e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
( Peer-Reviewed, Open Access, Fully Refereed International Journal )
Volume:06/Issue:06/June-2024 Impact Factor- 7.868 www.irjmets.com

# ANTHROPOMETRICAL AND PHYSICAL PARAMETERS OF INDIAN YOUNG MALE ROWERS, KAYAKERS AND CANOERS: A RELATIVE EXPLORATION

**Tamoghni Manna*1, Alak Kumar Syamal*2, Snehunsu Adhikari*3**

*1,2Post- Graduate Department Of Physiology, Hooghly Mohsin College, The University Of Burdwan, West Bengal, India.

*3Department Of Physiology, Sports Authority Of India, Netaji Subhash Eastern Centre, Sector-III, Bidhan Nagar, Kolkata, West Bengal, India.

DOI : Https://Www.Doi.Org/10.56726/IRJMETS59259

## ABSTRACT

Elite athletes' anthropometry and their body composition are strongly correlated with their athletic performance. We have examined the anthropometric and physical profiles of young male Indian rowers, kayakers, and canoeists.

The purpose is to recommend specialized training based on the athletes' anthropometric and physical profiles. A total of 37 trained male young athletes were chosen. Jagatpur, Orissa's Sports Authority of India (SAI) Special Area Game Scheme (SAG) served as the study's location. Several bio-parameters were measured using standard techniques, including height, weight, BMI, skinfold thickness, diameters, body fat %, aerobic, anaerobic power, SPO2, heart rate, and grip strength. SPSS version 26.0 for Windows was utilized. Rowers had a higher body height than the canoeists, kayakers had a greater body weight (kg) than men canoeists. Male canoeists were shorter in the arm than rowers and kayakers. Male rowers had a significantly higher VO2 max than male canoeists and rowers; male kayakers had a significantly higher maximum power than male rowers and male canoeists; male kayakers had a significantly higher average power than male rowers; and male kayakers reported a significantly higher fatigue index than male rowers. These three professions share the same basic idea—overcoming water resistance, but their methods differ only in terms of skill and manipulation potential.

**Keywords:** Anthropometry, VO2 Max, BMI, Rowing, Kayaking, And Canoeing.

## I. INTRODUCTION

Elite athletes' anthropometry and their body composition are strongly correlated with their athletic performance [1]. Sports endurance and strength in mass and size of the body are found in rowing [2]. Kayakers performed a variety of acrobatic maneuvers on a river. Canoeing is regarded as a resistance force sport. Through continued sport-specific training, athletes aim to match their anthropometric traits, body composition, and fitness. Athletes are mostly selected for a sport based on their anthropometric and physiological traits [4]. Our current study's goal was to compare the various physical and anthropometrical characteristics of three fields.

## II. METHODOLOGY

### 2.1. Participants

Thirteen junior male athletes (16 rowers, age = 16.81±3.99 years, fourteen kayakers, age = 16.75±1.5 years, and thirteen canoeists, age = 16.63±3.46 years) participated in this study. These sportsmen were all members of the Sports Authority of India (SAI). They are all uniform, well-trained subjects. Ethical Clearance was achieved from the Ethical Committee Post-Graduate Department of Physiology, University of Burdwan with Ref no: HMC/IEC/BU/02/2022 on 08.01.2022.

### 2.2. Physical Parameters

Body mass index, or BMI (kg/m2), weight (kg), and height (in cm) were measured using a standard technique [5].

Anthropometrical parameters: were measured using established techniques, including skin fold thickness (mm), femur and humerus (cm), arm length (cm), and calf girth (cm).

Body fat % is calculated using Siri's formula [6].

### 2.3. Physiological Conditions

Aerobic power: The Bleep Test was used to quantify the subjects' aerobic power (VO2 Max, expressed in milliliters/kg/min) [7].

Anaerobic Power: A repeated anaerobic sprint test (RAST) was used to calculate anaerobic power (in seconds).

Peak Power (watts): the maximum amount

Minimum Power: the lowest value in watts

The fatigue index (watts/sec) is calculated as (Maximum Power – Minimum Power)/total time of 6 sprints. Average power (watts) is the sum of all six values/6 [7].

SPO2.

Heart Rate (beats/min): A pulse oximeter was used to monitor SPO2 and heart rate.

Strength of Athletes: Using an established approach, athletes' hand grip strength (measured in kg) and trunk flexibility (measured in cm) were determined [7].

