Axiological Attributes
of Elite Indian Men Volleyball Players

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ABSTRACT

The sole purpose of the study was to find out the Auxological characteristics along with study of somatotype and body composition differences among elite Indian men Volleyball players. In the present research the data was collected through purposive sample technique from 56th Senior National Volleyball Championship, held at Jaipur (Rajasthan) India. The technique adopted for taking measurement was based on methods developed by Tanner and Whitehouse (1955) and Martin and Saller (1957). Total seventeen anthropometric measurements were taken on each subject and measurement were as: height (cm), weight (cm), arm span (cm), hand span (cm), the skin fold measurements such as: biceps (mm), triceps (mm), forearm (mm), thigh (mm) and calf (mm), diameter measurement of wrist (cm), elbow (cm), knee (cm) and ankle. The circumference measurement of upper arm (cm), forearm (cm), thigh (cm) and calf (cm) were measured. Apart from above measurement there are some derived variables based on equations given by Carter (1980) such as endomorphy, mesomorphy and ectomorphy. One more derived variable, body composition, was calculated by using equation, given by Durmin and Womersley (1974). Total 48 players were taken as subjects, including substitutes from four semifinalist teams. Statistical analysis has been carried out by calculating mean, standard deviation, and analysis of variance (F-test).

Positive role of height and body weight were found with performance of Volleyball players. Arm span values and hand span was found maximum positive results. Wrist width, knee width, upper arm circumference (normal & flexed) forearm circumference, thigh circumference and calf circumference were also found maximum in Haryana team that secured 1st position. Height weight ratio showed the positive results with performance and, in nut shell, we can say that body measurement and overall body composition has positive role in enhancing the performance; and play an important role in determining the competition performance.

Key words

Auxological Attributes, Elite Volleyball Players, Performance, Body Composition.

INTRODUCTION

Volleyball, as a sport, was officially included in the Olympic Programmeme in 1964. Since then, this game has grown up in leaps and bounds and as on today there are as per FIVB (2014) official website, the FIVB consists of 220 affiliated federations. Volleyball is a sport that alternates aerobic

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and anaerobic activity; thus, requiring muscular strength and power. The athlete must possess flexibility, strength, power, agility and aerobic fitness to practice it (Schutz, 1999). In Volleyball, technical and tactical skills, anthropometric characteristics and individual physical performance capacities are most important factors that contribute to the success of a team in competitions (Hakkinen, 1993). Success in sport competitions has been associated with specific anthropometric characteristics, body composition and somatotype (Bayios et al, 2006; Duncan et al, 2006; and Hakkinen, 1993). To execute Volleyball skills and tactics, players need high levels of physical performance, through muscle strength, speed of movement, arm spiking, jump with and without running up, stamina of movement, agility, and flexibility of shoulders, waist, knees, and wrist, etc. (Chen, 2005). The Predominance of scientific evidences obtained from different investigations have revealed that high level of performances depend upon various factors like somatic, physiological, anthropometrical and psychological, etc. The relevance of auxological factors and Volleyball performance was established from time to time through various researches.

Objectives

The sole objective of the study was to find out the auxological attributes along with study of somatotype and body composition differences among elite Indian men Volleyball players.

Delimitation

The attributes of performance was assessed from the players of top four position holder men teams in the 56th Senior National Championship, held at Jaipur, Rajasthan, India.

METHODOLOGY

The present research data was collected through purposive sample technique. The technique adopted for taking measurement was based on Tanner and Whitehouse (1955) and Martin and Saller (1957). Total seventeen anthropometric measurements were taken on each subject and measurement were as: height (cm), weight (cm), arm span (cm), hand span (cm), the skinfold measurements such as: biceps (mm), triceps (mm), forearm (mm), thigh (mm) and calf (mm), diameter measurement of wrist (cm), elbow (cm), knee (cm) and ankle. The circumference measurement of upper arm (cm), forearm (cm), thigh (cm) and calf (cm) were measured. Apart from above measurement there are some derived variables based on equations given by Carter (1980) such as endomorphy, mesomorphy and ectomorphy. One more derived variable, body composition, was calculated by using equation, given by Durmin and Womersley (1974). Total 48 players were taken as subject including substitutes from four semifinalist teams. Statistical analysis has been carried out by calculating mean, standard deviation, and analysis of variance (F-test).

