**Physical, physiological and anthropometrical profile of young male tribal and nontribal football and hockey players: A comparative study**

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**ABSTRACT**

***Introduction: Tribal population constitutes about 8%-10% of total population in India. Many of the researchers pointed out that anthropometric and physical phenomenon of the players for achieving victory globally. The main objective of our current study was to assess whether there is any difference in terms of physical, physiological and anthropometrical components in Indian amateur male tribal and nontribal football and hockey players.***

***Material and Methods: The current research was conducted on total (n=37) male players; out of which 10 tribal, 10 nontribal footballers and 8 tribal, 9 nontribal hockey players were selected. Their BMI was assessed. Body composition including fat mass, fat free mass, total body water including intra and extracellular water, body cell mass, muscle mass, glycogen, total body potassium, total body calcium, and mineral content were measured using Bioelectrical Impedance Analysis. Back strength and hand grip strength were measured using back and grip dynamometer. PFT (Pulmonary Function Test) was assessed using digital spirometer.***

***Results: Mineral content of nontribal footballers was significantly higher than that of tribal population were respectively 4.75±0.51 and 2.57±0.37 kg. Muscle mass, glycogen content and relative back strength were significantly higher in tribal than that of non-tribal footballers and were respectively 27.32±3.29 kg, 459.8±63.95gm, 2.2±0.33 and 24.32±3.4 kg, 417.1±28.96 gm, 1.5±0.16. In case of hockey players total body water content was found to be significantly higher than that of nontribal players were respectively 67.92±1.51 and 61.91±2.79litre%. FEV% of tribal population was found to be significantly higher than that of nontribal players and was respectively 94.14±3.09 and 90.4±2.88.***

***Discussion and conclusion: The findings of the present study showed that tribal footballers were found to be more muscular. Further, they have higher relative back strength as compared to their nontribal counterparts. In case of hockey players total body water content of tribal population was found to be significantly higher than that of nontribal. Intracellular fluid content of nontribal hockey players was found to be significantly higher than that of tribal. These physical and physiological differences could be due to the genetically predisposed.***

# Key Words: Tribal; Non-tribal; Football; Hockey; Anthropometry; Physiological profiles

**INTRODUCTION**

The dictionary of anthropology defines tribe as a social group, usually with a definite area, dialect, cultural homogeneity and unifying social organizations (Charlotte and Singh, 2014).Tribal population constitutes about 8.6% of the total population of India. India is a dwelling place of almost more than half of the world’s tribal population. Many of the researchers pointed out that anthropometric and physical phenomenon of the players for achieving success in the International arena. In India, till date several tribal communities are widely distributed throughout the geographical extent (Chakravorty and Chatterjee, 2008). Tribals in India have to struggle hard for their survival and development (Shah, 1990).

The Central and State Governments in India are trying to help the tribal with various policies and programmes. Now-a-days they are showing keen interests in participating team games like football and hockey. Football and hockey are recognized as most popular sports around the globe. These games are very fast, quick and endurance based. They are considered as strenuous games because it demands a high degree of fitness as well as intelligence and alertness of mind, speed, agility, jumping ability which is the basic qualities for the athletes. To achieve the best possible performance, the training has to be planned and formulated according to the principles of periodization (Bompa, 1999).

Despite concern about the fact that morphological parameters are an essential part of the evaluation and selection of sport persons for diverse fields of sports, standard data on such parameters are still lacking in the Indian context of tribal foot ball and hockey players. The present study was therefore aimed at evaluating the physical, physiological and anthropometrical parameters of tribal and non-tribal football and hockey players in West Bengal, India, and to compare the data among them

MATERIALS AND METHODS

SELECTION OF SUBJECTS

The current research was conducted on total (n=37) male players; out of which 10 tribal, 10 nontribal footballers and 8 tribal, 9 nontribal hockey players. All the athletes (tribal and non-tribal) belonged to the Centre of Excellence (COE) and the SAI Training Centre (STC) Schemes of Sports Authority of India (SAI), Kolkata and Cuttack, Orissa. The athletes were at least of the state level performer with a minimum of 4–5 years of formal training history. They were evaluated for various physical and body composition variables at the Human Performance Laboratory of Sports Authority of India, Kolkata. They had almost the same socio-economic status with similar dietary habits and of similar training at same geographical and climatic conditions. Hence, these subjects were considered as homogenous.