### 2.4. Statistics

The tool that was used to complete statistical analysis was SPSS version 26.0 for Windows, developed by SPSS Inc. in Chicago, Illinois, USA. For multiple comparisons, a one-way ANOVA was performed in conjunction with Schiff's Post hoc test, where $p < 0.05$ and $p < 0.01$ were considered significant.

## III. RESULTS

Table 1 shows that male rowers' body height was substantially higher than male canoers' at ($p<0.05$). Male kayakers had a considerably higher body weight (kg) than male canoeists at ($p<0.01$). Male canoeists had a considerably lower arm length (cm) than rowers and kayakers ($p<0.001$). Male rowers had a substantially greater maximum oxygen consumption (VO2 max ml/kg/min) than male kayakers and canoeists at ($p<0.05$).

Male kayakers' maximum power (in watts) was significantly higher than that of male rowers ($p<0.01$) and male canoeists ($p<0.05$). Male kayakers' average power (watts) was found to be significantly higher than that of male rowers at ($p<0.05$), and their fatigue index (watts/sec) was found to be significantly higher than that of men rowers at ($p<0.001$).

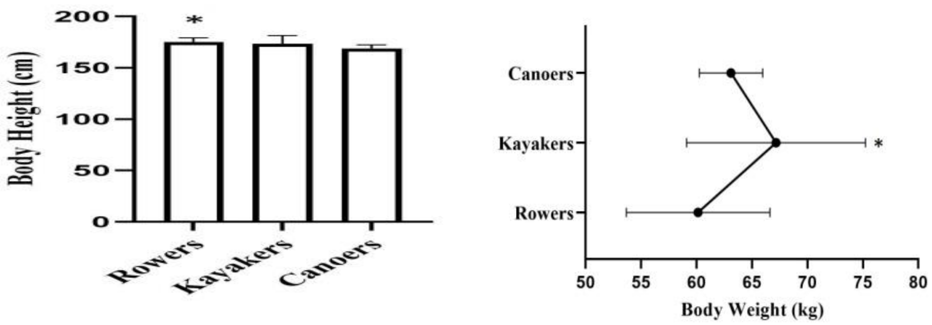
**Table 1.** Comparison of Physical and Anthropometrical Parameters of male rowers, kayakers and canoers

| MALE PHYSICAL AND ANTHROPOMETRICAL PARAMETERS | | | | | |
|---|---|---|---|---|---|
| VARIABLES | ROWER | KAYAKERS | CANOERS | F value | P value |
| Decimal Age (years) | 16.81±3.99 | 16.75±1.5 | 16.63±3.46 | 1.0234 | .669 |
| Body Height(cm) | 175.3±3.99 | 173.46±7.97 | 168.88±2.86 | 3.980* | .028 |
| Body Weight (kg) | 60.15±6.47 | 67.18±8.07 | 53.11±1.76 | 3.846* | .031 |
| Body Mass Index (BMI) (kg/m$^2$) | 19.13±1.65 | 21.77±2.56 | 22.14±1.35 | 7.022** | .003 |
| Body fat % | 12.15±2.4 | 13.38±2.13 | 12.72±1.21 | 1.030 | .368 |
| Biceps (mm) | 4.33±1.82 | 5.23±1.38 | 4.58±2.01 | 1.255 | .298 |
| Tricep (mm) | 8.23±3.03 | 7.85±1.40 | 7.38±2.54 | .447 | .643 |
| Subscapullar (mm) | 8.78±1.95 | 10.93±2.56 | 10.3440±1.32 | 2.405 | .105 |
| Suprailliac (mm) | 7.21±3.06 | 7.22±1.90 | 7.08±1.35 | .017 | .984 |
| Calf (mm) | 8.15±3.08 | 8.35±1.85 | 6.53±1.79 | 2.872 | .070 |
| Arm length (cm) | 27.88±2.57 | 27.86±1.78 | 24.95±1.95 | 9.280*** | .000 |
| Calf circumference (cm) | 33.75±2.67 | 33±2.2 | 33.65±0.53 | .351 | .706 |
| Humorous (cm) | 6.48±0.67 | 6.36±0.36 | 6.33±0.52 | .256 | .776 |

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
( Peer-Reviewed, Open Access, Fully Refereed International Journal )
Volume:06/Issue:06/June-2024 Impact Factor- 7.868 www.irjmets.com

