Study of Waist Hip Ratio-An Index for Childhood Nutrition in School Going Children

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ABSTRACT **Objectives:** *1. To study the Waist-Hip Ratio (WHR) in school going children in urban Bangalore.*

2. To correlate WHR with other anthropometric indices including BMI and body fat percentage

Methods: *Study was a cross-sectional study carried out on school going children in urban Bengaluru between the ages of 6-13 years. Their anthropometric data, Waist Hip Ratio (WHR) and BMI were calculated and analysed for nutritional status in the form of total body fat %, presence of obesity and malnutrition.*

Results: *A total of 347 students were the study subjects, of which 159 (45.8) were girls and 188 (54.2) were boys. 57.6 % were in the age group of 6 to 9 years, 42.4 % were in the 10-13 years age. The mean height for boys and girls was 123 centimetres, and 122 cms respectively, the mean WHR for boys was 0.860 and it was 0.865 for girls. Body fat % for boys was 13.71 and it was 16.99 for girls. The mean BMI for boys was 14.31 and for girls 14.32 respectively.*

Conclusion: *There were no children in the high body fat % suggestive of obesity; all the students were either in the normal or thin range of total body fat %. Even though obesity is increasing all over the world, under-nutrition remains the main problem of our school going children.WHR was either normal or low in the study group of children.*

Introduction

Childhood obesity is defined as excessive fat accumulation which presents a health risk in a person under the age of 19 years of age as defined by the World Health Organisation (WHO). Studies show that in India, nearly 16% of children are overweight and 31% are in the risk of falling in this category. (1) Recent studies conducted in Chennai and Delhi have shown that prevalence of 6.2% and 7.4% respectively.(1,2) Overweight and obesity in childhood increases the risk of developing many serious health conditions such as cardiovascular diseases, hypertension, diabetes mellitus, high cholesterol levels and cancers in adulthood.

A study done by Swati Bhardwaj and associates on Childhood obesity in Asian Indians showed that, they have a higher magnitude of adiposity, abdominal obesity and a lower muscle mass than white Caucasians. Therefore, they are more likely to develop insulin resistance, the metabolic syndrome and type 2 Diabetes Mellitus even with a BMI currently defined within normal limits.(1) Excess truncal subcutaneous fat has been proved to be a major determinant of insulin sensitivity and is associated with a high prevalence of insulin resistance in post-pubertal children.(4)

Body Mass Index (BMI) cannot distinguish fat and lean masses, and there is a two-fold range of variation in fatness for a given BMI. On the other hand, Waist-Hip Ratio (WHR) gives a better prediction of cardiovascular diseases and diabetes as it is based on abdominal measurements (1). It is important to identify the individuals that are at risk of facing these health conditions in the future so that we can work to prevent the prevalence of them in the near future. Identifying the possible subjects susceptible to these health conditions, prior to the onset will allow us to work towards prevention rather than control.

Implications

Using WHR as an indicator changes the classification of obesity as opposed to prior studies conducted on childhood obesity in India which took into account their BMI and various blood investigations. Many children that are categorised healthy according to BMI would be regarded overweight using WHR (1).

Moreover, identifying and counselling the high risk individuals at a younger age will have a higher impact on informing the new generation on the risks of obesity.

Additionally, all the indices are measured in a non-invasive method that can be carried out even in a rural clinic. As mentioned earlier, WHR is a suitable measurement for Indians due to body fat distribution being mostly in the abdomen area.

Objectives
1. To study the Waist-Hip Ratio (WHR) in school going children in urban Bangalore.
2. To correlate WHR with other anthropometric indices including BMI and body fat percentage.

Method
A cross-sectional study is carried out on school going children in urban Bengaluru between the ages of 6-13 years. Consent was taken prior to the gathering the data from relevant persons.

Inclusion Criteria: Students were selected at random in such a manner that an equal distribution of students from all age groups is attained. An equal proportion of girls and

boys are selected to eliminate sexual bias.

Exclusion Criteria: Children suffering from any major illness affecting nutrition were excluded from study.

Rationale for sample size: Based on the literature review on a study conducted by S.Kumar, DK Mahabalaraju and MS Anuroopa on Prevalence of Obesity and its influencing factor among affluent school children (1) it was found that the prevalence of obesity among children aged 10-15 years was 5.74%. Accordingly, with the absolute percentage of 4% and desired confidence level of 95%, the sample size is estimated to be 120.

Statistical analysis: All the quantitative variables like age, height, weight, BMI and other anthropometric measurements are expressed in terms of mean and standard deviation. All qualitative variables like gender are expressed in terms of proportion and 95% confidence interval. Chi-square test of statistical significance is used to test for difference in proportion of obesity between boys and girls.

Height is measured to the nearest 0.1cm using a non-flexible tape measure and noted in metres.

Weight is measured to the nearest 0.1kg using a balance scale.

Body mass index is calculated using the following formula:

BMI=$\dfrac{\text{Weight (kg)}}{\text{Height (m}^2)}$

Waist circumference is measured just above the umbilicus at the smallest circumference using a tape measure to the nearest 0.1cm. It is a highly sensitive and specific measure of central obesity.

