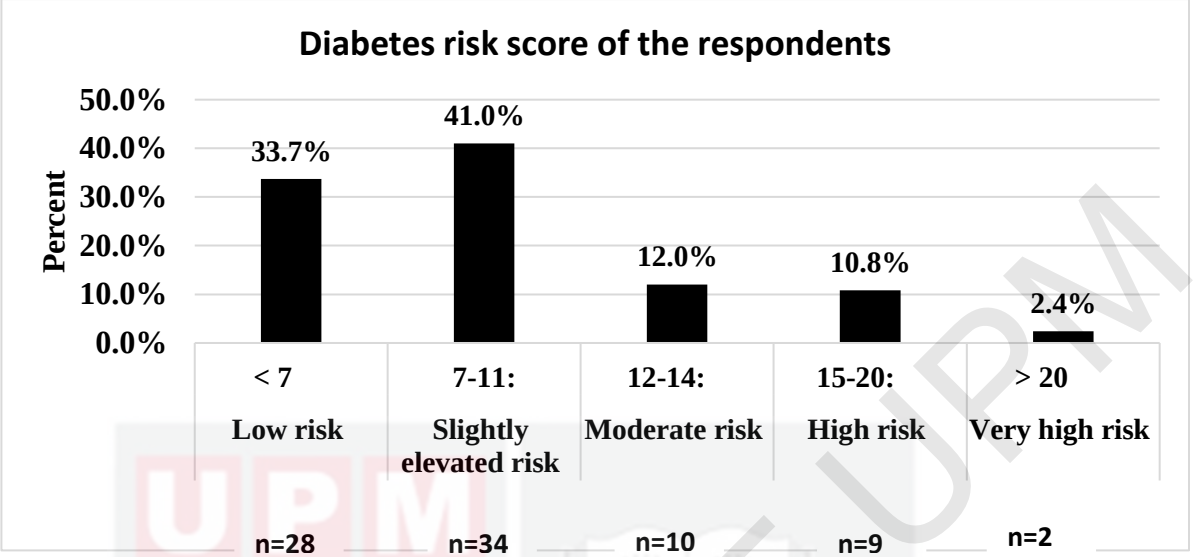


Figure 4.5: Overall diabetes risk score of the respondents (n=83)

4.6 Association of various factors and the risk of developing type 2 diabetes mellitus.

4.6.1 Association of socio-demographic characteristic with the risk of developing type 2 diabetes mellitus.

There was no significant association between socio-demographic characteristics with the risk of developing T2DM among childbearing age women in Universiti Putra Malaysia (Table 4.8) and (Table 4.9).

Pearson's correlation coefficient test was run to determine the association between ages with the risk of developing T2DM (p=0.31) while Chi square test was run to determine association between ethnicity, household income, and education level with the risk of developing T2DM. Both of the results show that there was no significant association between them. Thus, null hypothesis was accepted.

Table 4.8 Association between ages with the risk of developing type 2 diabetes mellitus

Variables	*r* - value	*p* - value
Age	0.11	0.31

*Significant value at p<0.05

Table 4.9 Association between ethnicity, household income, and education level with the risk of developing type 2 diabetes mellitus

Variables	*Low risk n (%)	*High risk n (%)	X^2	p value
Ethnicity			0.29	0.60
Malay	71 (85.5%)	11 (13.3%)		
Non-Malay	1 (1.2%)	0 (0%)		
***Household income (RM)**			3.37	0.07
≤ 3000	9 (10.8%)	4 (4.8%)		
≥ 3001	63 (75.9%)	7 (8.4%)		
Education level			1.78	0.18
Secondary level	6 (7.2%)	0 (0%)		
University level	66 (79.5%)	11 (13.3%)		

*Department of Statistics Malaysia (2019).

4.6.2 Association of nutritional status with the risk of developing type 2 diabetes mellitus.

4.6.2.1 Association of anthropometry data with the risk of developing type 2 diabetes mellitus.

Result from Pearson's correlation coefficient test confirm that there was a significant association between anthropometry data (BMI, waist circumference and weight) with the risk of developing type 2 diabetes mellitus among childbearing age women in Universiti Putra Malaysia.

Table 4.10: Association between anthropometry data with the risk of developing type 2 diabetes mellitus.

Variables	*r* - value	*p* - value
Anthropometry data (n=83)		
Body mass index (kg/m^2)	0.61	0.00*
Waist circumference (cm)	0.61	0.00*
Weight	0.63	0.00*
Height	0.18	0.10

*Significant value at p<0.05

4.6.2.2 Association of client history with the risk of developing type 2 diabetes mellitus.

Chi square test was performed to determine association between client history with the risk of developing T2DM. The result showed that there was no significant association between physical activity or smoking habit with the risk developing T2DM. However, there was a significant association between family history of diabetes and history of hyperglycaemia with the risk of developing T2DM.

Table 4.11 Association of client history with the risk of developing type 2 diabetes mellitus.

Variables	Low risk n (%)	High risk n (%)	X^2	p value
Family history of diabetes			14.31	*0.00
Type 2 diabetes mellitus and History of GDM	28 (33.7%)	11 (13.3%)		
No family history	44 (53.0%)	0 (0%)		
History of hyperglycaemia			15.9	*0.00
Yes	10 (12.0%)	8 (9.6%)		
No	62 (74.7%)	3 (3.6%)		

Physical activity (at least 30 minutes per day)			1.40	0.24
Yes	39 (47.0%)	8 (9.6%)		
No	33 (39.8%)	3 (3.6%)		
Smoking habit			0.83	0.36
Yes	2 (2.4%)	1 (1.2%)		
No	70 (84.3%)	10 (12.0%)		

*Significant value at p<0.05

4.6.2.3 Association of dietary intake with the risk of developing type 2 diabetes mellitus.

There was an association observed between dietary intake (energy, carbohydrate, protein and fat) with the risk of developing T2DM except for sugar intake.

Table 4.12 Association between dietary intakes with the risk of developing type 2 diabetes mellitus.

Dietary intake	***r* - value**	***p* - value**
Energy intake (kcal/day)	0.34	0.00*
Carbohydrate (g/day)	0.25	0.02*
Protein (g/day)	0.29	0.01*
Fat (g/day)	0.25	0.02*
Sugar (g/day)	-0.05	0.68

*Significant value at p<0.05

4.6.3 Association between diabetes knowledge with the risk of developing type 2 diabetes mellitus.

Chi square test was performed to determine the association between diabetes knowledge with the risk of developing T2DM. The result showed that there was no significant association between diabetes knowledge with the risk of developing type 2 diabetes mellitus.

Table 4.13 Association between diabetes knowledge with the risk of developing type 2 diabetes mellitus.

Variables	Low risk n (%)	High risk n (%)	X^2	p value
Diabetes Knowledge			0.36	0.55
Poor knowledge (<60%)	53 (63.9%)	9 (10.8%)		
Acceptable knowledge (60% - 80%)	19 (22.9%)	2 (2.4%)		

CHAPTER 5

DISCUSSION

5.1 Socio-demographic characteristics of the respondents

The mean age of the respondents was 37.65 ± 5.7 years old which was within the childbearing age definition by WHO and DOSM. Both defined childbearing age women as women in reproductive age from 15 to 49 years old (WHO, 2020; DOSM, 2014). The majority of the respondents were Malay and reported household income of RM2001-RM5000 per month which was categorized as middle income by Department of Statistic Malaysia (DOSM, 2019). The result was supported by a similar local study among adults in Penang, where the majority of the respondents were Malay and the mean monthly income was RM2024.23 (Rahim et al., 2020) however it contrast with another similar local study as majority of their respondents were Indians (Abdullah et al., 2018). Almost 80% of the respondents in this study completed their university educational level however this result was contradicted with a similar local study where majority of their respondents with mean age 47 years old only completed their secondary level of educations (Ahmed et al., 2019).

5.2 Nutritional status of the respondents

5.2.1 Anthropometry data

In this study, the mean BMI of the respondents was 26.6 ± 6.0 kg/m^2 which in average classified as overweight. This was supported by a local study in Cheras where majority of the respondents were female with mean age 47.5 years old and categorized as overweight with mean BMI was 26.6 ± 5.5 kg/m^2 (Ahmed et al., 2019). Another study among Malaysian with majority of respondents were female with mean age 42 years old also categorized as overweight and obese (Ismail et al., 2018). In addition, this study also reported that in average, respondents were abdominally obese as their mean waist circumference were 82.5 ± 12.2 cm. This result also similar with study in Malaysia where they found that more than half of their respondents were overweight and obese and also have waist circumference above the normal recommendation for Asian (Oo et al., 2020).

5.2.2 Respondent history

Majority of the respondents in this study have family history of diabetes. This result supported by similar local study where their respondent with majority of them were women less than 50 years old have positive family history of diabetes that increasing their risk of developing T2DM in future (Abdullah et al., 2018). Besides, a similar study conducted in Malaysia where they found that most of their respondents with higher risk of T2DM having family history of T2DM. Most of the respondents were female with mean age 30 years old (Tam et al., 2014). Less than 30% of the respondents in this study having

hyperglycemia and GDM during their pregnancy. However, a study among adult women in Selangor found that about 70% of women with age less than 35 years old has history of GDM (Logakodie et al., 2017). Another meta-analysis study had been done among Asian population where they found that higher prevalence of GDM (11.5%) among women in childbearing age (Lee et al., 2018).

Almost 60% of the respondents in this study engaged in physical activity and less than 5% of them were smoker. However, this was contradicted with the findings in local study where they found that more than 50% of the respondents majority were female more than 18 years old having low physical activity (Rahim et al., 2020). This result also supported with other local study when they found that more than 50% of the respondents were sedentary and women have lower engaged with physical activity compared to men (Cai Lian et al., 2016).

