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The Relationship Between the Playing Ability of University Male Volleyball Players and their Anthropometric Characteristics

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Abstract:

The science of anthropometry is all about taking precise measurements of people. Physical anthropologists have used anthropometry, or the measurement of human skeletal features, since the 19th century to learn more about human evolution and diversity. Human anatomy and physiology are taken into account while making anthropomorphic measurements. This research has the potential to improve the selection and screening processes for male volleyball players. Researchers hope these findings will aid PE instructors and coaches in creating more comprehensive and effective training plans for both physical and technical skills. The results of the study on motor fitness might be used by volleyball players as a tool for self-evaluation and inspiration to improve their skills. In this paper the sample includes both public and private institutions that took part in the next 2022–23 season's collegiate volleyball tournament. For this analysis, 104 sportspeople served as the sample. Volleyball in India, especially at the interuniversity level, might benefit from a more scientific approach if this research encourages other volleyball fans to do similar investigations. Scientists will be inspired to do similar research in other sports as a result of this study. The purpose of this research was to look into the connections between certain anthropometric measurements and aspects of physical fitness and the ability to play volleyball.

Keywords: Anthropometric, Measurement, Volleyball, Player, Ability

INTRODUCTION

Sport is now more often than not treated as a science rather than a hobby or pastime. Any sport may be seen through a scientific lens and analyzed on several levels and complexities, from predicting the final score to determining which players perform best in certain positions. Played both inside and outdoors, volleyball is a sport that welcomes players of all ages and ability levels. It's a physically challenging game that can help you burn up to 585 calories in only 45 minutes. Volleyball is great for your health since it uses your whole body, from your upper body and arms to your shoulders and legs. Players' hand-eye coordination, balance, and reflexes are all enhanced by playing volleyball. As a team activity, it encourages participants to interact socially and work together. There are six different positions that players take on the court in a game of volleyball, and they rotate between being the right back, right front, middle front, left front, and middle back. The map divides into an offensive zone and a defensive zone.

Each player moves through the game by adjusting their position in accordance with their overall plan. A total of six players, including five attackers (A) and one setter (S), are on the court at any one moment during a volleyball match. As the match develops, one libero (L) will replace one of the attackers. Regardless of the sport, various physical and physiological traits distinguish each player. As a result, relying on a single indicator of the state of play is very unlikely. This motivates research into new methods that may be used to better categorize players into appropriate places on the field. Machine learning plays a crucial role in these contexts. The quality of a player is often evaluated using a number of anthropometric and motor fitness characteristics, and these same variables may be used to put a numerical value on the player's performance in a certain game. The outcomes are often utilized as supplementary metrics to determine the player quality. This information is gathered as it happens. Data preparation methods are used after data collection to clean and organize the information. Data pre-processing and data transformation methods are common in traditional methodologies. Differences in a number of characteristics are highlighted by statistical studies of the data.

Because of its importance in preparing students for adulthood, PE and sports are now required of all students. When the UNESCO charter explicitly recognized it as a fundamental human right in 1978, it was widely recognized for the first time across the globe. The rise in sports participation has led to an increase in competitiveness, which has emerged as a significant facet of contemporary society. Success in a competitive setting is one way to prove one's value. It is crucial to identify, select, and develop a promising young sportsman in order to achieve peak performance, since it is generally agreed that athletes need to have certain innate abilities that may be honed via methodical and scientific training. Anthropometry, the measuring of human skeletal structure, has been practiced from the beginning of time. Over the centuries, several ideals of proportion emerged. The field of Physical Education in the United States was the first to widely use anthropometric measurements. Body symmetry and proportion were emphasized as important to the belief that exercise should be recommended to alter muscle growth. Simply put, anthropometry is the science of measuring human bodies from the outside. It's possible for these evaluations to be objective or subjective. The correlation between physical fitness and muscle mass is often made. Being physically fit is a highly prized trait. However, there are several methods to describe physical fitness, and many different aspects of fitness have been recognized. The question "fitness for what?" must be posed. Does the student want to be physically fit so that they can participate in sports or does the student want to be physically fit so that they can excel in general health? Physical fitness and performance in the context of health have many of the same defining characteristics. Some of these traits, however, may need to be developed further in order to achieve optimal physical performance.

