

## Relationship Between Anthropometric Measurements and Body Composition Among Santal Girls Aged Between 6-18 Years of Galudih, Jharkhand, India

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**ABSTRACT** A cross sectional study of 116 Santal girls was undertaken to compare the relationship of biceps and triceps skinfolds, waist, hip and mid upper arm circumferences, waist-hip ratio and conicity index with three body composition variables; percentage of body fat, fat mass and fat free mass of the anthropometric characteristics. Waist circumference displayed the strongest correlations ( $p < 0.001$ ) with present body fat ( $r = 0.85$ ) and fat mass ( $r = 0.86$ ). Waist-hip ratio did not significant correlation with any measure of body composition. The correlation of conicity index with body composition measures was intermediate between those of waist circumference and waist-hip ratio. Results also revealed that the greatest amount of variation of percentage of body fat (73.1%) and fat mass (75.5%) was explained by waist circumference. In conclusion the present study showed that waist circumference is much more strongly associated with body fat than other anthropometric measures including waist-hip ratio and conicity index. Thus the use of waist circumference instead of waist-hip ratio or conicity index could be advantageous in epidemiological and clinical studies which deals with the relationship of central adiposity with percentage of body fat and fat mass.

### INTRODUCTION

Typically the composition of human body is assessed to determine percentage of body fat (PBF). Fat mass (FM) and lean body mass or fat free mass (FFM). However, it is now clear that in addition to the amount of fat in the body, its topography particularly the abdominal fat deposition is considered to be the most atherogenic, diabetogenic and hypertensiogenic fat deposition of the human body (Bouchard et al., 1996; Kopelman, 2000). The three most commonly used measures of abdominal or central adiposity are waist circumference (WC), waist-hip ratio (WHR), and conicity index (CI). They have been utilized in recent investigations (Lean et al., 1998; Bose et al., 2003; Chatterjee et al., 2005; Ghosh et al., 2006) to study abdominal or central adiposity. Recent studies (Lean et al. 1996; Mueller et al. 1996; Bose et al., 2003) have also reported that central as well as subcutaneous adiposity is associated with body composition measures like PBF and FM.

The present investigation was therefore undertaken to investigate the relationship of various anthropometric measures with three body composition variables (PBF, FM, and FFM). This

is the first attempt to do the work among any tribal population specially in eastern India.

### MATERIALS AND METHODS

**Study Sample:** The present cross-sectional study was undertaken during the first quarter of 2003 among 116 Santal girls of two Santal villages namely "Deoli" and "Galudih" in the Galudih area of East Singhbhum, Jharkhand, India. Galudih is 20 km away from nearest big town Ghatsila in the district of East Singhbhum, Jharkhand. Jharkhand is in the central eastern part of India and is bounded by Bihar to the north, West Bengal to the east, Orissa to the South and Chattisgarh to the West. It lies between 86 degree- 88 degree E and latitude 22 degree – 26 degree N longitude. Jharkhand is an area of 79,714 sq. Km. The State Jharkhand was carved from the state of Bihar and became the twenty-eight state of India in 2000. The data comprise 153 boys and 135 girls aged 6 to 18 years. The age was determined from the school register, birth certificates and was then crosschecked by the local events and festival calendar.

**Anthropometric Measurements:** All anthropometric measurements were done by one of us (DC) using standard technique (Cameron, 1984). Height and weight was measured to the nearest 0.1cm and 0.2kg respectively. Circumference measures namely waist and hip were made using

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an inelastic tape to the nearest 0.1 cm. Body mass index was then computed using standard equation. Skin fold measurements were taken and fat mass, fat free mass, fat mass index, etc also calculated following the standard equations (Corbin, 2000).

## RESULTS

The mean age of the women was 10.06 years (sd = 3.78 years). The means and standard deviation (SD) of the anthropometric and body composition characteristics of the subjects are presented in Table 1. Mean BMI, PBF and FM of the subjects were 14.42 kg/ mt<sup>2</sup>, 13.55% and 4.13kg, respectively.

Linear regression analysis were undertaken with each anthropometric measure separately to determine the amount of variation (R<sup>2</sup>) of PBF and FFM explained by these measures. Results revealed that the greatest amount of variation of PBF (4.04%) and FM (5.58%) was explained by WC. While HC explained (9.06%) and (9.64%) of variation of PBF and FM. WHR explained only (3.14%) and (0.18%) of variation of PBF and FM respectively.

## DISCUSSION

The present study demonstrated that of all anthropometric measurements studied, WC and HC were most strong correlated with body fat. In

**Table 1: Anthropometric and body composition characteristics of the subjects**

| Variables        | Mean   | SD    |
|------------------|--------|-------|
| Age              | 10.06  | 3.78  |
| Anthropometric   |        |       |
| Height           | 127.07 | 17.96 |
| Weight           | 24.33  |       |
| BMI              | 14.40  | 2.53  |
| Circumferences   |        |       |
| WC               | 55.50  | 6.88  |
| HC               | 61.80  | 10.82 |
| MUAC             | 16.68  | 3.27  |
| Skinfolds        |        |       |
| TSF              | 5.55   | 1.52  |
| BSF              | 3.94   | 1.45  |
| Fat distribution |        |       |
| PBF              | 13.55  | 3.06  |
| FM               | 4.13   | 6.45  |
| FFM              | 20.63  | 8.97  |
| WHR              | 0.96   | 0.66  |
| CI               | 1.19   | 0.08  |

**Table 2: Pearson correlation coefficients of variables with fat distributions**

| Variables | PBF (R <sup>2</sup> ) | FM (R <sup>2</sup> ) | FFM (R <sup>2</sup> ) |
|-----------|-----------------------|----------------------|-----------------------|
| WC        | 0.2014<br>(0.0405)    | 0.2364<br>(0.0558)   | 0.7540<br>(0.5685)    |
| HC        | 0.3010<br>(0.0906)    | 0.3105<br>(0.0964)   | 0.7346<br>(0.5396)    |
| MUAC      | 0.3445<br>(0.1186)    | 0.3541<br>(0.1253)   | 0.7746<br>(0.6001)    |
| TSF       | 0.4686<br>(0.2195)    | 0.2138<br>(0.0457)   | 0.0433<br>(0.0018)    |
| BSF       | 0.0913<br>(0.0083)    | 0.1007<br>(0.0101)   | -0.1546<br>(0.0239)   |
| WHR       | 0.1774<br>(0.0314)    | 0.0425<br>(0.0018)   | 0.1183<br>(0.0139)    |
| CI        | -0.0530<br>(0.0028)   | -0.2528<br>(0.0639)  | -0.3742<br>(0.1400)   |

contrast, WHR did not have significant association with any body composition variables. The correlation of CI with body composition measures was intermediate between those of WC and WHR.

These results indicate that among Santal girls fat accumulation is primarily in the waist region. The mediating influence of hip circumference (Incise of WHR) and height and weight (in case of CI) is absent while considering WC as a measure of central adiposity. Both WHR and CI are indices which are dependent upon other variables, while WC is a simple measurement independent of confounding anthropometric measures. Thus the relationship of WC with both fat (PBF and FM) are much stronger than WHR and CI.

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