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An analysis on the effect of anthropomorphic varaibles on volleyball players at different positions

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Abstract
The objectives of the study were to analyse the effect of anthropometric variables on volleyball players playing in different position, to establish an anthropometric profile database for volleyball players at different positions (Attacker, Blocker, Universal, Setter and Libero) in volleyball and to develop a logistic regression model to predict the likelihood of volleyball player according to different playing positions on the basis of selected anthropometric variables. To achieve the purpose 50 male volleyball players were purposively selected for this study. Out of these, ten universal, six libero, ten setters, ten middle blocker, and fourteen attackers, within an age group of 19-33 years were selected from the top eight team of senior national volleyball championship. The study was delimited to only international and national male volleyball players.
Anthropometric and physical variables were selected for the study namely Height (HT), Weight (WT), Arm Length (AL). Hand Length (HL), Palm Width (PW), Arm Girth Relax (AGR), Arm Girth Flexed (AGF), Fore Arm Circumference (FAC), Wrist Circumference (WC), Chest Circumference (CC). Thigh circumference (TC). Calf circumference (CF_C), Ankle Girth (AG), Leg Length (LL), Foot Length (FL).Descriptive statistics were used to describe the nature and characteristic of data. For finding out significant difference in different parameters among the selected positions, one way ANOVA was applied and the level of significance was chosen as 0.05. For finding out the contribution of different parameters towards different playing positions, Logistic regression was applied.

Keywords: Anthropometric and playing positions, volleyball, logistic regression model

Introduction
Physical inactivity is considered more dangerous than physical activity. People in our country the young and the old do not get enough exercises, that is why modern society is increasingly drifting away from the habit of physical work. Inactive people are more likely to add more weight, became obese and develop impaired cardiac functions and have less tolerance of physical and mental stress and less able to cope with illness and injuries. People of the country should take an active part in sports to make the country a healthier one. Physical inactivity is considered more dangerous than physical activity. People in our country the young and the old do not get enough exercises, that is why modern society is increasingly drifting away from the habit of physical work. Inactive people are more likely to add more weight, became obese and develop impaired cardiac functions and have less tolerance of physical and mental stress and less able to cope with illness and injuries. People of the country should take an active part in sports to make the country a healthier one.
Volleyball has become a very popular game throughout the world. It has the world's second most popular sports and it is an international game that requires great skill and complex strategy, but it can be adapted to any level of play and it is always fun (Dumphy & Wilde, 2000). Volleyball, which is an excellent team sport, has been widely accepted as a highly competitive, as well as, recreational game throughout the world. It is now recognized as one of the most breath-taking and dramatic sport of the Olympics, both from the players and spectators view point.
Anthropometric parameters are of great importance in the selection of appropriate athletes for appropriate sports. The primary reason for determining an athlete's body composition is to obtain information that may be beneficial in improving athletic performance". Body composition and weight are two of the many factors that contribute to optimal exercise performance. Taken together, these two factors may affect an athlete's potential for success within a given sport. Body weight can influence an athlete's speed, endurance and power, whereas, body composition can affect an athlete's strength, agility, and appearance. Most athletes require a high strength-to-weight ratio to achieve optimal athletic performance, and because body fat adds to weight without adding to strength, low body fat percentages are often emphasized within many sports[1]. An athlete's anthropometric characteristics represent important prerequisites for successful participation in any given sport. It has been suggested that volleyball players at different positions have different anthropometric characteristics, especially in height. Successes in sport competitions have been associated with specific anthropometric characteristics Anthropometric measurements are widely used to assess and predict performance in various sports. Anthropometric measurements and morphological characteristics play an important role in determining the

success of a sportsperson (Wilmore & Costill, 1999; Keogh, 1999). An athlete's anthropometric and physical characteristics may represent important prerequisites for successful participation in any given sport (Gualdi-Russo & Zaccagni, 2001).
It can be assumed that an athlete's anthropometric characteristics can in some way influence his/her level of performance, at the same time helping to determine a suitable physique for a certain sport (Carter & Heath, 1990).

