Research Notes: Association of Waist Circumference and Health Risk Factors Among Faculty Members of a Philippine University

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ABSTRACT

According to the World Health Organization (2000), obesity is linked with the increasing trend in the prevalence of cardiovascular diseases (CVD) and diabetes mellitus (DM) in developed and developing countries.

In the Philippines, cardiovascular diseases such as hypertension and atherosclerosis remain to be the two leading causes of mortality. The study aimed to determine the relationship of waist circumference(WC) with health risk factors among faculty members of a Philippine university. Anthropometric, clinical, and biochemical examinations were conducted among 100 randomly selected members of the UP Los Baños faculty.

It was found that majority (57%) of the respondents had normal nutritional status, about one third (34%) was overweight, and 7% was found to be obese. Being overweight was more prevalent among males whereas obesity was more common in females.

It was observed that majority of the respondents in both genders were in the pre-hypertensive stage, with relatively higher prevalence (66%) in males than in females (48%). Hypertension was found to be highly prevalent in both genders, 10% higher among men than women.

Among males, the results of the study corroborates previous findings that increased adiposity which is indicated by increasing waist circumference is associated with increasing fasting blood sugar, triglyceride, and blood pressure.

The significant association of WC with risk factors suggests that abdominal obesity may play an etiologic role in the clustering of health risk factors which is a clinical feature of the metabolic syndrome. Metabolic syndrome is operationally defined as clustering of high blood pressure, hyperglycemia, high triglycerides, low HDL-cholesterol and abdominal obesity (Dorairaj and Anand, 2004). The association of waist circumference with selected health risks factors may suggest that larger waist measurement as indicator of abdominal obesity may predict the development of CVD and DM.

INTRODUCTION

Obesity is a condition in which there is excess body fat (Gibney, 2005). Abdominal or visceral fat, also known as android obesity, is associated with metabolic abnormalities such as hyperlipidimia or elevated blood lipids, hypertension, and impaired glucose tolerance (WHO, 2000). Abdominal fat is composed of abdominal subcutaneous fat and intra-abdominal fat. Excess intra-abdominal obesity contributes to the development of multiple risk factors through increased flux of free fatty acids in the portal circulation and dysregulation of multiple adipocytokines that contribute to altered energy metabolism and a pro-inflammatory state (Gibson, 2005).

Simple anthropometric measurements are used to assess obesity. The most widely used and the recommended index to define overweight and obesity by World Health Organization is the body mass index (BMI). The BMI correlates with general adiposity but does not account for the wide variation in body fat distribution (Whitney and Rolfes, 2002). Other anthropometric measures used are waist-hip-ratio (WHR) and waist circumference (WC) but several studies indicate WC is a more sensitive indicator of abdominal obesity than WHR (Zhu, et al., 2002; Chan, et al., 2003; Klein, et al., 2007). Waist circumference is considered as the most convenient and reliable clinical measure of abdominal fats for epidemiological studies (Chan, et al., 2003).

The current recommended cut off points by WHO were derived from Caucasians. This raises the question of applicability to other ethnic groups especially after a report by the same organization was published showing that South Asians have high levels of abdominal obesity, morbidity, and mortality are occurring in people with smaller waist circumference (WHO, 2000). It is postulated that populations differ in the level of health risk associated with a particular waist circumference since fat accumulation and distribution varies across race and ethnic groups (WHO, 2000).

In 1998, a new set of cutoff points were developed by WHO for identifying abdominal obesity. However in the Philippines, its applicability has not been fully investigated. We hypothesize that the cutoff points for Filipinos associated with health risks are lower than the internationally accepted cutoff points. The purpose of this study is to determine the association of WC with selected health risk factors of CVD and DM using the WHO and Asia Pacific cutoff points. Additionally, it evaluated the cutoff points in relation to selected health risk factors among adults.

MATERIALS AND METHODS

The data used for this study was part of the bigger study entitled "*The Relationship of Metabolic Syndrome and Lifestyle Factors Among Selected Faculty Members of the University of the Philippines Los Baños*". It was conducted at the University of the Philippines Los Baños (UPLB), Laguna from July 21 to July 25, 2008 with full time faculty members as subjects. The subjects were selected through stratified random sampling, with gender as the stratification variable. Faculty members who were either pregnant or diagnosed with or currently under medication for diabetes and cardiovascular diseases other than hypertension were excluded from the study. Of the 796 full time faculty members, 100 were randomly selected.

The anthropometric, clinical, and biochemical examinations were conducted at the Training Room of the Institute of Human Nutrition and Food of College of Human Ecology (IHNF) of the University of the Philippines Los Baños. It was a seven-day activity where the subjects could come anytime between 6:00 am to 8:00 am. Five stations were set up to facilitate an efficient and orderly collection. These stations were height and weight, waist and hip, blood pressure, and blood extraction. Trained personnel of the University Health Service and IHNF faculty member manned each station.

