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Original Research Article

Waist-to-Hip Ratio: A Better Anthropometric Index for Predicting the Risk of Obesity in Children and Adolescents

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ABSTRACT:
Obesity is a complex challenge that needs to be addressed at both a societal and individual level. Now obesity presents a huge public health threat and should be stressed and investigated. This project was planned to improve the health and nutrition status of children to avoid obesity in them. Both waist and hip measurements were found to be having significant differences between overweight and obese children in comparison with normal children.

Keywords: Obesity, Overweight, Normal, Health

INTRODUCTION

Waist-Hip-Ratio (WHR) predicts health risks beyond that are predicted by Body Mass Index (BMI) alone. However, very little is known about the WHR on health outcomes for children and adolescents. The chief objective of this study was to determine whether WHR predict diabetes risk factors independently for the children and adolescents. For this, there is a need to establish that WHR has independent effect on obesity-related health risks among young people and to assess the clinical utility of using this measure in this age group. The actual causes of the diabetic condition are little understood amongst children as well as adults. Waist-Circumference is commonly used as an anthropometric measure for abdominal obesity and is an independent predictor of insulin resistance (Lee et al., 2006).

The lacuna in the present status of this disease was filled by the present research. In this project, surveillance and intervention program to modify risk factors were appropriately implemented at the community level. The International Diabetes Federation (IDF) suggests the 90th percentile as a waist-circumference cut-off point for children aged 6 years or older (Zimmet et al., 2007). No widely accepted waist-circumference cut-off points or reference data set exist for children and/or adolescents, although some country-specific cut-off points have been suggested (Fredriks et al., 2005; Fernández et al., 2004).

This project was envisaged to improve the health and nutrition status of children to avoid obesity in them. So that the effective strategies or programs can be established to fight and

control various risk factors for obesity and diabetes. Obesity is a complex challenge that needs to be addressed at both a societal and individual level. Now obesity presents a huge public health threat and should be stressed and investigated. The strategy of this project was to recommend a comprehensive range of changes at the individual, community, national and international levels which, if effectively implemented, have the potential to turn around the obesity epidemic. The strategy also addressed the changes needed in lifestyles that have been linked to the increase in overweight and obese children over the last twenty years. The focus on major accomplishments over the next 25 years can alter the prevention, treatment and cure of diabetes. But India is likely to play wonders in this field. There should be close collaboration between clinical researchers and basic sciences researchers. India would do well to promote such cross-disciplinary research. Governments at all levels should strengthen the public education, health promotion activities and advocates a balanced diet and a healthy life style.

MATERIALS AND METHODS

A multistage random cluster sampling procedure was used to draw sample from this region. 2048 Children and adolescent aged 10-19 years were selected randomly. Waist-Hip-Ratio (WHR) is the ratio of a person's waist-circumference to hip-circumference, mathematically calculated as the waist circumference divided by the hip circumference. Waist-circumference was measured to the nearest one millimetre (mm) by using a calibrated anthropometric tape measure at the umbilicus and the superior iliac crest. The measurement was made at the end of a normal expiration while the subject stood upright, with feet together and arms hanging freely at the sides. Hip-circumference was measured at the maximum point below the waist, without compressing the skin. Girls with WHR ratios of more than 0.8 or boys with Waist-Hip-Ratios of more than 0.95 are overweight. Statistical analysis was applied to find out the significance of the study.

Before starting the data collection work, permissions in black and white were taken from Principals/headmasters of the schools. The permission from parents of the children, undergoing examination and questionnaire survey was also taken on the self-designed consent form.

RESULTS AND DISCUSSION

Waist-Hip-Ratio is an indicator of visceral and central adiposity (McCarthy et al, 2003). Both waist and hip measurements had significant differences between overweight and obese children in comparison with normal children. On the basis of WHR, 13.82% children were found to be overweight and girls were more overweight than boys, in both rural as well as urban areas.

