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DETERMINANTS OF OBESITY INDICES AMONG PRIMARY HEALTHCARE WORKERS IN PERAK, MALAYSIA

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DETERMINANTS OF OBESITY INDICES AMONG PRIMARY HEALTHCARE WORKERS IN PERAK, MALAYSIA

By

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Chair: Associate Prof Hazizi Abu Saad, PhD
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Overweight and obesity have been emerging as one of the most preventable nutritional problems worldwide. The most commonly used obesity indices to classify obesity are body mass index (BMI) and waist circumference, yet it has some drawbacks which affecting their reliability. Bioelectrical impedance analysis (BIA) has been suggested as a better index in determining obesity-related health risk by direct assessing the body fat mass. A cross-sectional study was conducted at 12 selected health clinics around Perak to determine the prevalence of obesity and investigate the determinants of obesity indices among the primary healthcare workers. Data were collected using self-administered questionnaire consisting seven sections include socio-demographic characteristics, physical activity, dietary intakes, sleep quality, psychological distress, smoking habits, and anthropometric measurements (BMI, waist circumference and body fat percentage). Findings showed that 49.9% of the primary healthcare workers were overweight and obese, 51.0% have abdominal obesity and 79.7% have high body fat percentage. Combined indices showed that 44.5% of them fell into the abnormal categories for all three indices. There were 45.6% of the primary healthcare workers categorised as physically inactive and spent a median of five hours daily in sedentary behaviours. More than half of them do not have enough calorie and micronutrients intakes. On the contrary, most of them showed good indication in psychological distress and were good sleepers. Only 4.6% primary healthcare workers categorised as ever smokers but more than 50% were passive smokers. Bivariate analysis showed that older age, good self-reported health status and implausible dietary intakes were significantly associated with all the three obesity indices. Professionals have significantly lower BMI whereas higher educational level have both lower BMI and waist circumference. Primary healthcare workers with abdominal obesity and high body fat percentage tend to have micronutrients deficiencies (calcium, zinc, vitamin E and vitamin B_{12}). Lastly, good sleep quality and non-smokers were significantly associated with high body fat percentage. Logistic regression analysis showed that plausibility of dietary intakes made the strongest significant contribution to all three obesity indices. Self-reported health

status was found to be another predictors for both waist circumference and body fat percentage. In addition, vitamin E and zinc deficiency, good sleep quality and non-smokers were linked to high body fat percentage. In conclusion, all the three obesity indices showed that obesity were prevalent among the primary healthcare workers in Perak and plausibility of dietary intakes made the strongest contribution as predictors for obesity. It is essential to increase the awareness and behavioural change among the primary healthcare workers. Practical approach such as continuous education to promote healthy lifestyle should be carried out.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuni keperluan untuk Ijazah Master Sains

FAKTOR-FAKTOR PENENTU INDEKS OBESITI DALAM KALANGAN PEKERJA SEKTOR KESIHATAN AWAM DI PERAK, MALAYSIA

Oleh

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Mac 2019

Pengerusi: Profesor Madya Hazizi Abu Saad, PhD
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Berat badan berlebihan dan obesiti telah muncul sebagai salah satu masalah pemakanan yang paling mudah dielakkan di seluruh dunia. Indeks obesiti yang paling biasa digunakan untuk mengklasifikasi obesiti adalah indeks jisim badan (BMI) dan lilitan pinggang, namun ia mempunyai beberapa kekurangan yang mempengaruhi kebolehpercayaannya. Analisis impedans elektrik telah dicadangkan sebagai indeks yang lebih baik dalam menentukan risiko kesihatan yang berkaitan dengan obesiti dengan menilai secara langsung jisim lemak badan. Satu kajian keratan rentas telah dijalankan di 12 buah klinik kesihatan terpilih di sekitar Perak untuk menentukan peratusan obesiti dan mencari penentu indeks obesiti dalam kalangan pekerja sektor kesihatan awam. Data dikumpul dengan menggunakan borang soal selidik diisi sendiri yang terdiri daripada tujuh bahagian, iaitu taraf sosio-demografi, tahap aktiviti fizikal, pengambilan makanan, kualiti tidur, tekanan psikologi, tabiat merokok dan pengukuran antropometri (BMI, lilitan pinggang dan peratusan lemak badan). Analisis menunjukkan bahawa 49.9% pekerja sektor kesihatan awam mempunyai berat badan berlebihan dan obes, 51.0% mengalami obesiti abdomen manakala 79.7% mempunyai peratusan lemak badan yang tinggi. Indeks gabungan menunjukkan bahawa 44.5% daripada mereka diklasifikasi ke kategori tidak normal untuk ketiga-tiga indeks. Terdapat 45.6% daripada pekerja sektor kesihatan awam dikategorikan sebagai kurang aktif dan menghabiskan median lima jam sehari untuk tingkah laku sedentari. Lebih separuh daripada mereka tidak mempunyai pengambilan kalori dan mikronutrien yang mencukupi. Sebaliknya, kebanyakan pekerja sektor kesihatan awam menunjukkan tanda yang baik dalam tekanan psikologi dan mempunyai kualiti tidur yang baik. Hanya 4.6% pekerja sektor kesihatan awam merupakan perokok semasa tetapi lebih dari 50% daripada mereka merupakan perokok pasif. Analisis bivariate menunjukkan bahawa usia yang lebih tua, status kesihatan dilaporkan sendiri yang baik dan pengambilan makanan yang tidak munasabah dikaitkan dengan ketiga-tiga indeks obesiti. Profesional dikaitkan dengan BMI yang lebih rendah manakala tahap pendidikan yang tinggi dikaitkan dengan kedua-dua BMI dan lilitan pinggang yang lebih rendah. Pekerja sektor kesihatan awam dengan obesiti abdomen dan peratusan lemak badan yang tinggi didapati mempunyai kekurangan mikronutrien

