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A Comparative Study on Professional and Non Professional Women Volleyball Players on Selected Anthropometric Variables

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Abstract- Volleyball is a complex game of simple skills. It has also shown in recent years that there is a trend that volleyball payers adopt the technique, tactics and physical performance. Volleyball Game requires comprehensive ability including physical, technical, mental and tactical abilities. Among them physical abilities of players exert marked effects on the skills of the players themselves and the tactics of the team. In order to succeed at the highest level in volleyball, a team sport, players must possess certain anthropometric traits, especially when it comes to domination over the net. While team court sports have been widely researched, no studies have been conducted comparing data from professional & non professional women volleyball players. Moreover, the differences in biomotor abilities, physiological and anthropometric them are also unknown. The present extensive study may elucidate which bio motor ability, physiological and anthropometric characteristics are most impacted by participation in Volleyball as professional and non professional players. For comparison between professional & non-professional women volleyball players, the investigator chose speed, strength, flexibility, & agility from the many biomotor skills; from the many physiological factors, resting pulse rate, VO2 max, mean arterial blood pressure, & breath holding time; and from the many anthropometric factors, standing height, weight, arm length, & leg length.

Keywords- Anthropometric Variable, Anthropometric measurements, Anthropology, Volleyball

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INTRODUCTION

The term "anthropometric measurement" refers to a group of quantitative methods used to assess a person's body composition without causing harm to the subject. These methods involve taking measurements of the subject's height, weight, skinfold thickness, & waist, hip, and chest areas and then analyzing the results. When choosing players for specific sports, anthropometric measurements are crucial. Determining an athlete's body composition is done primarily for the purpose of gathering data that could be used to enhance the athlete's performance. According to research by Gualdi-Russo (2001), an athlete's anthropometric and physical qualities can be crucial to their performance in their chosen activity.

Exercise efficiency is influenced by a wide variety of parameters, including body weight & composition. Athletes' chances of success in a specific sport may be influenced by the combination of these two elements. An athlete's strength, agility, and looks can all be affected by their body composition in addition to their weight, which can affect speed, endurance, and power. Low body fat percentages are commonly stressed within numerous sports due to the fact that most athletes require a high strength-to-weight ratio to attain maximum athletic performance.(Carter 1990)

Anthropometric & physiological measures are essential for talent detection & identification models, but only if they are measured after it is established that the relative values of the relevant variables between individuals are stable. It would also be important to account for gender differences in the timing of peak values. Since many factors, such as posture, flexibility, & speed, that are acknowledged as being vital to success in numerous sporting activities have not been examined systematically, developing such models would be difficult. Furthermore, due to the significant association that has been shown between the number of years of focused practice and success, the delayed identification of persons into sports would likely be rejected. While previous studies have shown that anthropometric and physical talent detection & identification models are better at predicting actual performance than potential, more recent studies have cast doubt on the validity of using these

characteristics to differentiate between athletes. (Ross A 2001)

Athlete potential can be evaluated and predicted through anthropometric measurements. There is a strong correlation between anthropometric data and athletic performance (Wilmore 1999; Keogh, 1999). According to research by Gualdi-Russo (2001), an athlete's anthropometric and physical qualities can be crucial to their performance in their chosen activity. The player's body proportions are typically interpreted as information about the player's physical build. In this context, they might be thought of as the single most important factor in determining a player's overall ability level. Body structure, proportionality, robustness or grackle skeleton, and muscular development are all based on the anthropometric parameters of specific body segments, which can be measured either longitudinally or circumferentially (Urban, 2010). There is a correlation between anthropometric data & physical multidimensional performance abilities, which has an impact on athletes' results in competitions (Nabieh, Mohamed, 2010).

