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Health Risks Determinants among Freshmen Students of the University of Santo Tomas

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Abstract. The objectives of this study are aimed to determine the anthropometric, WHR and BMI profile of the freshmen students; the relationship between BMI and WC; the relationship between BMI and WHR (Waist Hip Ratio) and to identify the percentage of individuals who have high risk of having health related problems. A total of three hundred ninety seven (397) freshmen students composed of one hundred eighty six (186) males and Two hundred eleven (211) females aged 16-18 years were included to participate in this study using purposive sampling method. The height, weight, waist, and hip circumferences were measured using standard methods. Descriptive anthropometric characteristics and the Body Mass Index (BMI) profile of the students were obtained using calculated means and + standard deviations. The correlation between BMI and WC and BMI and WHR were generated using Pearson correlation coefficient. This study was able to determine the anthropometric characteristics of all three hundred ninety seven (397) freshmen students of the University of Santo Tomas (UST) with mean age of 16.81 ± 0.75 for the male and 16.65 ± 0.6 for the female. The mean height and weight of male subjects were 167.36 6cm and 62.04 12.19kg respectively. For the female, the mean height and weight were 154.2 5.5cm and 51.14 9.93kg respectively. The mean BMI was 21.8 3.9. Using the World Health Organization's cut-off point, 62.5% of the students belong to the normal category. The values of the waist circumference (WC) showed that 95.16% and 86.63% of the male and female subjects respectively were at low risk of health related problems. The mean waist hip ratio (WHR) for male is .54±.37 while for the female, is .54±.34. There was a significantly low correlation between BMI and WHR for male (r= .149 p=.042) and no association for female (r= -.019 p=.784). Partial correlation coefficient indicated a significant positive correlation(r= 0.881 p< 0.0000) between BMI and WC among study population. Results of this study presented a good reference for interventions to be provided to individuals in the upper range of normal weight who are at greater risk for becoming overweight and obese. Post test can be done to keep track of the students' health status. Finally, further studies can include identifying the lifestyle and behavioral patterns of the students during secondary education.

Keywords: Body Mass Index, Waist Circumference, Waist Hip ratio, anthropometry

1. Introduction

Anthropometry, like any other area of science, depends upon adherence to the particular rules of measurement as determined by national and international standard bodies. It is the measurement of body size, weight and proportions and can be defined as a technique in measuring a human body where anthropometric measurements are derived from anatomical landmarks. The measurements taken give a good description of the body as whole. It includes height and weight where the Body Mass Index (BMI) is determined, Waist-Hip Ratio (WHR) and Waist Circumference (WC). The measurements obtained from these are routinely taken for a variety of purposes such as monitoring athletes, tracking growth, development, aging and motor performance, and linking physical activity and nutrition interventions to changes in body size, shape and composition.1 Anthropometry is the study of the measurement of the human body in terms of the dimensions of bone, muscle and adipose (fat) tissue.1 Measurements which are known to be predictive of health status in the general population are also included. Some medical conditions occur more frequently in the college-age population people have been recognized as experiencing higher rates of morbidity,

disability and mortality from various developmental, environmental and behavioral risk factors than the general population.2

BMI is the most commonly used indicator of obesity in population studies, although it is not a perfect one. It does not take into account body fat patterning as waist size, WHR and skin-fold measurements do.3 Furthermore, weight is usually positively related to increased morbidity and mortality whereas height is often associated with good health. Therefore, among obese subjects, the BMI can reflect the negative effects of both fatness and shortness. The risks of fatness and shortness are most likely mediated via different mechanisms. However, BMI also has several advantages compared with other methods of measuring obesity. BMI measurement is simple, inexpensive and reliable. It is widely used and the results of different studies are therefore easily compared.

During the 19th century, many health researchers and wellness professionals used the BMI index to predict health status in adults. At the population level, getting the BMI is a simple measurement of body weight in relation to height. Yet, the study of Janssen I et al. (2002) showed that a combination of BMI and Waist circumference (WC) can better predict metabolic risk than WC alone.4 Numerous studies by Kanaya AM et al. (2003), Pradhan AD et al. (2002), Kannel WB et al. (2002), show that Anthropometric indices including BMI, WC, WHR and Waist Height Ratio are associated with Coronary Heart Disease (CHD) risk factors or adverse events,5,6,7 the use of the waist circumference has been proposed as an index of intra-abdominal fatness and overall body fatness. At least in middle-aged populations a large waist circumference identified subjects at increased cardiovascular risk and with a high prevalence of other health outcomes.8

In developing countries such as the Philippines, undernutrition is a major concern. But as Filipinos adapt to the Western lifestyle of fast food diet, a considerable percentage in our population is subject to being overweight and consequently obese. An excerpt from an article written in Asian Bariatics (2005)9, showed that 34% of the total admitted patients are malnourished and yet surprisingly, about one-fourth of them are obese based on the data gathered from the NUTRISTAT Protocol at St. Luke's Medical Center (1999 - 2000). There was more overweight than undernourished patients.

