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Original Research Article

Study of waist circumference in school children

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ABSTRACT

Introduction: The objective of our study was to investigate by cross sectional survey and procure the anthropometric measurements of body waist circumference, in school going adolescent boys and girls who are 9 to 12 years of age and belonging to diverse socioeconomic groups. Waist circumference could be useful as an easy evaluator of physical and metabolic health illness and also as a method for assessing the visceral fat.

Materials and Methods: The cross-sectional analysis of body waist circumference was investigated on a total of 511 School children in Pune, India.

Result: We noticed that the values of waist circumference of higher income group (HIG) were much more than lower income group (LIG) values in all the age groups. The values of waist circumference were higher in females as compared to males of same age groups in HIG.

Conclusion: The evaluation could be used to depict the growth pattern of the 9 to 12 years males and females, which could be transformed by social and economic change in a society. This evaluation method could also efficiently be useful in field for the study of large population samples for prevalence of malnutrition, which includes obesity as well as to provide an additional parameter of undernutrition.

1. Introduction

Developing country like India have shown an immense divergence in its socio-economic status. Great diversity in the diet could have an effect on pattern of growth. The ultimate effect of growth potential and intelligence is the net effect of interplay of genetic factors, nutrition and environment. Phase of fast growth is seen in adolescence.[1] Adolescent and childhood growth stages are both significant phases of growth development. Physical developments in this phase brings about changes in both sexes and therefore makes it a necessity to study the growth pattern in both sexes. Evaluating growth of a child using anthropometric evaluation methods is economical in comparison to other health evaluation methods.[2] Malnutrition continues to be a persistent major health concern in the world, especially in the developing countries. At the time of surge of growth in adolescence, nutrients have to be gathered and hoarded in the body stores. Scarce body stores can start a chain of health issues affecting growth of the child, diminished work capability, and scholarly retardation.[3] Waist circumference is utilised as an anthropometric tool for evaluating growth pattern and nutritional status. Waist circumference has been proposed as a very simple, practical method of assessing distribution of fat in children and it has revealed that is a definite link with risk of cardiovascular diseases, unfavourable lipid levels in childhood.[4,5] The objective of our study was to investigate by cross sectional survey and procure the anthropometric measurements of body waist circumference, in school going adolescent boys and girls who are 9 to 12 years of age and belonging to diverse socioeconomic groups. We observed that the measurements of waist circumference of higher income group (HIG) were almost greater than lower income group (LIG) values in all the age groups. The values of waist circumference were higher in females as compared to males of same age groups in HIG.

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2. Materials and Method

After obtaining institutional ethics committee approval, the cross-sectional study was conducted on school going adolescents (Table 1), Pune, India. The adolescent students belonged to both girls and boys and both upper income group/Higher income group (HIG) and lower socio-economic status /Lower income group (LIG).[6]

The measurement was taken at midway between lower margin of the lowest rib and the iliac crest, in the horizontal plane. The circumference was measured at this point, at the end at normal expiration with a non-stretchable tape.

3. Results and Discussion

Values of Waist Circumference (WC) were higher in females as compared to males of same age groups in HIG. And in contrast, the values of waist circumference were higher in males as compared to females of same age groups in LIG. Our studies show that LIG children are facing nutritional deprivation in contrast to HIG children who are over nourished. The underprivileged LIG students lag behind the students of HIG. The girls in HIG show higher Waist circumference because Girls show fat deposit in lower part of abdomen and thigh and in contrast boys show fat deposit in the vicinity of anterior wall of the abdomen.[7] The females show steady growth in waist circumference irrespective of socio-economic groups. The values are much higher in HIG as compared to LIG. This difference could be because of consumption of more fatty food by HIG children leading to over nourishment, this is evident from the data collected about dietary intake. Very few studies of waist circumference are available in India for comparison[8] and so far, a western standards have been used for comparison purposes. Indian children as compared with the western children are living under different environmental settings and have different ethnological background. Therefore comparing Indian children with western standards could definitely have a drawback.

Table 1: Distribution of School going students

Age (yrs)	Male		Females	
	HIG	LIG	HIG	LIG
9-10	42	42	42	42
10-11	42	42	42	42
11-12	42	42	42	49
Total	126	126	126	133

Total no. 511 Males: 252 Females: 259

The survey was statistically investigated by utilizing 'Z' test for significance and was seen in the following tables (Tables 3 and 4) Z-test which was used for the comparison between the LIG and HIG groups showed that p-value $<$ 0.05, thus showing that there is important contrast between LIG and HIG adolescents. Z test for comparison between males and females, showed p-value $<$ 0.05, showing a significant difference between males and females.