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(kalsium, zink, vitamin E dan vitamin B_{12}). Akhirnya, kualiti tidur yang baik dan bukan perokok secara signifikan dikaitkan dengan peratusan lemak badan yang tinggi. Analisis regresi logistik menunjukkan bahawa kemunasabahan dalam pengambilan makanan memberi sumbangan yang paling kuat kepada ketiga-tiga indeks obesiti. Status kesihatan dilaporkan sendiri didapati sebagai peramal yang satu lagi untuk kedua-dua lilitan pinggang dan peratusan lemak badan. Di samping itu, kekurangan vitamin E dan zink, kualiti tidur yang baik dan bukan perokok dikaitkan dengan peratusan lemak badan yang tinggi. Kesimpulannya, ketiga-tiga indeks obesiti menunjukkan obesiti adalah lazim dalam kalangan pekerja sektor kesihatan awam di Perak dan kemunasabahan dalam pengambilan makanan menjadikan sumbangan yang paling kuat sebagai peramal untuk obesiti. Keperluan untuk meningkatkan kesedaran dan perubahan tingkah laku dalam kalangan pekerja sektor kesihatan awam adalah sangat penting. Pendekatan praktikal seperti pendidikan berterusan untuk menggalakkan gaya hidup sihat harus dijalankan.

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LIST OF ABBREAVIATIONS

BDI	Beck Depression Inventory
BF%	Body fat percentage
BIA	Bioelectrical impedance analysis
BMI	Body Mass Index
BMR	Basal Metabolic Rate
CDC	Centers for Disease Control and Prevention
CI	Confidence interval
CMDs	Common Mental Disorders
CVD	Cardiovascular Diseases
DASS	Depression, Anxiety and Stress scale
EI	Energy intake
FFM	Fat-free Mass
FFQ	Food Frequency Questionnaire
GHQ	General Health Questionnaire
GPAQ	Global Physical Activity Questionnaire
HADS	Hospital Anxiety and Depression Scale
HbA1c	Glycated haemoglobin
HPAQ	Habitual Physical Activity Questionnaire
IDF	International Diabetes Federation
IPAQ	International Physical Activity Questionnaire
ISCO	International Standard Classification of Occupations
MANS	Malaysian Adults Nutrition Survey
MET	Metabolic Equivalents
MOE	Ministry of Education, Malaysia
MOH	Ministry of Health, Malaysia
NCDs	Non-communicable Diseases
NHMS	National Health and Morbidity Survey, Malaysia
NPANM	National Plan of Action for Nutrition of Malaysia
PAL	Physical activity level
PD	Psychological distress
pER	Predicted energy requirements
PHQ-9	Patient Health Questionnaire-9
PPS	Proportionate to size
PSQI	Pittsburgh Sleep Quality Index
rEI	Reported energy intake
RNI	Recommended Nutrient Intake, Malaysia
SD	Standard deviation
SIDS	Sudden Infant Death Syndrome
TBW	Total body water
TEE	Total energy expenditure
TEI	Total energy intakes
UKM	Universiti Kebangsaan Malaysia
UPM	Universiti Putra Malaysia
USA	United States of America
WC	Waist circumference
WHO	World Health Organization
WHR	Waist-hip ratio
WHtR	Waist-to-height ratio

CHAPTER 1

INTRODUCTION

1.1   Background of the Study

Malaysia is a multicultural society made up of three major ethnicities: Malay, Chinese and Indian with other minorities such as the indigenous people (Department of Statistics, 2017). As one of the middle-income countries, Malaysia is now experiencing rapid urbanisation and industrialisation just like any other developing countries worldwide and these have brought significant changes in the lifestyle and dietary patterns of Malaysian. Apart from its own culinary diversity which originating from different ethnicities, the introduction of modern fusion foods has transformed Malaysian diet from plant-based products with low calories to diets rich in calories, fats and sugars (Lim, 2016; Rampal *et al.*, 2007).

