Measurements Indices of Obesity and Their Relation to Cardiovascular Disease Risks among Selected Employees of the Municipality of Naujan, Oriental Mindoro

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THE PROBLEM AND ITS BACKGROUND

Introduction

Obesity is now one of the most serious public health concerns of this century with increasing incidence and prevalence, high costs on medical and hospital expenses and poor outcome to being productive and efficient citizen (Maguire, 2010). The significance of obesity on the quality of life began to be recognized and recorded in the eighteenth century, but in the middle of the nineteenth century did the people identified it as the cause of illnesses. The morbid complications and increased mortality were documented only in the first decades of the twentieth century (Beller, A.S, 1977). The gradual emergence of obesity seen in increasing incidence over the past 60 years had alarmed and led the World Health Organization to declare it as a global epidemic and worldwide public-health crisis (World Health Organization Press, 2005).

Obesity is encountered daily by physicians around the world. It is popularly defined as a body mass index (BMI) ≥30 kg/m2 or greater (Maguire, 2010). Recent data suggests that the prevalence of obesity is dramatically increasing among adults worldwide between 1980 and 2013 from 25.8% to 36.9% in men and from 29.5% to 38.0% in women. In developing countries, the prevalence of overweight and obese has also increased in children and adolescents (Ng, 2014).

Increased weight is associated with higher levels of triglycerides and low-density lipoprotein cholesterol (LDL-C) and lower levels of high-density lipoprotein cholesterol (HDL-C), and at least 75% of hypertension can be attributed to obesity in adults (Krauss et al, 1998). However, obese men with low levels of visceral fat were found to have similar lipid levels to non- obese subjects (Lamarche et al, 1998).

Obese individuals have a greater risk of developing metabolic diseases resulting to cardiovascular diseases, diabetes, stroke, and other forms of chronic illnesses normally found to an individual who are categorized as obese. Metabolic syndrome (MS) is a clustering of several metabolic risk factors that increases the risk of cardiovascular disease and diabetes mellitus. (Lemoncito et al).

Cardiovascular diseases are the number 1 cause of death globally; it is found that more people die annually of this cause than any other. An estimated 17.5 million people had died from cardiovascular diseases in 2012, a total of 31% of all global deaths. Three quarters of these deaths take place in low- and middle-income countries. Cardiovascular diseases are a group of disorders of the heart and blood vessels. It can be prevented by addressing behavioral risk factors such as tobacco use, unhealthy diet and obesity, physical inactivity, and harmful use of alcohol using population-wide strategies (World Health Organization, 2014).

In the Philippines, the 8th National Nutrition Survey conducted by the Food and Nutrition Research Institute, shows that 3 in every 10 Filipino adults (31.1%) are overweight to obese, afflicting more females (34.4%) than male (27.6%).

Furthermore, in 2008, the National Statistics Office of the Philippines had reported that cardiovascular disease and other non-communicable diseases were responsible for the 54% of all deaths in the Philippines and about 30

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to 50 percent of these deaths occurred prematurely, that is before 60 years of age (Ona, 2013)

Statistics from the Department of Health (DOH) show that over 276 Filipinos die of heart disease every day and at least one Filipino suffers from stroke every nine minutes, making both among the top leading causes of death in the country. (Department of Health, 2009) methods of nutritional assessment can be enumerated as Anthropometric methods where it measures the body height, weight and body proportions, Biochemical Methods where it uses different tests to detect changes in metabolism and nutrition before the appearance of overt clinical sign, Clinical Methods where it utilizes a number of physical signs that are known to be associated with malnutrition and deficiency of vitamins and micronutrients, Dietary Evaluation Methods where it assesses the nutritional intake of humans. Direct methods can be summarized as ABCD.

Although there is a reliance on the use of several measures, an ideal objective measure of obesity is yet to be found. Each of these known measures assesses different aspects of obesity. One of the globally recognized and used measures is the body mass index. Established measures such as weight-height, waist circumference, waist to hip ratio and skinfold thickness can also provide good estimate of absolute disease risk. But each of these measures has disadvantages and sometimes error could be the result if done incorrectly (Ashwell, 2009).

Aside from the BMI, waist circumference and waist-to-hip ratio, a new anthropometric measuring tool has been the subject of recent studies, namely Waist to Height Ratio. It is found to have a strong association with other indices of obesity, central obesity and obesity-related cardiovascular diseases, and metabolic diseases (Ashwell, 2009).

Body mass index (BMI) is a useful index for the evaluation of obesity. Although in adults a BMI value greater than 28 kg/m2 is associated with a three to four-fold increased risk of ischemic heart disease, stroke, and diabetes mellitus (Rosenbaum et al, 1997), in Filipino adults there is an unclear definition of obesity that relates BMI to health measures.

Waist circumference correlates with visceral adipose tissue, plasma lipids, lipoproteins, and insulin levels better than waist-to-hip ratio (WHR) in adults. Waist circumference was also found in children to be correlated with high levels of plasma lipids and lipoprotein levels.

Background of the Study

Public health nutrition is a collective action of society that aims to promote good health in maintaining wellness and quality of life through nutrition and the primary prevention of nutrition related illness in the population. Nowadays, problems caused by inappropriate lifestyle which leads to obesity and cardiovascular disease risk are one of the major issues in public health. According to the World Health Organization, approximately 17 million people die from cardiovascular disease, whereas 80% occur in low-and middle-income countries, often in less than 60 years of age. In the Philippines, the increasing mortality and morbidity rates due to the prevalence of obesity and cardiovascular risk factors has been an alarming situation for the country.

Anthropometric indices played one of the vital roles in the public health community, which is one of the easiest to administer, inexpensive and readily available in every household. During the nineteenth century, a Belgian statistician in the name of Adolphe Quetelet introduces one of the pioneering anthropometric indices that had been generally recognized in every public health community. He came up with the Quetelet index of Obesity, which measures obesity by dividing a person's weight in (in kilograms) by the square of his or height. Today, this Quatelet index of obesity, is popularly known as the Body mass index (BMI), which has been an international standard for obesity in the 1980s. The public learned about the use of BMI during the 1990s, when different health organizations launched an initiative to encourage healthy eating and exercise. The World Health Organization regards a BMI of less than 18.5 as underweight and may indicate malnutrition, an eating disorder, or other health problems, while a BMI greater than 25 is considered overweight and above 30 is considered obese. However, BMI limitations to differentiate over fatness from an over-muscled individual have been questioned by different studies worldwide. BMI measures the total fatness in the body but could not represent the distribution of fat in the body. As early as the 1940s, there had been a discussion already on the

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reliability of BMI among different groups of people. In this scenario, a question lingers – what could be the most reliable index to measure obesity and cardiovascular disease risks using selected adult population?

Naujan, officially the Municipality of Naujan (Tagalog: *Bayan ng Naujan*), is a 1st class municipality in the province of Oriental Mindoro, Philippines. According to the 2020 census, it has a population of 109,587 people. It assumed the status of a full-fledged municipality on January 4, 1905, under Act 1280. Its boundaries were permanently established in 1919.

A successful employee of the Municipality of Naujan needs a healthy community, that is why the municipality of Naujan conducts wellness programs for their employees, to ensure a healthy and productive output. One of the components of the Municipality of Naujan wellness program was to assess the current nutritional status of their employee, this program was known as the wellness check program which aims to provide appropriate intervention that helps them to achieve optimum wellness. Anthropometric measurement is one of the components in determining the current nutritional status of the employees. To date however, there is only one anthropometric measurement that is popularly used and that is the Body Mass Index. Thus, the researcher wants to use other selected anthropometric measures of obesity and look at which among the four indices (BMI, Waist Circumference, Waist-to-Hip Ratio, and Waist-to-Height Ratio) will better predict CVD risks among the respondents.

Theoretical Framework

The study was anchored on the concept of health in which the quality of life is a result of the overall nutrition of an individual. Proper nutrition is needed by the body to work properly and regulate body processes. A diet with variety and adequate amounts should be considered. The energy intake should be equal to the energy expenditure of a person.

Through the years, the eating pattern and lifestyle of a person has changed from ancient or traditional diet that is bland and less processed toward more varied diets that include processed food, more foods of animal origin, more added sugar, and fat, and often more alcohol. This shift is accompanied by reduced physical activity in work and leisure, leading to a rapid increase in overweight and obesity. Moreover, there is also an increase of pre-mature deaths caused by diet-related chronic diseases such as hypertension, diabetes, and cardiovascular diseases.

In view of the changing lifestyle of the people, the Department of Health includes the following as one of its nutritional objectives: to improve the general health status of the population by promoting a healthy lifestyle through healthy diet and nutrition, physical activity and fitness, personal hygiene, mental health, and less stressful life, and to prevent violence and risk-taking behaviors (Reyala et al., 2000).

Research Paradigm

Using the above health promotion concept as a framework, the diagram below illustrates the research paradigm of the proposed study.