5.2.3 Dietary intake

The mean daily macronutrient intake per day of the respondents was within the recommendation of RNI 2017 for female adults (Ministry of Health Malaysia, 2017). However, a study among Malaysian adults found that the mean energy intake was slightly lower than recommended intake for female with mean age 41 years old (1500 kcal) (Lee & Wan, 2019). They also found that female had exceed protein intake (67 g) compared to RNI which was between 52 g to 53 g. However, the study have similar result for carbohydrate and fat intake which their intake were within recommendation. Another local study support the study result where the energy intake among female aged 18 years old

and above were within the RNI recommendation (1884 kcal). In contrast, the study does not support the carbohydrate intake (247g), protein intake (75g) and fat intake (65g) as their respondents intake for these three macronutrient were exceeding the recommendation (Zainuddin et al., 2019).

The mean of EI:BMR ratio for all respondents in this study was 1.67 ± 0.361. A ratio within (1.35 to 2.39) EI/BMR considered as normal range (Black, 2000). Similar result found in a study among Malaysian population female with age 18 years old to 49 years old where the EI:BMR ratio for the respondents was 1.48 EI/BMR (Zainuddin et al., 2019).

5.3 Diabetes knowledge of the respondents

The majority of the respondents (74.7%) had poor diabetes knowledge score which was less than 60%. This result also supported by study in Nepal where the mean DKQ-24 was 47% indicated poor diabetes knowledge score and this was related with poor education level (50% of them have lower educational level) (Shrestha et al., 2015). Local study among Malaysian adults in Seremban also support the result where they found that 75% of the respondents has poor diabetes knowledge (Li et al., 2019). Another study among Asian population in Pakistan supported the result where they found that majority of the respondents (53%) has poor knowledge diabetes assessed by DKQ-24 (Shams et al., 2016).

5.4 Risk of developing type 2 diabetes of the respondents using FINDRISC diabetes risk score.

The result showed that more than half of the respondents (66.2%) having risk on developing T2DM for the upcoming decade which 86.7% of them with low risk and 13.2% of them with high risk assessed by FINDRISC. A study among Pakistan population also have similar result where more than half of the respondents (57%) of them having low risk of developing T2DM while only 46% of them have higher risk of T2DM (Ishaque et al., 2016). A study in Malaysia also support the result where they found that more than 60% of Malay respondents have lower risk of T2DM assessed by FINDRISC (Hullon et al., 2018). In addition, another local study among adults age 18 to 25 years old found that half of the respondents have low risk on developing T2DM (74%) (Sapkota, 2020).

5.5 Association of various factors and the risk of developing type 2 diabetes mellitus.

5.5.1 Association of socio-demographic characteristic with the risk of developing type 2 diabetes mellitus.

There was no significant association between socio-demographic characteristics with the risk of developing T2DM among childbearing age women in Universiti Putra Malaysia.

For the age, study in central India with majority of female in childbearing age (55%) supported the result where there was no significant association between age and risk developing T2DM (Singh, Raju, Dubey, Kurrey, Bansal & Malik 2014). However,

our findings was contradicted with the study conducted in Africa where their finding confirm that there was a significant association among age and the risk of developing T2DM (Chivese et al., 2019). According to their meta-analysis study, the prevalence of T2DM was higher among older age group and they concluded that the prevalence of T2DM development among childbearing women increased with the age. Another study in India also reported that more than 50% of young adult aged 18 to 45 years old scored less in FINDRISC which indicated low risk of developing T2DM (Saleem, Khan & Jan, 2017). In addition, this study's result on ethnicity was not consistent with another study in Malaysian adults which found a significant association between ethnicity and the risk developing T2DM (Hussein, Taher, Singh & Swee, 2015). They found that Malaysian Indian have the highest prevalence of developing T2DM and the least prevalence was Chinese. Our result was not significantly associated because most of the respondents recruited in this study mainly Malays (98.8%).

Similar to a previous study conducted in central India, for household income and level of education, the result showed no significant association between household income and the risk developing T2DM (Singh, Raju, Dubey, Kurrey, Bansal & Malik 2014). Another study in Malaysia among adults where majority of respondents were within childbearing age women also reported no significant association of educational level with undiagnosed diabetes mellitus in Malaysia (Ismail et al., 2018). However, another similar study in United States, the Women's Health Study contradicted the finding. They showed that females in childbearing age with higher level of education and income was inversely associated with the risk of T2DM development (Lee et al., 2011). The result also supported by The Black Women's Health Study which most of the respondents were

within childbearing age where they discovered that the incidence rate ratio of T2DM was much higher among lower education women and those with low household income. (Krishnan, Cozier, Rosenberg, & Palmer, 2010).

5.5.2 Association of nutritional status with the risk of developing type 2 diabetes Mellitus

5.5.2.1 Association of anthropometry data with the risk of developing type 2 diabetes Mellitus

A study conducted in United Stated with majority of the respondents were female in childbearing age concluded that there was an association between BMI and weight with the risk of developing T2DM. They found that the prevalence of T2DM increasing with BMI (Gray, Picone, Sloan, & Yashkin, 2015). A study in Malaysia also suggested that the increasing prevalence of T2DM was associated with overweight and obesity. More than 50% of Malaysian who developed T2DM were obese (Hussein, Taher, Singh & Swee, 2015). Another study from European Prospective Investigation into Cancer and Nutrition (EPIC)-Potsdam indicated that 15% of diabetes risk increasing with a unit $(1\ kg/m^2)$ of BMI. The EPIC-Postdam study also showed a significant association between waist circumference with the risk of developing T2DM (Feller, Boeing & Pischon, 2010). They also found that an increase 1 cm of waist circumference was associated with a 8% increase of the risk developing T2DM. However, another EPIC-Postdam study found the significant association between height and risk of T2DM (Wittenbecher et al., 2019). Greater height (>10cm) was associated with reduce risk of T2DM.

5.5.2.2 Association of respondent history with the risk of developing type 2 diabetes mellitus.

A study in Korean population adults more than 20 years old supported the result, in which there was an association between family history of diabetes with the risk of developing T2DM (Noh et al., 2018). They found that those with family history of diabetes especially parental, had a 2.3 times increase in the risk of developing T2DM compared to those without history of diabetes mellitus. Another large, prospective case-cohort study (InterAct study) also reported the same result as they found that family history of diabetes was associated with the higher incidence of T2DM (Scott et al., 2013). Besides, mothers who had GDM during pregnancy also had seven-fold increased risk of developing T2DM and this result was reported by study in Saudi Arabia (Mahzari et al., 2018). Moreover, the result showed that history of hyperglycaemia was associated with the risk of T2DM (Mahzari et al., 2018). A study conducted among women in Africa showed the same result and they concluded that nearly 50% of the women with history of hyperglycaemia might develop T2DM within 5 to 6 years (Chivese, Norris & Levitt, 2019).

On the other hand, the result from this study showed that physical activity and smoking habit were not associated with the risk of developing T2DM. A study conducted among Semi-Urban Saudi population also having showed more tobacco smokers developed T2DM compared to non-smokers, but the relationship was not significant (Al Mansour, 2020). However, this result was opposed by another study in Sweden in which

they found that there was an association between physical activity and smoking habits with T2DM risk (Thelin & Holmberg, 2014). The result was opposed because, the study in Sweden showed that most of the smokers having T2DM compared to non-smoker however, most of the respondents involved in the study were not a smoker. Moreover, another study in United States suggested that by having 30 minutes of walking may reduce half of T2DM risk (Colberg et al., 2010). This also supported by study in Australia where they found that walking more than 30 minutes per day was associated with lower risk of developing T2DM (Hamasaki, 2016; van der Pligt et al., 2016).

5.5.2.3 Association of dietary intake with the risk of developing type 2 diabetes mellitus.

The result from Pearson's correlation coefficient test showed that there was an association between dietary intake (energy, carbohydrate, protein and fat) with the risk of developing T2DM among childbearing age women in Universiti Putra Malaysia except for sugar intake. This result was supported by previous cross-sectional study in United Kingdom in which higher energy intake was associated with the risk of developing T2DM (Donin et al., 2014). This is because they found that energy intake had strong positive association with insulin resistance that can lead to T2DM. Another study among Hispanic women in Los Angeles showed that high energy intake associated with decreasing insulin sensitivity which can increase risk of developing T2DM (Chen et al., 2014).

Besides, the carbohydrate intake also associated with the risk of T2DM. A study among female nurses from United States reported that higher carbohydrate intake was

associated with the increasing risk of developing T2DM (Halton, Liu, Manson Hu, 2008). However, this study did not observe a significant association between protein intake and the risk of developing T2DM. Those consuming low carbohydrate intake of food can improve their insulin sensitivity (Halton, Liu, Manson Hu, 2008). Moreover, a study in Malaysia also having contrast result with the study where they found that there was no significant association between dietary carbohydrate with the risk of T2DM (Chin et al., 2013).

In addition, PREvención con DIeta MEDiterránea (PREDIMED) study reinforced the association of fat intake with the risk of developing T2DM (Guasch-Ferré et al., 2017). They found that total dietary fat, monounsaturated fatty acids, polyunsaturated fatty acids, and trans-fatty acids were not significant associated with the prevalence of T2DM; instead, excessive intake of saturated fat and animal fat was associated with the risk on developing T2DM (Guasch-Ferré et al., 2017). In this study, sugar intake was not associated with risk of developing T2DM. However, a study that analysed data from 165 countries concluded that there was a strong association between sugar intake and incidence of diabetes (Weeratunga et al., 2014). Excessive sugar intake was reported to lead to overweight and obesity, subsequently leading to T2DM.