These tremendous development over the past few decades are now causing a "double burden of malnutrition" crisis among Malaysian, in both children and adults (United Nations Children's Fund, 2016a; Ihab *et al.*, 2013). It is defined as the coexistence of both undernutrition such as wasting, stunting and micronutrient deficiencies together with overweight or obesity and diet-related non-communicable diseases (NCDs) within three level (individuals, households, populations) across the life course (World Health Organization, 2016a).

In Malaysia, the National Plan of Action for Nutrition of Malaysia (NPANM) III has recognised the occurrence of double burden of malnutrition within the country, especially among the household level (Ministry of Health Malaysia, 2016b). Studies had found out that both undernutrition and over-nutrition exists in the same household in Malaysia as the prevalence of overweight mother/ underweight child outnumbered normal weight mother/ normal weight child (Ihab et al., 2013; Khor & Sharif, 2003).

Even so, obesity is still one of the major health problems that challenged the health sector of Malaysia. According to the findings by population-based National Health and Morbidity Survey (NHMS) 2015, it was reported that 47.7% of Malaysian adults aged 18 years old and above were either overweight or obese based on Body Mass Index (BMI) classification as compared to 6.7% underweight population. In addition, NHMS 2015 also measured the prevalence of abdominal obesity among adults Malaysian. It was found that 48.6% of the population were at risk of having abdominal obesity (Ministry of Health Malaysia, 2015).

The occurrence of overweight and obesity is not regional but has been emerging as one of the most common and preventable nutritional problems worldwide (Centers for

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Disease Control and Prevention, 2017a; World Obesity Federation, 2015). It is a state where excessive fat accumulated in the body and eventually jeopardised our health (World Health Organization, 2000b). Worldwide prevalence of obesity was recorded at 11% and 15% for men and women in 2016 respectively, based on a report by the World Health Organization (WHO). Generally, there were 39% and 13% adults aged 18 years old and above being overweight and obese (World Health Organization, 2018b).

Obesity is the risk factor of various chronic diseases and will bring mortality if no attention is paid to it. The occurrence of cardiovascular disease (CVD) such as heart disease and stroke, type 2 diabetes mellitus, musculoskeletal disorders, hypertension as well as some type of cancers are the consequences of obesity, especially high BMI and waist circumference (World Health Organization, 2018b; Jensen *et al.*, 2014). Besides, metabolic syndrome is also closely linked to abdominal obesity, which in turn, lead to the increased risk of getting CVD, stroke and type 2 diabetes mellitus too (National Heart Lung and Blood Institute 2016).

The occurrence of obesity is caused by various factors such as physical inactivity and unhealthy diet. Both these factors are inevitably the main causes contributing to the high percentage of obesity worldwide (United Nations Children's Fund, 2016b). According to NHMS 2015, 33.5% of Malaysians were physically inactive based on the International Physical Activity Questionnaire (IPAQ) definition (Ministry of Health Malaysia, 2015). This means that almost four out of 10 Malaysians were physically inactive. On the other hand, it is widely known that an imbalance between energy intakes and expenditures will lead to overweight and obesity. Obesity and overweight often happen when intake of calories is more than expenditure (National Heart Lung and Blood Institute, 2012).

Currently, diet and exercise have been recognised as one of the best ways to prevent obesity and its associated disorders (World Health Organization, 2009). Besides physical inactivity and unhealthy diet, recent studies have linked other lifestyle, psychological and environmental factors with overweight and obesity (Wilborn *et al.*, 2005). This includes sleep quality, psychological distress and smoking habits.

Recently, sleep has been increasingly recognised as one of the important lifestyle contributor to health (St-Onge *et al.*, 2016). It is recommended to sleep at least seven to nine hours a day for adults aged 18 to 64 years old (Hirshkowitz *et al.*, 2015). Some studies have suggested that lack of sleep has made some influences in the development of obesity (St-Onge & Shechter, 2014; Gonnissen *et al.*, 2013). Nevertheless, this factor still being overlooked in the search for modifiable risk factors for obesity (St-Onge & Shechter, 2014). Sleep quality, on the other hand, are the physiologic parameters that produce the feeling of restoration in the morning (Harvey *et al.*, 2008). A good sleep quality is associated with wide range of positive outcomes, for example better health, reduce daytime sleepiness, sense of well-being and good psychological functioning (Harvey et al., 2008). Sleep deprivation especially sleeping less than seven hours a day has been identified as one of the factors that linked to obesity due to decrease in physical

activity and increase in calorie intake because of fatigue (Patel & Hu, 2008; Patel *et al.*, 2006).

