UNIVERSITI PUTRA MALAYSIA

PREVALENCE OF DIABETES AND ITS FACTORS AMONG WORKERS AT PORT CONTAINER TERMINAL

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BY

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ABSTRACT

PREVALENCE OF DIABETES AND ITS FACTORS AMONG WORKERS AT PORT CONTAINER TERMINAL

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Introduction: Diabetes mellitus (DM) is a world health problem and the number of individuals having it is increasing. DM currently stands out as an important cause of morbidity and mortality. The prevalence of diabetes in Malaysia has increased by 41.0% in just 4 years, from 13.4% in 2015 to 18.3% in 2019. Focusing on job is necessary in the port industry and high accuracy is essential with any single movement. Irregular working hours can affect workers' daily routine such as eating time, exercise time and others which can lead to unhealthy lifestyle. The information on the prevalence of diabetes among port container terminal workers' in Malaysia is lacking. **Objectives:** The aim of this study was to determine the prevalence and contributing factors of diabetes among workers in port container terminals. **Methodology:** A cross sectional study was carried out at a port container terminal in the northern region, Peninsular Malaysia which voluntarily participated by N=200 respondents. The respondents were selected by using a purposive sampling method based on inclusion and exclusion criteria. A set of pretested questionnaires was used to obtain information such as socioeconomic, work related and lifestyle information by face-to-face interview. Anthropometry, blood glucose and blood pressure measurements were collected using OMRON HBF-516B Full Body Sensor, SECA 206 measuring tape, Sannuo GA-3 Glucometer, and Omron HEM-7121-Z Automatic Blood Pressure Monitor. All data was analyzed using SPSS version 25. **Results:** This study found the prevalence of diabetes among the respondents was 23.5%. The predictor of diabetes was daily carbohydrate intake ($p<0.05$) while BMI was marginally significant ($p=0.06$). **Conclusion:** This study concluded that those who consumed carbohydrates frequently have 3.2 times the odd of getting diabetes than those whose consumed carbohydrates less frequent (95% CI: 1.50, 6.63). Diabetes screening and proper healthy lifestyle programs are needed to be implemented among these workers in order to provide the ability to adopt lifestyle changes as early as possible, to improve wellbeing and thereby reduce the possibility of complications.

Keywords: Diabetes mellitus, workers, port container terminal, prevalence, carbohydrate intake.

ABSTRAK

PREVALENS DIABETES DAN FAKTORNYA DALAM KALANGAN PEKERJA DI TERMINAL PELABUHAN KONTENA

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Pengenalan: Diabetes mellitus (DM) merupakan salah satu masalah kesihatan di peringkat dunia dan bilangan individu yang menghidapiya semakin meningkat . DM merupakan penyebab utama morbiditi dan mortaliti pada masa kini. Kadar prevalens diabetes menunjukkan tren peningkatan dari tahun ke tahun. Prevalens diabetes di Malaysia telah meningkat sebanyak 41.0% dalam 4 tahun, iaitu daripada 13.4% pada tahun 2015 kepada 18.3% pada tahun 2019. Pekerja dalam industri pelabuhan memerlukan fokus dan ketepatan yang tinggi untuk setiap pergerakan jentera yang dilakukan. Waktu kerja yang tidak teratur mempengaruhi rutin harian pekerja seperti waktu makan, waktu bersenam dan lain-lain yang boleh menjurus kepada gaya hidup yang tidak sihat. Maklumat mengenai prevalens diabetes di kalangan pekerja di terminal pelabuhan kontena di Malaysia adalah tidak mencukupi. **Objektif:** Tujuan kajian ini adalah untuk menentukan prevalens dan faktor penyumbang diabetes dalam kalangan pekerja di terminal pelabuhan kontena. **Metodologi:** Kajian keratan rentas telah dilakukan di terminal pelabuhan kontena di wilayah utara, Semenanjung Malaysia dan disertai oleh N = 200 responden secara sukarela. Responden dipilih dengan menggunakan kaedah persampelan bertujuan berdasarkan kriteria inklusif dan eksklusif. Borang soal selidik yang telah menjalani prauji digunakan untuk mendapatkan maklumat seperti maklumat sosioekonomi, pekerjaan dan gaya hidup melalui kaedah temuramah secara bersemuka. Pengukuran antropometri, glukosa darah dan tekanan darah telah dijalankan menggunakan alat seperti *OMRON HBF-516B Full Body Sensor, SECA 206 measuring tape, Sannuo GA-3 Glucometer, Omron HEM-7121-Z Automatic Blood Pressure Monitor.* Semua data dianalisis menggunakan SSPS versi 25. **Hasil:** Kajian ini mendapati prevalens diabetes dalam kalangan responden adalah 23.5%. Faktor yang mempunyai perkaitan paling signifikan dengan diabetes adalah kekerapan pengambilan karbohidrat ($p<0.05$) sementara Indeks Jisim Tubuh (BMI) hampir signifikan ($p=0.06$). **Kesimpulan:** Kajian ini merumuskan bahawa pekerja yang mengambil karbohidrat secara kerap mempunyai 3.2 kali ganda kemungkinan mendapat diabetes berbanding mereka yang kurang kerap mengambil karbohidrat (OR = 3.16, 95% CI: 1.50, 6.63). Pemeriksaan kadar gula dalam darah dan program gaya hidup sihat yang bersesuaian perlulah dilaksanakan di kalangan pekerja ini agar dapat mengurangkan kemungkinan komplikasi diabetes dan meningkatkan kesejahteraan hidup.

Kata kunci: Diabetes mellitus, pekerja, terminal pelabuhan kontena, pengambilan karbohidrat.

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LIST OF ABBREVATIONS

mmol/l	millimoles per litre
mmHg	millimeters of Mercury
WHO	World Health Organization
T2D	Type 2 Diabetes
SSBs	Sugar-Sweetened Beverages
BMI	Body Mass Index
FG	Fasting Glucose
NCD	Non Communicable Disease
NHMS	National Health Morbidity Survey
NIH	National Institute Health
ADA	American Diabetes Association
IQR	Interquartile range
CPG	Clinical Practice Guidelines
GI	Glycaemic Index
GL	Glycaemic Load

CHAPTER 1

INTRODUCTION

1.1 Background

Diabetes is one of the chronic conditions needing continuous medical treatment to minimize the risk of long-term complications and prevent acute complications (Standards of Medical Care in Diabetes, 2007). The incidence of diabetes mellitus and its prevalence are increasing worldwide. According to American Diabetes Association (2010), Diabetes is a group of metabolic disorders characterized by hyperglycemia caused by insulin action, insulin secretion defects or both. Chronic diabetes or hyperglycemia is associated with long-term impairment, dysfunction, and failure of various organs, especially of the eyes, nerves, kidneys, heart and blood vessels.

Generally, diabetes may be categorized into a few general groups due to certain factors which are type 1 diabetes (T1D), type 2 diabetes (T2D), gestational diabetes mellitus (GDM), and specific types of diabetes due to some other reasons. T1D is characterized by hyperglycemia primarily due to absolute insulin insufficiency whereas T2D is associated with relative insulin resistance and insulin deficiency (Classification and Diagnosis of Diabetes, 2014). Meanwhile, Gestational

Diabetes Mellitus (GDM) is characterized as any degree of initially or firstly recognized glucose intolerance during pregnancy (WHO, 1999).

For T2D, it is recorded 90 to 95% of total diabetes cases which onset usually for individuals older than 30 years old. The prevalence of T2D increases with age. The largest increasewhen diagnosed diabetes is among individuals between the ages of 45 and 65 years (CDC, 2007). Most of the individuals do not require insulin until the progression of the disease much later. Genetic may also be the component for developing T2D (Edelman & Henry, 2005). However, other factors may increase the chance of developing T2D such as sedentary lifestyle, abdominal-visceral obesity, and age. Adults suffering from heart disease and diabetes have mortality rates 2 to 4 times higher than those without diabetes. Individuals with diabetes are also at 2 to 4 times higher risk of stroke (Ligaray, 2007).

Port is a harbor area which transfers cargo and passengers between land transportation and ships by the marine terminal facilities. The major function of a port is to give services to freight such as transshipment, warehousing, and ships such as refuelling, piers, repairs (Rodrigue, 2017). Roa et al. (2013) stated that the port terminal is also known as dedicated terminals, meaning that it served as a place where material was eventually uploaded or downloaded, and often the same. Only the types of goods they handle are permitted to their facilities. The vast majority of these are solid bulk, although they do have liquid bulk terminals as fuels, some gas forms.

Working at a port container terminal, as a crane operator with work intensity and long irregular working hours is a challenging one. The nature of working hours will limit their time to entertain themself to practice healthy and good lifestyles such as exercise, healthy eating, and others. This situation will lead to chronic diseases which can harm the workers and disturb the performance of the work. Diabetes is one of the common illnesses which workers suffer and is a major cause of morbidity and mortality. It occurs when the insulin produced by the pancreas is not enough, or when the insulin produced was not been effectively used. This study will benefit both sides of the respondent and the researcher. As for the respondent, their participation is important in providing workplace information on diabetes, and they should be aware of their state of health. The knowledge and data from this study will be used for the researchers to assess the prevalence of diabetes in the workplace and to help the organization prepare strategies for health promotion activities, developing strategic plans and prevention programs for target groups.

1.2 Problem Statement

Diabetes mellitus is a world health issue, and an increasing number of people with diabetes. This can be evidenced by many types of research and findings that had been done. This growing trend arises from several factors such as increased obesity , physical inactivity or a sedentary lifestyle, consume sugar-sweetened beverages, hypertension and work long hours. Currently, diabetes mellitus (DM) is a major cause of morbidity and mortality. The prevalence of diabetes in Malaysia has elevated by 41.0% in 4 years, from 13.4% in 2015 to 18.3% in 2019. Based on National Health and Morbidity Survey (2019), 1 in 5 adults in Malaysia have

diabetes that affect about 3.9 million people which can be divided into two categories which are known diabetes (9.4%) and undiagnosed diabetes (8.9%).

Individuals with T2D have the risk of death twice as great as individuals without diabetes. If blood glucose levels are not controlled, approximately a decrease of 20 years for life expectancy (CDC, 2007; Edelman & Henry, 2005). Patients with diabetes should understand and have some knowledge about their medication, diet and aware of their condition. Several studies have shown that increasing the frequency of self-monitoring is strongly linked to accomplishing dietary goals successfully (Servick et al., 2010; Mahfouz & Awadalla., 2011). The other major problem is the negative effects of diabetes on the socioeconomic level of the country. In Malaysia, it is rapidly escalating cater to diabetes patients' needs that will lead to an economic burden. One study reported that the direct cost of outpatient care was approximately RM 14.5 million per year for the 60,000 diabetic patients registered with the Malaysian Ministry of Health (Sadat et al., 2003). In developing countries, people are more likely to do less physical activity or sedentary activities. At the same time, they eat a calorie-rich diet that becomes a habit and weight gain which is a risk factor for T2D among Malaysians is a serious problem.

1.3 Study Justification

There are cases at the port that involve safety and health due to unaware of the diseases and continue doing their works. Many researchers had been conducted the research to identify the prevalence of diabetes in Malaysia but none of them specifically done for workers at the port container terminal. Based on the Prevalence

of Diabetes in the Malaysian National Health Morbidity Survey III (2006), the prevalence of diabetes for machine operators and assemblers was 11.7%. From this study, the workers can aware of their health status and exposure to possible health risks in the workplace. The company can take proper action towards the workers who have been diagnosed with diabetes and prepare for control measures. The company also can update their data on the prevalence of diabetes. It is important for the port workers to have a healthy body as they need to use maximum energy during working hours and their jobs are challenging to do. Maintaining a healthy body can avoid chronic diseases which can impact the quality of its work.

In a Port Harcourt research, the prevalence of diabetes among oil company employees was significantly higher than those of non-oil companies (Nwafor and Owhoji, 2010). Elmugarner et al. (1995) explain that it might be associated with reduced complex carbohydrate intake and the corresponding high fat consumption and a sedentary lifestyleDiabetes may increase absenteeism for the workers, productivity while working may also be affected and employees with diabetes may face discrimination in workplace (Lavigne et al., 2003). Study by Tunceli et al . (2005) proposes that diabetes affects patients, society and employers by contributing to job losses due to health-related work limitations and absenteeism. Realizing the long-term effects that Type 2 Diabetes patients have to suffer from poor blood glucose control, a research was conducted to determine the prevalence of diabetes and its determinants among workers at port container terminals.

1.4 Research Questions

This research was carried out to answer the following research:

1. What would be the prevalence of diabetes among workers in a port container terminal?
2. What would be the factors of diabetes among workers in a port container terminal?

1.5 Research Objectives

1.5.1 General objective

To determine the prevalence of diabetes and its determinant factors among workers in a port container terminal.

1.5.2 Specific objective

1. To determine the socio-demographic status and background information of the worker in the port container terminal.

2. To determine the prevalence of diabetes among workers in the port container terminal.

3. To identify the factors of diabetes among workers in the port container terminal.

4. To determine the predictors of diabetes among workers in the port container terminal.

1.6 Hypothesis

There is a significant association between diabetes with at least one of the factors which are work related factors, socio-demographic factors, health status and lifestyle factors.

1.7 Definition of Terms

1.7.1 Conceptual Definition

i) Diabetes Mellitus (DM)

The term diabetes mellitus describes a metabolic disorder of multiple etiology characterized by chronic hyperglycemia with disturbance of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action or both (World Health Organization, 1999).

ii) Prevalence

The number of persons with a disease or an attribute in a given population at a designated time (WHO, 2017).

iii) Determinant factors

Any characteristic, attribute or exposure of a person, which increases the likelihood to get a disease or other unwanted condition or event.

iv) Port Container Worker

People who work at the port container terminal and the job scope for crane operators include weighing, stacking and moving loads such as frozen goods, cargo and hazardous products using hoisting attachments like slings and spreaders (Yakub & Sidik, 2014).

vi) Socio-demographic

It refers to the background information of the population that involve in the study that may be the risk factors of diabetes. It also refers to, relating to or involving a combination of social and demographic factors.

1.7.2 Operational Definition

i) Diabetes

Diabetes in this research refers to type 2 diabetes (T2D). It is also known as "adult-onset diabetes" or "non-insulin-dependent diabetes," which accounts for 90-95% of overall diabetes. T2D refers to peoples who have insulin deficiency and usually insulin resistance. T2D was classified in those who had a fasting blood glucose (FG) level greater than or equal to 7.0 mmol/L or had a blood sugar level of 11.1 mmol/L two hours after taking food and this was classified as a diabetic patient.

ii) Prevalence

Data collection of the workers in the port container terminal used to calculate the proportion or percentage of diabetes. The prevalence was determined by using the formula:

$$\text{Prevalence} = \frac{\text{Number of workers with diabetes}}{\text{Total number of workers}}$$

iii) Determinant factors

It is a determining or causal element or factor that makes something happen or leads directly to a decision. The determinant factors for this study includes socio-demographic background (age, sex, race, marital status, education level, total monthly income, medical history), work-related factors (working

long hour, work shift), lifestyle factors (dietary intake, physical activity), and health status (obesity, hypertension).

iv) Port Container Worker

Male workers who work in shift hours at the port container terminal and expose to the determinants factors while working. The respondents are among local and full-time port container workers in the northern region, Peninsular Malaysia.

vi) Socio-demographic

The characteristics measured in socio-demographic include age, sex, race, marital status, educational level, total monthly income and medical history.

1.8 Conceptual Framework

Figure 1.1 shows the conceptual framework that describes the concept in this study. The research focused on port container terminal workers in the northern region, Peninsular Malaysia as the study population. The dependent variable is diabetes. The independent variables include all the potential determinants for diabetes among the workers which include work-related factors, lifestyle factors, socio-demographic, obesity, hypertension, and health status.

