ASSESSMENT OF NUTRITIONAL STATUS, ABDOMINAL OBESITY AND LEVEL OF PHYSICAL ACTIVITY AMONG SHIFT WORKING FEMALE NURSES IN HOSPITAL UNIVERSITI SAINS MALAYSIA

By

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DECLARATION

I hereby declare that the thesis is my original work except for the quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently submitted for any other degree or purposes in Universiti Sains Malaysia or at any other institutions.

I certify that Ms MARIA WONG SIAW MING has carried out her study entitled The assessment of nutritional status, abdominal obesity and level of physical activity among shift working female nurses in Hospital Universiti Sains Malaysia (HUSM) as a final year research project in nutrition under my supervision. She has complied with the ethical standard and regulations in conducting her study and has completed writing her 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.

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LIST OF SYMBOLS, ABBREVIATIONS AND ACRONYMNS

AHA	American Health Association
AO	Abdominal Obesity
BMI	Body Mass Index
CVD	Cardiovascular Disease
HDL-C	High-density Lipoprotein Cholesterol
HUSM	Hospital Universiti Sains Malaysia
IASO	International Association for the Study of Obesity
IDF	International Diabetes Federation
IOTF	International Obesity Task Force
IPAQ	International Physical Activity Questionnaire
LDL-C	Low-density Lipoprotein Cholesterol
MASO	Malaysian Association for the Study of Obesity
MET	Metabolic Equivalent
NCEP ATP III	National Cholesterol Education Program Adult Treatment Panel III
NHANES	National Health And Nutrition Examination Survey
NHLBI	National Heart, Lung and Blood Institute
WHO	World Health Organization
WHR	Waist-to-hip Ratio

ABSTRAK

Obesiti adalah masalah kesihatan utama dunia termasuk Malaysia dengan peningkatan prevalens obesiti di bahagian perut. Objektif utama kajian adalah untuk menilai taraf pemakanan, obesiti abdomen dan tahap aktiviti fizikal dalam kalangan jururawat yang sedang bekerja di Hospital Universiti Sains Malaysia (HUSM), Kelantan. Kajian hirisan lintang ini telah dilakukan terhadap 190 jururawat wanita berusia 21 hingga 55 tahun, yang telah dipilih secara sistematik dari semua wad melalui senarai nama. Responden ditemuduga mengenai ciri-ciri sosiodemografik, tabiat sarapan pagi, tempoh waktu tidur serta syif waktu malam, corak diet dan tahap aktiviti fizikal mereka. Berat, tinggi, indeks jisim tubuh, nisbah pinggang pinggul dan peratusan lemak badan diukur, direkod dan dihitung. Purata indeks jisim tubuh adalah 24.8 ± 5.1 dan hampir separuh dari responden (48.9%) mempunyai indeks jisim tubuh normal, 43.3% adalah berlebihan berat badan dan obese, dan 7.9% sahaja yang kekurangan berat badan. Dari kesemua responden, 78.0% mempunyai lilitan pinggang normal manakala 62.6% mempunyai nisbah pinggang pinggul yang normal. Dari segi peratus lemak, 48.9% mempunyai peratusan lemak badan normal manakala 45.8% mempunyai peratus lemak badan tinggi. Semua pembolehubah sosiodemografik tidak menunjukkan sebarang perkaitan dengan obesiti abdomen kecuali umur. Analisis lebih lanjut iaitu regresi linear mudah menunjukkan umur, pendapatan sebulan dan bilangan anak mempunyai perhubungan linear dan merupakan peramal terhadap obesity abdomen. Penemuan menunjukkan obesiti abdomen cenderung untuk meningkat dengan umur dalam kalangan jururawat wanita. Tempoh waktu tidur, kekerapan syif malam, tabiat sarapan pagi dan tahap aktiviti fizikal juga tidak menunjukkan sebarang perkaitan atau perhubungan linear dengan obesity abdomen. Dari segi corak diet, gula dan nasi putih adalah antara

kedua item makanan tertinggi penggunaannya setiap hari dan 72.4% dari mereka meninggalkan sarapan pagi, tetapi tiada sebarang perkaitan dengan obesiti abdomen ditemui. Kesimpulannya, sampel saiz yang lebih besar dari hospital yang berbeza dengan sampel yang lebih seragam dari segi umur sepatutnya dipertimbangkan dalam melaksanakan kajian akan datang bagi menentukan faktor-faktor berkaitan dengan obesity abdomen.

ABSTRACT

Obesity is a global major health problem including Malaysia with the increasing of prevalence in abdominal obesity. The objective of this study was to assess nutritional status, abdominal obesity and level of physical activity among nurses working in Hospital Universiti Sains Malaysia (HUSM), Kelantan. This cross-sectional study was conducted among 190 female nurses aged from 21 to 55 years old, who were systematically sampled from all wards by using the name list. Respondents were interviewed on sociodemographic characteristics, breakfast habit, sleep duration and night shift, dietary pattern and their level of physical activity. Weight, height, body mass index (BMI), waist-to-hip ratio and body fat percentage were measured, recorded and calculated. The mean BMI was 24.8 ± 5.1 and about half of the respondents (48.9%) were having normal body mass index (BMI), 43.3% were overweight and obese and 7.9% were underweight. Out of respondents, 78.0% had normal waist circumference whereas 62.6% had normal waist-to-hip ratio. In term of body fat, 48.9% had normal body fat percentage while 45.8% had high body fat percentage. All sociodemographic variables did not show any association with abdominal obesity except age ($p=0.001$). Further analaysis of simple linear regression showed, age, salary per month and number of children did have linear relationship and were predictors for abdominal obesity. Findings showed risk of abdominal obesity tend to increase with age among adult female nurses. Duration of sleep, night shift frequency, breakfast habit and physical activity level also did not show any significant association or linear relationship with abdominal obesity. In term of dietary pattern, sugar and white rice consumption was top two highest food items daily and 74.2% were breakfast skipper, but no association with abdominal obesity was found. In conclusion, larger sample size in different hospital setting with