Anthropometric measurements taken include weight, height, waist and hip circumferences. Body weight was measured using a calibrated beam balance and was recorded to the nearest 0.1 kg. Height was measured barefoot to the nearest 0.1 cm using a microtoise. Waist circumference was obtained using a nonflexible plastic tape with the person wearing lightweight clothing. It was measured among women by positioning the tape measure horizontally halfway between the lower rib margin and the superior anterior iliac crest, and among men at the level of the umbilicus. Measurement was taken at the end of normal expiration of breath.

Clinical assessment included systolic and diastolic blood pressure. Blood pressure was measured on the less used arm, with the subject in a sitting position and after a minimum of five-minute rest, using a standard sphygmomanometer. Two consecutive measures of systolic and diastolic blood pressure were recorded to the nearest 2 mmHg. The second blood pressure record was taken at least one minute after the first one. The average of the two blood pressure readings were taken into account.

Biochemical assessment included fasting blood sugar and complete lipid profile (triglycerides, total cholesterol, HDL-cholesterol and LDL-cholesterol). Extraction and analysis of blood samples were done by a trained and licensed medical technologist after the subjects fasted for 12 hours. Blood samples that were drawn at the site of extraction were kept at proper temperature and were analyzed at the University Health Service in University of the Philippines Los Baños, College, Laguna. Glucose was measured using the glucose oxidase method whereas serum triglyceride, total cholesterol, LDL and HDL cholesterol levels were measured enzymatically.

The table below shows the criteria that were used in the interpretation of the measurements for this study. These criteria were based from the WHO 2004 Expert Consultation and the 1998 National Cholesterol Education Program Expert Report.

Data were processed using SPSS and descriptive statistics such as means and frequency counts were employed to examine demographic characteristics. Spearman's correlation set at α 0.05 was used to determine the relationship of WC with health risk factors.

Table 1. Assessment criteria for health risk factors

Parameters	Classification	Cutoff Points	
Body Mass Index	Chronic Energy Deficient	<18.5	
	Normal	18.5-24.9	
	Overweight	25-29.9	
	Obese	≥30.0	
Waist Circumference	With abdominal obesity:	Asia Pacific Cutoff Points	WHO Cutoff Points
	Male	>90 cm	>102 cm
	Female	>80 cm	> 88 cm
Blood Pressure		Systolic (mmHg)	Diastolic (mmHg)
	Normal	<130	<85
	High Normal	130-139	85-89
	Hypertensive	≥140	≥90
Fasting Blood Sugar	Desirable	<110 mg/dL	
	Borderline	110-125 mg/dL	
	High	>125 mg/dL	
Serum Triglyceride	Desirable	<200mg/dL	
	Borderline	200-300mg/dL	
	High	> 400mg/dL	
Total Cholesterol	Desirable	<200 mg/dL	
	Borderline	200-239 mg/dL	
	High	≥240 mg/dL	
LDL-Cholesterol	Desirable	<130 mg/dL	
	Borderline	130-159 mg/dL	
	High	> 160 mg/dL	
HDL-Cholesterol	Normal	> 60 mg/dL	
	Borderline	40-59 mg/dL	
	Low	<40 mg/dL	

RESULTS AND DISCUSSION

All the selected subjects participated in all of the data collection activities conducted. The mean age of the sample was 46.25 ± 14.9 years old. There was an equal distribution of male and female subjects (Table 2).

Table 2. Profile characteristics of selected UP Los Baños faculty members in 2009

Characteristics	Gender	
	Male (*n* = 50)	Female (*n* = 50)
Age, mean (years)	46.25 ± 14.9	31 ± 12.3
Weight (kg)	67.9 ± 8.8	59.5 ± 11.5
Height (cm)	167.4 ± 5.0	154.1 ± 6.0
Waist circumference (cm)	88.9 ± 8.8	81.5 ± 9.3
Body Mass Index (kg/m2)	24.3 ± 3.3	24.7 ± 4.5

Nutritional Status of the Subjects

Figure 1 shows the percentage distribution of the faculty members according to nutritional status based on BMI. Only 3% of the total faculty members were underweight. Majority (57%) had normal nutritional status, 34% was overweight and 7% was found to be obese. The prevalence of obesity was considerably higher than the five percent prevalence at the national level (FNRI, 2006).

