ASSESSMENT OF NUTRITIONAL STATUS, NUTRIENT INTAKE, PHYSICAL ACTIVITY AND QUALITY OF LIFE AMONG OVERWEIGHT & OBESE FEMALE GOVERNMENT STAFFS IN KOTA BHARU, KELANTAN.

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ASSESSMENT OF NUTRITIONAL STATUS, NUTRIENT INTAKE, PHYSICAL ACTIVITY AND QUALITY OF LIFE AMONG OVERWEIGHT & OBESE FEMALE GOVERNMENT STAFFS IN KOTA BHARU, KELANTAN.

By

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DECLARATION

I hereby declare that the thesis is the result of my own investigations, except for the quotations and citations which have been acknowledged. I also declare that it has not been previously or concurrently submitted as a whole for any other degrees at Universiti Sains Malaysia or at any other institutions.

_____ (Signature)

Aqila Binti Ayoub (Name of student)

Date: _____

I certify that Ms (Mr) Aqila Binti Ayoub has carried out her (his) study entitled Assessment of Nutritional Status, Nutrient Intake, Physical Activity and Impact Weight Quality of Life among Overweight & Obese Female Government Servants In Kota Bharu, Kelantan as a final year research project in nutrition under my supervision. She (he) has complied with the ethical standard and regulations in conducting her study and has completed writing her (his) thesis. I am satisfied with her work and have no objection for the thesis to be examined by the appointed examiners by the School of Health Sciences, Universiti Sains Malaysia.

Thank you.

_____ (Signature)

Name of Supervisor: Assoc. Prof Rohana Abd. Jalil

Date: _____

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LIST OF ABBREVIATIONS

Abbreviation/Symbol	Definition
AAW	African- American women
BMI	Body Mass Index
Cm	Centimeter
CAD	Coronary Artery Disease
CHD	Coronary Heart Diseases
CVD	Cardiovascular diseases
DALYs	Disability-adjusted Life Years
GBD	Global Burden of Disease Study
HDL-C	High-Density Lipoprotein cholesterol
h/day	Hour per day
h/week	Hour per week
IPAQ	International Physical Activity Questionnaire
IPAQ-M	Malay Version of International Physical Activity Questionnaire
Kcal	Kilocalorie
Kg	Kilogram
LDL-C	Low-density lipoprotein cholesterol
LTPA	Leisure-time physical activity
MANS	Malaysian Adult Nutrition Survey

LIST OF ABBREVIATIONS CONT

METs	Metabolic equivalent of tasks
MFB	Malaysian Food Barometer
Mg	Milligram
min/d	Minutes per day
MyNCDS-1	Malaysian NON-Communicable Disease Study
NHMS	National Health and Morbidity Survey
NHANES	National Health and Nutrition Examination Survey
TC	Total cholesterol
WC	Waist circumference
WHO	World Health Organization

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PENILAIAN STATUS PEMAKANAN, PENGAMBILAN NUTRIEN, AKTIVITI FIZIKAL DAN KUALITI HIDUP KE ATAS WANITA YANG BERLEBIHAN BERAT BADAN DAN OBES DALAM KALANGAN KAKITANGAN KERAJAAN. DI KOTA BHARU, KELANTAN.

ABSTRAK

Penilaian status pemakanan, pengambilan nutrien, aktiviti fizikal dan kualiti hidup telah dijalankan ke atas sebanyak 160 wanita yang berlebihan berat badan dan obes dalam kalangan kakitangan kerajaan di Kota Bharu, Kelantan. Data telah dikumpulkan melalui soal selidik yang merangkumi ciri-ciri sosio-demografi, Soal Selidik Aktiviti Fizikal Antarabangsa (IPAQ), Ingatan Diet 24 jam dan soal selidik Kesan Berat kepada Kualiti Hidup (IWQOL) soal selidik. Indeks jisim badan, lilitan pinggang, berat dan ketinggian diukur dengan menggunakan kaedah yang seragam. Hampir separuh daripada responden (36.9%) berada dalam lingkungan umur 30-39 tahun. Majoriti responden adalah Melayu (99.4%) dan diikuti oleh Cina (0.6%). Purata berat badan, ketinggian dan BMI daripada responden masing-masing adalah 72.3 ± 9.12 kg, 1.55 ± 0.06 cm, dan 30.0 ± 3.33 kg/m2. Berdasarkan klasifikasi WHO, terdapat 60.0% daripada responden mempunyai berat badan berlebihan dan 40% daripada responden obes. Lilitan pinggang daripada responden adalah normal dan obes adalah masing-masing 1.9% dan 98.1%. Purata jumlah markah aktiviti fizikal adalah tinggi dalam kumpulan obes (17.171,63 ± 13.353,24) berbanding dengan kumpulan berat badan berlebihan (14.238,23 ± 9963,04) Tambahan pula, jumlah purata pengambilan kalori responden untuk berat badan berlebihan (1631,13 ± 458,18 kcal) adalah lebih tinggi daripada yang obes (1513,03 ± 475,68 kcal). Data menunjukkan hubungan linear signifikan antara pengambilan protein

dalam kehidupan seksual kepada kualiti hidup (b = 0.13, 95% CI = 0.001, 0.258, p <0.048), umur dalam tekanan di tempat awam kepada kualiti hidup (b = -0,386, 95% CI = -0,006, -0,106, p <0.007) dan pendapatan individu dalam tekanan di tempat awam kepada kualiti hidup (b = -0,002, 95% CI = -0,003, 0.000, p <0.024). Ini menunjukkan bahawa umur, pendapatan individu dan pengambilan protein boleh digunakan sebagai petunjuk kepada kualiti hidup. Tetapi, tiada hubungan dikenal pasti antara aktiviti fizikal dan BMI dengan kualiti hidup.