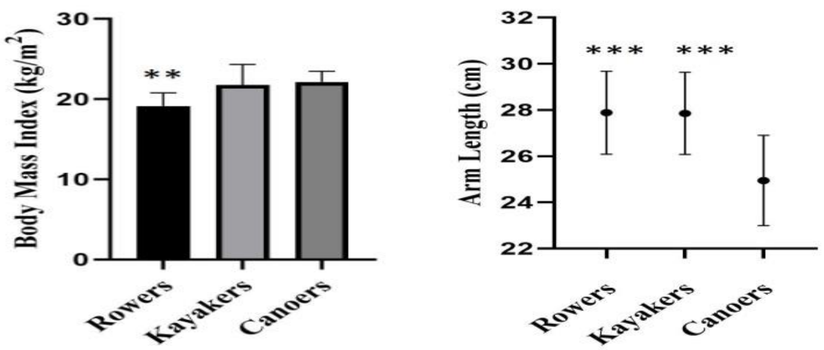
| | | | | | |
|---|---|---|---|---|---|
| Femur (cm) | 9.14±0.51 | 9.18±0.32 | 8.94±4.5 | 1.033 | .367 |
| Flexibility (cm) | 17.3±4.35 | 19.43±5.12 | 20±1.28 | .998 | .379 |
| SPO2 % | 97.4±0.97 | 97±0.78 | 96.85±4.17 | .848 | .437 |
| Heart Rate (beats/minute) | 65.6±3.92 | 70.64±6.18 | 68.15±5.77 | 3.045 | .061 |
| Right hand grip strength (kg) | 37±3.89 | 42.07±6.94 | 41.46±5.02 | 2.473 | .099 |
| Left hand grip strength (kg) | 38.5±5.74 | 41.71±8.51 | 40.31±4.46 | .666 | .521 |
| VO2 (ml/kg/minute) | 53.83±65.86 | 46.21±7.25 | 45.93±6.46 | 4.849* | .014 |
| Maximum Power (watts) | 499.13±85.57 | 669.18±121.19*** | 622.71±81.27** | 11.466*** | .000 |
| Minimum Power (watts) | 370.8±79.87 | 398.91±79.83 | 383.57±86.50 | .373 | .693 |
| Average (watts) | 405.67±76.39 | 514.82±75.07 | 462.07±104.24 | 5.071* | .011 |
| Fatigue Index (watts/sec) | 5.41±1.34 | 7.67±0.86*** | 6.48±1.49 | 9.784*** | .000 |

The values of the various variables are displayed as mean ± standard deviation; p<0.05 is indicated by an asterisk (*); p<0.01) is indicated by a **; and p<0.001 is indicated by a ***.




(a) (b)

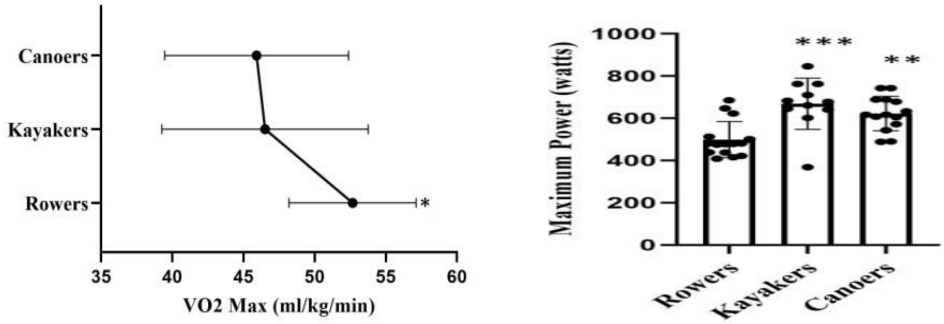
**Figure 1:** (a-b) compares the body height (cm) and weight (kg) of male rowers, kayakers, and canoers. (*) indicates significance at (p<0.05); values are displayed in mean and standard deviation.




(a) (b)

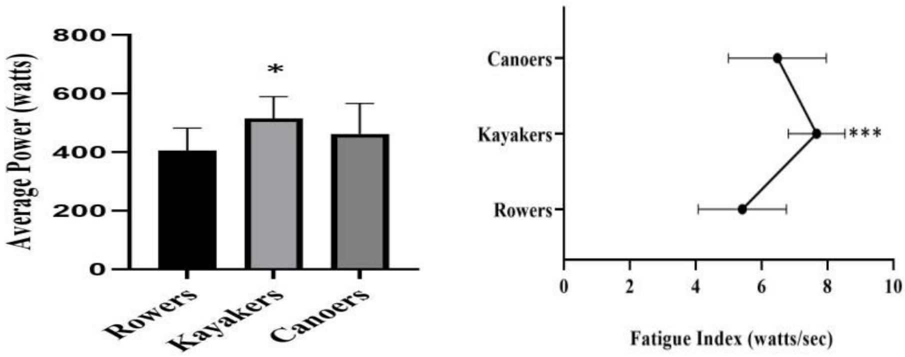
**Figure 2 (a-b)** compares the arm length (cm) and body mass index (BMI) (kg/m2) of male rowers, kayakers, and canoeists; values are displayed in mean and standard deviation. (**) indicates significant at (p<0.01); (***) indicates significant at (p<0.001)

