INTRODUCTION

The concept of “Physical efficiency” emerges by the late 1800s and early 1900s, characterized by efficient functioning of the body systems, viz., the circulatory, respiratory, muscular and nervous systems (Park, 1989). In the field of sports and work physiology, the study of body composition and physical performance has become a major interest. One’s capacity of doing any particular work for a prolonged period is different from another. One can work for a longer period with ease and without excessive fatigue but other does not. The factors that influence physical efficiency of an individual are physical fitness components such as strength, speed, agility and endurance. Physical efficiency is a significant component of physical fitness, it is very important for children and youth population. Progressive development in childhood was indicated by higher level of physical efficiency and during adulthood increased physical efficiency reduces the risk of civilization illness and retards involution (Ignasiak et al, 2003). Estimation of physical efficiency is a measure of biological quality of a population. In childhood, enhanced physical efficiency helps to maintain fitness of body, mind and character, which would help the children to remain mentally alert, physically strong and efficient to withstand stress and fatigue of everyday life. Information about the status of health related physical efficiency is a very crucial public health related issue for the tribal population of India having poor socio economic condition. Hence, in order to get some information about health related physical efficiency of tribal school going boys and their comparison with non-tribal counterparts, the present study was planned. The Bengali generally belongs to Indo-Aryan ethnic group and forms a heterogeneous population (Risley, 1891). In India the majority of Bengali is concentrated in the states of West Bengal, Tripura and Assam.

Out of the nineteen enlisted tribes found to be settled in Tripura today, eight, namely, Tripuri, Reang, Noatia, Jamatia, Halam, Kuki, Chaimal and Uchrai are known to have migrated to Tripura from other parts in the historical period, but they are considered to be the original settlers of Tripura (Adhikari,1988). Ethnically the Tripuris belong to Indo-Mongoloid origin and linguistically resembles to the Tibeto-
The Tripuris have well marked Mongolian characteristics with flat faces and thick lips. The pocket areas of the Tripuris are in Kamalpur sub-division (under North Tripura District), Khowai and Sadar Sub-division (under Khowai and West Tripura District) and Belonia (under South Tripura District). Besides these areas they are found to live scattered in small groups in other places also. The Tripuris, excepting the dwellers in the plains, live in a ‘Tongs’ or pile houses, on the hill tops. In spite of the spread of plough cultivation the ‘Tripuris’ still stick to the age old ‘JHUM’ or shifting cultivation on the slopes of hills but now-a-days they are more or less settled in the plains and started the plough cultivation in the plain land. Some are engaged in the work of daily labour, forest dwellers in search of fire woods, and very few are engaged in rubber plantation and work as tappers (Adhikari, 1988).

It is believed that the Reangs belong to the Mongoloid racial stock and their dialect has been classified as belonging to the Austro-asian group of Tibeto-Burman family. They are the endogenous tribe and had very little contact with Bengalis. Hence both socially and culturally they are much behind the Tripuris (Adhikari, 1988). The Reang are unevenly distributed over the whole state. And within the state, internal migration took place. That is evident from their district-wise distribution. The Reang are primarily a tribe dependent on agriculture. They practice ‘JHUM’ cultivation like Tripuris normally on the slopes of a hill (Choudhury, 2011). Besides agriculture they also work as forest dwellers to gather firewood for selling in the nearby markets.

In South Tripura majority of the population belongs to the Bengali ethnic group (63.6%) and 35.8% of the population are the Tribal population in rural areas out of which the Tripuri contributes the major part. It is more than 54% and the Reang shares more than 16%. The present study was carried out with two main objectives first to find out the status of health related physical efficiency and secondly to compare the physical efficiency status between tribal and non-tribal school students.

Tribal children are the most vulnerable section in our society, they receives less nutrition, due to their forest dwelling practices and other daily earning activities, they are facing hard livelihood, moreover they had poor access to different state and central government facilities that are announced time to time. Non-tribal populations of rural areas are also facing the same problems. Poor socioeconomic status and illiteracy are the contributing factors for under nutrition and poor health status. In a study conducted on physical fitness of tribal and non-tribal high school students it was found that the tribal students were superior in terms of explosive strength than the non-tribal boys and girls; better flexibility was reported in non-tribal boys and girls; tribal boys showed better dynamic flexibility than non-tribal boys; better endurance was found in non-tribal boys than the tribal boys; non-tribal girls showed lower endurance and speed in comparison to tribal girls (Devi, 2000).

In another study conducted by Dhara et al (1995) showed that tribal boys had significantly higher physical efficiency compared to non-tribal students of 14 to 17 years.

Children’s physical efficiency/fitness studies are many in different parts of the world, but among the present population, no such study has been conducted so far. Further, no study was found in the literature regarding the physical efficiency of the children of the Tripuri and Reang population.