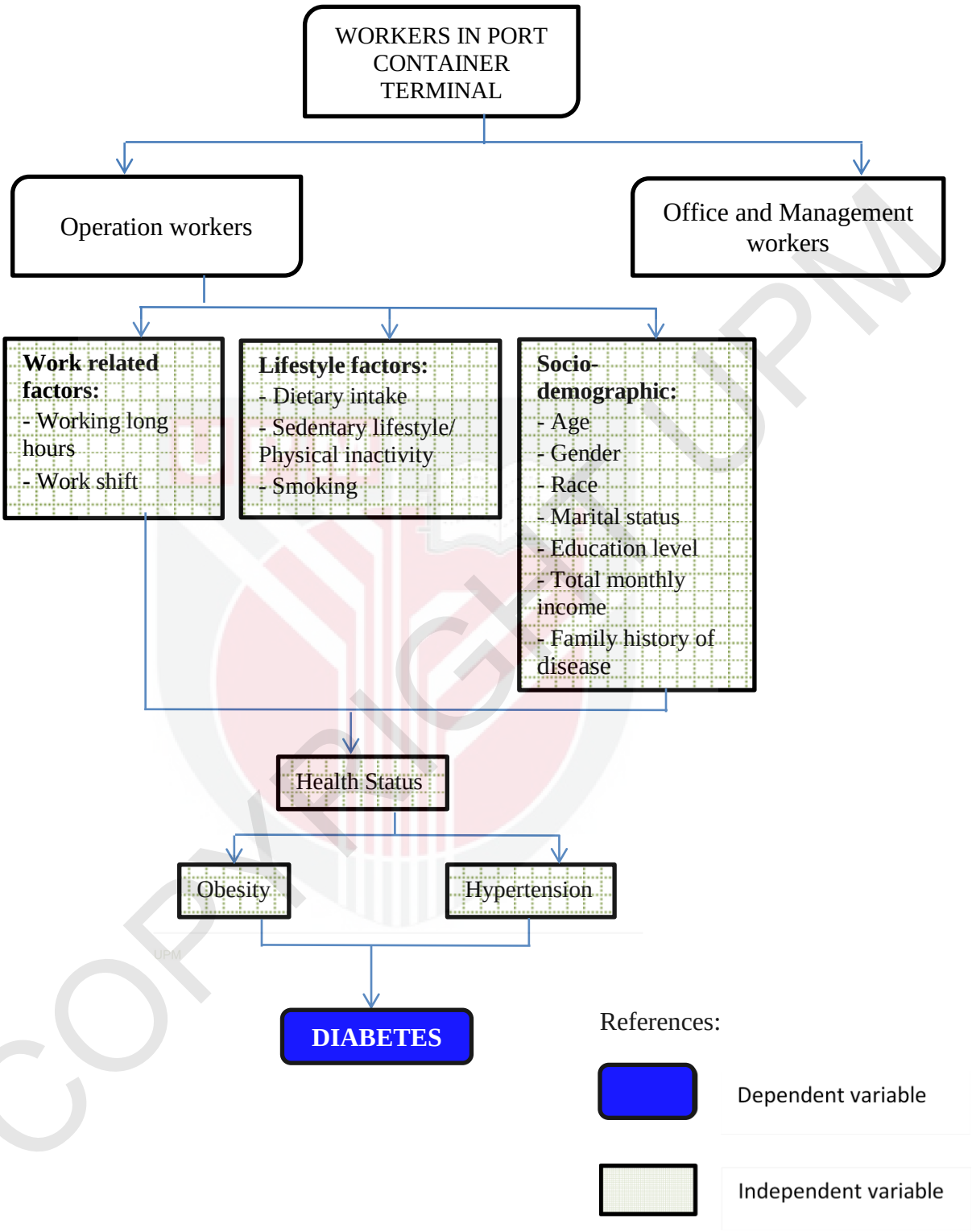

Figure 1.1: Conceptual framework

CHAPTER 2

LITERATURE REVIEW

2.1 Overview of diabetes

Globally, diabetes was estimated to cause 1.5 million deaths and having higher than optimal blood glucose can cause an additional 2.2 million deaths. Before the age of 70 years old, 43% of 3.7 million deaths had occurred. Diabetes is well-known as a cause of premature death and disability, including stroke, kidney failure, heart attack, nerve damage, blindness and lower limb amputation (World Health Organization, 2015). The main cause of morbidity and mortality among those with diabetes is cardiovascular disease. People with T2D usually have comorbidities such as obesity, abnormal blood lipids, and hypertension that can make the risk of cardiovascular disease higher (Matheus et al., 2013).

Type 2 diabetes, which is known as non-insulin-dependent diabetes, contributes to the most cases of diabetes globally. It can be developed when the insulin produced is insufficient to overcome the abnormality of increased resistance to its action. Perreault et al. (2012) mentioned that T2D can be delayed or prevented for a long period if medical intervention and or individual lifestyles are sought. Return the glucose levels to normal can reduces the risk of getting diabetes.

2.2 Risk Factors of diabetes

2.2.1 Obesity

Obesity increases the likelihood of developing diabetes, coronary heart disease, hypertension, certain cancers, stroke, osteoarthritis and sleep apnoea (World Health Organization, 2014). The increasing numbers of people with T2D are due to major changes in increasing of overweight and obesity rates, less physical activity and consuming unhealthy diet. Among adults, the most powerful determinant of increased glucose levels was the waist-to-hip ratio, then the body mass index as it was observed in other studies. An important determinant of insulin resistance is central adiposity which underlying abnormality in the cases of T2D. It has been reported that the overall prevalence of abdominal obesity in Malaysia that measured by waist circumference was between 55.6% and 57.4%. Abdominal obesity in people with T2D has been a growing prevalence and it is observed in 75% of Malaysian with T2D (Mohamud et al., 2011).

In Malaysia DiabCare study (2008), it was reported that the undesirable waist circumference for women (≥80 cm in 89.4%) was higher than men (≥90 cm in 73.7%) who have T2D. Also from the same study, it was found that 72% of individuals with T2D were categorised as obese (Mafauzy et al., 2011). Excess adiposity increases glucose intolerance and insulin resistance that leads to difficulty in treating patients with diabetes and obesity. The prevalence of overweight among adults in Malaysia was reported to be 29.4% (NHMS 2011) and 30.0% (NHMS 2015), while the prevalence of obesity was 15.1% and 17.7% respectively. Flor and Campos's (2017) studies show that there was a higher prevalence of diabetes in

people who have been diagnosed with hypercholesterolemia (22.0%) and arterial hypertension (17.0%). Excess adiposity will lead to glucose intolerance and insulin resistance, which makes the difficulty increase in treating patients with obesity and diabetes.

2.2.2 Sedentary Lifestyle

Sedentary lifestyle is a major cause of overweight and obesity, which in turn represent major risk factors for T2D. Individuals who are having a sedentary lifestyle and obese were approximately two times more affected by diabetes when compared to those who did not show signs and symptoms (Flor & Campos, 2017). Besides, a sedentary lifestyle also one of the factors which are associated with the occurrence of diabetes and independently of nutritional conditions (Passos, Barreto & Lima-Costa, 2005). Physical inactivity, the fourth leading risk factor for global mortality which is 6% of death globally was identified. Insufficient physical activity is elevated in many countries, which adds the burden of non-communicable disease (NCDs) and general health worldwide is affected.

The individual with insufficiently active has 20% to 30% increased risk of death compared to sufficiently active individuals. From the survey, it is stated that 43.7% of adults did not practice a physically active lifestyle. It was also reported that 54% of Malaysian adults who had diagnosed with diabetes were physically inactive (Tan & Magarey, 2008). From a study in Cheras health clinic that were conducted among T2D, only 20% reported a high physical activity level, 47% reporting a

moderate physical activity level, followed by 33.3% doing a low physical activity level (Shazwani et al., 2010).

2.2.3 Work Shift

Shift work is a practice in the workplace designed to make workers have a rest by taking turns when the factory running all day. Term "shift work" usually includes both long-term night shifts and when workers rotate or change shifts. The changes in the sleeping pattern will disturb circadian rhythms. Therefore, shift work is identified as a risk factor of health problems and may cause many negative effects (Guo et al., 2013). From the finding of prospective cohort studies, it shows that working long hours is associated with factors that lead to diabetes, such as work stress, depressive symptoms, sleep disturbances and unhealthy lifestyle (Murray et al., 2012). Virtanen et al. (2012) stated that working long hours is also related to an increased risk of cardiovascular disease, which is listed as one of the complications or issues of T2D. In a study, workers who work manually in industrial, the risk of incident T2D was elevated in those working long hours (Kawakami et al., 1999).

A few studies stated that there were association between rotating night shift work and increased risk of metabolic syndrome conditions which are closely related with T2D (De Bacquer D et al., 2009). Prospective studies in male Japanese workers showed that shift/alternation worker had chances of increased risk of diabetes and impaired glucose metabolism compared to day workers (Suwazono et al., 2006). Rotating night shift work is generally correlated with recurrent misalignment between the endogenic circadian timing system and behavioral patterns. This

circadian misalignment has been shown to result in detrimental metabolic and cardiovascular effects, including a reduction in leptin, a rise in glucose and insulin, an increase in mean blood pressure and a decrease in sleep performance (Scheer, 2009). Operating in a rotational shift, especially when it involves night work, may affect both the quality and quantity of sleep. Accumulation of data from prospective studies indicates an increased risk of type 2 diabetes correlated with sleep deprivation and sleep disorders (Sallinen & Kecklund, 2010).

2.2.4 Sugar-Sweetened Beverages (SSBs)

Sugar-sweetened beverages (SSBs) consumption includes fruit drinks, soft drinks, iced tea, vitamin, and energy water drinks has risen worldwide. Regular consumption of SSBs has been related to the risk of overweight, obesity and weight gain. Emerging evidence also indicates that chronic SSB intake entails an increased risk of metabolic syndrome and type 2 diabetes. Individuals who consumed SSBs most often 1-2 servings/day had a 26% greater risk in developing T2D than individuals who consumed SSBs none or less than 1 serving/month (Malik et al., 2010). Tsai et al. (2005) research findings indicate that a large dietary glycemic load often increases the risk of developing gallstone cholesterol, which is consistent with insulin resistance, metabolic syndrome, and T2D. Endogenous substances in SSBs, like advanced glycation final products, developed in cola-type beverages during the caramelization phase can also influence pathophysiological pathways associated with style type 2 diabetes and metabolic syndrome.

When people take SSBs, they consume high content of absorbable carbohydrates such as sucrose and high fructose corn syrup. Around half of SSB's impact on type 2 diabetes is induced by obesity. SSBs can increase the risk of T2D and metabolic syndrome not only through obesity but also by elevating dietary glycaemic load, leading to β-cell dysfunction, inflammation, and insulin resistance, when they consumed SSBs in large volumes (Schulze et al., 2004). Choi (2008) stated that fructose in SSBs also able to elevated the concentrations of uric acid in the blood, and SSB intake was related to hyperuricemia as well as increases blood pressure and metabolic syndrome mediated characteristics.

2.2.5 Hypertension

From the study of Souza et al. (2003), they observed that individuals with dyslipidemia or hypertension showed three times more chances of getting diabetes compared to the unexposed population. Having hypertension duplicated the chance of getting diabetes in the elderly (Viegas-Pereira et al., 2013). The average FG and blood pressure for shift workers were significantly increased compared to day workers (Guo et al., 2013). In their findings, their studies have shown that shift work in retired workers has been associated with an increased risk of poor quality of sleep, diabetes, and hypertension. On the other hand, an increased risk of diabetes and hypertension was associated with long-term shift work over 10 years. In a study, the results show that hypercholesterolemia and arterial hypertension were those most associated with the occurrence of diabetes according to behavioral and health variables (Passos et al., 2005). For data available in Malaysia, among T2D patients

audited in 2012, 70.1% had hypertension and 55.1% had dyslipidemia (Feisul & Azmi (Eds), 2013).

Endothelial dysfunction may be one amongst the common pathophysiological pathways explaining the strong association between blood pressure and incident type 2 diabetes. Studies have shown that markers of endothelial dysfunction are related to new-onset of diabetes, and endothelial dysfunction is closely associated with blood pressure and hypertension (Meigs, 2006). Markers of inflammation like C-reactive protein are consistently associated with incident of T2D, and to increasing blood pressure levels, suggesting that inflammation can be another explanatory factor for association between metabolic syndrome, blood pressure, and incident type 2 diabetes. Insulin resistance might be another potential link between blood pressure levels and also the incidence of type 2 diabetes (Blake, 2013).

2.3 Work Nature

In the port industry, crane operators must have high precision for every single movement and it is crucial. The job scope for crane operators includes weighing, stacking and moving loads such as frozen goods, cargo and hazardous products using hoisting attachments like slings and spreaders. The demanding tasks and challenges for them are to ensure the loads safely land on the wharf or on the vessel. They need expertise and skills to adjust the loads and avoid any damage or defect to the equipment and vessels. Increasing the strength and amount of physical work coupled with psychological pressures can have adverse effects on their wellbeing for those employed in an environment of rapid change. Crane operators must have the integrity

to work with precision and keep up with a certain pace in order to achieve daily production targets, as well as to avoid any damage and ensure the safety of the containers (Yakub & Sidik, 2014).

2.4 Complications of diabetes

Diabetes is closely related to elevated microvascular and macrovascular and complications, as well as preventable and premature mortality. 46% of the patients were having symptomatic neuropathy. The most common eye complications were cataract (27.2%) and nonproliferative retinopathy (22.8%), advanced eye disease (5.3%) and legal blindness were 1.7%. Patients also suffered from diabetic foot complications, leg amputation (3.8%), vascular surgery (2%) and active ulcer/gangrene (1.5%). For cardiovascular complications, a history of angina pectoris recorded the highest 18.4%, myocardial infarction 12.1%, followed by angioplasty/coronary artery bypass graft 13% and stroke 6.9%. For combined microvascular complications which are nephropathy, retinopathy and neuropathy, the prevalence was 75% and for macrovascular complications which are myocardial infarction, stroke, angioplasty/coronary artery bypassgraft and angina pectoris was 29% (Hussein et al., 2015).

Severe late complications such as myocardial infarction, legal blindness, cerebral stroke, angioplasty/coronary artery bypass graft, leg amputation, and end-stage kidney disease were recorded in 25% of patients. As the duration of diabetes increased, the complications become worse (Mafauzy et al., 2011). Approximately 100 people per week losing a toe, foot or lower limb due to damage to the nerve in

feet. Individuals who have diabetes have five times more likely to suffer heart failure; five fold increased risk of developing cardiovascular disease and at least 15% of death in people with T2D due to stroke (Diabetes UK, 2009). The individual's ability to do the jobs effectively will be affected and lead to costs of the economy because of the lost of working days due to the complications of diabetes.

CHAPTER 3

METHODOLOGY

3.1 Study design

In this study, quantitative research was conducted. For the quantitative study, blood glucose, blood pressure, body fat composition, height, weight, and waist circumference were measured. The cross-sectional study design was used among port container terminal workers in the northern region, Peninsular Malaysia. The data collection was done in January 2020, as shown in Gantt chart attached in Appendix D. All the data was collected during the changing shift of the workers with cooperation by logistic and safety and health department at the port terminal. The port's medical team was joining this program and facilitate this data collection. Poster and company announcements were the medium for the workers to taking part in this data collection part.

3.2 Study Location

The study location was at a port container terminal in the northern region, Peninsular Malaysia. This selected port was a longest and older port which had been operated since 1994. The port is the largest gateway to the northern part of Malaysia and Southern Thailand, connecting the Malacca Strait and Bengal Gulf basins.