5.5.3 Association between diabetes knowledge with the risk of developing type 2 diabetes mellitus.

The result showed that there was no significant association between diabetes knowledge with the risk of developing type 2 diabetes mellitus among childbearing age women in

Universiti Putra Malaysia. However, contrary to our study, a study in Pakistan found that diabetes knowledge was significantly associated with the risk of developing T2DM (Bukhsh et al., 2019). By having good diabetes knowledge, the individual will tend to have good glycemic control as well. This supported by study in Congo where more than 50% of patient developed diabetes have poor diabetes knowledge (Ntontolo et al., 2017).

CHAPTER 6

CONCLUSION, STRENGTH, LIMITATION AND RECOMMENDATION

6.1 Conclusion

This study involved 83 respondents within childbearing aged 18 years old to 49 years old recruited from several faculties in UPM. Most of them were Malay officer in UPM and on average they were categorized as M40 middle and T20 top which is income more than RM3000 indicated by Department of statistic Malaysia 2019. Majority of them already completed their university education level. In addition, most of the respondents were overweight, obese and abdominally obese based on the anthropometry data. On average, their dietary intake including macronutrient intake (carbohydrate, protein and fat) were within the recommendation by RNI 2017. Furthermore, majority of the respondents had poor knowledge diabetes score and lower risk on developing T2DM for the upcoming decade assessed by FINDRISC.

The study showed significant result for nutritional status where the anthropometry data result showed that there was an association between BMI (r=0.61, p=0.00), waist circumference (r=0.61, p=0.00)and weight (r=0.63, p=0.00) with the risk of developing T2DM. Besides, for client history, there was an association between family history (X^2= 14.31, p=0.00) and history of hyperglycaemia (X^2= 15.90, p=0.00) with the risk of developing T2DM. Moreover, for dietary intake, the result show that there was an association between energy intake (r=0.34, p=0.00), carbohydrate intake (r=0.25, p=0.02), protein intake (r=0.29, p=0.01) and fat intake (r=0.25, p=0.02) with risk of

developing T2DM except for sugar intake. Thus, proper management and strategies for each associated factor need to be done to reduce the risk on developing T2DM among childbearing age women. Further studies can be done to investigate other possible related factor that might contributed in increasing risk of T2DM among childbearing age women.

6.2 Strength of the study

There were still insufficient study to determine the factor associated with the risk of T2DM among childbearing age women especially in Malaysia. Thus, this study can contribute to the body of knowledge regarding common risks factor that associated with the risk of developing T2DM. The result may help health care professional to develop proper management to reduce prevalence of T2DM among Malaysian childbearing age women.

The tools used for the data intake were validated. For diabetes knowledge, the Cronbach's alpha is 0.78 which showing good internal consistency to measure level of diabetes-related knowledge. Moreover, to detect the risk of developing T2DM, FINDRISC was used as it was a validated and reliable screening tools (Cronbach's alpha is 0.84) showed good internal consistency.

6.3 Limitation of the study

There were some limitation of the study. Firstly, unequal distribution of ethnicity among the recruited respondents was due to the location of data collection. The study was conducted in administration offices, which consisted of more Malay officer compared to

other ethnicities. To improve this limitation, the study should be conducted at location with balanced ethnicity and recruit more respondents from other ethnicities. Secondly, no biochemical assessment was performed in this study. Biochemical assessment such as glucose test can be done to access their blood glucose level as an indicator for the risk of hyperglycaemia. Additionally, only selected factors were chosen for the study, which may have overlook any other potential significant factor. More reading should be done to identify any other factors that may contributed to the risk development of T2DM. On top of that, the sample size achieved was only 75% from the desired sample size (83 from 110 respondents. The data collection processed was halted halfway due to the Coronavirus disease (COVID-19) pandemic to avoid any adverse effects from the disease.

Moreover, the study is a cross-sectional study that only explained the association between variables at a single time point, thus, the study cannot establish any cause and effect. Lastly, FFQ was used to obtain data of dietary intake, however limit of information for some food items may cause the calculation become less accurate. Besides, the respondents also burdened with many question in FFQ and also having difficulties to remember their previous dietary intake can contributed to less accurate data. Thus, other alternative can be done such as doing 3 days diet record so that the respondents will easier to remember and record their previous dietary intake because the duration become more shorter. Furthermore, this study also do not calculate the possible under-reporting and over-reporting data for FFQ which may influence with the validity of the data. Hence, to avoid this issue in future, ratio of energy intake with basal metabolic rate (BMR) should be calculated to ensure that all incorrect data reported will be managed (Souza et al., 2015).

6.4 Recommendation for future studies

Other possible relevant factors that can influence the risk of developing T2DM can be studied to ensure that the all the factors can be prevented to reduce prevalence of T2DM among childbearing age women. In addition, the sample size should be bigger, conducted in various location in Malaysia and include respondents multiple ethnicities to increase the validity of the study. Moreover, to obtain causal and effect between variable, randomized controlled trial is recommended for future research. Furthermore, ratio of energy intake with BMR should be calculated to ensure that all the reported data for FFQ was not under-reported and over-reported (Souza et al., 2015). This is to ensure the validity of the dietary intake result.

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ETHICS COMMITTEE FOR RESEARCH INVOLVING HUMAN SUBJECTS
(JKEUPM)
UNIVERSITI PUTRA MALAYSIA

Research title	:	**Factors Associated with the Risk of Type 2 Diabetes Among Childbearing Women in Universiti Putra Malaysia, Serdang.**
Study Site	:	**Universiti Putra Malaysia**
JKEUPM Ref No.	:	**JKEUPM-2019-404**
Researcher	:	**Siti Nursyuhada Badrudin**
Supervisor	:	**Assoc. Prof. Dr. Barakatun Nisak Mohd Yusof**

Documents received and reviewed with reference to the above study:

1. Ethics Application Form, Version 1 dated 18/10/2019
2. Respondent Information Sheet & Consent (English), Version 1 dated 18/10/2019
3. Respondent Information Sheet & Consent (Malay), Version 1 dated 18/10/2019
4. Proposal (English), Version 2 dated 29/11/2019
5. Questionnaires/ Interviews (English), Version 1 dated 18/10/2019
6. Questionnaires/ Interviews (Malay), Version 1 dated 18/10/2019
7. Curriculum Vitae of:
    a. Assoc. Prof. Dr. Barakatun Nisak Mohd Yusof
    b. Siti Nursyuhada Badrudin

The University Research Ethics Committee, Universiti Putra Malaysia (JKEUPM) operates in accordance to the ICH-GCP Guidelines.

Decision by JKEUPM:

[X] Approved

[X] **Permission MUST BE OBTAINED from the respective hospitals/ institutions before conducting the research**

[ ] Disapproved

Please note that the approval is **VALID UNTIL 16 DECEMBER 2019**

Researchers should comply with the following:

I. Complete a Study Final Report upon study completion (Form 3.2).

II. Ethical approval is required in the case of amendments/ changes to the study documents/ study sites/ study team.

APPENDIX C: Information sheet for patient n consent form (Malay version)

JAWATANKUASA ETIKA UNIVERSITI UNTUK PENYELIDIKAN MELIBATKAN MANUSIA (JKEUPM)
UNIVERSITI PUTRA MALAYSIA, 43400 UPM SERDANG, SELANGOR, MALAYSIA

BORANG 2.4: PENERANGAN DAN PERSETUJUAN RESPONDEN

Sila baca maklumat berikut dengan teliti. Sekiranya anda mempunyai sebarang pertanyaan, sila kemukakan kepada penyelidik.

1.TAJUK KAJIAN

Faktor- faktor berkaitan dengan risiko diabetes mellitus jenis 2 dalam kalangan wanita yang sudah melahirkan anak di Universiti Putra Malaysia, Serdang.

2. PENGENALAN

Diabetes mellitus jenis 2 (T2DM) adalah sejenis penyakit diabetes yang lazim terjadi di Malaysia dan kadar peningkatannya ketara dari masa ke semasa. T2DM berlaku apabila sel-sel badan menentang kesan normal insulin, yang mengakibatkan peningkatan kadar glukosa darah dalam darah. Keadaan ini dipanggil rintangan insulin dan biasanya diklasifikasikan sebagai gula darah puasa yang terjejas (IGT) dan toleransi terhadap gula darah yang terjejas (IGT) selepas gangguan jangka masa yang panjang dalam metabolisme glukosa semasa peringkat pra klinikal. Diabetes menduduki tempat kesembilan sebagai punca utama kematian wanita, yang melibatkan 2.1 juta kematian setiap tahun. Menjelang tahun 2040, kadar kematian bagi wanita yang menghidap kencing manis (diabetes) dijangka meningkat kepada 313 juta yang menjadi kebimbangan bagi penduduk di seluruh dunia. Kurang kesedaran terhadap faktor-faktor yang berkaitan dengan risiko T2DM dan pengesanan awal T2DM, meningkatkan lagi risiko menghidap T2DM dalam kalangan masyarakat. Oleh itu, untuk meningkatkan pengesanan awal diabetes, pelbagai skor risiko T2DM telah dihasilkan di seluruh dunia. Skor risiko merangkumi beberapa faktor risiko yang mungkin berkaitan dengan risiko menghadapi T2DM dalam kalangan masyarakat. Skor risiko T2DM juga membantu dalam mengenal pasti masyarakat yang mempunyai risiko diabetes yang lebih tinggi dan mengenal pasti masyarakat yang menghidap diabetes yang tidak didiagnosis dalam penentuan keratan rentas yang dapat mengurangkan kadar peningkatan T2DM pada masa akan datang. Oleh itu, tujuan penyelidikan ini dijalankan adalah bagi membantu penyelidik mengenalpasti faktor-faktor berkaitan dengan risiko diabetes mellitus jenis 2 dalam kalangan wanita yang sudah melahirkan anak khususnya untuk wanita di Universiti Putra Malaysia dengan menggunakan skor risiko diabetes.

