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ANTHROPOMETRIC CHARACTERISTICS AND VO_2 MAX OF URBAN TRIBAL AND NON-TRIBAL BOYS OF TRIPURA

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ABSTRACT

Anthropometry is the single most portable, systemized technique, universally applicable, inexpensive, and noninvasive method available to assess the proportions, size, and composition of the human body. Maximum oxygen uptake (VO_2 max) is internationally accepted parameter to evaluate the cardiorespiratory fitness. But determination of VO_2 max is restricted within well equipped laboratory because of its exhausting, hazardous and complicated experimental protocol. The tests were carried out in 300 urban tribal boys (150 pre-pubertal tribal and 150 post-pubertal boys) and 300 urban non-tribal boys (150 pre-pubertal and 150 post-pubertal boys). Anthropometric characteristics including height, weight, body circumferences, bone widths, body fat%, TST, mesomorphy and cardiorespiratory fitness include VO_2 max which were all measured by standard procedures. The independent samples t-test revealed that non-tribal boys had found significantly higher height ($p<0.01$), weight ($p<0.01$), skinfold measurements and body fat % ($p<0.01$) as compared to tribal boys. Thus, non-tribal boys were found taller and heavier. On the other hand, the tribal boy also showed significantly greater circumferences, bone widths , mesomorphic component and VO_2 max ($p<0.01$) as compared to non-tribal boys. which may be due to lean body weight and greater body size in them. The high body fat % of non-tribal boys can also lead to reduced cardiorespiratory fitness.

KEY WORDS: Anthropometry , QCT, tribal, VO_2 max

Anthropometry is the single most portable, systemized technique, universally applicable, inexpensive, and noninvasive method available to assess the proportions, size, and composition of the human body. It reflects both health and nutrition and predicts performance, health and survival. For these reasons it is used for selecting individuals and populations for health and nutrition interventions, as well as for monitoring their health and nutrition.

Aerobic capacity or maximum oxygen uptake capacity (VO_2max) has been widely considered to be reliable and valid measure of cardio respiratory fitness. Persons possessing higher values and have the capacity to yield larger amounts of energy, are capable of performing better in athletic and other field activities.

The highest rate of oxygen consumption by the body in a given period of time is considered to be the best single index of cardio-respiratory fitness and it has therefore been widely studied in both adults (maximum oxygen consumption, VO_2 max) and children (peak oxygen consumption, peak VO_2) .It has been shown that the absolute value of peak VO_2 differes from country to country (Krahenbuhi et al.,1985). But the trend of development is almost the same. It increases with chronological age. There is no doubt, therefore, that the VO_2max is related to the maturity of the children at any given chronological age. However, there exists a great deal of variation not only in peak VO_2 but also in such physical dimensions as height and weight. Aerobic capacity tests can provide valuable baseline data about the fitness levels of individuals and data from which exercise programmes may be developed.

Queen's college step test provides a measure of cardio-respiratory or endurance fitness as it provides an estimation of VO_2 max indirectly. VO_2 max is the accepted measure of cardiorespiratory fitness and defined as the greatest rate at which oxygen can be consumed during exercise.

Tripura is inhabited by tribes who are basically Mongoloid in origin with short to medium stature and muscular body and tribal population of Tripura can be considered as a homogenous group (Dey and Debray , 2003). As there is a dearth of published data, the present cross-sectional study was conducted to determine the anthropometric characteristic and also to assess the suitability for application of QCT to predict peak VO_2 max of urban tribal and non tribal boys of Tripura.

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MATERIALS AND METHODS

Subjects

150 pre-pubertal tribal and non-tribal boys (Avg. age 12 yrs), 150 post-pubertal tribal and non-tribal boys (Avg. age 15 yrs) are selected as sample for the cross-sectional study. Data was collected only from the different higher secondary school situated in the Agartala Municipality Area, West Tripura. Stratified random sampling technique was used.They were well explained about the experimental protocol to allay apprehension. They took light breakfast 2-3 hr before the test and refrained from any energetic physical activity for that period. The participants had no history of any major disease and received no physical conditioning programme except some recreational sports. The study was done during 2006-2010.

Prior to initial testing all selected boys and their parents were given a complete explanation of the purposes, procedures, and potential risks and benefits involved in the study. They were asked to read and sign a statement.

Experimental Design

Maximum oxygen consumption of each subject was determined by indirect methods, All the subjects were instructed to avoid heavy exercise and food intake at least 2 hrs before the test. The detailed procedure of the test was explained to the subjects and the demonstration of the test was given to them. Subjects were also asked to take complete rest at least for half an hour prior to the exercise, so that pulmonary ventilation and pulse rate might come down to a steady state.

