Original Research Article

Augmented BMI and waist to height ratio as screening tools for overweight and obesity among school going children aged 5 to 15 years

Ushakiran C. B.*, Sowmya Jagadeeshwara, Bharathi Lingaraju

Department of Pediatrics, MMCRI, Mysore, Karnataka, India

Received: 22 October 2016

Accepted: 19 November 2016

*Correspondence:

Dr. Ushakiran C. B.

E-mail: ukboregowda@yahoo.co.in

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Worldwide raising trend in obesity among children is causing serious public health concerns and in developing countries it is threatening the viability of basic health care delivery. The objective of this study was to screen for overweight and obesity among school going children using the established methods as well as the newer screening tools and to compare the efficacy of the various screening tools

Methods: Prospective cross sectional study was conducted various government and non-government schools within city limits. And participants involves 1000 children in the age group of 5 to 15 years who met the predefined criteria were selected by purposive sampling.

Results: Using BMI as a screening tool, 6.3% were identified as overweight and 5.8% as obese. Using Waist circumference alone, 5.2% were identified as overweight and 4.5% as obese. 13.8% and 5% were identified as overweight and obese respectively by waist circumference to height ratio. Using augmented BMI, 14.7% were identified as overweight and 4.3% as obese.

Conclusions: Using WHTR and Augmented BMI, larger percentage of children were identified as overweight while the percentage of children identified as obese remained similar to using BMI or Waist circumference alone.

Keywords: Anthropometry, Augmented BMI, Metabolic syndrome, Waist to height ratio

INTRODUCTION

Worldwide raising trend in obesity among children is causing serious public health concerns and in developing countries it is threatening the viability of basic health care delivery. Many systemic co-morbid conditions like cardiovascular, orthopaedic, neurological, hepatic, pulmonary and renal disorders are seen in association with childhood obesity.¹

The treatment of overweight and obesity in children and adolescents requires a multi-disciplinary, multiphasic approach which includes dietary management, physical

activity enhancement, and reduction of sedentary behavior, pharmacotherapy and bariatric surgery.

In children and adolescents, overweight and obesity are defined using age and sex specific nomograms for BMI. Children with BMI equal to or exceeding the age-gender specific 95th percentile are defined as obese. Those with BMI equal to or exceeding 85th but are below 95th percentile are defined overweight and are at risk for obesity related co-morbidities. Obesity index which predicts metabolic syndrome includes BMI, waist circumference, waist hip ratio, and waist to Height Ratio and so on.²

The true measure of obesity and overweight is the total body fat content which can be measured as on today using dual energy X-ray absorptiometer (DEXA).³ This method is available in very few research centers and is not accessible and affordable to many.

Many studies have been conducted so far using indices like BMI, waist circumference, waist hip ratio, waist to height ratio (WHTR) alone or in combination for screening and evaluating children with obesity and overweight.⁴ There are very few studies which have used augmented BMI i.e (BMI X WHTR) or waist to height ratio (WHTR) to identify obesity and overweight which are better predictors of metabolic syndrome.^{5,6}

In this context, a clinical study to was taken up to find out the BMI and waist circumferences as percentiles and use augmented parameters to screen obesity and overweight in children aged 5-15 years.

METHODS

The study was a prospective cross sectional study which was conducted within the city limits after obtaining the ethical clearance.

The study data regarding the list of schools in Mysore city was collected from the Deputy Director of public instruction office. From the data collected schools were selected by purposive sampling.

A Pre tested questionnaire method for primary source of information was used. Parental consent was obtained for the study. The study duration was from June 2014 to June 2015.

Inclusive criteria

1. School going healthy children between age group of 5-15 years.

Exclusion criteria

- Children suffering from chronic illness
- Children on long term medications
- Children with congenital anomalies.

The weight, height, waist circumference were measured as per the established standards.

The body mass index was calculated as weight in kg by height in meters square. WHTR was calculated as waist circumference to height ratio. Augmented BMI was calculated as BMI X waist circumference to height ratio.