The health of students studying in tertiary education institutions (e.g college or university) is a matter of increasing concern.10,11 In the same way, the transition to college has been identified as a critical period for weight gain12. However, only a limited number of studies have examined this phenomenon. One of the reasons why first year students were selected as the target population in this study is because they provide a unique opportunity to examine factors associated with weight gain which might be relevant to understanding weight gain in the general population. Obesity, in combination with other lifestyle factors such as smoking and inactivity, which are behaviors that have been noted among female students10, could increase the risk of the development of chronic diseases of lifestyle (CDL).2 Early intervention to ensure proper weight management practices is therefore essential to prevent weight gain and obesity and to reduce other lifestyle-associated risk factors for CDL development. However, for effective intervention planning it is important to obtain a clear picture of the association between weight status, health and lifestyle indicators and weight management practices.2

It is because of these limited findings that an investigation was conducted to identify the health risk determinants among the freshmen students, them being the subject of probable weight gain.

Therefore, the objectives of this study are to determine the anthropometric and BMI profiles of the freshmen students of the University of Santo Tomas (UST); to determine the relationships between BMI, WC and WHR and to identify the percentage of individuals who have high risk of having health related problems.

2. Methodology

2.1. Research Design

Descriptive – correlational study design. This exploratory research utilized the descriptive-correlational study design with the objective of determining the anthropometric characteristics and the BMI profile of the freshmen students of the UST. The height (cm), weight (kg), waist and hip circumferences (cm) were measured using standard methods.

2.2. Subjects

Ten Thousand Three Hundred Nineteen (10,319) freshmen students officially enrolled in the UST were used as reference sample in this study and from these, purposive sampling was done. To be included in the

study, subjects had to meet the following criteria: 16-18 years of age and registered in a service physical education class with a class size of 50 students per section. Of the 10,319 first year students, only three hundred ninety seven (397) freshmen students consisted of one hundred eighty six (186) males and two hundred eleven (211) females met the inclusion criteria and comprised to participate in this study.

2.3. Testing procedures

Pre-test: Approvals were sought from the ethical committee of the College of Rehabilitation Sciences (CRS) of the UST and approval to request students' participation in this study was obtained from the Head of the Institute of Physical Education and Athletics (IPEA).

Students were assured that all information gathered would be held confidential and written informed consent was obtained prior to their participation. Upon approval, an orientation regarding the objectives and procedures of the study was conducted. Test preparations including schedules and venues for testing, calibration of testing equipment and printing of data sheets were done.

An intra reliability test among assessors before the conduct of the test proper was executed to ensure that there is validity, accuracy and reliability in measurements.

Test proper: Anthropometric measurements were taken using standard apparatus. A Detecto weighing Scale was used to measure BW and Standing Height (SH) of the subjects having the accuracy to the nearest 1kg and nearest 0.5 cm respectively. Subjects were weighed without shoes and in light clothing. SH was measured without shoes using the Stretch Stature Method that would require the subject to stand with feet together and the heels, buttocks and upper part of the back touching the scale. The circumferences in waist and hip were obtained using a retractable measuring tape to the nearest 0.1 cm while maintaining close contact with skin and without compressing the underlying tissues. Waist was measured horizontally between the lower costal rib and the upper border of the iliac crest. Subjects were in standing position and the measurement was made at the normal minimal respiration. Hip was measured at the maximum circumference of the buttocks. BMI was then calculated as BW in kilograms (kg) divided by square of the SH in meter (m2). Microsoft Excel was used to encode the data and calculations of BMI and WHR.

3. Data Analysis

Data was analyzed using SPSS version 14 program for data compilation and statistical analysis. Standard methods were used to compute the means, standard deviations and Pearson correlation coefficients. The numbers and percentages for BMI, WC and WHR categorization and anthropometric characteristics were determined.