Developing countries are confronted with dual burden of malnutrition, which comprises of under nutrition and over nutrition.[8] Under nutrition can lead to increased mortality in children in developing countries. Persistent under nutrition in children is associated with delayed cognitive growth and grave damage to health and well-being of these children in their future.[2] Globalization has changed our food habits and our life style throughout the globe. Inclusion of fatty diet are on a rise not only in developed countries but also in developing countries.[9]

Measurement of growth of a child using anthropometric tools is cheap, easy to execute and not invasive. Thus anthropometric evaluation is an essential and indispensable method in evaluation of health and status of nutrition in children.[10] Evaluation of nutritional state in a population is highly relevant to understand the social welfare and prosperity in a community.[10] Nutritional anthropometry is related with evaluation of variations in the physical proportions and the constitution of the human body during lifetime. It is one of the most effective methods of studying the status of nutrition in a population, which is highly valuable in governing public programs. Obesity is becoming a prominent cause leading to health problems not only in adults but also adolescents.[11] Reversal of obesity is very difficult in children. Evaluation studies utilizing WC are few. Spanish studies who used WC have concluded that measuring WC is an important method to measure obesity of the abdomen.[12] McCarthy states that WC could provide important facts in children in context to assessment of abdominal obesity and also linking it with overweight related diseases.[13] The National task force regards WC as appropriate, precise, easy anthropometric method to find out overweight.[14] Recently, studies done by Janssen et al and Messen et al have recommended that WC is a superior method to forecast the vulnerability of a person to being overweight and obesity associated health diseases.[15] If WC is seen to rise with age, it could propose that there is a unceasing fat build up, which can suggest that these children could have high likelihood of suffering from health related problems in their forth coming years of life and it is important to continue monitoring of the child's WC to find out for any uncontrolled rise in future.[15]

The increasing inclination for the assessment of WC in recent studies have made a justification that, distribution of fat around the waist of children population is a probability factor, which denotes its predisposition to Diabetes mellitus[15] and WC is recommended in big extensive health programme studies because of its rational precision, easy, cheap, and high prediction ability and which is equivalent to prediction endeavour of BMI (Body-Mass Index). Present day evaluation studies have made propositions that Central obesity values, that is WC values were equitable or superior at prediction of certain diseases

Table 2: Measurements of Waist circumference

Waist circumference Cm		9-10yrs		10-11yrs		11-12yrs	
		Males	Females	Males	Females	Males	Females
LIG	Mean	51.65	50.69	53.89	52.81	57.85	55.37
	S.D	2.68	3.89	4.60	3.66	4.00	6.72
HIG	Mean	60.79	63.76	67.68	71.42	70.53	76.10
	S.D.	4.01	6.97	8.15	7.89	8.04	6.73

S.D-Standard Deviation. L – Lower Socio-economic group (LIG) H – Higher Socio-economic group (HIG)

Table 3: 'Z' test analysis for comparison between low and high socio-economic group

Comparison Between Low and High socio-economic group			Waist
9-10 yrs.	Males	Z value	9.85
		p-value	0.00
		Significance	HS
	Females	Z value	10.14
		p-value	0.00
		Significance	HS
10-11 yrs.	Males	Z value	10.32
		p-value	0.00
		Significance	HS
	Females	Z value	13.59
		p-value	0.00
		Significance	HS
11-12 yrs.	Males	Z value	6.99
		p-value	0.00
		Significance	HS
	Females	Z value	11.8
		p-value	0.00
		Significance	HS

HS: Highly Significant S: Significant; NS: Not significant

Table 4: 'Z' test analysis for comparison between Males and females[A1]

Comparison Between Males & Females			Waist
9-10 yrs.	LIG	Z value	1.5
		p-value	0.56
		Significance	
	HIG	Z value	5.4
		p-value	0.00
		Significance	HS
10-11 yrs.	LIG	Z value	1.9
		p-value	0.001
		Significance	HS
	HIG	Z value	6.5
		p-value	0.00
		Significance	HS
11-12 yrs.	LIG	Z value	3.5
		p-value	0.00
		Significance	HS
	HIG	Z value	11.8
		p-value	0.00
		Significance	HS