ANTHROPOMETRY AND SPORTS PERFORMANCE

Anthropology has been used for identification, studying human physical variation, paleoanthropology, and correlating physical with racial and psychological features. At various points in history, certain anthropometrics have been cited by advocates of discrimination and eugenics, often as a part of novel social movements. The study of human body measurement for use in anthropological classification and comparison. The use of such data as skull dimensions and body proportions in the attempt to classify human beings into racial, ethnic, and national groups has been largely discredited, but anthropometric techniques are still used in physical anthropology and paleoanthropology, especially to study evolutionary change in fossil hominid remains. (Sunil Kumar 2017)

Presently, anthropometry considers individual differences, appraises each subject relative to his structural differences and determines his potentialities in light of those structural characteristics. For optimal performance during play at an elite level, a variety of areas must be addressed. Anthropometry provides scientific methods and observation to help in finding out talent in sports. (Anthropometry means the measurement of man). There is profound positive relationship between performance in sports and the anthropometric aspects of an athlete's body. It has been scientifically proved that different sports or different events in a same sport require the demand of different bodily characteristics. (Papadopoulou, et al. 2002).

ANTHROPOMETRIC CHARACTERISTICS AND VOLLEYBALL

Anthropometric measurements relevant to human movement gained formal recognition as a discipline with the inauguration of the International Society for Advancement of Kin anthropometry in 1986. Anthropometrists of all continents have participated in several major multidisciplinary studies that are being or have been conducted to assess the physical characteristics of people. Kin anthropometry has been defined as the quantitative interface between human structure and function. **(Ross, et al. 1980) .** This interface is examined through the measurement and analysis of age, body size, shape, proportion, composition and maturation as they relate to gross body function. Previous studies have demonstrated that physical traits like body composition (body fat, body mass, muscle mass), somatotype, and body structure are important factors in many sports, and they can have a big impact on how well an athlete performs (Duquet & Carter, 2001).

Anthropometric profiles may help in determining a player's fit for volleyball, especially at the elite level. The selection of athletes for many sports can be influenced by body type and morphological traits, according to reports from earlier branches of anthropometrical research. Cross-sectional anthropometric research has tended to support the idea that certain physical traits, such as somatotype & body composition, have a major impact on athletic performance (Carter, 1984).

ANTHROPOMETRICAL MEASURES OF VOLLEYBALL

The oldest method of bodily measurement, stretching back to the dawn of written history, is anthropometry. Measurement of the human body's dimensions in terms of bone, muscle, & adipose tissue is the subject of this study. In order to evaluate gross structure and function, anthropometry has been used. The performance of a sportsman is influenced by a variety of things. (Srivastva G.1994) Anthropometric profiles may help in determining a player's fit for volleyball, especially at the elite level. The selection of athletes for many sports can be influenced by body type and morphological traits, according to reports from earlier branches of anthropometrical research. Cross-sectional anthropometric studies tend to suggest that body composition (fat, mass, muscle mass), physique (somatotype), & athletic performance are related. have a substantial impact (Carter, 1984). A variety of elements influence good performance in contemporary sports. A lot of issues need to be resolved for peak performance. Furthermore, volleyball is the sport in which physical attributes like size, shape, and body composition are crucial in granting distinct advantages for particular playing positions. These include the player's level of proficiency, flexibility, stamina, and—most importantly—the precise application of anthropometric measures, which is crucial in challenging team-based sports. Since the ability of a team to succeed in the game depends, among other things, on how well the individual traits of some

players mesh with the group as a whole. (Sudhakara, G.2018)

According to Grgantov et al. (2006), a taller body would enable ball contact to happen higher above the net. All of these increase the demand for volleyball athletes with a certain physique. The goal of a modern volleyball match is to dominate the net, and the easiest method to achieve this domination is to sign individuals who are taller and have better jumping skills. It has also been argued that arm breadth and standing reach height are crucial elements for higher spiking and blocking.

