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Somatotyping and Physical Fitness of Pakistani National Rower

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Abstract

Rowing is a popular sport across the globe which involves both skill and strength. The aim of the present investigation is to examine the somatotype and physical fitness of the Pakistani rowers. Data was collected from (n = 08) lightweight, and (n = 14) heavyweight Pakistani national rowers. Age, height, body mass, skinfold of triceps, subscapular, supraspinal, and calf, breadths of elbow and knee were measurement for somatotype as guided by (Norton & Old's, 1996). Push up, anaerobic, 2000 meter of maximal rowing ergometer, and set and reach for flexibility. Pearson product of correlation and t-test was applied for statistical analysis. The result showed there was a slight difference among light and heavyweight rowers in their somatotype measurements. On the other hand, the vertical jump was significantly correlated with rowing performance. It was concluded the leg power is associated with the performance of rower. It is proposed that rowers would improve their leg strength through training that enhances rowing performance.

Key Words: Somatotype, Physical Fitness, Rowers

Introduction

Rowing is a physically demanding event, which required strong anthropomorphic characteristics of rowers (Bourgois et al., 2000). The performance of rowers depends on their physical traits and physical fitness (Carter & Heath, 1991; Bourgois et al., 2001; Kaloupsis, Bogdanis, Dimakopoulou & Maridaki, 2008; Akca, 2014). Thus, the anthropometric profiling and of athletes as stature, body mass and limb size (Karaba-Jakovljević, Jovanović, Erić, Klašnja, Slavić, & Lukač, 2016), and somatotype assist the coaches to identify the impact of body shape on the rowing performance (Massidda, Toselli, Brasili, & Calò., 2013). Previous, studies reported that the tall heightened rowers were significantly in the

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performance of rowers in elite competitions (Hahn, 1990). Therefore, it is essential to select appropriate rowers by considering their limb lengths, breadth and girths to attain optimal performance in the elite competition (Mikulić, 2008). No doubt, rowing is a sport where anthropometric characteristics of the rower as stature, body mass and segmental lengths play a significant role in the successful performance (Piotrowski et al., 1992; Shephard, 1998). Various studies have inspected the anthropometric characteristics and physical fitness of rowers (Jurimae, Maestu, Purge, & Jurimae, 2004; Arazi, Faraji, & Mohammadi, 2011). There is a lack of study in Pakistan where rowing has not been focused like cricket and hockey. Therefore, this research was design to examine the anthropometric measures and physical fitness of the Pakistani rowers. Whether, the profiling of Pakistani rower's match with international rowers. This study will also help to determine the anthropometric and physiological profiles of Pakistani rowers.

Materials and methods

Participants

Purposively, (n = 08) lightweight, and (n = 14) heavyweight national rowers were selected for the study. The selected participants were physically fit without any medical illness records. The willingness was obtained from all participating after briefing the procedure of the study. The selected participants were in age (24.4 ± 3.2 years), stature (183.6 ± 7.9 cm); body mass (79.6 ± 8.0 kg); rowing training (2.9 ± 2.5 years); 2000 m ergometer time (399.3 ± 21.1). The selected players took part in the 2015 Quaid-e-Azam National Championship. Participants were informed of food intake three hours before the data collection, as well as avoid the intake caffeine, alcohol and strenuous exercise 48 hours before tests.

The selected anthropometry dimension has been measured according to ISAK standards. Four physical performance was recorded by considering their specificity to rowing game. These tests were push-ups for upper body muscular power, standing vertical jump for lower muscular power, 30 seconds modified Wingate test for anaerobic power, and sit and reach test for lumbar flexibility.

The Procedure of Data Collection

The physical performance of each test was obtained twice from each player. Participants visited the laboratory on three different occasions with the interval least three days. Participants completed anthropometric and strength measurements at the first and second visits. The anaerobic power and an all-out 2000m rowing ergometer test readings were taken at National Championship 2015 at Islamabad. These measurements are comprised of 8 skinfolds sites (Triceps, biceps, Subscapular, Abdominal, Supraspinale, Iliac Crest, Front thigh, Mid-calf)

6 girths (Arm, chest, Forearm, Gluteal, mid-thigh, calf) 3 length measurements (arm, leg, arm span) 4 breadths (Biacromial, A-P chest, Biepicondylar humerus, epicondylar femur) and additionally stature, body mass, sitting height.

