96 - KINANTHROPOMETRICAL CHARACTERISTICS OF THE BRAZILIAN AND PAN AMERICAN MALE BEACH VOLLEYBALL PLAYERS

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Introduction

The anthropometric characteristics and by the somatotype are important indicators for detection and selection of players. It is an established fact that the somatotype may vary according to the function in the sport or event (CARTER & HEATH, 1990; DUQUET & CARTER, 1996; CARTER *et al.*, 2005; BATTISTA *et al.*, 2007). Although the dimensions of the body are not the unique necessary elements for the success of the player (GUALDI-RUSSO & ZACCAGNII, 2001) factors such as the technical ability, tactic, psychological profile and physical abilities can also contribute for the success of an player.

Several studies were already approached in the international literature about the morphological characteristics of the volleyball players (VIITASALO, 1982; FLECK *et al.*, 1985; HEIMER *et al.*, 1988; CARTER & HEATH, 1990; SMITH *et al.*, 1992; GUALDI-RUSSO & GRAZIANI, 1993; VIVIANI & BALDINI, 1993; GUALIDI-RUSSO & ZACCAGNI, 2001; BAYIOS *et al.*, 2006; DUNCAN *et al.*, 2006; KERR *et al.*, 2007) and other sports (CARTER & HEATH, 1990; GUALDI-RUSSO & GRAZIANI, 1993; VIVIANI, 1994; GODINHO *et al.*, 1996; CARTER *et al.*, 2005; BAYIOS *et al.*, 2006; KALAPOTHARAKOS *et al.*, 2006; RASCHKA & FROHLICH, 2006; KERR *et al.*, 2007).

In beach volleyball, the kinanthropometry parameters of the players are still insufficient and its referential for coaches and researchers are the ones of volleyball players, because these two sports are similar in their fundaments. However, the beach volleyball presents some features that makes it different from the volleyball, like for example, the influence of external factors (sun, wind, rain), the kind of terrain in which it is practiced (sand) and the reduced number of players by team (two) without substitutions. Besides, the player of volleyball faces all the functions of the volleyball players during the game, what may require more technical, tactic and physical demanding. Thus, it is possible that there is a physical type different for sportive modality.

The beach volleyball is one of the sports that developed more in the last years, with several international competitions taking place, being the principal the Olympic games, Pan American Games, Asian Games, European Championship of Beach Volleyball and the World Circuit of Beach Volleyball. Despite all this evolution, few information is found in the literature about the beach volleyball players. Until now the only study about kinanthropometry features of the beach volleyball players was the one of Davies (2002) that studied the South African masculine elite players.

The proposal of this study is to compare the anthropometric characteristics, the body composition and the somatotype of Brazilian and Pan American male elite players of beach volleyball.

Methodology

The population of the study was composed by Brazilian and Pan American male elite players of beach volleyball. The sample of Brazilian players was composed by eight (8) players from the four best teams from Brazil in the ranking of the International Federation of Volleyball (FIVB) from 2007. Which teams finished the season of 2007 among the top five (1st place, 2nd place, 4th place and 5th place). Having as evidence in this group two Olympic champions, three world champions and two champions under-21. The sample of the Pan American players was composed by eight (8) players from four countries, being 02 players in each country (Canada, Cuba, Puerto Rico and USA) that were among the five best places in the XV Pan American Games (2st place, 3nd place, 4th place and 5th place). This study was approved by the ethic committee of the Center of Heath Sciences of the Universidade Federal da Paraíba

Procedures for data collection

All the measures of the Brazilian players were done during the Brazilian Circuit of Beach Volleyball in the first semester of 2007 and the measures of the Pan American players were done during the XV Pan American Games that happened in July 2007 during the competition. The measures included the body height (EC) in a stadiometer (Seca 220, UK) close to 0,1 cm and the body mass registered with a portable scale (Seca alfa modelo 770 UK) close to 0,1 kg. The measures of the skinfold were done with a compass *Langer* (Cambridge, Maryland) in four places (triceps, subscapular, suprailiac and medial leg) close to 0.1 mm, the measures were carried out in accordance with the technique of Heath and Carter (CARTER & HEATH, 1990).