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KOTA BHARU, KELANTAN.

ABSTRACT

Assessment of nutritional status, nutrient intake, physical activity and quality of life were carried out among 160 overweight and obese women government staffs in Kota Bharu, Kelantan. Data was collected using a questionnaire which included socio-demographic characteristics, the International Physical Activity Questionnaire (IPAQ), 24-hour dietary recall and Impact Weight Quality of Life (IWQOL) questionnaire. Body mass index, waist circumference, weight and height were measured using standardized methods. Almost half of the respondents (36.9 %) were within age of 30-39 years. Majority of the respondents were Malay (99.4%) and followed by Chinese (0.6%). Mean weight, height and BMI of the respondents were 72.3 ± 9.12 kg, 1.55 ± 0.06 cm, and 30.0 ± 3.33 kg/m2 respectively. Based on WHO classification, 60.0% of respondent were overweight and 40% of respondents are obese respectively. The waist circumference of respondents for normal and obese individuals are 1.9% and 98.1% respectively. The mean total physical activity score was high in obese group (17171.63 ± 13353.24) than overweight group (14238.23 ± 9963.04). Furthermore, the mean total calorie intake of respondents for overweight (1631.13 ± 458.18 kcal) was higher than obese (1513.03 ± 475.68 kcal). Significant linear relationship was found between protein intake in sexual life of quality of life (b=0.13, 95% CI= 0.001, 0.258, $p < 0.048$), age in public distress of quality of life (b= -0.386, 95% CI= -0.006, -0.106, $p < 0.007$) and individual income in

public distress of quality of life (b= -0.002, 95% CI= -0.003, 0.000, p < 0.024). This indicate that age, individual income and protein intake can be used a predictor for quality of life. However, there is no association was identified between physical activity and BMI with quality of life.

INTRODUCTION

1.1 Background

Malaysia has been experiencing a rapid phase of industrialization and urbanization in recent decades and has often been recognized as a role model for developing economies. Statistics from several Ministries for the last two decades suggested that as the population achieve affluence, their intake of energy, fats and sugars increase (Ismail et al., 2002). At the population level, a high prevalence of obesity results from a complex interaction between changes in the population's lifestyle, involving a higher energy and fat consumption and an increasingly sedentary existence (WHO, 2002).

Obesity is a phenomenon happening worldwide, with global prevalence almost doubling since 1980. Worldwide, prevalence of overweight and obesity combined rose by 27.5% for adults between 1980 and 2013 (Ng et al., 2014). Obesity is an epidemic of the 21st century. Overweight and obesity are defined as a condition of abnormal or excessive fat accumulation that presents a risk to health and well-being (WHO, 2015b). It is a major causative factor for many other metabolic disorders, and is also a leading risk for global deaths. According to a global estimate by WHO, in 2014, there were more than 1.9 billion adults, 18 years and older, were overweight. Of these over 600 million were obese. About 13% of the world's adult population, comprising of 11% of men and 15% of women were overweight (WHO, 2015b).

National Health and Nutrition Examination Survey (NHANES) data in 2011-2012 reported that more than one-third of the adults were obese. In 2011-2012, the prevalence of adult obesity in the United State was 34.9%. Among these obese adults, the prevalence of obesity was higher among middle-aged adults aged 40-59 (39.5%) than younger (30.3%) adults or older adults (35.4%) aged 20-39 and aged 60 and above respectively. Prevalence of obesity among women was found to be 36.1% and it was more prevalent among either middle-aged or older women than among younger women. No difference was found between the prevalence of obesity between women aged 40-59 and 60 and over (39.5% compared with 38.1%) (Ogden et al.,2013).

Previously considered an epidemic of developed countries, in recent years the growing burden of obesity has affected most regions, including Southeast Asia (Prentice, 2006). Like other parts of the world, obesity is considered one of the key risk factors for chronic non-communicable disease in Southeast Asia (Dans et al., 2011). The prevalence of overweight and obesity in most of the Asian countries has increased many folds in the past few decades and the magnitude varies between countries. In a multi-country review on epidemic of obesity carried by Low, Mien and Yap, 2009, the prevalence of overweight for men and women ranged from 13.2% in Indonesia to 32.5% in Singapore. Singapore also ranked highest for adult obesity at 6.9%, compared to 2.4% in the Republic of Korea and Indonesia (Low, Chin, & Deurenberg-Yap, 2009a).

Amongst the Southeast Asia, Malaysia is the sixth most obese country in Asia. Dr Mohd Ismail Noor, president of the Malaysian Association for the Study of Obesity (MASO) said in an interview that Malaysia face a double burden syndrome in which the prevalence of

obesity is increasing while we are still grappling with the problem of under-nutrition (MASO, 2009). It is patent that the growing trend of obesity in the Malaysian population is steadily becoming a public health challenge.