more homogenous sample in term of age should be considered in future study to identify the factors that are associated with the abdominal obesity.

CHAPTER 1 INTRODUCTION

1.1. Obesity as global epidemic

The global epidemic of overweight and obesity which is also known as "globesity" is rapidly becoming a major health problem in many parts of the world (WHO, 2010). Global burden of overweight and obesity is estimated at more than 1.1 billion (WHO/IASO/IOTF, 2000). Prevalence of obesity is rising in most countries with global expectation of rise up to 700 million by 2015 (Nguyen & El-Serag, 2010; WHO, 2012). Prevalence of overweight and obesity among adult population already exceeds 50% and occupied third place as risk factors causing death in high and middle income countries (Nir & Jesse, 2012). Obesity has been identified as one of the single greatest risk factors for chronic diseases such as cardiovascular disease (CVD) and hypertension. It is also associated with increased morbidity and mortality worldwide in both developed and developing countries (National Heart, Lung and Blood Institute, 2003; Zaki *et al.,* 2010). Obesity is defined as abnormal or excessive accumulation of fat in adipose tissue which may lead to the health impairment (WHO, 2000).

Since 1980, worldwide obesity has more than doubled. WHO Region of Americas reported the highest obesity levels (26% of adults) whereas WHO South-East Asia Region reported the lowest prevalence of 3% of adults were obese. World Health Statistic 2012 reported that one in six adults obese and one in two adults was overweight. There is about half of a billion people (12.0%) of the world's population were considered obese (WHO, 2012). In a study that had been carried out in Turkish found out that two out of three Turkish adults above the age 20 were either overweight or obese (Aytekin Oguz *et al.*, 2008; Grundy *et al.,* 2005). There were

55.0% of Tonga women and 74% of Samoan women were obese (Galassie, 2004). In South Africa, one in every three men and more than half of the female population are obese, while in Morocco 40% of the population is obese (Aldair, 2005). In 2006, about 47.9% of Malaysian population aged 25-64 years old were overweight (BMI ≥ 25 kg/m²) and 16.3% obese (BMI ≥ 30 kg/m²) (WHO 2012). In women, the prevalence of obesity had increased 2.5 times from 5.7% to 14.66% while in men, prevalence of obesity had increased 3.3 times from 2.9% to 9.72% (Azmi *et al.*, 2009). Prevalence of obesity in women (20.6%) was clearly much higher than in men (7.2%) (Kee *et al.*, 2008). For older age groups, overweight women had significantly poorer obesity-related quality of life especially in the work-related and routine life (Song *et al.*, 2010).

Abdominal obesity occurred when there was deposition of body fat in the upper body (waist and trunk) as opposed to the hips and thighs. It is measured by the waist-hip ratio (WHR) or waist circumference (Dalton *et al.*, 2003). Abdominal obesity (AO) or central obesity has been recognized as a major risk factor for cardiovascular disease (Lawrence *et al.*, 2007). In a study that had been conducted in Turkey stated that more than one out of three are abdominally obese based on American Heart Association/ National Heart, Lung and Blood Institute (AHA/ NHLBI) criteria (waist circumference of >102 cm in men and >88 cm in women) (Aytekin Oguz *et al.*, 2008; Grundy *et al.*, 2005). A study had been done in 340 working women in India stated that 280 working women out of 340 were abdominally obese (Jyothi & Nayak, 2010). More than 50.0% of adult women in the Middle-Eastern countries were abdominally obese (Azizi, Azadbakht & Mirmiran, 2005). The overall national prevalence of AO among Malaysian adults was 17.4%.

The prevalence of AO increased steadily with age until the age of 50 to 59 years, after which the prevalence declined (Kee *et al.*, 2008).

Health personnel or health professional are important promoters and role models for maintaining a healthy lifestyle for the general population. However, in one of the study of 194 nurses from 6 hospitals, majority of nurses were either overweight (37.0%) or obese (28.0%) (Zapka *et al.*, 2009). Another finding from a mailed survey to 4980 randomly selected registered nurses, almost 54.0% of them were overweight and obese. Out of respondent studied, 35.0% reported that they are overweight but lack of motivation to change their lifestyle (Miller, Alpert & Cross, 2008). Long working hours and rotating shift work are the barriers to nurses' healthy behaviors (Keller, 2009; Lamond *et al.*, 2003). Nurses often skip meals in order to complete their work so that they would not burden their peers (Scott *et al.*, 2010). Few studies proved that regular consumption of breakfast can help to improve physical and psychosocial wellbeing (Rampersaud *et al.,* 2005). A study conducted in Taiwan showed that there was an association between skipping breakfast and increased likelihood of obesity in the Taiwanese adults even after controlling certain variables (Huang *et al.,* 2010). Findings showed breakfast skipping ranged from 1.7% in Croatia to 30.0% in Brazil based on recent review of studies of breakfast consumption patterns (Mullan & Singh, 2010).