Prior to initial testing, a complete explanation of the purposes, procedures, potential risks and benefits of the tests were given to the athletes. Clinical examinations of the participants were performed by SAI physicians who were specialized in Sports Medicine before the commencement of the various anthropometric and physiological tests.

SUBJECT CLASSIFICATION

Subjects of our present study who all are the young trainees of Sports Authority of India were classified as tribal and non-tribal groups following questionnaire method without hampering ethical limits and disclosing any matter. Tribal population of our present study are mostly the inhabitants of Mayurbhanj district, Sundargarh, Orissa. The main tribes of this district are Santal, Ho, Bhumji, Munda, Bhuniya, Mankadia and Kharia and others. Out of these Santal and Ho, Bhumji tribes are dominated.

TRAINING REGIMEN

The formulation and implementation of a systematic training program was made by qualified coaches with the guidance of a scientific expert from the Sport Science Department, SAI, Kolkata. The training regimen for both tribal and non-tribal athletes of the present study was held on average 4 to 5 hours every day except Sundays, which makes about 30 hours in a week. There were two sessions a day, i.e. the morning session and the evening session, both of which comprised physical training for one hour and skill training for about two hours. The physical training schedule included different strength and muscular endurance training programs along with flexibility exercises. A warm-up and cool-down session before and after the main practice were also included in the program. Besides the technical and tactical training, the athletes were also provided with a psychological or mental training session following standard methods as delineated in the studies of Manna and Adhikari (2018).

PROCEDURES

The physical characteristics of the groups including height (cm) & weight (kg) were measured by an anthropometric rod and digital scales, respectively, following a standard procedure (Sodhi, 1991).

The decimal age of all the subjects was calculated from their date of birth recorded from the original birth certificate, produced by them at the time of testing. The Body Mass Index (BMI) was calculated from body height and weight (WHO, 1995).

Back strength and hand grip strength (both right and left hand) were measured by a back and grip dynamometer (Senoh, Japan). The hip and back flexion as well as extension of the hamstring muscles was evaluated by a modified Sit-and- Reach Test using a ‘Flexometer’ (Lafayette Instrumental Co., USA) following a standard procedure (Johnson and Nelson, 1988).

Body composition including fat mass (FM), fat free mass (FFM), total body water (TBW), extracellular water (ECW), intra cellular water (ICW), the ratio between extra and intra cellular water (ECW: ICW), body cell mass (BCM), muscle mass (MM), total body potassium (TBK), total body calcium (TBCa), glycogen and mineral were measured using Bioelectrical Impedance Analysis (BIA) (Maltron Bioscan 920-2, Made in UK). Total body electrical impedance to an alternate current (0.2mA) with four different frequencies (5, 50, 100 and 200 KHz) was measured using a multi-frequency analyser. Measurements were taken following a standard testing manual of Maltron International. A subject was in a supine position taking rest for 5 minutes on a non-conducting surface, with the arms slightly abducted from the trunk and the legs slightly apart. Before placing the surface electrodes, the sites were cleaned using isopropyl alcohol ensuring adherence and to limit the possible errors. Surface electrodes were placed on the right side of the body on the dorsal surface of their hands and feet. In the case of hands, electrodes were placed proximal to the metacarpal-phalange and medially between the distal prominences of the radius and ulna. In the case of feet, electrodes were placed proximal to the metatarsal-phalange joints, respectively, and also medially between the medial and lateral malleoli at the ankle. Before testing, the analyser was calibrated according to the manufacturer’s instructions. Before taking the measurement, athletes were instructed, in consistence with Heyward and Stolarczyk (1996) to follow the guidelines: 1) no heavy exercise 12h before the test; 2) no large meals 4h before the test; and 3) consumption of liquids limited to 1% of body weight, or, two 8-oz glasses of water, 2h before the test. All the tests were conducted at a room temperature varying from 23 to 25 degree centigrade with relative humidity varying between 50–60%. PFT was assessed using digital spirometer.