3.3 Study Sample

3.3.1 Study Population

The study population was the port container workers in the northern region, Peninsular Malaysia. They were male operation workers that work in shift hours. There were five operation unit which are marine, cargo conventional, container business, IT and workshop.

3.3.2 Sampling frame

The sampling frame was the name list of all respondents working at the port container terminal. The name lists were obtained from the port Logistic department office. The recruitment of the respondents were based on the following inclusion and exclusion criteria:

The inclusion criteria:

a) Male workers in the container operation
b) Aged ≥ 18 years old.
c) Malaysian.

The exclusive criteria:

a) Those who absent during data collection.
b) Those who are not willing to participate.

3.3.3 Sampling Unit

The sampling unit was crane operator and officer who works at the port container terminal in the northern region, Peninsular Malaysia. The total number of

workers was approximately 1500 workers. Crane operators work in shift while office workers work in normal office hour. The main target category of this research is the crane operators with the total number of 800 employees and also the shift workers. The crane operators operates four types of crane which are rubber tyre gantry (RTG), rail mounted gantry (RMG), quay gantry crane (QGC), and prime mover (PM).

3.3.4 Sampling method

The respondents were selected by using a purposive sampling design with the approval by the Head of Safety and Health department. It is based on the work nature, suitability, and behavioral-based criteria.

3.3.5 Sample size calculation

The target population in this study was the port container workers. They are the male port workers in container operation and officer. There are five operation units which are marine, cargo conventional, container business, IT and workshop. Workers from crane operators and officer were chosen from the total numbers of workers, which is the sampling unit for this study.

The sample size (N) was determined using a single proportion formula that was calculated based on the formula by Naing (2003). Based on the Prevalence of Diabetes in the Malaysian National Health Morbidity Survey III (2006), the prevalence of diabetes for machine operators and assemblers was 11.7%. Since there is no exact prevalence of diabetes among crane operator, this prevalence is chosen

because of the nature of work is more or less similar to the crane operator, Therefore, the sample size will be calculated using Eq. 3.1 as below:

$$N = \left[\frac{Z}{d}\right]^2 \times P\,(1-P) \qquad \text{Eq. 3.1}$$

N = number of sample

d = precision

p = prevalence based on the previous study is 11.7% (Malaysian National Health Morbidity Survey III, 2006)

Z = 1.96 (this value of 1.96 is standard for CI of 95%)

$$N = \left[\frac{1.96}{0.05}\right]^2 \times 0.117\,(1-0.117)$$

N = 158.75 ≈ 159 (minimum estimation sample size)

An additional 20% of the sample size needs to be added to offset the missing or incomplete data. Total number respondents are calculated as follows:

= N + 20% of N

= 159 + 32

= 191

Therefore, the appropriate sample size would be at least 191.

3.4 Data collection and Study Instrument

3.4.1 Questionnaire

A set of modified questionnaires (Appendix B) adopted from Tan and Mangarey, (2008) that have been modified according to research needs was used. The questionnaire was available in Malay and English version. The translation was reviewed by the research supervisor to ensure the quality of the translation. The questionnaire was pretested among a community of similarly defined workers who did not participate in the study. The total questions used in this study were 36 questions which can be completed in 20 minutes by the respondents. Repondents were explained about the research. They were given an information sheet to be read together with a consent form (Appendix A) and to be signed if they agreed to participate in this study. The questionnaires were administered through a face-to-face interview and some explanations about the purpose of this study and how many sections that they need to respond in the questionnaires (Appendix E (i)). All the questionnaires were collected right after all the questions were completely answered. The questionnaires include 6 sections as the following:

Section A: Socio-Demographic Information

This section aims to gain an overall understanding of the general information related to age, sex, race, marital status, education level and total monthly income.

Section B: Medical History

The aim of this section is to know the status of respondents' health, clarification of respondents in having any the disease, duration of having the disease and related relatives having the same disease.

Section C: Sample Measurement

This section required the respondents to participate in doing anthropometry measurement which include the measurement of respondents' weight, height, and waist circumference. Blood glucose level, high blood pressure, and body fat composition were also measured. This section needs the researcher to fill in the field measurement. From the health assessment, every participant was given a copy of the measurements and readings of the participant for their record. For further evidence, those with borderline reading or an irregular degree were recommended to consult a doctor at health clinic.

Section D: Daily Diet Intake

This section required the respondents to provide information about their food intake.

Section E: Daily Lifestyle

This section required the respondents to give their behavioral lifestyle information that included physical activity, type of exercise, and duration of the exercise.

Section F: Work Routine

This section requires the respondents to give information on the types of shifts, working experiences, normal working duration, and overtime duration.

3.4.2 Blood Glucose Measurement

There are two major forms of screening blood chemistry which are dry and wet chemistry. Dry chemistry means blood is taken from the fingertip while wet chemistry means a sample of venous blood is taken. For this study, dry chemistry was conducted and blood glucose monitoring used the method as proposed by WHO STEPS Surveillance Part 3: Data Collection, Section 6: Collecting Step 3 data: Biochemical Measurement (WHO, 2017). The equipment used was Sannuo GA-3 Glucometer (Figure 3.1). Appendix E (ii) showed blood is taken from the fingertip. The equipment and supplies required for blood glucose included a device that measured blood glucose, sufficient batch of reagent test strips, single-use lancets, cotton balls and swabs, gloves and disposable container. Detail steps were shown in Appendix F. According to the Ministry of Health (2015), diabetes was classified into two categories. The details of the classification are shown Table 3.1.

Table 3.1: Diagnostic values for Diabetes

	Diagnostic values (mmol/L)	
Category	**0-hour**	**2-hours**
Normal	< 6.1	< 7.8
Diabetes	≥ 7.0	≥ 11.1

Source: Ministry of Health (2015)

Figure 3.1: Sannuo GA-3 Glucometer with lancing device, test strips, lancet

3.4.3 Blood Pressure Measurement

Systolic and diastolic pressures were measured by using the Omron HEM-7121-Z Automatic Blood Pressure Monitor (Figure 3.2). The procedure of the measurement followed by WHO STEPS Surveillance Part 3: Data Collection, Section 5: Collecting Step 2 data: Physical Measurements (WHO, 2017). The respondents were prohibited from taking caffeine-containing drinking and talk during the measurements. The measurement was taken with each of the respondents asked to sit comfortably and relax with their legs uncrossed for 15 minutes. If the participant has moved around, they will be asked to rest before taking the measurement. Before measurement was taken, the participants were advised to have an empty bladder. The readings were taken three times at least for each measurement to obtain an average value. Between each of the readings, the respondent rest for three minutes. Appendix E (iii) showed the respondent sat while taking blood pressure measurement. Detail steps are shown in Appendix G. According to the Ministry of Health (2018), hypertension was classified into few categories. The details of the classification are shown in Table 3.2

Table 3.2: Classification of Hypertension

Classification	**Systolic (mmHg)**		**Diastolic (mmHg)**
Optimal	< 120	And	< 80
Normal	120 – 129	and/or	80 – 84
At risk	130 – 139	and/or	85 – 89
Hypertension			
Stage 1 (Mild)	140 – 159	and/or	90 – 99
Stage 2 (Moderate)	160 – 179	and/or	100 – 109

Stage 3 (Severe)	≥ 180	and/or	≥ 110
Isolated Systolic Hypertension	≥ 140	And	< 90

Source: Ministry of Health (2018)

Figure 3.2: Omron HEM-7121-Z Automatic Blood Pressure Monitor

3.4.4 Weight Scale

OMRON HBF-516B Full Body Sensor (Figure 3.3) was used for weight measurement. The measurement followed the procedures of WHO STEPS Surveillance Part 3: Data Collection, Section 5: Collecting Step 2 data: Physical Measurements (WHO, 2017). The scales were set on a flat, firm surface. The measurement is used for calculation of Body Mass Index (BMI) (Weight/Height x Height). Appendix E (iv) showed the respondent doing weight measurement. The weights of respondents were taken at least three times each to take the average reading of their weight. According to WHO (1998), BMI was classified into 6 categories. The details of the classification are shown in Table 3.3.

Table 3.3: Classification of Weight by BMI

Classification	BMI (kg/m^2)
Underweight	< 18.5
Normal	18.5 – 22.9
Overweight	≥ 23.0
Pre-obese	23.0 – 27.4
Obese I	27.5 - 34.9
Obese II	35.0 - 39.9
Obese III	≥ 40.0

Source: CPG of Obesity, Ministry of Health (2004)

Figure 3.3: OMRON HBF-516B Full Body Sensor

3.4.5 Height Scale

Height was measured by SECA 206 measuring tape in Figure 3.4. The measurement followed the WHO STEPS Surveillance Part 3: Data Collection, Section 5: Collecting Step 2 data: Physical Measurements (WHO, 2017). The measuring tape was attached to a rigid wall. The record is used for Body Mass Index (BMI)

calculation (Weight/Height x Height). The height of respondents were taken at least three times each to take the average reading of their height.

Figure 3.4: SECA 206 Measuring Tape

3.4.6 Waist Circumference

The measurement was followed the WHO STEPS Surveillance Part 3: Data Collection, Section 5: Collecting Step 2 data: Physical Measurements and this measurement should be done directly over the skin, without clothing. The normal measurement for men was 90 cm (WHO, 2017). The accuracy of measurements of the waist circumference depends on the tightness of the measuring tape and the correct positioning thereof.

3.5 Data Analysis

All the data were analyzed by using IBM SPSS statistic software version 25. The details of each statistical analysis are shown in Table 3.4.

Table 3.4: Summary of research information and statistical analysis

Research Objective	Data/Type of Data	Statistical Analysis
To determine the socio-demographic status and background information among the workers in the port container terminal.	Categorical data - sex, race, marital status, education level, medical history	Descriptive analysis - frequency & percentage
	Continuous data - age and total monthly income	- mean, standard deviation (Normal) - median, IQR (not normal)
To determine the prevalence of diabetes among workers in the port container terminal.	Continuous data Blood glucose level	Descriptive analysis - mean, standard deviation (Normal) - median, IQR (not normal) - range, minimum, maximum
	Categorical data (yes/no) Diabetes	- frequency & percentage

To identify the the factors of diabetes among workers in the port container terminal.	i) Diabetes (yes/no) ii) Socio-demographic status (age, sex, race, marital status, education level, total monthly income, medical history) iii) Lifestyle factors (glucose intake, lifestyle, obesity, hypertension) iv) Work-related factor (working long hours) v) Anthropometry measurement (BMI, waist circumference)	Chi-square test.
To determine the predictors of diabetes among workers in the port container terminal.	Nominal data IV: Identified the factors (category) DV: Diabetes (category)	Multiple logistic regression test.

3.6 Ethical Consideration

This study has been reviewed and approved by Ethics Committee for Research Involving Human Subjects (JKEUPM), Universiti Putra Malaysia. The JKEUPM reference number was UPM/TNCPI/RMC/JKEUPM/1.4.18.2 (JKEUPM) as attached in Appendix C. Authorisation and approval to perform data collection for this study was obtained from the port container terminal in the northern region, Peninsular Malaysia. Individual written consent has been obtained from each respondent prior to data collection.

CHAPTER 4

RESULTS

4.1 Socio-demographic and Background Information of Respondents

4.1.1 Socio-demographic of Respondents

The whole study sample consisted of 200 port container terminal male workers aged between 25 to 63 years old. In order to explore the characteristics of the data, a descriptive statistic test was used. Referring to Table 4.1, the majority of the respondents were categorized as mature in the range of 41 to 64 years old (60.5%), followed by youth in the range of 15 to 40 years old. The mean age of the respondents was 44 ± 8 years old. Their monthly incomes were in the range from RM1000 to RM9000 per month. Among the workers, 78 of them (39%) have low income and 122 (61%) were high income. The mean monthly income of the workers was RM 3592 ± 982 which means, they are in low income group.

The findings of the research indicate that 95% of the respondents who took part in this study were Malay identified by 190 respondents and only 0.5% were Chinese and 4.5% were Indian. Married respondents were the higher contributor in providing a response to this study with a percentage of 97.5% which were 195 respondents and the remaining 2.5% were single. For education level, 79.5% of respondents completed secondary school as their highest education level and 20.5% had completed college or university.

Table 4.1: Distribution of Socio-demographic Information of the Respondents (N = 200)

Variable	Frequency (%)	Mean ± SD	Median (IQR)	Min-Max
[a]Age (Year):				
Youth	79 (39.5)	44 ± 8	45 (14)	25-63
Mature	121 (60.5)			
[a]Monthly Income (RM):				
Low income	78 (39.0)	3592 ± 982	3500 (1000)	1000-9000
High income	122 (61.0)			
Race:				
Malay	190 (95.0)			
Chinese	1 (0.5)			
Indian	9 (4.5)			
Marital Status:				
Single	5 (2.5)			
Married	195 (97.5)			
Educational Level:				
Secondary school	159 (79.5)			
Tertiary education	41 (20.5)			

[a] = Data not normally distributed. Kolmogorov Smirnov Normality Test; $p > 0.05$
Low Income: ≤ RM4850; High Income: ≥ RM4851 (Department of Statistics Malaysia, 2020)
Youth: 18 – 40 years old; Mature working age: 41 – 64 years old (The National Youth Development Policy of Malaysia, 2007)

4.1.2 Working Characteristics of the Respondents

The respondents working characteristics comprises of working type, work position, duration of working (years) and working duration (hours) whether working in a normal hour or overtime. The majority of respondents (n=168) were working at shift hours and 32 of them followed the normal office hours. A total of 121 of the respondents work as crane operators and 79 of them work in the office. The mean working experience among them was 17 years, which ranged between 1 to 39 years of working experience in the port container terminal. The mean of normal working hours was 46 ± 4 hours and for overtime, the mean was 14 ± 5 hours. The description of the working characteristics of the respondents has been summarized in Table 4.2.

Table 4.2: Descriptive Analysis for Working Characteristics of Respondents (N = 200)

Variable	Frequency (%)	Mean ± SD	Median(IQR)	Min-Max
Type of Work:				
Shift work	168 (84.0)			
Normal time	32 (16.0)			
Work Position:				
RTG	63 (31.5)			
RMG	10 (5.0)			
QGC	26 (13.0)			
PM	22 (11.0)			
Office workers	79 (39.5)			

[a]Duration of Working (years)	17 ± 7	15 (9)	1-39
[a]Normal Working Hour (Hour)	46 ± 4	48 (0)	30-72
[a]Over Time (Hour)	14 ± 5	16 (0)	0-24

[a] = Data not normally distributed. Kolmogorov Smirnov Normality Test; $p > 0.05$
RTG: Rubber Tyred Gantry, RMG: Rail Mounted Gantry, QGC: Quay Gantry Crane, PM: Prime Mover

4.1.3 Medical History of Respondents

Based on Table 4.3, only 20 workers which are 10% of them acknowledge the presence of diabetes and 75% of them mentioned that the duration of having diabetes was more than 1 year ago, 20% having diabetes between 1 month to 1 year ago and 5% having diabetes less than 1 month ago. The respondents also mentioned about diabetes medicine that they consumed which are Metformin, Gliclazide and Diamicron. The respondents that have a close relatives with diabetes were 86 (43%) respondents and 114 (57%) did not have relatives with diabetes. Only 3 workers stated that they have chronic disease which is heart disease. For hypertension, 39 workers which are 19.5% acknowledge the presence of it and 69.2% of them mentioned that the duration of having hypertension was more than 1 year ago, 20.5% having hypertension between 1 month to 1 year ago and 10.3% having hypertension less than 1 month ago. The respondents that have a close relatives with hypertension were 96 (48%) respondents and 104 (52%) did not have relatives with hypertension. The workers who had parents or siblings with diabetes and hypertension were about 43% and 48% respectively.