3. APAKAH YANG PERLU ANDA LAKUKAN?

Anda perlulah terdiri daripada wanita yang sudah melahirkan anak berumur 18 hingga 49 tahun yang bebas daripada didiagnosis dengan penyakit diabetes untuk menyertai kajian ini. Sekiranya anda bersetuju untuk menyertai penyelidikan ini, anda akan ditemuduga dan anda juga dikehendaki menjawab beberapa soalan bagi melengkapkan soal selidik ini. Anda akan ditemuduga berkaitan sejarah rekod perubatan anda dan anda dikehendaki menjawab beberapa soalan berkaitan faktor-faktor demografi sosial, diet seharian (kekerapan pengambilan makanan), gaya hidup dan pengetahuan terhadap diabetes di dalam borang kaji selidik yang disediakan. Beberapa ukuran seperti ketinggian dan berat juga akan diukur untuk

mendapatkan rekod perubatan semasa.

4. SIAPA YANG TIDAK BOLEH MENYERTAI KAJIAN INI?

Wanita yang sudah didiagnosis dengan diabetes mellitus jenis 1 dan jenis 2 dan juga ibu yang sedang hamil.

5. APAKAH FAEDAH MENYERTAI KAJIAN INI?

a) KEPADA ANDA SEBAGAI PESERTA?

Anda akan dimaklumkan tahap risiko anda untuk menghidap diabetes mellitus jenis 2 pada 5 tahun akan datang. Maklumat yang diperoleh daripada kajian ini boleh digunakan untuk mengetahui faktor-faktor berisiko yang berkaitan dengan T2DM dan menghasilkan intervensi yang lebih baik pada masa akan datang untuk meningkatkan mutu kesihatan bagi responden lain dengan keadaan yang sama.

b) KEPADA PENYELIDIK?

Kajian ini membantu penyelidik untuk mengenalpasti faktor-faktor yang berkaitan dengan risiko T2DM di kalangan wanita yang sudah melahirkan anak di Universiti Putra Malaysia. Penyelidikan ini diperlukan kerana dengan mengenal pasti faktor-faktor yang berkaitan dengan risiko T2DM, kita boleh menghasilkan intervensi yang lebih baik untuk faktor-faktor yang berisiko dan mengurangkan kadar T2DM di Malaysia.

6. ADAKAH IA BERISIKO?

Tiada risiko yang boleh menyebabkan kecederaan akan berlaku dalam penyelidikan ini kerana penyelidikan ini berunsurkan soal selidik. Anda hanya perlu menjawab soalan soal selidik sahaja. Kajian ini tidak dibayar oleh mana-mana badan atau geran. Oleh itu, tiada sebarang bayaran terhadap tuntutan perjalanan atau kos pengangkutan yang akan dibelanjakan dalam menyertai kajian ini.

7. ADAKAH MAKLUMAT DAN IDENTITI SAYA KEKAL RAHSIA?

Segala maklumat anda yang diperolehi dalam penyelidikan ini akan disimpan dan dikendalikan secara sulit, bersesuaian dengan peraturan-peraturan dan/ atau undang-undang yang berkenaan. Sekiranya hasil penyelidikan ini diterbitkan atau dibentangkan kepada orang ramai, identiti anda tidak akan didedahkan tanpa kebenaran anda terlebih dahulu. Segala data yang berkaitan dengan penyelidikan ini akan diarkib, tetapi identiti anda tidak akan didedahkan sama sekali pada bila-bila masa.

8. SIAPA YANG SAYA PERLU HUBUNGI SEKIRANYA SAYA MEMPUNYAI SOALAN TAMBAHAN SEMASA MENGIKUTI PENYELIDIKAN INI?

Anda boleh menghubungi penyelidik bagi penyelidikan ini, Siti Nursyuhada binti Badrudin pada sambungan telefon 011-55018311. Sekiranya anda mempunyai sebarang pertanyaan mengenai penyelidikan ini atau email kepada ctnursyuhadabadrudin@gmail.com jika anda mengesyaki anda mengalami kecederaan yang terhasil daripada penyelidikan ini dan anda mahukan maklumat tentang rawatannya. Anda boleh juga menghubungi pemantau bagi penyelidikan ini, Prof. Madya Dr. Barakatun Nisak binti Mohd Yusof, 03-89472524.

Terima Kasih Atas Kerjasama Anda

Sila tandatangan di sini sekiranya anda telah membaca dan memahami kandungan halaman ini _____

9. PERSETUJUAN

Saya…… No Kad Pengenalan. …… beralamat…… ……..dengan ini bersetuju untuk mengambil bahagian secara sukarela dalam penyelidikan yang tersebut di atas *(kajian klinikal/percubaan ubat-ubatan/rakaman video/kumpulan sasaran/temuduga/ soal selidik).

Saya telah diberi penjelasan secara menyeluruh mengenai penyelidikan ini dari segi metodologi, risiko dan komplikasi (seperti tertulis pada Helaian Penerangan Responden). Saya memahami bahawa saya berhak menarik diri dari penyelidikan ini pada bila-bila masa tanpa memberi sebarang alasan.Saya juga memahami bahawa sebarang maklumat yang berkaitan identiti saya akan dirahsiakan.

Saya* berminat / tidak berminat untuk mengetahui keputusan kajian yang melibatkan saya.

I setuju/tidak bersetuju untuk imei/gambar/rakaman video/ rakaman suara digunakan dalam apa jua bentuk penerbitan atau pembentangan. (sekiranya berkaitan).

*potong yang tidak berkenaan

Tandatangan ……..…… Tandatangan ……..…….
(*Responden*) (*Saksi*)

Tarikh :…….…….. Nama :……..…..

No. K/P: ……...

Saya mengesahkan bahawa saya telah menerangkan kepada responden ini sifat dan tujuan penyelidikan yang tersebut di atas.

Tarikh ……..…… Tandatangan ……..…….
(*Penyelidik*)

APPENDIX C: Information sheet for patient n consent form (English version)

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UNIVERSITI PUTRA MALAYSIA, 43400 UPM SERDANG, SELANGOR, MALAYSIA

FORM 2.4: RESPONDENT'S INFORMATION SHEET AND INFORMED CONSENT FORM

Please read the following information carefully and do not hesitate to discuss any questions you may have with the researcher.

1. STUDY TITLE :

Factors Associated with the Risk of Type 2 Diabetes among Childbearing Women in Universiti Putra Malaysia, Serdang.

2. INTRODUCTION:

Type 2 diabetes mellitus (T2DM) is the most common type of diabetes in Malaysia and its prevalence have been increasing significantly over time. T2DM occurs when the body's cells resist the normal effect of insulin, which lead to increase blood glucose level in the blood. This condition is called insulin resistance and commonly characterized by impaired fasting glucose (IFG) and impaired glucose tolerance (IGT) after a long term disruption in glucose metabolism during preclinical stage. Diabetes ranked ninth as the main cause of death in women, involving 2.1 million of deaths per year. By 2040, the rate of death for women with diabetes was expected to increase to 313 million which is worrisome for world population. Lack of awareness about the factors associated with the risk of T2DM and early detection of T2DM increased the risk of T2DM development among women. Thus, to enhance early detection of diabetes, various T2DM risk scores have been created worldwide. Risk score comprise several risk factors that may associated with T2DM development among population. T2DM risk scores also helps in identifying people who have a higher risk of diabetes development and identifying people with undiagnosed diabetes in cross-sectional setting which can reduce the prevalence of T2DM in future. Therefore, the purpose of this study is to help the investigator to determine the factors associated with the risk of T2DM among childbearing women specific to women in Universiti Putra Malaysia by using diabetes risk score.

3. WHAT WILL YOU HAVE TO DO?

You have to be childbearing women aged 18 to 49 years old without diagnosed with diabetes to participate in the study. If you agree to participate in the study, you will be interview and you also required to answer some questions to complete the questionnaire. You will be interviewed related to your history of medical record and you also required to answer all the questions related to your socio-demographic factors, dietary intake (food frequency), lifestyle factors and diabetes related knowledge in the questionnaire provided. Some measurement such as height and weight will also be measured to obtain the current medical record.

4. WHO SHOULD NOT PARTICIPATE IN THE STUDY?

Women who already being diagnosed with type 1 and type 2 diabetes mellitus and also pregnant mothers.

5. WHAT WILL BE THE BENEFITS OF THE STUDY:

(a) TO YOU AS THE SUBJECT?

You will be informed for your risk on developing type 2 diabetes mellitus over 5 years later. Information obtained from this study can be used to figure out the risk factor associated with T2DM development and develop better interventions in the future to improve health for other respondents with the same conditions.

(b) TO THE INVESTIGATOR?

The purpose of this study is to determine the factors associated with the risk of T2DM among childbearing women in Universiti Putra Malaysia. This research is necessary because by identifying the factors associated with the risk of T2DM, we can develop better interventions for the risk factors and reduce the prevalence of T2DM in Malaysia.

6. WHAT ARE THE POSSIBLE RISKS?

There is no risk of being injured in this study. This is a questionnaire-based study. You are only required to answer the questionnaire. This study is not funded by any bodies or grants. Therefore, unfortunately, it will not be possible to reimburse any travel or other expenses incurred in taking part in the study.