In the aspect of ethnicity, prevalence of abdominal obesity was higher among Indians and Malays compared to others. In term of marital status, women who were ever married had the higher risk of abdominal obesity compared to those who were not married (Kee *et al.*, 2008). In a study conducted in the Laussane population

showed that prevalence of obesity increased with age and decreased with educational level (Pedro Marques-Vidal *et al.*, 2008).

In order to estimate nutritional status and growth monitoring of individuals, anthropometric measurement is often being used (Gorstein *et al.*, 1994). Method that commonly used is waist circumference as it is convenient and inexpensive (Han *et al.*, 2006). Several studies found that waist circumference predicted obesity-related mortality risk better than body mass index (BMI), therefore waist circumference could be used as an alternative to BMI (Janssen Katzmarzyk & Ross, 2005; Simpson *et al.*, 2007; Pischon *et al.*, 2008; Kuk & Ardern, 2009; Seidell, 2010; Petursson *et al.*, 2011; WHO, 2011).

1.2. Justification of study

Abdominal obesity has been strongly linked with the risk of various chronic diseases (Huang *et al.*, 1999; Balkau *et al.*, 2007) and obesity will also affect fertility throughout a woman's life (Kulie *et al.*, 2011). Prevalence of abdominal obesity was higher in women than in men (Pedro Marques-Vidal *et al.*, 2008). Therefore, in this study, data collection among female respondents has been implemented. In addition, increased prevalence of obesity will lead to chronic non-communicable diseases which will cause an increase in economic cost. For example in USA, US health-care system spend more than USD99 billion each year for the treatment of obesity and its primary co-morbidities costs, whereas consumers themselves also spent about USD33 billion each year to purchase weight-reduction products and services (MASO, 2004).

Few studies to assess nutritional status via anthropometric have been carried out in Malaysia (Ismail *et al.*, 2002; Tan *et al.*, 2010; Moy, Sallam & Wong, 2008), however, there is no such study being done among nurses. It is very important to carry out a study on female nurses because nutritional status and percentage of body fat were both factors contributed to the development of abdominal obesity which will lead to the various chronic diseases (Ismail *et al.*, 2002; Kee *et al.*, 2008).

Waist circumference maybe a better predictor for the risk of chronic diseases, medical care costs and all-cause mortality than body mass index (BMI). This measurement also provide a simple and convenient way of measuring abdominal or central obesity (Sharma, 2002; Yusuf *et al.*, 2005; Wang *et al.*, 2005; Han *et al.*, 2002; Cornier *et al.*, 2002; Bigaard *et al.*, 2005; Pouliot *et al.*, 1994). Evidence of association between waist circumference and socioeconomic status is lacking especially in Asian population (Langenberg *et al.*, 2003; Velasquez-Melendez *et al.*, 1999). In term of body composition in adult, significant changes occurred. There will be a progressive increase in body fat and decrease in fat-free mass during adulthood (Kyle *et al.*, 2001). Thus, in this study, female nurses as an adult population will be studied.

According to Musaiger (2011), skipping breakfast is one of the possible factors determining obesity. Moreover, there were only a few studies has been conducted to investigate the relationship between breakfast consumption and body weight in adult population (Huang *et al.*, 2010). However, there is no such study being done previously to study the association of breakfast consumption and

obesity among nurses in Malaysia. Besides that, there was a high prevalence of sedentariness in Malaysia (Siti Affira *et al.*, 2011). Physical inactivity or sedentary lifestyle is a risk factor for obesity among adults and regular activity has been proven to prevent obesity (Kyle *et al.,* 2004; Haapanen *et al.,* 1997).

Study showed prevalence of obesity among nurses was high (Ogunjimi et al., 2010) due to shift working among nurses (Wong *et al,* 2010). Shift working has been found contribute to abnormal eating (Wong *et al.*, 2010) whereas snacking habit particularly high sugar consumption in order to cope with stress (Hoppe & Ogden, 1997; Lim, Hepworth & Bogossian, 2011). Working nurses were more likely to be overweight and obese than the general source populations (Bogossian *et al.,* 2012). Several studies had been implemented to assess nutritional status and abdominal obesity had been done in Malaysia (Lim *et al.*, 2003; Norimah *et al.,* 2003; Abdull Hakim *et al.,* 2012). However, there is no such study being done on nurses. Therefore, our study will focus on female adult nurses in Hospital Universiti Sains Malaysia, Kubang Kerian, Kelantan.

1.3. Research objective

1.3.1. General objective

To assess nutritional status, abdominal obesity and level of physical activity among nurses working in Hospital Universiti Sains Malaysia (HUSM), Kelantan.