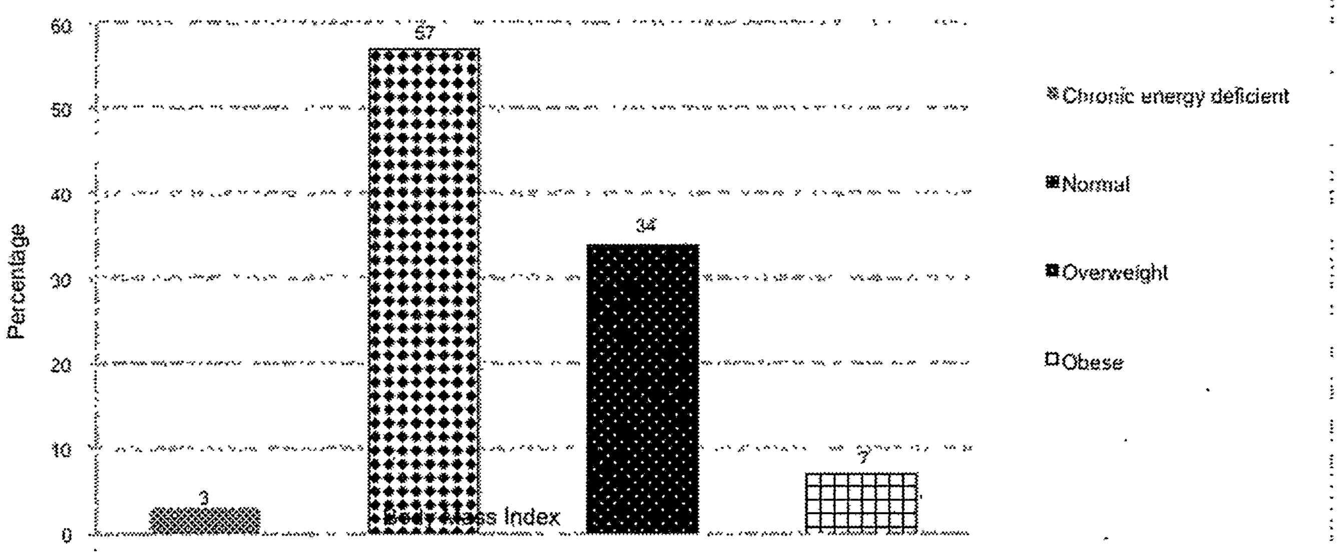

Figure 1. Percentage distribution of faculty members according to nutritional status

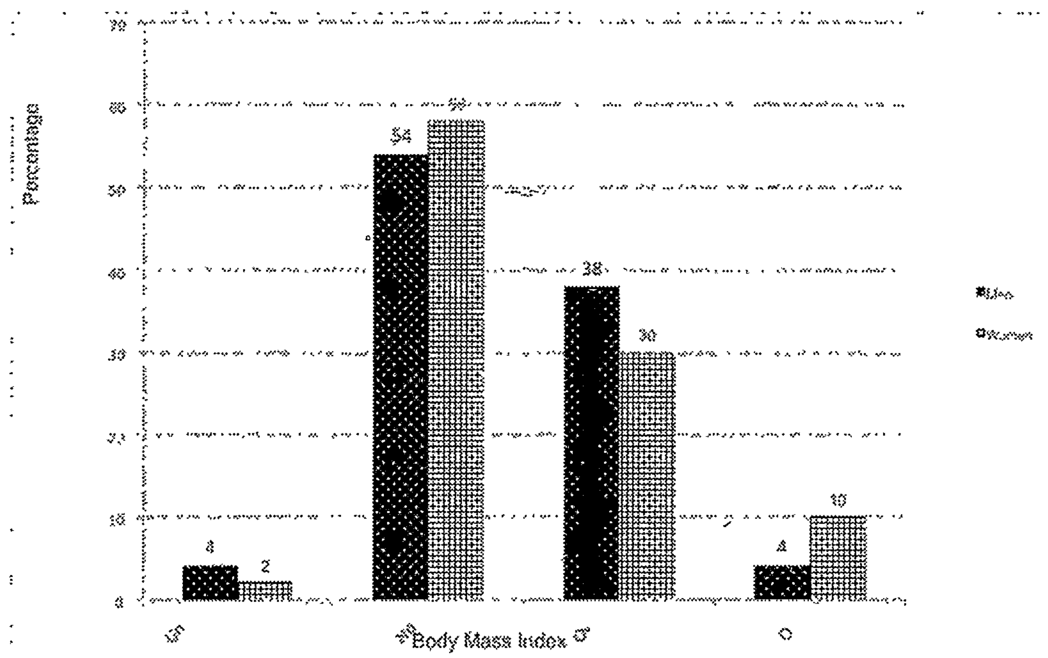

Figure 2. Nutritional status of faculty members according to gender

In Figure 2, it can be noted that majority of the respondents had normal nutritional status. Being overweight was more prevalent among males whereas obesity was more common in females. Meanwhile, only a few (4% and 2%) were found to be underweight among males and females, respectively.