National surveys have highlighted the rapid rise of obesity among adults. The second and third National Health and Morbidity Surveys (NHMS II and NHMS III) conducted in 1996 and 2006 respectively reported a three-fold increase in obesity prevalence among adults, surging from 4.4% to 1996 to 14.0% in 2006 with the highest prevalence of 19.3% seen among adults aged between 45 to 49 years old (Kee et al., 2008; Khambalia & Seen, 2010; MOH, 2003). Likewise, the number of overweight adults has increased from 16.6% to 29.1% over the same period (MOH, 2003).

The fourth NHMS in 2011 had reported that the prevalence of obesity among Malaysian adults has increased to 15.1%. This reflects an increase in obesity in Malaysia of 300% in years, from 4.4% in 1996 to 15% in 2011. NHMS 2011 also reported that one out of two Malaysian adults is either overweight or obese (Institute for Public Health (IPH), 2011). Malaysia has now become the most obese nation in Southeast Asia, with 43.8% of Malaysian men and almost half of women (48.6%) being overweight or obese (Ng et al., 2014).

The term quality of life encompasses standard of living, quality of housing and neighborhood, job satisfaction, family relationships, health and other factors (Kushner and Foster, 2000). Obesity have a relationship with quality of life that will give effect to obese people. According to Fontaine & Barofsky (2001) and Kushner & Foster (2000), stated that in recent years, there has been a strong interest in assessing quality of life of individuals with obesity and several of the studies developed reinforce the assumption that obesity is a

chronic disease associated to significant quality of life impairment (Silva *et al.*, 2008). A number of studies have shown an association between an increase in body mass index (BMI) and a reduction in quality of life (Sendi *et al.*, 2005) .

The earliest investigations into quality of life issues in obesity utilized severely obese patients who had undergone surgical interventions for obesity. With the occurrence of rapid, dramatic weight loss following surgery, patients experienced marked changes in quality of life which made them highly suitable for study (Kolotkin et al, 2011). As with intestinal bypass surgery, there are many reports of enhanced quality of life following dramatic weight losses through gastric restriction surgery (Stunkard, Stinnett & Smoller, 1986). For example, patients reported improved sexual functioning, such as increased sexual interest, enjoyment and frequency (Harris & Green, 1982), as well as increased physical and social activities. Similarly, patients experienced increased self-confidence and improved self-concept (Halmi , Stunkard , Mason ,1980).

In addition, patients reported decreased mirror avoidance, a sign of improving body image (Halmi, Stunkard & Mason, 1980). In the last decade, more sophisticated studies examining Health-Related Quality Of Life (HRQOL) changes following gastric surgery were conducted in which control groups, validated HRQOL measures, and longer follow-up periods were included (Sullivan M et al., 1993). Until recently, there has been little standardization of quality of life measures in obesity, with many researchers simply developing their own set of non-validated questions. The early papers on quality of life in surgical patients particularly relied on these types of questionnaires. Now that the field of quality of life research has grown considerably, standards for the development and validation of quality of life instruments have been proposed (Ware, 1987).

Nutrition and dietary intake is related to obesity because major dietary change includes a large increase in the consumption of fat and added sugar in the diet, often a marked increase in animal food products contrasted with a fall in total cereal intake and fiber (Popkin, 2001). In many ways this seems to be an inexorable shift to the higher fat Western diet, reflected in a large proportion of the population consuming over 30% of energy from fat. However, there are many exceptions and the foods that drive these changes differ by region. For instance, for Asia a major component appears to be the increase in amount of edible oils in the diet. But there is great heterogeneity in the diet shifts. For instance, one of the higher income countries in Asia, South Korea, has retained many elements of a traditional diet despite a rapid increase in income during this past half-century (Popkin, 2001).

Obesity is increasing at alarming rates worldwide (WHO,2000). The disease is due to an undesirable positive energy balance over prolonged periods of time. Similar inconsistencies have been found in the relation between eating frequency and energy intake, where some studies have reported a positive relation (Berteus Forslund , 2002) whereas other studies found no relation at all 2 or gender differences (Drummond et al, 1998). It has been suggested that the inconsistent associations reported between BMI, energy intake and eating frequency/snacking are due to differences in physical activity (Berteus Forslund , 2002). Drummond et all (1998) hypothesized that the lack of a relationship between increased snacking and BMI may be explained by the fact that frequent snackers may have higher energy intakes due to higher physical activity levels. This implies that those who have a frequent snacking intake are more physically active and also maintain normal weight.

Physical activity is one of the primary factors involved in the development of obesity. Physical activity has a desirable impact on weight and body composition in which it promotes fat loss and preserves lean body mass (Peterson & Turker, 2008). In 2008, 50% of women in both WHO Region of the Americas and the Eastern Mediterranean Region were sufficiently active, while the prevalence for men was 40% in the Americas and 36% in Eastern Mediterranean. In South East Region, men and women showed the lowest percentages for insufficient activity which is 15% and 19% respectively. In all WHO regions, men were more active than women, with the biggest difference in prevalence between the two sexes in Eastern Mediterranean. This was also the case in nearly every country (WHO, 2015c).

