BODY COMPOSITION OF VOLLEYBALL PLAYERS' COMPETING IN GAMES ON DIFFERENT LEVELS

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Abstract:
Introduction. Analysis of body composition is very important in sports, especially competitive. The content of each component of body composition has an influence on such qualities as: speed, endurance, power, force, and posture of an athlete. These, in turn, determine the effectiveness of the player during the game.
The aim of the work. The purpose of the work was to provide the analysis of body mass components of volleyball players with different sport level.
The material and the methodology. In the research took part 40 volleyball players representing teams of Wroclaw. Players were characterized by different sport level. GROUP 1 (n = 19) formed the players playing in the second-division. These people were trained 6 times a week for two hours a day. GROUP 2 (n = 21) formed the athletes of academic teams (training sessions 2 times a week for 2 hours). The body mass analysis was performed according to the electrical bioimpedance method (BIA) using Tanita Inner Scan V. Measurements were performed in the evening hours during players' starting period, at least 3 hours after the last meal and just before the training.
Results. Comparing parameters' mean values measured during body mass analysis, obtained by players representing various sport level, no statistically significant differences were observed.
Conclusions. Results of the research do not confirm the existence of statistically significant differences in composition of body mass between volleyball players representing various sport level, despite the much greater training load of athletes playing in the second-division.

INTRODUCTION

Volleyball is a sports discipline requiring of its players great physical fitness, which influences a given player's efficiency. According to Chromiński's considerations [Chromiński 1987] physical fitness depends on human genetic properties, such as: motor abilities, somatic conditions, sharpness of the senses, temperament and proper body proportions. It is a group of factors of endogenous character. The other group of factors – the exogenous ones – refers to the external environment and lifestyle. There is also a classification according to modification possibilities of a given feature. One of the most significant parameters, independent of training, is a player's height, which definitely determines the position on the field [Palao et al. 2014]. Nevertheless, adapting proper training has a crucial impact on modifiable parameters, such as jumping ability, muscle strength, reaction time and body mass composition.

Systematically carried out research provide information about players' training level, as well as its progress connected with the trainings conducted. Analysis of body composition is very important in sports. The content of each component has an influence on key factors such as: speed, endurance, power, force and posture of an athlete [Barr et al. 1994; Palacios et al. 2015].

In literature, there is a number of information about the correlation of the above mentioned factors with the position occupied on the field. Mielgo-Ayuso et al. [Mielgo-Ayuso et al. 2015] carried out research in this field, which research showed significant differences in the physique of blockers, hitters, and liberos. The differentiating parameter in this case was the size of fat-skin folds measured on the calf, thigh and abdomen. However there is a lack of thesis concerning comparisons of body composition of players competing in games on different levels.

THE AIM OF THE WORK

The purpose of the work was to provide the analysis of volleyball players' body mass components and to show the relations between the parameters examined and the players' sports level.

THE MATERIAL AND THE METHODOLOGY

In the research took part 40 volleyball players representing teams of Wroclaw. Players were characterized by different sport level. They were divided into two groups. GROUP 1 (n = 19) formed the players playing in the second-division. These people were trained 6 times a week for two hours a day. GROUP 2 (n = 21) formed the athletes of academic teams (training sessions 2 times a week for 2 hours).

The body mass analysis was performed according to the electrical bioimpedance method (BIA) using Tanita Inner Scan V device, BC-601 model (Japan). The reliability of the method has proved Kutáč et al. [Kutáč et al. 2011]. Before the examination, the players had been given oral instructions concerning the body position which needs to be taken during conducting the measurement. Entering the scales, the sportsmen should have been barefoot and shirtless, so that the calcaneus was on rear electrodes, the lower limbs straightened in knee and hip joints, while the upper limbs in slightly abduction and flexion in arm joints, straightened in elbow joints, and all fingers touching the manual electrodes. The measurements were performed in the evening hours during players' starting period, at least 3 hours after the last meal, immediately before the training unit. Additionally, body height was measured by an anthropometer.

Using analyzer, one has obtained information concerning body mass [kg], fat contents [%], water contents [%], bone mass [kg], Body Mass Index (BMI), Daily Calorie Intake (DCI) [kcal/day) and muscle mass [kg] of the whole body and individual limbs.