Prevalence of Abdominal Obesity

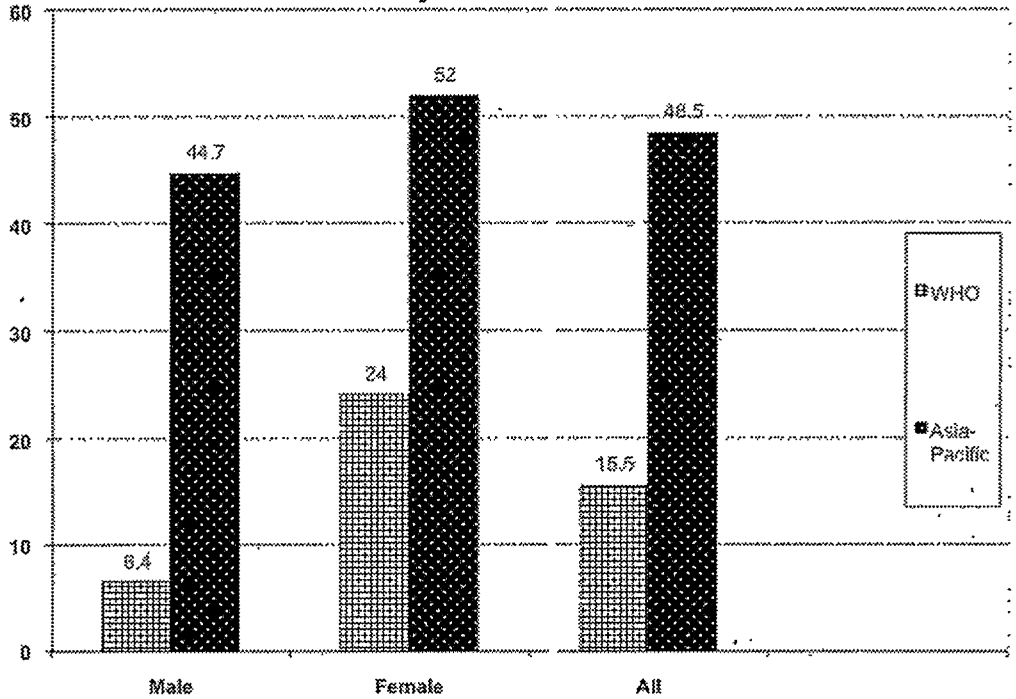

Figure 3. Gender-specific prevalence of abdominal obesity among faculty members

Figure 3 presents the gender-specific prevalence of abdominal obesity. More subjects were classified to have abdominal obesity using the Asia Pacific cutoff points compared to the WHO standards. Majority in of females were classified to have abdominal obesity, with a slightly higher prevalence in female (52%). Less than half of the males (44.7%) were found to have abdominal obesity. For the combined prevalence, 48.5% and 15.5% were classified to have abdominal obesity using the Asia-Pacific cutoffs and WHO cutoffs, respectively.

Prevalence of Selected Health Risks Factors

Table 3 presents the prevalence of selected health risks factors. Majority (64%) of the faculty had desirable level of total cholesterol. About one-third (32%) were at risk to hypercholesterolemia while four per cent of the respondents had high level of total cholesterol (> 240 mg/dL).

For LDL, more than half (57%) of the faculty had LDL-cholesterol within desirable levels. On the other hand, 31% had borderline values (130-159 mg/dL) and the remaining 12% had high levels of LDL-cholesterol (> 160 mg/dL).

One-half (50%) of the faculty members or one out of two adults was observed to have borderline level of HDL-cholesterol whereas more than one-third (38%) of them had low levels of HDL-cholesterol. Only 12% of the faculty had desirable levels of HDL-cholesterol. Also, 90% of the faculty had desirable levels of serum triglyceride. The remaining 10% had high levels of serum triglycerides.

Most (93%) of the faculty members had a desirable fasting blood sugar level. Meanwhile, about 2% of them were observed to be within the borderline values. The remaining 5% had elevated fasting blood sugar levels. Meanwhile, more than half (57%) of the faculty members were in the pre-hypertensive stage while one out of four (25%) was hypertensive. The remaining 18% of the faculty members had normal blood pressure.

Table 3 also shows the gender-specific prevalence of selected health risk factors. Majority (64%) of both male and female faculty members had a desirable level of total cholesterol. Also, there were more males (34%) who were at risk to hypercholesterolemia than females (30%) but essentially; it was prevalent in both sexes. Hypercholesterolemia levels were seen in both sexes, with relatively higher prevalence in females (6%) than in males (2%). This finding was consistent with the result of the national survey that indicated that hypercholesterolemia was more prevalent in females than in males.