Table 1: Prevalence of overweight and obesity according to waist hip ratio

Group/Sub Group	Normal		Over Weight.		
	N	%	N	%	
All Data	1765	86.18	283	13.82	
Area					
1.Urban	923	90.76	94	9.24	Chi^2=35.51**(df:1)
2.Rural	842	81.67	189	18.33	C=0.13;
Gender					
1.Male	1372	96.69	47	3.31	Chi^2=428.23**(df:1)
2.Female	393	62.48	236	37.52	C=0.42
Urban					
1. Male	828	98.81	10	1.19	Chi^2=367.76**(df:1)
2. Female	95	53.07	84	46.93	C=0.52;

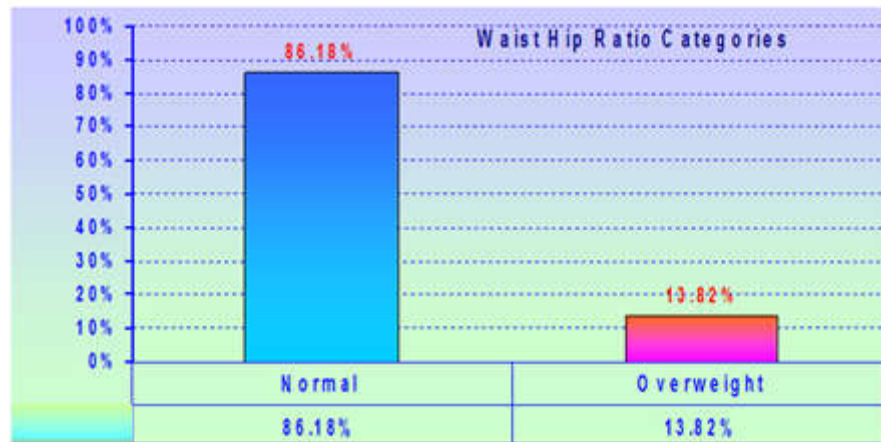| Rural					
1.Male	544	93.63	37	6.37	Chi^2=127.25**(df:1)
2.Female	298	66.22	152	33.78	C=0.33;

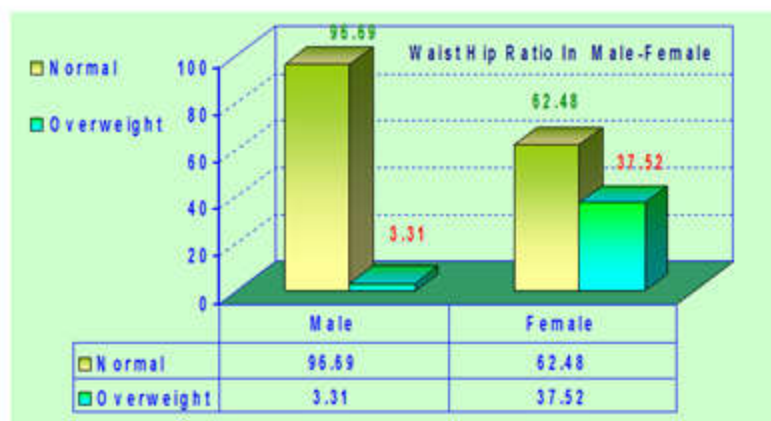**Figure 1:** Waist Hip Ratio categories

Figure 2: Waist Hip Ratio in Male- Female

Obesity and overweight result from an imbalance in the energy expenditure equation such that either food intake is in excess; energy expenditure is deficit or both. Obesity is now well recognized as a disease in its own right which is preventable through changes in life style especially diet. Obesity is a major determinant of many non-communicable diseases and induces diabetes mellitus and coronary heart disease.