LITERATURE REVIEW

Đurković, Tomislav & Marelić, Nenad & Zekić, Robert. (2020) The primary objective of this research is to compare senior male volleyball players who play various positions in terms of anthropometric traits, motoric skills, and functional capacities. Secondary selection, or volleyball specialization, is performed by coaches around the ages of 15 and 16, using the collected data to guide young players toward roles in which they have the greatest potential for success. Methods: Seventy-four senior volleyball players from Croatian premier league clubs participated in the study. Setters (n = 11), middles (n = 17), outside hitters (n = 20), middle blockers (n = 16), and liberos (n = 10) were the different player types identified. Four anthropometric measurements (height, weight, a single hand's standing reach, and a double hand's standing reach) made up the set of independent variables. Motor skills were evaluated using ten standardized measures, including lateral agility, starting acceleration, spike and block reach, general flexibility, explosive arm and shoulder strength, spiking speed, repetitive trunk flexor and extensor strength, and repetitive chest, arm, and shoulder strength. Functional capacities were estimated using the relative maximum oxygen consumption. The numerically specified dependent variable, "playing role," reflects a player's classification as either a (1) setter, (2) central player, (3) receiver-at-tacker, (4) opposite hitter, or (5) libero. To look for statistically significant differences between the groups of players, a one-way ANOVA with Tukey HSD post-hoc test was conducted. Eight of the sixteen examined variables (all four anthropometric measurements and four measures for the evaluation of particular speed - strength capabilities) showed statistically significant differences (p 0,05). When attacking, players primarily use spiking, blocking, and serving to score points, all of which need certain physical attributes and talents (such as height, weight, and arm span) to be successful. The ability to create fast spiking and serving speeds is crucial in order to avoid the opponent's response of blocking, defending, and receiving the ball. The second group is less

concerned with scoring points and more concerned with activities like service reception (libero), defense (libero and setter), and setting (setter and libero) in the attack and counterattack complex, for which physical attributes like height, weight, and specific speed-strength capacities are less important (setter) or irrelevant (libero). Experts in the training process may use the data to steer players toward roles with higher potential for success and help them hone abilities that have a strong correlation with success in such situations.

Tsoukos, Athanasios et al. (2019) This research looked at the feasibility of using anthropometric and fitness measures to choose promising young female volleyball players for a national junior squad. There were 64 female players considered for the junior national squad. Their average age was 14.4 years, their height was 1.76 meters, and their weight was 63.9 kilograms. Players were evaluated based on their anthropometric data, as well as the results of speed and power tests. Body height (3.4%; p 0.001), standing reach height (2.6%; p 0.001), total skinfolds (15.4%; p = 0.035), body mass index (BMI) (7.1%; p 0.005), and spike jump and reach (SJR) (2.5%) were all significantly different between qualified and nonqualified players. Selected players were taller than the average (97.2 1.6 percentile) and leaner than the average (66.7 18.6 percentile; p = 0.02) and heavier than the average (51.4% 20.6% percentile); p = 0.004 percentile). A discriminant function (p <0.001, 2 = 0.78) was shown to be strongly loaded by height, SJR, and BMI (r = 0.79, 0.74, and -0.53, respectively) by stepwise discriminant analysis. The prediction accuracy of the cross-validation model was 75% for the chosen players (20 out of 40) and 79.5 % for the unqualified players (35 out of 44). As a result, top young female volleyball players were successfully sorted into the qualifying and unqualified categories based on their body height, body mass index, and SJR height. The relevance of height and body mass index in selecting top junior female volleyball players is shown by the fact that chosen and non-qualified players had similar vertical leap, sprint, and agility scores.

Milić, M et al. (2017) Our research aimed to identify differences in anthropometric and physical performance variables between different playing positions and different performance levels within each position for young female volleyball players in Croatia (aged 13 to 15). There were 28 middle blocks, 41 opposite hitters, 54 passer-hitters, 30 setters, and 28 liberos, all of whom had a specific function in the game. Players were split into two groups at each position based on the team's performance in the most recent regional tournament and individual player quality. The dependent variables were measured in terms of height and weight, somatotype using the Heath-Carter technique, and four tests of lower body power, speed, agility, and upper body power. There were no statistically significant differences in body mass, body mass index, or assessed physical performance characteristics across players of various positions, however there were significant variations in height and all three somatotype components. There were large differences between players of various performance levels on measures of both body composition and athletic ability. Middle blockers tended to be taller, more ectomorphic, and less mesomorphic and endomorphic than other positions, whereas liberos tended to be shorter, less ectomorphic, and more mesomorphic and endomorphic. When comparing successful and unsuccessful players across positions, we found that the former had a lower body mass index, were less mesomorphic and endomorphic, and were more ectomorphic. The most successful athletes also exhibited superior upper-body strength, speed, agility, and explosiveness. A better understanding of how to employ somatotype selection and physical performance evaluation for talent discovery and development may be gained from this study's findings.

