Assessment of Maximal Aerobic Power of Tribal Adolescent of Bardwan Division of West Bengal

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Abstract

The present investigation was undertaken by the investigators as an attempt to assess the Maximal Aerobic Power of tribal adolescents of Bardwan division of West Bengal. The subjects for this study were a total of 1050 subjects viz. 525 boys and 525 girls. 525 boys and 525 girls belonged to three age categories i.e. 12 to below 14 years, 14 to below 16 years and 16 to below 18 years of age. Thus, each age group of boys and girls consisted of 175 subjects. The selected physiological variable was VO_2 max. To assess the maximal aerobic power of the selected subjects the descriptive statistics was used. The average values of Maximal Aerobic Power of Boys: 12 to 14 Years 18.0741 ±1.86006, 14 to 16 Years 26.2155 ±2.68792 and 16 to 18 Years 37.1546 ±3.54514 respectively. The average values of Maximal Aerobic Power of Girls: 12 to 14 Years 17.3907 ± 214132, 14 to 16 Years 25.1779 ±273066 and 16 to 18 Years 35.8373 ± 2.78102 respectively. The present study reveals that significant difference exists between adolescent boys and adolescent girls at different age groups in relation to maximal aerobic power.

KEYWORDS: Maximal Aerobic Power, Tribal, Adolescents, Bardwan Division.
Abbreviations: VO_2 max., $ml.kg^{-1}min^{-1}$.

Introduction

Who has not heard the adage “Health is Wealth” yet; regrettably a large majority of us do not realize the meaning of good health or how to keep good health. The questions what goes in the making of good health? Each person does not have to acquire a basic physical fitness without which his daily work would seem to be a burden, nor would he be able to discharge his duties and responsibilities properly as a citizen. Broadly speaking a person is said to possess good health when he has the required basic physical fitness, mental alertness and moral and spiritual favour- the combination of all these will make a life happy and worth living.

Today play exists as a highly organized institution, since the revival of modern Olympics by Baron-de-Coubertin in 1896, over increasing international interest and participation in games and sports has been observed.

We live in a complex world. The acquisition of basic physical fitness is dependent on many factors. But we also live in an advanced age of science and technology which have in a since made it easier for us to keep fit with a little effort and indignation[1].

Now in the modern age of science and technology in every field of education, objectives are followed in accordance with the application of principles of scientific research. In the field of games and sports almost all the developed countries like U.S.A., Russia, Germany, Britain, Japan, and China etc. have progressed rapidly due to the scientific research and their application in the field. These countries are providing ample facilities and systematic program for physical education, especially for school children and university youths of the country. India is now becoming concerned about the physical fitness of the children and the youth, realizing that physical fitness is fundamental for happy healthy and purposeful living beside the contribution to economic growth of the nation.

Both heredity and environment provide for greater variations in growth. These variations complicate the job of the educator, especially physical educator. An important step in establishing the educational process for children is to understand the nature of the child as revealed by his biological, psychological, emotional and social needs. Teachers, coaches and researchers, who work with children, must understand the needs and characteristics of these children that motivate and structure the behavior of the various age levels (Harold M. Barrow, 1991). The physical education teacher must understand the children and their level of physical development and maturity. Several research studies have been undertaken in this field to find out the degree of differences of boys and girls at the same age level in their physical development and maturation. In early childhood, the growth and development of the child goes in a uniform manner (Hagen, Dexter and Williams, 1951). A person with a high VO_2 max necessarily has good function in each of these determinants. Conversely, a sedentary person has relatively poor function for each determinant, which results in a low VO_2 max (Mc. Ardle, Katch and Katch, 1991).

Now a day, it is the concern of all coaches to select the players for team games according to certain predetermined standards that predict performance on the basis of certain characteristics specific to each activity. Through certain tests coaches can judge the players ability and standard and they can make further modification of programme for improving the performance in games sports.

The physical fitness of a person involves not only freedom from diseases but also a means for state of positive healthy. The individual should be capable of undertaking severe physical exertions with ease and comfort without undue fatigue. To be a positive state of health: all the system if the bodies like respiratory, cardiovascular, skeletal, nervous and endocrine has to work at their optimum level. The diet has also to be adequate in caloric and nutritional content for proper growth and development of the body and efficient functioning of various systems.