Methodology
The procedure adopted for the selection of subjects, selection of variables, criterion measures, reliability of test items, administration of tests, along with the procedures for collection of data and statistical techniques employed for the study have been presented. Data on selected anthropometric and physical variables were collected on the national and international volleyball players from Nine (9) state teams of the country within an age group of 19-33 years were selected from nine teams of Senior National Volleyball Championship, Bhubaneshwar, Odisha 2021-2022. The state teams were J&K volleyball team, Delhi Volleyball Team, Tamilnadu Volleyball Team, Kerala Volleyball Team, Maharashtra Volleyball, Punjab Volleyball Team, Haryana Volleyball Team, Rajasthan Volleyball Team and Uttar Pradesh Volleyball team. From these nine volleyball men teams a total of fifty (50) male volleyball players were purposively selected for this study. Out of these, ten universal, six libero, ten setters, ten middle blocker, and fourteen attackers.
Anthropometric variables were selected for the study namely Height (HT), Weight (WT), Arm Length (AL). Hand Length (HL), Palm Width (PW), Arm Girth Relax (AGR), Arm Girth Flexed (AGF), Fore Arm Circumference (FAC), Wrist Circumference (WC), Chest Circumference (CC). Thigh circumference (TC). Calf circumference (CF_C), Ankle Girth (AG), Leg Length (LL), Foot Length (FL). Descriptive statistics were used to describe the nature and characteristic of data. For finding out significant difference in different parameters among the selected positions, one way ANOVA was applied and the level of significance was chosen as 0.05. For finding out the contribution of different parameters towards different playing positions, Logistic regression was applied.
Height was measured with the help of Stadiometer in centimeter. Weight was measured with the help of weighing machine in kg. Arm length, Hand length, Arm girth relaxed, Arm girth flexed, fore arm circumference, Wrist circumference, Chest circumference, Thigh circumference, Calf circumference, Ankle girth and Leg length were measured with the help of Gullick tape in Centimeter. Hand length, Palm width and Foot length were measured with the help of Sliding caliper in Centimeter. All the necessary data on different parameters were collected by the researcher scholar himself with the help of the experts.
Descriptive statistics were used to describe the nature and characteristic of data. For finding out significant difference in different parameters among the selected positions, one way ANOVA was applied and the level of significance was chosen as 0.05. For finding out the contribution of different parameters towards different playing positions, Logistic regression was applied.

Reliability of test
The reliability of data was assured by establishing the instrument reliability, tester's competency and subject reliability.

Reliability of Instrument
The research scholar used the equipment's that were available at the Central University of Kashmir, Ganderbal, for the collection of data. These instruments were procured from the standard companies of India. Hence, the instruments were considered to be reliable.

Collection of Data
The data of the anthropometric variables (height, weight, arm length, hand length, palm length, arm girth relaxed and flexed, fore arm circumference, chest circumference, wrist circumference, thigh circumference, calf circumference, leg length, ankle length, foot length) were collecting by administering standard test. Before administering the tests the subjects were given a chance to practice so as to make them familiar with the testing procedure. They were explained about the use of the 7 Arm Girth Flexed Gullick tape Centimeter 8 Fore Arm Circumference Gullick tape Centimeter 9 Wrist Circumference Gullick tape Centimeter 10 Chest Circumference Gullick tape Centimeter 11 Thigh Circumference Gullick tape Centimeter 12 Calf Circumference Gullick tape Centimeter 13 Ankle Girth Gullick tape Centimeter 14 Leg Length Gulliek tape Centimeter 15 Foot Length Sliding caliper Centimeter during the testing procedure. All the data on different parameters were collected with the help of experts.

Statistical Technique
Descriptive analysis was carried out for describing the data and comparing the profile of the volleyball players playing at different positions. In descriptive analysis various statistics Like Mean, Standard Deviation, Standard Error of Mean, Variance, Range, Maximum, Minimum, Skewness, Standard Error of Skewness, Kurtosis, and Standard Error of Kurtosis etc. were computed for understanding the nature of the data.

