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Morphological Fitness Profile and the Prevalence of Hypertension and Diabetes among Benguet State University Employees

Eduardo P. Laconsay[1]* and Florence V. Poltic[2]

1- College of Human Kinetics, Benguet State University
2- University Health Services, Benguet State University
**Corresponding author email address: laconsayeduardo137@gmail.com*

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Abstract

Morphologic fitness reflects the quality of health and well-being hence, as key to lifelong vitality and longevity. The study assessed the morphological fitness of BSU employees using (BMI), body fat percentage (BFP), and Waist Circumference (WC). Measurements generated are sex-disaggregated data of anthropometry according to sex and age; the prevalence of cardiovascular disease risk factors: hypertension, overweight/obesity, and diabetes, and the association between HPN and diabetes among overweight/obese employees. The study is a descriptive cross-sectional survey that involved 325 employees. Results indicate that employees are obese class 1; Sex is a risk factor for BFP and WC, where females had higher BFP while males have higher WC. Age directly relates to BMI, BFP, and WC. The prevalent cardiovascular risk factors are overweight/obesity (82%) HPN (17.5%), diabetes (3.38%). The prevalence of HPN among overweight/obese is 17.28% and 27% respectively and 7.1% and 7.69% among the non-obese. The odds ratio is 2.71 for males and 4.44 for females. The prevalence of diabetes among overweight/obese is 14.28% and 3.7% respectively and 1% and 2.5% among the non-obese. The odds ratio is 17 for males and 1.5 for females. The risk factor demonstrated is obesity which can be managed through lifestyle modifications for a better quality of life.

Introduction

Lifestyle is one of the most critical factors affecting personal well-being dependent on wise choices initiated and continued throughout life (World Health Organization [WHO], 2018). Unhealthy lifestyle impacts negatively on one's morphological fitness. It is a non-performance component of fitness related to body composition factors such as body fat content, body circumferences and regional body fat distribution. Morphologic fitness profile is a measure of the body structure and morphological characteristics such as body composition (body mass, body fat and waist circumference). The study of Moncef and Said (2012) showed a strong correlation between morphological and physical characteristics with functional characteristics among Tunisian Athletes. Aandstad et al. (2014) pointed out that anthropometric data reflect the quality of life, high

working capabilities, and potentiality of individual creative abilities. Today, a greater focus has been placed on wellness and the prevention of disease and illness. Fitness and health have positioned for tremendous growth. However, the public's interest in fitness and wellness is intermittent and has never been stronger (Hoeger & Towson, 2018). Attaining health can be possible when prioritized; thus, maintaining average body weight and fitness, food intake patterns, weight control, energy balance activity, resilience, and hardiness in handling stress.

In 2016, more than one billion adults aged 18 years and older were overweight (WHO, 2018). With these, 650 million were obese. In the Philippines, a (Food and Nutrition Research Institute [FNRI], 2013) study revealed that the Cordillera Administrative Region (CAR) ranked 3rd among those regions with an obese and overweight population. The fundamental cause of obesity and overweight is an energy imbalance between calories consumed and calories expended. Globally, there has been an increased intake of energy-dense foods high in fat and increased physical inactivity due to the increasingly sedentary nature of many forms of work, technological advancements, changing modes of transportation, and increasing urbanization. Changes in dietary and physical activity patterns are often the result of environmental and societal changes associated with the development and lack of supportive policies in health, agriculture, transport, urban planning, environment, food processing, distribution, marketing, and education.

A raised BMI is a significant risk factor for cardiovascular diseases which are mainly heart disease and stroke and are the leading causes of death globally since 2012. It is also a risk factor for other non-communicable diseases (NCD) such as diabetes, musculoskeletal disorders, especially osteoarthritis and some cancers including endometrial, breast, ovarian, prostate, liver, gallbladder, kidney, and colon (WHO, 2018).

Waist girths exceeding 90cm in men and 80cm for women Filipinos are associated with approximately twice the likelihood of more significant mortality for men and women regardless of normal BMI levels FNRI-DOST National survey (2019). Furthermore, Dijk Van et al. (2012) study on different anthropometric adiposity measures and association with cardiovascular disease (CVD) clearly shows that waist circumference had the strongest correlation with all CVD risk factors for both men and women. When comparing BMI with waist circumference, the latter showed significantly better correlations to CVD risk factors.

Excess weight distribution in the abdominal area also increases colorectal cancer risk (Mc Ardle et al., 2015). A waist girth that exceeds 35 inches in men and 31 inches in women nearly doubles the risk of this cancer. Similarly, Goh et al. (2014) revealed that central obesity measurement also had higher sensitivity and specificity in identifying women above and below the 20% treatment threshold than BMI. Significant obesity measures also recorded better correlations with CVD risk compared with general obesity measures. Waist circumference (WC) and body fat percentage (BFP) were found to be meaningful and independent predictors of CVD risk, as indicated by the high area under the receiver operating characteristics curves (>0.76), after controlling for BMI in the simplified general CVD risk score model.

The findings of McArdle et al. (2015) correlate with the study of (Dijk Van et al., 2012) that central obesity measures are better predictors of CVD risk than general obesity measures. It is equally important to maintain a healthy weight and to prevent central obesity concurrently. It was exemplified by Reddy and Nambiar (2018) that WC is a better indicator of lipid profile when compared to BMI, signifying the importance of measuring abdominal and visceral fat in predicting CVD and associated complications. WC reflects abdominal fat, which contains a higher visceral fat that may affect abdominal adiposity, influencing blood lipid profile. This data supports that BMI, body fat percentage, and waist circumference are the predictors for cardiovascular disease. The goal of the study is to have a scientific evidenced-based measurements of the employees' fitness level as a basis for designing appropriate health and wellness programs and later measuring the impacts of these programs. This goal is based on the premise that employees' wellness greatly affects their productivity. The study hopes to contribute in increasing personal awareness of one's physical health and establishing attainable fitness goals in terms of lifestyle modification and accountability. Further, it serves as a basis for employees to seek further diagnostic tests and curative care for obesity-related diseases such as hypertension, diabetes, heart disease, and stroke. When employees

are health conscious and well informed, they become more responsible in taking care of themselves to achieve a better quality of life and lessen health care costs such as hospitalization.

This study primarily determined the morphological fitness and prevalence of hypertension and diabetes among Benguet State University (BSU) employees through anthropometric measurements. Specifically, it 1) assessed the body composition factors focusing on BMI, BFP, and WC; 2) determined the prevalence of CVD risk factors: hypertension, obesity, and diabetes; 3) determined the differences in morphologic fitness level according to age and sex; and 4) determined the association of obesity with CVD risk factors namely hypertension and diabetes.