The data collected was transferred to an excel sheet and the master chart was prepared and analysed.

The data was analysed using SPSS 23 software. Range, frequencies, percentages, means, standard deviations, percentiles were calculated.

The values between 85th to 95th percentiles in each of the screening tools was considered as overweight and above 95th percentile was considered as obese.

RESULTS

Out of 1000 children included in the study, 440 were males and 560 were females. Using accepted standards for measurement of overweight and obesity, augmented BMI percentiles were derived for both boys and girls between 5 to 15 years and was plotted as in Figure 1.

Figure 1: Age wise overweight and obesity percentiles (augmented BMI) for school going boys and girls aged 5 to 15 years.

The prevalence of overweight and obesity among school going boys and girls aged 5 to 15 years using various screening methods are presented in Table 1. Using BMI as a screening tool, 6.3% were identified as overweight and 5.8% as obese. Using Waist circumference alone, 5.2% were identified as overweight and 4.5% as obese. 13.8% and 5% were identified as overweight and obese respectively by WHTR. Using Augmented BMI, 14.7% were identified as overweight and 4.3% as obese.

DISCUSSION

BMI, waist circumference, Waist to height ratio are the most common methods used to define obesity. The drawback with each of these is that it fails to consider one or the other important anthropometrical parameters like weight or height or waist circumference. This deficiency can be overcome by using augmented BMI which includes weight, height and waist circumference.

The age wise and gender wise percentile charts were constructed for each of these tools. As per the standard, the values between 85th to 95th percentile were considered as overweight and the values above 95th percentile were considered as obese (Table 1).

According to the analysis, Out of 1000 children included in the study, 440 were males and 560 were females. The age and gender wise class interval was not equal whereas in the study by Thomachan S et al, the age and gender distribution in the study population was equal.⁵

Using BMI alone as a screening tool, only 6.3% were identified as overweight and 5.8% as obese. This is similar to the studies by Thomachan S et al.⁵ In the study by Thomachan S et al, 3.2% were identified as obese and 8% as overweight. But as stressed by Mc carthy et al, the

main pattern of fat distribution in adolescents is central obesity, distribution of fat in the abdominal area.⁶ Waist circumference is the recommended standard for its measurement.

Flodmark et al in their study have shown the relation between abdominal fat and adverse lipid profile (so waist circumference can be considered as an additional method to BMI and an indirect method for predicting Cardiovascular disorders.⁵

Table 1: Comparative efficiency of various methods for determining the overweight and obesity status in school going children.

	WC			BMI		
	M	F	T	M	F	T
OW (>85 th <95 th percentile)	23 5.20%	35 6.20%	58 5.80%	23 5.20%	40 7.10%	63 6.30%
Obese (>95 th percentile)	15 3.40%	30 5.30%	45 4.50%	19 4.30%	39 6.90%	58 5.80%
Total	440	560	1000	440	560	1000
	WHTR			AUG BMI		
	M	F	T	M	F	T
OW (>85 th <95 th percentile)	83 18.86%	55 9.82%	138 13.8%	70 15.9%	77 13.7%	147 14.7%
Obese (>95 th percentile)	13 2.95%	37 6.60%	50 5%	28 6.36%	15 2.67%	43 4.3%
Total	440	560	1000	440	560	1000

In this study, using Waist circumference alone, 5.2% were identified as overweight and 4.5% as obese. Though the percentage of children identified as overweight and obese by Waist circumference alone are relatively less compared to BMI, there is a good correlation between the two, similar to the findings in the study by Kurpad SS et al.⁸

The studies by Thomas et al, point out that the prevalence of obesity in Indian children is just below 4%.⁹ which is correlating with the estimates of obesity by waist circumference (4.5%) from our study.

The study by Hara M et al points out the importance of WHTR. Many studies have proved that WHTR is more sensitive than BMI.^{5,6,10} It is significantly associated with all the risk factors of metabolic syndrome and predicts mortality and morbidity better than BMI.