RESULTS & DISCUSSION

Section-I: Descriptive Measurements of Height, Arm Span, Weight, Hand Span

The descriptive Table shows that average height of Volleyball players of *Haryana, Tamilnadu, Kerala* and *Services* were 191.500 cm, 191.42 cm, 190.42 cm and 185.33 cm, respectively. The analysis of variance showed non-significant difference

Descriptive Measurements of Auxological Attributes' Mean, Standard Deviation and F- Value of the Elite Indian Men Volleyball Players

Sr. No. & Name of Parameters	1st, Haryana (N=12) MEAN ± SD	2nd, Tamilnadu (N=12) MEAN ± SD	3rd, Kerala (N=12) MEAN ± SD	4th, Services (N=12) MEAN ± SD	F-Value
Section-I, Descriptive Measurements of Height, Arm Span, Weight, Hand Span					
1. Height (cm)	191.500 ± 7.38	191.42 ± 8.13	190.42 ± 5.6	185.33 ± 5.6	1.968
2. Arm Span (cm)	196.7 ± 7.13	189.96 ± 7.3	191.33 ± 7.55	193.25 ± 8.77	2.925*
3. Weight (kg)	83.33 ± 9.09	75.75 ± 5.53	78.00 ± 8.12	78.33 ± 8.8	1.912
4. Hand Span (cm)	20.37 ± 1.15	20.71 ± 1.28	19.75 ± 0.62	19.84 ± 0.91	2.386
Section-II, Descriptive Measurements of Joint Width					
5. Elbow width (cm)	6.96 ± 0.64	7.04 ± 0.39	6.73 ± 0.5	7.11 ± 0.40	1.378
6. Wrist Width (cm)	6.00 ± 0.41	5.83 ± 0.38	5.73 ± 0.40	5.81 ± 0.40	0.603
7. Knee Width (cm)	10.33 ± 0.53	9.93 ± 0.49	10.20 ± 0.36	9.95 ± 0.94	1.21
8. Ankle Width (cm)	7.7 ± 0.43	7.5 ± 0.43	7.9 ± 2.7	7.31 ± 0.40	6.002**
Section-III, Descriptive Measurements of Limbs' Circumferences					
9. Upper Arm Circumference Normal (cm)	29.37 ± 2.07	27.39 ± 1.72	28.97 ± 1.5	27.8 ± 1.2	4.935**
10. Upper Arm Circumference Flex (cm)	33.57 ± 2.58	31.33 ± 2.5	32.6 ± 1.44	31.3 ± 1.7	3.191*
11. Forearm circumference (cm)	28.5 ± 1.8	26.8 ± 1.5	26.66 ± 0.07	26.66 ± 1.2	2.762
12. Thigh Circumference (cm)	55.6 ± 4.2	54.6 ± 3.8	53.08 ± 2.5	53.4 ± 3.09	1.203
13. Calf Circumference (cm)	37.04 ± 1.5	35.9 ± 1.7	36.42 ± 1.32	35.49 ± 2.8	1.466
Section-IV, Descriptive Measurements of Skinfolds					
14. Biceps Skinfold (mm)	4.8 ± 2.4	3.7 ± 0.93	4.31 ± 0.69	3.72 ± 0.81	1.660
15. Triceps Skinfold (mm)	8.45 ± 4.06	8.73 ± 2.7	5.81 ± 0.86	7.60 ± 1.94	2.907*
16. Forearm Skinfold (mm)	6.0 ± 1.5	5.39 ± 0.74	5.46 ± 0.95	5.6 ± 0.9	0.734
17. Calf Skinfold (mm)	6.58 ± 3.41	6.16 ± 3.10	5.43 ± 0.76	5.00 ± 7.5	0.74
Section-V, Descriptive Measurements of Derived Variables					
18. Height Weight Ratio	43.9 ± 0.82	45.26 ± 1.5	44.64 ± 1.6	43.39 ± 1.44	0.680
19. Mesomorphy	3.60 ± 0.84	2.81 ± 1.3	1.25 ± 0.93	3.66 ± 1.12	1.610
20. Ectomorphy	3.6 ± 0.60	4.6 ± 1.06	4.1 ± 1.14	3.2 ± 1.06	4.448**
21. Bone Mass (kg)	13.81 ± 1.97	13.22 ± 1.73	13.40 ± 1.13	12.71 ± 1.7	0.908
22. Muscle Mass (kg)	39.56 ± 5.04	36.06 ± 4.95	37.42 ± 2.15	24.90 ± 4.5	2.526

*Significant at 5% level, ** Significant at 1% level

the result that team which stood 1st, has highest height and followed by 2nd and same with 3rd and 4th place. So, it is evident from the results that height has positive role with the performance of the elite Indian Volleyball male players.

Further, Table indicates that maximum body weight has been found in the *Haryana* team (83.33kg) that stood first and minimum in *Tamilnadu* (75.75) that stood second. The body weight cannot depict its importance unless body composition is studied thoroughly. As for as F- ratio is concerned there was no significant difference in teams.