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
( Peer-Reviewed, Open Access, Fully Refereed International Journal )
Volume:06/Issue:06/June-2024 Impact Factor- 7.868 www.irjmets.com




(a) (b)

**Figure 3(a-b)** compares the maximum power (watts) of the RAST test with the (VO2 max) (ml/kg/min) of male rowers, kayakers, and canoers; values are shown in the mean and standard deviation. (*) indicates significant at ($p<0.05$), (**) indicates significant at ($p<0.01$), and (***) indicates significant at ($p<0.001$).




(a) (b)

**Figure 4(a-b)** compares the male rowers, kayakers, and canoers' average power (watts) and fatigue index (watts/sec) from the RAST test; values are displayed in mean and standard deviation. (*) Indicates significance at $p<0.05$, and *** indicates significance at $p<0.001$.

## IV. DISCUSSION

Athletes need to integrate their natural growth and development, environment, and training to achieve excellence in sports. As indicated by Table 1 and Figure 1(a), the body height (cm) of male rowers in our current study (175.3±3.99) was found to be substantially higher than that of male canoers (168.88±2.86) ($p<0.05$) and a shorter previous study (189.3± 5.0). Rowers need to have a high stroke rate. Taller rowers produce wider strokes, and better stroke range is strongly correlated with improved rowing performance. As shown in Table 1 and Figure 1 (b), the body weight (kg) of male kayakers was substantially greater ($p<0.05$) than that of male canoers (53.11±1.76). By using the hips and knees, the kayak paddle motion uses the arm and trunk muscles. In a kayak, the stroke rate is higher and speed requires a lot of force. Male kayakers in our current study have benefitted from higher body weights. As indicated by Table 1 and Figure 2(a), the BMI of the male rowers in this study was found to be significantly lower than that of the canoers. The BMI found by Penichet-Tomas et al. (2021) was lower than the male rowers in our study BMI (22.8 ± 1.3) [8]. Nonetheless, there was no discernible variation in the male rowers, kayakers, and canoers' body fat %. The correlation between anthropometric dimensions and rowing achievement indicates that these traits may be highly predictive of future sports performance [9]. The body weight (kg) of male rowers was found to be 60.15±6.47, which is less than the previous value (84.8±7.1) reported by others [10].

In contrast to previous findings, the male rowers in our current study had larger triceps (mm) (7.5± 1.9). The male rowers' humerus (6.48±0.67) and femur (9.14±0.51) diameters (in centimeters) were marginally smaller than those of earlier studies (7.7±0.3) and (9.14±0.51), respectively. Table 1 displays the male rowers' calf circumferences (cm) (33.75±2.67), which were found to be marginally smaller than those of earlier studies (38.1± 1.9). Table 1 and Figure 2 (b) demonstrate that the arm length (cm) of our male rowers and kayakers

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
( Peer-Reviewed, Open Access, Fully Refereed International Journal )
Volume:06/Issue:06/June-2024 Impact Factor- 7.868 www.irjmets.com

was found to be substantially longer than that of the male canoers. Longer arm length is necessary for maximum propulsion. Table 1 and Figure 3 (a) demonstrate that our male rowers' VO2 max (ml/kg/min) was 53.83±65.86, significantly higher than that of kayakers' (46.21±7.25) and canoeists' (45.93±6.46). When rowing, the body is compelled to do repetitive motions by moving the legs and the arms to maintain proper momentum. An athlete must breathe in more oxygen to keep their muscles functioning and their pulse rate elevated. Around 70 to 80 percent of the energy required in a 2000-meter rowing competition comes from the aerobic energy system. Using both muscular strength and endurance, rowers push with their legs and pull with their arms and lower back at the same time during the drive part of the exercise. The VO2 max of our male rowers was found to be lower than what others had previously demonstrated (60.7± 5.9) [12].

However, in the current investigation, there was no discernible difference between the three disciplines in terms of heart rate, SPO2, flexibility, or grip strength in the left and right hands.