LITERATURE REVIEW

Dr. Sudhakara G (2018) The participants were male intercollegiate volleyball players, and the study's goal was to determine the correlation between certain physiological indicators and performance on the court. Methods Forty (40) male collegiate volleyball players were chosen as subjects to complete the study. Vital capacity was measured using a dry spirometer, heart rate was tracked using an Omron automatic blood pressure monitor MX3, and systolic and diastolic blood pressure were taken with an Omron automatic blood pressure monitor MX3 during an intercollegiate tournament hosted by Visvesvaraya technological University. During the collegiate competition, the players' abilities were evaluated subjectively by three experts, with the average serving as the criterion score. Analyzing the data statistically, we examined the link between several physiological factors and performance on the volleyball court among males who compete at the collegiate level. A correlation coefficient between a number of physiological factors & volleyball performance was found in a study of men's intercollegiate volleyball players. Among male intercollegiate volleyball players, the analysis found a significant relationship between diastolic blood pressure & volleyball performance, but no such correlations between systolic blood pressure & volleyball performance, vital capacity, or pulse rate.

Dr. Krishnendu Pradhanv (2020) Among east zone inter university male volleyball players, an attempt was made to compare positional variations in biomotor motor ability. Fifty-six male volleyball players (N=56, mean age: 23.211.56 years) were randomly picked from the east zone inter university volleyball tournament in 2014. According to their roles on the court, the players were divided into four groups: middle blocks (N=14), outer hitters (N=18), liberos (N=12), and setters (N=12). Karada Scan; Body Composition Monitor measurements of the athletes' body compositions were taken to provide a basic descriptive sample indicative of how they performed in each position. Volleyball players' biomotor abilities were evaluated using a battery of standardized tests, including the standing broad jump, the medicine ball put for six pounds, the 50-meter dash, the 600-yard run/walk, the sit-and-reach test, & ball transfer test for eye-hand coordination and flexibility. Mean differences between the groups were determined using ANOVA. The significance level was determined to be 0.05. Explosive leg strength, explosive shoulder strength, speed, endurance, & flexibility were all found to differ significantly among positions. There are no major distinctions in eye-hand synchronization between the various positions on the court. The findings of this study will be useful for volleyball coaches and trainers in developing practice plans that take into account players' biomotor skills in relation to their location on the court. Therefore, further studies are needed to comprehend better talent identification && team selection in volleyball, taking into account the responsibilities & requirements of different positions.

Karla Đol et al. (2022) As a result of volleyball's increasing pace as a competitive sport, agility has emerged as a crucial set of skills for players to master. The purpose of this research was to examine how certain anthropometric characteristics correlated with the agility of young female volleyball players in terms of both direction changes & reactions. Body mass, body mass index, lower leg upper arm circumference, and four skinfold thicknesses (triceps, subscapular, abdominal, & lower leg) were measured, and 19 female volleyball players, aged 14,70,6, participated in three change of direction tests (T-test, X-test, Step-hop test). The primary finding demonstrates that, across all measures of directional shift, reactive agility was not significantly correlated (r = 0.02-0.26). Examination of Connection to Anthropometric Variables The correlations between the shuttle run test and other measures of movement are lower. Based on these results, it is necessary to track young female volleyball players' direction changes & reactions independently.

Farid Farhani **et al. (2022)** Individual athletes & sports have had their second-to-fourth-digit ratios (2D:4D) measured, but futsal performance has not been studied in this way. This study set out to examine whether or not elite female futsal players showed any correlations between the ratio of their dominant hand's 2D:4D to their non-dominant hand's 2D:4D and their performance on measures of physical capacity, selected functional variables, and hormone concentrations. Twenty-four professional female

futsal players had their dominant and non-dominant hands measured for 2D:4D. Also measured were hand-grip strength (HGS), aerobic power, and the futsal specific performance test (FSPT). Hormones such estradiol, cortisol, growth hormone, and insulin-like growth factor-1 were also tested in the blood. The correlational linkages were determined with the use of Pearson's correlation test. Two-dimensionality four-dimensionality (2D:4DD) was significantly correlated with both total test-time & performance time (total time + penalty time) for the FSPT (r = 0.53, p = 0.005 & r = 0.55, p = 0.003, respectively). As with the 2D:4DD, HGSND was shown to have a statistically significant connection with it (r = 0.59, p = 0.002). Both aerobic power & treadmill running time were significantly related to 2D:4DND (r = 0.54 & p = 0.006, respectively). Both the 2D:4DD ratio and the 2D:4DND ratio were significantly correlated with cortisol (0.58, p = 0.003) & (0.52, p = 0.008). Potential performance aspects and talent assessment of elite female futsal players may be aided by measuring the 2D:4D ratio. More research is required to fully understand the implications of these findings.