7. WILL THE INFORMATION THAT YOU PROVIDE AND YOUR IDENTITY REMAIN CONFIDENTIAL?

All your information obtained in this study will be kept and handled in a confidential manner, in accordance with applicable laws and/or regulations. When publishing or presenting the study results, your identity will not be revealed without your expressed consent. Data from the study will be archieved but your identity will not be revealed at any time.

8. WHO SHOULD YOU CONTACT IF YOU HAVE ADDITIONAL QUESTIONS DURING THE COURSE OF THE RESEARCH?

If you have any questions about the study or if you think you have a study related injury and you want information about treatment, please contact the study researcher, Siti Nursyuhada binti Badrudin at telephone number 011-55018311 or email at ctnursyuhadabadrudin@gmail.com. You may also contact the supervisor of this study, Prof. Madya Dr. Barakatun Nisak binti Mohd Yusof, 03-89472524.

Thank You for Your Cooperation

*Please initial here if you have read and understood the contents of this page*_____

9. CONSENT

I …… Identity Card No. …… address……..
…….hereby voluntarily agree to take part in the research stated above *(clinical /drug trial/video recording/ focus group/interview-based/ questionnaire-based).

I have been informed about the nature of the research in terms of methodology, possible adverse effects and complications (as written in the Respondent's Information Sheet). I understand that I have the right to withdraw from this research at any time without giving any reason whatsoever. I also understand that this study is confidential and all information provided with regard to my identity will remain private and confidential.

I* wish / do not wish to know the results related to my participation in the research

I agree/do not agree that the images/photos/video recordings/voice recordings related to me be used in any form of publication or presentation (if applicable)

* delete where necessary

Signature ……..…… Signature ……..…….
(Respondent) (Witness)

Date :…….. Name :……..…...

I/C No. :……..…...

I confirm that I have explained to the respondent the nature and purpose of the above-mentioned research.

Date ……..…… Signature ……..…….
(Researcher)

APPENDIX D (QUESTIONNAIRE)

Nombor Rujukan/ *Reference Number*:

FAKULTI PERUBATAN DAN SAINS KESIHATAN

JABATAN PEMAKANAN DAN DIETETIK

BORANG SOAL SELIDIK

QUESTIONNAIRE

Tajuk Kajian/*Research Question*:

FAKTOR- FAKTOR BERKAITAN DENGAN RISIKO DIABETES MELLITUS JENIS 2 DALAM KALANGAN WANITA YANG SUDAH MELAHIRKAN ANAK DI UNIVERSITI PUTRA MALAYSIA, SERDANG

FACTORS ASSOCIATED WITH THE RISK OF TYPE 2 DIABETES AMONG CHILDBEARING WOMEN IN UNIVERSITI PUTRA MALAYSIA, SERDANG

Penyelidik/ *Researcher* : Siti Nursyuhada binti Badrudin

No. Matrik/ *Matric no.* : 192575

Program/ *Program* : B. Sc. (Dietetics)

Penyelia/ *Supervisor* : Assoc Prof. Dr. Barakatun Nisak Mohd Yusof

Tarikh/ *Date* :

Borang soal selidik ini hanya untuk kegunaan akademik. Semua informasi yang dikumpul akan dijamin sulit. Penyertaan dan kerjasama anda amat dihargai. *This questionnaire is only for academic purposes. All information gathered is guaranteed confidential. Your participation and cooperation are highly appreciated.*

BAHAGIAN A / *SECTION A*

Sila isi maklumat pada tempat kosong atau tanda (/) pada pilihan yang paling sesuai dengan anda.

Please fill in the blank or tick (/) the answers that best applies to you.

No	Information	
1.	Tarikh lahir *Date of birth*	☐☐☐☐☐☐☐☐☐☐ Hari/ *Day* Bulan/ *month* Tahun/ *Year*
2.	Umur *Age*	☐☐ Tahun/ years old
3.	Kaum *Ethnicity*	❑ Melayu/ *Malay* ❑ Cina/ *Chinese* ❑ India/ *Indian* ❑ Lain-lain/ *Others* ❑ Sila nyatakan/ *Please specify*: …….
4.	Pendapatan bulanan isi rumah *Monthly household income*	Sila nyatakan / Please state: RM _____

5.	Tahap Pendidikan *Educational level*	❑ Tidak bersekolah/ *No education* ❑ Sekolah rendah/ *Primay level* ❑ Sekolah menengah/ *Secondary level* ❑ Pra-universiti/ *Pre-university* ❑ Universiti/*University*
6.	Sejarah keluarga *Family History*	❑ Kencing manis / *diabetes mellitus* ❑ Kencing Manis Ketika Mengandung / *History of Gestational Diabetes Mellitus (GDM)* ❑ Tiada sejarah diabetes / No history of diabetes
7.	Adakah anda merokok atau menggunakan produk yang mengandungi tembakau setiap hari? *Do you currently smoke cigarettes or any other tobacco products on a daily basis?*	❑ Tidak / *No* ❑ Ya / *Yes*

BAHAGIAN B / *SECTION B*:

Bahagian ini akan **DIISI OLEH PENYELIDIK** dengan merujuk kepada hasil ukuran dan sejarah rekod perubatan anda.

*This section is **TO BE FILLED BY RESEARCHER** by referring to your measurement result and history of medical record.*

No.	Maklumat Nutrisi / Nutritional Information		Catatan / Remarks
1	Antropometri data terkini / Current *anthropometry data*	Berat / *Weight*	kg
		Tinggi / *Height*	m
		Body Mass Index / BMI	kg/m^2
		Ukur Lilit Pinggang / *Waist Circumference*	cm
1a	Berat pra-kandungan / P*re-pregnancy weight*	Berat / *Weight*	kg
		Tinggi / *Height*	m
		Body Mass Index / BMI	kg/m^2
1b	Berat pada bulan terakhir kandungan / *Last weight during pregnancy*	Berat/ *Weight*	kg
1c	Berat selepas bersalin selepas enam bulan/ *Post-partum weight after 6 months*	Berat / *Weight*	kg
2	Sejarah Responden / *Client History*	Berat / *Weight*	kg
		Bil. Anak/ *No. of Children*	
		Cara Bersalin /	

		Delivery method	
		Tempoh anak terakhir menerima susu ibu/ *Breastfeeding duration for the most recent children*	months
		Bacaan OGTT/ *OGTT Reading*	
		Kencing Manis Ketika Mengandung / *History of Gestational Diabetes Mellitus (GDM)*	☐ Ya / *Yes* ☐ Tidak / *No*
2a	Jika ya / *If Yes*	Berat pada setiap trimester/ *Weight every trimester*	First : kg Second: kg Third: kg
		Tahun diagnosis / *Year of diagnosis*	
		Bil. Diagnosis / *No. of times of diagnosis*	
		Rawatan / *Treatment*	
		Bacaan OGTT 6 minggu selepas bersalin/ *OGTT reading 6 weeks after post-partum*	

BAHAGIAN C / *SECTION C*:

Sila tandakan (✓) pada tempat kosong ❑ berpandukan keputusan anda di **BAHAGIAN B**

Please tick (✓) to the blank ❑ *according to your result in SECTION B.*

No.	**Maklumat Responden / *Respondent Informations***	**Remarks**	**Points**
1	Kumpulan umur anda / *Your age group*	❑ Bawah 45 tahun / *Under 35 years* ❑ 45 – 54 tahun / *years* ❑ 55 – 64 tahun / *years* ❑ 64 tahun dan keatas *64 years or over*	0 points 2 points 3 points 4 points
2	Jisim Index Tubuh / *Body-mass index- BMI)*	❑ < 25 kg/m^2 ❑ 25-30 kg/m^2 ❑ > 30 kg/m^2	0 points 1 points 3 points
3	Pengukuran pinggang di bawah rusuk *Your waist measurement taken below the ribs (usually at the level of the navel, and while standing)*	❑ Kurang daripada 80 cm / *Less than 80 cm* ❑ 80-88 cm ❑ Lebih daripada 88 cm / *More than 88 cm*	0 points 3 points 4 points
4	Adakah anda selalu dalam setiap hari akan melakukan sekurang-kurangnya 30 minit fizikal aktiviti di tempat kerja/ atau ketika masa lapang? *Do you usually have daily at least 30 minutes of physical activity at work and/or during leisure time (including normal daily activity)?*	❑ Ya / *Yes* ❑ Tidak / *No*	0 points 2 points

5	Berapa kerap anda makan sayur dan buah? *How often do you eat vegetables or fruit?*	❑ Setiap hari / *Every day* ❑ Bukan setiap hari / *Not every day*	0 points 1 points
6	Adakah anda pernah mengambil ubat untuk tekanan darah tinggi dalam kebiasaan hari anda*?* *Have you ever taken medication for high blood pressure on regular basis?*	❑ Tidak / *No* ❑ Ya / *Yes*	0 points 2 points
7	Adakah anda pernah mengalami paras gula dalam darah yang tinggi ketika pemeriksaan kesihatan, ketika sakit atau ketika mengandung? *Have you ever been found to have high blood glucose (sugar) (for example, in a health examination, during an illness, during pregnancy)?*	❑ Tidak / *No* ❑ Ya / *Yes*	0 points 5 points
8	Adakah salah seorang daripada ibubapa anda atau adik-beradik anda sudah didiagnosis dengan kencing manis (Jenis 1 atau Jenis 2)? *Have either of your parents, or any of your brothers or sisters been diagnosed with diabetes (type 1 or type 2)?*	❑ Tidak / *No* ❑ Ya: datuk, nenek, bapa saudara, ibu saudara, sepupu/ *Yes: Grandparent, aunt, uncle, or first cousin* ❑ Ya: Ibu bapa, abang, kakak, anak kandung anda/ *Yes: parent, brother, sister or own child*	0 points 3 points 5 points