**RESULTS**

Table 1 demonstrates the mean value, standard deviation, F value (level of significance) and P value (Post Hoc) of some physical parameters of tribal and non-tribal male footballers. Body weight was found to be significantly higher in case of non-tribal footballers (166.4±7.77) than their tribal peers (161.62±5.56) at (p<0.01). BMI, fat free mass, fat%, right hand grip strength, left hand grip strength of tribal footballers were found to be (19.89±0.89), (88.18±2.67), (12.28±2.30), (38.0±4.24) and (37.5±4.65) respectively and in case of their non tribal peers (20.52±1.49), (88.85±4.80), (10.96±4.43), (34.7±5.29) and (34.7±6.07). Relative back strength of tribal group (2.2±0.33) were found to be significantly higher than non-tribal (1.5±0.16) at (p<0.01).

**Table 1.**Comparison of some physical parameters of tribal and non-tribal male footballers

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| VARIABLES | FOOTBALL | F VALUE | P VALUE | POST HOC |
| TRIBAL | NON TRIBAL |
| Age (yrs) | 15.42±1.40 | 15.51±1.60 | 0.018 | 0.895 | - |
| Body height (cm) | 161.62±5.56 | 166.4±7.77 | 2.500 | 0.131 | - |
| Bodyweight (kg) | 52.05±4.19 | 56.7±6.06 | 3.985 | 0.048 | T Vs. NT\* |
| BMI | 19.89±0.89 | 20.52±1.49 | 1.303 | 0.269 | - |
| Fat free mass (kg) | 88.18±2.67 | 88.85±4.80 | 0.149 | 0.704 | - |
| Fat(%) | 12.28±2.30 | 10.96±4.43 | 0.702 | 0.413 | - |
| Right hand grip strength (kg) | 38.0±4.24 | 34.7±5.29 | 2.367 | 0.141 | - |
| Left hand grip strength (kg) | 37.5±4.65 | 34.7±6.07 | 1.340 | 0.262 | - |
| RELATIVE BACK STRENGTH | 2.2±0.33 | 1.5±0.16 | 8.001 | 0.011 | T\* Vs. NT |

Values (Mean ±SD), \*= p < 0.01, T=Tribal Group, NT =Non-Tribal Group

Table 2 presents the mean value, standard deviation, F value (level of significance) and P value (Post Hoc) of body composition of tribal and non-tribal male footballers. Muscle mass content (27.32±3.29) and glycogen content (459.8±63.95) of tribal group were found to be significantly higher than that of non-tribal (22.11±1.790) and (417.1±28.96) respectively at (*p*<0.01). Mineral content of non-tribal footballers (4.75±0.51) were found to be significantly higher than their tribal peers (2.57±0.37) at (*p*<0.01). Total body water (TBW), extracellular water (ECW), intracellular water (ICW), ECW/ICW, body cell mass (BCM), total body potassium (TBK) and total body calcium (TBCa) of tribal footballers were found to be (60.2±10.21), (36.87±5.52), (62.4±5.06), (0.59±0.14), (24.93±1.98), (118.98±9.34), and (895.7±85.07) respectively, in case of their non tribal counterparts the mean and standard deviation values are (63.58±3.21), (37.59±5.06), (63.17±5.56), (0.611±0.13) , (27.05±3.42) , (128.81±16.59) and (944.8±162.44) respectively.

**Table2.**Comparison of body composition of tribal and non tribal footballers

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| VARIABLES | FOOTBALL | F VALUE | P VALUE | POST HOC |
| TRIBAL | NON TRIBAL |
| Total body water (TBW) (lt) | 60.2±10.21 | 63.58±3.21 | 0.994 | 0.332 | - |
| Extracellular water (ECW) (%) | 36.87±5.52 | 37.59±5.06 | 0.092 | 0.765 | - |
| Intracellular water (ICW) (%)  | 62.4±5.06 | 63.17±5.56 | 0.105 | 0.750 | - |
| ECW/ICW | 0.59±0.14 | 0.611±0.13 | .065 | 0.801 | - |
| Body cell mass (BCM) (kg) | 24.93±1.98 | 27.05±3.42 | 2.744 | 0.115 | - |
| Muscle mass (MM) (kg) | 27.32±3.29 | 22.11±1.79 | 3.465 | 0.049 | T \*Vs. NT |
| Total body potassium (TBK) (gm) | 118.98±9.34 | 128.81±16.59 | 2.665 | 0.120 | - |
| Total body calcium (TBCa) (gm) | 895.7±85.07 | 944.8±162.44 | 0.717 | 0.408 | - |
| Glycogen (Gly) (gm) | 459.8±63.95 | 417.1±28.96 | 3.699 | 0.039 | T \*Vs. NT |
| Mineral (kg) | 2.57±0.37 | 4.75±0.51 | 6.759 | 0.018 | T Vs. NT\* |