Somatotype

Somatotype ratings were predicted by the method of (Norton & Olds, 1996).

Physical and Physiological Performance Tests

Sit and reach was obtained for flexibility, vertical jump and push-ups test was taken on the same day as anthropometry measurements. Though the Wingate anaerobic test was taken with an interval of 72 hours. The order of measurements was as follow, standing vertical jump, sit and reach flexibility and push-ups. Every subject was required to perform the movements properly. Each subject was tested twice, and the best effort was recorded.

Vertical jump

A common test to evaluate leg power (Leger, & Lambert, 1982). Huang and colleagues (2007) investigated some strength and power determinants including vertical jump, inverted row, leg press and back extension. Vertical jump was one of the significant variables with correlation to a 2 km ergometer performance. Study of Changela and Bhatt (2012) also supported the idea that vertical jump is a widely accepted test for muscular power. According to the protocol, as defined by (Thomas, Fahey, Paul, Insel, Walton, & Roth, 2005), the participant was in an upright stationary position with free movements of upper limbs and freedom in joint flexion of the lower and upper limbs to produce maximal impulsive force for jump and touch as high as possible. Three trials were given, and the highest performance was recorded as a final score in centimeter (Thomas et al., 2005). The vertical jump height was calculated, from the standing height, at the vertical pasted chart on the mounted board. Participants have to put some chalk powder on the middle finger to make a mark on board. The researcher stood on the table to record the height of the jump.

Sit and reach flexibility test

sit and reach test was obtained for flexibility according to YMCA guidelines. The participants were asked to sit barefoot, feet against 26 cm box. Then the participants were required to gradually flex forward as far as possible. Care was taken to the subject's hand must be in a parallel position and does not approach with one hand. The best of three trials was recorded.

Push-ups test

The participants were instructed to be in position as both hands pointing forward under shoulders, back straight head up, toes touching the ground as a pivot. The subjects raised the body by straightening the elbows and return to the initial position. A helper pointed out his thump under the chest and one push-up was calculated when the subject's chest made contact with the thumb. The maximal number of push-ups performed in one-minute time consecutively without rest was recorded on the score sheet.

Anaerobic Power Test

Wingate anaerobic and VO_2 max test based on assumption rather than clearly quantifying the energy profile based on three pathway metabolisms (phosphagens, lactic and aerobic metabolism). This is because of the lack of blood sample handling or non-availability of expertise and lactate analyzer to measure the blood lactate concentration following exercise. A modified Wingate test, using a Concept II Model D rowing ergometer (*Concept 2*) was used to estimate anaerobic capacity (Riechman, Zoeller, Balasekaran, Goss, & Robertson, 2002). Participants were asked to warm-up on the ergometer for 3 minutes at moderate intensity (approximately 60%). Following the warm-up, the ergometer programmed for a 30s effort at maximum drag factor. The maximum drag factor was set according to the previous study (Mandic, Quinney, & Bell, 2004). The participants completed an "all-out" 30s trial with verbal encouragement. The screen was set to display Power/stroke and recorded by the researcher with the help of a video camera. Mean power was used to estimate the average stroke power of an individual over a trial of the 30s. Best power output from five highest consecutive strokes and the mean of the five lowest consecutive strokes was considered as the final score.

2000m maximal rowing ergometer test

Assessing on-water rowing performance is difficult. Therefore, Concept II rowing ergometer was used as it provides accurate estimates of a rower's physiological ability of power output and some submaximal and brief maximal ergometer performance. However, some argued that a 2000 m time trial on an ergometer might not reflect the metabolic demands of on-water rowing especially in smaller boats where it takes significantly less time to complete the effort on an ergometer than on the water.

The all-out 2000 m performance was obtained during the national championship organized by Pakistan Rowing Federation in December, on a stationary ergometer (*Concept II,* Model D2 global with performance monitor 4).