Theoretical Background

This study is anchored on the premise that morphologic fitness is greatly affected by physical activity and a healthy lifestyle. The absence of both will seriously threaten the health and hasten the deterioration rate of the human body. A better and healthier life is something that everyone needs to attain. Today's most prominent health challenge is to let employees know how and motivate them to control their health habits and adhere to a positive lifestyle. Wellness implies a constant and deliberate effort to stay healthy and achieve the highest well-being potential. It requires implementing positive lifestyle habits to change behavior, improve health and quality of life, prolong life, and achieve total well-being.

Morphological Fitness

Morphological fitness is a component of physical fitness related to body composition, including body weight and body fat (Bouchard et al., 1990). Body composition can be estimated and carried out through anthropometric measurements, a standardized technique that is quick, simple, and inexpensive estimates of body composition to quantify (or predict) body size and proportion. Anthropometric data reflect the quality of life, high working capabilities, and potentiality of individual creative abilities or the so-called morphologic fitness (Jackson & Pollock, 1985). It is believed that physical fitness capabilities depend on physical health, physical development, physical activity, and a healthy lifestyle.

Measures of height using a stadiometer and weight with a calibrated scale to calculate the BMI that provide an estimate of body fatness and help determine the risk of certain disease conditions and health outcomes (Kirk et al., 2019). Waist circumference measurement can be used to assess the risk for disease conditions, particularly cardiovascular diseases (Seidell et al., 2020). A tape measure is the most common device for measuring the waist circumference of the body.

An accurate body composition assessment is necessary to correctly estimate an individual's risk for certain health conditions such as cardiovascular disease, hypertension, diabetes mellitus, hyperlipidemia, and certain forms of cancer. Additionally, the relative and sometimes total body fat mass and lean body mass may influence performance in certain activities (Pischon, 2018). Furthermore, periodic assessments help determine the effectiveness of physical activities and exercise interventions for the employees. Other valid and reliable methods used to determine fat mass include densitometry, dual-energy X-ray absorptiometry, bioelectric impedance, and skinfold measurement. Having a good body composition has many benefits, including decreased risk of type 2 diabetes, hypertension, and heart disease; increased functional ability allowing us to move and exercise more freely, burn more calories-a better calorie-burning metabolism throughout the day and a lean and toned body.

Self-Care Agency and Quality of Life

Self-care agency is the skill to initiate or perform health activities to maintain one's life, health, and well-being (Orem & Taylor, 2006). Individuals are assumed to have the cognitive, psychomotor, and emotional skills needed to engage in operations essential to self-care and ensure the maintenance of health and well-being (Carter, 2008). Self-care agency is "the power to engage in the estimative and productive operations." Meanwhile, Gast et al. (2009) explained the capacity to carry out actions precisely the dimensions of self-care agency, including an active response to situations, motivation, a knowledge base, and a feeling of self-worth.

Quality of Life refers to the degree to which a person enjoys the significant possibilities of life. Enjoyment is relevant to three major life domains: belonging and becoming a quality-of-life (QOL) theory developed from Abraham Maslow's human developmental perspective; the higher the need

for satisfaction, the greater the quality of life (Ventegodt et al., 2003). It is a multidimensional concept that embraces happiness, satisfaction, performance, functioning, goal-attainment, needs satisfaction, health, and well-being. Schalock and Alonso (2002) described three levels of health-related quality of life: personal (subjective level of happiness), functional (objective, interaction with a community or organization), and social (external, environmentally based), example: health, social welfare, the standard of living, education, public safety, leisure, and others. The levels include physical well-being, functional (occupational) ability, general health perception and well-being, and social activity.

The theories and studies exemplify the importance of fitness and wellness. Hence, employees with confidence and high self-esteem feel good about themselves. They can cope effectively and efficiently with challenges and negative feedback and live in a social world where they believe they are valued, respected, and productive citizens. In contrast, substantial evidence links low confidence and low self-esteem with depression, shyness, loneliness, and society's liabilities (Heatherton & Wyland, 2003).

Methodology

The study utilized the descriptive cross-sectional survey design to understand existing conditions and the relationship between variables. Data were taken in July 2019 and September 2019 using a researcher-designed questionnaire pre-tested and reviewed by experts. The questionnaire was divided into two parts: Part 1 includes personal information and the presence of cardiovascular risk factor such as hypertension and diabetes. It was self-administered and accomplished by way of an informal interview. Part 2 was where the data on weight and height for the BMI computation, body fat percentage, and waist circumference were recorded. The employees' anthropometric data were measured using: a meter stick, weighing scale (Detecto), and Accu-Measure Fitness 3000 calipers, a thermoplastic polymer that stands behind accuracy, durability, consistency, and non-stretchable fiberglass tape.

The participants included BSU employees based on purposive sampling technique, the inclusion criteria where they must be currently employed and aged 21-64 years old. In addition, pregnant employees were excluded from the study. A master list of employees was acquired from the BSU Human Resource Management Office for verification. The whole population sample is difficult to reach due to conflict with work schedule and time of data collection. A total of 325 employees submitted themselves for anthropometric measurement. A minimum of 309 employees was required to achieve a 95% confidence level, a precision of 5%, and a power of 80. The set value of the error is .05, which is the risk that the actual value differs from the sample. Informed consent was obtained from the participants before the data gathering. The identities, responses, and assessment results were kept and treated with the utmost confidentiality. The nature, purpose, risk, and benefits of the research were explained thoroughly. Participants were assured that appropriate steps were taken to protect their privacy and anonymity. Letters seeking permission to conduct the study were forwarded to the university president and were approved. The validity and reliability of the instruments used in testing were calibrated based on manufacturer instruction. The researchers took anthropometric measurements (AM) with the assistance of the university medical personnel. Blood Pressure (BP) was taken before conducting the anthropometric measurement. After resting for 5 minutes, the patient's blood pressure was taken using a standard BP apparatus. A second reading followed after 3 minutes then the average of the two is taken as final BP. Moreover, the core elements of anthropometry were taken: height, weight, BMI, WC, and BFP. The height and weight were measured using a calibrated (Detecto) scale to calculate the BMI. Waist circumference was measured to assess the level of risk for cardiovascular and other disease conditions. Meanwhile, a caliper was used for skinfold determination of BFP to measure body fat at various sites for men: chest, abdomen, thigh, and for women: triceps, suprailium, and thigh (Jackson Pollock method). Heyward (2018) explained that the estimate is based on the principle that the amount of subcutaneous fat is proportional to the total amount of body fat. However, the proportion varies with gender, age, and ethnicity. Cardiovascular risk factors were also asked, specifically hypertension and diabetes.

The quantitative measurements served as bases for the computation of BMI, BFP, and WC, which later showed the diagnostic criteria for obesity.

BMI is a simple measure of body fat using weight to height. It is used in epidemiological research and has a high correlation (rxy=.89) with body density. It is easily calculated as BMI = body mass/height (m^2), where weight is measured in kilograms and height in meters. The computed BMI was interpreted using the BMI standard and the Philippine Association for the Study of Overweight and Obesity (2020).