Values (mean ±sd), \*= p < 0.01, \*\*= P < 0.001, T=Tribal Group, NT =Non-Tribal Group

Table 3 presents the mean value, standard deviation, F value (level of significance) and P value (Post Hoc) of pulmonary function of male tribal and non-tribal footballers. Forced vital capacity (FVC), forced expiratory volume in one second (FEV1), forced expiratory volume percentage (FEV1) and peak expiratory flow rate (PEFR) of tribal footballers are (3.34±0.6), (2.9±0.51), (88.7±1.89) and (471.2±6.19) respectively and that of their non tribal peers are (3.17±0.54), (2.84±0.59), (85.6±7.72) and (446.8±8.04) respectively. Pulmonary functions were consistent both in tribal and non tribal groups.

**Table 3.**Comparison of pulmonary function test of tribal and non tribal male footballers.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| VARIABLES | FOOTBALLERS | F VALUE | P VALUE | POST HOC |
| TRIBAL | NON TRIBAL |
| FVC | 3.34±0.63 | 3.17±0.54 | 0.416 | .527 | - |
| FEV1 | 2.9±0.51 | 2.84±0.59 | 0.105 | .749 | - |
| FEV1% | 88.7±1.89 | 85.6±7.72 | 1.521 | .233 | - |
| PEFR | 471.2±6.19 | 446.8±8.04 | 0.632 | .437 | - |

Values (Mean ±SD)

Table 4 represents the mean value, standard deviation, F value (level of significance) and P value (Post Hoc) of some physical parameters of tribal and non tribal hockey players. The mean and standard deviation values of age, body height, body weight, BMI, fat free mass (FFM), fat %, right hand grip strength, left hand grip strength and relative back strength of tribal hockey players were found to be (15.74±2.14), (162.1±5.47), (56.68±3.17), (21.24±0.93), (91.2±1.14), (9.36±0.73) , (41.6±6.11), (40.6±6.98) and (1.96±0.81) respectively, in case of their non tribal group the values were found to be (15.3±0.95), (166.07±5.99), (57.8±3.76), (20.96±1.24), (87.66±4.39), (12.36±4.05), (61.91±2.79), (47.2±4.94) and (1.84±0.15) respectively .

**Table4.** Comparison of some physical parameters of tribal and non tribal male hockey players

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| VARIABLES | HOCKEY | F VALUE | P VALUE | POST HOC |
| TRIBAL | NON TRIBAL |
| Age(yrs) | 15.74±2.14 | 15.3±0.95 | 6.568 | 0.078 | - |
| Height(cm) | 162.1±5.47 | 166.07±5.99 | 0.285 | 0.605 | - |
| Weight(kg) | 56.68±3.17 | 57.8±3.76 | 0.292 | 0.600 | - |
| BMI (kg/m2) | 21.24±0.93 | 20.96±1.24 | 0.183 | 0.678 | - |
| FFM | 91.2±1.14 | 87.66±4.39 | 3.028 | 0.112 | - |
| Fat % | 9.36±0.73 | 12.36±4.05 | 2.599 | 0.138 | - |
| Right hand grip strength (kg) | 41.6±6.11 | 61.91±2.79 | 0.019 | 0.001 | - |
| Lefthand gripstreength (kg) | 40.6±6.98 | 47.2±4.94 | 0.000 | 0.082 | - |
| Relative Back Strength | 1.96±0.81 | 1.84±0.15 | 1.487 | 0.046 | - |

Values (Mean ±SD)

Table 5 demonstrates the mean value , standard deviation , F value (level of significance) and P value (Post Hoc) of some physical parameters of tribal and non tribal hockey players. of body composition of tribal and non tribal male hockey players, total body water (TBW) (67.92±1.511) of tribal population was found to be significantly higher than their non tribal counterparts (61.91±2.79) at (*p*<0.01) and intracellular fluid (ICW) of non tribal group(57.04±3.15) was found to significantly higher than their tribal peers (62.78±4.93) at(*p*<0.01).Extracellular water (ECW) , ECW/ICW , body cell mass , muscle mass (MM), total body calcium (TBCa) , total body potassium (TBK), glycogen and mineral content of tribal hockey players were found to be (41.56±0.59), (0.7±1.25), (27.9±1.34), (24.96±1.74), (133.24±6.43), (1044.8±97.44), (469.0±24.87), and 3.43±0.36 respectively and in case of non tribal group (37.2±4.95), (0.61±0.110, (27.48±1.93), (24.8±1.99), (130.21±9.80), (979.0±93.84), (464.28±41.69) snd (3.82±0.38) respectively.