Psychological distress (PD) is one of the emotional problems that affecting the publics (Arvidsdotter *et al.*, 2016; Drapeau *et al.*, 2012). It is defined as a state of emotional suffering that comes with the symptoms of depression and anxiety (Drapeau et al., 2012; Payton, 2009). Psychological distress can act as one of the indicators used to determine the emotional health of the population in public health. According to NHMS 2015, 29.2% of the adults aged 16 years old and above were found to have some psychological problems (Ministry of Health Malaysia, 2015). Studies have shown that psychological distress such as depression, anxiety and fatigue was associated with obesity, especially on the elevation of BMI and abdominal obesity (Gu *et al.*, 2013; Block *et al.*, 2009; Brunner *et al.*, 2007). As suggested, this may be due to people who suffer from weight problems will have some psychological disorders, which in turn makes them hard to control their diet, have an inadequate amount of exercise and eventually, fails to maintain a healthy weight (Collins & Bentz, 2009).

Another factor that is linked to the occurrence of obesity is environmental factor such as smoking habits. Prevalence of smoking has been increasing globally. On top of obesity, unhealthy diet, and physical inactivity, smoking is another risk factors that cause cancer, respiratory problems, CVD and was the leading cause of death worldwide (World Health Organization, 2017b; World Health Organization, 2014). It is common beliefs that smoking may prevent weight gain due to the increase in metabolic rate and appetite reduction, thus decrease the energy intakes and metabolic efficiency (Dare *et al.*, 2015; Chiolero *et al.*, 2008). Nevertheless, the side effects of smoking cannot be underestimated and the causal relationship between smoking and obesity is not conclusive yet as heavy smokers and smoking cessations have been suggested to cause weight gain (Courtemanche *et al.*, 2018; Dare et al., 2015).

Obesity indices is the anthropometric techniques that are most applicable, inexpensive and non-invasive technique used for body assessment such as the body size, proportion and also body composition (Chinedu *et al.*, 2013; World Health Organization, 1995). Obesity indices have been widely used in the classification of body weight in humans as it can reflects both health and nutritional status, predicts performance and also health and survival of a person (World Health Organization, 1995). Obesity can be evaluated through different anthropometric measurements and indices as these indices can act as the sensitive indictors for wellness, maturation and development in humans.

The most commonly available obesity indices includes body mass index (BMI), waist circumference (WC), waist-hip ratio (WHR), waist-to-height ratio (WHtR) and body fat percentage (BF %) (Motamed *et al.*, 2017; Zeng *et al.*, 2014; Zhang *et al.*, 2013). Studies have been carried out to determine the usefulness of these indices as predictor of obesity among the adult population. Based on previous studies, it was found that BMI and waist circumference were more closely related to each other than body fat percentage (Flegal *et al.*, 2009; Bosy-Westphal *et al.*, 2006). Nevertheless, comparing with waist

circumference or waist-hip-ratio which mainly focusing on abdominal obesity and visceral fat, BMI has a higher precision in estimating body fat percentage (Wang *et al.*, 2013). On the other hand, body fat percentage was found to be more correlate with waist circumference in men whereas in women, it was more correlate with BMI. It was found that gender, age and ethnicity may affect the association between body fat percentage, BMI and waist circumference (Flegal et al., 2009; Gallagher *et al.*, 1996).

BMI is the most commonly used measurement to determine high body fatness (Centers for Disease Control and Prevention, 2015). It is generalised between both genders and all age groups for adults and is the most useful population-level measurement for overweight and obesity (World Health Organization, 2006a). BMI is calculated by dividing weight by the square of height. It can be divided into four categories, which is underweight, normal, overweight and obese where people with BMI $\geq 25.0\text{kg/m}^2$ is considered as overweight and $\geq 30\text{kg/m}^2$ is obese (World Health Organization, 2006a). Comparing to other obesity indices, the advantage of using BMI is height and weight are readily available and can be measured easily (Jackson *et al.*, 2002). Nevertheless, the reliability of BMI as a health measure is often being criticised as it does not distinguish fat from muscle and does not indicate where the body fat is stored (World Health Organization, 2018b).

On the other hand, waist circumference, waist-hip ratio and waist-to-height ratio are mainly used to determine the central adiposity of an individual (Motamed et al., 2017). Waist circumference is the central diagnostic index of obesity and only considers abdominal obesity whereas waist-hip ratio and waist-to-height ratio are indices used in evaluating fat distribution by comparing waist circumference to hip circumference or height (Yu *et al.*, 2016). According to WHO, the optimal cut-off values for these indices are: waist circumference (male: 90 cm; female: 80 cm), waist-hip ratio (male: 0.90; female: 0.85) and waist-to-height ratio (0.50) (Alberti *et al.*, 2006). For many years, waist-hip ratio was more commonly used in predicting the body fat distribution. Even so, waist circumference has been found to be more closely associated with central fat distribution than waist-hip ratio in recent years (Yu et al., 2016; Pouliot *et al.*, 1994).

