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Relationship of Body Mass Index with Fat Percentage and Waist Hip Ratio of University Boys

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Abstract:

Purpose: *-The purpose of the study was to find out relationship of body mass index with fat percentage and waist hip ratio of university boys.* ***Methodology: -*** *The subjects for this study were selected from G.G.V, Bilaspur, Chhattisgarh. A total of 100 university boys were selected. Age of the subjects ranged between 20 to 25 years. Selected Variables were body mass index (BMI), fat percentage (Fat %) and waist hip ratio (WHR). BMI was calculated from body weight and body height (kg/m²), Fat Percentage was measured by OMRON body fat analyzer and WHR was calculated as WC divided by HC. To find out relationship of body mass index with fat percentage and waist hip ratio, descriptive statistics and the Pearson's Product Moment Correlation was used.* ***Findings: -*** *There exists a significant relationship of BMI with Fat % (r = .903, p > .05) and WHR (r = .611, p > .05).*

Key words: Body Mass Index, Fat Percentage, Waist Hip Ratio and Adolescent.

Introduction

BMI is a ratio of a person's weight to height. BMI is commonly used to classify weight as "healthy" or "unhealthy." The negative effects of obesity on health are beyond dispute. Excessive body fat represents a strong risk factor for several diseases; the most important of which ones are type 2 diabetes, hypertension, cardiovascular diseases and osteoarthritis **(Pi-Sunyer, 1991 and World Health Organization, 2000)**. Most of these deleterious effects are more likely if the excess body fat is mainly stored in the upper body, with abdominal visceral fat being the most critical when evaluating the health risks of obesity **(Pi-Sunyer 1991, Björntorp 1993, World Health Organization 2000)**. Moreover, it has been reported that obesity is associated with disability and poor perceived health **(Wolk and Rössner 1996, Manderbacka 1998, Doll 2000, Ford 2001).** Obesity is also an escalating health problem **(World Health Organization 2000).** While BMI is far more commonly used to define obesity and closely related to the degree of body fat in most settings, its limitations can result in the wrong classification of certain individuals with increased muscle mass **(Uwaifo and Arioglu, 2004).** In this regards, WHO highlighted the needs for other indicators to complement the measurement of BMI, to identify individuals at increased risk of obesity-related morbidity due to accumulation of abdominal fat.

WHR is the ratio of the circumference of the waist to that of the hips. It is calculated by measuring the smallest circumference of the natural waist usually just above the belly button and divided by the hip circumference at its widest part of buttock or hips. The ratio can be measured more precisely than skin folds and it provides an index of both subcutaneous and intra-abdominal adipose tissue. Hence, waist circumference may be a better indicator of health risk especially when used in combination with BMI. Waist circumference is particularly

useful for individuals with a BMI of 25-34 kg/m2 **(Jacob et al., 2001).** For example, according to Uwaifo and Arioglu (2004), an athlete with increased muscle mass may have a BMI greater than 25 - making him or her overweight on the BMI scale - but a Waist Circumference measurement would most likely indicate that he or she is, in fact, not overweight. Waist-to-hip-ratio (WHR) is used as an indicator of abdominal obesity in population studies. It is increasingly clear that WHR is a better reflection of intra-abdominal/ visceral fat accumulation because of the postulated role of visceral fat depot in health risk disease **(Jacob et al., 2001).**

Hence this study aims at determining the relationship of BMI with fat% and WHR of adult male students of GGU, Bilaspur, so as to suggest possible remedies that can minimize health related problems associated with obesity, overweight and even underweight.

Objective of the study

- To find out the status of obesity according to BMI classification of subjects.
- To find out the relationship of BMI with WHR and Fat Percentage of university boys.

Methodology

Selection of Subjects:

A total of 100 university boys were randomly selected from different departments of Guru Ghasidas Vishwavidyalaya, Bilaspur. Age of the subjects was ranging between 20 to 25 years.

Selection of Variables

Keeping the feasibility criterion in mind, the researcher selected the following variables for the present study:

- Body Mass Index (BMI)

- Waist Hip Ratio (WHR)
- Fat Percentage (Fat %)

Criterion Measures

- BMI was calculated from body weight and body height (kg/m^2), and body fatness of participants was classified according to WHO standards.

Table 1: BMI Classification of under and overweight in adults according to WHO standards

Classification	BMI (kg/m2)	Population description
Underweight	**<18.5**	**Lean & Thin**
Normal range	**18.5-24.9**	**Normal, healthy, acceptable weight**
Overweight	**25-29.9**	**Overweight**
Obese	**>30**	**Obesity**

- Waist Circumference (WC) and Hip Circumference (HC) were measured with an anthropometric tape (Lufkin Executive Thinline) with minimal clothing, at the minimum circumference between the iliac crest and the rib cage, and at the maximum protuberance of the buttocks. Then WHR was calculated as WC divided by HC.
- Fat Percentage was measured by OMRON body fat analyzer.

Statistical Analysis

For determining the relationships of BMI with WHR and Fat %, descriptive statistics and the Pearson's Product Moment Correlation was used, the data analyzed with the help of SPSS (16.0 version) software and the level of significance was set at 0.05 level of confidence.