The circumference of the arm (cm) was measured in contraction and the one of the leg (cm) was measured with the subject stood. The width of the femur and by the humerus (cm) were also measured with the accuracy of 0.1 mm. All the measures were held in a closed environment and the same time of the evaluation by the same assessor. In addition, all measures have been carried out on the right side of the body that follow patterns unified and at rest. The body mass index (BMI) and height-weight ratio (HWR) in accordance with the procedures of literature (CARTER & HEATH, 1990); BMI = MC/Est^2, HWR = ; The sum of five skinfolds were used (biceps, triceps, subscapular, suprailiac and calf) for the calculation of body fat; the sum of four skin folds (biceps, triceps, subscapular and suprailiac) was used to calculate the body density (DB) (DURNIN & WOMERSLEY, 1974); Siri's equation (SIRI, 1956) was used for body fat percentage (PG%); the power of mass (PM), power of the height (PE) and body surface area (BSA) were also calculated. Components of somatotype (endomorph - mesomorph - ectomorph) were calculated in accordance with the procedures of Heath and Carter (CARTER & HEATH, 1990). We then calculated Somatotype Attitudinal Mean (SAM) and Somatotype Dispersion Mean (SDM) (CARTER & HEATH, 1990).

Analytical plan

All the values were reported in average ± standard deviation (sd). To calculate the significant differences in the averages was used Student's t-test for the independent samples with adjustment of Bonferroni. Multivariate Analysis of Variance (MANOVA) with Wilks' lambda was used for analysis of the somatotype. If the MANOVA was significant, so the comparisons were made using Hotelling's T2 with adjustment of Bonferroni to determine which components would contribute to the significant

differences between the somatotype. The level of statistical significance was set at $p < 0.05$.

Results and Discussion

The anthropometric characteristics and body composition of the Brazilian and Pan American players are reported in Table I. The Brazilian and Pan American players did not present significant differences between the anthropometric variables and body composition, with the exception of the triceps skinfold ($p < 0.05$). This may mean that the differences between the success of players from Brazil and Pan American of this search can be associated with other variables that were not objects of investigation of this research study, like for example the technical, tactical ability, physical and psychological preparation.

When compared the players of this study with beach volleyball players from South Africa it was observed that the body height of Brazilian players (194.65 ± 51 cm) and Pan American (190.72 ± 3.9 cm) were larger than the players of South Africa (185.00 ± 07 cm) (DAVIES, 2002). When analyzed this study with volleyball players it was observed that the body height of the Brazilian beach volleyball players was almost similar to the male players from Finland 1.94 ± 0.06m (VIITASALO, 1982), Canada 1.93 ± 0.04 m (SMITH et al. , 1992), Italians 1.93 ± 0.07m (GUALDI-RUSSO & ZACCAGNI, 2001). This can perhaps be explained by the natural tendency of the volleyball players migrate to the beach volleyball or by the own characteristic of the game that require taller players. Meanwhile, the players from the Pan American beach volleyball were shorter.

A comparison of the percentage of body fat (Table I) observed in this study with corresponding values to other players of beach volleyball. Showed that the Brazilian players presented a percentage of fat almost similar to the players of South Africa (13.1%) (DAVIES, 2002), while the players of the Pan American were fatter. When compared this study with volleyball players, the players of Pan American beach volleyball were bigger than all positions of game found in junior volleyball players (setter 12.9%, pointer 12.5%, central 11.5% and opposite 11.8%) (DUNCAN et al., 2006). The differences found between the beach volleyball players of the present study and junior volleyball players of specific positions of game can be explained for being players of different age.

