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Original Article

Anthropometric characteristics, body composition and physical performance of female cadet volleyball players

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Abstract: The volleyball player profile has undergone substantial changes recently. Volleyball player performance may be influenced by factors, such as anthropometric characteristics, physical fitness, reaction time and muscle strength. To our knowledge, for volleyball cadets (14-16 years), there is no comparative data between our region and international norms regarding body mass, explosive power and reaction time. Therefore, it is impossible to create a player profile in terms of these parameters. The aim of this paper was to establish a female cadet volleyball player profile that includes anthropometric characteristics, body composition and physical performance parameters. We tested twelve female junior volleyball players, who are members of an elite volleyball team from Romania. The girls (14 to 16 years old) underwent a body composition evaluation, visual reaction time test, a vertical jump height test and an explosive power test. The following group values were obtained: height = 176.7 ± 6.2 cm, weight = 65.7 ± 10.5 kg, body mass index = 21± 2.8 kg/m^2, body fat mass = 14.3 ±4.7 kg, percent body fat = 21.3 ± 4.3 %, soft lean mass (right arm = 2.6 ± 0.4 kg; left arm = 2.5 ± 0.4 kg; trunk = 22.2 ± 2.7 kg; right leg = 8.5 ± 1.2 kg; left leg = 8.4 ± 1.2), drop jump (height = 39 ± 5.7 cm; explosive power = 34.1 ± 5.3 w/kg), squat jump right leg (height = 14.8± 3.3 cm; explosive power = 9.1 ± 1.2 w/kg), Squat jump left leg (height = 14.8 ± 2.4 cm; explosive power = 9.1 ± 0.8 w/kg) and visual reaction time (right leg = 0.81 ± 0.04 s; left leg = 0.83 ± 0.06 s). The results of our study may represent a landmark in shaping cadet volleyball player profiles in terms of anthropometric characteristics, body composition and physical performance parameters. Furthermore, we hope that these data will contribute to the professional selection of female volleyball cadets.
Key Words*:* - volleyball, anthropometric characteristics, body composition, physical performance

Introduction

Currently, volleyball game seems to be in an intense transformation process. The game phases dynamics and the player preparation process is in a constant change. [1] These changes are primarily due to a more rigorous selection. The volleyball player profile has undergone substantial changes recently. In order to face the high demands of the game, the players should be well prepared not only technical and tactical but also physically. Volleyball player performance may be influenced by factors, such as anthropometric characteristics, physical fitness, reaction time and muscle strength. [2] To improve these factors, the trainers need information regarding the physical and functional abilities of athletes in order to establish proper training objectives. These objectives are designed to bring players closer to existing international standards for professional volleyball game. These standards are established from the analysis of the top team players profile in the world. [3]

To our knowledge, for volleyball cadets (14-16 years), there is no comparative data between our region and international norms regarding body mass, explosive power and reaction time. Therefore, it is impossible to create a player profile in terms of these parameters.

The aim of this paper was to standardise a female cadet volleyball player profile that includes anthropometric characteristics, body composition and physical performance parameters.

Material & methods

We tested twelve female junior volleyball players, who are members of an elite volleyball team from Romania. The girls (14 to 16 years old), underwent a body composition evaluation, visual reaction time test, a vertical jump height test and an explosive power test. For the body composition analysis the players were asked to have a 3 hour fasting period before evaluation. For motric abilities evaluation the players used their usual game outfit (volleyball sneakers and game clothing) and the testing sessions took place on a volleyball training

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court. The evaluation sequence was: Body composition evaluation, visual reaction test and jump tests (Drop jump, Squat jump on one leg).

The body composition was analysed using a multi-frequency bioimpedance analyser (InBody 720, South Korea). We recorded total body water, total skeletal muscle mass, total body fat, percentage of body fat, segmental muscle and fat mass.