Body Mass Index	Descriptive Equivalent
<18.5	Underweight
18.5-22.9	Normal
23.0-24.9	Overweight
25.0-29.9	Obese 1
>30.0-34.9	Obese 2
>35	Obese 3

Body Fat Percentage	Descriptive Equivalent
<12	Lean
12-21	Acceptable
>21-26	Moderately overweight
>26	Overweight

Sex	Waist Circumference	Descriptive Equivalent
Female	>35 inches	At risk
	< 35 inches	Not at risk
Male	>31 inches	At risk
	< 31 inches	Not at risk

To determine the prevalence of hypertension among the overweight/obese and its association with overweight/obese, a 2 x 2 table (Table 1) was used separately for male and female employees. From this table, the prevalence rate and odds ratio were computed. The prevalence rate of hypertension among the overweight/obese is computed as a/a + b x 100, while that of the non-obese/not-overweight is c/c + d. The odds ratio is computed as a x d / b x c. A similar computation is used for the prevalence of diabetes using BMI and hypertension using BFP and WC.

The following statistical methods: mean, frequency, and rank, were utilized to analyze the anthropometric measurement and the level of morphological fitness of employees. Inferential statistics such as *t*-test, range, and ANOVA were used to analyze the prevalence of CVD risk factors among the employees.

Results and Discussion

Profile of Participants

A total of 325 employees participated in the study. The ages ranged from 20-64 years old, with a median age of 39. The majority belong to the younger age group of 20-30 hence, majority of the participants (202) were females (Figure 1).

Height and Weight Measurements

The difference in hormonal balance between men and women, such as testosterone, estrogen, and growth hormone levels, contributes to the metabolic process variance. It suggests that physical growth or height and weight gain would also differ. This is supported by the average height and weight difference between adult men and women. According to the 8th National Nutrition Survey

Table 1

Distribution of Employees with Hypertension Among the Overweight/Obese and Non-obese

BMI	With Hypertension	Without Hypertension	Total
Obese/overweight	a	b	a + b
Normal	c	d	c + d

Note: The prevalence rate of hypertension among the overweight/obese is computed as:

Prevalence rate = a/ a + b x 100

The prevalence rate of hypertension among the non-overweight/obese is computed as:

Prevalence rate = c/ c + d x 100

Odds ratio = a x d/ b x c

(FNRI, 2015), the average height of adult Filipinos 20 years and older is 163cm for males and 151.4cm for females, while the average weight is 61.3kg for males and 54.3kg for females. The anthropometric measurements were statistically treated separately per sex to avoid factoring in the outliers, such as higher height in males, and to account for the metabolic differences.

As shown in Table 2, male participants have a mean height of 163cm, which is also the average male Filipino height. The mean weight for the male participants is 70.2kg which is higher than the national average for Filipino men (61.3kg). It is important to note that height and weight are hereditary and may not necessarily reflect good or poor physical status if used independently. They would have more utility if both measures were used in computing the body mass index.

Table 3 shows the mean height for the female participants is 150cm which is lower than the average female Filipino height (151.4cm). The shortest participant has a height of 138cm, and the tallest with 164cm. The mean weight for the female participants is 58.57kg which is higher than the national average for Filipino women (54.3kg). The lowest weight recorded is 40kg, and the highest is 89kg.

Figure 1

Population Distribution of BSU Employee Participants by Age Group (n=325)

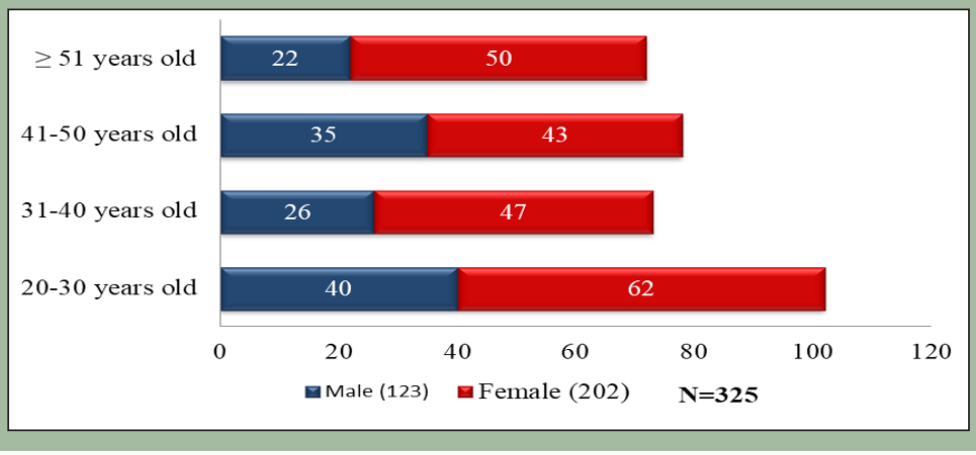


Table 2

Height and Weight Measurement of Male BSU Employees (n=123), "2019"

Measures	Mean	Standard Dev.	Coefficient of Var.	Min.	Max.
Height	163 cm	6.36	3.9 %	148.50	178.00
Weight	70.2 kg	11.54	16.44 %	44.00	106.50

Table 3

Height and Weight measurement of Female BSU employees (n=202), "2019"

Measures	Mean	Standard Dev.	Coefficient of Var.	Min.	Max.
Height	150 cm	4.73	3.15%	138.00	164.00
Weight	58.57 kg	9.41	16.06%	40.00	89.00

Weight Classification of Male and Female BSU Employees According to Body Mass Index

The Body Mass Index is commonly used as the standard to determine fitness level. Figure 2 presents that the majority of the male participants have a BMI above normal. Only 15 or 12% of males were classified as having a normal BMI. here is one with the lowest BMI classified as underweight.

Figure 3 shows that the majority of the female participants (155 or 77%) have BMI above normal, further classified as 22% overweight, 40% obese 1, 14% obese 2, and 1% obese 3. Only 44 or 22% were classified as normal. The lowest BMIs recorded include three participants classified as underweight; while the highest BMIs were three female participants classified as obese class 3.

The study revealed that the average BMI classification for both sexes is obese class 1. Table 4 shows that the average BMI of female and male employees is 26.15kg/m² and 26.42kg/m², respectively. Since both values are higher than 24.9, which is the maximum value for overweight, the descriptive equivalent is obese class 1. Results therefore show that BSU employees are more likely to develop cardiovascular disease.