Jumlah poin / *Total points*	

Risiko anda untuk menghidap diabetes mellitus jenis 2 dalam tempoh 10 tahun / *Your risk of developing type 2 diabetes within 10 years*	**< 7 : Risiko rendah / Low risk** Approximately one person in every 100 will develop diabetes
	7-11: Risiko sedikit sederhana / *Slightly elevated risk* Approximately one person in every 25 will develop diabetes
	12-14: Risiko sederhana / *Moderate risk* Approximately one person in every 6 will develop diabetes
	15-20: Risiko tinggi / *High risk* Approximately one person in every 3 will develop diabetes
	> 20: Risiko sangat tinggi / *Very high risk* Approximately one person in every 2 will develop diabetes

BAHAGIAN D/ *SECTION D*:

Arahan:

1. Dalam bahagian ini, responden akan ditanya soalan terbuka samada pernah atau tidak makan makanan makanan yang telah disenaraikan. Tulis angka dalam kolum bilangan kali diambil samada dalam **Per Hari** atau **Per Minggu** atau **Per Bulan**. (Pastikan hanya satu kolum sahaja yang diisi), Jika makanan yang tersenarai tidak diambil, isikan "0" pada kolum **Per Bulan.**
2. Berapa banyak sajian setiap kali makan merujuk kepada bilangan hidangan yang diambil setiap kali dimakan. Contohnya, jika responden makan buah betik, tanyakan berapa potong buah betik biasanya dimakan setiap kali. Jika responden menjawab makan dua potong buah betik, isikan "2" dalam ruangan jawapan. Ini kerana satu sajian ialah satu potong buah betik.
3. Setiap jenis makanan telah diberikan ukuran hidangan tertentu berdasarkan "Album Saiz Sajian Makanan Malaysia" dan juga senarai berat makanan dalam ukuran isirumah. Ukuran hidangan ini adalah berdasarkan "saiz serdehana".

Instruction:

1. *In this section, respondents will be asked questions on whether they have eaten or not the type of foods listed. Write down numbers in the column how many times were consumed whether* ***Daily, Weekly*** *or* ***Monthly****.*
2. *How many times each serving were taken refers to how many of those foods were eaten by the respondents for each time. For example, if respondents eat papaya, ask them how many slices of papaya were taken each time. If the respondents answered two slices, fill in "2" in the answer space. This is because each serving equals to one slice of papaya.*
3. *Each type of food has been given their appropriate meal measurement according to "Malaysian Food Serving Size Album" and also a list of weight of these food in household measurement. These meal measurements were based on regular size.*

Bil	Jenis Makanan *Type of food*	Berapa kali kekerapan pengambilan dalam (Isikan dalam salah satu kolum sahaja) *How frequent each food was taken (Fill in one of the columns only)*			Rujukan saiz hidangan/ *Reference of meal size*	Jumlah Sajian (setiap kali makan)/ *Total servings (each time eaten*
		a. Sehari/ *Daily*	b.Seminggu/ *Weekly*	c. Sebulan/ *Monthly*		
Bijirin dan hasil bijirin/ *Cereal and cereal product*						
1.	Nasi putih/ *White rice*				Cawan/ *cup*	
2.	Nasi beras perang/ *Brown rice*				Cawan/ *cup*	
3.	Nasi berperisa (Nasi biriyani, nasi goreng)/ *Flavoured rice*				Cawan/ *cup*	
4.	Bubur nasi/ *Rice porridge*				Cawan/ *cup*	
5.	Pulut/ *Glutinous rice*				Cawan/ *cup*	
6.	Mee kuning/ Mee siput/ Mee segera *Noodles*				Cawan/ *cup*	
7.	Mihun/ Kueh teow/ laksa/ laksam/ *loh shi fun*				Cawan/ *cup*	
8.	Pasta				Cawan/ *cup*	
9.	Sagu/ ambuyat/ linut				Cawan/ *cup*	
10	Roti/ *Bread*				Keping/*slice*	
11	Roti bijirin penuh/ *Wholemeal bread*				Keping/*slice*	
12	Roti bun/ *Bread bun*				Biji/ *pieces*	

13	Roti canai (termasuk roti telur, roti sardine, roti baeang , roti pisang, murtabak)				Keping/*slice*	

Bil	Jenis Makanan *Type of food*	Berapa kali kekerapan pengambilan dalam (Isikan dalam salah satu kolum sahaja) *How frequent each food was taken (Fill in one of the columns only)*			Rujukan saiz hidangan/ *Reference of meal size*	Jumlah Sajian (setiap kali makan)/ *Total servings (each time eaten*
		a.Sehari/ *Daily*	b.Seminggu/ *Weekly*	c.Sebulan/ *Monthly*		
Bijirin dan hasil bijirin/ *Cereal and cereal product*						
14	Capati				Keping/*slice*	
15	Tosai				Keping/*slice*	
16	Bijirin sarapan pagi (Cornflake, koko crunch, honeystar)/ *Breakfast cereal*				Cawan/ *cup*	
17	Bijirin tersedia perlu dibancuh (Nestum, quaker oats)/ *Cereal grains prepared with water*				Cawan/ *cup*	
18	Jagung/ *Corn*				Tongkol	
Makanan segera/ *Fast Food*						
1.	Burger				Biji/ *piece*	
2.	Ayam goreng				Ketul/ *pieces*	
3.	Pizza				Keping/*slice*	
4.	Kentang goreng/ *French fries*				Hidang medium/ *medium size*	
5.	Kentang Lenyek/ *Mashed potatoes*				Bekas kecil/ *small container*	
6.	Coleslaw				Bekas kecil/ *small container*	
7.	Sosej/Hotdog/ Frankfurter				Keping/*slice*	
8.	Nugget				Ketul/ *piece*	

Bil	Jenis Makanan *Type of food* ***Bagi peserta bukan islam**	Berapa kali kekerapan pengambilan dalam (Isikan dalam salah satu kolum sahaja) *How frequent each food was taken (Fill in one of the columns only)*			Rujukan saiz hidangan/ *Reference of meal size*	Jumlah Sajian (setiap kali makan)/ *Total servings (each time eaten*
		a.Sehari/ *Daily*	b.Seminggu/ *Weekly*	c.Sebulan/ *Monthly*		
Daging dan hasil daging/ *Meat and meat products*						
1.	Ayam/ *Chicken*				Ketul/ *piece*	
2.	Burung puyuh/ *Quail*				Ekor/ *whole*	
3.	Itil/ *Duck*				Ketul/ *piece*	
4.	Lembu/Kerbau *Meat*				Kotak mancis/ *matchbox size*	
5.	Kambing/ *Mutton*				Kotak mancis/ *matchbox size*	
6.	Organ Dalaman (hati, limpa, paru) *Internal organs (liver, spleen, lungs)*				Kotak mancis/ *matchbox size*	
7.	Bebola ayam/ daging *Chicken/meat ball*				Ketul/ *piece*	
8.	*Ham				Keping/*slice*	
9.	*Bacon				Keping/*slice*	
10.	*Luncheon meat				Keping/*slice*	
11.	*Babi				Kotak mancis/ *matchbox size*	
Ikan dan makanan laut/ *Fish and seafoods*						
1.	Ikan laut/ *Marine*				Ekor/ *whole*	

	fish					
2.	Ikan air tawar/ *freshwater fish*				Ekor/ *whole*	
3.	Udang basah/*Prawn*				Ekor/ *whole*	

Bil	Jenis Makanan *Type of food*	Berapa kali kekerapan pengambilan dalam (Isikan dalam salah satu kolum sahaja) *How frequent each food was taken (Fill in one of the columns only)*			Rujukan saiz hidangan/ *Reference of meal size*	Jumlah Sajian (setiap kali makan)/ *Total servings (each time eaten*
		a.Sehari/ *Daily*	b.Seminggu/ *Weekly*	c.Sebulan/ *Monthly*		
Ikan dan makanan laut/ *Fish and seafoods*						
4.	Sotong basah/ *Squid*				Ekor/ *whole*	
5.	Ikan dalam tin/ *Canned fish*				Ekor/ *whole*	
6.	Ketam/ *Crab*				Ekor/ *whole*	
7.	Ikan bilis/ *Anchovy*				Sudu makan/ *tbsp*	
8.	Kekerang (kerrang, lala, remis, kupang, mentarang)/ *Shellfish*				Sudu makan/ *tbsp*	
9.	Siput sedut (Belitung, siput buluh)/ *Snail*				Sudu makan/ *tbsp*	
10.	Ikan jeruk/ perkasam/ *Pickled fish*				Keping/*slice*	
11.	Sotong kering/ *Dried squid*				Keping/*slice*	
12	Keropok ikan/ udang/ sotong/ ketam *Fish/ prawn/ squid/ crab crackers*				Keping/*slice*	
13	Keropok lekor				Keping/*slice*	

14	Bebola/ kek ikan/ sotong/ udang/ ketam *Fish/ prawn/ squid/ crab ball/ cake*				Ketul/ *piece*	
15	Ikan kering/ *Dried fish*				Ekor/ *whole*	