Results

The main objective of this study is to identify parameters which are having significant contribution towards different playing position. (Universal, Libero, Setter, Blocker and Attacker) in volleyball. The study is confined to the selected anthropometric variables only. Descriptive statistics were used to describe the nature and characteristic of data. For finding out significant difference in different parameters among the selected positions, one way ANOVA was applied and the level of significance was chosen as 0.05. For finding out the contribution of different parameters towards different playing positions, Logistic regression was applied Anthropometric and physical characteristics have got a significant relationship with playing positions and these characteristics shall be kept in mind for selecting and preparing the volleyball players according to their playing positions. For the blockers in addition to the height, the length of the particular body parts such as limbs etc. are important. Along with the height, blockers also need to be speedy and explosive but generally it may be found that it is difficult to get the optimum combination of height, speed and strength qualities, although training can improve the relationship. Spikers (attackers) are those players who need the most varied combin3ations of selected anthropometric and physical characteristics namely, height, arm length, palm width, wrist circumference, leg length Libero's are having unique characteristics as compared to other players in terms of anthropometric Libero did not show any particular characteristic but in terms of physical characteristics libero need to possess speed, agility, flexibility and body composition for which he should have. The logistic regression analyses showed that the likelihood of being positional players in volleyball players was significantly predicted by ten parameters namely Height, Arm length, Land length, Palm width, Fore arm circumference, Wrist circumference, Leg length, Speed, Flexibility and Body composition. Rest of the other parameters was statistically insignificant as per the Wald test.

Table 1: Analysis of variance for height among volleyball players in different position

Sources	SS	DF	MSS	F	p-value
Between Groups	3574.683	4	893.671	52.854*	.000
Within Groups	1673.932	99	16.908		
Total	5248.615	103			

Significant at 0.05 level

Table 1 depicts that the obtained F-value is 52.854 for which, the obtained pvalue is 0.000 (p<0.05), Thus there exists a significance difference in height of volleyball players, playing in different positions. As the F value was found significant, the pair wise comparison was made among volleyball players playing in different positions.

Table 2: Analysis of variance for arm length among volleyball players playing in different position

Sources	SS	DF	MSS	F	p-value
Between Groups	1129.077	4	282.269	47.028*	.000
Within Groups	594.218	99	6.002		
Total	1723.295	103			

Table 2 depicts that the obtained F-value is 47.028 for which, the obtained p value is 0.000 (p<0.05). Thus there exists a significance difference in arm length of volleyball players, playing in different positions. As the F value was found significant, the pair wise comparison was made among volleyball players playing in different positions.

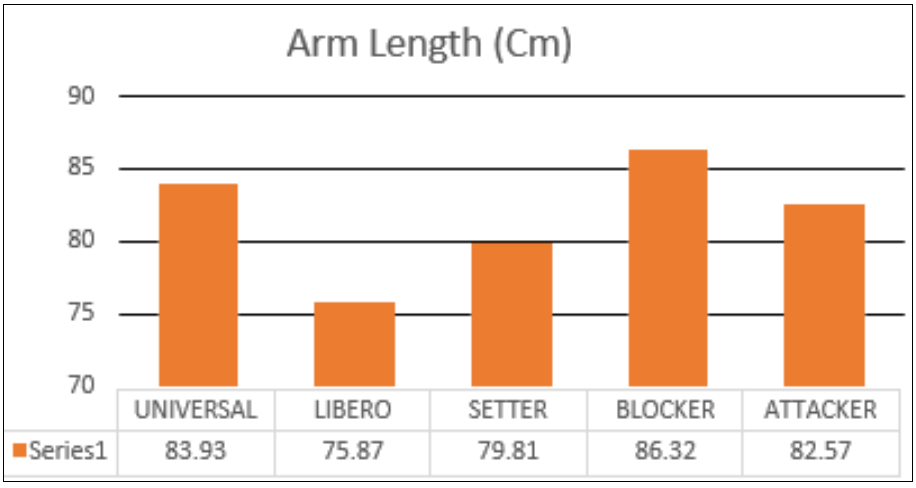

Fig 1: Shows the mean arm length of volleyball players in different positions

Table 3: Analysis of variance for thigh circumference among volleyball players playing in different position