Association of Obesity/Overweight with Hypertension Using Body Mass Index

In this study, of the 123 males, there were 17 overweight and obese with hypertension, equivalent to 13.82% (Table 5). The prevalence of

Figure 2

Weight Classification of Male BSU Employees According to Body Mass Index (BMI)

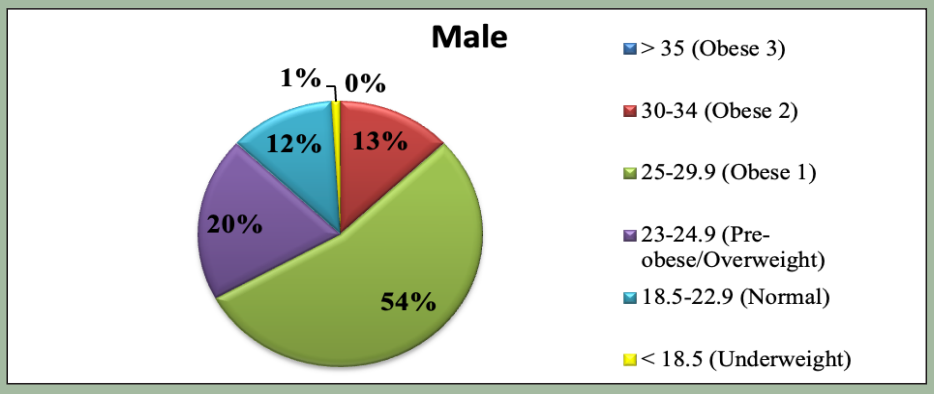


Figure 3

Weight Classification of Female BSU Employees According to Body Mass Index (BMI)

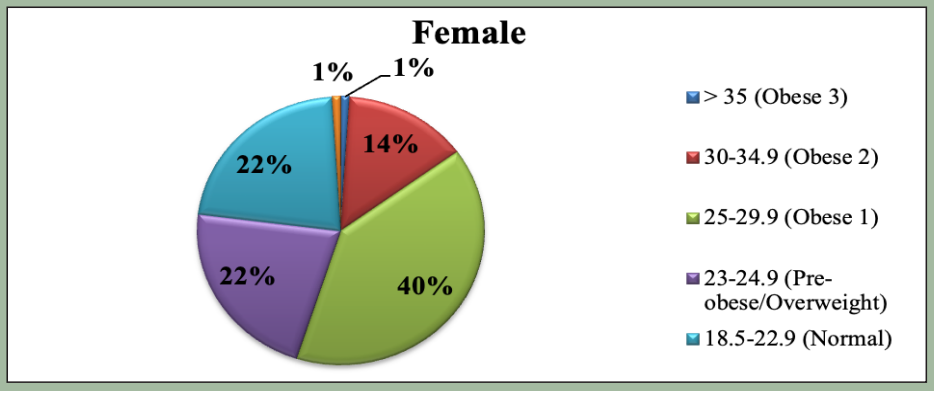


Figure 4

Body Mass Index Classification of Male and Female BSU Employees

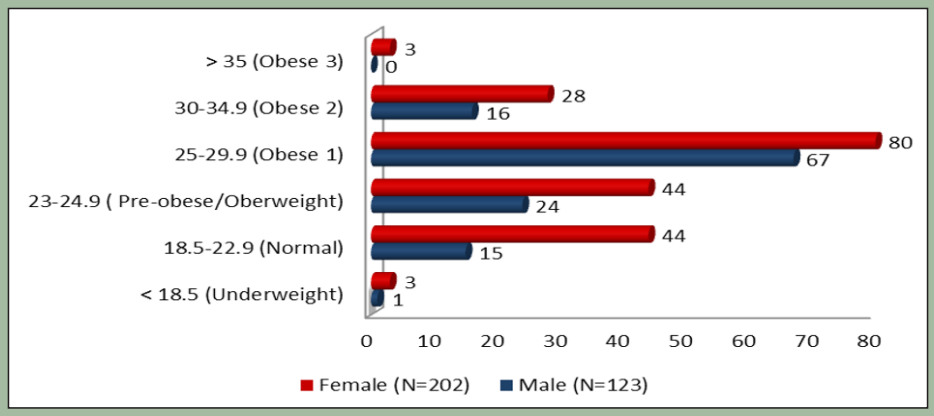


Table 4

Summary of Body Mass Index of BSU Employees According to Sex

Measures	Mean	Description	Standard Dev.	Coefficient of Var.	Min.	Max.
Body Mass Index (BMI) Female	26.15 kg/m²	Obese I	4.64	17.74%	17.64	39.64
Body Mass Index (BMI) Male	26.42 kg/m²	Obese I	3.43	12.98%	18.8	34.81

Table 5

Prevalence of Hypertension Among Male BSU Employees Using BMI (n=123)

BMI	With Hypertension	Without Hypertension	Total
Obese/Overweight	14	67	81
Normal	3	39	42
Total	17	106	123

P1: Prevalence of HPN among the overweight and obese male employees
P1= 14/81 x 100=17.28 %
P2: Prevalence of HPN among the non-overweight/obese
P2 = 3/42 x 100= 7.1 %
*OR = ad/bc= 14(39)/3 (67) = 546/201 = 2.71 95 % CI (.73- 10.55) not significant***

HPN is 17.28% among the obese and overweight and 7.1 among the non-obese. The computed odds ratio is 2.71, which means that the odds of hypertension is 2.71 times higher among overweight and obese male employees than those who are neither obese nor overweight. Among the females (202), 37 or 18.33% were either obese or overweight with hypertension (Table 6). The prevalence of HPN is 27 % among the obese and overweight and 7.69 among the non-obese. The odds ratio is 4.44, meaning the odds of hypertension among female employees is 4.41 times higher among those overweight and obese than those who are not. By way of comparison, the prevalence of hypertension among the obese and overweight, the odds ratio is higher in females than in males. Therefore, the odds of hypertension are higher among overweight/obese

Table 6

Prevalence of Hypertension Among Female BSU Employees Using BMI (n= 202)

BMI	With Hypertension	Without Hypertension	Total
Obese/Overweight	30	81	111
Normal	7	84	91
Total	37	165	202

P1: Prevalence of HPN among the overweight and obese female employees
P1 = a/a +b x 100
P1= 30/111 x 100 = 27 %
P2: Prevalence of HPN among the non-overweight/obese female employees
P2= 7/91 x 100= 7.69 %
*OR= ad/bc = 30 (84)/7 (81) = 2520/ 567=4.44 95 % CI (1.85-10.69) significant**

female employees than their male counterparts.

As a cross-sectional study, the exposure (overweight and obese) and the disease (hypertension) were measured at the same time. Similarly, the prevalence rate is measured only at one point in time without regard to duration. Therefore, the prevalence rate and odds ratio apply only to the specific period when this study was done. In this study on obesity and hypertension, some participants had chronic hypertension while others had just been newly diagnosed. As such, it will only demonstrate the association between exposure and outcome but not necessarily causality, although it is still meaningful because of the correlation between current exposures, which is obesity.

A raised BMI is a major risk factor for non-communicable diseases such as cardiovascular diseases (mainly heart disease and stroke), which were the leading cause of death in 2012; diabetes; musculoskeletal disorders (especially osteoarthritis – a highly disabling degenerative disease of the joints); some cancers (including endometrial, breast, ovarian, prostate, liver, gallbladder, kidney, and colon) (WHO, 2021).