METHODS AND METHADOLOGY

Research Design

The groups will be selected at random. Twenty female professional volleyball players, twenty female collegiate volleyball players, and twenty female intercollegiate volleyball players will be randomly selected to form three separate groups. Biomotor, physiological, anthropometric, & volleyball-specific tests will be administered to the participants. Athletes will be evaluated on a number of different parameters, including their speed, strength, flexibility, agility, resting heart rate, VO2 max, mean arterial blood pressure, breath holding duration, standing height, weight, arm length, leg length, & volleyball skills. Standardized tests will be used to determine biomotor, physiological, and anthropometric characteristics, and the volleyball playing ability will be measured subjectively by three experts in the field. ANOVA will be used to statistically analyze the acquired data to determine the significance of the differences between the chosen groups. The hypothesis in this study will be tested at the 0.05 level.

Table 1. Variables Selected, Testing Methods and Scoring Units

Category	Variable	Tests	Unit
Anthropometric Variables	Standing Height	Stadio meter	Centimeter
	Weight	Weighing machine	In K.gs
	Arm length	Measuring tape	Centimeter
	Leg length	Measuring tape	Centimeter

Collection of Data

The data will be gathered from three distinct populations of female volleyball players: those who play at the professional level, those who play at the collegiate level, and those who play at the intercollegiate level. Biomotor, physiological, and anthropometric factors will be measured with the help of standard tests.

Selection of Subjects

The study's goal is to evaluate the differences between professional & amateur female volleyball players on a number of biomotor, physiological, and anthropometric measures. Professional female volleyball players are defined in this study as those who have been recruited by top state or private organizations due to their demonstrated ability on the court and who are retained primarily for the purpose of competing in national & international volleyball tournaments.

Table 2. Number of Subjects Selected for this study

Professional Players	Non Professional Players	
	University Level	Intercollegiate Level
Chhattisgarh Police	Kalinga University	Rungta College
South East Central Railway	Amity University	Government College
Chhattisgarh Women volleyball	ITM University	Holy Cross Women's College
Total no. of. Players =20	Total no. of. Players =20	Total no. of. Players 20

Anthropometric Variables

- Standing Height
- Weight
- Arm Length
- Leg Length

STANDING HEIGHT

Objective

To calculate height

Apparatus used

Stadiometer & Anthropometric rod

Test Description

An anthropometric rod will be used to determine height. The subject stretches her body while standing upright, barefooted, against a wall with her heels, back of the shoulder, and head touching the wall. Stretched as high as she could without letting her heel leave the ground. The anthropometric rod is then placed in front of the subject, & crossbar is adjusted so that of the crossbar touches the

subject's highest point. The measurement of height is in metres.

WEIGHT

Objective

To calculate weight

Apparatus used

Weighing Machine

Test Description

The subjects' weights were recorded while they were simply wearing a vest and shorts on a weighing machine. They stepped on the scale, and the weight that came closest to half a kilogramme was recorded.

ARM LENGTH

Objective

To measure Arm Length

Apparatus used

Flexible Steel Tap, Rod, Pencil and Paper

Test Description

Position the end of the measuring tape to a spot about 5 inches from one end of the rod. The subject was asked to grasp the rod and to hold in his arm at about 45 degrees from the midline of the body The elbow must be extended fully during this measurement.

The arm length was the distance from the rod to the acromion process. The acromion process is the bone like protuberance at the edge of the shoulder Care was taken the measurement was taken from the top of the rod.

Scoring

After taking several measurements, record on the fit kit sheet under corrected arm length of the subject was recorded.