Physiologically, the body weight is constantly changing in every individual. Obesity is the result of excessive expansion of adipose tissue mass. This disorder is often accompanied by abnormalities in systemic carbohydrate and lipid metabolism and the secretion and action of insulin alterations thought to reflect diabetogenic effect of obesity. There remain questions about the best diagnostic criteria for this age group. Obesity is becoming an increasing problem for children and adults in the United States (Eckel and Krauss, 1998). Obesity can lead to cardiovascular disease, diabetes mellitus, sleep and respiratory problems and psychological difficulties (Himes

and Dietz, 1994). Abdominal obesity may be a better predictor than overall obesity for the risk of cardiovascular disease and Type-2 diabetes. Waist-Circumference and Waist-Height ratios are two simple, yet effective, surrogate measures of abdominal obesity. The work sought to examine the recent trends in mean waist-circumference and waist-height ratio and prevalence of abdominal obesity among children and adolescents aged 6 to 19 years.

Overweight and obesity in childhood are associated with early cardiovascular dysfunction and promote heightened risk of cardiovascular morbidity and mortality in adulthood. Waist-Circumference (WC) correlates with visceral obesity that is why obese children with elevated WC need to be carefully monitored to prevent long term cardio-metabolic complications (Trandafir et al., 2020). A more central deposition of fat has been shown to be associated with higher blood pressure, less favourable lipid and lipoprotein levels and increased left ventricular-mass-index (Daniels et al., 1999). It is found that the relations between anthropometric measures and body fat distribution are all dependent on age. In addition, some of the measures are also dependent on gender, race or percentage of body fat. These results suggest that waist-circumference may be the most useful measure of fat distribution. Obesity associated diseases are now reported with increasing frequency in obese children and adolescents. Among these diseases are Impaired Glucose Tolerance (IGT), Type-2 diabetes mellitus (Sinha et al., 2002, Goran et al., 2003) and cardiovascular diseases (Berenson, 2005)along with other problems such as impaired quality of life (Schwimmer et al., 2003), poor self-esteem (French et al.,1995) and depression (Needham and Crosnoe, 2004). Furthermore, overweight preschool children are more likely to be overweight school children (Nader et al, 2006) and obese children and adolescents are more likely to become obese adults with all the associated health hazards (Whitaker et al., 1997 and Ogden et al., 2002).The level of central adiposity among children in the USAP region is a major public health concern because overweight and obesity may lead to chronic non communicable diseases. Study from

USAP region suggested a need for lower percentile cut points for children, who may be at greater risk than children of other races/ethnicities for metabolic diseases such as diabetes. The use of waist-circumference measurements is recommended to define health risks for policy development and intervention strategies. Early detection and screening of waist-circumference among children can lead to prevention-oriented research and practice to decrease the likelihood of adverse health outcomes later in life among children with metabolic risk (Yamanaka et al., 2021). Obesity-related cardiovascular disease is becoming more prevalent in conjunction with the rise in childhood obesity. Children with obesity may exhibit early signs of cardiovascular dysfunction: increased arterial stiffness, early atherosclerosis, changes in the myocardial structure and function. These are the result of their excess adiposity, often independent of other obesity-related comorbidities such as dyslipidaemia and insulin resistance. Obesity in childhood predisposes to an increased risk of morbidity and cardiovascular mortality (Russu et al., 2017).

CONCLUSION

Waist circumference is a useful measure, since it is not related to race or gender. However, it is still important to measure the fat distribution in children and adolescents.

REFERENCES

1. Berenson G.S. and Srinivasan S.R. (2005). Cardiovascular risk factors in youth with implications for aging: The Bogalusa study. Neurobiology of Aging 26(3), 303-307.
2. Daniels SR, Morrison JA, and Sprecher DL. (1999). Association of body fat distribution and cardiovascular risk factors inchildren and adolescents. Circulation. 99, 541–5.[ISI][Medline]
3. Eckel RN, Krauss RM. (1998). American Heart Association Call to Action: obesity as a risk factor for coronary heart disease. Circulation 97, 2099–100.[ISI][Medline]
4. Fernández JR, Redden DT, Pietrobelli A, and Allison DB. (2004). Waist circumference

percentiles in nationally representative samples of African-American, European-American, and Mexican-American children and adolescents. J Pediatr, 145(4), 439–44.