Clearly, the prevalence of hypertension among overweight/obese employees is higher than that of non-obese. HPN prevalence among obese and overweight male employees is higher by 10.18 than that of the non-obese. Among the obese/ overweight females, the prevalence of HPN is higher by 19.31 than that of the non-obese/ overweight group. Results of the data gathered shows that the prevalence of HPN is lower in the male group (17.28%) than in the female group (27%). Further, it showed that the prevalence of HPN among the non-obese is 7.1 and 7.69, respectively. Therefore, the study proved that overweight and obese BSU employees are at higher risk of hypertension than non-obese overweight.

Although BMI is often considered an indicator of body fatness, it is a surrogate measure of body fat because it measures excess weight rather than excess fat. Despite this fact, studies have shown that BMI is correlated to more direct measures of body fat, such as underwater weighing and dual-energy x-ray absorptiometry. BMI is a simple, inexpensive, noninvasive surrogate measure of body fat. In contrast to other methods, BMI relies solely on height and weight. With access to the proper equipment, individuals can have their BMI routinely measured and calculated reasonably.

Furthermore, studies have shown that BMI levels correlate with body fat and future health risks. High BMI predicts future morbidity and death. Therefore, BMI is an appropriate measure for screening for obesity and its health risks. Lastly, the widespread and longstanding application of BMI contributes to its utility at the population level. Its use has resulted in increased availability of published population data that allows public health professionals to make comparisons across time, regions, and population subgroups. The clinical limitations of BMI should be considered. Factors such as age, sex, ethnicity, and muscle mass can influence the relationship between BMI and body fat. Also, BMI does not distinguish between excess fat, muscle, or bone mass, nor does it indicate the distribution of fat among individuals. Certain variables can influence

the interpretation of BMI: On average, older adults tend to have more body fat than younger adults with an equivalent BMI, women have greater amounts of total body fat than men with an equivalent BMI, and muscular individuals, or highly-trained athletes, may have a high BMI because of increased muscle mass (DOH, 2018).

Association of Obesity/Overweight with Diabetes Mellitus Using Body Mass Index

Table 7 shows the prevalence of diabetes among overweight and obese male BSU employees to be 14.28 % and 1% among those who are not. The odds ratio is 17. The above results indicates that overweight/obese male employees are 17 times more likely to be diabetic than those with normal weight. Meanwhile, Table 8 likewise shows that the prevalence of diabetes among overweight and obese female employees is 3.7%, far lower than their male counterparts but 2.5 % among the non-overweight/ non-obese. The odds ratio is 1.5, which is also lower than the males. It can be inferred that the prevalence of diabetes increases with obesity, and there are links between obesity and type 2 diabetes. Obesity accounts for 80-85% of the risk of developing type 2 diabetes, while recent research suggests that obese people are up to 80 times more likely to develop type 2 diabetes than those with a BMI of less than 22.

Conversely, one does not have to be overweight or obese to get type 2 diabetes. One can have high blood sugar even if one looks thin. Nearly 10% to 15% of people with type 2 diabetes are at a healthy weight. It is called lean diabetes (WHO, 2018). Based on the results, it can be deduced that the risk of hypertension and diabetes is higher among overweight and obese employees than among those who are not.

Body Fat Percentage Classification of Employees

Along with determining BFP for men and women, the ideal or desired body weight is often based on the individual's desired percent of fat. The Accu-measure Fitness 3000 Personal Body Fat Measurement Chart (2018) was used as a reference to estimate the body fat percentage in millimeter

Table 7

Prevalence of Diabetes Among Male BSU Employees Using BMI (n=123)

BMI	With Diabetes	Without Diabetes	Total
Obese/Overweight	3	18	21
Normal	1	101	102
Total	4	119	123

P1= Prevalence of Diabetes among Obese and overweight male employees
P1= 3/21 x 100 = 14.28 %
P2= 1/102 x 100 = 1 %
*OR: 3 x 101/1 x 18 = 306/18 = 17, 95% CI (1.66- 170.96) significant**

Table 8

Prevalence of Diabetes Among Female BSU Employees Using BMI (n=202)

BMI	With Diabetes	Without Diabetes	Total
Obese/Overweight	6	156	162
Normal	1	39	40
Total	7	195	202

P1= 6/162 x 100 = 3.7 %
P2= 1/40 x 100=2.5 %
*OR: 6 x 39/ 1 x 156= 234/156= 1.5, 95% CI (.18- 12.82) not significant***

reading using a caliper. The anthropometric measurement of the subcutaneous fat (skinfold) and circumference (girths) predicts body fatness.

Figure 5 shows that from among the male employees, 17 (13.82 %) are overweight, 47 (38.21%) are moderately overweight, 54 (43.9%) have an acceptable BFP, while 5 (4%) are lean. The foregoing results indicates that 64 out of 123 males (52%) have BFP above the acceptable level and are considered overweight. Almost 50% (98) of the female employees are moderately overweight, 26.7% are overweight, and 25% have acceptable BFP. Meanwhile, the result shows that 152 (75.24%) females and 64 (50%) males are overweight, indicating that more females are overweight/obese than males. Explicitly, more males have an acceptable BFP than females (42.4% versus 24.75%, respectively). There are more male employees (36%) who are moderately overweight (BFP: 12-21) than female employees (25%), while there are leaner females than male employees. More importantly, the study further showed that among female employees with BFP <12-21, 7 are hypertensive while 97 are not. Among those with BFP >21, 30 are hypertensive, and 68 are not.

Association of Moderately Overweight and Overweight with Hypertension Using Body Fat Percentage

From the findings, the result showed that individuals with high body fat percentage were significantly associated with increased risk of hypertension even in individuals with low BMI, WC and Waist Hip ratio. The foregoing findings are conformable to the results gained in the study of Park et al. (2019). Specifically, Table 9 shows that among males, the odds of HPN are 2.73 times higher among those with BFP >21 up than those with normal BFP. The odds of HPN in females (Table 10) are 6.11 times higher among those with BFP >21 up as compared to those with BFP 21 and below. The results reveal that hypertension is higher among the moderately overweight and overweight as compared to those who are not.