Physical inactivity is partly due to insufficient participation in physical activity during leisure time and an increase in sedentary behavior during occupational and domestic activities. Besides, an increase in the use of passive modes of transportation has also been associated with declining physical activity levels among society (WHO, 2015c). Sedentary lifestyle leading to a decline in daily physical activity levels and decreased energy expenditure causes energy imbalance resulted in increasing trends of obesity levels (Poh et al., 2010; Saris et al., 2003). According to WHO, in 2008, around 31.0% of adults aged 15 and above were insufficiently active and physically inactivity has caused an approximately 3.2 million of deaths globally (WHO, 2015c).

The prevalence of physical activity in Malaysia is lower than in other Asia countries such as China (93.1%), Hong Kong (84.7%), and India (76.6%), but higher than Japan (56.7%) and Taiwan (57.7%) (Bauman et al., 2009). The Malaysia Non-communicable Diseases Surveillance-1 (MyNCDS-1), conducted in 2005/2006, found that approximately

60% of Malaysian adults were physically inactive (Disease Control Division (DCD), 2006). NHMS III reported a lower level of physical inactivity which is 43.7% with 35.3% men and 50.5% women being classified as inactive, meanwhile the World Health Survey conducted in 2003 reported a much lower prevalence of physical inactivity at 19.6% in Malaysia (WHO,2008).

1.2 Problem statement

Study in Malaysia had shown that socio demographic factors such as ethnicity, gender, education level and health–lifestyle factors including family history of serious illnesses and smoking status have significant effects on obesity risks (Tan, Dunn, Samad,& Feisul, 2011). Specifically, Malaysians more likely to be obese are females (5.3%), lower educated (0.9%), those with history of family illnesses (4.8%), and non-smokers (6.4%) (Tan etal., 2011).

In recent decades, there has been a shift towards increased obesity and non-communicable diseases as a result of the latest pattern of transition in physical activity, diet and nutritional status in human history (Popkin, 2006; Poh et al., 2010). Obesity increases the risk of chronic diseases such as diabetes mellitus, cardiovascular disease, stroke and some cancers. It is a serious public health problem that is growing in countries with low or middle income (Low, Chin, & Deurenberg-Yap, 2009). In 2010, overweight and obesity were estimated to cause 3.4 million deaths, 4% of years of life lost, and 4% of disability-adjusted life-years (DALYs) worldwide (Ng.et al., 2014).

The prevalence of obesity in developing countries especially among women is on the rise (Sidik and Rampal, 2009). Obesity affects women more often than men where males

have a 5.3% lower obesity risk compared with females (Tan *et al.*, 2011). NHMS III reported a higher prevalence of abdominal obesity in women (26.0%) than men (7.3%) and obesity among Malaysian women had increased from 7.6% in 1996 to 17.4% in 2006 (Kee et al., 2008).

Based on the classification from Malaysian Clinical Practice Guidelines on Management of Obesity (2004), prevalence of obesity in Malaysia was significantly higher in women (29.6%) as compared to men (25.0%). The highest obesity prevalence was among adults aged 45-49 years (35.2%) followed by the 55-59 years group (34.4%) and 50-54 years (32.6%). In the aspect of ethnicity, prevalence of obesity was highest amongst the Indians (35.8%), followed by Malays (32.0%), the other Bumiputras (25.3%), Chinese (19.7%) and others (13.8%) (Institute for Public Health (IPH), 2011).

The national prevalence of abdominal obesity was 43.0% and women showed a significantly higher prevalence of abdominal obesity (51.3%) than men (35.4%). Prevalence of abdominal obesity increased with age peaking at 65 to 69 years and approximately 60% the adults between 50-69 years had abdominal obesity. Among the three major ethnic groups, the prevalence of abdominal obesity was significantly higher among the Indians (61.8%), Malays (45.3%) and Chinese (40.4%) (Institute for Public Health, 2011). Obesity will affect fertility throughout a woman's life (Kulie et al., 2011).

In 2011, NHMS reported that 64.3% of Malaysian adults aged 16 and above were physically active. The male population (59.5%) was more physically active than the female population (59%). It was also observed that there was an increasing level of physical activity from adolescents aged 16-19 years old to adults aged 40-44 years old, whereby the later was the most physically active group amongst all age group.physical activity level decreased

with increasing age, which is particularly apparent in the elderly (Institute for Public Health, 2011).

Both physical activity and high BMI were found to be related to a number of health-related risk factors (Hu et al., 2004; Mora et al., 2006). Raised BMI in obesity is a major risk factor for non-communicable diseases such as cardiovascular diseases, and type 2 diabetes mellitus, musculoskeletal disorders and some cancers including endometrial, breast, colon, kidney and gall bladder (ACE, 2014; Peterson & Tucker, 2008; Popkin & Gordon-Larsen, 2004; Wildman et al., 2005). Adiposity in mid-life strongly relates to reduced probability of healthy long term survival in women (Shah & Braverman, 2012).

There high prevalence of sedentariness in Malaysia was due to rapid industrialization and urbanization (Siti Affira et al., 2011). Prevalence of physical inactivity was found to be higher amongst women (23.2%) compared to with men (16.0%) (Poh et al., 2010). Both obesity and decreasing physical activity level are major risk factors for the development of coronary heart diseases (CHD) among women. Women who were obese and are sedentary had the highest CHD risk (Li et al., 2006).

