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Morphological characteristics of male volleyball players: A review

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Abstract:

The main purpose of this article was to review a series of studies (n =25) on the morphological characteristics of male volleyball players. Four main findings emerged from our review: (1) the élite players are taller, heavier, and with a higher fat-free mass than the low-level athletes. (2) The body fat percentage of male players is between 7.8 % - 15.6 %. (3) the middle blockers and opposite hitters are the tallest and heaviest players, whereas the libero players are the smallest and the lightest. (4) the taller players were more efficient than the shorter ones at the attack.

Keywords: Morphological characteristics; Anthropometry; Volleyball; Volleyball players.

1. INTRODUCTION

The development of the sport has guided the Sport Sciences researchers to the study of excellence in sports performance and in particular to the characteristics and requirements of each sport. However, to meet these requirements, each individual must hold a set of specific characteristics similar to the group to which he belongs. Among this set of characteristics, necessarily multivariate (e.g.,

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general and specific physical fitness, technical and tactical performance during the game), the most studied until now are undoubtedly the anthropometric characteristics(1). Morphological features are basically inherited by genotype, while others are influenced by environmental factors. Certain of these features could be improved by training, provided, as a prerequisite, that the athletes have the proper somatometric characteristics required by the sport they practice(2).

Technical and tactical skills, anthropometric measurements, and individual physical performance capacities highly contribute to success in volleyball. Faber & al. (2011) stated that talent identification programs should be based on the sport-specific determinants for success under several areas such as anthropometry, physical qualities, motor skills, mental skills, and contextual factors. Although the ideal physique is not the sole contributor to sport success, a lack of optimal anthropometric characteristics may hinder athletes from reaching higher performance levels. With regard to the specificity of the volleyball game, the considerable effect of certain morphological characteristics on the success of the game is logical. Using morphological anthropometry it is possible to collect information for the primary selection of candidates for volleyball, but also information that could be used in the secondary selection – so-called specialization(3). A large number of authors researched the anthropological characteristics in volleyball players, morphological differences between teams, various playing positions, different levels of competition, precisely because

(1) – Massuça, L and Fragoso. I. (2015). Morphological Characteristics of Adult Male Handball Players Considering Five Levels of Performance and Playing Position. Coll. Antropol. 39 (1), 109.

(2) - 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 (1), p26.

(3) - Durkovic, T., Marelic, N., & Resetar, T. (2012). Morphological differences of premier league volleyball players according to their playing roles. Hrvat. Športskomed. Vjesn, (Croacia). 27, p72.

they are of great importance for achieving excellent results(1). The morphological space is defined by the longitudinal dimension of the skeleton, the transversal dimensionality of the skeleton, and the mass and volume of the body. Body composition research and morphological characteristics among athletes of different sports indicate that athletes of different sports possess their own specific characteristics, mostly due to the reason that absolute size contributes a significant percentage of total variance associated with athletic success(2). The recognition of the actual talent is a very demanding and complex process that requires a good knowledge of anthropometry and body composition, strongly linked to the high performances in sport(3). The pattern of morphological characteristics being changed among volleyball players during 11 years; it was noticed that the body height was increased 1.6% from 1995 to 2000 and 2001, the body weight was increased 13.3% between 1996 and 2005, which reflects the increase of LM, body adiposity (sum of the five skinfold measurements in mm) decreased 43.04% from 1996 to 2001, percent fat decreased from 1996 to 2001(4).

From the above, the following question can be asked: What are the results of the morphological measurement of male volleyball players?

2. The purpose of the study:

The aim of this study is to describe the morphological characteristics of male volleyball players, by means of the reports found in the literature.