In addition to the above-mentioned indices, another obesity indices that has been broadly used in body composition measurements is through body impedance analysis (BIA). Body impedance analysis has been recognised as the most accurate and precise way, yet non-invasive, low cost and quick instrument to measure total body fat and lean muscle mass (Khalil *et al.*, 2014; Flegal et al., 2009). Measuring the body fat percentage let us know more about our body fat distribution. It has been suggested that excessive accumulation of body fat will increase the risk of premature death and lower the quality of life. Also, the development of glucose intolerance and type 2 diabetes mellitus are highly linked to the body fat distribution of a person (Gómez‑Ambrosi *et al.*, 2011).

Healthcare workers are responsible in promoting wellness and healthy lifestyle. According to WHO, healthcare workers are people responsible for protecting, improving and enhancing the communities' health (World Health Organization, 2006b). Basically,

they should always be physically fit and can project the right image of healthy living and body weight to the public.

Despite this, healthcare workers are no exception in falling into the traps of obesity and this create doubts on their role as health promoters. Nonetheless, this may be due to the fact that most of the healthcare workers are too focused on providing care to their patients and thus ignoring their own health (Kasu *et al.*, 2015). Conversely, studies also showed that not every healthcare worker can play their role well in health promotion. Lack of knowledge to diagnose obesity, deliver weight management advice to their patients and low confidence level were the problems faced by the healthcare workers (Bucher Della Torre *et al.*, 2018; Perry *et al.*, 2015a).

1.2   Problem Statement

Obesity is one of the major enemies of our country's development. As the number of people with obesity increases, our country is now facing an upward surge of NCDs such as type 2 diabetes mellitus, hypercholesterolemia and also hypertension (Mustapha *et al.*, 2014). It is understood that the high prevalence of obesity will bring negative impact to our economy, as it is directly linked to underperformance and absenteeism of the workers due to health-related diseases. Eventually, it will lead to the increase of medical cost due to burden in treating many obesity-related diseases and transportation cost as well as low productivity (Hammond & Levine, 2010; Runge, 2007).

Healthcare workers are expected to be well-educated with knowledge on obesity and able to share the knowledge with their patients. This is not only restricted to healthcare professionals but also the supporting staffs working in the healthcare setting. It has been suggested that healthcare workers played a major role and responsible in changing the mind-set of obese patients towards a healthy lifestyle as well as reducing obesity. Previous studies had shown that obese doctors agreed that it will be easier to convince and motivate patients if they themselves have a healthier lifestyle (Simfukwe *et al.*, 2017; Oguns, 2014).

Healthcare workers play a major role in combating the obesity epidemic. They are responsible for disseminating messages on healthy living as well as improving the health of communities. It is especially obvious in health clinics as it act as one of the most important places to educate the public on health and nutritional education. In Malaysia, the increasing number of patients visiting health clinics each year revealed the importance of health clinics as the major healthcare setting for patients to seek treatments and pieces of advice. As a matter of fact, statistics had shown that there were 40 million attendances at 1061 health clinics (including maternal and child health clinics) around Malaysia in 2016 and the number is still growing yearly (Ministry of Health Malaysia, 2017a).

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Despite the fact that obesity have been identified as a serious health and social problem which brings negative impacts to the economy, studies on the prevalence of obesity among the primary healthcare workers in Malaysia are still very scarce, especially in Perak. Comparing with other states in Peninsular Malaysia, Perak has the second highest number of health clinics. Overall, there is a total of 85 health clinics, equivalent to 8% of total health clinics in Malaysia were built in Perak.