1.3.2. Specific objectives

i. To evaluate nutritional status and body composition among nurses working in Hospital Universiti Sains Malaysia (HUSM).

ii. To assess abdominal obesity among nurses working in Hospital Universiti Sains Malaysia (HUSM).

iii. To determine level of physical activity among nurses in HUSM using validated Malay version of International Physical Activity Questionnaire (IPAQ).

iv. To identify the pattern of dietary pattern among female nurses working in Hospital Universiti Sains Malaysia (HUSM)

v. To identify the association between sociodemograhic characteristics, frequency of night shift and sleep duration, breakfast habit, and sitting time with abdominal obesity

vi. To determine the relationship of sociodemograhic characteristics, frequency of night shift and sleep duration, breakfast frequency, and sitting time with abdominal obesity

1.4. Research question

Is there any association between sociodemographic characteristics, frequency of night shift and sleep duration, breakfast habit and sitting time with abdominal obesity among female nurses working in Hospital Universiti Sains Malaysia?

Is sociodemographic characteristics, frequency of night shift and sleep duration, breakfast habit and sitting time are the predictors of abdominal obesity among female nurses working in Hospital Universiti Sains Malaysia?

1.5 .Research hypothesis

i) Null Hypothesis (H_0): There is no association between sociodemograhic characteristics, frequency of night shift and sleep duration, breakfast habit and sitting time with abdominal obesity.

Alternative Hypothesis (H_A): There is an association between sociodemographic characteristics, frequency of night shift and sleep duration, breakfast habit and sitting time with abdominal obesity.

ii) Null Hypothesis (H_0): There is no linear relationship between sociodemograhic characteristics, frequency of night shift and sleep duration, breakfast habit and sitting time with abdominal obesity.

Alternative Hypothesis (H_A): There is a linear relationship between sociodemographic characteristics, frequency of night shift and sleep duration, breakfast habit and sitting time with abdominal obesity.

1.6. Conceptual framework

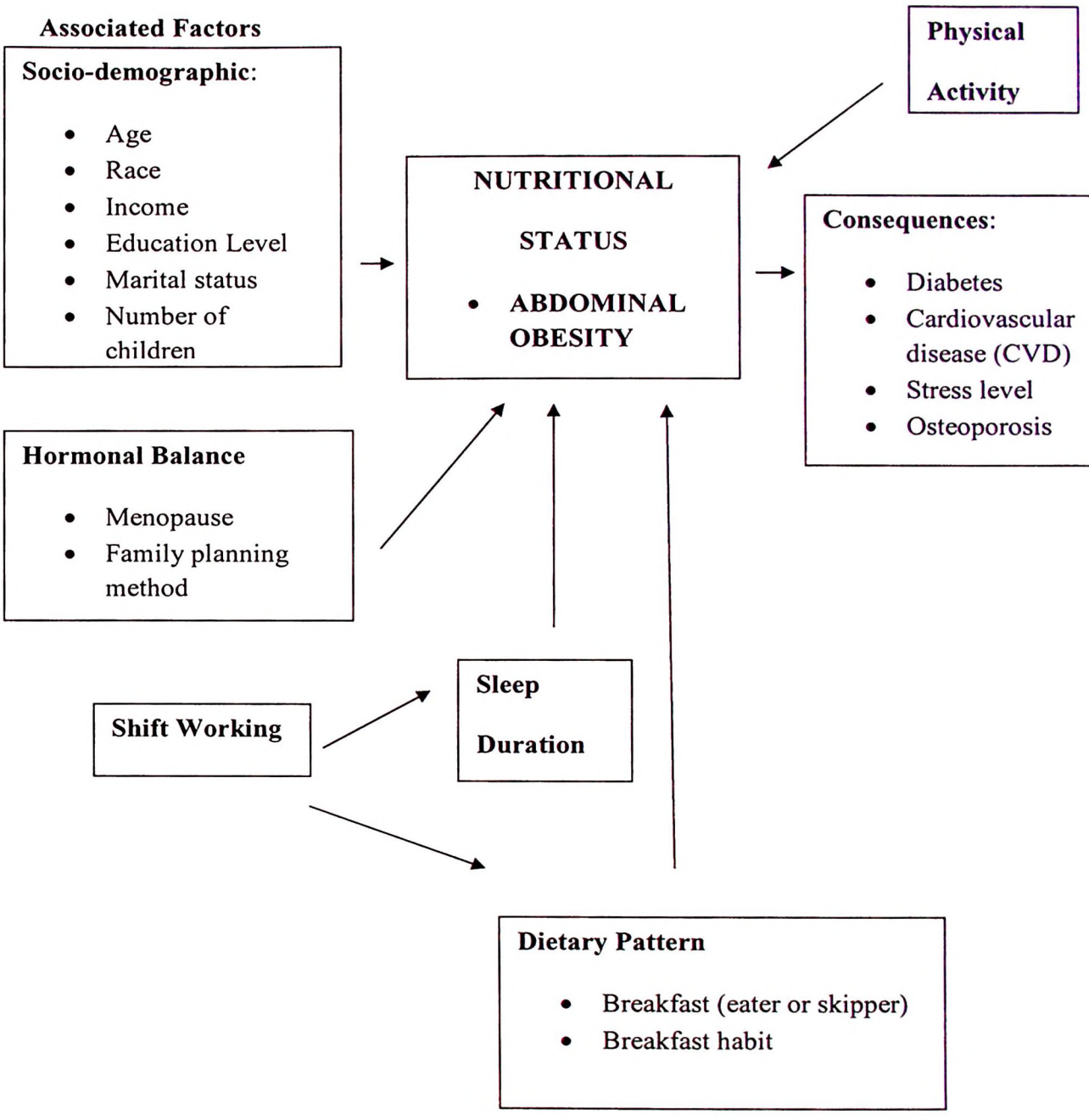

Figure 1.1. Conceptual framework of associated factors and health consequences of abdominal obesity