**Table 5.**Comparison of body composition of tribal and non tribal male hockey players

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| VARIABLES | HOCKEY | F VALUE | P VALUE | POST HOC |
| TRIBAL | NON TRIBAL |
| Total body water (TBW) (lt) | 67.92±1.51 | 61.91±2.79 | 18.780 | 0.001 | T \*Vs. NT |
| Extracellular water (ECW) (%) | 41.56±0.59 | 37.2±4.95 | 3.741 | 0.082 | - |
| Intracellular water (ICW) (%) | 57.04±3.15 | 62.78±4.93 | 5.187 | 0.046 | T Vs. NT\* |
| ECW/ICW | 0.7±1.25 | 0.61±0.11 | 3.117 | 0.108 | - |
| Body cell mass (BCM)(kg) | 27.9±1.34 | 27.48±1.93 | .169 | 0.689 | - |
| Muscle mass (MM) (kg) | 24.96±1.74 | 24.8±1.99 | .014 | 0.908 | - |
| Total body calcium (gm) | 133.24±6.43 | 130.21±9.80 | .360 | 0.562 | - |
| Total body potassium (TBK) (gm) | 1044.8±97.44 | 979.0±93.84 | 1.391 | 0.266 | - |
| Glycogen(GLY) (gm) | 469.0±24.87 | 464.28±41.69 | .050 | 0.827 | - |
| Mineral (kg) | 3.43±0.36 | 3.82±0.38 | 3.180 | 0.105 | - |

Values (Mean ±SD), \*= p < 0.01, T=Tribal Group, NT =Non Tribal Group

Table 6 presents the mean value, standard deviation, F value (level of significance) and P value (Post Hoc) pulmonary function tests of tribal and non tribal hockey players. FEV1% of tribal hockey group (94.14±3.08) was found to be significantly higher than their non-tribal peers (90.4±2.88) at (p<0.01). Forced vital capacity (FVC), forced expiratory volume in one second (FEV1) and peak expiratory flow rate (PEFR) of tribal hockey group were found to be (3.52±0.78), (3.22±0.57) and (414.4±38.68) respectively and in case of non tribal hockey group(3.24±0.66), (3.02±0.65 )and (411.17±97.08) respectively.

**Table 6.**Comparison of pulmonary function tests of tribal and non-tribal male hockey players

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| VARIABLES | HOCKEY | F VALUE | P VALUE | POST HOC |
| TRIBAL | NON TRIBAL |
| FVC | 3.52±0.78 | 3.24±0.66 | .444 | 0.520 | - |
| FEV1 | 3.22±0.57 | 3.02±0.65 | .278 | 0.609 | - |
| FEV1% | 94.14±3.08 | 90.4±2.88 | 4.537 | 0.049 | T \*Vs. NT |
| PEFR | 414.4±38.68 | 411.17±97.08 | .003 | 0.955 | - |

Values (Mean ±SD), \*= p < 0.01, T=Tribal Group, NT =Non Tribal Group

**DISCUSSION**

A number of underlying factors may contribute to an athlete’s performing capacity. The Importance of Muscular Strength in Athletic Performances has extensively been studied by several investigators. However, there is paucity of knowledge regarding tribal versus non-tribal sports performances. In our present study, we have critically analysed the physical, physiological and anthropometrical profile of young male tribal and nontribal football and hockey players with a view to find any comparison between these two groups.

Our present study indicates that the body weight and mineral content of nontribal male footballers were found to be significantly higher than their tribal counterparts. In football BMI, fat mass and lean body mass of an athlete closely relates to on-field performance. Movement and speed requires good strength, power and flexibility, but also too much body weight and air resistance can act to slow the person down. (Akgün, 1996).

Periodic measurement of body composition is essential to assess the effectiveness of training program and to monitor changes in body composition. Type, intensity and duration of exercise on body composition greatly affect athletes’ performance. The magnitude of changes in is related to age, genetics, environmental factors, nutrition and physical activity disease. Greater lean body mass can be affected by physical performance, and the higher values of fat free mass can be an advantage for athletes.