Table 4.3: Descriptive Analysis for Medical History of Respondents (N = 200)

Variable	Frequency (%)
Diabetes:	
Yes	20 (10.0)
No	180 (90.0)
Type of Diabetes Medicine:	
- Metformin	
- Gliclazide	
- Diamicron	
Duration of having Diabetes (n = 20):	
Less than 1 month ago	1 (5)
1 month to 1 year ago	4 (20)
More than 1 year ago	15 (75)
Close Relative with Diabetes:	
Yes	86 (43.0)
No	114 (57.0)
Chronic Disease:	
Yes	3 (1.5)
No	197 (98.5)
Type of Chronic Disease (n = 3):	
- Heart disease	
Hypertension:	
Yes	39 (19.5)
No	161 (80.5)

Type of Hypertension Medicine:

- Zanidip

Duration of having Hypertension (n = 39):

Less than 1 month ago	4 (10.3)
1 month to 1 year ago	8 (20.5)
More than 1 year ago	27 (69.2)

Close Relative with Hypertension:

Yes	96 (48.0)
No	104 (52)

4.1.4 Anthropometry, Body Fat and Blood Pressure Measurement

Referring to Table 4.4, the mean body weight and height of the respondents who participated in the study were 79.8 ± 17.8 kg and 169.6 ± 5.7 cm. Among them, 131 respondents which are 65.5% have abnormal waist circumference which is greater than 90 cm. The mean waist circumference was 96 cm, indicating that on average they were abnormal and having over inches. Overall, the respondents' mean blood pressure value was 140/85 mmHg. The mean systolic pressure value was 140 ± 15 mmHg, and diastolic pressure was 85 ± 11 mmHg.

The mean BMI of the respondents was 27.7 kg/m^2, indicating that on average they were obese. The proportion of the respondents that classified as overweight and obese were 45.5% and 44.5% respectively. Only 9% of them had normal body weight. The percentage of the workers that categorized as having high and very high body fat composition were 36% and 40.5% respectively. The mean for body fat was

26.3% which indicated that most of them have high fat in their body. Figure 4.1 shows the percentage of respondents' BMI and body fat composition.

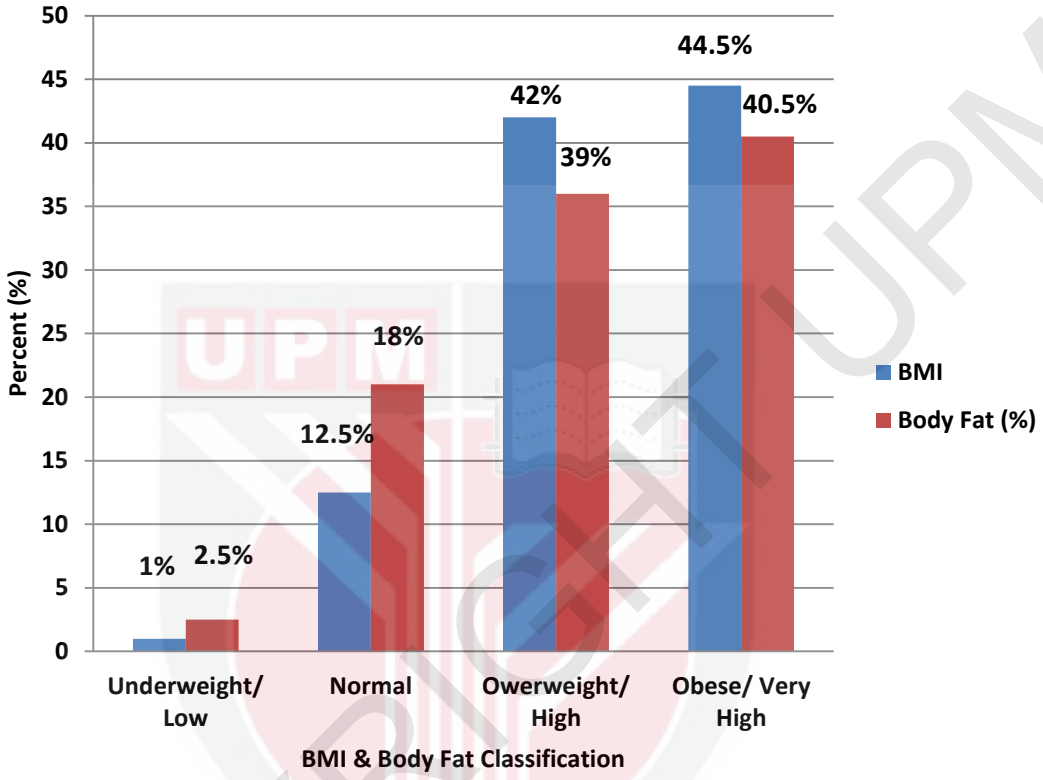

Figure 4.1: BMI and body fat composition of the respondents (N = 200)

Table 4.4: Anthropometry, Body Fat and Blood Pressure Measurement (N = 200)

Variable	Frequency (%)	Mean ± SD	Median (IQR)	Min-Max
Weight (kg)		79.8 ± 17.8	77.0 (17.1)	46.3-181.1
Height (cm)		169.6 ± 5.7	169.5 (7.9)	151.5-182.5

[a]Waist Circumference (cm):		96 ± 10	94 (12)	64-133
Normal	69 (34.5)			
Abnormal	131 (65.5)			
[a]Hypertension (mmHg)		Systolic	Systolic	Systolic
Hypertension	101 (50.5)	140 ± 15	138 (17)	109-200
Non-hypertension	99 (49.5)	Diastolic 85 ± 11	Diastolic 84 (13)	Diastolic 54-133
[a]BMI (kg/m^2):				
Underweight	2 (1.0)	27.7 ± 5.6	26.9 (5.1)	16.9-63.4
Normal	25 (12.5)			
Overweight	84 (42.0)			
Obese	89 (44.5)			
[a]Body Fat (%):				
Low	5 (2.5)	26.4 ± 7.6	26.1 (8.4)	4.0-58.1
Normal	36 (18.0)			
High	78 (39.0)			
Very high	81 (40.5)			

[a]Cut off point:
Normal waist circumference was defined as ≤ 90 cm (Ministry of Health, 2004)
Hypertension was defined as the blood pressure of ≥ 140 or/ ≥ 90 (Ministry of Health, 2018)
BMI: Underweight: <18.5, Normal: 18.5 – 22.9, Overweight: ≥23.0, Obese: 27.5 (Ministry of Health, 2004)
Body fat: Low: < 11.0%, Normal: 11.0% - 21.9%, High: 22.0% - 27.9%, Very high: >28.0% (NIH/WHO guidelines for BMI)

4.2 Prevalence of Diabetes among Workers in Port Container Terminal

Blood glucose was divided into 2 categories which are fasting blood glucose (FBS) and random blood glucose (RBS). 10% known diabetes is based on drug and care self-reports from respondents. This study classified 13.5% as having abnormal glucose levels. Table 4.5 shows that 175 workers were remarks as fasting and 25.1% of them were diagnosed having diabetes and the mean value was 6.3 ± 2.2 mmol/l. For random blood glucose, 3 out of 25 workers were diagnosed with diabetes and the mean value was 8.6 ± 3.3 mmol/l. The total percentage having diabetes among the workers was 23.5% which represents 47 individuals. The mean value was 9.5 ± 2.9 mmol/l.

Table 4.5: Blood Glucose Measurement of the Respondents (N = 200)

Variable	Frequency (%)	Mean ± SD	Median (IQR)	Min-Max
[a]Fasting Blood Glucose (n=175):				
Diabetic	44 (25.1)	6.3 ± 2.2	5.7 (1.9)	1.2-17.7
Non-diabetic	131 (74.9)			
[a]Random Blood Glucose (n=25):				
Diabetic	3 (12)	8.6 ± 3.3	8.2 (3.2)	4.9-21.3
Non-diabetic	22 (88)			

Total diabetic (N=200)				
Diabetic	47 (23.5)	9.5 ± 2.9	8.4 (3.4)	7.0-21.3
Non-diabetic	153 (76.5)			

[a]Cut off point
Diabetes was defined as Fasting Blood Glucose of ≥ 7 mmol/l
Diabetes was defined as Random Blood Glucose of ≥ 11.1 mmol/l. (Ministry of Health)

4.3 Factors of Diabetes

4.3.1 Dietary Intake of the Respondents

For the dietary intake part, the respondents answered 12 questions about the food that they ate. In total, there were 35% of the workers who ate fast food like KFC/McD/burger/pizza/hot dogs more than 3 times in a week. The percentages of respondents who ate outside food 3-5 times and 6 or more times in a week were 40% and 33.5% respectively. These showed that the respondents often eat fast food and eat outside food. Only 96 individuals regulated their diet for health (32.5%) and sick (48%). Most of them controlled sweet foods (18%), followed by fatty foods (6.5%), oily food (4%) and 20% of them controlled all of the foods mentioned before. Fewer of them regulated their diet that probably will increase the risk of getting diabetes. 30% of the respondents take rice with sugary drinks once and 31% take rice with sugary drinks twice a day and portrayed that most of them love to drink sugary drinks during eating.

There were 13 (6.5%) workers that did not eat fruits at all and 70 (35%) workers just take fruits 1 to 2 times a week. For vegetable intake, there were 5 (2.5%) individuals who did not eat vegetables at all and 42 (21%) workers just eat 1

to 2 times a week. The number of workers that seldom eat fruits and vegetables were quite high. Overall, 65% of the workers do not like foods that contain high salt content. On average, 103 respondents eat 3 times a day which contributes to 51.5% and it was a huge percentage. A total of 107 (53.5%) individuals ate 2 times in a day, foods containing carbohydrates such as rice, noodles, rice vermicelli (beehon), bread, and potato. The data distribution of dietary intake of the respondents was stated in Table 4.6.

Table 4.6: Descriptive Analysis for Dietary Intake of Respondents (N = 200)

Variable	Frequency (%)
In average, how often do you eat fast food like KFC/McD/burger/pizza/hotdogs and so on in a week?	
0 (Did not eat)	100 (50.0)
1-2 times	30 (15.0)
3-5 times	6 (3.0)
6 or more times	64 (32.0)
How often do you eat outside food in a week?	
0 (Did not eat)	15 (7.5)
1-2 times	38 (19.0)
3-5 times	80 (40.0)
6 or more times	67 (33.5)
Have you ever regulated your diet?	
Yes	96 (48.0)
No	104 (52.0)
Why do you regulate your diet? (n=97)	

Sick	31 (15.5)
For health	66 (32.5)
What kind of food is controlled?	
Sweet foods	36 (18.0)
Fatty foods	13 (6.5)
Oily foods	8 (4.0)
All of above	40 (20.0)
In a day, how often do you take rice with sugary drinks?	
Never	70 (35.0)
1 time	60 (30.0)
2 times	62 (31.0)
3 times	8 (4.0)
How often do you take fruits in a week?	
0 (Did not eat)	13 (6.5)
1-2 times	70 (35.0)
3-5 times	80 (40.0)
6 or more times	37 (18.5)
How often do you take vegetables in a week?	
0 (Did not eat)	5 (2.5)
1-2 times	42 (21.0)
3-5 times	76 (38.0)
6 or more times	77 (38.5)
Do you like foods that contain high salt content?	
Yes	70 (35.0)
No	130 (65.0)

If yes, how frequent do you consume food with a high content of salt in a week? (n=70)	
1-2 times	42 (21.0)
3-5 times	25 (12.5)
6 or more times	3 (1.5)
In average, how many times do you eat in a day?	
1 time	7 (3.5)
2 times	79 (39.5)
3 times	103 (51.5)
4 times	11 (5.5)
In a day, how often you eat carbohydrate (rice, noodles, beehoon, bread, potato)?	
1 time	47 (23.5)
2 times	107 (53.5)
3 times	46 (23.0)

4.3.2 Daily Lifestyle of the Respondents

As for physical activity status, 177 (88.5%) of respondents doing physical activities and another 23 (11.5%) did not perform physical activities. Among the respondents that perform physical activities, 2 (1%) respondents doing it more than 15 minutes while the majority of them doing it for more than 15 minutes. The percentage of physical activity was 35.5% of respondents perform a low level of physical activity, 44% perform a moderate level of physical activity and the

remaining 20.5% perform a high level of physical activity. The data distribution of the daily lifestyle of the respondents was stated in Table 4.7.

Out of 200 respondents, 120 (60%) of them were smoking. The mean age for start smoking was 19 ± 5 years old and the range was 12 to 40 years old. Figure 4.2 indicates the percentage the respondents smoked cigarettes in a day. A majority of them smoked more than 10 cigarettes a day (58%), 17% smoked 4-6 cigarettes a day, followed by 12.5% smoked 1-3 cigarettes and also 12.5% of them smoked 7-9 cigarettes a day.

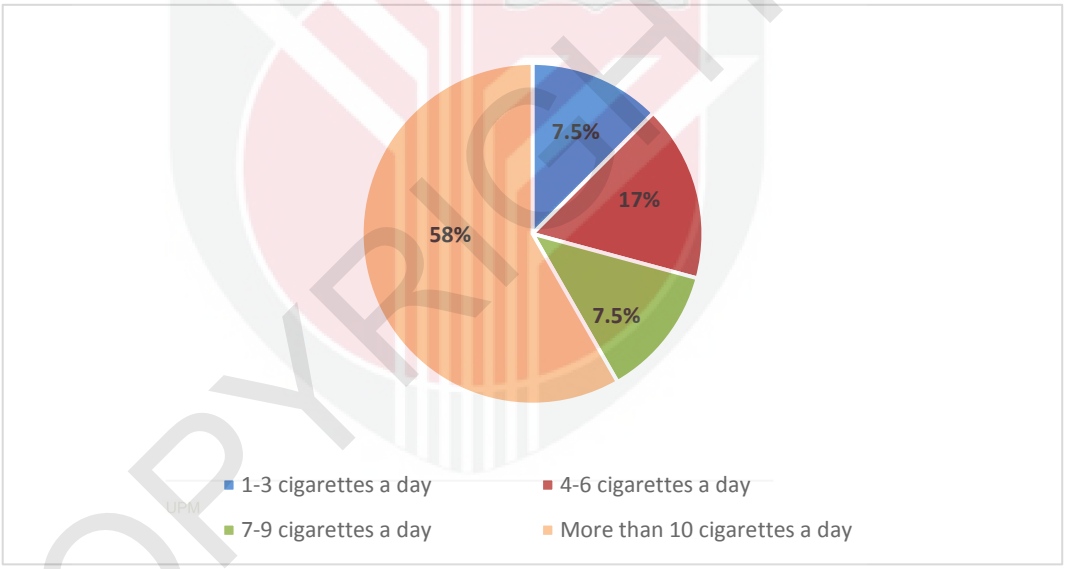

Figure 4.2: Amount of cigarettes a day (n=120)

Table 4.7: Descriptive Analysis for Daily Lifestyle of the Respondents (N = 200)

Variable	Frequency (%)	Mean ± SD	Median (IQR)	Min-Max
Smoking				
Yes	120 (60)			
No	80 (40)			
Age start smoking (years old)		19 ± 5	18 (5)	12-40
Amount of cigarette a day (n=120)				
1-3 cigarettes	15 (12.5)			
4-6 cigarettes	20 (16.7)			
7-9 cigarettes	15 (12.5)			
More than 10 cigarettes	70 (58.3)			
Physical activities				
Yes	177 (88.5)			
No	23 (11.5)			
Level of activities (n=177)				
Low	63 (35.5)			
Moderate	78 (44)			
High	36 (20.5)			
Duration of exercise (n=177)				
< 15 minutes	2 (1.1)			
> 15 minutes	175 (98.9)			

4.4 Association between Diabetes with The Factors

4.4.1 Association between Socio-demographic Characteristic and Diabetes

Based on Table 4.8, the results of the Chi-square test showed that no significant association was found between age, monthly total income, marital status and level of diabetes education ($p \geq 0.05$).