All players performed a Squat Jump test (SJT) and a modified version of "Drop Jump" test (DJT) in order to measure explosive power and vertical jump height. For this evaluation we used Optojump Next system (Italy). For the SJT, subjects started inside the testing area, in a one leg position with hands on hips and knee bent at 90°. The test consists in a vertical jump and landing on both feet. We recorded the maximum, minimum and mean value of five consecutive jumps.

The DJT starts with the subject outside the testing area. The subject performed a volleyball attack action with the last two steps of the take-off and the landing phase inside the testing area (between the Optojump rails).

The visual reaction test (VRT) recorded the reaction time after receiving a visual stimulus. The subject starts in a slightly bent position of both knees and had to raise the foot from the floor (as quick as he can) after receiving the visual stimulus.

Results

Data were analyzed using the statistical program GraphPad Prism 6 and the results are presented in the tables below as descriptive statistics. Anthropometric and body composition evaluation data are presented in detail in Table 1.

Table 1. Anthropometric measurements and body composition characteristics of cadet volleyball players.

	Minimum	25% Percentile	Median	75% Percentile	Maximum	Mean	Std. Deviation
Height (cm)	168	169.5	178	180	188	176.7	6.21
Weight (Kg)	48.8	56.25	65.6	74.3	81.7	65.66	10.53
Body mass index (Kg/m^2)	15.2	18.9	20.5	23.35	25.2	20.97	2.843
Body Fat Mass (Kg)	6.7	11.2	12.9	19.75	22.4	14.3	4.695
Percent Body Fat (%)	13.6	18.3	20.7	24.4	29.4	21.31	4.335
Soft Lean Mass:							
Right Arm (Kg)	1.83	2.245	2.6	2.965	3.28	2.573	0.4449
Left Arm (Kg)	1.91	2.165	2.51	2.895	3.18	2.54	0.4278
Trunk (Kg)	17.9	20	22.4	24.5	26.1	22.18	2.67
Right Leg (Kg)	6.69	7.425	8.52	9.255	10.3	8.452	1.165
Left Leg (Kg)	6.72	7.395	8.57	9.36	10.36	8.441	1.154
Intracellular Water	19.1	20.7	23.6	26.1	28.3	23.41	3.146
Extracellular Water	11.7	12.65	14.2	15.6	17	14.18	1.719

The physical performance parameters (jump hight, explosive power and reaction time after a visual stimulus) obtained using the Optojump Next testing system are presented in Tabel 2.

Table 2. Physical performance parameters of cadet volleyball players

	Minimum	25% Percentile	Median	75% Percentile	Maximum	Mean	Std. Deviation
Drop Jump (Spike)							
Height (cm)	32.9	34.73	37.55	43.65	49.6	39.05	5.68
Explosive Power (w/kg)	29.44	30.18	31.19	38.34	44.58	34.06	5.3
Squat Jump (Right Leg)							
Height (cm)	8.7	12.73	14.5	17.08	20.9	14.83	3.35
Explosive Power (w/kg)	6.95	8.44	8.9	9.76	11.24	9.09	1.16
Squat Jump (Left Leg)							
Height (cm)	12.2	12.7	13.95	17.55	19	14.84	2.41
Explosive Power (w/kg)	8.21	8.46	9.1	9.59	10.61	9.14	0.77
Visual reaction time							
Right leg reaction time (s)	0.762	0.784	0.819	0.835	0.878	0.814	0.035
Left leg reaction time (s)	0.761	0.771	0.833	0.869	0.919	0.827	0.055

Discussion

For the volleyball game, players' height is considered the most important physical parameter, representing a great advantage in competition. As presented in the Table 1, the average height of the team we studied was 176.4 ± 6.4 cm. Comparing to other volleyball girl cadet teams (14-16 years) our cadet team has a higher average height, even though our team had a smaller mean age (between 0.7 and 1.2 years) comparing to the other 3 teams.