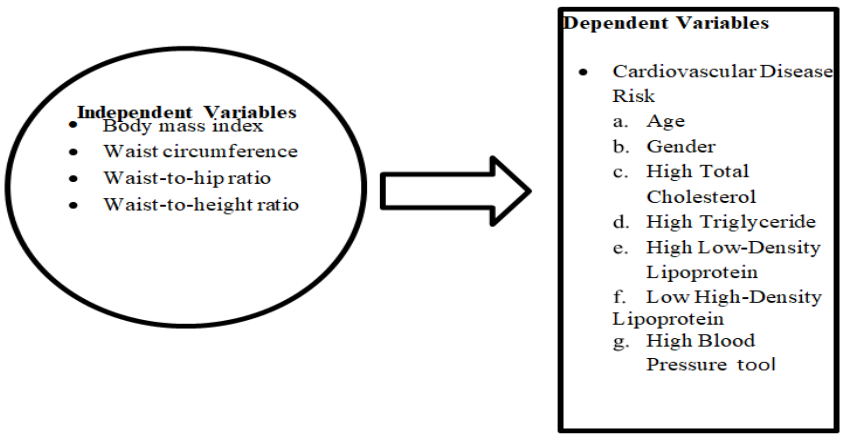

Figure 1 Research Paradigm

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Anthropometric indices are one of the most accessible tools in measuring one's health status. This can also be used in determining the future health condition that a person may have. The study as shown in Figure 1 wants to determine the relationship and sensitivity of the independent and dependent variables. The independent variables in the study are the following: Body Mass Index, Waist Circumference, Waist to hip Ratio, and Waist to Height Ratio. In this case, independent variables are not manipulated, but are already there and are fixed already. The researchers evaluated the association of the dependent variables which are: obesity and cardiovascular disease risk, which is further divided to total cholesterol, total triglyceride, low density lipoprotein, high density lipoprotein, and blood pressure.

Statement of the Problem

The study attempted to assess the selected anthropometric indices namely: body mass index, waist circumference, waist-to-hip ratio, and waist-to-height ratio as measures of obesity and relate it to cardiovascular disease risk among employees of selected Municipality of Naujan. Specifically, it attempted to answer the following questions:

1. What is the profile of the respondents in terms of:

1.1 Age

1.2 Gender

2. What is the nutritional status of respondents in terms of the following anthropometric measures of obesity:

2.1 Body mass index

2.2 Waist circumference

2.3 Waist to hip ratio

2.4 Waist to height ratio

3. What is the nutritional status of respondents in terms of the following cardiovascular disease risk:

3.1 Total Cholesterol

3.2 Total Triglycerides

3.3 High Density Lipoprotein

3.4 High Low-Density Lipoprotein

3.5 High Blood Pressure

4. Is there a significant relationship between the anthropometric measures of obesity and the cardiovascular disease risk among respondents?

5. Is there a significant difference in each of the following anthropometric measures of obesity: body mass index, waist circumference, waist-to-hip ratio, and waist-to-height ratio when the respondents are grouped according to:

5.1 Age

5.2 Gender

6. Is there a significant difference in each of the following cardiovascular disease risk: high total cholesterol,

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high total triglycerides, high low-density lipoprotein, low high density lipoprotein, and high blood pressure when the respondents are grouped according to:

6.1 Age

6.2 Gender

Hypotheses

Based on the problems of the study, a hypothesis was formulated and was tested with a significance level of $p < 0.05$.

The study is premised on the following hypotheses:

- The anthropometric measures of obesity, namely body mass index, waist circumference, waist-to hip ratio and waist-to-height ratio have equal relationship to cardiovascular disease risks among respondents.

- There is no significant difference between body mass index, waist circumference, waist- to-hip ratio, and waist-to-height ratio when the respondents are grouped according to age and gender.

- And there is no significant difference between high total cholesterol, high total triglycerides, high low-density lipoprotein, low high-density lipoprotein, and high blood pressure when the respondents are grouped according to age and gender.

Scope and Delimitation

The study was cross-sectional in nature and so association cannot be interpreted as causal. Convenient sampling was used in selecting the respondents. To assess different anthropometric indices that have been utilized in the public health as measures of obesity to predict cardiovascular disease risk, the study focuses only with the use of Body mass index, Waist Circumference, Waist-to-Hip Ratio and Waist-to-Height Ratio. The study did not consider factors such as birth weight, genetics, physical activity, and other variables such as consumption of tobacco and dietary habits. In addition, the study uses blood pressure and secondary lipid profile data to strengthen the depths of the study. Larger studies in other countries will be needed to explore these associations further. Future research could evaluate whether there are different predictive powers for predicting obesity by gender and in different age groups. Future research should explore how these risk factors can be associated with obesity and cardiovascular disease risk.

Significance of the Study

This study will be significant to these groups of people:

Registered Nutritionist Dietician, as it will contribute to the body of knowledge about the aspects of nutrition assessment regarding the anthropometric standards. RND's may use this study to further improve their comprehension and learning about the variation and differences between the used of the four anthropometric measurements.

Researchers, as it will add to the list of research that can be improved and that the ideas and results may be used as reference data in conducting new research or in testing the validity of other related findings.

The Municipality of Naujan, this study may serve as a future reference in strengthening the wellness program that the institution has. This study can also be useful in further assessing their employees to current nutritional status.

Philippine Government, as it will help them tackle obesity and to raise awareness about the epidemic and will help the community in establishing preventive measures against obesity and the risk of cardiovascular disease

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risk in adults.

Definition of Terms

The following terms and concepts were listed based operational terms. It was anchored on how the researchers interpret and used these terms:

Anthropometric Measurement – in this study, this refers only to Body Mass Index, Waist Circumference, Waist to Hip ratio, and Waist to Height ratio. The anthropometric measurement that was used in the study is all non-invasive, inexpensive, and easy to execute. These measurements are used to measure the size, weight, and proportion of the body of an individual.

Body Mass Index (BMI) - refers to one of the anthropometric measuring tools that has been widely used in public health and is being compared with WHtR, WC and WHR, which measures weight in terms of kilogram divided by height in terms of m^2. The classification of very severe underweight is less than 15, severely underweight is from 15.0 to 16.49, Underweight is from 16.5 to 18.49, Normal (healthy weight) is from 18.50 to 24.99, Overweight is from 25.0 to 29.99, Obese class I (Moderately Obese) is from 30.0 to 34.99, Obese Class II (severely Obese) is from 35.0 to 39.99 and Obese Class III (Very Severely Obese) is over 40.

Cardiovascular disease risk - In the study, this may refer to the presence of low high density lipoprotein cholesterol (HDL-C), high low density lipoprotein cholesterol (LDL-C), high Triglyceride (TG), high Total Cholesterol (TC) and high blood pressure.

Lipid Profile – in this study, this refers to the total cholesterol, total triglyceride, HDL-c, and LDL- c levels of the respondents.

Obesity – refers to the population of people who are at risk due to excessive accumulation of fat in the body and will be measured using BMI, Waist-to-Height Ratio, Waist-to-Hip Ratio and Waist Circumference.

Waist circumference (WC) – refers to one of the anthropometric measuring tools used in the study and being compared with WHtR, WC and WHR, which measures waist circumference with the help of measuring tape. The cutoff of waist circumference for males is >102 cm, while for females is >88 cm.

Waist-to-Height Ratio (WHtR) - refers to one of the anthropometric measuring tools used in the study and compared with the validity of WHtR which measures the waist divided by height. The cutoff for waist-to-height ratio is greater than 0.50. This had been proposed for abdominal obesity in both sexes and at all ages.

Waist-to-Hip Ratio (WHR) - refers to one of the anthropometric measuring tools used in the study and being compared with WHtR, WC and WHR, which measures the waist divided by the hip circumference. The cutoff of >0.90 in men and >0.80 in women is already considered at risk.

REVIEW OF RELATED LITERATURE AND STUDIES

This chapter comprises the review of related literature, the foreign/local studies and literature that has been done previously as well. All the accounts were scanned from various libraries and were gathered to provide comprehension of the subject under discussion. This chapter presents a synthesis of research that supports the development, validation, and testing of the study. Also, this chapter emphasizes the relation between the current study and the works of researchers and authors.

Local Literature

Undernutrition together with micronutrient deficiency has been a problem for the public health community for the past decades. Undernutrition is defined as the inadequate consumption and utilization of food, manifesting in growth failure such as underweight, stunting and wasting among Filipinos. However, this problem lessened its impression in the public health, instead it is now shifting from poor nutrition to over nutrition (Florencio,

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2004).

Overnutrition is defined as excessive intake of food, manifesting in conditions such as Overweight and Obesity (Florencio, 2004). Obesity and Overweight condition occur in two ways: hypertrophy and hyperplasia. All obese individuals experience hypertrophy but not all have abnormal number of fat cells. Hyperplastic obesity is also called "juvenile onset" due to development of extra adipocytes which occurs during early or late childhood (Panlasigui, 2005). Obesity, as one of the major contributors to non-communicable disease in relation to cardiovascular diseases are known to be the leading cause of premature death (Ruiz et al, 2011). In the Philippines, the use of Body mass index has been adopted as an index for obesity. However, BMI does not directly measure body fat, which results in a misconception among physically active person, like athletes, may have a BMI that identifies them as overweight even though they do not have excess body fat (NDAP, 2016 - 2015).