LEG LENGTH

Objective

To measure Leg Length

Apparatus used

Flexible Steel Tape

Test Description

To determine the leg length, the examiner faced the subject the hands approximately four to six inches below the subject's waist on the hip and asked the subject to swing the right leg back and forth slowly and lifting it to the outside. By manipulation, the examiner could locate the spot where the greater trochanator entered the pelvic girdle. The bigger trochanator's height above the ground was measured. Each individual underwent this process five times total. The centimetres were used to measure the distance. (Baljeet Singh 2016)

RESULTS AND DISCUSSION

The results presented in this study proved that there were significant differences among professional, university level nonprofessional and college level nonprofessional volleyball players on selected anthropometrical variables standing height, weight, arm length, and leg length and the formulated hypothesis No. 3 that there would be significant differences between professional & non-professional women volleyball players was accepted at 0.05 level as there were significant differences.The study's goal was to evaluate a few biomotor, physiological, and anthropometric characteristics between professional & amateur female volleyball players. Twenty professional women's volleyball players were chosen from Chhattisgarh to carry out the study's objectives. Twenty women volleyball players at the collegiate level were chosen from Chhattisgarh's Kalinga University, Amity University, and ITM University. Additionally, 20 players competing at the intercollegiate level were chosen from Holy Cross Women's College, Government College for Women, and Rungta College in Chhattisgarh. The use of random grouping was made. Twenty professional female volleyball players, twenty non-professional female volleyball players at the university level, and twenty non-professional volleyball players at the intercollegiate level were chosen at random into three separate groups. Using accepted techniques, the subjects' biomotor, physiological, anthropometric, and volleyball-playing abilities were assessed. The criterion variables selected were speed, strength, flexibility, agility, resting heart rate, VO2 max, mean arterial blood pressure, breath holding time, standing height, weight, arm length, leg length and volleyball playing ability. The biomotor, physiological and anthropometric variables were measured using standard tests and volleyball playing ability was measured through three experts in the field subjectively.

Results on Anthropometric Variables

Standing Height

The standing height mean differences across groups were significantly different dependent on competition intensity. Professional players had 173.87, followed

by university non-professionals with 169.70 and professional collegiates with 163.53. The post hoc analysis showed that professional players outperformed university and college non-professionals. Compared to college non-professional players, university players were substantially better.

The results on the anthropometric variable Height among the Professional, University level non Professional and college level non professional women volleyball players is existing in Table 1.3.

Table 3. Display the ANOVA on means from professional, university non professional & professional college women volleyball players on height

Mean Values of Women volleyballplayers of			Source of Variance	Sum of Squares	df	Mean Squares	F
Professional	University level non Professional	College level non professional					
173.87	169.70	163.53	Between	1621.67	2	810.83	19.47*
			Within	3623.23	87	41.65	

Table 1.3 demonstrates that professional women volleyball players had a mean height of 173.87, university players 169.70, and college players 163.53. The differences were statistically analysed, & F value 19.47 exceeded the 0.05 significance threshold of 3.10. There were substantial variations between groups tested.

Weight

The mean weight differences between groups were significantly different dependent on competition level. Professional players had 64.0, followed by university non-professionals with 57.08 and college non-professionals with 56.32. Post hoc study showed that professional players were heavier than college and university non-professionals. Comparing between the non professional players of university and college, there was no significant difference on weight.

The results on the anthropometric variable Weight among the Professional, University level non Professional and college level non professional women volleyball players is existing in Table 1.4

Table 4. Display the ANOVA on means from professional, university non professional & professional college women volleyball players on weight

Mean Values of Women volleyballplayers of			Source of Variance	Sum of Squares	df	Mean Squares	F
Professional	University level non Professional	College level non professional					
64.00	57.08	56.32	Between	1074.87	2	537.44	12.81*
			Within	3650.54	87	41.96	

Table 1.4 demonstrates that professional women volleyball players had a mean weight of 64.00, university players 57.08, and college players 56.32. The differences were statistically analysed and the F value 12.81 exceeded the 0.05 significance threshold of 3.10.