(1) - Malousaris, G. G., & al. (2008). Somatotype, size and body composition of competitive female volleyball players. J. Sci. Med. Sport, 11(3), 337-44; Palao, J. M., & al. (2008). Height, weight, Body Mass Index, and age in beach volleyball players in relation to level and position. J. Sports Med. Phys. Fitness, 48(4): 466-71.
(2) - Carvajal, W., & al. (2012). Kinanthropometric profile of Cuban women Olympic volleyball champions. MEDICC Rev, 14(2): p16.
(3) - Srhoj, V., & al. (2006). A New Model of Selection in Women's Handball. Coll. Antropol, 30 (3): p601.
(4) - Petroski, E.L., & al. (2013). Anthropometric, morphological and somatotype characteristics of athletes of the Brazilian Men's volleyball team: an 11-year descriptive study. Rev Bras Cineantropom Desempenho Hum, 15(2), p187.

3. Research Terms and Definitions:

3.1 Morphological characteristics: Includ measurements of length, weight, fat percentage and fat free mass for volleyball players.

3.2 volleyball players: male volleyball players of various age groups and competitive level.

4. Materials and methods:

Literature searches were conducted in Google Scholar, Research Gate, and PubMed. electronic databases were consulted using the following keywords: anthropometric characteristics of the male volleyball, body composition of volleyball players, morphological characteristics of male volleyball players.

Subsequently, the documents related to the study topic were selected following the inclusion criteria. publication date: that the documents have been published between 2000 and the present. language of publication: that the studies be written in English. access: that they are freely accessible. level of execution: that the publications refer to male volleyball players in any age category and competitive level. Therefore, studies published before the year 2000, in languages other than English, that are not freely available, have been excluded.

5. Results:

Table 1. A summary of the morphological characteristics of male volleyball players (means ± SD).

study	Subjects	Height (cm)	Weight (kg)	BF (%)	FFM (kg)/ MM (kg)
Gualdi-Russo and zaccagni, 2001, p. 259	Italian A1 (n = 107) and A2 (n = 127) leagueplayers	Super Lega: 193.9 ± 6.5 A2: 191.1 ± 7	Super Lega:88.4 ± 7.7 A2:87.1± 8.9	Super Lega: 22.1±4.7 A2: 23.7±5.6	N/A
Duncan & al, 2006, p.	Junior players (n = 25); Age = 16–19	Setters: 191 ± 5.0	Setters: 71.2 ± 9.3	Setters: 12.9 ± 3.4	Setters: 43.4 ± 5.2

650	years (17.5 ± 0.5)	Hitters: 193 ± 4.5 Centers: 187 ± 3.6 Opposites: 190 ± 5.9	Hitters: 77.9 ± 8.4 Centers: 77.6 ± 5.9 Opposites: 71.3 ± 9.2	Hitters: 12.5 ± 2.4 Centers: 11.5 ± 2.2 Opposites : 11.8 ± 3.5	Hitters: 50.9 ± 7.1 Centers: 49.6 ± 4.4 Opposites : 44.5 ± 5.2
Gabbett and Georgieff, 2007, p. 905	Junior volleyball players (n = 57) Scholarshipholders within the Queensland Academy of Sport Talent Search volleyball program (age= 15.6±.1 years	National level: 195.2 ±2.4 State level: 190.0 ± 1.2 Novice: 187.3±.5	National level: 80.2 ± 1.9 State level: 81.8 ± 1.7 Novice: 80.9 ± 2.5	N/A	N/A
Gabbett & al, 2007, p. 1342	Junior playersfrom Brisbane metropolitanarea (n = 28); Age = 15.5 ± 1.0 years	Selected for program: 184.0 ± 8.0 Not:selected: 184.0 ± 7.0	Selected for program: 71.1±6 Not:selected: 77.3 ± 13.6	N/A	N/A
Marques & al, 2009, p. 1108	professional male volleyball players (n=35)	Middle blockers 203 ± 0.04 Opposite hitters 200 ± 0.04 Outsidehitters 191 ± 0.02 Setters 190 ±0.05 Liberos 182 ± 0.04	Middle blockers 100.3 ± 4.7 Opposite hitters 101.0 ± 1.4 Outsidehitters 92.7 ± 5.0 Setters 86.0 ± 5.3 Liberos 81.7 ± 2.1	N/A	N/A
Koley & al, 2010, p. 392	inter-universityIndian volleyball players (n=63)	181.9 ±6.3	69.0± 69.0	13.4 ± 2.9	**N/A**
Gaurav & al, 2010, pp. 29 - 30	differentcollegesaffiliated to Guru Nanak Dev University, Amritsar, Punjab, India (n= 36)	183.25 ± 6.15	73.02 ± 7.58	13.30 ± 4.01	63.1 ± 5.3