According to the recent data of the Department of Health, a total of 34,000 are afflicted with heart disease. Cases of cardiovascular diseases have been steadily rising with the rate of 79.1 death per 100,000 people. CVD is the number one cause of mortality in the country. High cholesterol levels are often caused by diets high in saturated fat, smoking, being overweight and lack of exercise. However, there are also non-controllable factors that can lead to high cholesterol level and heart disease like age, sex, family history and other disease such as infection, diabetes, and high-blood pressure. Studies found that cholesterol level begin to rise after age of 20, and men are usually prone to CVD (Manila Bulletin June 2005). Another discussion on the risk of having cardiovascular disease has been released by the newspaper named Malaya Business Insight last July 17 entitled, lowering low density lipoprotein: Not enough to prevent heart diseases, shows that a considerable risk of cardiovascular disease remains the same with optimal LDL reduction. According to Paul Nestel, Professor of Medicine at the Baker Heart Research Institute in University in Melbourne evidence claims that accumulating triglycerides and high- density lipoprotein should be a therapeutic target as well. It was also discussed that an individual should aim for an HDL level of at least 39 mg/dl. Moreover, study showed that for every 1 mg/dl rise in HDL, your risk of developing CVD decreases by *two* to *three percent* (2-3%). On the other hand, in another article published in the Manila Bulletin written by Dr. Eduardo Gonzales entitled, “Why is cholesterol bad/good for the body” on the 23rd day of March 2008 it was discussed also that the relationship between blood cholesterol and hormone level rises with age. Consequently, when testosterone level decreases, the body starts to produce more and more cholesterol. Thus, increasing the cholesterol level and exposing the body to cvd risk. In addition, as men reach their prime age, they must ensure that bad cholesterol or LDL is below 100 mg/dl, while good cholesterol or HDL is above 40 mg/dl (Prof. W.J. Serfontein, February 2. 2006).

Foreign Literature

It was written in the USA Today that about 800,000 people die each year from cardiovascular disease (Hellmich N., 2013). Cardiovascular Disease, as mentioned in one of the article in the Medical News today include illnesses that involve the blood vessels (veins, arteries and capillaries) or the heart, or both - diseases that affect the cardiovascular system. On the other hand, the majority of cardiovascular disease (CVD) is caused by risk factors that can be controlled, treated or modified, such as high blood pressure, cholesterol, overweight/obesity, tobacco use, lack of physical activity and diabetes. However, there are also some major CVD risk factors that cannot be controlled (World Health Federation, Geneva 2011).

Obesity, as one of the risk factors, is a major public health problem due to its increasing prevalence and its associations with higher morbidity and mortality from multiple diseases (Liuet al, 2004). The preponderance of obesity is increasing in which it estimates that 250 million people worldwide, which is 7% of the adult population, are obese. Obesity in a public health community is measured with the used of Anthropometric indices. According to the World Health Organization anthropometry provides the single most portable, universally applicable, inexpensive and non-invasive technique for assessing the size, proportions and composition of the human body. It reflects both health and nutritional status and predicts performance, health and survival. As such, it is a valuable, but currently underused, tool for guiding public health policy and clinical decisions. Commonly known anthropometric indices were Body Mass Index, Waist Circumference, Waist-to-hip ratio and Waist-to-height ratio.

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Body Mass Index

BMI is the most recommended and widely used index for classifying overweight and obesity in adults (Strawn et al, 2002). Body Mass Index (BMI) has long been a predictor of morbidity and mortality that are due to numerous chronic diseases, such as type 2 diabetes, cardiovascular disease, and stroke (Janssen et al, 2004).

In a period of five years, the National Institutes of Health and the World Health Organization have provided guidelines for the definition of overweight and obesity that use BMI as the criterion measure. A BMI cutoff of 25 for overweight and 30 for obesity have been upheld by both organizations, where it has been adopted by many clinicians and researchers in Europe as well as in the United States (Steven et al, 2002). BMI provides a measure of overall adiposity but the distribution of adipose tissue in predicting health risks associated with obesity is also important. Abdominal fat deposition is generally considered a key component of obesity. Waist circumference is a convenient way of measuring abdominal fat deposition and may be a more useful measure of obesity than BMI. Decades later, long-term follow-up studies showed that so- called "abdominal obesity" was strongly associated with an increased risk of type 2 diabetes, cardiovascular disease, and death, even after controlling for body mass index.

Waist-to-hip Ratio

Waist-to-hip ratio (WHR) is an anthropometric measure commonly used to characterize regional adiposity. WHR is a crude estimate of the relative amount of abdominal fat: the higher your waist girth compared to your hip girth, the greater your proportion of abdominal fat. As early as the 1980s, several prospective epidemiological studies reported that WHR is a significant predictor of type 2 diabetes (Ohlson,1985). Unlike waist circumference, WHR is not necessarily a measure of absolute abdominal fat mass. It is, however, a measure of abdominal fat relative to lower body mass. As such, a relatively lean individual could theoretically have the same WHR as an obese individual. In addition, when using WHR, it is unclear whether an individual has a high WHR due to a high waist circumference or a small hip circumference. This is important as the health risks associated with a high waist circumference, and the measures to treat them, may differ from the health risks and interventions associated with a small hip circumference. For example, individuals with a high waist girth may benefit from reducing their obesity, whereas resistance training may be better for individuals with a small hip circumference due to low muscle mass. Interpreting WHR and choosing the appropriate treatment is complicated and likely provides little insight over waist and hip circumferences alone (The International Chair on Cardiometabolic Risk, 2014).

Waist-to-height Ratio

A campaign proposed by Margaret Ashwell and her team 'Keep your waist circumference less than your height' Propose the use of waist-to-height ratio as primary screening tool to assess obesity. The ratio (R) of the waist circumference (W)-to-height (Ht) (WHtR) was originally proposed simultaneously in Japan (Hsieh SD, 1995) and the UK (Ashwell, 1995) as a way of assessing shape and monitoring risk reduction. Both proposers suggested that WHtR values above 0.5 should indicate increased health risk.

Analyses to determine the performance of each anthropometric index as a screening tool in adults (that is, assessing and comparing the diagnostic accuracy of different indices for a particular outcome), showed that WHtR was invariably a better tool than waist circumference or BMI. These specificity and sensitivity analyses were performed in more than 26 studies covering men and women in many ethnic groups including white European, South Asian, Afro Caribbean and Hispanic. The ages of subjects in these studies ranged from 18 to 100 years (Browning LM, 2010). These data also confirmed that the cut-off (or boundary) value of WHtR 0.5 for increased risk is appropriate across age, gender, and ethnic populations in adults.

Local Studies

Cardiovascular diseases are recognized globally as a major problem affecting the world today. Most individuals who develop cardiovascular diseases have multiple risk factors such as dyslipidemia, hypertension, hyperglycemia, and obesity. The clustering effect of each risk factor contributes to the higher risk

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cardiovascular disease (Santos, 2005). The risk factors are well known, but preventive efforts are difficult to provide because they are not established yet in developing countries compared to those developed nations of the world (Dans et al, 2005). Factors including diet and environment are independently associated with a higher chance of cardio metabolic risk but indices of obesity can help to interpret individual who are at risk of cardiovascular diseases. Even in the absence of other risk factors, those who are obese are the most likely to develop heart disease (Cinco et al, 2009).

In a comparison of the National Nutrition and Health Survey I and II shows that the prevalence of five atherosclerosis risk factors (hypertension, diabetes, dyslipidemia, obesity, and smoking) and 3 atherosclerosis-related diseases—coronary artery disease (CAD), cerebrovascular disease (CVD), and peripheral arterial disease (PAD) are the accurate picture of the cardiovascular health of the Philippines (Sy et al, 2012).

In the study of Orense et al, two surveys were conducted in 1991 and 1996 to determine the prevalence of nutrition-related risk factors to cardiovascular diseases in the Bicol Region. A total of 3,386 adult men and women in 16 barangays of the four mainland provinces of the region were examined.

Result shows that nutrient intake generally decreased with age and was higher among male subjects. Blood lipid profile showed that 54.2 % and 54.0 % had borderline and high cholesterol levels in 1991 and 1996, respectively. Female subjects tended to have higher low density lipoprotein cholesterol, (LDL-c) and lower high density (HDL-c) than male subjects, which demonstrates a susceptibility of hyperlipidemia among this group. Hypertension prevalence was 28.6% and 39.2% in 1991 and 1996, respectively, and was higher among male than female subjects.

In recent decades, the prevalence of obesity has risen in the Philippines and has likely contributed to trends of having cardiovascular diseases. Obesity has a negative impact on the quality of life and a study determining obesity is needed to find strategies to stop this epidemic. The prevalence of android obesity and high degree risk from being overweight and obese were noted to be higher among females than among males in all regions of the country (Velandria, 2001). The study of Zubair, however, also wants to emphasize the importance of screening lean and overweight individuals for cardio-metabolic risk. It is because obesity cannot just be defined by overall fat adiposity but can also be found to those individuals who has concentrated adiposity of fat in other part of the body. In this matter, indices of obesity concerning not only to overall fat adiposity can help to predict risk in early adulthood, but that could also prevent acquiring diseases in future (Zubair, 2014).

The National Nutrition Survey (NNS) by the Food and Nutrition Research Institute of the Department of Science and Technology (FNRI-DOST) revealed that from 2003 to 2008, there was an increasing trend of overweight and obesity among adults aged 20 years and over. In 1998, there were about 20 out of 100 adults who were overweight. The number increased to 24 and 27 out of 100 in 2003 and 2008, respectively. Overweight, when left unattended, may result in different chronic degenerative diseases like diabetes mellitus, heart diseases, and hypertension. In 2008, the 7th NNS says, 2.7% Filipino adults aged 20 years and over were suffering from impaired fasting glucose. Hyperglycemia or high fasting blood sugar (FBS) level was found among 4.8% adults while the prevalence of hypertension among adults was 25%, increasing with age starting from age 40-49 years. Hypertension is a disorder characterized by sustained systolic blood pressure reading equal to or more than 140 millimeters mercury (mmHg) or a diastolic blood pressure reading of equal to or more than 90 mmHg. Hypertension increases the danger of acquiring heart diseases. Thus, the health data indicate a need for the policy makers to develop appropriate policies and strategies to prevent the continuing increase of overweight Filipinos.