5. Fredriks AM, van Buuren S, Fekkes M, Verloove-Vanhorick SP, and Wit JM. (2005). Are age references for waist circumference, hip circumference and waist-hip ratio in Dutch children useful in clinical practice? Eur J Pediatr, 164(4), 216–22.

6. Himes JH, Dietz WH. (1994). Guidelines for overweight in adolescent preventive services: recommendations from an expert committee. Am J ClinNutr, 59, 307–16.

7. Lee S, Bacha F, Gungor N, and Arslanian SA. (2006). Waist circumference is an independent predictor of insulin resistance in black and white youths. J Pediatr, 148(2), 188–94.

8. McCarthy HD, Ellis SM, and Cole TJ. (2003). Central overweight and obesity in British youth aged 11-16 years: cross sectional survey of waist circumference. BMJ. 326; 624-6.

9. Michael I Goran, Geoff D. C. Ball, and Martha L. Cruz. (2003). Obesity and risk of type-2 diabetes and cardiovascular disease in children and adolescents The Journal of Clinical Endocrinology & Metabolism 88(4), 1417–1427

10. Nader R. Philip, Marian O' Brian, Renate Houts, Robert Bradley, Jay Belsky, Robert Crosnoe, Sarah Friedman, Zuguo Mei, Elizabeth J. S. (2006). Identifying risk for obesity in early childhood. Pediatrics, 118 (3), e594–e601.

11. Ogden CL, Kuczmarski RJ, Flegal KM, Mei Z, Guo S, Wei R, Grummer-Strawn LM, Curtin LR, Roche AF, Johnson CL. (2002). Centers for Disease Control and Prevention 2000 growth charts for the United States: improvements to the 1977 National Center for Health Statistics version. Pediatrics, 109, 45– 60.

12. Ranjana Sinha, Gene Fisch, Barbara Teague, R.N., William V. Tamborlane, Bruna Banyas, R.N., Karin Allen, R.N., Mary Savoye, Vera Rieger, Sara Taksali, Gina Barbetta, Robert S. Sherwin and Sonia Caprio. (2002). Prevalence of Impaired Glucose Tolerance among Children and Adolescents with Marked Obesity. New England J. Med, 346: 802-810.

13. Russu G, Frăsinariu OE, and Trandafir L. (2017). Prevalence of impaired glucose tolerance among children and adolescents with marked obesity Cardiovascular suffering in childhood obesity. Rom J Pediatr, 56, 12–7.

14. Trandafir, Laura, Russu, Georgiana, Moscalu, Mihaela, Miron, Ingrith, Lupu, Vasile, Constantin, Maria, Cojocaru, Elena, Lupu, Ancuta, Frasinariu, Otilia. (2020). Waist circumference a clinical criterion for prediction of cardio-vascular complications in children and adolescences with overweight and obesity. Medicine.99.e20923. 10.1097 /MD 0000000000020923.

15. Whitaker Robert C., Jeffrey A. Wright, Margaret S. Pepe, Kristy D. Seidel, and William H. Dietz. (1997) Predicting Obesity in Young Adulthood from Childhood and Parental Obesity. N Engl J Med, 337, 869-873

16. Yamanaka AB, Davis JD, Wilkens LR, Hurwitz EL, Fialkowski MK, and Deenik J. (2021). Determination of Child Waist Circumference Cut Points for Metabolic Risk Based on Acanthosis Nigricans, the Children's Healthy Living Program. Prev Chronic Dis, 18, 210021. DOI: http://dx.doi.org/10.5888/pcd18.2100 21external icon.

17. Zimmet P, Alberti KGM, Kaufman F, Tajima N, Silink M, and Arslanian S, et al. (2007). IDF Consensus Group. The metabolic syndrome in children and adolescents — an IDF consensus report. Pediatr Diabetes, 8(5), 299–306.

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