The findings exemplify that obesity is indisputably the most significant preventable health-related cause of mortality. Any excess body fat and obesity rates increase, so do their problems. Experts believe that life expectancy will soon decline if the current trends in overweight and obesity (and their related health problems) continue. Subsequently, overweight and obese people, especially the sedentary ones, suffer from the so-called metabolic syndrome or insulin resistance syndrome. The body is resistant to the effect of insulin resulting in high blood glucose levels, high blood pressure, abnormal fat levels (high triglycerides and low HDLs, or "good" cholesterol), and fat deposits in the abdominal region. Metabolic syndrome increases the risk of heart disease. Chen et al. (2021) reported that among the predictors for diabetes mellitus type 2 are body fat percentage, waist-hip ratio, and visceral fat. As illustrated, there is no significant association between BFP and HPN among male employees as the confidence interval includes the

Figure 5

Body Fat Percentage Classification of the BSU Employess According to Sex

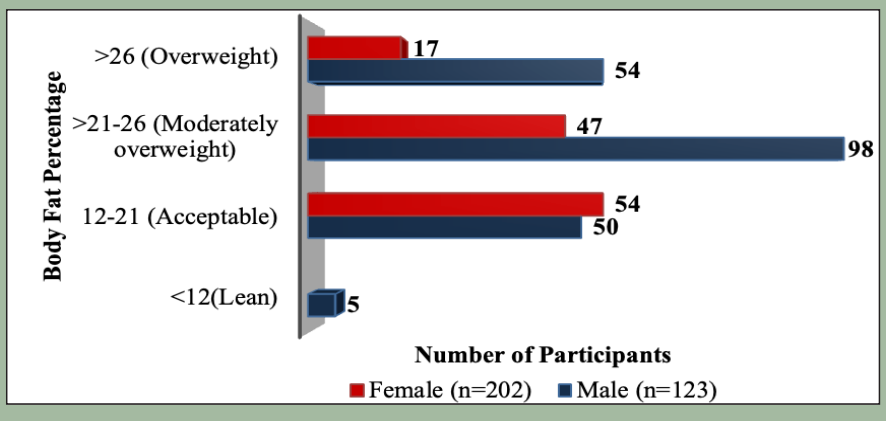


Table 9

Prevalence of Hypertension Among Male BSU Employees (n=123) Using BFP, "2019"

BFP	With HPN	Without HPN	Total
>21 up	8	26	34
<12-21	9	80	89
Total	17	106	123

P1= 8/34 x 100 = 23.52 %
P2= 9/89 x 100= 10.11 %
*Odds ratio: 8/26/9/80=8x80/9x26= 640/234=2.73; 95 % CI (0.96-7.82) not significant***

Table 10

Prevalence of Hypertension Among Female BSU Employees (n=202) Using BFP, "2019"

BFP	With HPN	Without HPN	Total
>21 up	30	68	98
<12-21	7	97	104
Total	37	165	202

P1= 30/98 x 100 = 30.61
P2= 7/104 x 100= 6.73%
*Odds ratio: a/b / c/d = 30/68/ 7/97 = 30x 97/7 x 68= 2,910/476= 6.11; 95 % CI (2.54; 14.73) highly significant**

value 1 but there is a significant association of the same among the females.

Waist Circumference of BSU Male and Female Employees

Waist circumference measures the abdomen around the top of the iliac crest (or the middle point between the last rib and the pelvic bone). FNRI (2013) explicated that waist circumference provides a unique indicator of body fat distribution, which can identify employees who are at increased risk for obesity-related cardio metabolic diseases above and beyond the measurement of BMI.

Meanwhile, Table 11 presents that among the participants, 97 males have a waist circumference of less than 90cm and are considered not at risk, while 26 have a waist circumference of more than 90cm. There were 102 female participants with a waist circumference of less than 80cm, while 100 with more than 80cm. From the findings, the result indicates that almost 50% of the participants are considered at risk based on waist circumference, and the other 50% are not at risk.

The result implies that body fat distribution (the fat locations on the body) is also an important indicator of health. Men tend to store fat in the upper regions of their bodies, particularly in the abdominal area (the "apple shape"), or called "android obesity." It is evident in individuals who tend to store fat in the trunk or abdominal area. Women in their reproductive years are more likely to accumulate fat around the hips and thighs and acquire a "pear shape."

A widening waist or "apple" shape is a warning signal. A wider waist correlates with high levels of harmful blood fats in young women, such as low-density lipoprotein (LDL) cholesterol and triglycerides (Moreira-Andres et al., 2004). In both sexes, abdominal fat, unlike fat in the thighs or hips, increases the risk of high blood pressure, type 2 diabetes, high cholesterol, and metabolic syndrome: a dangerous combination of overweight, high blood pressure, and high cholesterol levels and blood sugar.

Table 12 shows that the mean WC for female employees is 31.25 inches, while that of the males is 32.52 inches. Specifically, the results indicate that female employees are more at risk of type 2 diabetes than males. The general guideline is that a waist measuring more than 31 inches in women or more than 35 inches in men signals more significant health risks. According to Hales (2017), these waist circumferences indicate "central" obesity, which is characterized by fat deposited deep within the central abdominal area of the body. Such "visceral" fat is more dangerous than "subcutaneous" fat just below the skin because it moves more readily into the blood stream and directly raises harmful cholesterol levels. Excess fat deposition, especially in the abdominal area, is a consequence of energy imbalance that results from the interaction of several factors such as increased intake of energy-dense foods, decreased intake of food rich in nutrients and bioactive compounds, and decreased physical activity.

Association of Obesity/Overweight with Hypertension Using Waist Circumference

Waist girth exceeding 90cm in men and 80cm for women among Filipinos is associated with approximately twice the likelihood of more significant mortality for men and women regardless of normal BMI levels (FNRI, 2015). Furthermore, the findings of Dijk Van et al. (2012) showed that WC and BFP had the strongest correlation with all CVD risk factors in both men and women. Excess weight distribution in the abdominal area (and correspondingly high blood insulin levels) also increases colorectal cancer risk (Calle et al., 2013). Accordingly, a waist girth that exceeds 35 inches in men and 31 inches in women nearly doubles the risk of this cancer. Delving into the prevalence of HPN among male at-risk employees is presented in Table 13. This information represents 33.33%, while among those not at risk, it is 5.74%. The odds ratio is 8.2, which means the odds of HPN is 8.2 times higher among the at-risk group than the not-at-risk group.

Table 11

Waist Circumference of BSU Male and Female Employees, "2019"

RISK LEVEL	FREQ	PER (%)
Female		
Not at risk (<80 cm waist circumference)	102	50.50
At-risk (≥ 80cm waist circumference)	100	49.50
TOTAL	202	100.00
Male		
Not at risk (<90 cm waist circumference)	97	79.00
At-risk (≥ 90cm waist circumference)	26	21.00
TOTAL	123	100.00

Table 12

Summary of Waist Circumference of BSU Employees, "2019"

Measures	Mean	Description	Standard Dev.	Coefficient of Var.	Min.	Max.
Waist Circumference (Female)	31.25 inches	High risk of Type 2 Diabetes	3.65	11.68 %	22.00	44.00
Waist Circumference (Male)	32.52 inches	Low risk of Type 2 Diabetes	3.55	10.92 %	24.50	43.00

As gleaned from Table 14, the prevalence of HPN among the at-risk female employees is 25.66% compared to that of the non-risk, which is 8.98 %. The odds ratio is 3.5, the above results mean the odds of HPN is 3.5 times higher among the at-risk than the not at-risk. The prevalence of HPN among the at-risk population is higher in males (33.33%) than in females (25.66%) but lower among the not-at-risk, where the prevalence is 8.98 % among females and 5.74 among males.