Based on Figure 1.1, there are several associated factors contribute to nutritional status and abdominal obesity such as sociodemographic factors. For example, age, race, income, educational level, marital status and number of children will affect nutritional status and abdominal obesity. Besides that, hormonal balance factors such as menopausal and family planning method will also contribute to nutritional status and abdominal obesity. Apart from that, shift working will affect sleep duration and also dietary pattern especially breakfast habit. The affected sleep duration and dietary pattern which in turn will influence the nutritional status and abdominal obesity. In addition, level of physical activity will also contribute to nutritional status and abdominal obesity especially low level of physical activity.

Therefore, it is very important to know the associated factors contribute to nutritional status and abdominal obesity in order to prevent the consequences of abdominal obesity such as diabetes, cardiovascular disease, stress, osteoporosis, infertility and others.

1.7. Operational definition

i. Nutritional status is defined as the level intake of food, considered in relation to the body's dietary needs (WHO, 2006). Anthropometry measurement can be used to assess nutritional status. Anthropometry is a measurement of body area and mass for certain purpose.

ii. Body Mass Index (BMI) is defined as the ratio of weight in kilograms to square of height in meters. BMI was categorized according to the

classification system recommended by the WHO Technical Report Series as follows: (WHO, 2000)

- Underweight, <18.5 kg/m²
- Normal, 18.5 – 24.9 kg/m²
- Overweight, 25 – 29.9 kg/m²
- Obese I, 30 – 34.99 kg/m²
- Obese II, 35 – 39.99 kg/m²
- Obese III, ≥40 kg/m²

iii. Abdominal obesity was defined based on the National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) and WHO 1998 criteria of waist circumference ≥102 cm for men and for women is ≥88 cm. Abdominal obesity was also defined according to International Diabetes Federation (IDF) criteria for Asians where waist circumference is ≥90 cm for men and ≥80 cm for women (Kee *et al.,* 2008). Besides that, abdominal obesity was defined as WC ≥90 cm for men and ≥85 cm for women in accordance with Korean Society for the Study of Obesity criteria (Lee *et al.,* 2006).

iv. Body fat composition is adipose tissue composition that consist of adipocytes, inflammatory cells, vascular, connective and neural tissues (Klein, 2007). Body fat percentage is predicted using a simple and without anthropometric variables equation. The equation using BMI, age and sex (Pongchaiyakul *et al.*, 2005):

- Percentage of body fat = 1.65 × BMI + 0.06 × age(year) – 15.3 × sex – 10.67

  (where sex = 1 for men and sex = 0 for women)

Healthy body fat range, for men is 10-22% and for women is 20-32% (The American College of Sports Medicine, 2012).

v. Physical activity is any bodily activity that enhances or maintains physical fitness and overall health or wellness. International Physical Activity Questionnaire (IPAQ) short form consists of seven items that will help to identify frequency and time spent on walking and other moderate-vigorous intensity physical activities during seven days prior to the questionnaire administration, and count only those sessions that last 10 minutes or more (Siti Affira *et al.*, 2011). The following values continue to be used for the analysis of IPAQ data: Walking = 3.3 METs, Moderate physical activity = 4.0 METs and Vigorous physical activity = 8.0 METs. Using these values, four continuous scores are defined:

- Walking MET – minutes/week = 3.3 × walking minutes × walking days
- Moderate MET – minutes/week = 4.0 × moderate-intensity activity minutes × moderate days
- Vigorous MET – minutes/week = 8.0 × vigorous-intensity activity minutes × vigorous-intensity days
- Total physical activity MET – minutes/week = sum of Walking + Moderate + Vigorous MET – minutes/week scores

Level of physical activity by IPAQ short form is as follow: (IPAQ Research Committee 2005 categorical score; Nor Shazwani *et al.*, 2010).

✓ Low

- No activity is reported OR
- Some activity is reported but not enough to meet categories moderate or high.

✓ Moderate

- Three or more days of vigorous- intensity activity of at least 20 minutes per day OR
- Five or more days of moderate-intensity activity and/or walking of at least 30 minutes per day OR
- Five or more days of any combination of walking, moderate-intensity or vigorous-intensity activities achieving a minimum of at least 600 MET-minute/week.

✓ High

- Vigorous-intensity activity on at least three days and accumulating at least 1500 MET-minute/week OR
- Seven or more days of any combination of walking, moderate or vigorous intensity activities accumulating at least 3000 MET-minute/week.

vi. Many studies defined breakfast consumption as food consumed between certain time periods (between 5am and 9am) (Haines, Guilkey & Popkin, 1996; Rampersaud *et al.,* 2005) However, this definition was inappropriate for use in a sample of university students who may vary significantly in their waking times (Kothe, Mullan & Amaratunga, 2011). There is another more suitable definition which is same with the definition used in the Third National and Health Examination Survey (NHANES III). The definition is any food or beverage consumed in a meal occasion named by the respondent as breakfast (Cho *et al.,* 2003). This research focus on the first definition where breakfast eaters are those who eat their breakfast in between 5am to 9am and those who eat after 9am is considered breakfast skippers.

vii. Shift work nurse is a health professional that perform work outside typical daytime hours and includes evening shifts, rotating shifts, irregular shifts and flexitime (Green-McKenzie & Shofer, 2006).