**MATERIALS AND METHODS**

Seven hundred seventy two subjects from two tribal communities (Tripuri and Reang) and Bengali community in the age group of 8-15 years from seventeen schools of two sub divisions, in the south district were chosen randomly for the present study. The subjects were from similar socioeconomic condition. Ethical approval and prior permission were obtained from the institutional Ethics Committee before commencement of the study and the experiment was performed in accordance with the ethical standards of the committee and with the Helsinki Declaration of 2000 (Touitou et al, 2004). Written consent was taken from the subjects in prescribed format. The age of the subjects was obtained from the school records. The socioeconomic status of the participants was evaluated by modified Kuppuswamy’s scale (Gururaj and Maheshwaran, 2014). The socioeconomic status of the participants was determined by the scores suggested in this scale. The body mass index (BMI) of the subject was determined by dividing the weight (kg) by the squared value of height (meter) (Park, 2017). The factors that influence physical efficiency of an individual are physical fitness components such as cardio-pulmonary fitness, strength, endurance, flexibility and body composition were measured by using standard methodologies. Cardio-pulmonary fitness was measured by Queens college step test (Mc Ardle et al, 2006), hand dynamometer was used to measure hand strength, the test was repeated for three times with sufficient rest intervals in between (Johnson and Nelson, 1996). Modified push-ups was measured by using the standard procedure of Johnson and Nelson (1996). Modified push-ups was watched carefully so that the body must maintain a straight line throughout the trial without sagging. For modified sit and reach test flex measure case was used. The reading is taken at the near edge of the flex measure case. Three trials are given as per the standard methodology of Johnson and Nelson (1996). After data collection, analysis was performed using SPSS software version 23.

**RESULTS**

Altogether 256 Tripuri boys, 260 Reang boys and 256 Bengali boys aged 8-15 years, were included in the study. Table 1 showed the age wise distribution of both tribal and non-tribal communities.

<table>
<thead>
<tr>
<th>Category</th>
<th>Age (Years)</th>
<th>No. of Boys</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tripuri</td>
<td>8</td>
<td>33</td>
</tr>
<tr>
<td>Reang</td>
<td>9</td>
<td>31</td>
</tr>
<tr>
<td>Bengali</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>Tripuri</td>
<td>11</td>
<td>31</td>
</tr>
<tr>
<td>Reang</td>
<td>12</td>
<td>31</td>
</tr>
<tr>
<td>Bengali</td>
<td>13</td>
<td>34</td>
</tr>
<tr>
<td>Tripuri</td>
<td>14</td>
<td>33</td>
</tr>
<tr>
<td>Reang</td>
<td>15</td>
<td>33</td>
</tr>
</tbody>
</table>

Table 2 showed that the participants mostly belonged to lower class strata (Upper middle: 4.30% Tripuri, 5.38% Reang and 3.52% Bengali; lower middle: 8.98% Tripuri, 15.38% Reang...
and 8.59% Bengali and upper lower : 86.72% Tripuri, 79.23% Reang and 87.89% Bengali) of the society, as indicated by modified Kuppuswamy’s scale.

Table 2 Socio-economic status of Tripuri, Reang and Bengali students

<table>
<thead>
<tr>
<th>Socio-economic status</th>
<th>Tripuri</th>
<th>Reang</th>
<th>Bengali</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boys</td>
<td>Boys</td>
<td>Boys</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>Upper middle</td>
<td>11</td>
<td>4.30</td>
<td>14</td>
</tr>
<tr>
<td>Lower middle</td>
<td>23</td>
<td>8.98</td>
<td>40</td>
</tr>
<tr>
<td>Upper lower</td>
<td>222</td>
<td>86.72</td>
<td>206</td>
</tr>
</tbody>
</table>

Table 3 Classification of grades of malnutrition (thinness) according to BMI for age of Tripuri, Reang and Bengali boys

(Figures in the parenthesis indicate percentage)

Table 3 clearly indicated that the nutritional status of Tripuri, Reang and Bengali, boys were not satisfactory with very high rates of thinness of 54.69%, 56.15% and 65.63% respectively. The recent study of Cole et al. (2007) has stated that undernutrition could be better assessed as thinness (low body mass index for age) than as wasting (low weight for height). Thinness has been assessed using the indicator BMI- for age and compared with the z-score classification by WHO (2007) and as per the data from Table 3 it was observed that the degree of total malnutrition was higher among Bengali students followed by Reang and Tripuri students respectively.

The performances of both tribal and non-tribal school children in terms of different physical efficiency tests was represented in Table 4 and Table 5 according to the age of the subjects.