Table I. Anthropometric Characteristics and body composition of Brazilian and Pan American male beach volleyball players

Variáveis	Brasil (n=08)	Pan Americano (n=08)	t	P
Age (years)	29.0 ± 5.3	29.20 ± 5.2	0.29	0.77
Body Mass (kg)	90.04 ± 9.0	89.85 ± 7.2	0.05	0.95
Height (cm)	194.65 ± 5.1	190.70 ± 3.9	1.92	0.07
Biceps Skinfold (mm)	5.1 ± 1.0	4.6 ± 0.6	-0.43	0.66
Triceps Skinfold (mm)	6.15 ± 1.2	8.35 ± 1.9	-3.02	0.00
Subscapular Skinfold (mm)	9.5 ± 3.1	11.15 ± 1.6	-1.46	0.16
Suprailiac Skinfold (mm)	9.00 ± 2.3	10.25 ± 1.9	-1.30	0.20
Calf Skinfold (mm)	6.81 ± 2.7	8.05 ± 1.6	-1.24	0.23
Biepicondylar Umerus (mm)	7.31 ± 0.4	7.17 ± 0.5	0.70	0.49
Biepicondylar Femur (mm)	10.36 ± 0.3	10.30 ± 0.5	0.31	0.75
Perimeter of the Arm (cm)	34.82 ± 1.9	35.26 ± 2.6	-0.43	0.66
Perimeter of the Leg (cm)	38.85 ± 1.9	39.03 ± 2.5	-0.18	0.86
HWR	43.49 ± 0.9	42.63 ± 1.3	1.71	0.10
body fat (%)	13.41 ± 2.6	15.04 ± 1.2	-1.81	008
Fat mass (KG)	12.17 ± 3.1	13.87 ± 1.8	-1.49	0.15
Fat free mass (kg)	77.87 ± 7.1	75.98 ± 6.4	0.62	0.54
BMI (kg/m^2)	23.72±1.6	24.71 ± 1.9	-1.22	0.24
SAM	1.2 ± 0.6	1.6 ± 0.7	-1.36	0.18
SAD	2.7 ± 1.9	3.3 ± 1.9	-0.62	0.54

The somatotype of Brazilian and Pan American players are reported in Table II. No significant differences were found in the analysis of the somatotype of the Brazilian and Pan American players (Wilks' lambda = 0.741; F = 1.867). But in the analysis of individual components the endomorphy of Brazilian players was smaller than the Pan American players (Table II). What may have contributed to the differences between the component endomorph was the triceps skinfold that was bigger in Pan American players.

Table II. Somatotype of Brazilian and Pan American male beach volleyball players

Variables	Brasil (n=08)	Pan Americano (n=08)	F	P
Endomorphy	2.5 ± 0.7	3.1 ± 0.5	4.83	0.04
Mesomorphy	4.1 ± 0.9	4.5 ± 1.4	0.65	0.43
Ectomorphy	3.3 ± 0.7	2.6 ± 0.9	3.20	0.09

The somatotype of Brazilian elite male beach volleyball players was classified as ectomorphic mesomorph (2.5-4.1-3.3). That is, mesomorphy is dominant and ectomorphy is greater than endomorphy (CARTER & HEATH, 1990). The somatotype of the male players of Pan American beach volleyball was classified as endomorphic mesomorph (3.1-4.5-2.6). That is, mesomorphy is dominant and endomorphy is greater than ectomorphy (CARTER e HEATH, 1990).

When the somatotype of this study is analyzed with players of volleyball from the international literature, although this somatotype vary due to the sport (CARTER & HEATH, 1990; DUQUET & CARTER, 1996) and that the specific training of the sport can alter certain physical characteristics having by different physical results (BATTISTA, *et al.*, 2007). This study analyzed the players of beach volleyball with players of volleyball. The Brazilian players were almost similar to elite Italian players, classified as ectomorphic mesomorph (2.2-4.2-3.2) (GUALDI-RUSSO & ZACCAGNI, 2001). While the Pan American presented an increase of the endomorphy component. About the homogeneity, the Brazilian and Pan American players were not significantly different. Despite the review of SAM and SDM indices showed that the Brazilian players are more homogeneous.