Cut off values for risk - 102 cm (males), 88 cm (females), and 71 cm (Pre-pubertal children).

Hip circumference is measured at the widest point around the buttocks using a tape measure to the nearest 0.1cm.

Waist-to-Hip ratio is calculated using the following formula:
WHR= $\dfrac{\text{Waist circumference (cm)}}{\text{Hip circumference (cm)}}$

Waist hip ratio: Waist circumference / Hip circumference > 0.9 = Central Obesity. [8]

Skin fold thickness is measured using a calliper which measures the thickness of a fold of skin along with its underlying fat. Measurements are taken at the triceps, biceps and waist. This is then used to calculate the total percentage of body fat on the body using fat percentage charts.

Cut-off values for obesity - 30% body fat (girls) and 20-25% body fat (boys).

Disadvantages – Significant inter and intra-observer variation, affected by gender and ethnicity, no Indian reference data, no significant advantage over BMI. [8]

Body fat percentage is the percentage of fat your body contains; it will be calculated using the formula:

Child Body Fat % = (1.51 x BMI) - (0.70 x Age) - (3.6 x gender) + 1.4

Male=1 & Female=0

Results:
A total of 347 students present were included in the study, out of which 159 (45.8) were girls and 188 (54.2) were boys. 200 (57.6%) were in the age group of 6 to 9 years, 147 (42.4%) were in the 10-13 years age (Table 1). The mean height for boys was 123 centimetres, and 122 cms for girls, the mean weight of boys was 22 kg and it was 21.6 kg for girls, the mean WHR for boys was 0.860 and it was 0.865 for girls. Body fat % for boys was 13.71 and it was 16.99 for girls. The mean BMI for boys was 14.31 and for girls 14.32 respectively (Table 2).

Table1: Distribution of study group according to age and sex.

	6-9 yrs	10- 13 yrs	Total
Girls	96 (48%)	63 (42.9%)	159 (45.8%)
Boys	104 (52%)	84 (57.1%)	188 (54.2%)
Total N=	200 (57.6%)	147 (42.4%)	347 (100%)

Table2: Mean weight, height, BMI, WHR and Body Fat %.

Age groups	6-9 yrs		10- 13 yrs	
Measure	Boys	Girls	Boys	Girls
Height in Cms	115	115.3	132.7	132
Weight in Kg	18.96	18.95	25.86	25.71
BMI	14.08	14.10	14.59	14.64
Waist Hip Ratio	0.870	0.875	0.847	0.846
Body fat %	14.64	17.67	12.56	15.94

Discussion:
In the present study the body fat % for girls was 17.67 in the age group of 6-9 yrs compared to 15.94 in 10 to 13 years. The boys had a body fat % of 14.64 in the age group of 6-9 yrs compared to 12.56 in 10 to 13 years. With age the total body fat % decreased in both boys and girls. There were no children in the high body fat % suggestive of obesity, all the students were either in the normal or thin range of total body fat %. There was no statistically significant difference in association between obesity, WHR, body fat %, and BMI.

In an urban study on affluent adolescents school children in Delhi overweight / obese was seen in 7.4% of the subjects, while in a rural set up it was only 0.4 % (3). In a study in Chennai by Ramachandran et al overweight (including obese) adolescents ranged from 22% in better off schools to 4.5% in lower income group schools. Overweight/obesity is significantly higher among urban students. The prevalence of overweight was 31% in better off school, of which 7.5% were frankly obese in Delhi.

The WHO has estimated that the global burden of obesity to be 10% among children in the age group of 5-17 years, but the obesity is unequally distributed. (10).The problem of obesity is more in urban children compared to rural children.

The presence of abdominal obesity aggravates the deleterious effects arising from general overweight/obesity alone. Abdominal obesity could be present in the absence of

general overweight/obesity. Thus the girls are more prone for complication of central obesity than boys. In age group of 10 to 13 years girls are under-going the process of menarche, which may alter the body fat distribution; this factor might contribute to disproportionate increase in WHR in them. Central obesity is predominantly higher among girls of both urban and rural schools as compared to boys. There is paucity of data in our population. Total body fat % is a good indicator over all nutrition of children. Total body fat % increased with increase in WHR but the increment is not proportionate.

The data in our study suggests that under nutrition remain very high in urban children. Under nutrition is seen in school children even though there is a provision of free mid day meal at schools. In many cases the total body fat % is much below the prescribed limit. That shows children in urban areas are undernourished and at risk of deficiency disorders. Special attention needs to be given for their overall nutrition. The under-nutrition in urban children may be mainly due to poor food habits, poor selection of food and other life style modification

Conclusion:

There were no children in the high body fat % suggestive of obesity; all the students were either in the normal or thin range of total body fat %. Even though obesity is increasing all over the world, under-nutrition remains the main problem of our school going children.WHR was either normal or low in the study group of children and it was unreliable for measurement of obesity in our study group of children.

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