Studies on the prevalence of overweight and obesity among children and adolescents had been conducted in Kelantan (Sakinah et al., 2012; Soo et al., 2011; Wan Manan, Norazawati & Lee, 2012). Nevertheless, very little information is available on the prevalence of overweight and obesity among women in any of the east cost of peninsular Malaysia.

In recent years, there has been a strong interest in assessing quality of life of individuals with obesity and several of the studies develop reinforce the assumption that obesity is a chronic disease associated to significant quality of life impairment (Silva *et al.*, 2008). In order to evaluate the impact of severe obesity and its treatment on quality of life (QoL), an

important initial step would be to identify the areas of patients QoL most likely to be specifically affected by the disease (Duval *et al.,* 2006). A study reported that patients with severe obesity, higher BMI was not associated with a lower quality of life (Sendi *et al.*, 2005).

1.3 Significance of study

According to MyNCDS-1, the prevalence of adult obesity in Kelantan state is 13.7%, with more prevalence of obesity in women than men (Disease Control Division (DCD), 2006). Women obesity is significantly higher than in males (Khor & Zalilah, 2003; Narayan & Khan, 2007; Yunus et al., 2004), and is becoming more prevalent with a wide range of effects on a variety of women's health issues.

Many women, irrespective of demographic characteristics of income, are vulnerable to becoming overweight or obese due to limited resources for physical activity and healthy food choices, work commitments and family demands (American College of Obstetricians and Gynecologist, 2014). Nevertheless, very little information is available on the prevalence of overweight and obesity among women in any of the east cost of peninsular Malaysia.

Being overweight or obese increases the risk of diabetes and coronary artery disease (CAD) in women. Obese women are of higher risk of low back pain and knee osteoarthritis. Higher weight exert excess load on the joint, increased cartilage turnover and increased risk of degenerative meniscal lesions. Obese women are also found to be at higher risk for

multiple cancers, including endometrial cancer, cervical cancer, breast cancer, and perhaps ovarian cancer (Kulie et al., 2011).

Kelantan is one of the state that having a high population of working people especially who are working as government servants. It can be observed that some of the women living in Kelantan work as government servants, many of them work in different location in this state. Women play an important role to the family as well as make economic and social contribution to the community. Thus, understanding their health status and determining how their nutrient intake, physical activity and nutritional status affect their quality of life, health and daily activities are important. This study would be useful for assessing their body composition, and eventually help in planning, implementing and intervention against overweight and obesity among women.

1.4 Research objective

1.4.1 General objective

To assess nutritional status, dietary intake, physical activity and quality of life among female overweight and obese government staffs in Kota Bharu, Kelantan.

1.4.2 Specific objective

a. To determine the nutritional status and body composition among female overweight and obese government staffs in Kota Bharu, Kelantan.
b. To assess nutrient intake of female overweight and obese government staffs in Kota Bharu, Kelantan.
c. To assess the physical activity level of female overweight and obese government staffs in Kota Bharu, Kelantan.
d. To assess impact weight quality of life among female overweight and obese government staffs in Kota Bharu, Kelantan
e. To identify the associated factors of quality of life among female overweight and obese government staffs in Kota Bharu, Kelantan.

1.5 Research questions

a) What are the associated factors (socioeconomic status, physical activity and nutrient intake) contributing to quality of life of female overweight and obese government staffs in Kota Bharu, Kelantan?

1.6 Hypotheses

1.6.1 Null hypothesis (Ho)

There is no association between socioeconomic status, nutritional status, nutrient intake and physical activity with quality of life among female overweight and obese government servants in Kota Bharu, Kelantan.

1.6.2 Alternative hypothesis (HA)

There is an association between socioeconomic status, nutritional status, nutrient intake and physical activity with quality of life among female overweight and obese government servants in Kota Bharu, Kelantan.

1.7 Conceptual Framework

Based on the conceptual framework in Figure 1, sociodemographic factors including age, ethnicity, income level, educational level and health status along with nutrient intake pattern, physical activity level as well as time spent sitting may be the factors affecting body composition in terms of body mass index (BMI). Increasing age of women may cause their physical activity level to be reduced and they might spend more time on sedentary behaviour including sitting. Types of occupation may also affect the time spend on sitting. Government servants usually working in office and spend more time on sitting because they use computer tables while working. Women with lower income may prefer to purchase foods that are cheaper in price but are energy-dense. Women who attained higher education level may be more knowledgeable in choosing healthier and nutritious foods as well as exercising healthy lifestyles, meanwhile women with lower educational level may not fully understand the

importance of healthy eating and healthy body weight. Nutrient intake pattern and food consumption frequency may contribute to weight gain by causing excessive energy intake. Changes in body composition will affect nutritional status by either leading to underweight, overweight or obesity. Both overweight and obesity are risk factors that cause non-communicable diseases such as diabetes, cancers, CVD or hypertension.