In the association between diabetes and race, the result showed that 41 out of 190 Malays (22%) had diabetes as compared to Non-Malay where 6 out of 10 respondents (60%) of them had diabetes. This study found that diabetes is significantly associated with race.

Table 4.8: Association between Age, Monthly Total Income, Race, Marital Status, Level of Education with Diabetes (N = 200)

	Diabetic		**Total**	**x^2**	**p-value**	**df**
	Yes	**No**				
Age (years old)						
Mature	32 (26.4%)	89 (73.6%)	121	1.479[a]	0.224	1
Youth	15 (19%)	64 (81%)	79			
Monthly Total Income						
Low Income	17 (21.8%)	61 (78.2%)	78	0.207[a]	0.649	1
High Income	30 (24.6%)	92 (75.4%)	122			
Race						

Malay	41 (21.6%)	149 (78.4%)	190	5.810[b]	0.016*	1
Non-Malay	6 (60%)	4 (40%)	10			
Marital status						
Married	47 (24%)	148 (76%)	195	0.520[b]	0.209	1
Single	0 (0%)	5 (100%)	5			
Level of Education						
Secondary School	38 (24%)	121 (76%)	159	0.069[a]	0.793	1
Tertiary education	9 (22%)	32 (78%)	41			

Low Income: ≤ RM4850; High Income: ≥ RM4851 (Department of Statistics Malaysia)
Youth: 15 – 40 years old; Mature working age: 41 – 64 years old (The National Youth Development Policy of Malaysia)
[a]0 cells (0.0%) have expected count less than 5. Therefore, Pearson Chi-Square test was considered.
[b]1 cells (25.0%) have expected count less than 5. Therefore, Continuity Correction test was considered.
*significant at $p < 0.05$

4.4.2 Work Related Information

Table 4.9 (Chi-square test) and 4.10 (Mann-Whitney U test) summarized the statistical test results to associate diabetes with work related information of the respondents. The Chi-square test showed that type of work and work positions were not associated with diabetes.

The Mann-Whitney U test showed that working duration has slightly different in mean rank which was higher among diabetic people as compared to non-diabetic people. Individuals who work in normal time showed lower mean rank among diabetic compared to non-diabetic and these results found that there were small number of workers with diabetic in a normal working hours. However, no significant different was observed between lengths of working time with diabetes

among the workers in the port container terminal. This results showed that the duration of working time is not associated with having diabetes among the workers.

Table 4.9: Association between Type of Work and Work Position with Diabetes (N = 200)

	Diabetic		Total	x^2	p-value	df
	Yes	No				
Type of Work						
Shift work	41 (24.4%)	127 (75.6%)	168	0.478	0.489	1
Normal time	6 (18.8%)	26 (81.2%)	32			
Work Position						
Shift workers	29 (24%)	92 (76%)	121	0.037	0.847	1
Office workers	18 (22.8%)	61 (77.2%)	79			

Table 4.10: Association between Working Duration, Normal Working Hour and Over Time with Diabetes (N = 200)

	Diabetic		U	Z	p-value
	Yes (n=47)	No (n=153)			
	Mean Rank	Mean Rank			
Working Duration	114.62	96.16	2932.00	-1.92	0.06
Normal Working Hour	90.68	103.52	3134.00	-1.80	0.07
Over Time	102.35	99.93	3508.50	-0.29	0.77

4.4.3 Medical History of Respondents

Chi-square was used to associate between diabetes and the medical history of respondents. As summarized in Table 4.11, none of the medical history components were significantly associated with diabetes among the workers.

Table 4.11: Association between Medical History with Diabetes (N = 200)

	Diabetic		Total	x^2	p-value	df
	Yes	No				
Relative having Diabetes						
Yes	22 (25.6%)	64 (74.4%)	86	0.364[a]	0.547	1
No	25 (22%)	89 (78%)	114			
Suffering Hypertension						
Yes	7 (18%)	32 (82%)	39	0.830[a]	0.362	1
No	40 (24.6%)	121 (75.2%)	161			
Relative having Hypertension						
Yes	19 (20%)	77 (80%)	96	1.412[a]	0.235	1
No	28 (27%)	76 (73%)	104			

[a]0 cells (0.0%) have expected count less than 5. Pearson Chi-Square test was considered.

4.4.4 Anthropometry, Body Fat and Blood Pressure Measurement (N = 200)

Chi-square test was performed to associate diabetes with anthropometric, Body Fat and Blood Pressure Measurement as displayed in Table 4.12. The result showed that there is marginal significant association between BMI with diabetes among workers at the port container terminal. Underweight, overweight and obese respondents were categorized as having abnormal BMI and 45 (26%) of them are diabetic and only 2 (8%) of them have normal BMI. Among those with diabetes, 40 (25%) of them have abnormal body fat as compared to 7 (17%) who have normal body fat with diabetes. 25% of the workers were having abnormal waist circumference and having diabetes. 25% of the workers who are having hypertension were also diagnosed having diabetes. Measurement of waist circumference, body fat and blood pressure among the workers in the port container terminal were not significantly associated with diabetes.

Table 4.12: Association between Waist Circumference, BMI, Body Fat and Blood Pressure Measurement with Diabetes (N = 200)

	Diabetic		Total	x^2	p-value	df
	Yes	No				
Waist circumference						
Abnormal	33 (25%)	98 (75%)	131	0.604	0.437	1
Normal	14 (20.3%)	55 (79.7)	69			
BMI						
Abnormal	45 (25.7%)	130 (74.3%)	175	3.818	0.051	1

Normal	2 (8%)	23 (92%)	25			
Body fat measurement						
Abnormal	40 (25.2%)	119 (74.8%)	159	1.185	0.276	1
Normal	7 (17%)	34 (83%)	41			
Blood pressure measurement						
Yes	25 (24.8%)	76 (75.2%)	101	0.178	0.673	1
No	22 (22.2%)	77 (77.8%)	99			

4.4.5 Dietary Intakes of the Respondents

The chi-square test was conducted to associate components of dietary intake with diabetes as displayed in Table 4.13. The results showed no significant association between the dietary intake components with diabetes, except for eating carbohydrates. The frequency of eating more carbohydrates was found to be significantly different between diabetic and non-diabetic workers ($p = 0.005$). It showed that among those who consume carbohydrates only once a day, 17% (8 out of 47) of them were diabetic as compared to 83% were non-diabetic. Among those who consume carbohydrates twice a day, 19% (20 out of 107) of them were diabetic as compared to those who were non-diabetic (81%). Among those who consume carbohydrate trice a day, 41% (19 out of 46) of them were diabetic as compared to those who were non-diabetic (59%). This result showed that individuals who frequently consume more carbohydrates have high tendency to have diabetes.

Table 4.13: Association between Regulated Diet with Diabetes (N = 200)

	Diabetic		Total	x^2	p-value	df
	Yes	**No**				
Eating Fast Food a week						
None	27 (27%)	73 (73%)	100	2.562	0.464	3
1-2 times	4 (13.3%)	26 (86.7%)	30			
3-5 times	1 (16.7%)	5 (83.3%)	6			
Others	15 (23.4%)	49 (76.6%)	64			
Eating outside foods a week						
None	4 (26.7%)	11 (73.3%)	15	0.133	0.988	3
1-2 times	9 (23.7%)	29 (76.3%)	38			
3-5 times	19 (23.8%)	61 (76.2%)	80			
Others	15 (22.4%)	52 (77.6%)	67			
Regulated Diet						
Yes	21 (21.9%)	75 (78.1%)	96	0.271	0.603	1
No	26 (25%)	78 (75%)	104			
Taking Rice with Sugary Drinks						
Never	14 (20%)	56 (80%)	70	4.719	0.194	3
1 time	19 (31.7%)	41 (68.3%)	60			
2 times	11 (17.7%)	51 (82.3%)	62			
3 times	3 (37.5%)	5 (62.5%)	8			

Taking Fruits in a week						
None	2 (15.4%)	11 (84.6%)	13	0.901	0.825	3
1-2 times	16 (22.9%)	54 (77.1%)	70			
3-5 times	21 (26.3%)	59 (73.7%)	80			
Others	8 (21.6%)	29 (78.4%)	37			
Taking Vegetables in a week						
None	0 (0%)	5 (100%)	5	2.577	0.462	3
1-2 times	10 (23.8%)	32 (76.2%)	42			
3-5 times	21 (27.6%)	55 (72.4%)	76			
Others	16 (20.1%)	61 (79.9%)	77			
Foods with High salt content						
Yes	18 (25.7%)	52 (74.3%)	70	0.294	0.588	1
No	29 (22.3%)	101 (77.7%)	130			
Frequency of eating in a day						
1 time	2 (28.6%)	5 (71.4%)	7	4.071	0.254	3
2 times	13 (16.5%)	66 (83.5%)	79			
3 times	28 (27.2%)	75 (72.8%)	103			
4 times	4 (36.4%)	7 (63.6%)	11			

Daily carbohydrate intake						
1 time	8 (17%)	39 (83%)	47	10.585	0.005*	2
2 times	20 (18.7%)	87 (81.3%)	107			
3 times	19 (41.3%)	27 (58.7%)	46			

*significant at $p < 0.05$

4.4.6 Lifestyle of the Respondents

Table 4.14 reported the findings of the Chi-square test of association between lifestyle with diabetes. A total of 23% of the respondents who were diagnosed with diabetes smoked cigarettes. Among them, 43 (24%) workers who were doing physical activities or exercises were also categorized as diabetic. However, the results showed that smoking and exercises were not significantly associated with diabetes.

Table 4.14: Association between Lifestyle of Respondents with Diabetes (N = 200)

	Diabetic		**Total**	**x^2**	**p-value**	**df**
	Yes	**No**				
Smoking						
Yes	27 (22.5%)	93 (77.5%)	120	0.167	0.683	1
No	20 (25%)	60 (75%)	80			

Exercises						
Yes	43 (24.3%)	134 (75.7%)	177	0.539	0.463	1
No	4 (17.4%)	19 (82.6%)	23			

4.5 Predictor of Diabetes among Workers at Port Container Terminal

Table 4.15 shows the important factor of diabetes among the workers. There was one factor that significantly associated with diabetes namely daily carbohydrate intake. However, BMI shown marginally significant. These two factors were included in Multiple Logistic Regression.

Table 4.15: The Association between Factors with Diabetes among Workers at Port Container Terminal (Simple Logistic Regression)

Variable		**Crude OR (95% CI)**	**Wald Statistics (df)**	**p-value**
Age	Mature	0.65 (0.33, 1.30)	1.47 (1)	0.23
	Youth	-	-	-
Monthly income	Low	0.86 (0.43, 1.68)	0.21 (1)	0.65
	High	-	-	-
Marital status	Married	0.65 (0.11,3.95)	0.22 (1)	0.64
	Single	-	-	-
Level of education	Secondary	0.90 (0.39, 2.04)	0.07 (1)	0.79
	Tertiary	-	-	-
Type of work	Shift	0.72 (0.28, 1.86)	0.48 (1)	0.49

	Normal	-	-	-
Work position	Crane	0.94 (0.48, 1.83)	0.04 (1)	0.85
	Office	-	-	-
Family history	Yes	0.82 (0.42, 1.58)	0.36 (1)	0.55
with diabetes	No	-	-	-
Family history	Yes	1.49 (0.77, 2.90)	1.40 (1)	0.24
with	No	-	-	-
hypertension				
Waist	Abnormal	0.76 (0.37, 1.53)	0.60 (1)	0.44
circumference	Normal	-	-	-
BMI	Abnormal	0.25 (0.06, 1.11)	3.33 (1)	0.06
	Normal	-	-	-
Hypertension	Yes	0.87 (0.45, 1.67)	0.18 (1)	0.67
	No	-	-	-
Body fat	Abnormal	0.61 (0.25, 1.49)	1.17 (1)	0.28
	Normal	-	-	-
Eating fast food	None	-	-	-
in a week	1-2 times	2.40 (0.77, 7.53)	2.27 (1)	0.13
	3-5 times	1.85 (0.21, 16.56)	0.30 (1)	0.58
	Others	1.21 (0.58, 2.50)	0.26 (1)	0.61
Eating outside in	None	-	-	-
a week	1-2 times	1.17 (0.30, 4.60)	0.05 (1)	0.82
	3-5 times	1.17 (0.33, 4.10)	0.06 (1)	0.81
	Others	1.26 (0.35, 4.54)	0.13 (1)	0.72
Eat rice with	Never	-	-	-

sugary drinks	1 time	0.54 (0.24, 1.20)	2.29 (1)	0.13
	2 times	1.16 (0.48, 2.78)	0.11 (1)	0.74
	3 times	0.42 (0.09, 1.96)	1.23 (1)	0.27
Eat fruits in a	None	1.52 (0.28, 8.29)	0.23 (1)	0.63
week	1-2 times	0.93 (0.36, 2.43)	0.02 (1)	0.88
	3-5 times	0.78 (0.31, 1.96)	0.29 (1)	0.59
	Others	-	-	-
Eat vegetables in	None	1.00 (0.67, 1.48)	0.01 (1)	0.98
a week	1-2 times	0.84 (0.34, 2.06)	0.15 (1)	0.70
	3-5 times	0.69 (0.33, 1.45)	0.97 (1)	0.32
	Others	-	-	-
Foods high salts	Yes	0.83 (0.42, 1.63)	0.29 (1)	0.59
	No	-	-	-
Frequency of	Less	-	-	-
eating	frequent			
	Frequent	0.70 (0.09, 5.43)	0.12 (1)	0.73
Daily	Less	-	-	-
carbohydrate	frequent			
intake	Frequent	3.16 (1.50, 6.63)	9.22 (1)	**0.02***
Smoking	Yes	1.15 (0.59, 2.23)	0.17 (1)	0.68
	No	-	-	-
Physical	No	1.52 (0.49, 4.73)	0.53 (1)	0.47
activities	Yes	-	-	-

* $p < 0.05$

Table 4.16 showed a Multiple Logistic Regression which was conducted by including the significant factor into the model. Workers who consumed carbohydrates frequently have 3.2 times the odd of getting diabetes than those whose consumed carbohydrates less frequent. The regression analysis result displayed in Table 4.16 explained 11.5% variation in diabetes among the workers.

Table 4.16: The Predictor of Diabetes among Workers at Port Container Terminal (Multiple Logistic Regressions)

Variable		Adjusted OR (95% CI)	Wald Statistics (df)	p-value	B
BMI	Healthy	-	-	-	
	Unhealthy	0.23 (0.52, 1.03)	3.68 (1)	0.06	-1.47
Daily carbohydrate intake	Less frequent	-	-	-	
	Frequent	3.16 (1.50, 6.63)	9.22 (1)	**0.02***	1.15

Less frequent: ≤ 2 times, Frequent: 3 times
Nagelkerke, R^2 = 0.115
*** p < 0.05**

Therefore, the prediction model of diabetes among workers is:
Diabetes = 0.06 + [1.15* carbohydrate intake frequent], $R^2 = 0.115$, $p<0.05$

CHAPTER 5

DISCUSSION

5.1 Socio-demographic and Background Information of Respondents

In this sample, all respondents were men with a mean age of 44 ± 8 and the age range was between 25 and 63 years. Most of the respondents who had elevated blood glucose were among mature workers. These were in line with the research done by Mordarska & Godziejewska-Zawada (2017) that mentioned about the most important factors of hyperglycaemia are known to be insulin secretion dysfunction that occurs with age and growing insulin resistance. The research was done by Holman et al. (2008) stated that Type 2 diabetes usually occurs in people over the age of 40; it is a largely preventable, non-curable disorder that is controlled by diet and regular physical exercise while it requires medication and/or insulin. According to International Diabetes Federation (2013), approximately 5.1 million people between the ages of 20 and 79 died of diabetes in 2013, accounting for 8.4% of all deaths worldwide from this age range. Feisul & Azmi (Eds), (2013) in National Diabetes Registry Report emphasizes that those aged between 45 and 54 years were the largest proportion (32.6%) followed by those between the ages of 55 and 64 (28.7%) and those between the ages of 30 and 44 (20.1%).