Table also shows the mean value of arm span among elite Indian Volleyball players in men section. The maximum arm span of 196.7 has been found in *Haryana* team that rank 1st and the F- ratio (2.925) in statistical term for arm span also was observed significant among all teams.

Addition to above findings, the hand span of the elite Indian Volleyball players in men section and maximum hand span of 20.37cm has been noticed in 2nd ranked *Tamilnadu* Volleyball team. However, in statistical team the F- ratio 2.39 was not found significant among all teams. These four teams are position winning teams. Therefore, the difference in the different body measurement would not be always being up to the level of statistically significant.

Section-II: Descriptive Measurements of Joint Width

It is evident from Table, that the biepicondylar humerus diameter or elbow width among elite Indian men Volleyball players was highest in *Services* Volleyball players (7.11 ± 0.40) followed by *Tamilnadu* (7.04 ± 0.39), *Haryana* (6.96 ± 0.64) and *Kerala* (6.73 ± 0.5). The result of the F-ratio (1.378) was found non-significant. The conclusion of the present study shows that the role of the elbow width is not very important in Volleyball.

Table also shows the wrist diameter among elite Indian men Volleyball players. It was observed that *Haryana* Volleyball players possessed the maximum diameter of wrist (6.00 ± 0.41) and whereas the *Kerala* players had minimum (5.73 ± 0.40). In statistical terms, the F-ratio (F=0.60) was found non-significant. Therefore, on the basis of findings, it is clear that though there is statiscal similarity of wrist diameter in the all teams; but. 1st rank team, *Haryana* had maximum value of wrist width.

In addition to above findings. Table illustrates the values of biepicondylar femur or knee width among elite Indian Volleyball male players. This Table shows that *Haryana* Volleyball players, who ranked 1st in the competition, had maximum femur width (10.33 ± 0.53); but, in statistical terms, the F-ratio (F=1.21) was found non- significant. Therefore, on the basis of findings, it is clear that though there was statical similarity in all teams but teams that secured first position had better body measurements.

Volleyball players of *Kerala* had 7.9 cm as mean value of ankle diameter ; and this value is the maximum among all teams. The Volleyball players of *Services* had the minimum diameter of the ankle, as 7.31cm. In statistical terms, F-ratio, (F=6.002) has been found significant at 1% level. *Haryana* Volleyball players had greater ankle diameter than *Tamilnadu* players. Similarly, *Tamilnadu* Volleyball players and *Kerala* volleyball players had greater ankle diameter.

Section-III: Descriptive Measurements of Limbs' Circumferences

Serial number 9: Parameters depict the upper arm circumference (normal) among elite Indian men Volleyball players. It is evident from the Table that Volleyball players of *Haryana* had maximum upper arm circumference (29.37cm) whereas *Tamilnadu* had minimum diameter (27.39 cm). With this, in statistical terms, the F-ratio (F=4.93) is highly significant.

Serial number 10, parameters shows that *Haryana* players had possessed the maximum circumference of upper arm (flexed) (33.57cm); whereas, Volleyball players of *Services* had shown minimum value (31.3cm). In statistical terms, the F-ratio (F=3.19) was found significant. *Haryana* team had greater circumference of upper arm (flexed) than *Kerala* Volleyball players and *Kerala* team had greater values than *Services*.

Serial number 11, parameters of *Haryana* had shown the maximum value of forearm circumference (28.5 cm), whereas, *Kerala* had almost equal but minimum value 26.66. In statistical terms F-ratio was found non-significant (F=2.276).

Serial number 12 : parameters shows that *Haryana* team had the maximum value of thigh circumference (55.6cm); whereas, *Kerala* Volleyball players showed minimum thigh circumference (53.08).

Serial number 13: parameter shows that players of *Haryana* have the maximum value of calf circumference (37.04 ± 1.5); whereas, *Services* Volleyball players had shown minimum Calf Circumference (35.49 ± 2.8). In statistical terms the F-ratio (F=1.466) has been found non-significant. As in above anthro-pometric measurement, it is shown that *Haryana* has highest body measurement scores and also secured first

position in the national championship. So, it can be said that anthropometric measurement have significant role in performance.

Section-IV: Descriptive Measurements of Skinfolds

It is clear from the descriptive Table that the Volleyball players of *Tamilnadu* team were found to be the leaner in biceps skinfold (3.7mm); whereas, the most fatty Volleyball players were found to be that of *Haryana* (4.80mm). *Haryana* team, who ranked 1st have shown more mean value of biceps skinfold as compared to other teams; but, it is perhaps due to greater variation in the data that the S.D. value of 2.4mm reported for biceps skinfold in *Haryana* team is too much. However, in statistical terms, the F-ratio (F=1.67) has been found non-significant.