BMI was calculated as BW in kilograms (kg) divided by square of the SH in meter (m2). BMI may not correspond to the same degree of fatness in different populations due, in part, to different body proportions. The health risks associated with increasing BMI are continuous and the interpretation of BMI gradings in relation to risk may differ for different populations.[13] Using the World Health Organization (WHO) guideline; underweight is <18.50, normal weight ranges from 18.50 up to 24.99, overweight is ≥25, and obese is ≥30. [14] An additional guideline used was the WHO Asia-Pacific guideline for Asian adults: underweight (BMI <18.5), normal weight (BMI = 18.5--22.9), overweight (BMI = 23.0--24.9), and obese (BMI >25.0).[15] A high value indicates excessive body fat and consistently relates to increased health risk and mortality.2

Waist to Hip Ratio was calculated by dividing the waist circumference by the hip circumference. The recommended WHR is <1.0 for male and <0.8 for female. Value greater than the recommended cut-off point is correlated with cardiovascular risk factors and increased mortality.[16]

Cut-offs for Waist circumference by Lean and adopted from the World Health Organization (WHO) were used. Low risk (≤ 79cm in women, ≤ 93cm in men), increased risk (80-87cm in women, 94-101cm in men), and substantially increased risk (≥ 88cm in women, > 102cm in men).[17,18]

4. Results

A total of three hundred ninety seven (397) freshmen students of the University of Santo Tomas (UST) with mean age of 16.81 ± 0.75 for the male and 16.65 ± 0.6 for the female. Table 1 presents the anthropometric characteristics of the study population. Table 2 shows the means and standard deviations of BMI, WC and WHR according to categories. Table 3 bares the correlation between BMI and WC values among the male and female subjects and Table 4 reveals the correlation between BMI and WHR of male and female subjects. Figure 1 displays the summary distribution of BMI using WHO and Asia Pacific

classifications and figures 2 and 3 show the summary distribution of WC and WHR categories among the study population.

Table1: Anthropometric Characteristics of UST Freshmen Students

	Male	Female
Anthropometry	Mean ± SD	Mean ± SD
Height (cm)	167.36 ± 6.0	154.2 ± 5.5
Weight (kg)	62.04 ± 12.19	51.14 ± 9.93
Age	16.81 ± 0.75	16.65 ± 0.6

Table 2: Mean ± SD and Distribution According to Categories of BMI, WC, and WHR (N=397)

Measurement	**Mean ± SD**	**Gender**	**Classification**	**Cut off Point**	**Interpretation**	**Number**	**Percentage**
Body Mass Index	21.8 ±3.9		WHO	<18.5	Underweight	85	21.40%
				18.5-24.9	Normal	248	62.50%
				25.0-29.9	Overweight	48	12.10%
				≥30.0	Obese	16	4%
						n=397	**100%**
			ASIA PACIFIC	<18.5	Underweight	84	21.20%
				18.5-22.9	Normal	177	44.60%
				23.0-24.9	Overweight	68	17.10%
				≥25.0	Obese	68	17.10%
						n=397	**100%**
Waist Circumference	73.9±10.5	Male		<93cm.	Low Risk	177	95.16%
				94-101cm.	Increased Risk	7	3.76%
				>102cm.	Substantially Increased Risk	2	1.08%
						n=186	**100%**
	69.51±9.10	Female		<80cm.	Low Risk	187	88.63%
				80-87.9cm.	Increased Risk	14	6.64%
				<88cm.	Substantially Increased Risk	10	4.74%
						n=211	**100%**
Waist Hip Ratio	.54±.37	Male		<1.0	Normal	184	99%
				>1.0	At risk	2	1%
						N=186	**100%**
	.54±.34	Female		<0.8	Normal	139	66%
				>.8	At risk	72	34%
						N=211	**100%**

Table3: Correlation of BMI and WC of male and female subjects

		BMI	**Waist**
BMI	Pearson Correlation	1	.881(**)
	Sig. (2-tailed)		.000
	N	397	397
Waist	Pearson Correlation	.881(**)	1
	Sig. (2-tailed)	.000	
	N	397	397

Table 3b: Correlation of BMI and WC of female subjects

		BMIf	**Wf**
BMIf	Pearson Correlation	1	.847(**)
	Sig. (2-tailed)		.000
	N	211	211
Wf	Pearson Correlation	.847(**)	1
	Sig. (2-tailed)	.000	
	N	211	211

Table 4: Correlation of BMI and WHR of male subjects

		BMIm	**WHRm**
BMIm	Pearson Correlation	1	.149(*)
	Sig. (2-tailed)		.042
	N	186	186
WHRm	Pearson Correlation	.149(*)	1
	Sig. (2-tailed)	.042	
	N	186	186