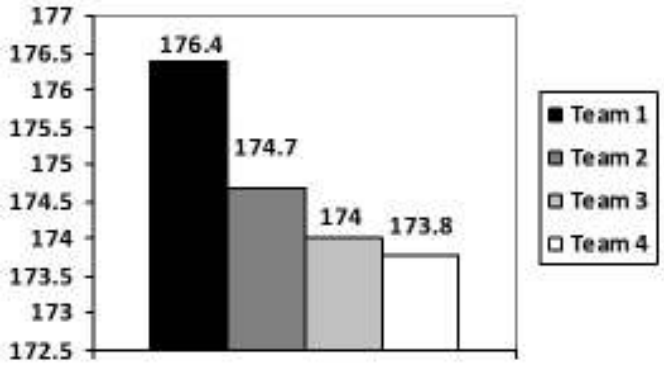

Figure 1. Medium hights comparison of 4 volleyball cadet girl teams
Team 1: The Romanian team from the present study (mean age 14.8 years)
Team 2: Brasilian volleyball girls group (mean age 15.8 years) (4)
Team 3: Brasilian volleyball girls group (mean age16 years) (5)
Team 4: Olymp Praha volleyball girls team from Czech Extraleague (mean age15.5 years) (6)

Trying to find out which is the height that must be reached by our study girls in order to be competitive at the next age category (junior level: 16-18 years) at international level, we search for data about junior girls teams from around the world. Making a comparison with the first three ranked teams at Volleyball Girls' U18 World Championship, we noticed a difference of 10.1 cm between the USA team (16.9 years) [11] and our team; a 7 cm hight difference compared with China's team (16.8 years) [11] and 5.5 cm compared with Italy's team (16.8 years) [11] (Figure.2). We might conclude that our team should gain at least 5 cm in the next 2 years to be competitive at U18 World Championship level.

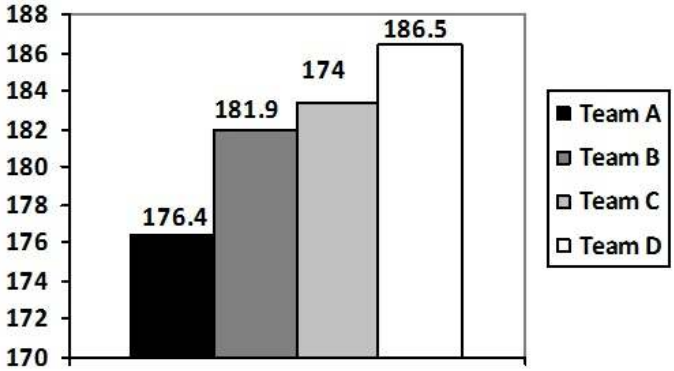

Figure 2. Hight comparisons between our cadet team and the first three ranked Volleyball Girls' U18 World Championship teams
Team A - Romanian cadet team
Team B - Italy TEAM (11)
Team C - China Team (11)
Team D - USA team (11)

It was previously demonstrated that specific strength and flexibility imbalances higher than 15% between lower limbs, represents an injury risk factor (lower extremity level) in female collegiate athletes [10]. We did not find significant differences between left and right lower limb in terms of explosive power and neither skeletal muscle mass as we expected (based on the experience in sport field testing). This could be due to the fact that unlike other team sports, the spike technique in volleyball is executed on both legs.

Explosive power was analyzed on each leg (SJT one leg) with the intention of using this data in the training individualization process. Our data shows no significant imbalance ($p>0.05$) of explosive power and hight jump in cadets volleyball players.

Body composition is also a factor with great influence in sport performance. Body fat and segmental muscle mass can help physical trainers in the training organization process. We found no significant differences of body fat percentage between our study group and other international volleyball teams from the same age and performance category. (Figure 3)