Result and Findings of the Study

Table 2: Descriptive statistics of BMI, WHR and Fat Percentage of university boys

Variables	Mean	Std. Deviation	N
BMI	21.061	2.717	100
WHR	.861	.062	100
Fat %	20.181	5.661	100

Table-2 indicates the descriptive statistics i.e Mean and SD of selected variables. The Mean and SD of selected variables are i.e. BMI (21.0621±2.717), WHR (.861±.061) and Fat % (20.181±5.661).

Table 3: Fatness of University boys, classified according to BMI values

BMI Classification	Subject %
Underweight	16
Normal range	73
Overweight	07
Obese	04

The above table indicated that most of the participants (73%) had normal body fat content. 16% participants fall in underweight category, 07% participants comes in overweight category and 04% subjects comes in obese category.

Fig. 1 Graphical representation of classification of subjects according to their fatness

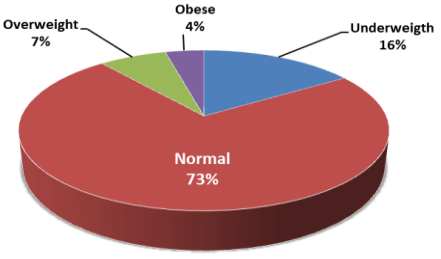


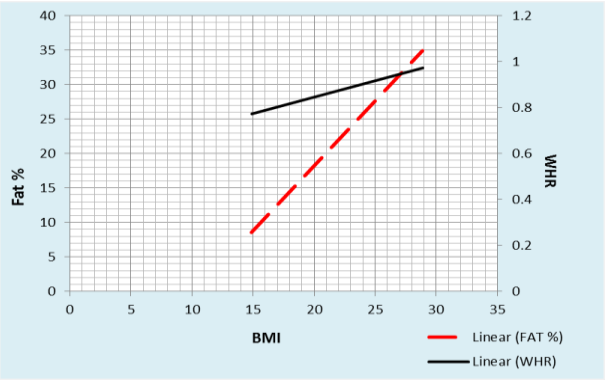
Table 4: Correlation Coefficient (r) of BMI with Fat percentage and WHR of adult male students

Variables	Correlation coefficient (r)	Sig.
Fat %	.903*	.000
WHR	.611*	.000

*P <0.05, Statistically Significant.

Table 4 clearly indicates that there exists a significant relationship of BMI with Fat percentage and WHR as the p-values were less than 0.05.

Fig. 2: Graphical representation of relationship of BMI with Fat percentage and WHR of adult male students



Discussion of the Findings

The body mass index (BMI) has been the most commonly applied clinical measure to characterize body composition in individuals. However, the BMI has been criticised as being an inaccurate measure of body fatness (Suchanek et.al, 2012). This measure was introduced in the 19th century by Quetelet (Eknoyan 2008), who recognised that it is necessary to correct for differences in body size when comparing adiposity among individual patients. Because growth is linear, weight cannot be increased as the cube of height, but as the square, and the human represents a cylinder more than a sphere. The Quetelet

index was renamed the BMI by Ancel Keys and is the ratio of weight to height squared (Keys *et al.* 1972).

BMI the relative composition of fat mass vs. lean body mass depends on age, sex, physical activity etc., the BMI has been criticised as being an inaccurate measure of body fitness and therefore inadequate for the assessment of percentage body fat (PBF)(Rahman *et al.* 2010; Garrido-Chamorro *et al.* 2009). In addition, taking into account the child growth standards (McCarthy *et al.* 2006), the BMI is not a good method to classify children according to their fat content; the most prevalent approach for children is to use BMI normalised by age, however, this method involves complex mathematical calculations. Moreover Body Mass Index is the screening tool to identify the category of an individual in which he falls. This identification never specifies the percentage of fat present in a human body. Whereas Omron Body Fat analyzer specifically determines the amount of fat percentage, present in an individual. Also waist-hip-ratio is an anthropometric measurement which specifically determines the central adiposity. Both factors directly lead a person to be overweight or obese. Waist hip ratio & body fat percentage are obesity indicators which finds out the BMI category of an individual, because BMI is only an overall diagnosing or filtering method. Our study confirmed the significant relationship between BMI and Fat% which was demonstrated in most of the former studies. Rush et al. who studied European, Maori, Pacific Islanders and Asian Indian adults also confirmed the significant relationship in BMI and Fat% in all these races. An early study by P. Deurenberg done in Caucasians, this interaction was significant; whereas Jackson et al. who compared Caucasians with Blacks reported the same and Ranasinghe et. al. done a study on Sri Lankan adults, this interaction was significant relationship between BMI and Fat %. In other hand our study shows there is a statistically significant correlation between BMI and WHR as shown by

correlation coefficients and linear graphical analysis. The finding is in agreement with the results of Farida Munawar et. al., Gandhi R. et.al. They also stated that a significant relationship existed between BMI and WHR.

Conclusions

Within the limitation of the present study and on the basis of findings the following conclusions have been drawn –

- Findings of the study shows that the maximum numbers of adult male students (73%) were fall in normal category of BMI table according to WHO norms.
- Significant relationship was observed between BMI and Fat % ($r = 0.903$, $p < 0.05$).
- Significant relationship was observed between BMI and WHR ($r = 0.611$, $p < 0.05$).

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