Table 4a: Correlation of BMI and WHR of female subjects

		BMIf	**WHRf**
BMIf	Pearson Correlation	1	-.019(*)
	Sig. (2-tailed)		.784
	N	211	211
WHRf	Pearson Correlation	-.019(*)	1
	Sig. (2-tailed)	.784	
	N	211	211

** *Correlation is significant at the 0.01 level (2-tailed).*

* *Correlation is significant at the 0.05 level (2-tailed).*

**There is no significant association between BMI and WHR in females since the computed p value of 0.784 is greater than 0.05.*

5. Discussion

To our knowledge, this study has provided a comprehensive profiling of health risk determinants such as

the BMI, WC and WHR among collegiate students to date. The descriptive anthropometric characteristics of the freshmen students are shown in Table 1.

The means and standard deviations of BMI, WC and WHR according to categories shown in Table 2 indicated that a measurement of BMI of the subject population was normal among male (BMI of 18.5-24.9) and female (BMI of 18.5-22.9) based on WHO and Asia Pacific cut-off points respectively. On the other hand, WC measurements of the subject population revealed that male and female were at low risk (<102cm in male and <88cm in female). The percentage of normal BMI value of 62.50% and low risk WC values of 95.16% among male and 88.63% among female posed a relatively good health status among the freshmen students.

A study on Caucasians, confirm the importance of the WC as a surrogate marker of the distribution adiposity in the abdominal region. That proposes WC as the most convenient and reliable clinical measure of abdominal fat compartments. These findings were applicable to women, young age groups, and other racial groups independent to body size.[19] Several studies such that of Welborn TA et al (2003), Larsson B et al (1984) and Lapidus L et al (1984) suggest that WHR may be a more appropriate and universal indicator of CVD risk for ethnically diverse populations, due to its less dependence on body size and height compared to waist circumference.[20,21,22]

When BMI has been correlated with WC as shown in Table 3, it showed a positive correlation for both male ($r=.921$, $p<.001$) and female ($r=.847$, $p<.001$). WHR revealed a normal percentage for both male and female which resulted to 99% and 66% respectively. In terms of WHR categorization as shown in Table 4, only 1% of the male subjects were considered at risk while 34% were at risk in female. However, when BMI is correlated with WHR results, it showed significantly low correlation in male ($r=.149$, $p=0.042$) while there was no association in female ($r= -.019$, $p=0.784$).

The fact that elevated WC values add to the risk of disease predicted by BMI alone is recognized within the classification system proposed by the National Institutes of Health to identify the relative health risk associated with overweight and obesity. Men and women with high WC values are considered to be at a greater relative health risk than are those with low WC values.[23]

Independent of gender, an increase in the WC category was associated with corresponding significant increases in total fat and in the different fat depots within each of the 3 BMI categories. The present study shows that health risk predicted by WC is related to its ability to act as a surrogate for abdominal fat. It has been observed that within each BMI category, those in the high WC category had substantially greater quantities of abdominal fat by comparison to those in the low WC category. Similar study by Janssen I. et al. (2002) showed that combination of BMI and WC can better predict metabolic risk than does either variable alone. Thus, the health risks associated with abdominal obesity are best identified by the combination of BMI and WC, not WC alone.[4]

This study did not inquire factors that are directly or indirectly related to health, such as physical activity levels, detailed dietary history of the subjects of any type that can be related to all measures of obesity, viz., BMI, waist and WHR and these are the limitations of the study.

6. Conclusion

The anthropometric and BMI profiles of the freshmen students were established and based on specific norms and categorizations, the subjects of this study encompass a generous proportion of large number that falls on the normal category. In this study the association of BMI, waist, and hip circumferences were examined. Findings revealed that BMI and WC measurements have a positive correlation, and through acquiring these assessments, individuals who are at risk of health- related problems can be identified while BMI and WHR revealed a significantly low correlation among male subjects and no association among female subjects.

The findings of this study can be a springboard to another research by identifying the students' behavior or physical activity patterns during their senior year in high school or the summer vacation prior to entering tertiary level. The existing findings can be used in a continuous study by conducting a follow up measurement at the end of the semester. The reasons for the changes in the figures maybe further explored. It may be particularly and equally important also to target interventions to individuals in the upper range of normal weight who may already be at greater risk for becoming overweight in the first semester of college.

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