CHAPTER 2 LITERATURE REVIEW

2.1. Obesity

Obesity or increase in body fat is an important, serious and widespread public health issue and its prevalence is reaching alarming state in both developed and developing countries (Aneesa *et al.*, 2003; James, 2008). Obesity is associated with five out of ten leading causes of death and disability and about 300 000 people die each year due to obesity-related diseases (Sidik & Rampal, 2009). Percentage of obese Americans has increased by 74.0% and more than 21 million US men and over 23 million women are obese (Moore *et al.*, 2004). In Greece, as in most Mediterranean countries, prevalence of obesity and abdominal obesity is constantly increasing in both genders across all ages (Roditis *et al.*, 2009; Tzotzas & Krassas, 2004; Panagiotakos *et al.*, 2004).

In year, 2006, WHO stated that overweight and obesity lead to adverse metabolic effects on blood pressure, cholesterol, triglycerides and insulin resistance. The non-fatal, but debilitating health problems associated with obesity include respiratory difficulties, chronic musculoskeletal problems, skin problems and infertility. The more life-threatening problems fall into four main areas: CVD problems; conditions associated with insulin resistance such as type 2 diabetes; certain types of cancers, especially the hormonally related and large-bowel cancers and gallbladder disease.

The likelihood of developing Type 2 diabetes and hypertension rises steeply with increasing body fatness. Approximately 85.0% of people with diabetes were type 2, and of these, 90.0% were obese or overweight. The increase of overweight

and obesity is also becoming a developing world problem. Apart from that, obese individuals will be more susceptible to metabolic syndrome (Devaraj *et al.*, 2011; Florentin *et al.*, 2010; Querales *et al.*, 2010) and cardiovascular disease (Baz-Hecht & Goldfine, 2010; Swales & Wang, 2010; Grandi, Breitling & Brenner, 2010; Zittermann & Gummert, 2010). Raised BMI also increases the risks of cancer of the breast, colon, prostrate, endometrium, kidney and gallbladder. Chronic overweight and obesity contribute significantly to osteoarthritis, a major cause of disability in adults (WHO, 2003). Obesity also leads to musculoskeletal overload and cause chronic diseases via metabolic syndrome which in turn leads to atherosclerotic diseases (Sturm, Ringel & Andreyeva, 2004). Obesity also increased risk for a number of mental disorder (Ball, Burton & Brown, 2009; Lim *et al.*, 2008; Mather *et al.*, 2009; Petry *et al.*, 2008; Simon *et al.*, 2006; Zhao *et al.*, 2009) which will have impact on public health (Birnbaum *et al.*, 2010; Moussavi *et al.*, 2007).

2.2. Abdominal obesity

Abdominal obesity increases with age (Lahmann *et al.*, 2000). Abdominal obesity predisposes persons to diabetes and cardiovascular disease (CVD) (Despres & Lemieux, 2006). The prevalence of abdominal obesity in women (74.8%) was higher than men (62.2%; $p<0.01$) which was evidenced by studies done in North (57.3% in men, 68% in women) and South India (35.1% in men, 56.2% in women) (Swati Bhardwaj *et al.*, 2011; Deepa *et al.*, 2009; Gupta *et al.*, 2007).

Waist circumference and the waist-hip ratio are widely used as indicators of abdominal obesity in epidemiological studies. Waist circumference has been shown to be a better marker of visceral fat (Han *et al.,* 1997; Stewart *et al.,* 2003) and correlates more strongly with cardiovascular risk (Ho *et al.,* 2001; Janssen, Katzmarzyk & Ross, 2004; Wei *et al.,* 1997) compared to waist-hip ratio. However, waist-hip ratio has also been shown to be a good predictor of increased risk of diabetes (Carey *et al.*, 1997; Kaye *et al.,* 1991) and coronary heart disease (Rexrode *et al.,* 1998). This is because hip circumference is inversely associated with the development of cardio-metabolic risk factors and CVD (Seidell *et al.,* 2001; Okura *et al.,* 2004; Lissner *et al.*, 2001; Heitmann, Frederiksen & Lissner, 2004).

However, there was a study showed that waist-to-hip ratio was significantly associated with increased CVD risk for men and women (Lawrence *et al,* 2007). This study also showed that waist circumference was also significantly associated with the risk of incident CVD events. A 1 cm increase in waist circumference is associated with a 2% increase in risk of future CVD and a 0.01 increase in waist-to-hip ratio is associated with a 5% increase in risk of CVD. Parker *et al.* (2009) found out that those who were in the highest quintile of hip circumference had higher BMIs and higher waist-hip ratio. This study also showed that hip circumference was highly correlated with waist circumference, BMI and body weight and poorly correlated with height and modestly correlated with waist-hip ratio.

2.3. Body composition

Body composition gradually change throughout individual's life. Muscle mass begins to reduce from the age of 30 and accelerating after the age of 60 while there is an increase in adipose tissue (Balagopal, Proctor & Nair, 1997). Starting at the age of 45, secretion of growth hormone reduces gradually and being accompanied with an increased deposition of fat in the abdominal cavity and reduced growth hormone secretion (Waters *et al.,* 2008).