At present, a lot of methods like fad diets, diet pills, and fasting may indeed induce rapid weight loss and these attract a lot of people who want to be slim. However, like any sudden change to the body, these can be dangerous because they may also injure the heart and other organs (Agdeppa, 2012)

Considering that metabolic syndrome, with its co-morbidity factors, is prevalent among Filipino adults, aged 20 years and over, it is recommended that health programs geared towards minimizing the morbidity risk factors be properly developed, promoted, and fully implemented. Determining the appropriate anthropometric measurement to predict and minimize the morbidity risk factors is important in public health thus a study

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determining which anthropometric should be used risk factors is important.

Foreign Studies

Non communicable, also known as chronic diseases are diseases of long duration and generally slow progression. The four main types of non-communicable diseases are cardiovascular diseases (like heart attacks and stroke), cancer, chronic respiratory diseases (such as chronic obstructed pulmonary disease and asthma) and diabetes. Non communicable diseases, or NCDs, are by far the leading cause of death in the world, representing 63% of all annual deaths. Non communicable diseases (NCDs) kill more than 36 million people each year. Some 80% of all NCD deaths occur in low- and middle-income countries. (World Health Organization, March 2013). The Global Burden of Diseases, Injuries, and Risk Factors (GBD) is an approach to global descriptive epidemiology. It is a systematic, scientific effort to quantify the comparative magnitude of health loss due to diseases, injuries, and risk factors by age, sex, and geographies for specific points in time. The GBD is led by the Institute for Health Metrics and Evaluation (IHME) at the University of Washington. Part of the results in the Global Burden of Disease study estimated the yearly deaths and its causes for 188 countries (including the Philippines) between 1990 and 2013. The study showed that a general pattern of reduction in age-sex-specific mortality has been associated with a progressive shift toward a larger share of the remaining death caused by non-communicable diseases and injuries. To add, global deaths from cardiovascular disease increased by 41% between 1990 and 2013 despite a 39% decrease in age-specific death rates; this increase was driven by a 55% increase in mortality due to the aging of populations and a 25% increase due to population growth.

Obesity is the accumulation of excessive fat in the adipose tissue due to high consumption of calories, which is more than the daily requirements to sustain day to day energy needs (Maguire and Haslam, 2009). Obesity, as one of the leading causes of non-communicable diseases, is now becoming a major clinical and public health concern contributing to increasing morbidity and mortality rates for several chronic diseases and affecting both adult and child populations worldwide (Al-Sindi, 2000). As estimated by the World Health Organization in 2014 more than 1.9 billion adults, 18 years and older, were overweight. Of these over 600 million were obese, *thirty-nine percent* (39%) of adults aged 18 years and over were overweight in 2014, and *thirteen percent* (13%) were obese. Moreover, most of the world's population lives in countries where overweight and obesity kills more people than underweight.

Anthropometric indices of obesity played one of the most vital roles in assessing the health status of an individual in the public health community for it is one of the easiest and most inexpensive to administer. Anthropometric indices

Different groups in the field of health and science have conducted a cross sectional and longitudinal studies across different population to corroborate the used of Body Mass Index, Waist- Hip circumference and (recently) Waist to height ratio as a simple anthropometric tool for Obesity.

Body mass index (BMI)

The body mass index has been widely recognized by the World Health Organization as a simple indicator for Obesity, which measures weight in terms of kilogram divided by height in terms of m^2, wherein a BMI of ≥ 30 kg/m^2 are considered to be obese (Freedman et al, 2013). BMI is currently the best available anthropometric that estimate body fatness for public health purposes (Al-Sindi, 2000) and it is independently associated with systolic and diastolic (Hsu et al.). However, the used of BMI has been questioned by different studies for its inability to measure fat distribution and its low feasibility for parents and non professional use (Yan et al, 2012). In the study conducted by the HERITAGE family for about 366 sedentary male (111 black and 255 white Americans) and 462 sedentary female (203 black and 259 white Americans), they have concluded that relationships between BMI, disease risk, and mortality have not been controlled for physical activity or fitness which makes it an important limitation, given that physically inactive individuals are more likely to be obese compared with active individuals (Katzmarzyk et al, 2004).

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Waist circumference (WC)

As presented in thepaper of Margaret Ashwell, as early as 1940s Vague first pointed out that people with central type of fat distribution (Android shape) were at greater health risk than those whose fat was distributed peripherally (Gynoid Shape). This scenario has said to be the advantage of measuring Waist circumference, which measures intra-abdominal fat rather than the use of BMI which measures total fatness. A waist line of >80cm among female and waist line of >90cm among male is already considered to be at risk.

Waist to height ratio (WHtR)

Intra-abdominal fat (Al-Sindi, 2000) or visceral fat (Maguire and Haslam, 2010) can be predicted from waist to height ratio, which may allow the same boundary value for children and adults (Ashwell and Hsieh, 2005). WHtR is being acquired by dividing waist circumference in centimeters from height in inches (Hsu, 2014). A boundary value of WHtR=0. 5 indicate a risk for men, women and people in different ethnic group (Ashwell and Hsieh, 2005). Waist circumference has been shown to be a better marker than BMI in predicting CVR in adults. (Yan et al, 2012), however, the advantage of WHtR over waist circumference alone in a public health is that boundary values are same for men and women. Still, previous researchers recommended the validation of WHtR to a more diverse group of people due to inconsistency of results of applicability (Hsu, 2014).

In search of an optimal anthropometric measuring tool for obesity is still in controversy and is pivotal to identify individuals at risk (Borch, 2011). It has been suggested that an ideal measure of obesity, especially in public health, should meet the following criteria: simplicity of the measuring tool, low cost, easy to use and its applicability to various types of subjects (Power et al.).

Waist-to-hip Ratio (WHR)

Waist-to–hip circumference is a well-established measurement of relative fat distribution (Ashwell et al, 2009) and it is often used as a marker for intra-abdominal fat accumulation (Al- Sindi, 2000). On the other hand, a study conducted by the Oxford University which was quoted by Harvard University, on their official website for public health, it summarizes some of the pitfalls of Waist to hip ratio as proxy measure of obesity and it stated the following: (1) More prone to measurement error because it requires two measurements, (2) more difficult to measure hip than it is to measure waist, (3) more complex to interpret than waist circumference, since increased waist-to-hip ratio can be caused by increased abdominal fat or decrease in lean muscle mass around the hips, (4) turning the measurements into a ratio leads to a loss of information: Two people with very different BMIs could have the same WHR, and (5) may be difficult to measure and less accurate in individuals with a BMI of 35 or higher. In addition, WHpR is not helpful in practical risk management because the waist and hip can decrease with weight reduction, so the ratio of WHpR changes very little (Ashwell et al, 2009).

Relationship of the 4 anthropometric measures of obesity to age and gender

The cut offs used for each anthropometric measure of obesity differ in terms of age gender like in the scenario of Body mass index wherein there is separate standard for both sexes and was sub-categorized to different age groups. Moreover, several research papers and reviews have been initiated to verify and test the association of age and gender to the four anthropometric measures of obesity.

The Effect of Age on the Association between Body-Mass Index and Mortality was a study conducted by the team of June Steven, Ph. D in January 1998 that intended to verify whether recommended body weight should remain constant throughout adulthood or should be higher for older adults. In this study, over 1 million men and women 30 years of age or older in 26 states were recruited. The result of the study suggests that among men and women 30 through 74 years of age, greater body weight increased the risk of death from any cause and death from cardiovascular disease over a 12-year period; however, the relative risk associated with excess weight was higher among younger subjects. Although the various models used to examine relative risk resulted in consistent conclusions, different measures of risk could produce different conclusions because of the large differences in the age-specific mortality rates. For example, whereas the relative risk associated with excess weight was higher among the 30-to-44-year-olds than among the 65-to-74-year-olds, the difference in the crude

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mortality rates between overweight and lean subjects was larger among the older subjects. Among 30-to-44-year-old women, the difference in the crude rates of death from cardiovascular disease between women with body-mass indexes of 19.0 to 21.9 and those with values of 29.0 to 31.9 was 29 per 100,000 person-years, whereas the difference was 455 per 100,000 person years among 65-to-74-year- old women. Moreover, in the study of J. Stevens, EG Katz and RR Huxley entitled, Associations between gender, age and waist circumference that was published online in the European Journal last September 9, 2009 they have concluded that there has been a large differences in body composition between men and women, with women having more body fat.

Relationship of cardiovascular disease risk to age and gender

In the study entitled, The association of cardiovascular disease risk factors with abdominal obesity in Canada administered to a number of 16,007 men and women aged 18 to 74 appeared that simple correlations between anthropometric variables and cardiovascular disease risk variables were highest for SBP; moderate for DBP, HDL, TRIG and TC/HDL; and lowest for LDL and TC. Of the anthropometric variables, WC demonstrated the greatest correlations with the risk variables. The first canonical correlations were significant ($p < 0.0001$) in men (0.58) and women (0.61) of all ages. Of the anthropometric variables, WC consistently demonstrated the highest loading values in the first canonical variable in men (0.56) and women (0.59). Of the risk variables in both sexes, the loadings of TRIG were generally the largest, those of HDL, SBP, DBP intermediate and those of LDL the smallest. In men, the strength of these associations generally decreased with age, whereas in women they peaked in the 35-54 year age group. To conclude the result of the study, considerable association was seen between measures of abdominal obesity and blood pressure and plasma lipid levels. WC is the measure of abdominal obesity most highly correlated with these cardiovascular disease risk factors.