The participants were asked to perform an all-out 2000 m test on a rowing ergometer. The screen of an ergometer set to display remaining meters, average 500m time and accumulated time. Verbal encouragement was given during the last 250 meters of the test. Participants viewed the performance feedback on the ergometer screen at every 500m average time, total time and the distance remaining. The completion time of the average power outputs was recorded immediately after the test and each 500m splits were recorded separately.

Statistical Analysis

The mean and standard deviation of all variables was obtained. The comparison between Light Weight and Heavy Weight rowers was made by using the independent *t*-test. On the other hand, Pearson Product Moment of correlation was applied to examine the correlation between anthropometric characteristics and rowing performance. The α value of 0.05 was set for significance.

Results

The anthropometric, somatotype, physical fitness data consists of the minimum, maximum, mean values, standard error, standard deviation and coefficient of variation, independent *t*-test, and Pearson Product Moment of correlation.

Table 1. Association between physical tests scores and 2000mergometer performance of the participants (N=22*)*

Variables	Min	Max	Mean	SE	SD	Coefficient	r 2km)
Vertical jump (cm)	13	52	38.14	1.86	8.76	22.9	.034
1 Minute push-ups	20	70	48.8	3.22	15.1	30.9	.619**
Sit & reach flexibility (cm)	16	56	40.36	2.04	9.58	23.7	-.347
Anaerobic power (watts)	202	383	317.0	9.84	46.18	14.56	.931**

**Correlation is significant at the 0.01 level.*

The anthropometric profile of rowers of the lightweight and heavyweight category was assessed as length, breadth, body mass, body height, and somatotype. Table 1 presents the statistics of variables of physical tests and Pearson Correlation values with relation to 2 km ergometer performance. Negative values indicate an increase in a specified physique trait (per unit) for example, anaerobic power (W) will result in a decrease in 2 km time (Slater *et al.,* 2005). Pearson Correlation (r) shows interpretation with each variable. According to the results, push-ups and anaerobic power were found significantly correlated ($p < 0.01$).

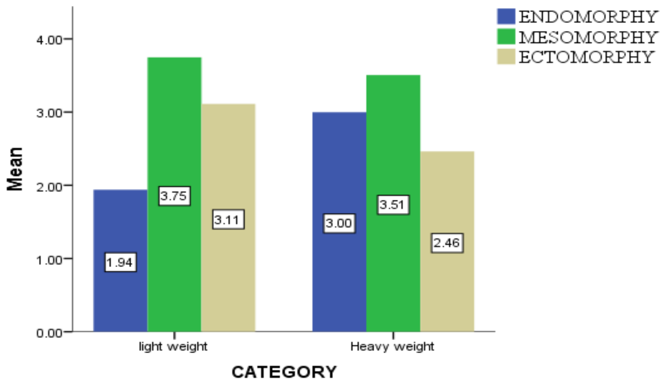

Figure 1. The somatotype comparison of Pakistani light and heavyweight Rovers

Figure 1 demonstrates the mean somatotype of rowers, showed slight differences in somatotype values. The non-significant difference observed in mesomorphic indices and slight change was observed in endomorphic indices of lightweight and heavyweight rowers.

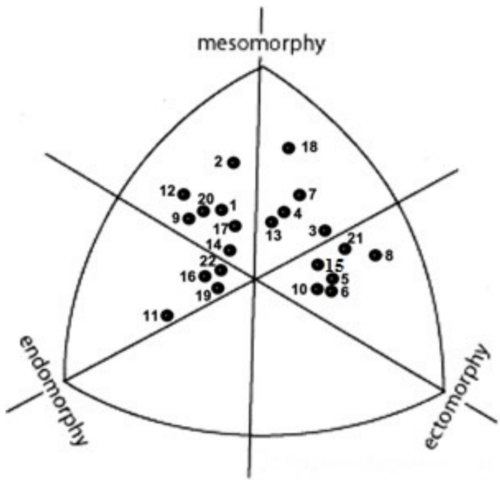

Figure 2. Description of the somatotype 2-D chart of Pakistani Rowers

Figure 2 demonstrated the greater variability of endomorphic and mesomorphic indices. Results indicate the average physique of Pakistani lightweight and heavyweight rowers as 2.8-3.7-2.6 shows the endomorphic and mesomorph percentage were higher.