Notably, more than half of both sexes (58% for males and 56% for females) had desirable levels of LDL-cholesterol. Also, almost one-third of them were at risk to high levels of LDL-cholesterol, with slightly higher prevalence in females (32%) than in males (30%). Apparently, high levels of LDL-cholesterol were prevalent in both sexes (12% for both male and female).

The table shows that only 12% of both sexes had a desirable level of HDL-cholesterol. The borderline level of high-density lipoprotein was 4% higher among females than in males. Meanwhile, low levels of HDL-cholesterol were prevalent in both sexes and were observed to be relatively higher in male (40%) than in female (36%).

As shown, majority of both sexes had desirable levels of serum triglycerides, 8% higher in females than in males. Also, it was noted that more males (14%) were at risk to high serum triglycerides than females (4%).

Nearly equal percentages (94% and 92%) among males and females, respectively of faculty members for both sexes had desirable level of fasting blood sugar. High level of fasting blood sugar was highest in males (8%) than in females (2%). Only females had borderline levels of fasting blood sugar.

It was observed that majority of the respondents in both sexes were in the pre-hypertensive stage, with relatively higher prevalence (66%) in males than in females (48%). Meanwhile, there were more females (32%) than males (4%) with normal blood pressure. Nonetheless, hypertension was highly prevalent in both sexes, 10% higher among males than females.

Table 3. Prevalence of selected health risk factors among faculty members

Health Risk Factors	Prevalence		
	Male	Female	All
Total cholesterol			
Desirable	64	64	64
Borderline	34	30	34
High	2	6	2
LDL-Cholesterol Level			
Desirable	58	56	57
Borderline	30	32	31
High	12	12	12
HDL Cholesterol Level			
Low	40	36	38
Borderline	48	52	50
Desirable	12	12	12
Serum Triglycerides Level			
Desirable	84	96	90
Borderline	16	4	0
High	0		10
Fasting Blood Sugar Level			
Desirable	92	94	93
Borderline	0	4	2
High	8	2	5
Blood Pressure Level			
Normal	4	32	18
Pre-Hypertensive	66	48	57
Hypertensive	30	20	25

Relationship of Waist Circumference and Selected Health Risk Factors

In the study, waist circumference was found to have significant association with individual risk factors of CVD and DM. These are high levels of triglyceride ($R^2 = 0.196$, $p = 0.027$), FBS ($R^2 = 0.169$, $p = 0.049$), and increased measures of systolic ($R^2 = 0.221$, $p = 0.015$) and diastolic blood pressure $R^2 = 0.220$, $p = 0.015$). However, the significant association was found only in males (Table 4).

Table 4. Association of individual health risk factors with waist circumference

	Male		Female	
	R^2	p-value	R^2	p-value
Low HDL-chol vs. WC	-0.06	0.345	0.030	0.419
High LDL-chol vs. WC	-0.089	0.279	-0.173	0.114
High Triglyceride vs. WC	0.367	0.006*	0.012	0.467
High FBS vs WC	0.333	0.012*	0.107	0.230
High SBP vs. WC	0.292	0.025*	0.052	0.363
High DBP vs WC	0.329	0.013*	0.053	0.357

The results of the study corroborates previous findings that increased adiposity which is indicated by increasing waist circumference is associated with increasing fasting blood sugar, triglyceride, and blood pressure. Yet, this association was only present among males. Earlier studies showed that WC were significant correlates of high blood pressure and high triglycerides (FNRI Digest, 2011). It was also postulated that the incidence of health risk factors in male and female population differ, with males having the greater chance of developing abdominal obesity, elevated triglycerides and high blood pressure (FNRI Digest, 2011; Zuliunas, et al., 2008; Desigamani, et. al., 2011; Yang, et al., 2011).

Furthermore, it was noted that the clustering of at least three factors occurred between WC values 80cm to 90cm (Figure 4). Based on the trend, the cutoff points for Filipinos associated with health risks were relatively closer to the Asia Pacific cutoff points than the WHO criteria for identifying abdominal obesity.

Among males, the clustering of the three factors: LDL-cholesterol, systolic blood pressure, and fasting blood sugar occured at waist circumference of 84 cm (Figure 5a). On the other hand, clustering among women occured at the waist circumference of. 90 cm (Figure 5b).