Arm Length

The mean arm length differences between groups were significantly different dependent on their competitiveness level. Professional players had 78.17, followed by university non-professionals with 74.18 & college non-professionals with 72.38. The post hoc analysis showed that professional players outperformed university and college non-professionals. Comparing between the non professional players of university and college, there was no significant difference on arm length.

The results on the bio motor fitness variable Arm Length among the Professional, University level non Professional & college level non professional women volleyball players is existing in Table 1.4

Table 5. Display the ANOVA on means from professional, university non professional & professional college women volleyball players on arm length

Mean Values of Women volleyballplayers of			Source of Variance	Sum of Squares	df	Mean Squares	F
Professional	University level non Professional	College level non professional					
78.17	74.18	72.38	Between	525.54	2	262.77	23.56*
			Within	970.25	87	11.15	

Table 5. Demonstrates that professional women volleyball players had a mean arm length of 78.17, university players 74.18, and college players 72.38. The F value 23.56 was more than the 3.10 required to be significant at 0.05 level after statistical analysis of the differences.

Leg Length

Leg length mean differences were considerably different between groups based on competition level. Professional players scored 103.47, followed by university non-professionals with 102.22 and college non-professionals with 98.50. The post hoc analysis showed that professional players outperformed college ones. Comparing between the professional and university non professional players there was no significant difference on leg length. Pearson et.al. (2004) investigated the anthropometric

The results on the bio motor fitness variable Leg Length among the Professional, University level non Professional & college level non professional women volleyball players is existing in Table 1.6

Table 6. Display the ANOVA on means obtain from professional, university non professional & professional college women volleyball players on leg length

Mean Values of Women volleyballplayers of			Source of Variance	Sum of Squares	df	Mean Squares	F
Professional	University level non Professional	College level non professional					
103.43	102.22	98.50	Between	396.32	2	198.16	11.53*
			Within	1495.71	87	17.19	

Table 1.6 demonstrates that professional women volleyball players had a mean leg length of 103.43, university players 102.22, and college players 98.50. The differences were statistically analysed, and the F value 11.53 exceeded the 0.05 significance threshold of 3.10.

Table 7. Test-Retest Scores Intraclass Correlation Coefficient

S. No	Variable	Coefficient of Correlation
1.	Standing Height	0.98*
2.	Weight	0.99*
3.	Arm Length	0.97*
4.	Leg Length	0.98*

*** Significant at 0.05 level**

CONCLUSION

The study compared anthropometrical factors of professional and non-professional women volleyball players. Twenty professional women volleyball players from Chhattisgarh Police, South East Central Railway, and Chhattisgarh Women volleyball were chosen for the study. Kalinga, Amity, and ITM, Chhattisgarh chosen 20 university women volleyball players. Twenty intercollegiate players were chosen from Rungta College, Government College, and Holy Cross Women's College, Chhattisgarh. Random group design was employed. Three independent groups, namely 20 volleyball women professional players; 20 university level non professional women volleyball players and 20 inter collegiate level non professional volleyball players were randomly chosen. The subjects were calculated of their bio motor, physiological, anthropometric and volleyball playing ability using standard methods. The criterion variables selected were speed, strength, flexibility, agility, resting heart rate, VO2 max, mean arterial blood pressure, breath holding time, standing height, weight, arm length, leg length and volleyball playing ability. The biomotor, physiological and anthropometric variables were measured using standard tests and volleyball playing ability was measured through three experts in the field subjectively. Women professional and non professional players are selected for this sport based on their skills, performance levels, physique and muscular strength. Team court sports have been extensively studied, but professional and non-professional women volleyball players have not been compared. Moreover, the differences in biomotor abilities, physiological and anthropometric them are also unknown. The present extensive study may elucidate which bio motor ability, physiological and anthropometric characteristics are most impacted by participation in Volleyball as professional and non professional players.