Borras & al, 2011, p. 1687	Spanish National Team for2008 (n=13).	191.9 ± 7.4	86.9 ± 8.0	10.4 ± 2.4	N/ A
Trajkovic, 2011, p. 63	youth national team - U16) of Serbia (n=28) averageage=15.68± 0.47 years	Outsidehitters: 195.2 ± 3.1 blockers: 201.5 ± 4.9 Setters: 194.3 ± 6.1 Liberos: 181.5 ± 4.9 Opposite hitters 203.0±4.4	Outsidehitters: 82.5 ± 5.1 blockers: 86.1 ± 6.7 Setters: 81.6 ± 8.5 Liberos: 66.5 ± 12.0 Opposite hitters 91.6 ± 6.6	Outsidehitters: 13.1 ± 1.3 blockers: 13.0 ± 2.6 Setters: 13.2 ± 2.3 Liberos: 11.6 ± 3.0 Opposite hitters 14.0 ± 1.64	N/A
Petroski & al, 2013, p. 187	volleyballplayers of the Brazilian national team 2005(n=12)	197.0 ± 8.0	90.3 ± 13.0	12.3 ±1.8	N/A
Palao & al, 2014, p. 231	playerswhoparticipated in the volleyball competitions of the Olympic Games and World Championships in the 2000-2012 period (n=1454)	Setter 1.92±0.06 Middle 2.02±0.05 Outside 1.97±0.05 Opposite 1.99±0.06 Libero 1.860.06	Setter 84.8±7.1 Middle 92.1±7.8 Outside 89.0±7.0 Opposite 91.1±7.8 Libero 81.2±6.6	N/A	N/A
Popovic & al, 2014, p. 269	Volleyball playersfrom volleyball premier league in Serbia (n=14)	198.5 ± 3.89	92.6 ± 7.8	13.5 ± 2.5	N/A
Alsarraf and Mohamed bakr, 2015, p. 218	Kuwaiti male volleyball players (n=29)	First Division 186.3 ± 5.6 Second Division 181.1 ± 4.7	First Division 75.1 ± 9.9 Second Division 71.1 ± 9.7	First Division 9.5 ± 1.9 Second Division 13.5 ± 2.9	N/A