Relationship of the 4 anthropometric measures of obesity to cardiovascular disease and its risk factors

A study initiated by the team of Masaru Sakurai et al entitled, Gender Differences in the Association between Anthropometric Indices of Obesity and Blood Pressure in Japanese which aims to investigate the four anthropometric variables of obesity in association with blood pressure (BP), and to investigate whether there are gender differences in these relationships in Asian adults, the researchers used body mass index (BMI), waist circumference, waist-to-hip ratio and waist-to-height ratio, with BP and the prevalence of hypertension in a cross-sectional study. A total of 4,557 employees of a metal-products factory in Toyama, Japan (2,935 men and 1,622 women, aged 35 to 59 years) were included in the study. In the said study it was find out that Waist circumference in men and BMI in women had the strongest associations with BP. As for the age-adjusted rate ratio (RR) of the prevalence of hypertension for one standard deviation increase in each anthropometric variable, RR was the highest for waist circumference in men (RR, 1.44; 95% confidence interval [CI], 1.31–1.58), and for BMI in women (RR, 1.61; 95% CI, 1.38– 1.88). The associations of waist circumference in men and BMI in women remained significant after adjustment for each of the other variables. Waist circumference in men and BMI in women should be given more importance in the screening of and guidelines on hypertension in Asians. In relation, the study of T S Han, PhD student et al entitled, Waist circumference action levels in the identification of cardiovascular risk factors: prevalence study in a random sample in November of 1995 supported the relationship of CVD risk to anthropometric measure and it was concluded that larger waist circumference identifies people at increased cardiovascular risks. The main objective of the study was to determine the frequency of cardiovascular risk factors in people categorized by previously defined "action g126 levels" of waist circumference to a number of 2183 men and 2698 women aged 20-59 years selected at random from the civil registry of Amsterdam and Maastricht (Netherland). To further analyzed the result of the study, it was shown that a waist circumference exceeding 94 cm in men and 80cm in women correctly identified subjects with body mass index of >/=25 and waist to hip ratios >/=0.95 in men and >/=0.80 in women with a sensitivity and specificity of >/=96%. Men and women with at least one cardiovascular risk factor (total cholesterol >/=6.5 mmol/l, high density lipoprotein cholesterol </=0.9 mmol/l, systolic blood pressure >/=160 mmHg, diastolic blood pressure >/=95 mmHg) were identified with sensitivities of 57% and 67% and specificities of 72% and 62% respectively.

Compared with those with waist measurements below action levels, age and lifestyle adjusted odds ratios for having at least one risk factor were 2.2 (95% confidence interval 1.8 to 2.8) in men with a waist measurement of

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94-102 cm and 1.6 (1.3 to 2.1) in women with a waist measurement of 80-88 cm. In men and women with larger waist measurements these age and lifestyle adjusted odds ratios were 4.6 (3.5 to 6.0) and 2.6 (2.0 to 3.2) respectively. However, the cut off used in the said study was not the same as the current cut off nowadays.

Relevance of the Study

Cardiovascular risk factors as defined by the World health Organization are the most important behavioral risk factors of heart disease and stroke are unhealthy diet, physical inactivity, tobacco use and harmful use of alcohol. The effects of these behavioral risk factors may show up in individuals as raised blood pressure, raised blood glucose, raised blood lipids, and overweight and obesity. These "intermediate risks factors" can be measured in primary care facilities and indicate an increased risk of developing a heart attack, stroke, heart failure and other complications. In the study conducted by the National Institute of Health No. 93-3095 year 1935 the Adult Treatment Panel II was presented. The Adult Treatment Panel II published in 1988 developed an approach which aimed to detect, treat, and monitor high-risk patients who have elevated blood cholesterol. There are two major strategies for preventing coronary heart disease (CHD) by lowering blood cholesterol. These two strategies are complementary, and both are incorporated in the National Cholesterol Education Program (NCEP). This study also articulated the possibility of a person suffering from cardiovascular diseases within ten years of time. A study conducted by Jellinger, et al entitled, American Association of Clinical Endocrinologist' Guidelines for Management of Dyslipidemia and Prevention of Atherosclorosis (AACE, 2012) they have concluded that high LDL-C, low HDL-C are independent factors in denoting an individual's susceptibility to cardiovascular diseases. On the other hand, NCEP-ATP II discusses that high LDL- C, low HDL-C, age, tobacco use, and diabetes were independent risk factors for cardiovascular diseases.

In recent years, there has been increasing speculation over which anthropometric indices of overweight and obesity are best able to determine those individuals who are at increased cardiovascular risk. Body mass index (BMI) is used by the World Health Organization to define severity of overweight and obesity across populations. But increasingly, measures of central adiposity, namely waist circumference (WC) and waist-to-hip ratio (WHR), and waist-to-height ratio (WHtR) have been adopted as more accurate predictors of obesity-related cardiovascular risk and have replaced BMI in several definitions for clinical diagnosis of metabolic syndrome. Reported differences in the discriminatory capability between these indices of obesity with cardiovascular risk factors are small, and despite many studies not formally conducting any statistical comparison, claims have been made to suggest the superiority of some measures of obesity over others in the discrimination of cardiovascular risk. To date, there has been no systematic attempt to compare how well these different measures of obesity perform at discriminating cardiovascular risk factors across diverse populations. If significant, and clinically relevant, differences were shown to exist between these measures, it would provide a strong rationale for the universal adoption of a single measure for defining obesity.

METHOD AND PROCEDURE

Research Design

The study is a descriptive research design in nature, employing the survey type. A descriptive research design study collects information without changing the environment or has not been subject to manipulation. It may involve the use of surveys or an interview to collect the necessary information needed in the study. Different types of descriptive design are the following: descriptive-survey, descriptive-normative survey, descriptive-status, descriptive- analysis, descriptive-classification, descriptive-evaluative, descriptive-comparative, correlational and longitudinal survey. This study used the design of descriptive-comparative where the researchers consider two or more variables that will not be manipulated and establishes a formal procedure to compare and conclude that one is better than the other if significant difference exists.

Sample and Sampling Technique

Samples were selected through non-probability convenient sampling. Convenient sample was used because of inclusion and exclusion criteria that had been set in selecting the subjects for the study. An assent form was distributed among the employees who had given their interest to participate in this study. This form initially

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assessed target subjects, based on the exclusion criteria set by the researchers. The recent lipid profile (secondary data) was not available to the researchers, hence the taking of the lipid profile (primary data) as one of the inclusion criteria set by the researchers.

The study excluded students and employees who are 19 years of age and below, 60 years of age above, pregnant women, diagnosed with type 1 and type 2 diabetes mellitus, presently on weight reducing pharmacologic therapy, presently taking medication such as cholesterol lowering and blood pressure maintenance and other insulin resistant states. Subjects who passed the inclusion criteria became the participants of the study and were briefed on the procedures on the day of the data gathering.

Measurement Procedure

Researchers have taken all measurements. Weight was measured using a portable weighing scale. Height was measured using a stadiometer, while the circumferences were taken using a tape measure.

Body mass index (BMI) had been calculated as the weight in kilograms divided by the square of height in meters. BMI is classified according to the following scale: less than 18.5 kg/m^2 were defined as underweight, 18.5 to 24.9 kg/m^2 was defined as normal, 25.0 to 29.9 kg/m^2 or higher was defined as overweight, 30.0 to 34.9 kg/m^2 was defined as obese I, 35.0 to 39.9 kg/m^2 were defined as obese II and BMI greater than 40 was considered as obese III.

Waist circumference (WC) was measured using a tape measure. To measure, the top of the right iliac crest must be located, the highest point of the hip bone on the right side. Place a measuring tape in a horizontal plane (parallel to the floor) around the abdomen at the level of the iliac crest. The tape should be snug but should not compress the skin. Take the reading at the end of a normal expiration. Repeat the measurement to ensure accuracy (Lee et al.). The parameters used for waist circumference as follows: >102 cm for men and >88 cm for women (Lean et. al).

Waist-to-Height Ratio (WHtR) had been calculated by obtaining the waist circumference and height of the respondents. Waist circumference (WC) was measured using extending a tape measure in a horizontal plane at the top of the right iliac crest, the highest point of the hip bone on the right side. Place a measuring tape in a horizontal plane (parallel to the floor) around the abdomen at the level of the iliac crest. The tape should not be too tight, but close to the skin. Take the reading at the end of a normal expiration. Repeat the measurement to ensure accuracy (Lee et al.). On the other hand, height was measured using a stadiometer with a fixed vertical backboard and an adjustable head piece where the head is in the Frankfort plane, and the horizontal line from the ear canal to the lower body of the orbit of the eye is parallel to the floor and perpendicular to the vertical backboard (CDC Manual). The parameter used to calculate at risk for Waist to Height Ratio is that the computed value is greater than 0.50.