According to NHMS 2015, the prevalence of overweight and obesity based on BMI classification among Perak population was 29.8% and 17.5% respectively (Ministry of Health Malaysia, 2015). Figure 1.1 shows the prevalence of overweight and obesity (BMI) among adults aged 18 years old and above by different states. Even though Perak has the second highest number of primary health care setting, yet the prevalence of overweight and obesity still almost reaching 50% of the population alerting the government and health department to pay more attention to this problem considering the serious consequences of overweight and obesity. One of the ways is to determine the body composition of the primary healthcare workers knowing that they are the role model for the communities.
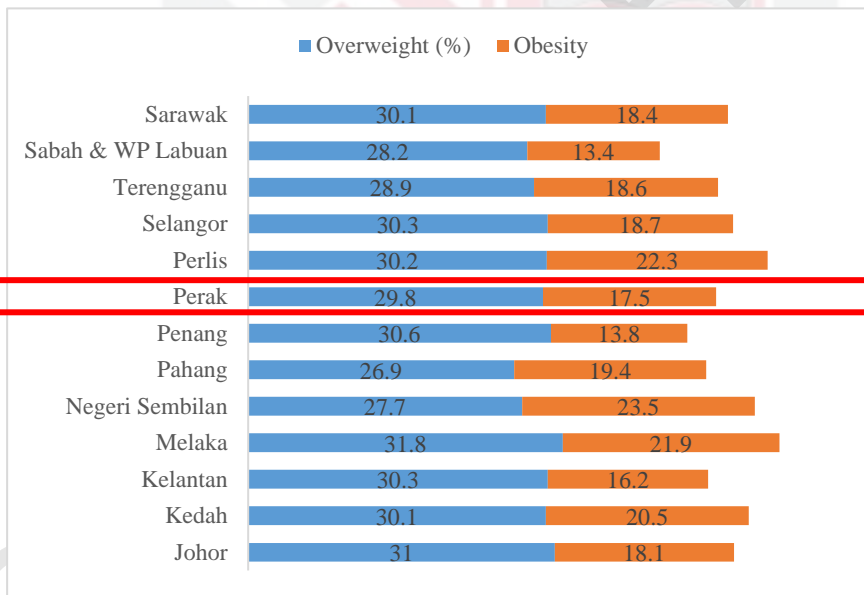
Figure 1.1: Prevalence of Overweight and Obesity among Adults Aged 18 Years Old and Above by Different States
(Source: Ministry of Health, 2015)

Even so, to the best of our knowledge, no study has been done among the primary healthcare workers in Perak before to determine their body composition using different obesity indices. Looking into other states, only one study has been carried out previously in health clinics of Hulu Langat, Selangor to determine the body composition of the

healthcare workers. The study reported that 46.1% of the primary healthcare workers were overweight and obese based on BMI classification (Mustafa *et al.*, 2013). With such limited references, it is difficult to establish statistics on causes, social problems and health implications of obesity among the healthcare workers in Malaysia.

Similar to the above study done in Hulu Langat, Selangor, other studies that have been carried out among the healthcare workers in other countries were mostly depended solely on BMI in determining the prevalence of obesity (refer Table 2.1). Although BMI has been suggested to be the most commonly used measurement to determine body fatness, it was found to have some limitations such as cannot truly reflect the degree of fatness in different individuals as it cannot differentiate the proportion of weight from fat or from muscle, especially on those with higher muscular weight or elderly with lower body mass, doubts have been arisen on its reliability (Lim, 2016; Flegal et al., 2009; Janssen *et al.*, 2002; Frankenfield *et al.*, 2001). Besides, it was also found that BMI showed differences in body adiposity across age, gender and ethnicity (Jackson et al., 2002). For example, Asian people have a higher risk of getting type 2 diabetes mellitus and CVD with a substantial lower BMIs than the existing WHO cut-off point for overweight (> or =25 kg/m^2) (WHO Expert Consultation, 2004).

Seeming this, on top of BMI measurement that mainly used to classified abnormal body weight, another choice of obesity indices such as waist circumference and waist-hip ratio which focusing on abdominal fat or body fat distribution should be considered (World Health Organization, 2000b). Nevertheless, when comparing between waist circumference and waist-hip ratio, it was found that waist circumference are better correlates of abdominal visceral adipose tissue accumulation than waist-hip ratio according to previous study (Pouliot et al., 1994). Therefore, waist circumference has been selected as the second indices used in the current study.

Even BMI and waist circumference have been suggested as the most frequently used and widely satisfactory methods in the classification of body weight and medical risk, it was suggested that direct assessment of body fat mass may be a better indices in determining obesity-related health risk (Leitzmann *et al.*, 2011; Bosy-Westphal et al., 2006). Therefore, the simplest yet reliable, quick, and non-invasive method to measure body fat mass is to use body impedance analysis (Khalil et al., 2014).

However, there are still very less updated studies measuring the body fat percentage of the healthcare workers using body impedance analysis and thus no study can be used as reference. In addition, as measuring and estimating body fat based on BMI and waist circumference for an individual has some drawbacks, measuring the body fat percentage using BIA can act as comparison and provide a more holistic picture on obesity's prevalence among the healthcare workers.

Therefore, in the current study, three obesity indices were used as the obesity indices to determine the prevalence of obesity among the primary healthcare workers. This

includes BMI and two other indices (waist circumference and body fat percentage) that have not been considered in previous studies among the primary healthcare workers in Perak.

At such, the present study would like to answer the following research questions:

1. What are the prevalence of obesity in the three obesity indices among the primary healthcare workers in Perak?

2. What are the factors contributed to the three obesity indices among the primary healthcare workers in Perak?

1.3 Research Objectives

1.3.1 General Objectives

To study the determinants of obesity indices among the primary healthcare workers in Kinta District, Perak Tengah District and Kuala Kangsar District, Perak.