Table 4 Hand strength, Flexibility and Endurance of Tripuri, Reang and Bengali boys in different ages

Table 6 and 7 showed the comparison of physical efficiency variables between the children of Tripuri, Reang and Bengali communities. From the results presented in the Table 6 which showed the comparison of physical efficiency variables between tribal and non-tribal children of 8-10 years and 11-12 years, it was revealed that in case of boys significant (p<0.001; p<0.05) differences were noted between Tripuri and Reang boys as well as Tripuri and Bengali boys for the variables flexibility and maximum aerobic capacity. In 11-12 years age group Tripuri boys showed higher hand grip strength than that of Bengali and Reang children. Tribal students showed higher hand strength, better flexibility and cardio-respiratory endurance compared to non-tribal children. However, Bengali boys showed higher upper body endurance in comparison to Tribal students.

Table 6 Comparison of physical efficiency variables among Tripuri, Reang and Bengali children of 8-10 years and 11-12 years age group

The comparison between tribal and non-tribal children in terms of physical efficiency variables in 13-15 years has been shown in Table 7. In this particular age group, no significant differences were noticed, which clearly indicates that the physical efficiency gradually decreases with advancement in age, moreover the results showed that the children in this age group exhibits lower levels of physical activities and children of all the communities showed more or less similar values of hand grip strength, flexibility endurance and VO2 max.
DISCUSSION

Tribal community showed slightly better socio-economic status than their non-tribal counterparts. This might be due to fact that Bengali community rely mostly on agriculture and some of them working as daily labourers and hawkers. Only a little percentage of this community had small business or employed in Government service. The people of the tribal community, on the other hand, were engaged in small business or employed in Government services and some of them were working as tappers in rubber plantation fields, in addition to their engagement in agricultural work. Beside these tribal population were also engaged themselves in Jhum cultivation. Women of this community were used to bring the fuel wood from forests and sell in the local markets. They also earned money by selling vegetables grown from Jhum cultivation.

Prevalence of undernutrition continues to be a problem of higher magnitude in developing countries like India. Several earlier studies have shown that dietary and environmental constraints to be the major causes of undernutrition (Dugdale et al, 1994; Chatterjee, 2007). Besides this, poor socioeconomic status, lack of proper nutritional knowledge, poor food habits, lack of social awareness, genetic factors might also be responsible for undernutrition among the present studied population. The prevalence of thinness observed in the present study was almost similar with the findings of IIPS (2007).

From the ANOVA results it was revealed that there were significant variations (p<0.001; p<0.05) of the scores of physical efficiency parameters among the children of different ages. The mean scores of hand grip strength of both tribal and non-tribal children in higher age groups were significantly greater (p<0.001) when compared with lower age groups. It referred to the muscular strength of an individual and the results also indicated that mean scores were significantly increased (p<0.001) with the advancement of age which might be associated with the changes in muscle mass during the growth period of the children. Similar findings were reported by Sartario et al (2002). Similar trends of results were noted in case of tests for flexibility, endurance, VO_{2} max and Physical fitness index. The mean scores of flexibility, endurance and VO_{2} max were significantly (p<0.05) increased with advancement of age in both tribal and non-tribal children.

When all age groups were considered together it was observed that Tripuri children had significantly greater scores in most of the physical efficiency parameters than that of Bengali children. In some of the cases, although, the differences were not significant but there were a tendency of higher scores in Tripuri boys. The Reang boys also had significantly higher physical efficiency scores than that of Bengali boys in some of the cases. Only in a few cases Bengali children showed significantly higher scores of physical efficiency variables than that of Reang children.

The differences in the hand grip strength values might be due to ethnic variations, differences in socio-cultural environment, nutritional status, genetic factors and lifestyle variations among children of different communities of different age groups. Similar conclusions were drawn by Al-Hazzaa et al (2002, 2011) that hand grip strength was related to life style pattern and socio-cultural environment of the Saudi school children. Other groups of investigators (Yim et al, 2003; Poole et al, 2005, Hager-Ross et al, 2002) showed that anthropometrical variables and ethnicity influences hand grip strength. Moreover, in a study conducted by Jeune et al (2006) showed the influence of nutritional status, genetic factors and socio-cultural environment on handgrip strength. Sartorio et a. (2002), had reported age-dependent increase of hand grip strength, which strongly correlated with muscle mass during the childhood.

Bengali boys showed lower flexibility in comparison to the children of both the tribal communities. This might be due to the different socio-economic condition and different culture (Sarkar et al, 2015), age (Brown and Miller,1998) and heritability (Youdas et al, 2008). The significant difference in flexibility was found at the age of 8-10 years of age group between tribal and non tribal communities might be due to differences in ethnicity, life styles and socio-economic status. Lower BMI results in lower flexibility which was in conformity with the findings obtained by Aboshkair et al (2012). No significant difference was obtained in flexibility scores between tribal and non-tribal boys of 11-12 years and 13-15 years of age group. Lower BMI and unhealthy life styles among the children might be the reason for non-significant relationship in these age groups.