Waist-to-Hip Ratio (WHR) was obtained by measuring the waist and hip circumference using a measuring tape. By extending the measuring tape on top of the right iliac crest in a horizontal plane (parallel to the floor) around the abdomen at the level of the iliac crest. The tape should be closed but should not compress the skin. Take the reading at the end of a normal expiration. Repeat the measurement to ensure accuracy (Lee et al.). Hip circumference was measured by extending a measuring tape at the horizontal level around the buttocks that will yield the maximum measurement. Then Waist to Hip Ratio was calculated as the waist circumference divided by the hip circumference. The parameters used as follows: >0.90 for men and >0.80 for women.

Biochemical Procedures (Lipids and lipoproteins)

The data for lipid profile (Total cholesterol, total triglycerides, HDL-c, LDL-c) of the respondents was taken by professionals hired by the researchers because the annual lipid profiles of the respondents were not available. Included in the briefing of the respondents was the instruction to fast for 8 to 10 hours before the blood extraction on the day of the data gathering. The parameters used as follows: Total Triglycerides: <150 Normal,

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150-199 Near High, 200-499 High, and ≥500 Very High. LDL-Cholesterol: <100 Normal, 100-129 Near Normal, 130-159 Near High, 160-189 High, and ≥190 Very High. Total Cholesterol: <200 Normal, 200-239 Near High, and ≥240 High. HDL-Cholesterol: <40 Low, 41-59 Normal and ≥60 High.

Clinical Procedures (Blood Pressure)

Blood pressure was measured in the right arm with the respondent at the sitting position, at rest, with the mercury sphygmomanometer and digital sphygmomanometer. The respondents were gathered in an air-conditioned room during the daytime wherein the respondents were requested to rest for at least 5 minutes before taking the BP measurement. The mean of 3 measurements taken during a single visit was used in the analysis. High blood pressure (hypertension) was defined, according to NCEP-III recommendations as systolic BP (SBP) of 140 mm Hg or higher, diastolic BP (DBP) of 90 mm Hg or higher. The parameters used in the study as follows: <120 SBP and <80 DBP Normal, 120-139 SBP and 80-89 DBP Pre-Hypertension, 140-159 SBP and 90-99 Stage 1 Hypertension, and ≥160 SBP and ≥100 DBP Stage 2 Hypertension

Research Instrument

The study used an individualized questionnaire. This instrument was used in collecting needed information from the sample. A questionnaire is a set of questions for obtaining statistically useful information from the subject of study (Merriam-Webster).

The questionnaire was used on the actual day of data gathering. This was patterned to the objective of the study, which is to compare Body Mass Index, Waist Circumference, Waist- to-Hip Ratio and Waist-to-Height Ratio as a predictive measure for Cardiovascular Risk Diseases. The individualized questionnaire was divided into three sections: Personal information, Anthropometric measurements, and Clinical data. First part of the questionnaire includes personal information like name, age and gender this part was answered by the respondents themselves. The second part includes measurements to be used in the index namely: Body Mass Index, Waist Circumference, Waist-to-Hip Ratio and Waist-to-height ratio. The anthropometric indexes will measure the height (cm), waist circumference (cm), Hip circumference (cm) and weight (kg) of the subjects. The last part of the questionnaire was to get the measurement of the respondent's blood pressure. The second and third part of the questionnaire was completed by the assigned personnel and by the researchers themselves. Subjects were assisted thoroughly to lessen confusion, specifically among subjects who do not have enough background in nutrition or in other medical courses.

Reliability tests and validation tests were no longer needed, since data to be gathered are constant, measurable, and simple. For certification, researchers asked a statistician to certify the reliability of the questionnaire, while the validity of the questionnaire was checked by a registered nutritionist-dietitian and by a public health nutritionist-dietitian.

Data Collection Technique

FIGURE 2 Data Collection of the Study

Prior to actual data collection, the researcher sent a proposal letter addressing the human resource department of the Municipality of Naujan, this was to ask their assistance to gather respondents among employees of the Municipality of Naujan. After a month the researcher received feedback from the Human Resources of the Municipality of Naujan to partially discuss the number of respondents needed, the methodology and the gain as they participate in the study. While waiting for the approved schedule date on when to conduct the data gathering procedures, the researcher seeks a mobile diagnostic center who will administer the lipid profile testing plus the provision of equipment needed for the study. The Naujan Community Hospital helped the researcher. They were chosen due to economical purposes.

A day was given to scout for willing and qualified respondents inside the cafeteria of the building during lunch time, the researchers posted posters and go from table to table to look for interested employees to join in the

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study). Self-administered questionnaires were then distributed among employees who initially showed their interest. Employees who are 19 years of age and below, 59 years of age and above, pregnant, presently diagnosed with type 1 and type 2 diabetes mellitus; presently on weight reducing pharmacologic therapy; presently taking medication such as cholesterol lowering, and blood pressure maintenance and other insulin resistant states were excluded in the study. Respondents that qualify to criteria set by the researchers were oriented right after. During the orientation their gains as they join the study were discussed accordingly together with the protocols during the actual data gathering procedures. Respondents were encouraged to wear light clothing and go too fast for 8 to 10 hours before the actual day for the data gathering. 158 questionnaires were distributed wherein only 112 employees qualify to join the study. The protocols discussed before the employees reduce the number of potential subjects to 98 and only 64 respondents' resort to attend the actual data gathering scheduled by the management of the Municipality of Naujan for the study to take place.

A space in the cafeteria was set up by the researcher and by the management for data gathering. As the respondents come, they will register first on the registration area. In this area, respondent's name will be crossed checked in the checklist prepared by the researcher. After they register, they will proceed to the next station wherein height, weight, waist, and hip circumference will have obtained. After collecting these measures, respondent will now precede at the 2nd to the last station. In this station the respondent's blood pressure and lipid profile were collected. At the last station employees' results were collected and they were given a simple token in exchange for their participation.

After collecting height, hip circumference, waist circumference, weight, blood pressure and lipid profile (Total Cholesterol, Low Density Lipoprotein, High Density Lipoprotein and Triglyceride) it was then encoded for the statistical treatment. Respondents BMI, WC, WHR, WHtR were computed and evaluated by the researcher together with the result of the lipid profile. Summary of their anthropometric measurements, biochemical and clinical results were sent through email after 2.3 weeks' time.

Statistical Treatment of Data

Descriptive statistics were used for physical characteristics for gender and age. Chi-square test of independence and odds ratio were used for the independent and dependent variables to test the relationship and measure the strength of relationship. The dependent variables for this study are the established cardiovascular disease risk (total cholesterol, total triglyceride, low density lipoprotein, high density lipoprotein and blood pressure). Independent variables are the four parameters of the study that was tested (body mass index, waist circumference, waist to hip ratio and waist to height ratio). Differences between genders were calculated with Student's t- test. Gender is transformed as a continuous variable (0 for female, 1 for male). One-way Analysis of Variance is calculated to find difference on the group means for the four age groups. Significance will be selected at p values < 0.05 for all tests.

PRESENTATION, ANALYSIS, AND INTERPRETATION OF DATA

This chapter covers the presentation, analysis and interpretation of the data collected in relation with statement of the problem, namely: profile of the respondents in terms of age and gender; nutritional status based on the four (4) selected anthropometric indices (measures of obesity); nutritional status based on the six (6) cardiovascular disease risk; relationship between the anthropometric measures of obesity and the cardiovascular disease risk among respondents; difference in the anthropometric measures of obesity when respondents are grouped according to age and gender; and difference in the cardiovascular disease risk when respondents are grouped according to age and gender.

The objective of the study was to identify the significant relationship among the four anthropometric measures namely Body Mass Index, Waist Circumference, Waist-to-Hip Ratio and Waist-to-Height Ratio to the cardiovascular disease risk namely: Total Cholesterol, Total Triglycerides, High Density Lipoprotein, Low Density Lipoprotein, Systolic Pressure and Diastolic Pressure among selected employees of the Municipality of Naujan towards improvement of their wellness program

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Profile of the Respondents

Age

Table 1 Profile of Respondents in Terms of Age

AGE RANGE	f	%
20 – 29	23	35.9
30 – 39	19	29.7
40 – 49	14	21.9
50 – 59	8	12.5
TOTAL	**64**	**100.0**

Table 1 shows the profile of the 64 respondents according to age. To determine the age bracket for the respondents, the researchers followed the provisional guidelines on standard international age classification. On the other hand, the WHO also suggests ten age brackets. 35.9% or 23 out of 64 respondents falls under the age range of 20 to 29 years of age, 29.7% or 19 out of 64 respondents falls under 30-39 years of age, 21.9% or 14 out of 64 respondents falls under 40-49 years of age, and 8 or 12.5% of the respondents belong to age range of 50 to 59.

The highest percentage of the population belongs to the age range of 20 to 29 years of age that covers for almost one-third (35.9%) of the total population, while 50 to 59 years of age shows the lowest percentage in the population.

Gender

Table 2 Profile of Respondents in Terms of Gender

Gender	f	%
Female	45	70.3
Male	19	29.7
Total	**64**	**100**

As reflected in Table 2, 70.3% or 45 out of 64 respondents are female while 29.7% or 19 out of 64 respondents are male respondents. Majority of the respondents falls to the female category which covers almost three-fourth of the total population.

Nutritional Status of Respondents using Anthropometric Measures of Obesity

Body mass index

Table 3 illustrates the number of "normal" and "at risk" individuals based on the results of their Body Mass Index (BMI).