1.3.2 Specific Objectives

1. To determine the prevalence of obesity in the three obesity indices (BMI, waist circumference and body fat percentage) among the primary healthcare workers in Perak.

2. To determine the physical activity level, dietary intakes, sleep quality, psychological distress and smoking habits of the primary healthcare workers in Perak.

3. To determine the association between socio-demographic characteristics, physical activity level, dietary intakes, sleep quality, psychological distress and smoking habits with the three obesity indices among the primary healthcare workers.

4. To determine the contribution of factors as predictors towards the three obesity indices among the primary healthcare workers.

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1.4 Research Hypothesis

Null Hypothesis, H_0:

1. There is no significant association between socio-demographic characteristics (age, gender, monthly income, ethnicity, marital status, educational level, occupational status, family size and self-reported health status) and the three obesity indices among the primary healthcare workers.

2. There is no significant association between physical activity level, dietary intakes, sleep quality, psychological distress and smoking habits with the three obesity indices among the primary healthcare workers

3. There is no significant contribution of factors as predictors towards the three obesity indices among the primary healthcare workers.

1.5 Significance of the Study

The findings from this study would be helpful in providing updated scientific knowledge on several research findings related to obesity among the primary healthcare workers in Perak. Additionally, as the availability of data on the three obesity indices especially body fat percentage among the primary healthcare workers in Malaysia are still very limited, this study can be used as a reference for future study and for the development of other researches. As BMI has been found to have some limitations in determining body composition, the addition of two other indices can provide more reliable data on the prevalence of obesity among the healthcare workers. Besides, the combination of three obesity indices also can help to identify the actual body composition and degree of body fatness of the primary healthcare workers.

This study also can provide baseline information that is useful in developing intervention programmes among the primary healthcare workers in Perak that aim to reduce the complications arise from obesity. By knowing the prevalence of obesity among the primary healthcare workers in Perak and its associated factors, various approaches and plans can be used to handle these problems. For example, campaign and intervention approach on the importance of physical activity and healthy diet can be organised continuously among the primary healthcare workers to improve their awareness and practical skills. Besides, their body composition should be monitored annually.

Furthermore, the findings from this study can also provide a more holistic picture of the factors that are related to the three obesity indices among the primary healthcare workers in Perak. It can help to identify the possible contributions of obesity caused by adverse workplace conditions, for example the lack of place to exercise, high workload that lead to psychological distress or poorer sleep quality and lack of access to healthy food

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choices which may increase the chance of becoming obese among the primary healthcare workers.

It is expected that the healthcare workers be the role model for healthy behaviours but yet there were studies showing that not all of them aware on their responsibility as health promoters. For example, a recent study carried out to identify the patients' attitude towards doctors with overweight also showed that 36% of the respondents preferred doctors with normal BMI as it reflects competence, knowledgeable, capability, healthier and role modelling among the doctors (Goldring & Persky, 2018). Policymakers and related department such as the Ministry of Health (MOH) can use this data to plan intervention programme to enhance the knowledge and change the behaviours and health practices among the primary healthcare workers. If all the primary healthcare workers can have healthy markers on all the three obesity indices, it can increase the chance to influence the frequency and willingness of the public to follow the health advices from them.

1.6   Conceptual Framework

Figure 1.2 shows the conceptual framework of the study. It shows that there are various factors that can influence the three obesity indices such as socio-demographic characteristics which included age, ethnicity, gender, monthly income, educational level, marital status, family size, health status and occupational status.

Besides, other factors such as lifestyle (physical activity level, dietary intakes and sleep quality), psychological (psychological distress) and environmental factors (smoking habits) were listed into consideration as factors that can affect the obesity indices of a person.