Pietraszewska, et al (2015) Many variables influence whether or not an athlete makes it to the professional level. Physical fitness, mental health, and motor proficiency are all crucial. The purpose of this study was to compare elite female volleyball players to their non-athletic counterparts in terms of a variety of anthropometric variables. The variation in these characteristics among the various court ranks was also investigated. Female volleyball players from the first division (N=17) were used as the sample, with a control group of 50 students from the university's school of physical education. The counter movement jump (CMJ) was used to biomechanically evaluate lower limb power and supplement the 35 anthropometric measures taken. Female volleyball players had considerably larger values for height, length, breadth, and body circumference than the control group. The female volleyball players showed a mesomorphic somatotype that was both healthy and attractive. Height differentials were associated with social standing in the court. The CMJ of the receivers, middles, and liberos was higher than that of the attackers and setters. Injuries may be prevented if coaches have this information to better tailor training to each athlete's unique somatic predisposition.

RESEARCH METHODOLOGY

Dimensions of the human body Measurements of body mass index, upper arm circumference, forearm circumference, thigh circumference, and calf circumference were taken as well as weight, height, arm span, hand span, and upper arm circumference.

Study Design

The current research was a comparative study designed to identify the Anthropometric Variables associated with volleyball playing skill and to make direct comparisons between the Anthropometric profiles of volleyball winners and losers. The sample includes both public and private institutions that took part in the next 2022–23 season's collegiate volleyball tournament. For this analysis, 104 sportspeople served as the sample.

Data Collection

The tests for the selected variables were administered, and the data needed was gathered. The examiner demonstrated each item and provided a practice run through the testing procedure before actually putting the examinees through it. In order to avoid disrupting people's regular schedules, data collection took place at times most convenient to the organization and the individuals involved.

Statistics Instruments

All Volleyball players had their Minimum, Maximum, Mean, and Standard Deviation calculated across all research criteria. Student t test for independent sample was used to compare means between the two groups of athletes.

DATA ANALYSIS

Anthropometric Characteristics

Weight, height, body mass index, arm span, hand span, upper arm circumference, forearm circumference, thigh circumference, and calf circumference were all recognized by the study as important anthropometric characteristics for improving volleyball players' performance. Here, we provide a descriptive statistics analysis of volleyball players' height (cm) and weight (kg) across many teams, as well as a comparison of the anthropometric characteristics of the winning and losing teams.

Table 1: descriptive data on the athletes' weight (kg) in different teams

Team	N	Min. - Max.	Median	Mean ± SD	Kurtosis	Skewness
KUK Kurukshetra	13	82.0 - 97.0	86.5	88.3 ± 4.53	-0.363	0.726
LPU Jalandhar	13	82.0 - 89.0	84.0	84.9 ± 2.74	-1.504	0.452
P U Patiala	13	81.0 - 89.0	83.0	84.1 ± 2.79	-0.638	0.819
GNDU Amritsar	13	80.0 - 90.0	85.5	85.5 ± 3.20	-0.810	-0.362
BU Jhansi	13	81.0 - 89.0	85.6	85.2 ± 2.83	-1.429	-0.192
MRU Faridabad	13	74.0 - 89.0	82.9	83.3 ± 3.79	2.985	-1.045
HNBGU Garwal	13	81.0 - 93.0	87.5	86.8 ± 3.92	-1.226	0.050
CDLU Sirsa	13	83.0 - 98.0	89.5	89.4 ± 4.82	-0.642	0.279
Total	104	74.0 - 98.0	85.5	85.9 ± 4.02	0.864	0.532

Table 1 displays descriptive statistics on team weights for a number of different volleyball squads. Students at MRU Faridabad have a median body mass index of 82.9, whereas those at CDLU Sirsa have a median BMI of 89.5. Most teams' distributions were flat (kurtosis = 0), but MRU Faridabad was an exception. At simply MRU Faridabad, there was a huge discrepancy in weight distribution (-1.045). The weight distribution of P U Patiala athletes was highly skewed (0.819), whereas that of KUK Kurukshetra athletes was just slightly skewed (0.726). The rest team's members were quite evenly distributed in terms of body mass. All participants were about the same weight on average (0.532).