As illustrated, the association between hypertension and obesity among female employees is significant having an odds ratio of 3.5 which is more than one and a confidence interval that does not include the value 1.

Differences in the Level of Morphological Fitness According to Age

Statistical analysis revealed highly significant differences in the BMI, BFP, and WC of employees when grouped according to age (Table 15). This finding implies that age significantly affects the employees' morphological fitness or that age is a significant contributor to BMI, BFP, and WC of employees. As age increases, the BMI, BFP, and WC also increase. As to WC, employees who are 40 years old or younger were not at risk, while those older than 40 were at risk. The above result means that the older age groups had higher disease risks than the younger age groups. For females, the hormone estrogen is responsible for reducing adipose (fat) tissue and regulating body weight. However, at menopause, there is a decrease in estrogen; therefore, there is no control for adipose tissue proliferation (Aubead, 2021).

Table 15 presents the differences in BMI, BFP, and WC among employees according to age. The results revealed that those under the oldest age category had the highest BFP while those under the youngest had the lowest BFP, with computed average BFP values of 30.17 and 22.39, respectively. These results conform to studies conducted by the FNRI-DOST (2013) and WHO (2018), which indicate that adults gain one to two kilograms of weight per year. As people age, their metabolism rate decreases resulting in weight gain. However, because of the typical reduction in physical activity, the average person also loses half a kilogram of lean tissue each year. Therefore, a span of 40 years will have produced an actual fat gain of 40 to 80kg accompanied by a 20kg loss of

Table 13

Prevalence of Hypertension Among Male Employees Using WC, "2019"

Waist Circumference	With Hypertension	Without Hypertension	Total
>35 inches	12	24	36
< 35 inches	5	82	87
Total	17	108	123

P1= 12/36 x 100= 33.33 %
P2 = 5/87 x 100= 5.74 %
*OR: 12 x 82/5 x 24= 984/120= 8.2 95% CI (2.63, 25.59) highly significant**

Table 14

Prevalence of Hypertension Among Female Employees Using WC, "2019"

Waist Circumference	With Hypertension	Without Hypertension	Total
>31 inches	29	84	113
< 31 inches	8	81	89
Total	37	165	202

P1 = 29/113 x 100 = 25.66 %
P2= 8/89 x 100 = 8.98 %
*OR: 29/84/8/81= 29 x 81/8x84=2,349/672=3.5 95% CI (1.51, 8.1) significant**

Table 15

Comparison of BMI, Body Fat Percentage, and Waist Circumference of "BSU" Employees According to Age, "2019"

Variable/Age Group	Mean	De.	F Value	Sig
BMI				
21-30 years old	24.27	Overweight	14.723**	0.00
31-40 years old	28.82	Obese I		
41-50 years old	27.47	Obese I		
51 years or older	26.95	Obese I		
Body Fat Percentage				
21-30 years old	22.39	Moderately Overweight	16.629**	0.00
31-40 years old	26.82	Obese I		
41-50 years old	27.40	Overweight		
51 years or older	30.17	Overweight		
Waist Circumference				
21-30 years old	29.41	Not at Risk	24.608**	0.00
31-40 years old	31.91	Not at Risk		
41-50 years old	33.01	At Risk		
51 years or older	32.21	At Risk		

body mass. These changes cannot be detected without assessing body composition periodically. Subsequently, the findings corroborate with Donatelle (2009) that excess body fat is an independent risk factor for coronary heart disease.

As opposed to in the hips and thighs, fat in the abdomen is at higher risk for infection. Furthermore, when abdominal fats are stored primarily around internal organs (visceral fat), disease risk is more significant than when abdominal fat is stored subcutaneously or retroperitoneal. The best approach to prevent increases in visceral fat is through an active and healthy lifestyle.

Differences in the Level of Morphological Fitness According to Sex

Results of the gathered data shows no significant differences in the BMI of the respondents when compared according to their sex (Table 16). Based on the result, it can be deduced that the average BMI of the respondents is the same regardless of their sex. Specifically, both male and female respondents were under Obese 1 based on their computed BMIs. On the other hand, highly significant differences are observable in the BFP and WC of employees grouped according to sex. The finding demonstrates that differences observed in the BFP and WC of employees were significantly affected by sex. Specifically, female employees had higher BFP than male employees. On the other hand, male employees had higher waist circumference than female employees, although not at risk. Females are expected to have higher BFP than males due to hormonal factors, and the result showed that they are overweight. Using BMI, both sexes were under the Obese 1 classification. Using the BFP, the descriptive equivalent was overweight and moderately overweight for females and males, respectively. According to Goonasegaran (2012), BMI has a limited diagnostic performance due to its inability to discriminate between fat and lean mass. In his study using BMI versus BFP in defining body composition, out of the 490 subjects recruited, 43% of males and 24.6% of females were overweight, while 14.3% of males and 7.8% of females were obese when calculated using BMI. However, 8.9% of males and 22.8% of females were considered obese based on the BFP. Among males, the BMI is higher by 5.4 than BFP, while among females, BFP is higher than BMI by 15. BFP then plays a more critical role in distinguishing

Table 16

Comparison of BMI, Body Fat Percentage, and Waist Circumference of "BSU" Employees According to Sex, "2019"

Variable/Age Group	Mean	De.	F Value	Sig
BMI				
Female	26.09	Obese 1	0.0749NS	0.454
Male	26.42	Obese 1		
Body Fat Percentage				
Female	30.89	Overweight	-16.676**	0.00
Male	21.12	Moderately Overweight		
Waist Circumference				
Female	31.25	At Risk	3.013**	0.003
Male	32.52	Not at Risk		

between healthy and obese individuals, as it has a more remarkable ability to differentiate between lean mass and fat mass compared to BMI.

Common Cardiovascular Risk Factors Among BSU Employees

The health of employees is a critically important issue. An active and healthy lifestyle plays an essential role in promoting good overall individual health. The findings implies that employees are at high risk of cardiovascular disease and have all three risk factors: hypertension, diabetes, and overweight/abdominal obesity. All these, however, are modifiable and, therefore, are preventable. These three risk factors are among the four identified intermediate risk factors for CVD by the WHO, namely raised blood pressure (hypertension), raised blood glucose (diabetes mellitus), raised blood lipids (hyperlipidemia), and overweight and obesity. These "intermediate risk factors" can be measured in primary care facilities and indicate an increased risk of heart attack, stroke, heart failure, and other complications. Figure 6 presents the cardiovascular risk factors of BSU employees.

Overweight/Obesity Among BSU Employees

Based on the result, overweight/obesity is the most prevalent CVD risk factor among BSU employees, equivalent to 266 or 82% (Figure 6). This is higher than the Expanded National Nutrition Survey result conducted by FNRI in 2019, where the prevalence of overweight is 28.82% and obese at 9.67% among adults aged 20-59 years old. FNRI-DOST (2019) reported that the prevalence of overweight and obesity is higher than the national estimates across all population groups in the highly-urbanized cities (HUCs). Additionally, it was noted that WC measurements were notably higher among female adults and among adults aged 40 to 69 years, peaking at age 50 to 59.