Their monthly incomes were in the range from RM1000 to RM9000 per month. Among the workers, 78 of them (39%) had low income and 122 (61%) were high income (Department of Statistics Malaysia). The mean monthly income of the workers was RM 3592 ± 982 which means, they were in low income group. The findings also revealed that respondents with low incomes had better levels of glucose than those with high incomes. It is because respondents with low incomes have insufficient financial resources to purchase food. Respondents then only purchase basic foods. One factor low-income respondents may control their level of glucose is that most of them have their own home meals. That means the use of cooking ingredients can be regulated by the respondents themselves thus helping respondents to consistently and efficiently control their diet. According to the Agency for Healthcare Research and Quality (2011), individuals residing in low-income neighbourhoods are more likely to be admitted in the hospital for diabetes or associated complications than people living in wealthier regions. In contrast, a study by Gordon et al., (2011) found that food deserts have a disproportionate impact on lower-income, minority, and rural communities, while access to fast-food outlets and energy-dense food in lower-income and urban areas is larger.

The results of the research showed that 95 % of the respondents who took part in this study were Malay, represented by 190 respondents and only 0.5% were Chinese and 4.5% were Indian. This pattern is in line with National Diabetes Registry Report (2013) which reported that the ethnic distribution for patients registered were Malay 58.9%, Chinese 21.4%, Indian 15.3%, other Malaysian 4.2% and foreigner/unknown 0.2%.

Married respondents are the higher contributor in providing a response to this study with a percentage of 97.5% which is 195 respondents and the remaining 2.5% were single. For education level, 79.5% of respondents completed secondary school as their highest education level and 20.5% had completed college or university. A previous study from Chin, Sathyasurya, Saad & Mohamed (2013) revealed that in their diabetes study the majority of respondents were married people (56.2%) and housewives (50%) and had poor levels of education (39.5%). Previous prospective research done by Valdes et al. (2007) stated that the relationship between educational accomplishments and diabetes occurs, and concludes that low education is an important T2D indicator. A cross-sectional analysis from Dasgupta, Khan & Ross (2010) showed that the incidence of T2D among the undereducated, obese and inactive was higher than in the more educated. These previous research were parallel with this study which showed that 38 out of 47 (24%) of diabetic workers were among those who completed secondary school.

5.2 Prevalence of Diabetes among Workers in Port Container Terminal

The prevalence of T2D in this research is 23.5%. This finding is in line with results from previous studies Hussein (2015) stated that the prevalence of T2D in adults over the age of 30 has risen to 20.8%, impacting 2.8 million people. A new review of the regional studies by Tee and Yap in 2017 also reported that the overall prevalence of DM in 2015 was 17%, more than double since 1996. Letchuman et al. (2010), carried out a study among workers with workload almost similar with the port container terminal workers namely machine operators and assemblers. Their findings on the prevalence of diabetes among machine operators and assemblers was

11.7% which was slightly low than this study. Previously, the Malaysian Ministry of Health (MOH) estimated that the incidence of T2D could increase to as high as 20.1% by 2020 if the related variables such as overweight/obesity, unhealthy diet, and inappropriate physical activity were not tackled comprehensively. The finding of this study was slightly higher than the MOH prediction and the related factors were discussed in the next subchapter.

5.3 The Factors of Diabetes among Workers at Port Container Terminal

5.3.1 Working Characteristics of the Respondents

Most of the respondents had been working at port container terminal for over 17 years as the mean value was 17 ± 7 years. The mean value of normal working hours was 46 ± 4 hours which ranged between 30-72 hours per week. For overtime, the mean value was 14 ± 5 hours which ranged between 0-24 hours per week. The Malaysian Employment Act defines the workweek as 48 hours, with a maximum of eight working hours per day and six working days per week. However, there were some workers who had been working until 72 hours per week which can lead to health issues. From the finding of prospective cohort studies, they showed that working long hours is associated with factors that lead to diabetes, such as work stress, depressive symptoms, sleeps disturbances and unhealthy lifestyle (Murray et al., 2012). Virtanen et al. (2012) stated that working long hours is also related to an increased risk of cardiovascular disease, which is listed as one of the complications or issues of T2D. In the low socioeconomic status community, the association between long working hours and diabetes was clear, but null in the high socioeconomic status category (Kivimäki et al., 2015). However, this study showed

no significant association between working duration, normal working hours and overtime working hour factors with diabetes. The long duration of working hours usually leads to work stress or work strain and the workers have less time to eat and rest. There was a study showed that there was a high prevalence of job strain among port workers resulting from physical job demand, anxiety, physical isometric and muscle ache (Yakub and Sidik, 2014).

84% of the respondents have been working in shift hours as compared to 16% in normal working hours. In this study, there was no association between work shifts with diabetes. However, previous research found the relationship between shift work and diabetes. Shift work was identified as a risk factor of health problems and may cause many negative effects (Guo et al., 2013). Operating in a rotational shift, especially when it involves night work, may affect both the quality and quantity of sleep. Accumulation of data from prospective studies indicated that an increased risk of type 2 diabetes was correlated with sleep deprivation and sleep disorders (Sallinen & Kecklund, 2010). A few studies stated that there were associations between rotating night shift work and increased risk of metabolic syndrome conditions which are closely related to T2D (De Bacquer D et al., 2009). Prospective studies in male Japanese workers showed that shift/alternation workers had chances of increased risk of diabetes and impaired glucose metabolism compared to day workers (Suwazono et al., 2006). The results were in contrast with this study which may be due to different cultures between the country and the nature of the works itself.

5.3.2 Medical History of Respondents

From this study, a few respondents noted that they consumed Metformin as diabetes medicine. According to the National Diabetes Registry Report (2013), Metformin was the most popular Oral Anti-Diabetes Drugs (OAD) prescribed in 2012 with 82.5% of T2DM patients being treated with the medicine, followed by 56.9% being controlled with Sulphonylurea. In this study, the workers who had parents or siblings with diabetes and hypertension were about 26% and 20% respectively. A previous research found that genetic components play a significant role in T2D pathogenesis (Amini & Janghorban, 2007). Another research documented that positive family history of first degree relations gives an increased risk of T2D and the risk is stronger when both parents are involved. (Ma et al., 2008). Even though, in this study, there was no significant association between family history with diabetes as the p-value more than 0.05.

5.3.3 Anthropometry, Body Fat and Blood Pressure Measurement

The mean weight of the respondents was 79.8 ± 17.8 kg and ranging between 46.3 – 181.1 kg. Meanwhile, the mean height of the respondents was 169.6 ± 5.7 cm and the range was between 151.5 – 182.5 cm. The mean value for BMI of the respondents was 27.7 kg/m^2 which can be concluded as obese. The respondents also been categorised into 4 categories; underweight 2 (1%), normal 25 (12.5%), overweight 84 (42%) and obese 89 (44.5%). Underweight, overweight and obese respondents were categorized as having abnormal BMI and 45 (26%) of them are diabetic and only 2 (8%) of them have normal BMI. According to the National

Diabetes Registry Report (2013), the mean body mass index (BMI) of 27.4 kg/ m2 was observed in individuals with T2D and BMI less than 23 kg/m2 was only reached by 16.6%. A research by Almdal et al. (2008) research showed that there is a clear positive association between obesity and type 2 diabetes in males.

The range of body fat was 4.0% – 58.1% and the mean value for body fat of the respondents was 26.4% which indicated the most of them have high body fat. The respondents have also been categorised into 4 categorises; low fat 5 (2.5%), normal 36 (18%), high fat 78 (39%) and very high fat 81 (40.5%). Then, workers with normal body fat were categorized as normal while workers with high and very high body fat were categorized as abnormal. However, in this study, the result of the chi-square test showed there was no significant association between body fat with diabetes ($p>0.05$). Cross-sectional studies have found that elevated rates of BMI are correlated with higher levels of total cholesterol and undesirable lipids, low levels of HDL cholesterol and lower concentrations of triglycerides. In addition to triglycerides, it has been shown that all these lipids represent diabetes risk independently of BMI, but little research has been performed about how they interact (Wild & Byrne, 2006). Also, a study was done by Chin, Sathyasurya, Saad & Mohamed (2013), indicating that most of the respondents for their diabetes research had high central adiposity (83.8%), as well as hyperlipidaemia (66.2%). Another research done by Flor and Campos (2017) showed that there was a higher prevalence of diabetes in people who have been diagnosed with hypercholesterolemia (22.0%) and arterial hypertension (17.0%). Excess adiposity will lead to glucose intolerance and insulin resistance, which makes the difficulty increase in treating patients with obesity and diabetes.

Among all the respondents, 131 (65.5%) have abnormal waist circumference which is greater than 90 cm. The mean waist circumference was 96 cm, indicating that on average they were abnormal and having over inches. 25% of the workers were having abnormal waist circumference and having diabetes. However, this study found no significant association between waist circumferences with diabetes. In contrast, studies conclude that waist circumferences have an association with diabetes. According to a research, a Palau study found that age and broad waist circumference were variables correlated with diabetes. (Hilawe et al., 2016). In the Malaysia DiabCare study (2008), the unfavourable diameter of the waist was stated to be higher for women (≥80 cm in 89.4%) than men (≥90 cm in 73.7%) who have T2D. Among adults, the most powerful determinant of increased glucose levels was the waist-to-hip ratio, then the body mass index as it was observed in other studies (Mohamud et al., 2011).

Overall, the mean systolic and diastolic pressure of the respondents was 140 mmHg and 85 mmHg respectively, which can be categorized as uncontrolled blood pressure. 25% of the workers who are having hypertension were also diagnosed having diabetes. According to the National Diabetes Registry Report (2013), the mean systolic and diastolic BP was 135.5 mmHg and 78.4 mmHg respectively, of which 40.9% had a BP control of roughly 130/80 mmHg and for data available in Malaysia audited in 2012, 70.1% of T2D patients had hypertension and 55.1% had dyslipidemia. A study was done by Viegas-Pereira et al. (2013) emphasized that having hypertension duplicated the chance of getting diabetes in the elderly. Hypertension not only raises the likelihood of complications like cardiovascular diseases in patients with co-morbid hypertension and T2D, but it also greatly impacts

the treatment of all conditions, long-term survival and the health care network. Anyhow, the results in this study do not coincide with previous studies as the p-value > 0.05. Thus, there was no significant association between hypertension with diabetes.

5.3.4 Dietary Intake of the Respondents

The dietary patterns are significant factors in lifestyle correlated with the progression of T2D. There has been a strong correlation between the possibility of T2D and the various food intake patterns (Sun, 2010). In total, there were 35% of the workers who ate fast food like KFC/McD/burger/pizza/hot dogs more than 3 times in a week. The percentages of respondents who ate outside food 3-5 times and 6 or more times in a week were 40% and 33.5% respectively. These showed that the respondents often eat fast food and eat outside food. Varieties of dishes and food options available in the stall certainly have the ingredients which suit the tastes of the customers. This situation will make it difficult to control food intake when eating out. After all, enough money makes it easy for respondents to buy or eat whatever they want.

The result from this study showed that 30% of the respondents take rice with sugary drinks once and 31% take rice with sugary drinks twice a day and portrayed that most of them love to drink sugary drinks during eating. In a research done by Malik et al., (2010), they mentioned that emerging evidence also indicates that chronic Sugar Sweetened Beverages (SSB) intake entails an increased risk of metabolic syndrome and T2D. Individuals who consumed SSBs most often 1-2

servings/day had a 26% greater risk in developing T2D than individuals who consumed SSBs none or less than 1 serving/month. Choi (2008) stated that fructose in SSBs also able to elevate the concentrations of uric acid in the blood and SSB intake was related to hyperuricemia as well as increases blood pressure and metabolic syndrome mediated characteristics. Although this study indicates a high percentage of fruit and vegetable consumption, the control of diabetic respondents is not influenced by this. Fruit intake is good for patients with diabetes but patients can monitor and minimize sweet and high-calorie fruit intake.

For this study, on average, 103 respondents eat 3 times a day which contributes to 51.5% and it was a huge percentage. For working respondents, the frequency of eating is inevitable due to time constraints and busywork. Based on the previous study, extremely high eating frequency led to significantly higher amounts of 24-hour glucose (Munsters & Saris, 2012). Research done by McCrory & Campbell (2011) stated that, frequent eating or snacking can also influence body weight and the risk of metabolic diseases. Increased meal frequency thus retaining a consistent calorie intake has been recommended to boost risk factors for chronic diseases in T2D patients (Timlin & Pereira, 2007). However, the result showed that, there was no significant association between the frequencies of eating with diabetes.

Epidemiological research has demonstrated over the past few decades that diet plays a significant role in the development of T2DM, and have documented the correlation between the consumption of individual foods or nutrients and also the risk of T2DM (Cooper et al., 2012). In this study, 41% of the respondents who consumed carbohydrates more frequent were diabetic. The frequency of eating more

carbohydrates was found to be significantly different between diabetic and non-diabetic workers (p = 0.005). This result showed that individuals who frequently consume more carbohydrates have high tendency to have diabetes. Sakurai et al. (2016) in their cohort study found that higher intakes of carbohydrate were associated with an increased risk of new-onset T2D in obese individuals rather than in non-obese people. Villegas et al. (2007), in a cohort study conducted in Chinese women, recorded positive associations between dietary carbohydrate consumption, Glycaemic Index (GI) and Glycaemic Load (GL), and the occurrence of T2D and a stronger correlation between white rice intake and risk of developing T2D.

However, the assessments of dietary intake may not accurately reflect respondents' calorie intake and nutrient levels as the results depend on the honesty of the respondent during the interview. This study also found that there was no significant relationship between eating fast food, outside food, eating rice with sugary drinks, consumption of fruit, vegetable and frequency of eating in a day with diabetes.

5.3.5 Daily Lifestyle of the Respondents

Out of 200 respondents, 120 (60%) of them were smoking. The mean cigarettes smoked per day were 19 ± 5. The majority (35%) of them smoked more than 10 cigarettes a day, 10% smoked 4-6 cigarettes a day, followed by 7.5% smoked 1-3 cigarettes and also 7.5% of them smoked 7-9 cigarettes a day. A total of 22.5% of the respondents who were diagnosed with diabetes are smoking. Several reports indicate that heavy smokers with proof of elevated systemic inflammation, who gain

substantial weight after smoking, are at high risk of developing T2D (Yeh et al., 2010). Many reports have documented smoking's adverse effects on diabetes mellitus. Smoking raises the incidence of diabetes and aggravates micro and macro-vascular complications. Smoking is related to insulin resistance, inflammation, and dyslipidemia, but the specific mechanisms by which smoking cause's diabetes mellitus are not established (Chang, 2012). A research done by Seet et al. (2012) revealed that smokers have a significantly elevated insulin resistance index homeostatic model assessment one hour after smoking. A few findings have been seen in ethnic groups including research of almost 50,000 Chinese people who have been tracked for 5.4 years on average. For this cohort, those who consumed more than 20 cigarettes a day had an increased T2D incident hazard ratio of 1.25 (95% CI: 1.00, 1.56), and people with an average of ≥ 40 pack-year experience of smoking had an elevated T2D hazard of 1.28 (95%CI: 1.04, 1.57) (Shi et al., 2013). However, the results of this study did not parallel with the previous study as there was no significant association between smoking with diabetes (p-value > 0.05).