Gaurav & al, 2015, p. 1000	volleyballplayers at differentlevel of competition (inter-collegelevel and inter-schoollevel) (n= 72)	inter-Collegeleval: 178.06 ± 6.1 inter-schoollevel: 174.06 ± 6.1	inter-Collegeleval: 67.6 ± 6.8 inter-schoollevel: 64.6 ± 6.8	N/A	N/A
Sattler & al, 2015, p. 15	Volleyball playersfromSlovenian 1st and 2nd volleyball division (n=113).	186.9 ± 7.0	85.2 ± 10.0	10.7 ± 2.8	N/A
Campos, 2016, p. 117	Elite World Cup	196.0 ± 8.9	87.2 ± 9.2	N/A	N/A
Giannopo -ulos & al, 2017, p. 134	Greek A1 (n= 68) and A2 (n= 76) volleyball players	A1 196.8 ± 5.3 A2 190.5 ± 5.9	A1 94.6 ± 9.0 A2 88.7 ± 9.8	A1 14.9 ± 2.8 A2 15.6 ± 3.4	A1 80.2 ± 6.2 A2 74.7 ± 7.0
Stamm & al, 2017, p. 66	The members of the estonian, italian, french and croatian national volleyball teams whoparticipated in Pool B of the europeanchampion ship.	200.2 ± 6.8	93.4 ± 9.1	N/A	N/A
toselli and campa 2017, p 2602	Elite volleyball playerscompeting at the italian National League (Super Lega = 39, and A2 = 30	Super lega: 195.28 ± 8.31 A2: 192.01 ± 11.04	Super lega: 90.50 ± 9.08 A2: 86.43 ± 9.52	Super lega: 11.72 ± 4.51 A2 16.34 ± 5.85	Super lega: 79.43 ± 8.30 A2: 73.55 ± 9.38
Campa and Toselli, 2018, p. 13	volleyballplayers, playing in the first threeitalian National divisions (n=201)	Super Lega: 194.7 ± 9.9 A2 193.2 ± 9.8 low-level: 185.8 ± 6.4	Super Lega: 91.0 ± 10.4 A2: 87.4 ± 10.1 low-level 81.8 ± 10.3	Super Lega: 11.9 ± 2.8 A2: 15.5 ± 4.1 low-level: 10.8 ± 2.2	Super Lega: 80.1 ± 9.3 A2: 73.9 ± 8.8 low-level: 73.1 ± 8.8

Challouma-s, and Artemiou, 2018, p. 17	volleyballplayersfr omtwo teams participating in the first division of the Cypriotchampionsh ip (n=22)	192±0.08	88.2±11.3	12.1±3.5	N/A
Masanovic & al, 2018, p. 3	Volleyball PlayersfromSerbian National League (n=14)	194.28±5.30	82.04±8.8	13.33±1.9	N/A
Sánchez - Moreno & al, 2018, p. 291	professional male volleyball playersplaying in the first national division of the Spanish National League (n=12)	189.5 ± 5.4	83.4 ± 9.7	11.4 ± 2.0	N/A
Pena & al, 2018, p. 33	Male first division professionalSpanis hplayersage 26.1±4.8 years (n=13)	193.23 ± 5.9	88.49 ± 7.3	7.8 ±1.0	N/A
Bojanic& al, 2020, p. 905	volleyballplayers of the threemostsuccessfu l volleyball clubs in Montenegro (n=43)	191.9 ± 6.8	82.5 ± 8.08	11.7 ± 4.1	41.2 ± 4.7

n = number of subjects; N/A = data not availabl; %BF = percentage body fat; FFM = fat free mass; MM = Muscle mass (kg).

6. discussion:

Height and body mass values vary between 174.06 ± 6.14 and 64.64 ± 6.88 kg in inter-College and inter-school volleyball players(1)

(1) - Gaurav, V., Singh, M., Singh, S. (2015). Anthropometric Measurements of Volleyball Players at Different Level of Competition. Int. J. of Multidisciplinary and Current research, Vol.3, p.p999-1002.

to 203.1 ±3.9 cm in Middle players[1]and 101.0 ± 1.4 kg in Opposite hitters players[2] respectively.

When mean Body Height and body mass was measured in players playing different positions, it was reported that the middle blockers and opposite hitters were the tallest and heaviest players, whereas the libero players were the smallest and the lightest. For example, in a study on the best volleyball players (youth national team - U16) of Serbia[3]. The middle blockers and the opposing hitters are the tallest (201.57± 4.92 cm; 203.00 ± 4.41 cm) and the heavies (86.14 ± 6.79 kg, 91.60 ± 6.69 kg) players in the team. The smallest values for body height and body weight were found among liberos (181.50 ± 4.94 cm, 66.50 ± 12.02 kg). In another study on players who participated in the volleyball competitions of the Olympic Games and World Championships in the 2000-2012 period[4], the tallest and heaviest players were middle blockers(2.02 ± 0.05, 92.1±7.8), followed by opposites (1.99 ± 0.06, 91.1±7.8), outsides(1.97 ± 0.05, 89.0±7.0), setters (1.92 ± 0.06, 84.8 ± 7.1) and liberos (1.86 ± 0.06, 81.2 ± 6.6). Finally, in a study on Professional Volleyball players[5], The middle blockers and opposite hitters were the tallest (203 ± 0.04, 200 ± 0.04) and heaviest (100.3 ± 4.7,101.0 ± 1.4) players, whereas the libero players were the lightest (81.7 ± 2.1).