Endurance scores of boys of all age groups did not showed any significant differences between tribal and non tribal communities. Endurance is the measure of upper body muscle strength which depends on growth and maturation process. Boys of both the tribal communities and Bengali community exhibited similar growth patterns as a result no significant difference was found. The physical activity status is an important determinant of endurance also reported by Fang et al, (2016). The children of higher age groups showed increased growth and increased muscle mass but they showed lack of physical activities or reduced physical activity at the school as well as in the household works.

Maximum aerobic capacity or oxygen uptake levels (VO_{2}max) depends on hematological changes, cardiovascular activities and pulmonary functions. It gave necessary information regarding the cardiovascular and respiratory systems in carrying out the vital functions like circulation of blood and respiratory gaseous exchange. Maximum gaseous uptake was the best indicator for cardiovascular status. In the present study, VO_{2} max scores showed significant difference (p<0.001) in lower age groups. Among the tribal, Reang boys showed higher values than Tripuri and Bengali boys. In 11-12 years of age groups boys did not show any significant differences between tribal and non tribal communities. Again in 13-15 years of age group no significant difference was found among boys of tribal and non tribal communities.

The VO_{2} max values increased with increment of age in both tribal and non-tribal communities. Age wise variation might be due to the differences in growth pattern, increased levels of activities and muscular development. During adolescent period boys showed higher values of VO_{2} max. Rodrigues et al (2006) also concluded that during adolescent period maximum value of VO_{2} max was found.

In the present study, Reang boys showed higher values of VO_{2} max in 8-10 years of age, this might be due to higher growth status of Reang boys. Tribal children showed higher
values of maximum oxygen uptake compared to non tribal Bengali communities.

The differences in the physical efficiency variables among the ethnic groups were probably due to genetic factor and socioeconomic conditions. In addition to that the tribal children had higher physical activity level in their daily life. The tribal students are generally laborious and most of them are forest dwellers and traditionally they occupy in the hill slopes. As a result of this, their cardio-respiratory endurance and strength were higher than the Bengali children. Similar conclusions were also drawn by other investigators (Devi,2000; Haider et al,1987 and Sarkar and Paul, 2015).

It may be pointed out that significant difference in physical efficiency parameters was noted mostly in lower age groups (8-10 years). The cases of significant difference became fewer with the increase of age. Further, it was noteworthy that the physical efficiency scores were greater in Tripuri children than that of other two groups, particularly non-tribal children.

So it may be stated that the tribal boys were more physically efficient than that of non-tribal children.

**CONCLUSION**

The study reveals that all the studied tribal and non-tribal children belonged to low to middle socio-economic group. Tribal population had slightly better socio-economic condition compared to their Bengali counterpart.

The prevalence of undernutrition, in terms of WHO defined BMI for age, in Tripuri children was slightly below 55.0%, and in Reang children it was more than 55.0%. The Bengali children showed the highest percentage of malnutrition which was more than 65.0%. This might be due to a poor socio-economic status, low (parental) cultural status, income source, poor feeding practices and both quality and quantity of food was thought to play an important role for the incidence of these types of under nutrition.

The comparison of different physical efficiency parameters between tribal and non tribal children represented notable variations. When all age groups were considered together it was observed that Tripuri children had significantly greater scores in most of the physical efficiency parameters than that of Bengali children. In some of the cases, although, the differences were not significant but there were a tendency of higher scores in Tripuri boys. The Reang boys also had significantly higher physical efficiency scores than that of Bengali boys in some of the cases. Only in a few cases Bengali children showed significantly higher scores of physical efficiency variables than that of Reang children. Thus it may be concluded the ethnicity had an influence on the physical efficiency in children.

**Acknowledgement**

I am thankful to the academic and administrative heads of different schools for granting permission to carry out the study. The investigator thanks to all the participant students of the study for sharing their valuable time, active participation and co-operation without which this study could not have been possible. I would also like to thank my students, those who help me to carry out the field study.

**Conflict of Interest**

The author declares that there is no conflict of interest.

**References**


How to cite this article:
Deb, P and Dhara PC.2020, Comparative Study on Health Related Physical Efficiency Between Tribal and Non Tribal School Going Boys of South Tripura, India. Int J Recent Sci Res. 11(05), pp. 38388-38393.
DOI: http://dx.doi.org/10.24327/ijrsr.2020.1105.5301

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