WHO introduced body mass index (BMI) as a recommended index of obesity to evaluate disease risk. However, in some studies (Pongchaiyakul *et al.,* 2005), (Caprio *et al.*, 1996) and (Aneesa *et al.,* 2003) suggested that the body fat distribution is an important determinant of disease risk. Individuals with a high proportion of abdominal fat have higher risk for developing diabetes, hypertension, CVD and cancer (Esmailzadeh, Mirmiran & Azizi, 2004). Body fat composition measurement can be used to assess nutritional status. It needs only simple equipment and relatively inexpensive, noninvasive anthropometric variables and non-time consuming (Pongchaiyakul *et al.,* 2005). Apart from that, studies showed that BMI did not able to distinguish between muscle and fat accumulation (Nevill *et al.*, 2006; Heymsfield *et al.*, 2009; Gomez-Ambrosi *et al.,* 2012; Bray *et al.,* 2012) and did not differentiate fat locations (Ruhl & Everhart, 2010; Kang *et al.,* 2011; Katzmarzyk *et al.*, 2012; Lumeng & Saltiel, 2011).

Several studies showed that majority of nurses were overweight (Miller, Alpert & Cross, 2008; Zapka *et al.,* 2009; Zitkus, 2011). Certain job-related characteristic of nursing such as irregular meal pattern, long working hours and

high stress level were known as risk factors for obesity (King, Vidourek & Schwiebert, 2009). Rotating shift nurses had greater waist circumference, higher serum triglyceride and fasting plasma glucose and lower concentration of HDL cholesterol (Copertaro *et al.,* 2008). Depression has a positive relationship with BMI in women (Heo *et al.,* 2006; Istvan, Zavela & Weidner, 1992; Onyike *et al.*, 2003; Beydoun & Wang, 2010; Carpenter *et al.*, 2000).

2.4. Dietary intake

Energy intake through dietary consumption is related with obesity occurrence. A cross-sectional study of 420 healthy Mongolian men and women aged 25 years old and above was carried out in urban and province of Mongolia. This study showed that healthy dietary pattern consisted of high consumption of egg, barley, whole grain bread, vegetable salad, fruits and rice could help to lower the risk of BMI (Otgontuya *et al.,* 2009). An association between major dietary intake pattern with obesity and abdominal obesity has been found in many previous studies (Newby *et al.,* 2006; Newby *et al.,* 2003; McNaughton *et al.,* 2007; Fung *et al.,* 2001). Higher intakes of meat and sugar also associated with weight gain (Schulze *et al.,* 2002)

Higher protein consumption instead of carbohydrate was associated with less abdominal obesity. Lower carbohydrate-moderate protein diets can help to reduce abdominal obesity in a multi-ethnic population (Merchant *et al.,* 2005) due to protein can increase satiety and postprandial thermogenesis is higher after intake of a high-protein diet (Halton & Hu, 2004; Johnston, Day & Swan, 2002). It also helps to improve insulin sensitivity (McAuley *et al.,* 2005).

2.5. Breakfast skipping

Data from the National Health and Nutrition Examination Surveys (NHANES) revealed that breakfast consumption among adults decreased from 89.0% in 1971 to 82.0% in 2002 (Kant & Graubard, 2006). According to a study by Siega-Riz, Popkin and Carson (2000) showed that as numbers of education year increase, breakfast skipping appears to decline. In term of household income, those from higher family incomes eat breakfast more often. In America, about 74.0% of individuals with income less than $25,000 eat breakfast compared to 86.0% with incomes of $75,000 or more (Breakfast in America, 2001-2002).

Findings from the Seasonal variation of Blood Cholesterol Study (SEASONS, 1994-1998) found out that risk of obesity increased 4.5 times in breakfast skippers compared with breakfast consumers (Ma *et al.,* 2003). Reduction in day-long serum insulin concentration and hepatic cholesterol production can be achieved by regular breakfast consumption (Farshchi, Taylor & MacDonald, 2004; Farshchi, Taylor & MacDonald, 2005) and led to increased satiety. Regular breakfast habit could reduce energy intake and help to reduce the risk of chronic diseases, particularly if the breakfast meal consisted of whole grain products (Pereira *et al.,* 1998; Liese *et al.*, 2003). For example, ready-to-eat cereal and cooked cereal contain of high diet quality and would lower body mass index (BMI) compare with other breakfast foods (Siega-Riz, Popkin & Carson, 2000; Cho *et al.,* 2003). In Korea, the "Rice, Kimchi and Vegetables" breakfast pattern was positively associated with lower serum triglyceride levels among women (Min *et al.,* 2012).

2.6. Factors associated with abdominal obesity

2.6.1. Age

Body mass index (BMI) and obesity prevalence grew rapidly with advanced age. A study which showed average BMI rose from 21.6 to 26.9 kg/m² between ages of 18 and 40 while prevalence of obesity increased from 1.0% to 23.2% (Baum & Ruhm, 2009).