regarding the percentage of fat of the players, ranged from 7.85±1.05% in first division professional Spanish players age 26.1 ± 4.8 years (n = 46) to 15.61 ± 3.40 % in volleyball players (aged 27.5 ±

(1) - Sheppard & al, 2009, p1862.
(2) - Marques, M. C., & al. Physical fitness qualities of professional volleyball players: Determination of positional differences. Journal of Strength and Conditioning Research, 2009: 23(4), p1108.
(3) - Trajkovic, N., & al. (2011). positional differences in body composition and jumping performance among youth elite volleyball players. Acta Kinesiologica, 5(1), p.p62-66.
(4) - Palao, J. M., Manzanares, P., & Valadés, D. (2014). Anthropometric, Physical, and Age Differences by the Player Position and the Performance Level in Volleyball, Journal of Human Kinetics, 44 (1), 2014, p.p223-236.
(5) - Marques, M. C., & al, op. cit, p1108.

5.5 years). This data is in accordance with the finding of another study where they suggested that the approximate range of fat value among volleyball players should be within 6-15%[(1)]. An increased fat percentage will be detrimental in volleyball because, in these sport, the body is moved against gravity (e.g. volleyball spiking, blocking) as the additional body fat adds to the weight of the body without contributing to its force production or energy-producing capabilities[(2)].

To succeed in a sport, it is important usually to have specific bodily attributes[(3)]. When anthropometric characteristics were compared in male players playing different competitive levels it was reported that players competing at higher levels of competition are taller, heavier, and possess less body fat percentages than do players at lower levels of competition. For example, In a study on (201) élite, sub-élite, and low-level male volleyball players registered in the first three Italian National divisions, the élite players were taller, heavier, and with higher FFM and BCM than the low-level athletes. compared to the sub-élite, the elite players showed a greater amount of fat-free mass (FFM) and total body water (TBW), and a lower fat mass (FM) than sub-élite players[(4)]. In another study on (69) volleyball players, playing in the highest divisions of the National Italian League, super lega players were taller (195.28 ± 8.31), had a higher body weight (90.50 ± 9.08), less body fat (12.22 ± 3.11) and a higher fat-free mass (79.43 ± 8.30) than those of Division A2 (192.01 ± 11.04 cm, 86.43 ±

(1) - Rahaman & Bakhtiar, 2017, p. 738.
(2) - Gaurav, V., Singh, M., Singh, S. (2010). Anthropometric characteristics, somatotyping and body composition of volleyball and basketball players. Journal of Physical Education and Sports Management, 1(3), p31.
(3) - Ziv, G., lidor, R .(2009). Physical characteristics, physiological attributes, and on-court performances of handball players: A review. European Journal of Sport Science, 9(6), p376.
(4) - Campa & Toselli. (2018). Bioimpedance Vector Analysis of Élite, Sub-Élite and Low-Level Male Volleyball Players. International Journal of Sports Physiology and Performance Human Kinetics, 13(9), p.p1-13.

9.52 kg, 14.71 ± 3.50%, 73.55 ± 9.38 kg, respectively)[1] . In a study by Giannopoulos et al[2] , The players of Division A1 were taller, heavier, and had a higher fat-free mass than those of Division A2. also, a study on first division and second division Kuwaiti volleyball players showed first division (N1) volleyball players were taller (186.3 ± 5.6), slightly heavier (75.1 ± 9.9) and, had lower fat percent (9.5 ± 1.9) than volleyball players of the second division. in a study with Italian A1 and A2 volleyball leagues[3], volleyball players of the league A1 had higher mean values of height, weight and lower mean values of skinfolds than A2 volleyball players. The results revealed that first division (N1) volleyball players were taller (193.9/191.1 cm) and heavier (89.5/85 kg). finally, national players were taller than state and novice players in a sample of Junior volleyball players (n = 57). In only one study[4], the inter-college players had more height and weight than inter-school volleyball players.