Minerals are essential for a wide variety of vital metabolic and physiologic processes in the

Human body. Some of the physiologic roles of mineral are their major involvement in: muscle contraction, normal hearts rhythm, nerve impulse conduction, oxygen transport, oxidative phosphorylation, enzyme activation, immune functions, antioxidant activity, bone health, and acid-base balance of the blood. The two major classes of minerals include the macro minerals and the trace elements.

In our present study muscle mass (27.32±3.29), glycogen content (459.8± 63.95) and relative back strength (1.96±0.81) of tribal footballers were found to be significantly higher than that of non-tribal. In case of footballers the importance of glycogen is always greater. After a match, glycogen levels are severely depleted (as high as 84%) and athletes can lose 1-5% of body weight through sweating which can result in impaired endurance performance. If insufficient post-exercise carbohydrate consumption takes place then the glycogen levels may not be restored. This means that performance may be affected for the next match or training session. So glycogen is one of the most important factors. Muscle glycogen stores are spared enabling players to run for longer distances with great ease.Greater muscular strength not only allows an individual to potentiate earlier and to a greater extent, but also decreases the risk of injury (Timothy et al, 2017).

In our present study, in case of hockey players total body water content (67.92±1.51litre %) of tribal population was found to be significantly higher than that of nontribal players (61.91±2.79litre %). Intracellular fluid content (62.78±4.93%) of nontribal population of hockey players was found to be significantly higher than that of tribal population 57.04±3.15%. FEV% of tribal population (94.14±3.09) was found to be significantly higher than that of nontribal group (90.4±2.88).Field hockey requires a high level of intra-, inter-, and neuromuscular coordination, since each action activates simultaneously different body parts, and a lack of coordination and self-control could make the action disjointed and pointless. The average distance covered in a field hockey match is 5.6 miles (9 kilometres), so their need for calories is high in both training and competition phase. One can lose 2 litters of fluid in sweat during games played in moderate temperatures.

Hydration is one of the most important nutritional concerns for a sportsperson. Approximately about 60 percent of body weight is water. Research has shown that losing as little as 2% of total body weight can negatively affect sports performance. For example, if a 150-pound athlete loses 3 pounds during a training session or competition, their ability to perform at peak performance due to dehydration is greatly reduced. Proper fluid replenishment is the main key for preventing dehydration and reducing the risk of heat injury in athletes engaged in workouts and competition. In a study conducted by Matias et al (2015), the ICW compartment is determined as the difference between the TBW and ECW compartments. As per literature the relationship between hydration and cognitive or exercise performance, intracellular water should be an indicator of choice, as functional impairment is greatly related to cell volume than that of the cell environment .

It has recently been shown that reductions in the ICW compartment decrease strength and power in elite judo athletes and leg strength and jumping height over a season in basketball, handball and volleyball players. These findings further support the important role of effective monitoring of the water distribution volumes (TBW, ECW, and ICW) in physical performance of an athlete (Proper hydration and electrolyte balance is important for cellular metabolism, blood flow and hence physical and athletic performance. The maintenance of precise osmotic gradients of electrolytes is important. Such gradients affect and regulate the hydration of the body as well as blood pH, and are critical for nerve and muscle function. Electrolytes are molecules capable of conducting electrical impulses and include sodium (Na+), potassium (K+), calcium (Ca2+), magnesium (Mg), and chloride (Cl) (Lätt et al, 2010). The indigenous Bajau people (“Sea Nomads”) of Southeast Asia live a subsistence lifestyle based on breath-hold diving and are well known for their extraordinary breath-holding power. However, it is not known whether this has a genetic basis. Using a comparative genomic study, it has been shown that natural selection on genetic variants in the PDE10A gene have increased spleen size in the Bajau, providing them with a larger reservoir of oxygenated red blood cells (Ilardo et al, 2018). In our present study the tribal and non-tribal athletes had almost the similar dietary habits and of similar training at more or less same geographical and climatic conditions. Hence, in these aspects subjects were considered as homogenous. Agriculture is the main occupation of the tribal people of Mayurbhanj district so the effect of training of some of the physical parameters are comparatively much more pronounced in tribal football and hockey players. The difference in their physical, physiological and anthropometrical parameters are mainly due their genetic variations.

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