Bil	Jenis Makanan *Type of food*	Berapa kali kekerapan pengambilan dalam (Isikan dalam salah satu kolum sahaja) *How frequent each food was taken (Fill in one of the columns only)*			Rujukan saiz hidangan/ *Reference of meal size*	Jumlah Sajian (setiap kali makan)/ *Total servings (each time eaten*
		a.Sehari/ *Daily*	b.Seminggu/ *Weekly*	c.Sebulan / *Monthly*		
Telur/ *Eggs*						
1.	Telur ayam (mata kerbau, teur dadar, telur rebus, telur masak sambal, telur pindang/ *Hen eggs (bulks egg, omelette, boiled, with chillies or herbs)*				Biji/ *piece*	
2.	Telur itik (masak lemak/gulai, telur dadar)/ *Duck eggs (cooked with coconut milk gravy, omelette)*				Biji/ *piece*	
3.	Telur puyuh (rebus, masak sambal)/ *Quail eggs (boiled, with chillies)*				Biji/ *piece*	
4.	Telur masin/ *Salted egg*				Biji/ *piece*	
Kekacang dan hasilnya/ *Legumes and legumes product*						
1.	Kekacang (kacang				Sudu makan/	

	hijau, kacang parang, kacang kuda, kacang merah) *Legumes*				*tbsp*	
2.	Kacang tanah/ *Groundnuts*				Sudu makan/ *tbsp*	
3.	Taufufa				Sudu makan/ *tbsp*	
4.	Tauhu				Keping/*slice*	
5	Tempe/ *Fermented soy beans*				Keping/*slice*	
Bil	Jenis Makanan *Type of food*	Berapa kali kekerapan pengambilan dalam (Isikan dalam salah satu kolum sahaja) *How frequent each food was taken (Fill in one of the columns only)*			Rujukan saiz hidangan/ *Reference of meal size*	Jumlah Sajian (setiap kali makan)/ *Total servings (each time eaten*
		a.Sehari/ *Daily*	b.Seminggu/ *Weekly*	c.Sebulan / *Monthly*		
Susu dan hasil tenusu/ Milk and milk products						
1.	Susu segar (tidak diproses)/ *Fresh milk*				Cawan/ *cup*	
2.	Susu komersial/ *Comercial milk*				Cawan/ *cup*	
3.	Yogurt/ lassi/ tairu				Cawan/ *cup*	
4.	Susu tepung/ *Powered milk*				Sudu makan/ *tbsp*	
5	Susu sejat/ cair/ *Evaporated milk*				Sudu makan/ *tbsp*	
6	Keju/ *Cheese*				Keping/*slice*	
Sayur-sayuran/ *Vegetables*						
1.	Sayuran berdaun hijau (bayam, kangkong, kalian) *Leaf green vegetables*				Sudu makan/ *tbsp*	

2.	Bendi/ *Ladies finger*				Sudu makan/ *tbsp*	
3.	Sayuran kekacang lain (kacang Panjang, kacang buncis, kacang botol)/ *Other type of legumes*				Sudu makan/ *tbsp*	
4.	Taugeh/ *Bean sprout*				Sudu makan/ *tbsp*	
5.	Sayuran berubi (kentang, keladi, keledek)/ *Tubers (potatoes, sweet potatoes, yam)*				Sudu makan/ *tbsp*	

Bil	Jenis Makanan *Type of food*	Berapa kali kekerapan pengambilan dalam (Isikan dalam salah satu kolum sahaja) *How frequent each food was taken (Fill in one of the columns only)*			Rujukan saiz hidangan/ *Reference of meal size*	Jumlah Sajian (setiap kali makan)/ *Total servings (each time eaten*
		a.Sehari/ *Daily*	b.Seminggu/ *Weekly*	c.Sebulan/ *Monthly*		
Sayur-sayuran/ *Vegetables*						
6.	Sayuran kobis (kobis bulat, brokoli, kobis cina, bunga kobis) *Cabbages*				Sudu makan/ *tbsp*	
7.	Cili/ *Chillies*				Sudu makan/ *tbsp*	
8.	Tomato/ *Tomatoes*				Sudu makan/ *tbsp*	
9.	Terung/ *Brinjal*				Sudu makan/ *tbsp*	
10	Sayuran berbuah lain (petola/labu/timun				Sudu makan/ *tbsp*	

	/putik jagong)/ *Fruit vegetables (Luffa/pumpkin/ cucumber/ baby corn)*					
11	Sayuran asin/ kering (pucuk soo hon)/ *Salted or dried vegetables*				Sudu makan/ *tbsp*	
12	Ulam-ulaman/ *Local fresh salad*				Sudu makan/ *tbsp*	
13	Cendawan basah/ *Mushroom*				Sudu makan/ *tbsp*	
14	Cendawan kering/ *Dried mushrooms*				Sudu makan/ *tbsp*	

Bil	Jenis Makanan *Type of food*	Berapa kali kekerapan pengambilan dalam (Isikan dalam salah satu kolum sahaja) *How frequent each food was taken (Fill in one of the columns only)*			Rujukan saiz hidangan/ *Reference of meal size*	Jumlah Sajian (setiap kali makan)/ *Total servings (each time eaten*
		a.Sehari/ *Daily*	b.Seminggu/ *Weekly*	c.Sebulan/ *Monthly*		
Buah-buahan/ *Fruits*						
1.	Betik/ *Papaya*				Biji/ *piece*	
2.	Mangga/ *Mango*				Biji/ *piece*	
3.	Nenas/ *Pineapple*				Biji/ *piece*	
4.	Tembikai/ *Watermelon*				Biji/ *piece*	
5.	Buah naga/ *Dragon fruit*				Biji/ *piece*	
6.	Tembikai susu/ *Honey dew*				Biji/ *piece*	
7.	Rock melon				Biji/ *piece*	
8.	Jambu batu/ *Guava*				Biji/ *piece*	

9.	Jambu air/ *Water apple*				Biji/ *piece*	
10.	Limau/ *Lime*				Biji/ *piece*	
11.	Pisang (pisang segar, pisang goreng, pengat pisang, pisang salai) *Banana*				Biji/ *piece*	
12.	Belimbing/ *Starfruit*				Biji/ *piece*	
13.	Epal/ *Apple*				Biji/ *piece*	
14.	Oren/ Mandarin/ *Orange*				Biji/ *piece*	
15.	Pir/ Lai/ *Pear*				Biji/ *piece*	
16.	Anggur/ *Grape*				Biji/ *piece*	
17.	Rambutan				Biji/ *piece*	
18.	Mata kucing segar/ *Longan*				Biji/ *piece*	
19.	Laici segar/ *Lychee*				Biji/ *piece*	
20.	Manggis/ *Mangosteen*				Biji/ *piece*	
21.	Durian				Ulas/ *piece*	

Bil	Jenis Makanan *Type of food*	Berapa kali kekerapan pengambilan dalam (Isikan dalam salah satu kolum sahaja) *How frequent each food was taken (Fill in one of the columns only)*			Rujukan saiz hidangan/ *Reference of meal size*	Jumlah Sajian (setiap kali makan)/ *Total servings (each time eaten*
		a.Sehari/ *Daily*	b.Seminggu/ *Weekly*	c.Sebulan/ *Monthly*		
Buah-buahan/ *Fruits*						
22.	Nangka/ cempedak/ *Jackfruit*				Ulas/ *piece*	
23.	Buahan dalam tin (laici, longan)/ *Canned fruits*				Sudu makan/ *tbsp*	
24.	Buahan kering (kurma, prun, kismis)/ *Dried fruit*				Sudu makan/ *tbsp*	
25.	Buahan jeruk/acar *Pickled fruits*				Sudu makan/ *tbsp*	
26.	Kelapa muda/ *Young coconut*				Sudu makan/ *tbsp*	
Minuman/ Drinks						
1.	Air kosong/ *Plain water*				Cawan/ *cup*	
2.	Teh/ *Tea*				Cawan/ *cup*	
3.	Kopi/ *Coffee*				Cawan/ *cup*	
4.	Minuman bercoklat (van houten, Cadbury)/ *Chocolate drink*				Cawan/ *cup*	
5.	Minuman bermalt (Milo, Horlick)/ *Malted drink*				Cawan/ *cup*	
6.	Minuman pra campuran 2 in 1/ 3in 1 (kecuali botani/ herba) *Pre-mixed drinks*				Cawan/ *cup*	
7.	Minuman Ready-to-drink sprt air tin/ air				Cawan/ *cup*	

	kotak (kecuali botani/ herba)					

Bil	Jenis Makanan *Type of food*	Berapa kali kekerapan pengambilan dalam (Isikan dalam salah satu kolum sahaja) *How frequent each food was taken (Fill in one of the columns only)*			Rujukan saiz hidangan/ *Reference of meal size*	Jumlah Sajian (setiap kali makan)/ *Total servings (each time eaten*
		a.Sehari/ *Daily*	b.Seminggu/ *Weekly*	c.Sebulan/ *Monthly*		
Minuman/ Drinks						
8.	Sirap cordial/ *Cordial syrup*				Cawan/ *cup*	
9.	Jus buah-buahan/ *Fruit juice*				Cawan/ *cup*	
10.	Minuman bergas (termasuk isotonic) *Carbonated drinks (includes isotonic)*				Cawan/ *cup*	
11.	Air kacang soya/ *Soy milk*				Cawan/ *cup*	
12.	Minuman botani/ herb 2in1/ 3in1 (pra campuran)/ *Herbal/ botanical drinks (pre-mixed)*				Cawan/ *cup*	
13.	Minuman botani/ herb 2in1/ 3in1 (ready-to-drink)/ *Herbal/ botanical drinks (ready-to-drink)*				Cawan/ *cup*	
14.	Minuman air rebusan botani/ herba/ *Herbal/ botanical brewed drinks*				Cawan/ *cup*	
15.	Minuman bertenaga (red bull, livita)/ *Energy drinks*				Cawan/ *cup*	
16.	Minuman yogurt/				Cawan/ *cup*	