The bench mark of aerobic capacity is accepted as maximal oxygen uptake which is used as a measure of aerobic power. Although laboratory testing using indirect calorimetric is the most accurate method to determine maximal aerobic capacity, the procedure is expensive time consuming and requires a highly motivated subjects exercising to voluntary exhaustion. Not all the individuals have the motivation to perform a maximal test and certain contra indications may prohibit maximal testing of some individuals. Consequently, test to estimate aerobic capacity was devised based on the heart rate response at a sub maximal workload. These methods, which commonly use bench stepping, cycle ergometer, and walking/running protocols, can be used to quickly test large groups of individuals. Some of the more will known

prediction tests include the Harvard Step Test , the Cooper 12 minute Run, 1.5 mile run, and the Astrand Rhyming Nomogram.
If sophisticated instruments are not available certain indirect methods of estimation of VO_2max have been suggested. VO2 max assessed by indirect methods Astrand[2] has given a nomogram for prediction of max VO_2 from heart rate of sub-maximal work load. This work load may be given by bicycle ergometer, treadmill or step bench (for men and women) for six minute exercise with such a load. That heart rate reaches between 120 and 170 beats / min. In this case heart rate and oxygen consumption/minute can be measured between 5 to 10 minutes. These heart rate and oxygen consumption data are applied to nomogram to predict the max VO_2 max. This test is valid for age group of 25 years the approximate are correction factor must be applied to predict max VO_2.

1.1 Objective of the Research

Sports have gained tremendous popularity all over the globe during the last few decades. The popularity of sports is still increasing at a fast pace and this trend is likely to continue in the future. India the largest democratic is not lagging behind in this aspect. India is often referred as the land of contrast with a population of over 1 billion. The diversity in its culture, customs, foods, languages and moods are glaringly visible. Since in India many youths and adults do not fully understand and appreciate the importance of health and fitness, a heavy responsibility rests on the shoulders of teachers and coaches. The main objective of the study was to find out the true picture of cardiovascular endurance in general and VO_2 max in particular of the tribal adolescents of the tribal adolescents of Bardwan division of West Bengal of India. The outcome of the study would not only help the trainers to know the physical standard of the children for which accordingly they would be trained but also to develop health related physical fitness program or training schedule. This study would also help to know the strong and weak point of the selected population.

2. Materials and Methods

The purpose of the study was to find out the maximal aerobic power of the tribal adolescent boys and girls and then further divide the group into three age categories so that the cardiovascular efficiency could be assessed in relation to their growth.

2.1 Subjects

The subjects for this study were a total of 1050 subjects viz. 525 boys and 525 girls. 525 boys and 1005 girls belonged to three age categories i.e. 12 to below 14 years, 14 to below 16 years and 16 to below 18 years of age. Thus, each age group of boys and girls consisted of 175 subjects. The subjects of the study were selected at random. Only healthy adolescents were selected on the basis of teachers of their respective school's appraisal. For the true representation of the subjects the scholar selected them only from the schools of State Government and Private Schools, since students of original natives of that particular area whose parents had been spanning

[2] P. Astrand and I. Rhyming. "A Nomogram for Calculation of Aerobic Capacity) Physical Fitness) from Pulse During Sub maximal Work," **Journal of Applied Physiology** 7 (1954):218-221.

the entire strata in terms of economic consideration belong to those schools. The subjects belonged to different socio-economic status.

As pet the Archeological Survey of India, New Delhi, Metrological Department, New Delhi and the website **www.khoj.com** the Indian State of West Bengal is divided into three administrative division viz. Burdwan Division, Jalpaiguri Division and Presidency Division. The Burdwan division consists of seven districts namely Bankura district, Bardhaman district, Birbhum district, East Midnapore district (Purba Medinipur), Hooghly district, Purulia district and West Midnapore district (Paschim Medinipur).

2.2 Procedure

Indirect measurement of maximal aerobic power was applied by using Astrand and Astrand Nomogram. Indirect measurement of maximal aerobic power was conducted because of reliability and administrative feasibility on a large number. To obtain required data for the study a step up test was adopted to assess VO_2 max of adolescent boys and girls by Astrand and Astrand Nomogram. For the step up test the subjects were asked to step all the way up on the bench each time with the body erect. The stepping process was performed in four counts as: The stronger foot placed on bench; other foot placed on the bench; stronger foot placed on floor; other foot placed on floor. Soon after the cessation of 5 min. exercise on the bench, heart rate was recorded from 0 to 10 seconds, which was further converted to 60 seconds in terms of number of beats/min. Maximal Aerobic Power (VO_2 max) was measured in $ml.kg.^{-1}.min^{-1}$ using Astrand and Astrand Nomogram.