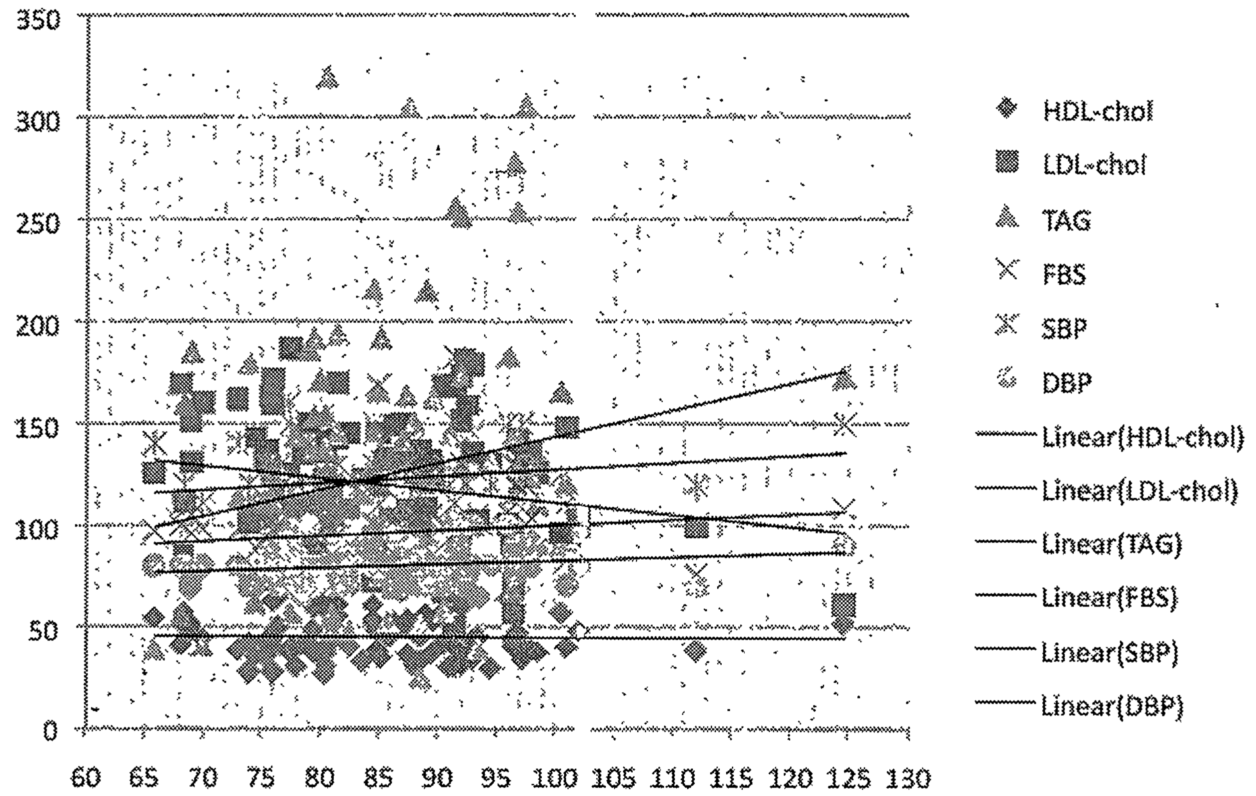

Figure 4. Association of waist circumference with risk factors of CVD and DM in selected faculty members