It is evident from the Table that *Tamilnadu* had most fat deposit (8.73mm); whereas, *Kerala* players were found most leaner (5.81mm). In statistical term the F-ratio (F=2.90) was found significant. Volleyball players of *Haryana* have leaner triceps skinfold as compared to Volleyball players of *Tamilnadu*.

For forearm skinfold (mm) *Haryana* had shown the maximum value (6.0); whereas, *Tamilnadu* players were found to be leaner (5.39). In statistical terms, the F-ratio of forearm skinfold (mm) was found non- significant. Thus, it can be said that in forearm skinfold (mm) there is resemblance among all teams.

The calf skinfold of *Haryana* contained maximum value (7.58); whereas, *Tamilnadu* players were found to be leaner (6.16). In statistical terms, the F-ratio of calf skinfold (mm) was found non-significant. Thus, it can be said that, in calf skinfold there is similarity among all four teams.

Section-V: Descriptive Measurements of Derived Variables

Tamilnadu had maximum height weight ratio (45.26 ± 1.5); whereas, *Services* Volleyball players had the minimum (43.39 ± 1.44) ratio. Thus, *Tamilnadu* players had heavier height weight ratio, as compared to *Haryana*, *Kerala* and *Services*. The F - ratio (1.97) was also found non- significant.

The *Haryana* team showed more values of mesomorphic components followed by *Tamilnadu* and *Kerala*. Mesomorphy refers to musculo-skeletal development per unit of height. It has been observed that better development of mesomorphy leads to better performance. In present study, *Services* team had slightly higher value of mesomorphy than *Haryana*. In nut shell, F - ratio has shown non-significant differences in Mesomorphy among these four teams.

The *Tamilnadu* team in which height weight ratio was also found highest had reported the maximum value of ectomorphy attributes followed by *Kerala* and *Haryana* teams. Ectomorphy refers to the linearity of an individual and present study has shown that *Tamilnadu* Volleyball players were more linear as compared to *Kerala*, *Haryana*, and *Services*. F-ratio too has significant differences.

The bone mass of *Haryana* Volleyball players had maximum value (12.71kg) that secured 1st position in the national championship; whereas, *Services* who secured 4th position in national championship had minimum bone mass (12.71kg). The magnitude of bone mass can be visualized from these results. Bone mass refers to mass due to bones present in the body. These results also indicate that better bone mass results in better performance.

Haryana team had maximum muscle mass (39.56 ± 5.04 kg) and this team secured first place in the Championship. With these results, positive association of the muscle mass can be seen with performance. The muscle mass of *Tamilnadu* and *Kerala* teams was not found to be much different but, *Services* team definitely had less amount of muscle mass. However, F-value (2.526) does not show significant difference of muscle mass among the hierarchy of position among all four teams.

CONCLUSION AND RECOMMENDATIONS

1. Positive role of height and body weight was found with performance of Volleyball players. This might be due to the reason that Volleyball requires taller players to attack, block and setup the ball quickly from height. Therefore, if possible, this composition of height and body weight may be followed while selected a team.

2. Arm span values showed the better result performance as it is required for vertical reach, for blocking ability and to defend the ball away from the players' reach.

3. Hand span was found maximum in the *Tamilnadu* team that secured second position but it is pertinent to mention that the difference between *Tamilnadu* and *Haryana* was not too much.

4. Wrist width, knee width, upper arm circumference (normal & flexed) forearm circumference, thigh circumference and calf circum-ference were also found maximum in *Haryana* team that secured 1st position.

5. Height weight ratio was highest in Tamilnadu team players followed by Kerala and Haryana, but their statistical difference was not significant But, it is important to mention here that Services team that was at last position has registered lowest height weight ratio.

6. Mesomorphy (muscular skeletal development per unit of height) was found highest in the Services team. Mesomorphy is a trainable attribute, which can be trained by strength exercises and proper nutrition. Here, it is important to mention that the difference of mesomorphy between 1st ranked Haryana and 4th ranked Services team is very less but due to better height weight ratio Haryana secured 1st position and Services team was placed at 4th position.

7. It has been observed that body composition has direct influence on performance. In present study, results show that Haryana, team who secured the first place, reported highest bone mass and muscle mass. They were followed by Tamilnadu Volleyball players, who secured 2nd position in the competition.

8. In nutshell, we can say that body measurement and overall body composition has positive role in enhancing the performance and plays an important role in determining the competition performance. This study has its implications for Volleyball coaches, team selectors, scientists of Kinanthropometry and officials involved in Volleyball talent identification.

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