In this study, 177 (88.5%) of respondents doing physical activities and another 23 (11.5%) did not perform physical activities. Among the respondents that perform physical activities, 2 (1%) respondents doing it more than 15 minutes while the majority of them doing it for more than 15 minutes. The percentage of the level of physical activity was 35.5% of the respondents performs a low level of physical activity, 44% in a moderate level of physical activities and the rest 20.5% of the respondents perform a high level of physical activity. Among them, 43 (24%) workers who were doing physical activities or exercises were also categorized as diabetes. This study showed that the respondents actively involved in physical

activities. However, there was no significant association between physical activities with diabetes ($p>0.05$). Most of the researchers found that physical inactivity can lead to diabetes. Research and surveys done by Tan and Magarey (2008) reported that Malaysia's general adult population recorded the physical inactivity of one in two Malaysian adults with diabetes. It was also reported that 54% of Malaysian adults who had diagnosed with diabetes were physically inactive (Tan & Magarey, 2008). A sedentary lifestyle is a major cause of overweight and obesity, which in turn represent major risk factors for T2D. Individuals who are having a sedentary lifestyle and obese were approximately two times more affected by diabetes when compared to those who did not show signs and symptoms (Flor & Campos, 2017). According to NHMS (2015), physical inactivity was listed as the fourth leading global mortality risk factor (6% of deaths worldwide), after high blood pressure (13%), tobacco usage (9%) and high blood glucose (6%). For certain countries, inadequate physical activity is on the increase, contributing to the risk of non-communicable diseases (NCDs), and impacting public wellbeing around the world. People who are not adequately active have an elevated chance of mortality of 20% to 30% compared to those who are adequately active.

5.4 Association between Diabetes with The Factors

5.4.1 Association between Socio-demographic Characteristic and Diabetes

Chi-square analysis was performed on socio-demographic factors and showed that there is a significant relationship between race with diabetes. Malaysian research showed the highest incidence of Type 2 diabetes (T2D) is led by Indians, followed by Malays and Chinese (Hussein et al., 2015). However, this finding shows that Non-

Malays led the highest number of people having diabetes, than Malays. On the other hand, this study found that age, monthly income, marital status, education level were not significantly associated with diabetes.

5.4.2 Anthropometry, Body Fat and Blood Pressure Measurement

The result of chi-square test showed there was a marginally significant association between BMI with diabetes (p=0.06). The correlation between obesity and the development of diabetes was attributed to insulin resistance induced by fatty tissue accompanied by progressive beta-cell loss due to the assumption that insulin blood glucose accumulates and causes beta-cell apoptosis, insulin deficiency may arise and diabetes is diagnosed (Willi et al., 2007). A study conducted by Mohamud et al. (2011) also found that abdominal obesity epidemiology in Malaysian adults is strongly associated with T2D, such that both have been inseparable in terms of increasing prevalence and patterns across socio-demographic groupings. Other than BMI, this study found no significant association between waist circumferences, hypertension and body fat with diabetes (p>0.05).

5.4.3 Dietary Intakes of the Respondents

The frequency of eating more carbohydrates was found to be significantly different between diabetic and non-diabetic workers (p = 0.005). This result showed that individuals who frequently consume more carbohydrates have high tendency to have diabetes. In their systematic analysis of white rice intake and risk for T2D, Hu et al. (2012) stated that increased white rice consumption was associated with an

increased risk of T2D in the Japanese and Chinese populations. They also suggested that the correlation between white rice intake and T2D was greater for the population of Asia compared to the western population.

5.5 The Predictors of Diabetes among Workers at Port Container Terminal

Frequency of consuming carbohydrates in a day were the most significant factor and BMI shown marginally significant association with diabetes after conducting Multiple Logistic Regression.

Workers who consumed carbohydrates frequently were 3.2 times the odd of getting diabetes than those whose consumed carbohydrates less frequent.

CHAPTER 6

CONCLUSION & RECOMMENDATION

6.1 Conclusion

For socio-demographic factors, the study showed that the majority of respondents were Malays (95%), married (97.5%), mean age 44 years old which was in mature working age and graduated from high school (79.5%). The mean monthly income of the workers was RM 3592 ± 982 which means, they are in high income group. The majority of the respondents work in shift working hours (84%) and work in RTG (31.5%) where they need to ensure that the loads settle securely on the vessel or wharf. They require expertise to change the loads in order to prevent any harm to the vessels and equipment. Crane operators need to operate correctly and keep pace with achieving their everyday profitability goal, as well as maintaining container protection and preventing any harm. The mean duration of working of the respondents was 17 years with the mean of normal working hours was 46 hours that not exceed the maximum working hours which was 48 hours.

The prevalence of diabetes among the workers was 23.5% which represents 47 individuals. 10% were known diabetes based on respondents' self-reports on medication and treatment. 13.5% were newly identified as having abnormal blood

glucose levels from this study. The mean value was 9.5mmol/l and can be categorized as abnormal blood glucose level.

In the association between diabetes and race, the result showed that 41 out of 190 Malays had diabetes as compared to Non-Malay where 6 out of 10 respondents of them had diabetes. Mean BMI of the respondents was 27.7 kg/m^2, indicating that on average they were obese. On average, 103 respondents eat 3 times a day which contributes to 51.5% and it was a huge percentage. A total of in this study, 41% of the respondents who consumed carbohydrates more frequent were diabetic.

There was one factor that significantly associated with diabetes namely daily carbohydrate intake. However, BMI shown marginally significant. These two factors were included in Multiple Logistic Regression and the most significant factor of diabetes among workers at port container terminal was the daily carbohydrate intake. Workers who consumed carbohydrates frequently have 3.2 times the odd of getting diabetes than those whose consumed carbohydrates less frequent.

6.2 Strength and Limitation of the Study

This study is among the first to assess the prevalence of diabetes among workers at the port container terminal in Malaysia. If early detection of diabetes such as in this study had been done, the complications which potentially influence an individual's ability to do their job effectively can be avoided. The result in increase of medical costs to treat the disease due to working days lost also can be prevented. From the results of this study, employer can reorganize the position or work load and prioritize the risk workers from doing such a risk works which can increases the

cases at the work place. The screening for diabetes in this port container terminal gives the opportunity to the workers to implement lifestyle interventions at the earliest possible, which could prevent the development of diabetes. They can plan something such as practicing a healthy lifestyle and have a healthy food in order to have a better health condition. The employers can take prompt action to decrease the chances of getting chronic diseases among workers at the port container terminal by implementing health related programs. Employer also can plan preventive action and conduct physical activities that involves all the workers to enhances their awareness about chronic diseases especially diabetes among themselves.

There were several limitations from this study for instance, the duration of the research provided by the company is limited and forces the researcher to conduct the study in a tight schedule. This study only conducted at one port container terminal as the study population. Hence, the finding is suitable to explain the study population only and cannot be generalized to the whole workers' community. Next, the imbalanced ethnicity contributes to the different prevalence of diabetes. The majority of ethnic in this study were Malays (95%). Memory bias may occur where the accuracy of the data provided depends on the honesty of the respondent. The data that required respondents to recall things were all based on their memory capacities such as dietary intake and physical activities. This situation depends on the age and environmental factors at which this study was conducted. Furthermore, this study is limited to several health determinants to determine the prevalence of diabetes. There are several determinants not included in this study and may influence the prevalence of diabetes. This is due to some limitations such as research costs, study duration and lack of expertise. Another limitation of this study was the sampling method used

which the cross-sectional design study, gives the inclusive results. This type of study design could not define the true causal effect or any temporal relationship.

6.3 Recommendation

The most important recommendation for future studies by researchers was the selection of the respondents must include balanced ethnicity that can affect the dependent variable of this study. As for employers' recommendation, the employers need to take prompt action to reduce the chances of the workers to get diabetes among workers. This step was important to ensure the increase in workers' productivity and healthy manpower for the long term period. This statement can be supported by section 15 in Occupational Safety and Health Act 1994, which stated It shall the duty of every employer and every self-employed to ensure as far as practicable, the safety, health and welfare at work of all the employees at all time. As the results show that over 85% of patients are overweight and obese, another recommendation for the workers was to conduct appropriate physical activity and programs that involve all the workers to enhance their awareness about the benefits of exercising and the effectiveness of glucose control in their blood. Diabetic patients also should be advised to reduce their intake of sugary, carbohydrate and fatty foods.

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APPENDICES

APPENDIX A

Respondent's Information Sheet and Consent

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
Prevalens Diabetes dan Faktor Penentu dalam Kalangan Pekerja di Terminal Pelabuhan Kontena.

2. PENGENALAN
Diabetes merupakan salah satu penyakit yang dibimbangi dan merupakan penyakit kronik yang boleh menjejaskan kesejahteraan kehidupan manusia di seluruh pelusuk dunia berdasarkan dari morbiditi dan mortaliti yang tinggi. Kadar prevalens diabetes menunjukkan tren peningkatan dari tahun ke tahun. Perawatan diabetes bukan sahaja melalui ubat-ubatan yang diambil dengan cara sempurna tetapi ia juga memerlukan perubahan cara hidup, tingkahlaku disamping pengetahuan, amalan pemakanan, aktiviti fizikal, sokongan keluarga dan kemahiran pengurusan diri bagi mengawal tahap diabetes seseorang pesakit yang menjadi fokus dalam kajian ini. Diabetes yang tidak dirawat dan dikawal dengan baik boleh menyebabkan berlakunya komplikasi dan penyakit kronik lain seperti hipertensi, kegagalan fungsi buah pinggang, hilang penglihatan, strok, penyakit jantung dan lain-lain lagi. Keadaan diabetes yang tidak terkawal juga akan menurunkan produktiviti dalam pekerjaan seharian sekaligus menjejaskan ekonomi syarikat. Ini secara tidak langsung akan merugikan pihak syarikat dan pekerja yang terpaksa bercuti dan berehat di rumah akibat serangan penyakit tersebut. Kajian di terminal pelabuhan kontena ini akan dijalankan selama sebulan untuk tujuan pengumpulan data.

3. TUJUAN KAJIAN
Tujuan penting dalam kaian ini:

1. Untuk menentukan sosiodemografi dan maklumat latar belakang pekerja
2. Untuk menentukan prevalens diabetes
3. Untuk mengenalpasti faktor penentu
4. Untuk menentukan faktor yang paling penting yang berkaitan dengan diabetes di kalangan pekerja di terminal pelabuhan kontena.

4. APAKAH YANG PERLU ANDA LAKUKAN?
Anda dikehendaki menyertai pemeriksaan kesihatan dan memberi maklumat seperti yang dinyatakan dalam borang soal selidik yang disediakan, dijangka mengambil masa kira-kira 20 minit.

5. SIAPA YANG TIDAK BOLEH MENYERTAI KAJIAN INI?
Pekerja wanita, sesiapa yang tidak bersetuju untuk mengambil bahagian dalam kajian ini dan sesiapa yang tidak memahami Bahasa Melayu dan Inggeris tidak boleh menyertai kajian ini dan tidak digalakkan menjadi responden.

6. APAKAH FAEDAH MENYERTAI KAJIAN INI?

a) KEPADA ANDA SEBAGAI PESERTA?
Penglibatan anda sangat penting untuk memberikan maklumat tentang diabetes di tempat kerja dan mengetahui tahap kesihatan anda. Kajian ini juga membantu syarikat

untuk membuat program kesihatan seperti intervasi dan promosi kesihatan lebih berkesan kepada pekerja. Anda juga boleh mendapatkan hasil pengukuran selepas program dijalankan untuk simpanan anda.

b) KEPADA PENYELIDIK?
Maklumat dan data daripada kajian ini akan digunakan untuk mengetahui prevalen diabetes di tempat kerja dan membantu syarikat merancang aktiviti promosi kesihatan, membentuk plan strategik dan program pencegahan kepada kumpulan sasar.

7. ADAKAH IA BERISIKO?

Kajian ini tidak akan memberi risiko kepada anda

8. ADAKAH MAKLUMAT DAN IDENTITI SAYA KEKAL RAHSIA?

Semua maklumat yang diberikan adalah sulit dan akan disimpan rapi dan hanya digunakan dalam kajian ini sahaja.

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

Jika ada sebarang pertanyaan, sila hubungi personel di bawah:

i) Penyelidik:
Azmin Najihah binti Abd. Rahman
Jabatan Kesihatan Persekitaran dan Pekerjaan,
43400 UPM Serdang,
Selangor.
Tel. No : 014-2569496
Email : azminnajihah97@gmail.com

ii) Project supervisor:
Dr. Saliza bt Mohd Elias
Jabatan Kesihatan Persekitaran dan Pekerjaan,
Fakulti Perubatan dan Sains Kesihatan,
43400 UPM Serdang,
Selangor.
Tel no : 016-2213574
Email : saliza_me@upm.edu.my

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 B

Questionnaire

Jabatan Kesihatan Persekitaran dan Pekerjaan,

Department of Environmental and Occupational Health,

Fakulti Perubatan dan Sains Kesihatan,

Faculty of Medicine and Health Sciences,

Universiti Putra Malaysia.

Prevalens Diabetes dan Faktor Penentu dalam Kalangan Pekerja di Terminal Pelabuhan Kontena.

Prevalence of Diabetes and Its Determinant Factors among Workers at Port Container Terminal.

Arahan/*Instruction:*

1. *Borang soal selidik ini terbahagi kepada [6] bahagian:*
   This questionnaire is divided into [6] sections:

   Bahagian A/Section A: Maklumat Sosiodemografik/ *Socio-demographic Information*
   Bahagian B/Section B: Sejarah Penyakit/*Diseases History*
   Bahagian C/*Section C*: Ukuran Sampel/*Sample Measurement*
   Bahagian D/ *Section D*: Pengambilan Diet Harian/*Daily Dietary Intake*
   Bahagian E/ *Section E*: Gaya Hidup Seharian/*Daily Lifestyle*
   Bahagian F/ *Section F*: Rutin Kerja/*Work Routine*

2. Anda dikehendaki menjawab semua soalan di dalam buku ini.
   You are required to answer all the questions in this booklet.
3. Untuk menjawab, sila tandakan [/] pada kotak dan isi tempat kosong di ruangan yang disediakan.
   To answer, please tick [/] in the box and fill in the blanks in the space provided.
4. Semua jawapan adalah sulit dan rahsia, hanya untuk tujuan kajian.
   All answers will remain confidential and private, for research purposes only.
5. Borang soal selidik perlu dikembalikan kepada penyelidik setelah selesai menjawab soalan.
   The questionnaire should be returned to the researcher after complete answering the question.

ID Pekerja : _____ Jabatan/Unit : _____

No. Telefon : _____

[SECTION A: MAKLUMAT SOSIO DEMOGRAFIK/*SOCIO DEMOGRAPHIC INFORMATION*]

Sila tandakan [/] pada kotak dan isi tempat kosong di ruangan yang disediakan.
Please tick [/] in the box and fill in the blanks in the space provided.

Tarikh/*Date*: _____

1. Jawatan/*Position*: _____

2. Umur/*Age* : _____

3. Jantina
Gender

☐ Lelaki/*Male*
☐ Wanita/*Female*

4. Nyatakan jumlah pendapatan dalam sebulan/
State your total monthly income:

_____

5. Bangsa
Race

☐ Melayu/*Malay*
☐ Cina/*Chinese*
☐ India/*Indian*
☐ Lain-lain/*Others*

Nyatakan/*State*: _____

6. Status perkahwinan
Marital status

☐ Bujang/*Single*
☐ Berkahwin/*Married*
☐ Bercerai/*Divorced*
☐ Lain-lain/*Others*

Nyatakan/*State*: _____

7. Tahap pendidikan tertinggi
Highest level of education

☐ Tiada Pendidikan formal/*No formal education*
☐ Sekolah rendah/*Primary school*
☐ Sekolah menengah/*Secondary school*
☐ Universiti/*University*
☐ Lain-lain/*Others*

Nyatakan/*State*: _____

1

[SECTION B: SEJARAH PENYAKIT/*DISEASES HISTORY*]

1. Adakah anda menghidapi kencing manis?
Are you suffering diabetes?

☐ Ya/*Yes*
☐ Tidak/*No*

Jika Tidak, terus ke soalan 3/
If No, proceed to question 3.