Discussion And Conclusion

The somatotype average of the Olympian rowers of 30 countries was "1.4-4.4-3.4", and the somatotype average of the present study is "2.8- 3.7-2.6". This comparison shows the similarity in the endomorph score, in contrast, the mesomorph and ectomorph scores of Olympians were higher than the Pakistan rowers. It is concluded that the Pakistani rowers were lesser in muscle mass, and bone density than the Olympian Rowers. It is also concluded that Pakistani rowers higher in body fats. Secher and colleagues (1983) reported that tall heightened rowers perform significantly longer and better stroke than small heightened (Ingham et al., 2007). The present study confirmed the finding of (Bourgois et al., 2000). On the other hand, it contradicted that the stature of Pakistani heavyweight rowers is 1.2 cm higher than the Olympian of 1968, but 5 cm shorter than the 1976 Olympian (Carter, 1982). The heavyweight and lightweight seem to have (9 cm), (5.1 cm) less sitting height and (2.9 cm), (3.4 cm) higher leg length respectively. A short sitting height and long limbs are the key physical appearance of HW and LW rowers which associated with biomechanically benefits to the rowers (Hahn, 1990). The previous study reported the stature and body mass of elite oarsmen were 189 to 195 cm and 90 to 93 kg respectively (Bourdin et al., 2009). The results of the current study are stature 183.6 cm and body mass 79.6 kg. Bourgois and colleagues (2001) believe that small body sizes can negatively affect the performance of rowers because body segments produce lesser power that the large body parts.

In comparison, the HW rowers of present study were higher than the Olympic rowers in the measures of total leg length (2.9 cm), bi-acromial breadth (0.2 cm), triceps skinfold, (1.8 mm), subscapular skinfold (3.5), thigh skinfold (2.7 mm) and calf skinfold (2.2 mm), but lower in forearm girth (1.3 cm) and humerus breadth (0.4 cm). The results of the current study showed the body mass was strongly correlated (r =0.90**) with the performance of 2000 m ergometer. Morris and Payne (1996) find out the percentage of body fat has been decreased in lightweight rowers. As a result, the fat-free body mass has a significant correlation (r = -0.64), (-0.58) with a 2 km ergometer, which has been reported in previous studies (Riechman et al*,* 2002). It is concluded, the fat-free mass would be considered as a stronger factor to enhance the performance of rowers.

The mean somatotype of heavyweight and lightweight rowers is 2.9-3.5-2.4 and 1.9- 3.7-3.1, respectively. This evidence that Pakistani heavyweight rowers have more fat. On the other hand, Pakistani lightweight rowers have a mesomorphic-ectomorph tendency which is similar to literature. The results of the current study, support the findings of (Kerr et al., 2007), that low-rank rowers were higher in ectomorphic characteristics which negatively effects the performance.

The anthropometric profiles of heavyweight and lightweight rowers were assessed as stature, body mass, skinfolds, girth, length, and breadths. The HW rowers were (7.5 cm) larger in stature than the LW rowers, which indicate as a key factor in the successful performance in the stroke length (Kerr et al*,* 2007). Arm span and leg length distinguished the heavyweight from lightweight rowers, results of the present study have accordance with previous studies (Cosgrove *et al.,* 1999; Yoshiga & Higuchi, 2003) indicate that oarsmen's height and length would be proportional for rowing performance. It was confirmed, the finalist of the 1997 World Rowing Championship was significantly taller in stature than the non-finalist (Bourgois et al., 2000). The study showed that lightweight medalists were (0.6 kg) lighter than non-finalist. Therefore, anthropometric indices should be a considerable factor in recruiting potential athletes.

The aerobic capacity would be explained as long hours of training and a large body size (Mikulic, 2008). According to Secher and colleagues (1983), VO_2 max plays a significant role to perform well in international competitions. The current VO_2 estimation of Pakistani rowers was estimated with an equation that was developed by Hagerman (1984) by using the spirometer. Moreover, a high correlation has been observed between the VO_2 max and the 2 km ergometer test (Cosgrove, et al., 1999). While the average aerobic capacity of this study is 4.9 min^{-1} was considerably low from the international elite standard. It is proposed that the Pakistani rowers should focus to enhance aerobic capacity by adopting specific training.

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