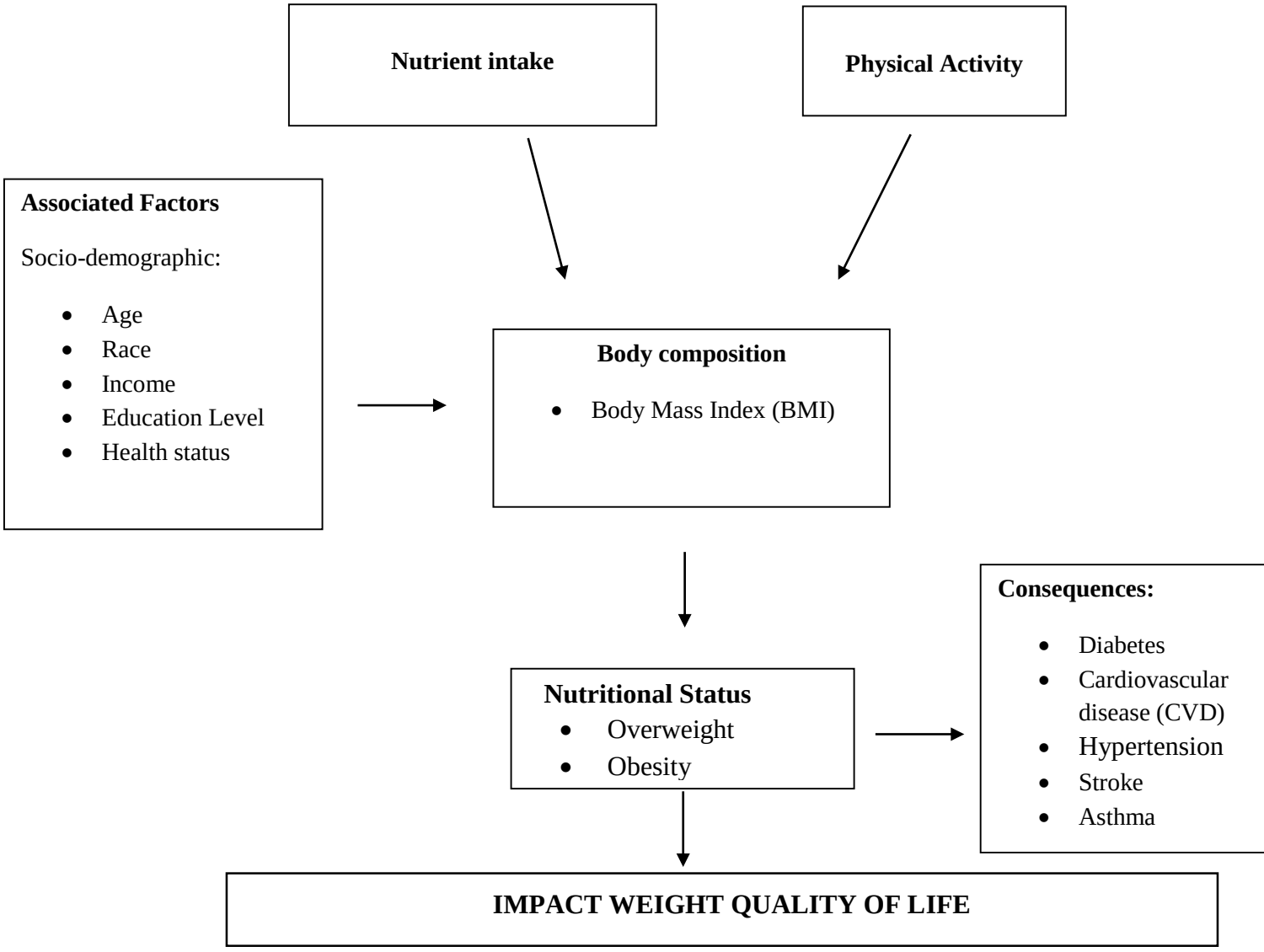

Figure 1: Conceptual framework of the study

1.8 Operational Definition

1.8.1 Anthropometry measurements

Anthropometry measurement can be used to assess and determine body composition. Anthropometry measurements include measurement of BMI include height and weight.

1.8.1.1 Body Mass Index (BMI)

BMI is defined as the weight in kilograms divided by the square of the height in meters (kg/m^2). BMI is categorized according to the classification system recommended by the WHO Global Data Base (WHO, 2014) as follow:

Table 1.1 BMI classifications according to WHO

Classification	**BMI(kg/m^2)**	
	Principal cut-off points	**Additional cut-off points**
Underweight	**<18.50**	**<18.50**
Severe thinness	<16.00	<16.00
Moderate thinness	16.00 - 16.99	16.00 - 16.99
Mild thinness	17.00 - 18.49	17.00 - 18.49
Normal range	**18.50 - 24.99**	**18.50 - 22.99**
		23.00 - 24.99
Overweight	**≥25.00**	**≥25.00**

Pre-obese	25.00 - 29.99	25.00 - 27.49
		27.50 - 29.99
Obese	**≥30.00**	**≥30.00**
Obese class I	30.00 - 34.99	30.00 - 32.49
		32.50 - 34.99
Obese class II	35.00 - 39.99	35.00 - 37.49
		37.50 - 39.99
Obese class III	≥40.00	≥40.00

(Adapted from WHO, 2006)

1.8.2 Physical activity

Physical activity is defined as any bodily movement produced by skeletal muscles that require energy expenditure(WHO, 2015c). The International Physical Activity Questionnaire (IPAQ) was developed to measure health-related physical activity (PA) in populations. IPAQ is a questionnaire designed specifically for adults aged 18 to 65 years. The IPAQ items capture moderate and vigorous intensity leisure-time, domestic, occupational and transport-related domains, which summate to total physical activity (Bauman et al., 2009; Maria, Pekka, & Michael, 2005). The IPAQ assesses physical activity undertaken across a comprehensive set of domains including leisure time physical activity, domestic and gardening (yard) activities, work-related physical activity and transport-related physical activity (IPAQ, 2005).