FNRI (2015) reported changes in the dietary pattern of Filipinos, which they attribute to the following: (a) increasing urbanization with the association with westernized food habits such as high-fat diets, processed foods, and consumption of refined carbohydrates; (b) globalization which increased trade liberalization, making available a wide variety of processed and fast foods; (c) increased frequency of eating away from home; (d) use of computer games; and (e) influence of mass media.

Typical treatment for obesity includes behavior modification, lifestyle management, nutritional modification, and increased physical activity. Pharmacologic and surgical interventions are available to those individuals who have been unsuccessful in repeated attempts to lose weight (Sugerman & Kral, 2015).

Hypertension Among BSU Employees'

Among the employees, 57 or 17.53% are hypertensive and rank the second-highest of the most prevalent CVD risk factors (Figure 6). The findings imply that lifestyle changes are imperative

as the first line of defense against this risk factor. These include losing weight, eating healthy foods, reducing sodium, exercising more, and keeping blood sugar levels as stable as possible to prevent complications that produce the best results. This result aligns with the survey conducted by the Philippine Heart Association among the hospital-based population. Hypertension was the highest CVD risk factor (38.6%), followed by stroke (30%), coronary artery disease (CAD) (17.5%), and heart failure (10.4%) Seidell et al. (2020). In 2015, the WHO estimated that 1.13 billion people worldwide have hypertension, two-thirds living in low- and middle-income countries, and 1 in 4 men and 1 in 5 women had hypertension. Hypertension is a significant cause of premature death worldwide. Based on the latest WHO data published in 2018, hypertension deaths in the Philippines reached 14,488 or 2.38% of total deaths. The age-adjusted death rate is 23.44 per 100,000 of the population. The Philippines ranks number 25 in the world in terms of hypertension-related deaths.

A study conducted by the Department of Health (2018) found that the prevalence of hypertension in the country is increasing. The data showed that 16% or approximately 7 million Filipino adults 20 years and above have hypertension. The incidence increased to 10 million or 21% of Filipino adults 20 years and above. Men and women are equally likely to develop hypertension, but blood pressure tends to rise around menopause in women. Half of all women over age 45 have hypertension. For individuals who smoke, are overweight, do not exercise, or have high cholesterol levels, hypertension multiplies the risk of heart disease and stroke. At ultra-high risk are diabetes or kidney diseases (Chobanian et al., 2003). Even mild hypertension can cause organs such as the heart, brain, and kidneys to deteriorate in a young person. By age 50 or 60, the damage may be irreversible.

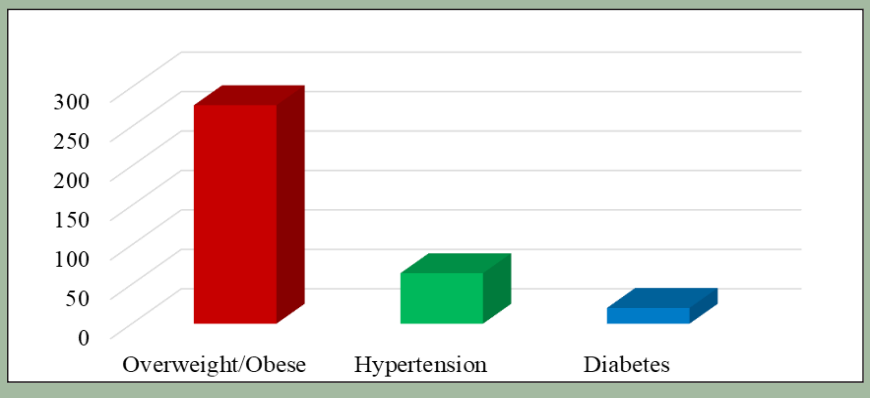
Diabetes Among BSU Employees

Figure 6 further shows that 11 or 3.38% of employees have diabetes, a disorder of the endocrine system that increases the likelihood of hypertension and atherosclerosis, increasing the risk of heart attack and stroke. It could be inferred that employees at high risk for this disease are overweight, have a family history of the disease, have mildly elevated blood pressure and blood sugar levels, and above-ideal levels of harmful blood fats. Hence, they may already be at increased risk of heart disease. Up to one-half of those with diabetes also had hypertension, another risk factor.

According to the WHO (2018), diabetes mellitus deaths in the Philippines reached 25,528 or 4.19% of the total deaths. The age-adjusted death rate is 38.17 per 100,000 of the population; ranks the Philippines number 59 globally. Lifestyle factors, especially a lack of physical activity, significantly increase the risk of type 2 diabetes. Obesity and physical inactivity are independent risk factors for diabetes (Choi et al., 2020).

Figure 6

Cardiovascular Risk Factors of BSU Employees



Conclusions

The study revealed that morphologically, majority of male and female employees fall under the obese 1 classification having a BMI of 25-29.9. Sex is a risk factor for BFC and WC where the females had higher BFC than males, on the other hand, males have higher waist circumference than the females. The prevalence and odds of hypertension and diabetes are higher among the obese/overweight than those of the non-obese/ overweight employees. Specifically, the prevalence of hypertension is higher among obese male than female employees. Conversely, diabetes prevalence is lower among obese males than females. Age has a direct relationship with the three parameters that with increasing age, the body mass also increases, as reflected in the BMI, BFP, and WC. BMI as a measure of body adiposity or fatness yields a higher value than BFP. The prevalent cardiovascular risk factors among BSU employees in descending order are overweight/obesity, hypertension, and diabetes. The study, therefore, demonstrated that BSU employees are not morphologically fit. The risk factor demonstrated in the study is obesity which is modifiable and can be managed through lifestyle modifications.

Recommendations

Periodic assessment of the morphologic and physiologic aspects of health is a valuable tool for improving employees' overall health; therefore, in addition to the anthropometric measurement, laboratory tests need to be conducted to demonstrate other risk factors such as serum cholesterol, blood sugar, BUN, creatine, SGOT, SGPT, BUA, etc. Promotion of a healthy lifestyle is necessary, which includes having proper nutrition or a balanced diet and engaging in physical activity or exercise. In addition, developing a weight loss program is recommended to address the physical fitness needs of employees. The BSU employees must make a conscious effort in maintaining a healthy weight using the energy balance equation or the balanced diet using the Filipino Food Plate Formula. Further, they should engage in regular aerobic physical activity and moderate to high-intensity exercise to maintain and enhance physical performance, wellness, and quality of life. Weekly blood pressure monitoring may be conducted. Weekly blood pressure monitoring is essential for controlling hypertension, thereby promoting overall good health and a high level of performance. BSU employees with diabetes should have regular follow-up check-ups to regulate and control blood sugar levels.

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