Jika Ya, nyatakan ubat yang diambil/
If Yes, state type of medicine:

_____

2. Bilakah anda di diagnosis mempunyai kencing manis?
When were you diagnosed to have diabetes?

☐ Dalam tempoh kurang 1 bulan yang lepas/ Less than 1 month ago
☐ Dalam tempoh 1 bulan - 1 tahun yang lalu/1 month - 1 year ago
☐ Lebih dari tempoh 1 tahun lepas/*More than 1 year ago*
☐ Lain-lain. Nyatakan/*Others.*
*State:*_____

3. Adakah anda mempunyai saudara mara yang menghidapi kencing manis?
Do you have any close relative who is/are suffering from diabetes?

☐ Ya/*Yes*
☐ Tidak/*No*

Jika Ya, nyatakan siapa: _____
If Yes, state who: _____

4. Adakah anda mempunyai penyakit kronik yang lain?
Do you have any chronic diseases?

☐ Ya/*Yes*
☐ Tidak/*No*

Jika Ya, nyatakan: _____
If Yes, state : _____

2

[SECTION C: UKURAN SAMPEL/*SAMPLE MEASUREMENT*]

*Di isi oleh penyelidik/*Fill by the researcher*

UKURAN ANTROPOMETRI/*ANTHROPOMETRY MEASUREMENT*

Tarikh pengukuran/*Date of measurement*: _____

Ukuran antropometri/ *Anthropometry measurement*	Bacaaan/*Reading*
Berat badan/*Weight* (kg)	
Tinggi/*Height* (m)	
Ukur lilit pinggang/*Waist circumference (cm)*	

BMI (kg/m^2) = _____

KEPUTUSAN SARINGAN PERUBATAN/*RESULTS OF SCREENING*
A. Glukosa dalam darah/*Blood Glucose (finger prick)* _____ mmol/L
B. Tekanan darah tinggi/*High Blood Pressure* _____ mmHg
C. Komposisi lemak/*Body fat composition* _____%

3

[SECTION D: PENGAMBILAN DIET HARIAN/*DAILY DIETARY INTAKE*]

No.	Soalan/*Question*	Kekerapan/*Frequency*
1.	Secara purata, berapa kerapkah anda mengambil makanan segera seperti KFC/McD/burger/pizza/hotdog dan lain-lain dalam seminggu? *In average, how often do you eat fast food like KFC/McD/burger/pizza/hotdogs and so on in a week?*	☐ Tiada/*None* ☐ 1 – 2 kali seminggu/*1 – 2 times* ☐ 3 – 5 kali seminggu/*3 – 5 times* ☐ 6 kali atau lebih seminggu/*6 times or more per week* ☐ Lain-lain. Nyatakan/*Others. State:* _____
2.	Berapa kerapkah anda makan makanan yang dimasak di kedai (termasuk dibawa pulang dalam seminggu)? *How often do you eat outside food (including being taken home in a week)?*	☐ Tiada/*None* ☐ 1 – 2 kali seminggu/*1 – 2 times* ☐ 3 – 5 kali seminggu/*3 – 5 times* ☐ 6 kali atau lebih seminggu/*6 times or more per week* ☐ Lain-lain. Nyatakan/*Others. State:* _____
3.	Pernahkah anda mengawal pengambilan makanan anda? *Have you ever regulated your diet?*	☐ Ya/*Yes* ☐ Tidak/*No* **Jika Ya, jawab soalan 4. Jika Tidak, terus ke soalan 6.** ***If Yes, answer question 4. If No, proceed to question 6.***
4.	Mengapakah anda mengawal pengambilan makanan anda? *Why do you regulated your diet?*	☐ Sakit/*Sick* ☐ Untuk sihat/*For health* ☐ Tiada selera/*No appetite* ☐ Lain-lain. Nyatakan/*Others. State:* _____

5.	Apakah jenis makanan yang dikawal? *What kind of food is controlled?*	☐ Makanan manis/*Sweet foods* ☐ Makanan berlemak/*Fatty foods* ☐ Makanan berminyak/*Oily foods* ☐ Semua di atas/*All of above*
6.	Dalam sehari, berapa kerapkah anda mengambil nasi bersama minuman bergula? *In a day, how often do you take rice with sugary drinks?*	☐ Tidak/*Never* ☐ 1 kali/*1 time* ☐ 2 kali/*2 times* ☐ 3 kali/*3 times* ☐ 4 kali/*4 times* ☐ Lain-lain. Nyatakan/*Others. State:* _____
7.	Berapa kerapkah anda mengambil buah-buahan dalam seminggu? *How often do you take fruits in a week?*	☐ Tiada/*None* ☐ 1 – 2 kali seminggu/*1 – 2 times* ☐ 3 – 5 kali seminggu/*3 – 5 times* ☐ 6 kali atau lebih/*6 times or more* ☐ Lain-lain. Nyatakan/*Others. State:* _____
8.	Berapa kerapkah anda mengambil sayur-sayuran dalam seminggu? *How often do you take vegetables in a week?*	☐ Tiada/*None* ☐ 1 – 2 kali/*1 – 2 times* ☐ 3 – 5 kali/*3 – 5 times* ☐ 6 kali atau lebih seminggu/*6 times or more per week* ☐ Lain-lain. Nyatakan/*Others. State:* _____
9.	Adakah anda penggemar makanan yang mengandungi kandungan garam yang tinggi? *Do you like foods that contain high salt content?*	☐ Ya/*Yes* ☐ Tidak/*No* **Jika Ya, jawab soalan 10. Jika Tidak, terus ke soalan 11.** ***If Yes, answer question 10. If No, proceed to question 11.***

10.	Jika ya, berapa kerapkah anda makan makanan yang mengandungi kandungan garam yang tinggi dalam seminggu? *If yes, how frequent do you consume food with a high content of salt in a week?*	☐ Tiada/*None* ☐ 1 – 2 kali seminggu/*1 – 2 times* ☐ 3 – 5 kali seminggu/*3 – 5 times* ☐ 6 kali atau lebih seminggu/*6 times or more per week* ☐ Lain-lain. Nyatakan/*Others. State:* _____
11.	Secara purata, berapa kali anda makan dalam sehari? *In average,* how many times do you eat in a day?	☐ Tidak/*Never* ☐ 1 kali/*1 time* ☐ 2 kali/*2 times* ☐ 3 kali/*3 times* ☐ 4 kali/*4 times* ☐ Lain-lain. Nyatakan/*Others. State:* _____
12.	Dalam sehari, berapa kerapkah anda mengambil makanan berkarbohidrat (nasi, mi, bihun, roti, ubi)? *In a day, how often you eat carbohydrate (rice, noodles, beehoon, bread, potato)?*	☐ Tidak/*Never* ☐ 1 kali/*1 time* ☐ 2 kali/*2 times* ☐ 3 kali/*3 times* ☐ 4 kali/*4 times* ☐ Lain-lain. Nyatakan/*Others. State:* _____
13.	Dalam sehari, berapa kerapkah anda makan makanan tinggi lemak (daging merah, makanan tenusu tinggi lemak)? *In a day, how often you eat high fat in food (red meat, dairy food)?*	☐ Tidak/*Never* ☐ 1 kali/*1 time* ☐ 2 kali/2 *times* ☐ 3 kali/*3 times* ☐ 4 kali/*4 time* ☐ Lain-lain. Nyatakan/*Others. State:* _____

[SECTION E: GAYA HIDUP SEHARIAN/*DAILY LIFESTYLE*

1.	Berapa kerapkah anda melakukan senaman dalam seminggu? *How often do you exercise in a week?* ***Jika tak pernah, terus ke soalan 4*** ***If Never, proceed to question 4***	☐ Tak pernah/*Never* ☐ 1 kali/*1 time* ☐ 2 kali/*2 times* ☐ 3 kali/*3 times* ☐ 4 kali/*4 times* ☐ Lain-lain. Nyatakan/*Others. State:* _____
2.	Apakah jenis senaman yang anda lakukan ?/What kind of *exercise did you do?* ☐ Senaman berat (Degupan jantung laju dan meningkatkan pernafasan) (Contoh: berlari, jogging, bola sepak, skuash, bola keranjang, berbasikal jarak jauh, tenis) *Strenuous exercise (Rapid heart rate and increased breathing)* *(Examples: running, jogging, soccer, squash, basketball, long distance cycling, tennis)* ☐ Senaman sederhana (Sedikit kesan kenaikan pada degupan jantung atau pernafasan) (Contoh: berjalan cepat, berbasikal, bola tampar, badminton, ping pong, berenang santai, tarian poco-poco, bowling) *Moderate Exercise (Minor side effects on heart rate or breathing)* *(Examples: walking, cycling, volleyball, badminton, ping pong, swimming, poco-poco, bowling)* ☐ Senaman ringkas (Kesan yang minima) (Contoh: yoga, golf, berjalan santai, Tai Chi, seni senaman Cina, memancing, memanah) *Mild exercise (Minimal effects)* *(Examples: yoga, golf, relax walking, Tai Chi, Chinese exercise, fishing, archery)*	
3.	Berapa lamakah masa yang anda peruntukan ketika melakukan senaman? *How long did you spend time to exercise?*	☐ Kurang 5 minit/*Less than 5 minutes* ☐ 5 minit/*5 minutes* ☐ 6 – 15 minit/*6 – 15 minutes* ☐ 16 – 30 minit/*16 – 30 minutes* ☐ Lebih 31 minit/*More than 31 minutes*

4.	Apakah aktiviti yang dilakukan pada masa lapang?/*What is your activity during leisure time?* ☐ Berbasikal/*Cycling* ☐ Berjalan sekeliling rumah/*Walking around house* ☐ Menonton televisyen, membaca majalah surat khabar, mengguna komputer/*Watching television, reading magazine newspaper, use computer* ☐ Lain-lain/*Others* Nyatakan/*State:* _____	

[SECTION F: RUTIN KERJA/*WORK ROUTINE*]

1.	Jenis pekerjaan: *Work type:*	☐ Kerja syif/*Shift work* ☐ Waktu kerja biasa/*Normal time*
2.	Jenis jentera yang dikendalikan: Type of machinery you operate.	☐ RTG ☐ RMG ☐ QGC ☐ Lain-lain/*Others* Nyatakan/*State:* _____
3.	Sudah berapa lama anda bekerja untuk jawatan semasa anda sekarang? *How long have you been working in your current position?*	_____ bulan/tahun _____ *month/year*
4.	Purata jam bekerja biasa (atas jentera) dalam seminggu. *Average time for normal working hour (on the machinery) in a week*	Nyatakan/*State:* _____
5.	Purata jam bekerja lebih masa dalam seminggu *Average time for over time in a week*	Nyatakan/*State:* _____

APPENDIX C

Ethical Committee Approval UPM

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

Research title	:	Prevalence of Diabetes and its Determinant Factors among Workers at Port Container Terminal.
Study Site	:	Port container terminal in northern region, Peninsular Malaysia.
JKEUPM Ref No.	:	JKEUPM-2019-425
Researcher	:	Azmin Najihah Abd Rahman
Supervisor	:	Dr. Saliza Mohd Elias

Documents received and reviewed with reference to the above study:

1. Ethics Application Form, Version 1 dated 25/10/2019
2. Respondent Information Sheet & Consent (English), Version 2 dated 28/11/2019
3. Respondent Information Sheet & Consent (Malay), Version 2 dated 28/11/2019
4. Proposal (English), Version 1 dated 25/10/2019
5. Questionnaires/ Interviews (English), Version 1 dated 25/10/2019
6. Questionnaires/ Interviews (Malay), Version 1 dated 25/10/2019
7. Curriculum Vitae of:
    a. Dr. Saliza Mohd Elias

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 5 DECEMBER 2020**

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 D

Gantt Chart

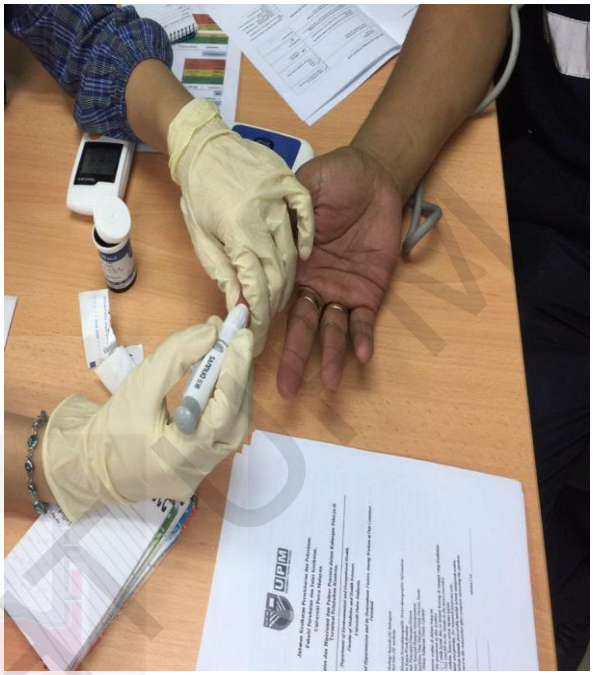
GANTT CHART

	2019					2020				
PLANNING/MONTH	September	October	November	December	January	February	March	April	May	June
Determine Research/Title										
Proposal writing										
Proposal submission										
Amended proposal ethical committee										
Proposal presentation										
Ethical clearance										
Order/ book for equipment & material										
Data collection										
Data analysis										
Thesis writing										
Thesis submission & VIVA										

APPENDIX E

Pictures during Data Collection

(i) Face-to-face interview to complete the questionnaire.



(ii) Blood is taken from the fingertip's of the respondent.

(iii) The respondent sat while taking blood pressure measurement.

(iv) The respondent doing weight measurement monitored by the researcher.

APPENDIX F

Procedure to measure the blood glucose

Procedure to measure the blood glucose of the respondents.

Step	Action
1.	Gloves will be put on.
2.	A test strip will be removed, put into the machine and the test strip box will be closed. The strips are sensitive to humidity and heat, so at one time, only take one strip and immediately closed.
3.	A fingertip will be rubbed to ease withdraw blood.
4.	The fingertip will be wiped or swabbed by using a sterile swab.
5.	The massaged place will be lanced by using a sterile swab.
6.	A hanging blood drop will be allowed to form without applying too much pressure.
7.	Without touching it, the blood will be put onto the test strips. Note: The test field must be completely covered with blood. If too little blood is applied, do not rub it in or apply a second drop, but repeat the measurement with a fresh test strip.
8.	A cotton ball will be given to the participant to press on the puncture.
9.	The measurement will be displayed on the machine. The results are usually displayed in mmol/L or mg/dL.
10.	The result will be recorded.

APPENDIX G

Procedure to measure the blood pressure

Procedure to measure the blood pressure of the respondents

Step	Action
1.	The respondents will be asked to place their right arm on the table with the palm facing upwards.
2.	The respondent will be ordered to roll up or remove their clothing on the right arm.
3.	Appropriate cuff size will be selected for the respondents using the Arm Circumference (cms) Cuff Size. 17 – 22 for Small (S) 22 – 32 for Medium (M) >32 for Large (L)
4.	To make sure the lower band is positioned 1 – 2 cm above the elbow joint, the cuff will be positioned above the elbow.
5.	The cuff will be wrapped snugly onto the arm and secured fasten with the Velcro.
6.	When the measurement is taken, the level of the cuff will be kept at the same level.