Decimal age was computed from date of birth and date of tests. Body weight was recorded using standard weighing machine when boys were without shoes and wearing minimum clothes. Height was measured by the anthropometric rod (Sodhi , 1991) ; body circumference (Johnson and Nelson , 1982) ; biepicondylar breadth of the humerus and femur (Heath and Carter,1967). Harpenden skinfold caliper was used for skinfold measurements at the site of biceps, triceps, subscapular and suprailliac by standard procedures (Eston et al.,1995). The body fat % was calculated by using the formula of Siri ,(1956).

The pubertal stage was assessed according to the indices developed by Marshal and Tanner(1970) by averaging pubic hair ratings with genetalia ratings to find out the sexual maturity status of the boys.

Prediction of VO_2 max by QCT

The step test was performed on a stool of 16.25 inches (or 41.3 cm) height. The subjects steps up and down on the platform at a rate of for 24 steps per minute for males, for a total of 3 minutes. The subject immediately stops on completion of the test, and the heart beats are counted for 15 seconds from 5-20 seconds of recovery.

Men : VO_2 max (ml/kg/min) = 111.33 (0.42 x HR Rec)

Whereas HR Rec= 15 sec recovery HR (bpm)

Statistical Analysis

Microsoft ® Office Excel 2003 (11.8326.8324) SP3 was used to analyze the collected data. Mean, standard deviation, t-test were performed to see whether any significant differences exist among the two groups tribal and non-tribal boys .The level of significance was set at $p < 0.05$.

RESULTS

The mean and standard deviation of the anthropometrical characteristics and VO_2 max of pre-pubertal boys are summarized in Table, 1 while those of the post-pubertal boys are presented in Table,2.

The non-tribal boys were significantly greater height ($p<0.01$) and weight than the tribal boys. In all circumferences i.e. MUAC ($p<0.01$), thigh ($p<0.01$), chest ($p<0.01$), and calf ($p<0.01$), significantly greater values were observed in tribal boys when compared to non-tribal boys. The tribal boy also showed significantly greater humerus ($p<0.01$) and femur ($p<0.01$) widths as compared to non-tribal boys. On the other hand, the percentage body fat ($p<0.01$), total body fat ($p<0.01$) and total skinfold thickness ($p<0.01$) were reported significantly greater among non-tribal boys. The tribal boys were found to have significantly greater mesomorphic component ($p<0.01$) when compared to non-tribal boys.

The results also indicated that VO_2 max of pre-pubertal and post-pubertal tribal boys (49.0ml/kg/min±1.8; 50.6ml/kg/min±3.4) are significantly higher than pre-and post-pubertal non-tribal boys (46.5ml/kg/min±1.3; 47.2ml/kg/min±3.4) at $P<0.01$ which are similar with finding of Miyatake et al., 2001. The degree of difference

Table1: Comparison of the anthropometric variables and VO_2 max of pre-pubertal tribal boys and non-tribal boys

Variables	Tribal boys (n= 150)	Non-Tribal boys (n= 150)	t-value with the level of significance
Age (yrs)	12.0± 0.8	12.2±0.8	NS
Height (cm)	138.7±6.0	141.6±5.8	4.20**
Weight (kg)	28.2±4.7	30.5±5.1	3.99**
Circumference			
MUAC (cm)	18.3±2.1	17.5±2.0	3.38**
Thigh (cm)	35.0±3.3	33.7±2.1	4.17**
Chest (cm)	65.2±4.0	63.5±3.8	3.71**
Calf (cm)	27.5±2.5	26.2±2.8	4.12**
Biepicondylar breadth of the humerus (cm)	5.40±0.54	5.08±0.50	5.32**
Biepicondylar breadth of the femur (cm)	7.50±0.93	7.26±0.81	2.41*
TST (mm)	25.2±2.1	27.5±2.3	4.74**
Body fat (%)	11.52±1.63	13.25±1.72	8.94**
Somatotype			
Mesomorphic component	2.06±0.35	1.85±0.50	4.24**
VO_2 max (ml .kg^{-1} mn^{-1})	49.0±1.8	46.5±1.3	13.43**

Values are (mean±SD) ; NS, Not significant; **, P < 0.01; *,P < 0.05 ; TST, Total skinfold thickness i.e. (biceps + triceps + subscapular +suprailiac+ calf); VO_2 max, peak oxygen consumption

Table2: Comparison of the anthropometric variables and VO_2 max of post-pubertal tribal boys and non-tribal boys