HS: Highly Significant S: Significant NS: Not significant

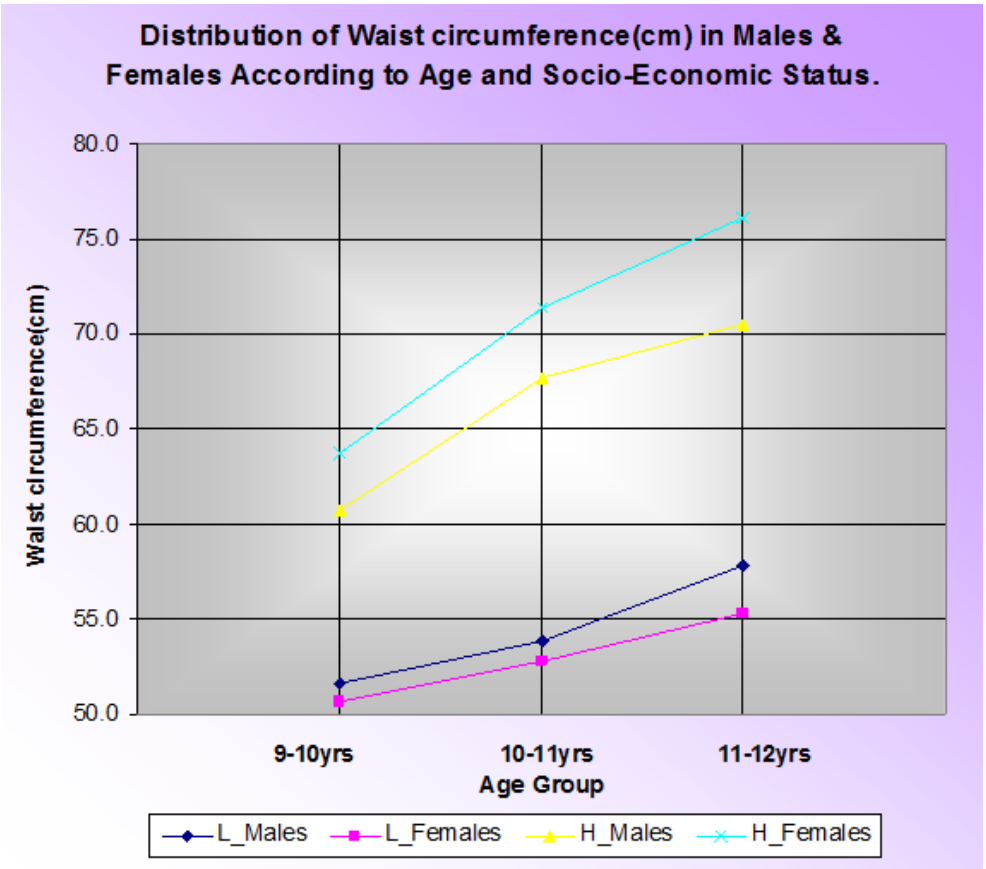

Fig. 1: Distribution of Waist Circumference (cms) in males and females according to age and socio-economic status L – Lower Socio-economicgroup (LIG) H – Higher Socio-economic group (HIG)

which are not commensurable as measuring all over body adipose level using BMIand Freedman et al. had conveyed same connection of lipids and central obesity in children [15] .Per Morten Fredriksen et al. supported the use of WC as an important and vital anthropometric tool for prediction of health diseases. [15]

Different research works have also approved the link of WC as determining factor of physical wellbeing, metabolic outcome, in children below twelve years and also its capacity in prediction of myocardial infarction in future. Public health authorities could implement health schemes for decreasing WC to decrease overweight related health illnesses. Ford et al. in reference to adult population has given the following preferences of WC over BMI, they are as follows WC is superior at prediction and its correlation with cardiac illness, Diabetes mellitus, metabolic illness, and all leading to mortality than BMI. WC is good at prediction of medical expenditure than BMI, easy method, and easy to understand for the public. [15] Some discrepancies were seen in our study, because the choice of the school children was structured only on one measurement that is, socio economic status.

4. Conclusion

Our study revealed differences in rate of growth in LIG and HIG. It was perceived that LIG waist circumference values are constantly lower than HIG values in all age groups. The above analysis could be used to interpret the growth pattern in school children of 9-12 years, which could be transformed by social and economic change in a society and secondly, malnutrition could be also measured in school children by using WC as an alternative anthropometric tool.

5. Source of funding

None.

6. Conflict of interest

None.

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