2.6.2. Level of education

Based on a study conducted in Korea showed that women with higher levels of education were significantly associated with lower BMI, lower waist circumference and was positively associated with income (Yoon, Oh & Park, 2006). Besides that, a study conducted in Iran also showed that there was a negative association between education and abdominal obesity in women. Women with higher educational level were more active than illiterate women and tend to engage in a healthier lifestyle (Hajian-Tilaki & Heidari, 2009).

2.6.3. Marital status

Marital status has been shown to be associated with BMI and most cross-sectional studies found that overweight and obese was prevalent in married people than those living alone. However, significant variation existed according to gender and ethnicity (Sobal, Hanson & Frongillo, 2009; Sobal, Rauschenbach & Frongillo, 2003). Marriage had a positive relationship with the prevalence of overweight, obesity and abdominal obesity in both men and women. However, an association between abdominal obesity and marital status was much stronger in

women. This is due to less physical activity after marriage, change in their dietary patterns, less focused on being attractive and have more social support which can lead to obesity through diet, activity and social values (Janghorbani *et al.*, 2008).

2.6.4. Pregnancy

Overweight related to pregnancy (Rooney & Schauberger, 2002; Linne, Barkeling & Rossner, 2002; Harris *et al.*, 1997) and has been associated with number of deliveries. Multiparous women were found to have a higher mean BMI and greater waist circumference compared to nulliparous or women with 1-2 children (Riitta *et al.*, 2011). Middle-aged women found out that there was a 7.0% increase in risk of obesity for each additional child after adjustment of age, race, household income, work status and physical activity (Weng *et al.*, 2004).

2.6.5. Menopause

Body composition in women changes while menopause. These changes include an increase in overall and central adiposity (Poehlman & Tchernof, 1998). Postmenopausal women tend to have higher parity, BMI, waist circumference, systolic and diastolic blood pressure as well as prevalence of central obesity compared to premenopausal women. This is due estrogen deficiency in menopause which was found to be associated with a change in fat distribution (Achie *et al.*, 2012). Long-term lifestyle dietary and physical activity intervention has been proven to prevent weight gain and also central adiposity in postmenopausal women (Simkin-Silverman *et al.*, 2003).

2.6.6.Family planning method

Injectable contraceptive like depot medroxyprogesterone acetate (DMPA) had been found to cause arterial impairment using magnetic resonance imaging among women using DMPA more than one year which suggests that long term use could increase the risk of CVD (Sorensen *et al.*, 2002) and DMPA also may increase the risk by increasing the percent body fat and truncal obesity (Berenson & Rahman, 2009).

2.7. Shift workers or rotating shift

Shift workers were found to be 1.6 times more likely to be overweight than day workers (Chee *et al.*, 2004). There was a significant association between shift work with abdominal obesity and high serum triglycerides (Copertaro *et al.*, 2008). Each 5 years increase in rotating night shift work was associated with an increase of 0.17 units in body mass index (BMI) (95% CI 0.14-0.19) and an increase of 0.45 kg in weight gain (95% CI 0.38-0.53) (Pan *et al.*, 2011). There was a positive association between years in rotating night shift work and diabetes. This was entirely mediated by BMI in an analysis of Nurses' Health Study II (NHS II) data with 6 years of follow up (1993-1999) (Kroenke *et al.*, 2007). Nurses having at least 4 shift duties per month were 2.91 times more likely to have abnormal emotional and 3.35 times more likely to have self-control in their eating behavior (Wong *et al.*, 2010).

Previous studies showed that long-term of shift work will cause many health problems (Atkinson *et al.*, 2008) such as higher risk of anxiety (Ardekani *et al.*, 2008), depression, insomnia (Ursin *et al.*, 2009), chronic fatigue and

cardiovascular as well as gastrointestinal disorder (Waterhouse, Folkard & Minors, 1992; Celik, Veren & Ocakci, 2008). It also causes stress among hospital nurses (Callaghan, Shiu & Wyatt, 2000), family life disturbance (Gates, 2001) and abnormal regular meal schedules (Persson & Martensson, 2006; Lancaster, Pickles & Dobson, 2001; Geliebter *et al.*, 2000). Recently, there were studies proved that shift work increased job strain and risk of metabolic syndrome (Esquirol *et al.*, 2009; De Bacquer *et al.*, 2009). Therefore, it was recognized as an occupational stressor (Golubic *et al.*, 2009). Night shift nurses tend to choose to sugary and junk foods because it is easy to get and no preparation is needed (Persson & Martensson, 2006; Hope, Kelleher & O'Connor, 1998). Shift workers were reported to have increase in their serum cholesterol and low density lipoprotein cholesterol (LDL) level (Ghiasvand *et al.*, 2006).

Duration of longer work hours was associated with higher body mass index (BMI) (Lallukka *et al.*, 2005; Ko *et al.*, 2007; Ostry *et al.*, 2006; Shields, 1999; Lallukka *et al.*, 2008), poorer dietary habits (Jones *et al.*, 2007; Wardle *et al.*, 2000; Devine *et al.*, 2009; Nakamura *et al.*, 1998) and lack of time to do physical activity (Artazcoz *et al.*, 2009; Ball, Burton & Brown, 2009; Mein *et al.*, 2005; Popham & Mitchell, 2006). A study showed that those who work 50 or more hours per week tend to have higher body mass index than those working less than 40 hours per week (Escoto *et al.*, 2010). Poorer dietary intake has been proven to have association with longer work hours among women (Jones *et al.*, 2007).