A comparison of anthropometric measurements among players from different team sports can help shed light on the specific attributes of volleyball players. In one study (Masanovic& al, 2018), volleyball players were taller (194.28 ± 5.30cm) and heavier (82.04 ± 8.85 kg) than handball (181.51 ± 5.33, 74.73± 10.17 kg) players. The volleyball players have also had a lower percent fat (13.33±1.93%) than the handball players (16.39 ± 3.28%). Similarly, volleyball players were taller than soccer players[5]. In a study on Spanish players (n =13), volleyball players were shorter and lighter than basketball players but of a similar percent fat. Compared to handball players, The

(1) - Toselli, S & CAMPA, F. (2017). anthropometry and functional movement patterns in elite male volleyball players of diferent competitive levels. Journal of Strength and Conditioning Research, 32(9), p.p2601-2611.
(2) - Giannopoulos, N., et al. (2017). Somatotype, Level of Competition, and Performance in Attack in Elite Male Volleybal. Journal of Human Kinetics, vol. 58, 131-140.
(3) - Gualdi-Russo E, Zaccagni L. Somatotype, role and performance in elite volleyball players. J Sports Med Phys Fitness, 41(2), pp256-262.
(4) - Gaurav, V., et al. op. cit.
(5) - Popovic & al, 2019; Buvanendiran &Virupaksha, 2018.

volleyball players were taller, had a lower percent fat than the handball players, while the handball players were heavier than basketball and volleyball players(1).

Probably the most important aspect of describing physical characteristics is in determining whether or not they are related to success. In one study(2), the taller players were more efficient than the shorter ones at the attack. In another study(3), significantly positive correlations were found between some anthropometric variables and right-hand grip strength and Vo2max.

Although morphological characteristics are assumed to affect volleyball playing performance, scientific evidence for this notion is still lacking. More studies are needed to assess the contribution of physical attributes to actual performance. Success in sports is affected by a number of variables in addition to the notably important one of anthropometric attributes, among them being the physiological attributes of the players and their psychological state.

7. CONCLUSION

morphological characteristics represent important prerequisites for successful participation in any given sport and in volleyball sport in particular, through our study of the morphological characteristics of volleyball players, we reached a set of results, the most important of which are: (1) the élite players are taller, heavier, and with a higher fat - free mass than the low-level athletes. (2) The body fat percentage of male players is between 7.85% - 15.61 %. (3) the middle blockers and

(1) - Pena, J., Moreno-Doutres, D., Coma, J., Cook, M., & Buscà, B.(2018). Anthropometric and fitness profile of high-level basketball, handball and volleyball players, Rev Andal Med Deporte, 11(1), p.p30–35.
(2) - Stamm, R., & al.(2017). Do height and weigth play an important role in block and attack efficiency in high-leval men's volleyball?. Papers on Anthropology XXVI/1, p66.
(3) - Koley S, Singh J, Sandhu J S. (2010). Anthropometric and physiological characteristics on Indian inter-university volleyball players. JOURNAL OF HUMAN SPORT & EXERCISE. 5(3), p392.

opposite hitters are the tallest and heaviest players, whereas the libero players are the smallest and the lightest. (4) the taller players were more efficient than the shorter ones at the attack.

Based on the above, the following proposals can be submitted:

- Interest when selecting players in volleyball on the anthropometrics under study.

- Benefiting from the results of this study for coaches of clubs and Algerian national teams.

- Paying more attention to this type of studies in the Algerian environment, due to itslack on the one hand, and its extreme importance in the selection and training processes on the other hand.

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