	Yoghurt drinks					
Minuman beralkohol/ *Alcoholic drinks* *Bagi peserta bukan Islam						
1.	Syandi				Gelas / *glass*	
2.	Bir/lager/ale/stout				Gelas / *glass*	
3.	Todi (tuak kelapa/ bahar)				Gelas / *glass*	
Bil	Jenis Makanan *Type of food*	Berapa kali kekerapan pengambilan dalam (Isikan dalam salah satu kolum sahaja) *How frequent each food was taken (Fill in one of the columns only)*			Rujukan saiz hidangan/ *Reference of meal size*	Jumlah Sajian (setiap kali makan)/ *Total servings (each time eaten*
		a.Sehari/ *Daily*	b.Seminggu/ *Weekly*	c.Sebulan/ *Monthly*		
Minuman beralkohol/ *Alcoholic drinks* *Bagi peserta bukan Islam						
4.	Wain/ cider/ champagne/ peri				Gelas / *glass*	
5.	Wain beras/ tuak beras/ lihing				Gelas / *glass*	
6.	Brandi/ rum/ wiski/ vodka/ gin/ samsu/ samcheng/ montoku/ langkau				Gelas / *glass*	
Konfeksi/ Confectionaries						
1.	Kuih-muih/ *Local kuih*				Ketul/ *piece*	
2.	Gula-gula/ *Sweets*				Ketul/ *piece*	
3.	Coklat bar/ *Chocolate bar*				Bar kecil 40g/ *small size 40g*	
4.	Kek/ *Cake*				Potong/*slice*	
5.	Agar-agar/ kastard/ *Jelly/ custard*				Potong/*slice*	
6.	Aiskrim (tanpa susu)/ *Lolly ice*				Potong/*slice*	
7.	Aiskrim (susu)/				Potong/*slice*	

	Ice cream					
8.	ABC (Air batu campur)/ ais/ *Ice-blended*				Cawan/ *cup*	
9.	Biskut tawar/ krim kraker/ *Cream crackers*				Keping/ *pieces*	
10.	Biskut berperisa/ berkrim/ berinti/ *Flavoured/ cream/filled cookies*				Keping/ *pieces*	
Bil	Jenis Makanan *Type of food*	Berapa kali kekerapan pengambilan dalam (Isikan dalam salah satu kolum sahaja) *How frequent each food was taken (Fill in one of the columns only)*			Rujukan saiz hidangan/ *Reference of meal size*	Jumlah Sajian (setiap kali makan)/ *Total servings (each time eaten*
		a.Sehari/ *Daily*	b.Seminggu/ *Weekly*	c.Sebulan/ *Monthly*		
Konfeksi/ Confectionaries						
11.	Pastri (pai, croissant)/ *Pastry (pie, croissant)*				Keping/ *pieces*	
12.	Snek/ kerepek/ *Snack/ cracker*				Keping/ *pieces*	
Sapuan roti/ *Bread spread*						
1.	Jem/ *Jam*				Sudu teh/*tsp*	
2.	Seri kaya/ *coconut jam*				Sudu teh/*tsp*	
3.	Mentega/ *Butter*				Sudu teh/*tsp*	
4.	Marjerin/ *Margerine*				Sudu teh/*tsp*	
5.	Mentega kacang/ *Peanut butter*				Sudu teh/*tsp*	
6.	Krim keju/ *Cream cheese*				Sudu teh/*tsp*	
7.	Sapuan coklat/				Sudu teh/*tsp*	

	Chocolate spread					
8.	Sapuan bawang putih/ *Garlic spread*				Sudu teh/*tsp*	
Perencah/ Perasa/ *Flavours*						
1.	Gula (putih, perang, melaka)/ *Sugar (white, brown, melaka)*				Sudu teh/*tsp*	
2.	Madu/ *Honey*				Sudu teh/*tsp*	
3.	Susu pekat manis (susu isian pekat manis/ krimmer pekat manis)/ *Condensed milk (creamer)*				Sudu makan/ *tbsp*	
Bil	Jenis Makanan *Type of food*	Berapa kali kekerapan pengambilan dalam (Isikan dalam salah satu kolum sahaja) *How frequent each food was taken (Fill in one of the columns only)*			Rujukan saiz hidangan/ *Reference of meal size*	Jumlah Sajian (setiap kali makan)/ *Total servings (each time eaten*
		a.Sehari/ *Daily*	b.Seminggu/ *Weekly*	c.Sebulan/ *Monthly*		
Perencah/ Perasa/ *Flavours*						
4.	Sambal (lada, belacan, tempoyak, bambangan)/ *Condiment*				Sudu teh/*tsp*	
5.	Jeruk (bawang, tauhu)/ *Pickles*				Sudu teh/*tsp*	
6.	Belacan/ *Shrimp paste*				Sudu teh/*tsp*	
7.	Budu				Sudu teh/*tsp*	
8.	Cencalok				Sudu teh/*tsp*	
9.	Kicap/ *Soy sauce*				Sudu teh/*tsp*	
10.	Sos cili/ *Chilli sauce*				Sudu teh/*tsp*	
11.	Sos tomato/				Sudu teh/*tsp*	

	Tomato ketchup					
12.	Sos tiram/ *Oyster suace*				Sudu teh/*tsp*	
13.	Sos ikan/ *fish sauce*				Sudu teh/*tsp*	
14.	Petis/heko/otak udang				Sudu teh/*tsp*	
15.	Cili kering/ *Chilli flakes*				Sudu teh/*tsp*	
16.	Salad dressing				Sudu teh/*tsp*	

BAHAGIAN E (Kaji selidik : Pengetahuan tentang Diabetes)

SECTION E: (Diabetes Knowledge Questionnaire)

Sila tanda (✓) pada pilihan yang paling sesuai dengan anda.

Please tick (✓) the answers that best applies to you.

Item	**Soalan / *Question***	**Ya/** *Yes*	**Tidak /** *No*	**Saya tidak tahu /** I don't know
1	Makan terlalu banyak gula dan makanan yang manis adalah penyebab kepada diabetes *Eating too much sugar and other sweet foods is a cause of diabetes.*			
2	Penyebab kepada berlakunya diabetes adalah kerana fungsi insulin yang kurang efektif/berkesan. *The usual cause of diabetes is lack of effective insulin in the body.*			
3	Diabetes berlaku kerana buah pinggang gagal untuk menahan gula daripada keluar melalui air kencing. *Diabetes is caused by failure of the kidneys to keep sugar out of the urine.*			
4	Buah pinggang menghasilkan insulin. *Kidneys produce insulin.*			
5	Diabetes yang tidak dirawat menyebabkan jumlah gula dalam darah meningkat. *In untreated diabetes, the amount of sugar in the blood usually increases.*			
6	Jika saya menghidap diabetes, risiko untuk anak saya menghidap diabetes juga akan meningkat			

	If I am diabetic, my children have a higher chance of being diabetic.			
7	Diabetes boleh disembuhkan *Diabetes can be cured*			
8	Kadar gula darah puasa sebanyak 210 adalah terlalu tinggi. *A fasting blood sugar level of 210 is too high.*			
9	Kaedah yang berkesan untuk mengesan diabetes adalah dengan mengkaji air kencing saya. *The best way to check my diabetes is by testing my urine.*			
10	Sentiasa bersenam akan meningkatkan keperluan menggunakan insulin atau rawatan diabetes yang lain. *Regular exercise will increase the need for insulin or other diabetic medication.*			
11	Diabetes terbahagi kepada dua : Jenis 1 (Diabetes bersandar insulin) dan Jenis 2 (penghasilan insulin yang berkurangan/ Diabetes tidak bersandar insulin) *There are two main types of diabetes: Type 1 (insulin dependent) and Type 2 (non-insulin-dependent).*			
12	Tindak balas insulin berlaku kerana terlalu banyak makanan. *An insulin reaction is caused by too much food.*			
13	Ubat-ubatan lebih penting daripada diet dan senaman mampu mengawal diabetes saya. *Medication is more important than diet and exercise to control my diabetes.*			
14	Diabetes menyebabkan peredaran yang tidak lancer. *Diabetes often causes poor circulation.*			

15	Luka dan melecet akan lambat sembuh kepada penghidap diabetes. *Cuts and abrasions on diabetes heal more slowly.*			
16	Diabetes perlu lebih berhati-hati ketika memotong kuku kaki. *Diabetes should take extra care when cutting their toenails.*			
17	Penghidap diabetes perlu mencuci luka dengan menggunakan iodin dan alcohol. *A person with diabetes should cleanse a cut with iodine and alcohol*			
18	Cara saya menyediakan makanan adalah penting seperti mana makanan yang saya makan. *The way I prepare my food is as important as the foods I eat.*			
19	Diabetes boleh merosakkan ginjal saya. *Diabetes can damage my kidneys.*			
20	Diabetes menyebabkan kehilangan rasa di tangan, jari dan kaki. *Diabetes can cause loss of feeling in my hands, fingers, and feet.*			
21	Berketar dan berpeluh merupakan tanda tinggi gula dalam darah. *Shaking and sweating are sign of high blood sugar.*			
22	Kerap membuang air kecil dan dahaga merupakan tanda kurang gula dalam darah. *Frequent urination and thirst are signs of low blood sugar.*			
23	Stokin yang ketat tidak membawa keburukan kepada penghidap diabetes.			

	Tight elastic hose or socks are not bad for diabetics.			
24	Kebanyakan diet kepada penghidap diabetes terdiri daripada makanan yang spesial. *A diabetic diet consist mostly of special foods*			

Source: Diabetes Knowledge Questionnaire 24, adapted from the Starr County Diabetes Education Study. Retrieved from http://diabetesnpo.im.wustl.edu/resources/tools/documents/8-GATE-KNOWLEDGEQUESTIONAIREF.pdf

NOTES