On average, athletes at GNDU Amritsar, BU Jhansi, and KUK Kurukshetra were 198.3 cm tall, while those at MRU Faridabad measured in at the smallest (187.2 centimeters). On average, the athletes were 196 and 1 cm tall. The distribution was almost mesokurtic at P U Patiala, leptokurtic at GNDU Amritsar (1.004), and platykurtic at CDLU Sirsa (5.655). Athletes at MRU Faridabad averaged 0.167 meters in height, compared to -0.228 meters at KUK Kurukshetra and 0.392 meters at P U Patiala. At BU Jhansi, GNDU Amritsar, HNBGU Garwal, and LPU Jalandhar, the height distribution was found to be somewhat skewed, however at CDLU Sirsa (-1.923), it was found to be significantly skewed.

Table 2: Height (cm) associated descriptive statistics for teams

Team	N	Min. - Max.	Median	Mean ± SD	Kurtosis	Skewness
KUK Kurukshetra	13	191.4 - 202.3	198.2	197.3 ± 3.63	-1.375	-0.228
LPU Jalandhar	13	187.5 - 199.3	195.8	195.0 ± 3.87	-0.291	-0.970
P U Patiala	13	192.1 - 201.6	195.7	196.1 ± 2.76	0.172	0.392
GNDU Amritsar	13	192.2 - 201.3	198.3	197.7 ± 2.47	1.004	-0.918
BU Jhansi	13	192.9 - 199.6	198.3	197.4 ± 2.18	-0.245	-0.836
MRU Faridabad	13	182.2 - 196.1	187.2	189.4 ± 5.12	-1.902	0.167
HNBGU Garwal	13	185.9 - 197.8	195.2	193.3 ± 3.83	-0.283	-0.953
CDLU Sirsa	13	185.8 - 201.6	196.6	196.5 ± 3.88	5.655	-1.923
Total	104	182.2 - 202.3	196.1	195.3 ± 4.35	0.757	-1.069

Physical characteristics of volleyball players who won and those lost

Table 3: Athletes' Average Height (in Centimeters) Relative to Their Performance

Playing outcome	N	Mean	Standard deviation	Mean difference	t	df	p- value
Winner	52	196.56	3.32	2.396	2.793	94	0.006^{S}
Loser	52	194.17	4.93				

S – Significant ($p<0.05$)

Table 3 displays a mean comparison of athletes based on their height and the results they achieved on the field. The winning team's athletes, with a mean height of 196.56 ±3.32, towered over the losing teams, whose heights averaged 194.17 ±4.93. Loser had a considerably lower mean height than Winner (t-2,793, p-0.006($p<0.05$)).

Table 4: Average Athlete Weight (Kg) by Performance Level

Playing outcome	N	Mean	Standard deviation	Mean difference	t	df	p-value
Winner	52	85.75	3.65	-0.444	-0.541	94	0.590^{NS}
Loser	52	86.19	4.40				

NS - Non-Significant ($p>0.05$)

According to Table 4, it seems that athletes' weight has no impact on their performance. The winning competitors averaged a somewhat lower weight (M-85.75) than the losing athletes (M-86.19). There was no statistically significant difference between the two groups, with a mean difference of -0.445 (t=-0.541, p-0.590).

CONCLUSION

Based on the results of this paper, we may utilize a player's Anthropometric (AP) to determine the position in which they will be most successful. Volleyball is one of the most popular sports worldwide because it is a fun and effective way to get exercise and is liked by men and women of all ages and skill levels. This is a game that calls for a quick tempo and little physical contact. Based on the results, it was determined that there is a very weak positive correlation between athletes' height and their performance on the field. An athlete's performance may benefit somewhat by having above-average height. It was shown that athletes' weight had a very weak negative correlation with their performance. Volleyball players' abilities are somewhat diminished by extra pounds. The average height of the athletes on the winning teams was higher, suggesting that having some taller teammates might be an advantage. The athletes on the winning side had a much lower mean body mass index than those on the losing squad.

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