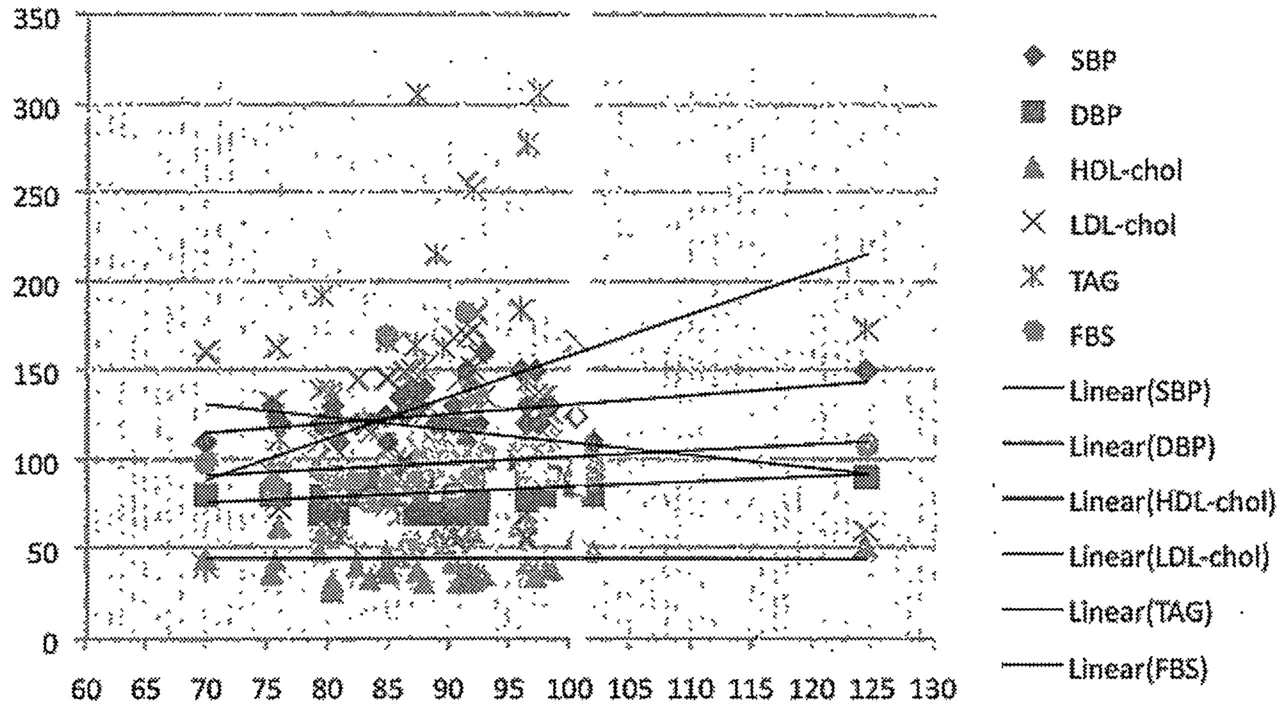

Figure 5a. Association of waist circumference with risk factors of CVD and DM in selected male faculty members

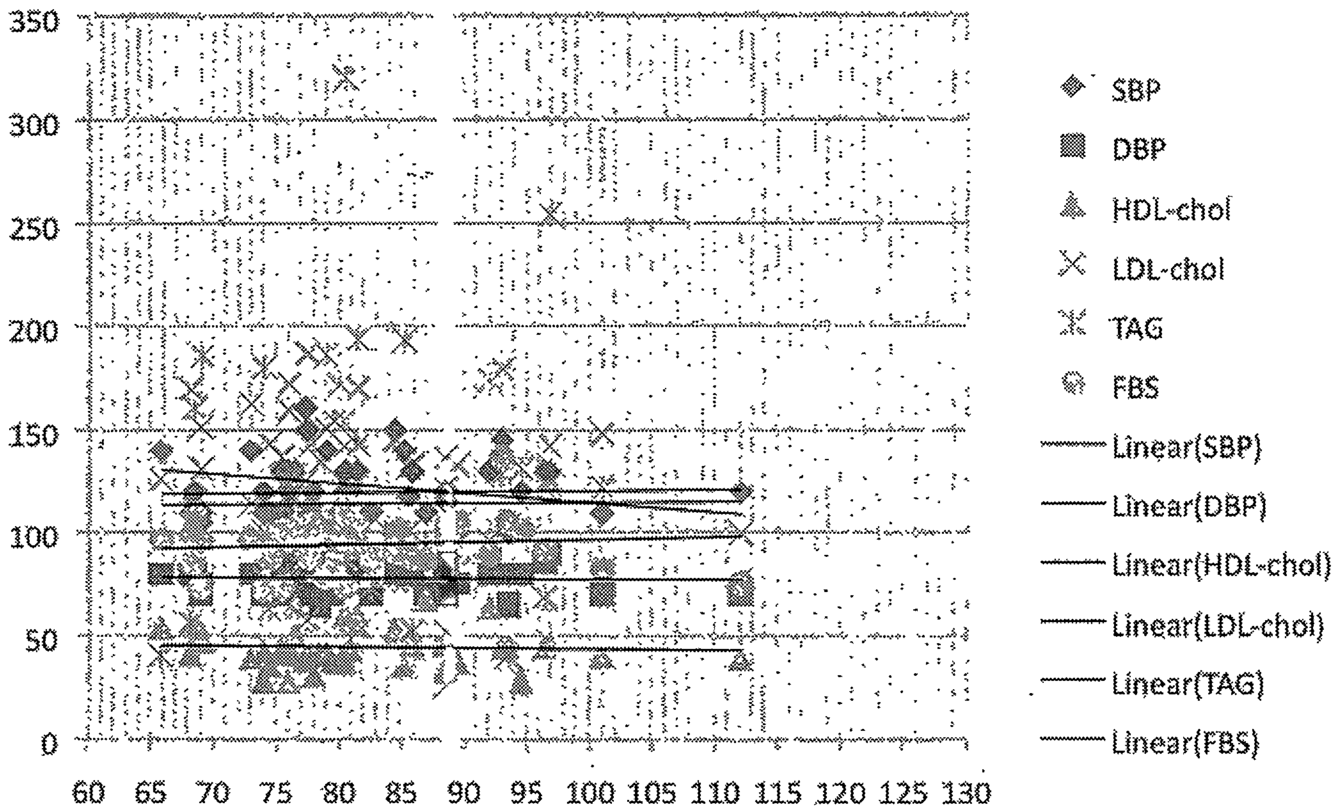

Figure 5b. Association of waist circumference with risk factors of CVD and DM in selected female UPLB faculty