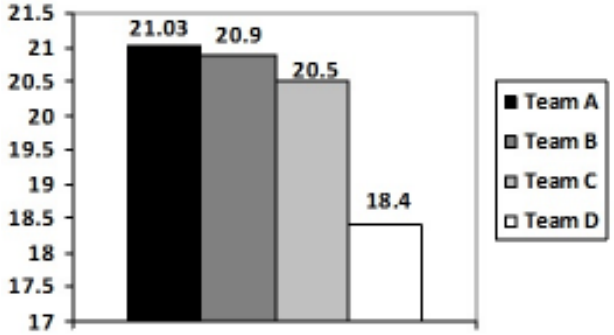

Figure 3. Comparison of body fat percentage between our study group and other international volleyball teams
Team A- our study group of cadet volleyball players (the team included in our study)
Team B - adolescent club volleyball girl players (mean age 14.31 years) [7]
Team C - professional adolescent volleyball girls (mean age16 years) [5]
Team D - volleyball team that won the Inter-high School championship in Japan (mean age 17.4 years) [8]

In the 2010 edition (second edition) of *Sport Nutrition: An Introduction to Energy Production and Performance*, an article about fat percentage of volleyball players, framed this parameter between 16-25 %, but there were no age specification for this value.(9) We noticed that the body fat percentage of adolescents and cadets presented in Figure 3 fits in same desirable interval.

We did not find other studies that present measurements about the lower limbs power, jump height or reaction time for volleyball players in this age category. However, we believe that these physical parameters can influence the technical performance of the athletes and their knowledge can facilitate the development of tailored workouts. We hope that our reference data for volleyball cadet girls will be of interest in volleyball selection process but also in establishing exercise training targets.

Conclusion

The results of our study may represent a landmark in shaping cadet volleyball player profiles in terms of anthropometric characteristics, body composition and physical performance parameters. Furthermore, we hope that these data will contribute professional selection of female volleyball cadets.

References:

Sorin Grădinaru (2012) Parametri ai modelului coordonatorului de joc în voleiul masculine seniori. Analele UVT - Seria EFS, No.14

Edio Luiz Petroski et all (2013) Anthropometric, morphological and somatotype characteristics of athletes of the Brazilian Men's volleyball team: an 11-year descriptive study. Revista Brasileira de Cineantropometria & Desempenho Humano, vol.15 no.2

Adrian Nagel, Claudiu Avram (2013) Reference Values and Gender Differences of the Functional Parameters in Romanian Elite Junior Tennis Players Romanian Elite Junior Tennis Players. Timisoara Physical Education and Rehabilitation Journal Vol. 5 No. 10

Viviane Bortoluzzi Frasson, Fernando Diefenthaeler, Marco AurélioVaz (2009), Comparative study of anthropometric variables in female classical ballet dancers, volleyball players and physically active subjects. Rev Bras Cineantropom Desempenho Hum 2009, Vol. 11 No. 1 P:8

Tania Abreu de Almeida, Eliane Abreu Soares (2003) Nutritional and anthropometric profile of adolescent volleyball athletes. Rev Bras Med Esporte vol.9 no.4

Rostislav Vorálek, MiroslavTichý and VladimírSüss (2010) Movement analysis related to functional characteristics of upper extremities in female junior volleyball players. International Journal of Volleyball Research, Vol. 10, No. 1, Pag. 8-13

Melrose, Donald R.; Spaniol, Frank J.; Bohling, Mark E.; Bonnette, Randy A. (2007) Physiological and performance characteristics of adolescent club volleyball players. Journal of Strength & Conditioning Research: Vol. 21, No. 2

Noriaki Tsunawake, Yasuaki Tahara, Kazuhiko Moji, Satoshi Muraki, Kengo Minowa and Koichi Yukawa (2003) Body Composition and Physical Fitness of Female Volleyball and Basketball Players of the Japan Inter-high School Championship Teams. J PhysiolAnthropolAppl Human Sci Vol. 22 No. 4 Pag.: 195–201

Sport Nutrition, Second Edition, by Asker Jeukendrup, PhD, and Michael Gleeson, PhD.

Joseph J. Knapik, Connie L. Bauman, Bruce H. Jones, John McA. Harris, Linda Vaughan. (1991) Preseason strength and flexibility imbalances associated with athletic injuries in female collegiate athletes. Am J Sports Med January19 76-81;

Website: 11. http://www.fivb.com/