The IPAQ sitting question is an additional indicator variable and is not included as part of any summary score of physical activity. To-date there are few data on sedentary (sitting) behaviors and no well-accepted thresholds for data presented as categorical levels. For the sitting question 'Minutes' is used as the indicator to reflect time spent in sitting rather than MET-minutes which would suggest an estimate of energy expenditure (IPAQ, 2005).

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Three levels of physical activity are proposed and are categorized as follow *(*IPAQ, 2005):

1. Low

No activity is reported **OR**

a. Some activity is reported but not enough to meet Categories 2 or 3.

2. Moderate

Any of the following 3 criteria:

a. 3 or more days of vigorous-intensity activity of at least 20 minutes per day **OR**

b. 5 or more days of moderate-intensity activity and/or walking of at least 30 minutes per day **OR**

c. 5 or more days of any combination of walking, moderate-intensity or vigorous-intensity activities achieving a minimum of at least 600 MET-min/weeks.

3. High

Any one of the following 2 criteria:

• Vigorous-intensity activity on at least 3 days and accumulating at least 1500 MET-minutes/week **OR**

• 7 or more days of any combination of walking, moderate- or vigorous- intensity activities accumulating at least 3000 MET-minutes/week

1.8.4 The 24-hour Dietary Recall

The 24-hour dietary recall is a retrospective method of assessing the food and supplement intake of respondents. A trained interviewer will asks the respondents to recall in detail all the food and drink consumed in the previous 24 hours (Lee & Nieman, 2013). Interviewers will help respondents to remember all that was consumed during the period in question and assists the respondent in estimation portion size of foods consumed (Subar *et al.*, 2007; Thompson and Subar, 2001).The data are collected for the previous 24 hours, without prior notice, thus the method does not affect food choices on the day before the interview(Subar *et al.*, 2007)

1.8.5 Impact Weight Quality of life (IWQOL) Questionnaire

IWQOL questionnaire is developed by Professor Kolotkin, from Duke University. This questionnaire contain many types of language and I was used Malay version of IWQOL and it is validated and translated original from Professor Kolotkin. The IWQOL was the first instrument specifically developed to assess the effects of the obese condition on the quality of life of respondents. Respondents (individually and in groups) were asked to describe the effects of being overweight in their everyday lives. Their responses were recorded, re-written in the form of items, and grouped by category. The result of this process was a 31-item IWQOL questionnaire, with 11 items relating to physical functions, 7 items self-esteem, 4 relating to sexual life, 5 relating to public distress, and 4 relating to work.

CHAPTER 2

REVIEW OF LITERATURE

2.1 Obesity

Obesity is a result from an energy imbalance that occurs when energy consumption exceeds energy expenditure (Musingarimi, 2009; Papas et al., 2007). Paradoxically coexisting with under nutrition, an escalating global epidemic of overweight and obesity – "globesity" – is taking over many parts of the world, both in affluent, developed countries and in poorer, developing nations (Peterson & Tucker, 2008; WHO, 2015b).

Worldwide, at least 2.8 million people die each year as a result of being overweight or obese, and an estimated 35.8 million (2.3%) of global Disability Adjusted Life Years (DALYs) are caused by overweight or obesity (Heymann & Goldsmith, 2012). It was projected that by 2030, 1.35 billion and 573 million adults will be overweight and obese respectively, without adjusting for secular trends (Kelly, Yang, Chen, Reynolds & He, 2008).

Being overweight or obese constitutes a health risk as it is associated with multiple co-morbidities, including cardiovascular disease (McQuigg et al., 2008; Nangia, Singh, & Kaur, 2014; Song et al., 2014), hypertension (Hall et al., 2010; Rahmouni et al., 2005), dyslipidemia (Bays et al., 2013; Klop, Elte, & Cabezas, 2013), diabetes (Chiang, Pritchard, & Nagy, 2011; Martyn, Kaneki, & Yasuhara, 2008; Whitlock et al., 2009),

stroke (Bazzana et al., 2010; Strazzullo et al., 2010; Whitlock et al., 2009), sleep apnea and respiratory diseases , as well as a higher risk of all-cause mortality (Flega et al., 2013; Song et al., 2014).

Overweight and obesity are also known to contribute to colon cancer (Laiyemo, 2014), pancreas cancer (Preziosi, Oben, & Fusai, 2014), breast cancer (postmenopausal women) (Kuhl, 2005; Morris et al., 2011), liver cancer and kidney diseases (Joachim & Kumar, 2010; V.Mathew, Okada, & Sharna, 2011). Besides as a risk factor for breast cancer in postmenopausal women, overweight ad obesity causes osteoporosis in women.