Those who kayaks tend to have stronger lower limbs. Paddle striking rates and lower limb motions are strongly correlated. Our kayakers' height (cm) and body weight (kg) (67.18±8.07) were found to be earlier study results (184.9 ± 5.8 and 78.1 ± 4.9, respectively). Male kayakers had a higher fat percentage (13.38±2.13) than in the previous study (0.78 ± 0.02). The male canoeists in our study had lower body height (168.88±2.86) and weight (53.11±1.76) than the athletes in an earlier study (176.9 ± 6.9, 75.5 ± 8.0, and 0.81 ± 0.02, respectively), but their fat percentage (12.72±1.21) was higher. Hagner-Derengowska observed this difference in 2014 [13].

The kayak is essentially a boat with a covered porch that is joined to a cabin, inside of which the athlete sits with their back to the water. In a canoe, the paddler uses a single-bladed paddle when kneeling, but in a kayak, a double-bladed paddle is used (Nealy, 1986). It was discovered that the arm lengths of male rowers, kayakers (27.86±1.78), and canoers (24.95±1.95) in our current study were shorter than those of earlier studies (31.38±±1.59 and 30.46 ±1.91, respectively). Our male kayakers and canoers had shorter humerus (6.36±0.36), femur (6.33±0.52), and femur (9.18±0.32), (8.94±4.5), than the previous findings. Male kayakers and canoers have smaller calf circumferences (33±2.2 cm and 33.65±0.53) than those found in earlier studies (Alacid et al, 2015) [14].

Table 1 and Figure 3 (a) in our study demonstrate that the VO2 max (ml/kg/min) of male rowers was substantially greater (53.83±65.86) than that of kayakers (46.21±7.25) and canoers ($p<0.05$). Rowers' VO2 max was less than that of a previous study (68.2 ml/kg/min) [15].

The VO2 max of canoeists (45.93±6.46) and kayakers (46.21±7.25) in our study was lower than that of their foreign counterparts, who had VO2 maxes of 58.9 and 51.9, respectively in the study of others. [16,17]. Table 1 and Figure 3(b) show that our men kayakers (669.18±121.19) and canoers (622.71±81.27) had higher maximum power (watts) in the RAST test variables than did our male rowers (499.13±85.57).

For forty seconds, 40 percent of the energy used in freestyle kayaking is anaerobic. Even though the events are significantly shorter in duration, such as the 500- and 1000-meter kayak races, specific preparation for the anaerobic energy system is still necessary. Canoeing is a high-intensity, continuous sport that involves both high and low-exhaustion phases. The anaerobic energy system is crucial in this activity [18]. Table 1 and Figure 4 (a-b) of our study demonstrate that male kayakers had an average power (watts) of 514.82±75.07 and a fatigue index (watts/sec) of 7.67±0.86, respectively, greater than male rowers (405.67±76.39 and 5.41±1.34).

It is known already that an athlete's capacity to sustain performance over extended periods is positively correlated with their average power (watts) value [19] [20] [21]. A lower fatigue index score (measured in watts/sec) indicates a greater capacity for sustained anaerobic activity. Our athletes' training regimens need to be highly prioritized if they are to perform to the best of their abilities.

## V. CONCLUSION

The current study found that rowers were much taller than male canoers, suggesting that a taller rower would have more mechanical advantage. Male kayakers have a heavier body weight than male canoeists, which allows them to overcome water resistance more effectively by exerting greater effort with each stroke. Male rowers' VO2 max was higher than that of male kayakers and canoeists; rowing for longer than two to three minutes is primarily powered by the aerobic energy system. Male canoeists had significantly shorter arm lengths (in centimeters) than rowers and kayakers. Having long arms is necessary to get maximum propulsion. Male kayakers had a much greater fatigue index and average power (watts) than male rowers, as well as a significantly higher maximum power (watts) than male canoeists and rowers. Our current analysis suggests that while the methods used by the three disciplines to overcome water resistance are very different, their fundamental idea is the same. It takes a different set of abilities, manipulative potentials, and specialized training for each specialty.

## ACKNOWLEDGEMENTS

We would particularly need to thank the coaches, doctors, and physical pros who worked with the members in our consideration, as well as the people who have given their authorization to take part.

## VI. REFERENCES

[1] Hebbelinck M., Ross W.D., Carter J.E.L., et al Anthropometric characteristics of female Olympic rowers. Canadian Journal of Applied Sports Science. 1980; 5:255–62.