CONCLUSION

Brazilian and Pan American beach volleyball players did not show statistically significant differences between the anthropometric variables and body composition. With the exception of the triceps skinfold that was greater in Pan American players. In the analysis of the somatotype composed by three dependent variables no significant statistical differences were found. Meanwhile in the analysis of the individual components the endomorphy that indicates the component fat was more prevalent in Pan American players and the indexes SAM and SDM showed that the Brazilian players are more homogeneous. But

the differences between players of the elite can also be associated to variables that were not investigated in this study like, technical ability, tactics, physical and psychological preparation

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KINANTHROPOMETRICAL CHARACTERISTICS OF BRAZILIAN AND PAN AMERICAN MALE BEACH VOLLEYBALL PLAYERS

ABSTRACT

The aim of this research is to compare anthropometry, body composition (BC) and somatotype (S) of the Brazilian and Pan American male beach volleyball elite. Methodology. The sample consists of 16 players: eight (08) Brazilian players (BR) and eight (08) Pan American players. The somatotype was calculated by Heath and Carter technique. The sum of four skinfolds (biceps, triceps, subscapular and suprailiac) was used to the body fat percentage calculation (BF%) by Siri's equation. It was used a multivariate analysis of variance (MANOVA) and significance 5%. Results. It was found height 194.65±5.1cm (BR) and 190.70±3.9cm (PAN); body mass 90.04±9.0kg (BR) and 89.85±7.2kg (PAN); body fat (%) 13.41±2.6 (BR) and 15.04±1.2 (PAN); fat mass 12.17±3.1kg (BR) and 13.87±1.8kg (PAN) fat free mass 77.87±7.1kg (BR) e 75.98±6.4kg (PAN). It was found significant differences (p=0.007) in the skinfold triceps. The BR players' somatotype was classified in ectomorphic mesomorph (2.5-4.1-3.3) and the PAN in endomorphic mesomorph (3.1-4.5-2.6). It was concluded that the BR and PAN beach volleyball athletes did not present statistically significant differences in the anthropometrical variables and corporal composition, except for the skinfold triceps. Concerning the somatotype, the PAN athletes were bigger in endomorphy. However, the differences among elite athletes may also be associated with the variables which were not investigated in this study such as technical ability, tactics, physical fitness and psychological preparation.

KEYWORDS: Beach Volleyball, Somatotype, Performance.

CARACTÉRISTIQUES CINEANTHOPOMÉTRIQUES DES JOUEURS DE VOLLEY-BALL DE PLAGE MASCULINE DU BRÉSIL ET PAN AMÉRICAIN

RÉSUMÉ

l'objectif de cette étude c'est comparer anthropométrie, composition corporelle (CC) et somatotype (S) de l'élite du volley-ball de plage masculin du Brésil et Pan Américain. Méthodologie. L'échantillon s'est constitué par 16 athlètes, en étant huit (n=08) athlètes brésiliens (BR) et huit (n=08) PAN américaines (PAN). S'est calculée la somatotype par la Technique de Heath et de Carter. L'addition de quatre pli cutanées (PC) (biceps, triceps, subescapular et suprailiac) a été utilisé pour le calcul du pourcentage de graisse (%G) par l'équation de Siri. S'est utilisée l'analyse multivariée de variance (MANOVA) et d'importance 5%. Résultats. Il s'est trouvée stature 194,65±5,1cm (BR) et 190,70±3,9cm (PAN) ; masse 90,04±9,0kg (BR) et 89,85±7,2kg (PAN) ; PG% 13,41±2,6 (BR) et 15,04±1,2 (PAN), PGO 12,17±3,1kg (BR) et 13,87±1,8kg (PAN) ; MCM 77,87±7,1kg (BR) et 75,98±6,4kg (PAN). Il s'est trouvées des différences significatives (p=0,007) dans PC tríceps. La somatotype des athlètes BR s'est classée dans mesomorfic-ectomorfic (2.5-4.1-3.3) et le PAN dans mesomorfic-endomorfic (3.1-4.5-2.6). Il s'est conclu que les athlètes de volley-ball de plage BR et PAN n'ont pas présenté de différences statistiquement significatives dans les variables anthropométriques et de composition corporelle, avec exception de PC tríceps. Concernant à la somatotype, les athlètes du PAN ont été plus grands dans l'endomorfie. Néanmoins les différences entre des athlètes d'élite aussi peuvent être associées a variables qui n'ont pas été enquêtées dans cette étude comme habilité technique, tactique, préparation physique et psychologique.