All the factors are assumed to have effects on the three obesity indices. Although the benefits of losing weight are well-known, the prevalence of overweight and obesity is still soaring in Malaysia. Therefore, measuring the prevalence of obesity through various obesity indices such as BMI, waist circumference and body fat percentage is crucial as it allows the primary healthcare workers to know more about their body composition and degree of body fatness.
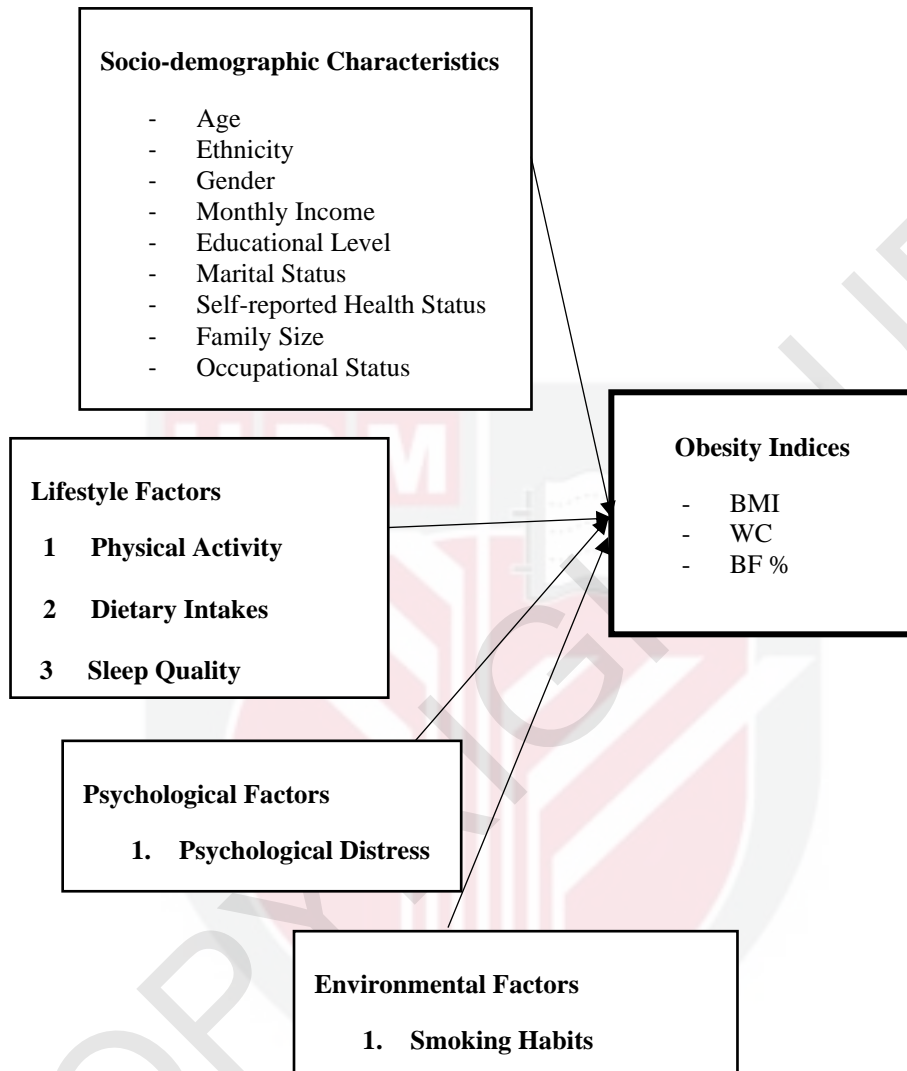
Figure 1.2: Conceptual Framework on Factors that are related to the Obesity Indices among the Primary Healthcare Workers

1.7   Operational Definitions

Obesity Indices
: The different anthropometric measurements that used to classify obesity. In present study, BMI, waist circumference and body fat percentage were used as obesity indices to determine obesity.

Body Mass Index
: An index use to measure weight-for-height. In present study, BMI above or equal to $25kg/m^2$ were considered as overweight and BMI greater or equal to $30kg/m^2$ were classified as obese.

Waist Circumference
: The measurements of the distance around the abdomen in centimetre. In present study, the cut-off value for waist circumference were > 90 cm for men or > 80 cm for women.

Body Fat Percentage
: The measurement of total body fat mass in percentage. In present study, body fat percentage $\geq 20\%$ for men and $\geq 30\%$ for women were defined as having high body fat.

Healthcare Workers
: A group of people responsible in protecting, improving and enhancing the communities' health. In present study, all the staffs working in healthcare setting were considered as healthcare workers.

Physical Activity
: Any bodily movement by the skeletal muscles that lead to energy expenditure. In present study, physical activity level were divided into vigorous, moderate and low-intensity.

Dietary Intakes
: The daily eating patterns of an individual consuming food consist of calories, macro and micro-nutrients. In present study, three-day food record were used to collect and analyse the dietary intakes.

Sleep Quality

A self-reported physiologic parameters that produce the feeling of restoration in the morning. In present study, Pittsburgh Sleep Quality Index (PSQI) were used to determine sleep quality.

Psychological Distress

A state of emotional suffering that comes with the symptoms of depression and anxiety. In present study, the scores in the Depression, Anxiety and Stress scale (DASS) were defined as psychological distress.

Smoking Habits

The action of smoking of one or more manufactured or hand rolled tobacco cigarettes. In present study, person who smoked ≥ 100 cigarettes in his/ her entire life was defined as ever smoker.

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LIST OF PUBLICATIONS

Low, P.K., Hazizi, A.S., Jamaluddin, R., Chee, H.P., (2018). Prevalence of Overweight and Obesity among Primary Healthcare Workers in Perak, Malaysia. The International Medical Journal of Malaysia (Submitted)