2.3 Pilot Study

A pilot study was conducted to assess the optimum work load (number of steps per minute) which brought the heart rate of the subjects approximately between 125 to 170 beats/minute after 5 minutes of step ups on specific height bench for both girls and boys of all the age groups at that optimum work load. The height of the benches was fixed as for boys 16 inches and for girls 13 inches.

3 Results

The results found after analyzing the data have been presented in the following tables.

Table -1

Descriptive statistics of Adolescent Boys in Burdwan division of West Bengal

Age Category	Mean	Std. Deviation
12 to 14 Years	18.0741	1.86006
14 to 16 Years	26.2155	2.68792
16 to 18 Years	37.1546	3.54514

Third and fourth column of Table-1 clearly indicates the mean and standard deviations of Adolescent Boys in Burdwan division of West Bengalwere **12 to 14 Years** 18.0741 ±1.86006, **14 to 16 Years** 26.2155 ±2.68792 and **16 to 18 Years**

37.1546 ±3.54514 respectively.

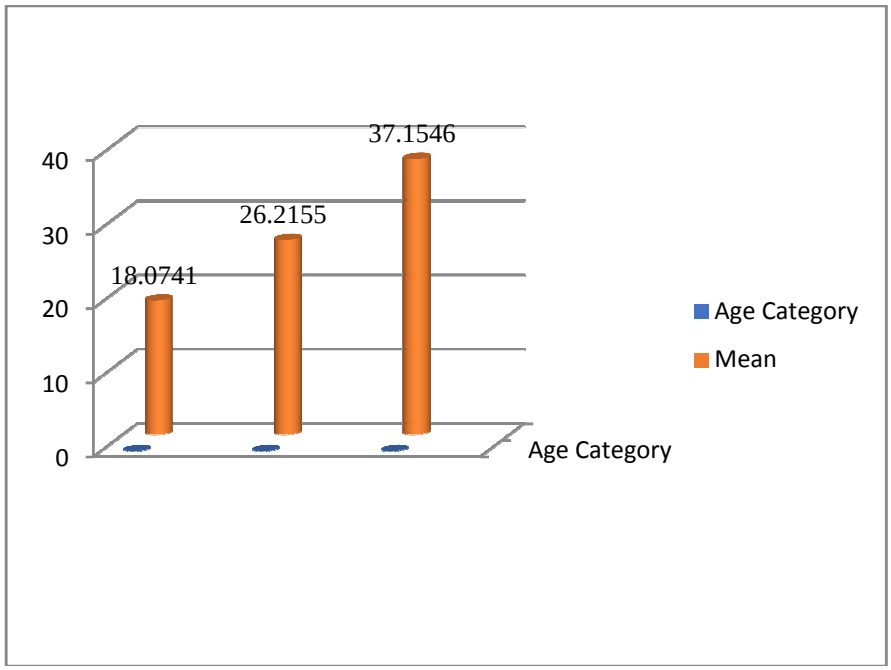

Table -2
Descriptive statistics of Adolescent Girls in Burdwan division of West Bengal

Age Category	Mean	Std. Deviation
12 to 14 Years	17.3907	2.14132
14 to 16 Years	25.1779	2.73066
16 to 18 Years	35.8373	2.78102

Third and fourth column of Table-2 clearly indicates the mean and standard deviations of Adolescent Girls in Burdwan division of West Bengalwere **12 to 14 Years** 17.3907 ± 214132, **14 to 16 Years** 25.1779 ±273066 and **16 to 18 Years** 35.8373 ± 2.78102 respectively.