2.2 Obesity among Women

Obesity is a major health problem with higher prevalence among women (Popkin & Gordon-Larsen, 2004). Prevalence of obesity was found to be higher in women in developed and developing countries than in men (Ng et al., 2014). This nutritional disorder affects almost 48 million adult women in the United States (Jarosz et al., 2014). African-American women (AAW) have the highest obesity rate of any group in the United States at 58.6%, a rate nearly twice that of non-Hispanic White women at 33.4% (Jarosz Et al., 2014; Ogden et al., 2012).

According to a systematic analysis for the Global Burden of Disease Study (GBD) 2013, prevalence of women obesity had increased from 28.8% in 1980 to 38.0% in 2013 (Ng et al., 2014). In developing countries, specifically Malaysia, 49% of Malaysian women were overweight or obese (Ng et al., 2014). In some developing countries, obesity especially among women is regarded as a sign of affluence (Ramachandra et al., 2012).

Women tend to have more health complications associated with obesity than men. The sex difference is possibly related to differences in dietary patterns (Milen et al., 2005), physiological and behavioral changes associated with ageing (Milen et al., 2001), higher levels of body fat and the ability to store more fat (Wu & O'Sullivan, 2011), fluctuation in sex hormone concentrations (Freeman, Sammel, Lin, & Gracia, 2010) and higher lepin levels (Wu & O'Sullivan, 2011).

Obesity is an independent risk factor for the development of CAD in women but abdominal obesity may be more harmful than BMI or weight alone in women. Waist circumferences is also an independent risk factor for CAD in both normal weight and overweight women (Weiss, 2009). In addition, degree and duration of overweight and obesity as well as central or visceral fat enhances the degree of insulin resistance associated with obesity (Bray, 2003; Gallagher, LeRoith, & Karnieli, 2008).

2.3 Age and Obesity

Age pattern associated with overweight and obesity differed in men and women. GBD 2013 reported that men older than 10 years showed higher rates of overweight and obesity than women in developed countries; in developing countries, women have higher rates than men older than 25 years. In developed countries, overweight and obesity peak in men at about 55 years old and at about 45 years old in developing countries. For women, overweight and obesity peak at age near to 60 years, with 64.5% being overweight or obese and 31.3% being obese. The highest prevalence of obesity was found in women at about age of 55 years, and about 45 years for men (Ng et al., 2014).

Similarly, studies had shown that mean body weight and BMI gradually increase during most of adult life and reach peak values at 50-59 years old in both women and men. The mean body weight and BMI tend to decrease after the age of 60 years old (Flegal, Carroll, Ogden & Johnson, 2002; Hedley et al., 2004; Villareal, Apovian, Kushner & Klein, 2005). In older adults, age-related changes in body composition such as decreases in fat-free mass and increase in fat mass, together with loss of height will alter the relation between BMI and body fat percentage (Sorkin, Muller, & Andres, 1999). Thus, at any given BMI value, changes in body composition would tend to underestimate fatness, whereas the loss of height would tend to overestimate fatness.

Trends in prevalence of adult age-standardized obesity over successive cohorts in developed and developing countries showed that successive cohorts seemed to be gaining weight at all ages, including childhood and adolescence, with most rapid gains between the ages of 20 and 40 years. In developed countries, peak prevalence of obesity is moving to younger ages (Ng et al, 2014).

A combined data from study in Morocco and Tunisia found that BMI of women increased significantly with age up to a maximum at 55 years (Mokhtar et al., 2001). Increased in body weight with age has been attributed to increasing sedentariness, changes in physical activity, diet and lifestyles that are associated with aging (Chee et al., 2004). Morocco, Tunisia and Malaysia are being categorized as middle human development countries (United Nations Development Programme (UNDP), 2002).

A multinomial analysis by Gouda and Prusty (2014) showed that women aged 35 years and above are 5 times more likely to be overweight and 12 times more likely to be obese

than women of 15-24 years. Middle-aged men and women were more likely to be overweight or obese than their younger and older counterparts.

2.4 Physical Activity and Obesity

Physical inactivity is one of the risk factors in development of obesity (Bryan & Walsh, 2004; Peterson & Tucker, 2008) and it is also the forth leading risk factor for mortality. Insufficient physical activity accounted for 20% to 30% increase in risk of all-cause mortality in those who did not engage in at least 30 minutes of moderate intensity exercise in most days of the week (WHO,2015a).

At all ages, women and girls are less likely to participate in physical activity (Bryan and Walsh, 2004). Women with increased physical activity have a decreased in body fat and weight while those with decreased physical activity tended to have an increase in body fat and weight (Peterson & Tucker, 2008). Working women were found to spend few hours exercising, which decrease calories expended and leading to weight gain (Au et al., 2013; Courtemanche, 2009).

According to the 2011-2012 National Health Survey in Australia, the lowest rate of sedentary levels of physical activity was reported by people aged 18-24 years, and sedentary levels of physical activity generally increased between young and adult ages and middle age (Australian Bureau of Statistics, 2013). Study also showed that physical inactivity accounted for the highest proportion of ischemic heart disease in Australian women from age 31-36 to 85-90. From about age 30, physical inactivity has the biggest impact on the risk of heart disease, which outweighs that of other risk factors, including high BMI (Brown, Pavey, & Bauman, 2014).