[2] Shephard R.J. Science and medicine of rowing: a review. J Sports Sci 1998; 16:603–20.

[3] Naka T., Han I., Ohno M. Right and left segmental body composition in female basketball players and swimmers. Bull Nippon Sport Sci Univ. 2008;38(1):1–8.

[4] Markoviæ G., Durakoviæ M.M. and Trnini S. Fitness profile of elite Croatian female Taekwondo athletes. Collegium Antropologicum. 2005;29(1): 93-99.

[5] WHO s. Physical status: the use and interpretation of anthropometry. Report of a WHO Expert Committee. World Health Organization Technical Report Series.1995; 854:1452.

[6] Siri WE. Body Composition from Fluid Spaces and Density: Analysis of Methods. In: Brozek J, Henschel A, Eds., Techniques for Measuring Body Compositions, National Academy of Sciences, Washington DC. 1961; 223-244.

[7] Heyward VH. Stolarczyk LM. Applied body composition assessment Champaign, Human Kinetics. 1996

[8] Penichet-Tomas A., Pueo B., Selles-Perez S., Jimenez-Olmedo J.M. Analysis of Anthropometric and Body Composition Profile in Male and Female Traditional Rowers. Int. J. Environ. Res. Public Healt;2021; 18:7826. https://doi.org/10.3390/ ijerph18157826.

[9] Mikulic P. Anthropometric and metabolic determinants of 6000-m rowing ergometer performance in internationally competitive rowers. J. Strength Cond. Res.2009; 23:1851–1857.

[10] Bourgois J., Claessens A.L., Vrijens J., Philippaerts R., Renterghem B.V., Thomis M, Janssens M., Loos R., Lefevre J. Anthropometric characteristics of elite male junior rowers. Br J Sports Med.2000; 34:213–217.

[11] Arslanog^lu E. Acar K. Mor A. Baynazid K. Ipekoglu G. Gökhan. Arslanog^lu C. Body composition and Somatotype Profiles of Rowers. Turkish J of sports and exercise 2020; 81(3):431-37

[12] Gao W., Nuuttila O., Fang H.B., Chen Q. and Chen X . A New Fitness Test of Estimating VO2max in Well-Trained Rowing Athletes. Frontiers in Physiology.2021;12:701541.

[13] Hagner-Derengowska M., Hagner W., Zubrzycki I.Z., Krakowiak H,, Słomko W., Dzierżanowski M., Rakowski A., Wiącek-Zubrzycka M.Body structure and composition of canoeist and kayakers: Analysis of Junior and teenage Polish national canoeing team. Biol. Sport.2014; 31:323-326.

[14] Alacid F., Marfell-Jones M., Muyor J.M., Lopez-narrow P.A. and Martinez I. Kinanthropometric Comparison between Young Elite Kayakers and Canoeists Coll. Antropol .2015; 39 (1): 119–126.

[15] Secher, N.H. Rowing. Reilly, T., Secher, N, Snell, P. and Williams, C. (Ed.) In: Physiology of Sports. 1990; 259-286.

[16] Fry R.W. and Morton A.R. Physiological and kinanthropometric attributes of elite flat water kayakists. Medicine and Science in Sports and Exercise.1991; 23: 1297-1301.

[17] Bunc V. and Heller J. Ventilatory threshold and work efficiency on a bicycle and paddling ergometer in top canoeists. Journal of Sports Medicine and Physical Fitness.1991; 31: 376-379.

[18] Sheykhlouvand M., Khalili H., Agha-Alinejad H., Gharaat M. Hormonal and physiological adaptations to high-intensity interval training in professional male canoe polo athletes. J Strength Cond Res.2016; 30:859–866. doi:10.1519/JSC. 0000000000001161.

[19] Manna T. Adhikari T. Medabala T. Physical, Physiological and Anthropometrical Profile of Young Male Tribal and Nontribal Football and Hockey Players: A Comparative Study. Sports Research 2020;9(4):20-29.

[20] Manna T. Adhikari S. Syamal AK. Comparison of physical and anthropometrical parameters of teen-age male rowers, kayakers, canoers and sedentary school children. Int.J. Kinanthrop.2022; 2(1):25-30. DOI:https://doi.org/10.34256/ijk2214.

[21] Manna T. Adhikari S. Syamal AK. Influence of Training on Body Composition and Physical Health of Indian Young Female Canoers. International Research Journal of Pharmacy and Medical Sciences (IRJPMS).2022; 6 (1): 5-8.