MOTS CLES: Volley-ball de plage, Somatotype, Performance

CARACTERÍSTICAS CINEANTROPOMÉTRICAS DE LOS JUGADORES DE VOLEIBOL DE PLAYA MASCULINO DE BRASIL Y PANAMERICANO

RESUMEN

El objetivo de este estudio es comparar antropometría, composición corporal (CC) y somatotipo (S) de la elite del voleibol de playa masculino de Brasil y Panamericano. Metodología. La muestra está constituida por 16 atletas, siendo ocho (n=08) atletas brasileños (BR) y ocho (n=08) panamericanos (PAN). Se calculó el somatotipo por la Técnica de Heath y Carter. La suma de cuatro pliegues cutáneos (PC) (bíceps, tríceps, subescapular y suprailíaco) fue utilizada para el cálculo da porcentaje de grasa (%G) por la ecuación de Siri. Se utilizó análisis multivariado de varianza (MANOVA) y significancia 5%. Resultados. Se encontraron estatura 194,65±5,1cm (BR) y 190,70±3,9cm (PAN); masa 90,04±9,0kg (BR) y 89,85±7,2kg (PAN); PG% 13,41±2,6 (BR) y 15,04±1,2 (PAN), PGO 12,17±3,1kg (BR) y 13,87±1,8kg (PAN); MCM 77,87±7,1kg (BR) y 75,98±6,4kg (PAN). Se encontraron diferencias significativas (p=0,007) en la PC tríceps. El somatotipo de los atletas BR se clasificó en mesomorfo-ectomórfico (2,4-4,1-3,3) y el PAN en mesomorfo-endomórfico (3,1-4,5-2,6). Se concluye que los atletas de voleibol de playa BR y PAN no presentaron diferencias estadísticamente significantes en las variables antropométricas y composición corporal, con excepción de la DOC tríceps. Con relación al somatotipo, los atletas del PAN fueron mayores en la endomorfía. Sin embargo, las diferencias entre atletas de elite también pueden estar asociadas a las variables que no fueron investigadas en este estudio como, habilidad técnica, táctica, preparación física y psicológica.

PALABRAS-CLAVES: Voleibol de playa, Somatotipo, Desempeño.

CARACTERÍSTICAS CINEANTROPOMÉTRICAS DOS JOGADORES DE VOLEIBOL DE PRAIA MASCULINO DO BRASIL E PAN AMERICANO

RESUMO

O objetivo deste estudo é comparar antropometria, composição corporal (CC) e somatotipo (S) da elite do voleibol de praia masculino do Brasil e Pan Americano. Metodologia. A amostra constituiu-se por 16 jogadores, sendo oito (n=08) jogadores brasileiros (BR) e oito (n=08) pan americanos (PAN). Calculou-se o somatotipo pela Técnica de Heath e Carter. A soma de quatro dobras cutâneas (DOC) (bíceps, tríceps, subescapular e suprailíaca) foi utilizada para o cálculo da porcentagem de gordura (%G) pela equação de Siri. Utilizou-se análise multivariada de variância (MANOVA) e significância 5%. Resultados. Encontrou-se estatura 194,65±5,1cm (BR) e 190,70±3,9cm (PAN); massa 90,04±9,0kg (BR) e 89,85±7,2kg (PAN); PG% 13,41±2,6(BR) e 15,04±1,2 (PAN), PGO 12,17±3,1kg (BR) e 13,87±1,8kg (PAN); MCM 77,87±7,1kg (BR) e 75,98±6,4kg (PAN). Encontrou-se diferenças significativas (p=0,007) na DOC tríceps. O somatotipo dos jogadores BR classificou-se em mesomorfo-ectomórfico (2,5-4,1-3,3) e o PAN em mesomorfo-endomórfico (3,1-4,5-2,6). Concluiu-se que os jogadores de voleibol de praia BR e PAN não apresentaram diferenças estatisticamente significantes nas variáveis antropométricas e composição corporal, com exceção da DOC tríceps. Quanto ao somatotipo, os jogadores do PAN foram maiores na endomorfia. Porém as diferenças entre jogadores de elite também podem estar associadas a variáveis que não foram investigadas neste estudo como, habilidade técnica, tática, preparação física e psicológica.

PALAVRAS-CHAVE: Voleibol de praia, Somatotipo, Performance.