On the other hand, when individual risk factors were evaluated against the WHO and Asia-Pacific cut off points, no as sociation was observed. However, significant association was noted when the risk factors were combined.

Table 5. Association of WC with health risk factors

Health Risk Factors	WHO Criteria		Asia-Pacific Criteria	
	r^2	p-value	r^2	p-value
Cholesterol	-0.066	0.392708	-0.072	0.523368
Diastolic Blood Pressure	-0.139	0.469689	0.161	0.566762
Fasting Blood Sugar	-0.007	0.962977	0.088	0.708917
Systolic Blood Pressure	-0.108	0.475915	-0.176	0.427881
Hypertension	-0.05	0.828341	-0.064	0.850183
LDL-Cholesterol Level	-0.052	0.658643	0.054	0.750103
Triglyceride	-0.228	0.090858	-0.101	0.606228
Cluster/Combination of risk factors	0.223	*0.000001	0.228	*0.000313

**significant association*

The significant association of WC with risk factors suggests that abdominal obesity may play an etiologic role in the clustering of health risk factors which is a clinical feature of the metabolic syndrome. Metabolic syndrome is operationally defined as clustering of high blood pressure, hyperglycemia, high triglycerides, low HDL-cholesterol and abdominal obesity (Dorairaj and Anand, 2004). Essentially, various studies have presented line of evidences that showed a strong association of abdominal obesity with metabolic syndrome. The latter increases the risk of individuals to CVD and DM. Significantly, this finding confirmed the results of several investigations that WC can be used to identify individuals at greater health risk (Meigs, 2002).

The association of waist circumference with selected health risks factors may suggest that larger waist measurement as indicator of abdominal obesity may predict the development of CVD and DM. The pathophysiology indicates that visceral fat pumps out immune system chemicals called cytokines such as tumor necrosis factor and interleukin-6 that can increase the risk of cardiovascular disease by promoting insulin resistance and low-level chronic inflammation. These are thought to have deleterious effects on cells' sensitivity to insulin, blood pressure and blood clotting. Moreover, substances released by visceral fat, including free fatty acids, enter the portal vein and travel to the liver, where they can influence the production of blood lipids such as total cholesterol, HDL-cholesterol and LDL-cholesterol (Gibney, 2005).

The limitations of this study were the sample size and most of the participants had fairly good health status. These may have attenuated the potential associations between WC as surrogate measure of abdominal obesity and health risk factors defined by WHO and the Asia-Pacific cutoffs. Moreover, other factors such as genetics, age and lifestyle may have modified WC and health risk association.

CONCLUSIONS AND RECOMMENDATIONS

Taken collectively, the prevalence of abdominal obesity and health risk factors such as high triglycerides, low LDL-cholesterol, and high blood pressure is high. High triglycerides and high blood pressure were found as significant correlates of waist circumference for males. Using the WHO cutoff points and Asia Pacific cutoff points, significant association was observed with clustering of health risk factors but not with individual risk factors. This finding suggests that WC can be used to identify individuals who are at greater risk for subsequent development of chronic degenerative diseases such as CVD and DM. Therefore, waist circumference may be used as an assessment tool in clinical practice to detect health risk.

Furthermore, clustering of health risk factors was noted at WC value of 84cm and 90cm for male and female, respectively which are relatively closer to the Asia Pacific cutoff points than WHO cutoff points for identifying abdominal obesity.
With this, it is recommended that more studies must be done on a bigger population to further investigate the association of WC with health risk factors as well as the applicability of the international criteria of abdominal obesity to Filipinos. Confounding factors such as sample size, genetics, age, and lifestyle must be taken into consideration.

Essentially, the findings suggest that the nutrition and health condition calls for creation of policies and interventions that focus on health promotion and prevention of obesity and obesity-related diseases. It is necessary that people are aware of their existing nutrition conditions as awareness is considered as a vital component of disease prevention. Campaigns on nutrition and health awareness and nutrition counseling are some strategies that may be taken into consideration. Moreover, promotion of healthy lifestyle such as proper diet and regular exercise are highly relevant for the prevention of obesity-related diseases.

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