Table 3 Nutritional Status of the Respondents in Terms of BMI

BMI	F	%
At Risk ($\geq$ 25 kg/m^2)	36	56.3
Normal (18.50 to 24.99 kg/m^2)	28	43.8
TOTAL	**64**	**100**

BMI is usually categorized into four categories which are normal (18.5 – 24.99), underweight (<18.5), overweight (≥25) and obese (≥30) but for uniformity to other categories used in the study it was compressed

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into to two. Falling under "normal" category are individuals classified as normal and overweight while under "at risk" category are individuals classified as overweight and obese. As shown in the table above, a high number of *thirty-six* (36) out of *sixty- four* (64) respondents turned out to be "at risk" while only *twenty-eight* respondents fell under "normal". In summary, more than half of the populations are obese and overweight based on the Body mass index. Thus, this also reflects the result of the 8th National Nutrition Survey 2013 in the country which concludes that *three* out of *ten* Filipino adults or 30 out of 100 were obese compared from *twenty-seven* out of *one hundred* during the 7th National Nutrition Survey 2008. This statistic shows the rising prevalence of obesity among Filipino adults aging *twenty* and above.

Waist circumference

Table 4 illustrates the number of "normal" and "at risk" individuals based on the results of their Waist Circumference (WC).

Table 4 Nutritional Status of the Respondents in Terms of Waist Circumference

WAIST CIRCUMFERENCE	f	%
AT RISK (>102 cm for men, > 88 cm for women)	18	28.1
NORMAL (≤102 cm for men, ≤88 cm for women)	46	71.9

A WC > 102 for male and > 88 for female were "at risk" and lower than these cut off falls under the "normal" level. As reflected to Table 4, 28.1% or 18 out of 64 respondents are at risk in terms of waist circumference. As compared to 71.9% or 46 out of 64 respondents fall under the normal range. In summary, most of the population is normal with the use of waist circumference and only one-third of the population was considered nutritionally at risk. Furthermore, this result reflected the result of the 8th National Nutrition Survey in the prevalence for the high waist circumference among Filipino adults aging *twenty* and above from 1993 to 2013.

Waist to Hip Ratio

Table 5 illustrates the number of "normal" and "at risk" individuals based on the results of their Waist-to-hip ratio (WHR).

Table 5 Nutritional Status of the Respondents in Terms of Waist Hip Ratio

WAIST TO HIP RATIO	f	%
AT RISK (0.90 for men, 0.80 for women)	56	87.5
NORMAL (<0.90 for men, <0.80 for women)	8	12.5
TOTAL	**64**	**100**

A WHR >.90 for male and >.80 for female were "at risk" and lower than these cut off falls under the "normal" level. The ratio of the measures for the waist and hips is shown in Table 5. A substantial rate of 87.5% or 56 out of 64 respondents are at risk while 8 out of 64 respondents can be considered to fall under normal ratio.

In summary, the use of WHR were able to detect a high percentage of defining at risk individual which encompasses more than half of the population. Moreover, this result also reflects the prevalence of obesity in terms of high Waist-to-hip Ratio among adults aging *twenty* years and above for both male with a mean of 0.9 and female with a mean of 0.87 during the 8th National Nutrition Survey in 2013.

Waist to Height Ratio

Table 6 illustrates the number of "normal" and "at risk" individuals based on the results of their Waist-to-height ratio (WHtR).

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Table 6 Nutritional Status of the Respondents in Terms of Waist-Height Ratio

WAIST to HEIGHT RATIO	f	%
AT RISK (≥0.50 both for men and women**)**	55	85.9
NORMAL (<0.50 for both men and women)	9	14.1
TOTAL	**64**	**100**

A WHtR >.50 for both sexes were "at risk" and lower than these cut off falls under the "normal" category. A very high ratio of 85.9% or 55 out of 64 respondents are considered at risk based on the measures of their waist and height. 9 out of 64 respondents are within the normal ratio, which is only 14.1% of the entire sample. In summary, a high percentage (85.9%) of individuals was rated as at risk with the use of this measure.

Nutritional Status of Respondents using Cardiovascular Disease Risk

Total Cholesterol

Table 7 illustrates the number of "normal" and "at risk" individuals based on the results of their Total Cholesterol (TC).

Table 7 Nutritional Status of the Respondents in Terms of Total Cholesterol

Total Cholesterol	f	%
AT RISK (≥240)	43	67.2
NORMAL (<240)	21	32.8
TOTAL	**64**	**100**

Commonly, TC were categorized into three which is desirable (<200), borderline high (200-239) and high (≥240) but for uniformity to other categories used in the study it was compressed into to two. Falling under "normal" category are the desirable and borderline high; and to "at risk" are those individuals who resulted to have a high level of TC.

The table above shows that *forty-three* (43) out of *sixty-four* (64) respondents were classified as "at risk" whereas only *twenty-one* (21) respondents out of *sixty-four* falls under the normal category. As defined by the National Cholesterol Education Program Total cholesterol is a direct cholesterol measurement that measures all cholesterol molecules in the blood, including low density lipoproteins (LDL), high density lipoproteins (HDL), and very low-density lipoproteins (VLDL). A high level of TC increases the risk of serious health conditions including cardiovascular diseases.

Total Triglycerides

Table 8 illustrates the number of "normal" and "at risk" individuals based on the results of their Total Triglyceride (TG).

Table 8 Nutritional Status of the Respondents in Terms of Total Triglycerides

Total Triglycerides	F	%
AT RISK (≥200)	13	20.3
NORMAL (<200)	51	79.7
TOTAL	**64**	**100**

TG were usually categorized into four which is Normal (<150), borderline high (150-199), high (200-499) and very high (≥500) but for uniformity to other categories used in the study it was compressed into to two. Falling under "normal" category are the normal and borderline high; and to "at risk" are those individuals who resulted to have a high and very high level of TG.

The table above shows that *fifty-one* (51) out of *sixty-four* (64) respondents were in the "normal" category,

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whereas only *thirteen* (13) respondents out of *sixty-four* falls under the "at risk" category. As discussed by the American Heart Association, Triglycerides are the most common type of fat in your body. They come from food, and your body also makes them. High levels of blood triglycerides are often found in people who have high cholesterol levels, heart problems, are overweight or have diabetes.

High Density Lipoprotein

Table 9 illustrates the number of "normal" and "at risk" individuals based on the results of their High-Density Lipoprotein (HDL).

Table 9 Nutritional Status of the Respondents in Terms of High-Density Lipoprotein

High Density Lipoprotein	F	%
AT RISK (<40)	2	3.1
NORMAL (≥40)	62	96.9
TOTAL	**64**	**100**

HDL were usually categorized as low (<40), normal (40-59) and high (≥60) but for uniformity to other categories used in the study it was renamed. Falling under "normal" category was the normal and high and to "at risk" are those individuals who resulted to have a low level of HDL.

The table above shows that *sixty-two* (62) out of *sixty-four* (64) respondents were "normal" and only *two* (2) respondents out of *sixty-four* falls under the "at risk" category. High- density lipoprotein (HDL) cholesterol is called the "good kind." It carries harmful cholesterol away from the arteries and helps protect you from heart attack and stroke. It's better to have a lot of HDL cholesterol in your blood (American Heart Association, 2012)

Low Density Lipoprotein

Table 10 illustrates the number of "normal" and "at risk" individuals based on the results of their Low-Density Lipoprotein (LDL).

Table 10 Nutritional Status of the Respondents in Terms of Low-Density Lipoprotein

Low Density Lipoprotein	f	%
AT RISK (≥160)	11	17.2
NORMAL (<160)	53	82.8
TOTAL	**64**	**100**

The table above shows that *fifty-three* (53) out of *sixty-four* (64) respondents were "normal" and only *eleven* (11) respondents out of *sixty-four* falls under the "at risk" category. LDL were usually categorized into five which is Optimal (<100), near optimal (100 - 129), Borderline high (130 - 159), high (160 – 189) and very high (≥190) but for uniformity to other categories used in the study it was compressed into to two. Falling under "normal" are the optimal, near optimal and borderline high; and to "at risk" are those individuals who resulted to have a high and very high level of LDL.

In the book entitled, Medical Nutrition Therapy by Jamorabo Ruiz, LDL, also known as Beta Lipoprotein transports, most of the total plasma cholesterol and responsible for depositing cholesterol in the artery walls. LDL is the most important lipoprotein associated with fatty cholesterol deposits. LDL is the source of "Bad Cholesterol".

Blood Pressure

Table 11 illustrates the number of "normal" and "at risk" individuals based on the results of their Blood pressure (BP).

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Table 11 Nutritional Status of the Respondents in Terms of Blood Pressure

Blood Pressure	F	%
AT RISK (≥140/90)	11	17.2
NORMAL (<140/90)	53	82.8
TOTAL	**64**	**100**

BP were usually categorized into three which is normal (<120/80), pre-hypertension (120- 139/80-89) and hypertension (≥140/90) but for uniformity to other categories used in the study it was compressed into to two. Falling under "normal" category are the normal and pre- hypertension classification; and to "at risk" category are those individuals who are classified as hypertensive.

As reflected in this table several *fifty-three* respondents (53) out of *sixty-four* (64) have a "normal" blood pressure while only *eleven* shows to be "at risk". As reported by the 8th National Nutrition Survey about 22.3% of the adult population is considered hypertensive; this figure is lower than the 25.3% 2008 prevalence (7th NNS).

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATION

In this chapter, the researcher summarized the findings according to the statement of the problem. This chapter also contains the conclusion of the study as well as the recommendation of the researcher to give more depth to future studies.