Sources	SS	DF	MSS	F	p-value
Between Groups	69.166	4	17.292	1.697	.157
Within Groups	1008.701	99	10.189		
Total	1077.867		103		

Table 3 depicts that the obtained F-value is 1.697 for which, the obtained pvalue is 0.157 (p>0.05). Thus there exists a significance difference in thigh circumference of volleyball players, playing in different positions

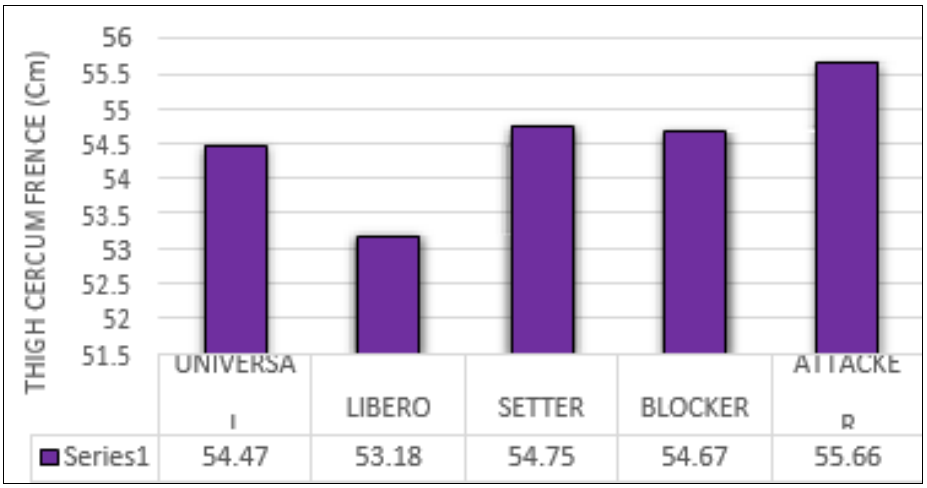

Fig 2: Shows the mean thigh circumference of volleyball players in different positions

Table 4: Schefee's post-hoc test for pairwise comparisons of different playing positions for wrist circumference

Universal	Libero Mean	Setter	Blocker	Attacker	Difference	p-value
16.86	16.43				0.43	.569
16.86		16.18			0.68	.120
16.86			17.15		-0.29	.827
16.86				17.48	-0.62	.085
	16.43	16.18			0.25	.910
	16.43		17.15		-0.72	.078
	16.43			17.48	-1.05*	.000
		16.18	17.15		-0.97*	.005
		16.18		17.48	-1.3*	.000

It was evident from table 3 that there exists a significant difference in wrist circumference between, Libero and attacker (p=O.OOO), Setter and blocker (p=O.OOS) and between Setter and attacker (p=O.OOO),as the obtained p-value is less than O.OS. But there was an insignificant difference was obtained between Universal and libero (p=O.569), Universal and seller (p=O.l20), Universal and blocker (p=O.827), Universal and allacker (p=O.085), Libero and Seller (p=O.910), Libero and blocker (p=O.078) and between Blocker and attacker (p=O.638).