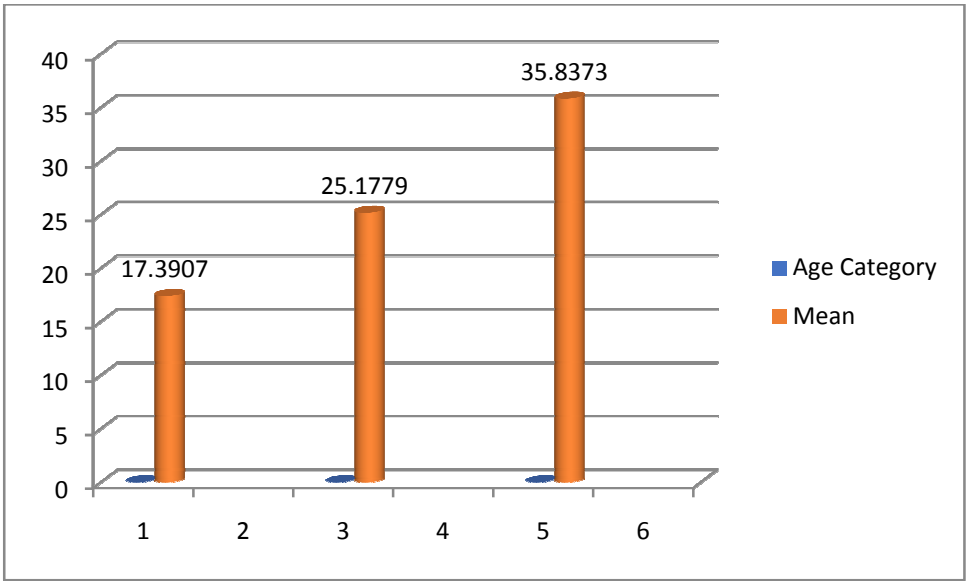

Table -3
Descriptive statistics Maximal Aerobic Power of Adolescent Boys and Girls in Burdwan division of West Bengal

Sex	Mean	S.D.
BOYS	27.0796	8.26193
GIRLS	26.2178	7.97770

Second and third column of Table-3 indicates the mean and standard deviations of Adolescent Boys and Girls in Burdwan division of West Bengalwere 27.0796 ±8.26193, GIRLS 26.2178 ±7.97770 respectively.

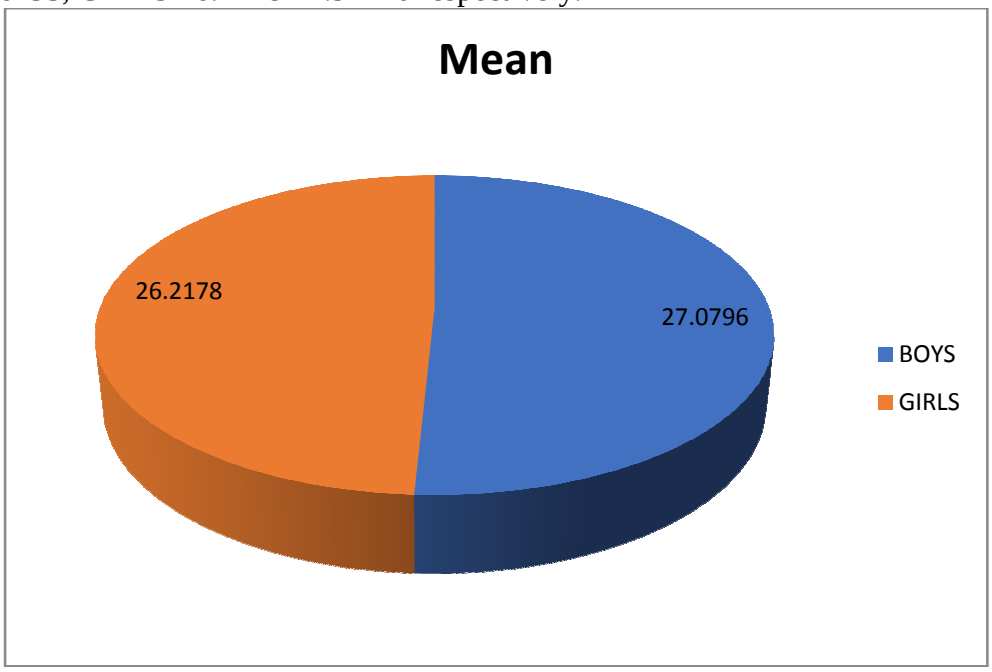

Table -4
Comparison of Mean on VO_2 Max between Adolescent Boys and Adolescent Girls in Burdwan division of West Bengal

Variable	Group Mean		Mean Diff.	σ Dm	t-Ratio
	Boys	Girls			
VO_2 max	27.0796	26.2178	.8618	.16202	5.319*

*Significant at .05 level of confidence
$t_{.05}$ (1048) =1.980

It is evident from Table-4that there was a significant difference between the means of boys and girls on the scores of VO_2 max since the obtained value of 't' (5.319) was higher than the tabulated value of 't' (1.980) which was required to be significant at (1048) degree of freedom with 0.05 level of confidence. Thus there was a significant difference between the mean of boys and girls of Burdwan division of West Bengal.