REFERANCES

1. Arvind Bahadur Singh, Satchidananda Behera (2013). Relationship of Anthropometric Characteristics and Kinematic Variables with Spiking of Volleyball Players. *Journal of Education and Practice.* Vol 4, No 10.
2. Baljeet Singh and Azad Singh(2016), Relationship between structural and functional ability of Volleyball Players, *International Journal of Physiology, Nutrition and Physical Education,* 1(1): 83-85.
3. Carter, J.E.L. & Heath, B.H. (1990). *Somatotyping - development and applications,* Cambridge University Press, New York; United States.
4. Duquet, W. & Carter, J.E.L. (1996). *Kinathropometry and exercise physiology laboratory manual.* (eds. Eston R, Reilly T), pp. 35-50. London: E&FN Spon.
5. Gualdi-Russo E and Zaccagni L. (2001). Somatotype role and performance in elite volleyball players. J Sports Med Phys Fitness, 41(2), 256-262. Urban, F. (2010). Somatotypes of Handball Players. Diploma thesis. Presov: FS PU, p-87.
6. Gualdi-Russo E, Zaccagni L. (2001). Somatotype, role and performance in elite volleyball players. *J Sports Med Phys Fitness.*41(2):256-62.
7. Gualdi-Russo, E. & Graziani, I. (1993). Anthropometric somatotype of Italian sport participants. *J Sports Med Phys Fitness.* 33(3):282-91.
8. Heyward, V.H (2006), *"Advanced Fitness Assessment and Exercise Prescription"* (5th ed.), Champaign, IL: Human Kinetics.
9. Leake C.N. and Carter J.E.L (1991) Comparison of body composition and somatotype of trained female triathlete Journal of Sports Sciences, 9, 125- 135
10. Nabieh, A., Mohamed, I. (20[0). Anthropometric measurements as a significant for choosing juniors in Both Volleyball and Handball Sports (Factorial analysis study). World J Sport Sci., 3(4), 277-289.
11. Papadopoulou S. D., Zorzou A., Garcia-de-Alcaraz A., Rosemann T., Knechtle B. and Nikolaidis P. T. (2020), "*Subcutaneous Adipose Tissue in Female Volleyball Players: Is It Related with Performance Indices?*", Medicina, April 2020, Vol. 56(4), 159.

12. Papadopoulou, S.D., Papadopoulou, S.K., Gallos, G.K., Likesas, G., Paraskevas, G. & Fachantidou, A. (2002). Anthropometric differences of top Greek and foreign volleyball players. *International Journal of Volleyball Research,* 5, 26-29.
13. Ross A, and Leveritt M. (2001), "Long-term metabolic and skeletal muscle adaptations to short-sprint training: implications for sprint training and tapering.", Sports Med. 31(15):1063-82.
14. Ross, W.D., Carr, R.V. & Carter, J. (2003). *Anthropometry Fundamentals. In The Human Animal Serials.* Canda: Rosscart.
15. Slater, G.J., Rice, A.J., Mujika, I., Hahn, A.G., Sharp, K. & Jenkins, D.G. (2005). Physique traits of lightweight rowers and their relationship to competitive success. *British Journal of Sports Medicine.* 39:736-741.
16. Sudhakara, G. (2018) Relationship of selected physiological variables with volleyball playing ability among intercollegiate volleyball men players. International Journal of Academic Research and Development ISSN: 2455-4197 Impact Factor: RJIF 5.22 www.academicsjournal.com Volume 3; Issue 2.
17. Sunil Kumar, Pramod Kumar Yadav and Kashi Nath Yadav (2017), "*Assessment of mental toughness between volleyball and kho-kho Indian players of 12th South Asian games: A comparative study*", International Journal of Yoga, Physiotherapy and Physical Education 2017, Vol. 2, Issue 3, pp. 21-22.
18. Srivastva, G. (1994). *Advanced research methodology.* New Delhi: Radha Publications, pp. 219-220.
19. Wilmore, J.H. & Costill, D.L. (1999). *Physiology of Sports and Exercise.* 2nd ed. Human Kinetics, Champaign. Pp. 490-507.
20. Wilmore, J.H. (1982). Training for sports and activity- The physiological basis of the conditioning process. Allyn and Bacon Inc., 2, 119-137.

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