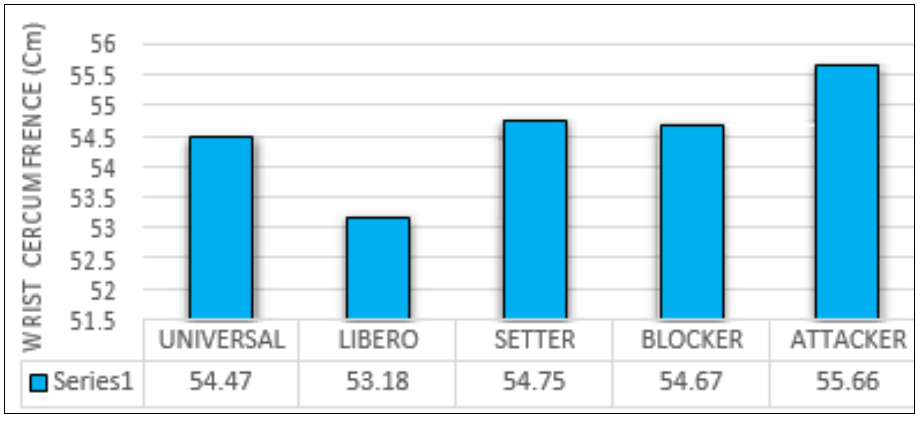

Fig 3: Shows the mean wrist circumference of volleyball players in different positions

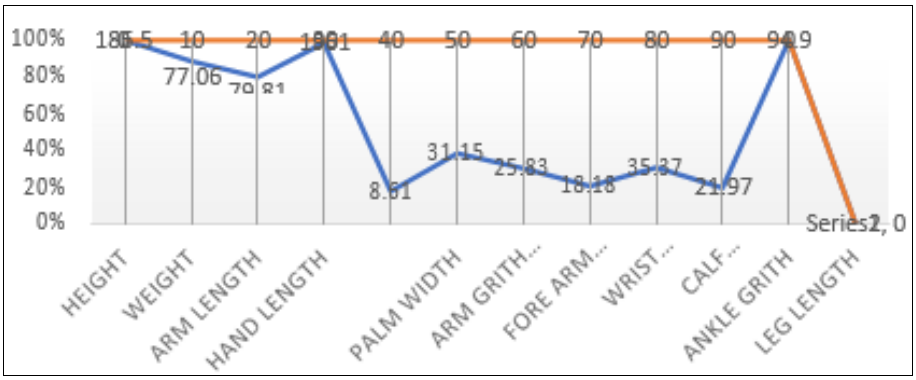

Fig 4: Shows the Anthropometric Profile of Setter

Discussion

The study was designed to analyse the effect of anthropometric variables on volleyball players playing in different positions. To develop anthropometric profile of national level male volleyball players positions wise (Attacker, Blocker, Universal, Setter and Libero) and to develop a logistic regression model to predict the likelihood of volleyball players according to different playing positions on the basis of selected anthropometric and physical variables. Descriptive statistics were used to describe the nature and characteristic of data. For finding out significant difference in different parameters among the selected positions, one way ANOVA was applied and the level of significance was chosen as 0.05. For finding out the contribution of different parameters towards different playing positions, Logistic regression was applied. The findings of the study showed significant difference among different position in height, weight, arm length, hand length, palm width, arm girth flexed, fore arm circumference, wrist circumference, calf circumference, ankle girth, leg length, foot length, and found no significant difference in arm girth relaxed, chest circumference, thigh circumference and agility.

Conclusion

It was concluded from the results of the study that there is a significant difference between the heights of the volleyball players playing at different positions. The blockers were found to be tallest followed by universal, attacker, setter and libero respectively. This could be due to the reason that the blockers are required to reach the ball before the opponent sets the ball, for that they require greater limbs for the locomotion, as well as, to block the ball by extending and penetrating their upper limbs. Due to the above mentioned reason blocker requires greater height in comparison to other players. Small height give better stability due to low CG. Libero have to first receive the pass and also defend the opponent attack. For this purpose Libero have to be in a low stance position. Short heighted player like libero take less time to come in a low stance position as compare to other players. Height is selected as a factor to differentiate the players according to their position as the taller player in the volleyball has an advantage. In volleyball, teams compete by manipulating skills of spiking and blocking high above the head. Therefore, the presence of tall players is an indispensable factor in the success of a team.

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