The objective of the study was to see association among the four anthropometric measures namely Body Mass Index, Waist Circumference, Waist-to-Hip Ratio and Waist-to- Height Ratio as measures of obesity to predict cardiovascular diseases among selected employees of the Municipality of Naujan towards improvement of their wellness program.

Summary of Findings

This section will present the summary of findings as presented in Chapter IV. It includes the profile of the respondent in terms of age and gender, nutritional status based on the four (4) selected anthropometric indices (measures of obesity), comparison between the four (4) anthropometric measures to predict cardiovascular disease risk and the significance of each anthropometric measure as they grouped according to age and gender.

Respondent's profile

Gender

Majority of the respondents in the study falls to the female category which encompasses *seventy percent* (70%) or *forty-five* (45) out *sixty-four*. On the other hand, only *nineteen* (19) respondents or 29.7% falls to the male category.

Age

A total of *twenty-three* (23) out of sixty-four respondents belongs to 20-29 years of age, nineteen out of sixty-four respondents belong to 30-39 years of age, fourteen out of sixty-four belongs to 40-49 years of age and only eight out of sixty-four respondent belongs to 50-59 years of age.

Nutritional Status based on the four selected anthropometric measures: Body mass index

Out of *sixty-four* (64) respondents, *thirty-seven* (37) fall to the "at risk" level with a Body mass index equals and greater than *twenty-five* (25) and less than 18.5. Only *twenty-seven* (27) respondents were categorized as not at risk or normal. Those who were categorized as normal has a BMI result of 18.5 to 24.99.

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Waist Circumference

Forty-six (46) out of *sixty-four* (64) respondents were normal based on Waist Circumference. A waist circumference of >102 centimeters for male and a circumference of >88 centimeters for female were classified as "at risk". However, there were only *eighteen* (18) out of *sixty-four* (64) respondents who were considered at risk.

Waist-to-Hip Ratio

Out of *sixty-four* (64) respondents, *fifty-six* (56) falls to the "at risk" whereas only *eight* (8) respondents were categorized as not at risk. Respondents with a result of >0.90 (men) and >0.80 (women) were already considered at risk.

Waist to Height Ratio

In this Anthropometric measure, several f*ifty-five* (55) out of *sixty-four* (64) respondents falls to the "at risk" level whereas only *nine* (9) respondents were categorized as not at risk. Respondents with a result of greater than 0.50 were at risk already.

Nutritional status of respondents in terms of the following cardiovascular disease risk:

Total Cholesterol

Out of *sixty-four* respondents a high number of *forty-three* were classified as "at risk". "At risk" individual resulted to a total cholesterol level at desirable (<200), borderline high (200-239) levels. Only *twenty-one* respondents were classified as "normal" with a desirable (<200) and borderline high (200-239) total cholesterol level.

Total Triglycerides

It shows that in this risk factor, majority of the respondent fall under the "normal" category, these individuals resulted to fall under the normal (<150) and borderline high (150- 199). On the other hand, *thirteen* respondents were classified as "at risk ", this individual has a triglyceride level of greater than *two hundred*.

High Density Lipoprotein

Most number of respondents has high level of high-density lipoprotein with this risk factor. Out of *sixty-four* respondents *sixty-two* fall under the "normal" category and only *two* falls under "at risk". Under the "normal" individual resulted to have an HDL result greater than *sixty*, while at "at risk" individual resulted to have an HDL level less than *forty*.

Low Density Lipoprotein

In this risk factor, a high number of *fifty-three* out *sixty-four* falls under the "normal" category, while only *eleven* respondents were "at risk". Individuals who fall under the "normal" category have a LDL less than *one hundred fifty-nine* and "at risk" individual resulted to have an LDL count greater than *one hundred sixty*.

Blood Pressure

Most of the respondents were categorized as "normal" with this risk factor. Several *fifty- three* respondents were normal or had a BP result less than 120-139/80-89 and *eleven* respondents had a BP result greater than ≥140/90.

The 4 common anthropometric measures of obesity and their relationship with cardiovascular disease risk:

Pearson Chi-square and Odds Ratio were used to compute the significance and relationship of anthropometric

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measures of obesity to cardiovascular disease risk.

Body mass index (BMI)

In the study, it was found out that BMI is statically significant to blood pressure. This connotes that having a BMI greater than *twenty-five* or falling under the category of overweight to obese connotes susceptibility to high blood pressure or hypertension.

Waist-to-Hip Circumference (WHR)

In the study, it was found out that WHR was related to total triglyceride and high-density lipoprotein cholesterol. A WHR greater than 0.90 for men and 0.80 for women shows a statistically significant relation to high total triglyceride which implies for being at risk in cardiovascular diseases. On the other hand, a WHR lower than 0.90 for men and 0.80 for women shows a protective effect to high density lipoprotein.

Waist Circumference and Waist to Height Ratio

In the study, these two measures showed no significance in relation to cardiovascular risk factors. In comparison to other studies which show significance, one reason is due to the inadequate number of respondents that will not suffice to represent the entire population. In addition, gender differences were not further explored due to unequal proportions for both sexes.

Significance of the four anthropometric measures as they are grouped according to: Age

ANOVA was used in determining the respondent's profile according to age. Each Anthropometric measure was grouped in a four-age range with a ten-year gap. A computed value greater than the critical value was computed with the use of Waist-to-hip ratio and Waist-to- height ratio. This value shows a significant difference in the different range of age used in the study. However, there has been no significance measured with the used of Body mass index and Waist Circumference.

Gender

Student t-test was used in determining the profile of the respondents according to gender. A computed value greater than the critical value was computed with the use of Body mass index and Waist circumference which resulted to be significant. However, there has been no significance measured with the used of Waist-to-hip ratio and Waist-to-height ratio.

1. Significant difference in each of the following cardiovascular disease risk: high total cholesterol, high total triglycerides, high low-density lipoprotein, low high-density lipoprotein, and high blood pressure when the respondents are grouped according to:

Age

ANOVA was used in determining respondent's profile in terms of age and in relation to cardiovascular disease risk. A computed value of 0.032 in Systolic pressure which is higher than the critical value, turned out to be significant. However, other risk factors turned out not to be significant.

Gender

Student T-test was used to evaluate the respondent's profile in terms of gender and in relation to cardiovascular disease risk. Having a computed value of .014 for TG, .0001 for systolic pressure and .0001 for diastolic pressure indicates significance. Other cardiovascular disease risk resulted not to be significant in the study.

Conclusion

The used of Body mass index, Waist Circumference, Waist-to-hip ratio, and Waist-to-height ratio measures of

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Obesity used in the study resulted to have different strength and weaknesses as it was being associated in selected cardiovascular risk factors. Conclusions were stated according to the statement of the problem.

1. Majority of the respondents in the study were female and a higher percentage falls from *twenty* (20) to *twenty-nine* (29) years of age.
2. The four measures of Obesity resulted to have an unequal number of sorting "at risk" and "not at risk" individuals. A much higher percentage of "not at risk" individual was measured with the use of Body Mass Index and Waist circumference. However, with the use of Waist-to-hip ratio and Waist-to-height ratio most of the respondents were classified as "at risk".
3. The cardiovascular disease risk used in the study resulted in different have different view in determining "normal" and "at risk" individuals. A much higher percentage of "normal" individuals were classified according to total triglyceride, low density lipoprotein, high density lipoprotein and blood pressure. While most of the respondents were "at risk" with total cholesterol.
4. Among the four anthropometric measures only two indices show a statistically significant value. Body mass index was statistically related to blood pressure while Waist-hip Ratio was statistically related to total triglyceride and high-density lipoprotein.
5. Among the four anthropometric measures, the Waist-to-hip ratio and Waist-to-height ratio is statically significant with age, while Body mass index and Waist Circumference is statistically significant with gender.
6. Among the cardiovascular disease risk used in the study Total triglyceride, systolic and diastolic shows to be statistically significant with gender.

Recommendation

To the future researchers, to further improve the results of the study, the researchers recommend extending the range of the population in terms of size and location since the study was limited to employees of Municipality of Naujan only. It is recommended also to have a focus analysis on each age range to further have a comparative analysis between the four anthropometric measures used in the study. Furthermore, it is encouraged to have another study that will determine the specificity and sensitivity of each anthropometric measure used to strengthen the results of the study.

To the registered nutritionist and dietitian, to further establish the results of the study, it is recommended to conduct the same study that will consider other cardiovascular risk factors like familial history, tobacco use, lack of physical activity and diabetes, other lipid factors and the new emerging risk factors. Since the study was basically concentrated with age, sex, lipid profile and blood pressure, only.

To the Community of the Municipality of Naujan, regular wellness check among its employees only includes only the use of Body mass index, it is recommended that the Municipality to include the use of Waist-to-hip ratio and Waist-to-height ratio measures of Obesity as a predictor to cardiovascular diseases. These two measures had shown a higher relativity to low density lipoprotein which is considered as a positive independent indicator of having cardiovascular diseases.

To the Philippine Government, due to the rising prevalence of obesity in the country, the researchers recommend to further have more in-depth research with the used of these four (4) Anthropometric measures of obesity and be able to raise awareness about the epidemic.

DEDICATION

This research is dedicated to the researcher's parents, for their ever-lasting love, guidance, support, and motivation. They are the reason the researcher is inspired to do their best to complete this research from the beginning.

This research is also dedicated for the betterment of society, may this be a tool to contribute and profoundly change for the good of the people's lives.

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