Variables	Tribal boys (n= 150)	Non-Tribal boys (n= 150)	t-value with the level of significance
Age (yrs)	15.5±1.2	15.7±1.2	NS
Height (cm)	158.0±4.7	160.6±4.6	4.82**
Weight (kg)	41.4±4.0	43.2±6.6	2.86**
Circumference			
MUAC (cm)	21.0±2.0	19.5±2.0	6.42**
Thigh (cm)	44.3±2.3	42.5±2.3	6.59**
Chest (cm)	76.2±3.5	74.5±3.6	3.99**
Calf (cm)	33.0±2.2	30.7±2.6	8.14**
Biepicondylar breadth of the humerus (cm)	6.20±0.28	6.05±0.58	2.85**
Biepicondylar breadth of the femur(cm)	8.50±0.65	8.04±1.07	4.39**
TST (mm)	28.4±2.2	31.0±3.2	3.87**
Body fat (%)	12.26±1.66	14.35±2.12	9.48**
Somatotype			
Mesomorphic component	2.26±0.39	2.10±0.35	3.71**
VO_2 max (ml .kg^{-1} mn^{-1})	50.6±3.4	47.2±3.4	8.53**

Values are (mean±SD); NS, Not significant; **, P < 0.01; TST, Total skinfold thickness i.e (biceps + triceps + subscapular +suprailiac+ calf); VO_2 max, peak oxygen consumption

found during pre-pubertal stage between two groups was 5.1 per cent and these differences increased to 6.7 per cent during post-pubertal stage. The cardiorespiratory fitness is reduced at post-pubertal stage of tribal groups (3.2 per cent) and non-tribal groups (1.5 per cent) when compared with the value of pre-pubertal tribal and non-tribal groups.

DISCUSSION

Height and weight are the most important indicators of health and nutritional status. The results of the present study show that the non-tribal boys were found taller and heavier than tribal boys.

Various circumferences like mid upper arm circumference (MUAC), thigh circumference and calf circumference were measured in tribal and non-tribal boys as the indicator of nutritional status and growth. The results revealed that all these circumferences were relatively and significantly higher in tribal boys as compared to those of non-tribal boys. Tribal boys show large dimension than their counterpart which may be due to ethnic factor.

Body fat is assessed to measure the body composition. The negative life style coupled with increased energy intake seems to be the reason for increase in fatness in non-tribal boys. It is concluded from the present study that tribal boys had less adiposity as compared with non-tribal boys.

The tribal boys exhibit considerably higher mesomorphic component throughout the periods as compared to their counterpart in cross-sectional study which may be due to relatively wider biepicondylar breadth of humerus and femur and the study also reveals that they are more physical active than non-tribal boys.

Queen's college step test provides a measure of cardio-respiratory or endurance fitness as it provides an estimation of VO_2 max indirectly. The tribal boys had found relatively higher VO_2 max in comparison to non-tribal boys which may be due to lean body weight and greater body size in them. The high body fat *per cent* of non-tribal boys can also lead to reduced cardiorespiratory fitness (Siahkouhian et al., 2006).

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REFERENCES

Dey S.K. and Debray P., 2003. A comparative study of maximal aerobic power of school boys of east and north-east regions of India. India Pediatr., **40**(2): 105-14.

Eston R.G., Fu F. and Fung L., 1995. Validity of conventional anthropometric techniques for predicting body composition in healthy Chinese adults. Brit J Sports Med., **29**: 52-56.

Heath H. and Carter J.E.L., 1967. Standard procedure for determination of somatotype. Amer J Phys Anthropol., **27**: 57-74.

Johnson B.L. and Nelson J.K., 1982. Practical Measurements For Evaluation in Physical Education. Third ed., Surjeet Publication,New Delhi (India)

Krahenbuhl G.S., Skinner S. and Kohart W.M., 1985. Development of maximal aerobic power in children. Exer Sports Sci Rev ., **13**: 503-538.

Marshall W.A. and Tanner J.M., 1970. Variations in the pattern of pubertal changes in boys. Arch Disab Child., **45**: 13-23.

Miyatake N., Nishikawa H. and Fujii M., 2001. Clinical evaluation of physical fitness in male obese Japanese. Chin Med J., **114**(7): 707-10.

Siahkouhian F., Rahmaninia U. and Barahmand U., 2006. Effects of body composition measures on dimensions of VO_2 max. J Fit.: 1-5.

Siri W.E., 1956. The gross composition of the body. In: *Adv. Biol and Med. Physics* ,Edited by J. Lawrence and C. Tobias C ,(Academic Press) London:239-280.

Sodhi H.S., 1991. Sports Anthropometry. A kinanthropometric Approach. ANOVA Publication, Mohali, India:136-174.