Mc Carthy et al says “keep your waist circumference to less than half of your height”.¹¹

However the cut off of 0.5 was not used in our study. Instead we considered the percentile values between 85th to 95th as overweight and >95th as obese. According to

our study, 13.8% of the children were identified as overweight which is approximately 2.3 times higher than those identified by BMI and WC alone. However the % of children identified as obese by WHTR is 5%, almost comparable to BMI and WC.

A very important drawback of WHTR is that it fails to include weight which is a very sensitive and a very important component in the human growth dynamics.

The newer tool, augmented BMI is a combination of BMI and WHTR. In our study, 14.7% were identified as overweight and 4.3% were identified as obese. The findings well correlated with the WHTR. The augmented BMI was even better than WHTR in identifying overweight children (14.7% versus 13.8%).

The observed prevalence rates of obesity according to WHTR and Augmented BMI is well within the accepted limits of Indian school going children. However these tools are probably oversensitive in identifying overweight children which is above the acceptable Indian standards.

The percentile charts for overweight and obesity, constructed using augmented BMI were not smooth linear curves (Figure 1) unlike in the study by

Thomachan S.⁵ The possible reasons could be the sample size of 1000 as against 3000 in their study. Also there is unequal age wise and gender-wise distribution of the samples.

CONCLUSION

Augmented BMI is an integrated tool for screening obesity among school children. It encompasses all the anthropometrical parameters like weight, height and waist circumference.

More studies involving larger population size is necessary to obtain percentile charts.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Singh AS, Mulder C, Twisk J, Van Mechelen W, Chinapaw MJ. Tracking of childhood overweight into adulthood: a systematic review of the literature, Obesity reviews. 2008;9(5):474-88.
2. Bahl D, Singh K, Sabharwal M, Arora M. Anthropometric Indices for the prediction of metabolic syndrome as its features, among children and adolescents. Indian J Sci Technol. 2004;7(8):1066-77.
3. Deurenberg, Paul. Limitations of the bioelectrical impedance method for the assessment of body fat in severe obesity. Am J Clin Nutr. 1996;64(3):449-52.
4. Bassalli R, Waller JL, Gower B, Allison J, Davis C L. Utility of waist circumference percentile for risk evaluation in obese children. International J Pediatr Obes. 2010;5(1):97-101.
5. Panjikkaran ST, Kumari KS. Augmenting BMI and waist height ratio for establishing more efficient obesity percentiles among school going children. Indian J Com Med. 2009;34:112-5.
6. McCarthy HD, Ashwell M. Trends in waist: height ratios in British children aged 11-16 over a two - decade period. Proc Nutr Soc Am. 2003;62:46.
7. Flodmark CE, Sveger T, Nilsson EP. Waist measurement correlates to a potentially atherogenic lipoprotein profile in obese 12-14 year old children. Acta Paediatr. 1994;83:941-5.
8. Kurpad SS, Tandon H, Srinivasan K. Waist circumference correlates better with BMI than waist to hip ratio in Asian Indians. Natl Med J India. 2003;16:189-92.
9. Thomas B, Heged M, Jayaraj. Eating to die. Food Nutr world. 2003;1:11-2.
10. Hara M, Saitou E, Iwata F, Okada T, Harada K. Waist height ratio is the best predictor of cardiovascular disease risk factors in Japanese school children. J Atheroscler Thromb. 2002;9:127-32.
11. McCarthy HD, Ashwell M. A study of central fatness using waist to height ratios in UK children and adolescents over two decades supports the simple message-‘keep your waist circumference to less than half your height’. Int J Obesity. 2006;30:988-92.

Cite this article as: Ushakiran CB, Jagadeeshwara S, Lingaraju B. Augmented BMI and waist to height ratio as screening tools for overweight and obesity among school going children aged 5 to 15 years. Int J Contemp Pediatr 2017;4:174-7.