Table -5
Percentile norms of Maximal Oxygen Uptake of Adolescent boys and Adolescent girls in Burdwan division of West Bengal (N=525)

SEX		BOYS	GIRLS
Percentiles	5	16.34	14.63
	10	17.32	16.34
	15	17.98	17.56
	20	18.64	18.27
	25	19.63	18.94
	30	20.00	19.68
	35	21.16	21.06
	40	24.15	23.26
	45	24.75	24.18
	50	26.35	25.05
	55	27.56	26.35
	60	28.56	27.56
	65	29.68	29.68
	70	34.02	32.15
	75	34.87	34.26
	80	36.26	35.26
	85	36.98	36.26
	90	38.67	36.96
	95	40.15	38.95

4 Discussion and Conclusions

From the results it is obvious that the 16 to 18 years boys had shown highest VO_2 max (**37.1546)** in comparison to 12 to 14 and 14 to16 years and on the other hand 16 to 18 years girls had shown highest VO_2 max (**35.8373)** in comparison to 12 to 14 and 14 to16 years. The reason could be that they were directly involved in the activity which is primarily aerobic in nature.

Further the boys of 14 to 16 years and girls of 14 to 16 years had more or less same VO_2 max with a small range of variation. The reason could be that they were involved in similar kind of training/ school activity, which is based on strength endurance and explosive strength.

On the other hand girls of 12 to 14 years have shown the lowest VO_2 max. This is probably because area of school may have adapted activities which may be primarily an anaerobic base activity where VO_2 max is not an essential quality more over the duration of activity may also very short and moreover it might be possible their physical activity classes are not probably taken care of..

Normally the boys are having high tendency of engaging themselves in variety of activities. Thus their VO_2 max is above then the girls.

To conclude the discussion of finding it can be stated that subject chosen in this above study were mainly selected from the Bardwan division of West Bengal, who belong to tribal community who still feel themselves out of world and most of them are the first learner of their family. But one finding is very clear that on an average the VO_2 max of all the subjects were 27.0796 for boys and 26.2178 for girls. Whereas the values of normal sedentary individuals should be between 38-40 ml./kg.[3]. This might be attributed by the fact that most of the subjects selected for this study belonged to very poor family who basically don't understand the importance of health properly. A lot has to be done to improve the overall physical efficiency of the children belonging to the tribal community of west Bengal.

Research Highlights

- The VO_2 max was measured using the indirect method by using the Astrand and Astrand Nomogram.
- Specific bench heights were used for the Step-up test.
- Only the Adolescents between the age group of 12 to below 18 years were considered for the study.
- The subjects were drawn from the Bardwan division of West Bengal of India. The entire population was stratified and clustered to reduce the heterogeneity of the population.

Limitation

Thought the subjects selected for this study were all belong to tribal community still they varied in their diet, social and economic status which the scholar tried to control by selecting the subject by following proper sampling technique but that heterogeneity if neglected is considered as the limitation of the study. The study was limited to the indirect measurement of maximal aerobic power using Astrand and Astrand nomogram. To minimize the error the scholar got the proper training of measuring the pulse rate.

Recommendations

Similar types of study may be conducted in the other part of India and further comparison can be done among the groups. A similar study could be conducted by

[3]S. Chatterjee, P. Chatterjee, P.S. Mukharjee and A. Bandyopadhyay, **British Journal of Sports Medicine**, Validity of Queen's College Step Test for the Use of Young Indian Man (Men) 38 (2004): p. 281-291.

selecting another indirect experimental method and further validate that method scientifically. It is further recommended to formulate norms of cardiovascular efficiency based on direct or indirect experiments and the fitness of the youths should be assessed accordingly.

Acknowledgment

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Author's Contribution and Competing Interests

The whole study will help to add new knowledge in the field of physical education in general and exercise physiology in particular. The study will help to help to know the cardiovascular efficiency in quantitative manner of the tribal adolescents of Bardwan division of West Bengal of India. The outcome of the study might help physical educators or coaches to evaluate and modify the training programs pertaining to cardiovascular fitness. This study will help to assess the proper growth pattern of the Bardwan division of West Bengal.

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