Data have been obtained in a form of means, minimum, maximum and standard deviations. Normality of data distribution was verified by Shapiro-Wilk's test. Because the data distribution satisfied the condition of normality, so to compare the results obtained in both groups, t-test for independent samples was performed. Statistically significant differences were found when $p \leq 0.05$. Statistical analysis was made using computer program Statistica 10.0 (StatSoft).

RESULTS

Table 1 and 2 show the results achieved by volleyball players of both groups during body mass analysis performed according to the electrical bioimpedance method.

Table 1. Descriptive statistics of measured parameters – GROUP 1; UL- upper limb, LL- lower limb.

PARAMETER	N	Mean	Minimum	Maximum	SD
Age (years)	19	21.6	18	30	3.2
Body height (cm)	19	191.6	177	201	7.5
Body mass (kg)	19	85.6	71.8	99.9	8.3
Fat content (%)	19	11.6	7.9	18.6	3.4
Muscle mass (kg)	19	71.3	59.8	79.9	6
Bone mass (kg)	19	3.7	3.1	4.1	0.3
BMI	19	23.1	20.6	25.9	1.4
DCI (kcal/day)	19	4666.4	3952	5299	407.9
Water content (%)	19	63	56.8	65.8	2.7
Muscle mass right UL (kg)	19	4.7	3.7	5.8	0.6
Muscle mass left UL (kg)	19	4.5	3.5	5.3	0.5
Muscle mass right LL (kg)	19	12	10.4	13.4	0.9
Muscle mass left LL (kg)	19	12	10.4	13.7	1

Table 2. Descriptive statistics of measured parameters – GROUP 2; UP- upper limb, LD- lower limb.

PARAMETER	N	Mean	Minimum	Maximum	SD
Age (years)	21	21.2	19	29	2.2
Body height (cm)	21	187.7	169	202	8.1
Body mass (kg)	21	81.3	61.4	101.5	8.8
Fat content (%)	21	11.9	5	16.7	3.7
Muscle mass (kg)	21	67.7	55.4	80	6
Bone mass (kg)	21	3.5	2.9	4.1	0.3
BMI	21	23.2	18.5	27.2	2
DCI (kcal/day)	21	4446.2	3586	5376	418.8
Water content (%)	21	63.1	59.3	70	3.2
Muscle mass right UL (kg)	21	4.4	3.2	5.4	0.5
Muscle mass left UL (kg)	21	4.3	3.1	5.1	0.5
Muscle mass right LL (kg)	21	11.5	9.7	14.5	1.1
Muscle mass left LL (kg)	21	11.6	9.7	14.3	1.1

Comparing parameters' mean values measured during body mass analysis, obtained by players representing different sport level, no statistically significant differences were observed (table 3). Players of academic teams were characterized by slightly higher percentage of fat content. Athletes playing in the second-division dominated mostly in height and body mass, muscle mass and bones mass, however differences were not statistically significant even there.

DISCUSION

Sport disciplines form various patterns of players' physique [Carbuhn et al. 2010]. Sprinter or powerlifter is characterized by well developed musculature. Team sports i.e. basketball, football or volleyball set a distinct group in which it is difficult to describe universal model of "perfect" player's body structure [Bayios et al. 2006]. It is a consequence of diversity of tasks being performed by players playing on various positions.

Table 3. Comparison of body mass content between groups. UL- upper limb, LL- lower limb

PARAMETER	Mean GROUP 1	Mean GROUP 2	t	df	p
Age (years)	21.6	21.2	-0.51171	38	0.611813
Body height (cm)	191.6	187.7	-1.58848	38	0.120466
Body mass (kg)	85.6	81.3	-1.59186	38	0.119702
Fat content (%)	11.6	11.9	0.28342	38	0.778391
Muscle mass (kg)	71.3	67.7	-1.88994	38	0.066412
Bone mass (kg)	3.7	3.5	-1.78159	38	0.082809
BMI	23.1	23.2	0.08344	38	0.933944
DCI (kcal/day)	4666.4	4446.2	-1.68107	38	0.100953
Water content (%)	63	63.1	0.10873	38	0.913986
Muscle mass right UL (kg)	4.7	4.4	-1.55648	38	0.127884
Muscle mass left UL (kg)	4.5	4.3	-1.84498	38	0.072845
Muscle mass right LL (kg)	12	11.5	-1.36020	38	0.181783
Muscle mass left LL (kg)	12	11.6	-1.35552	38	0.183254

Researches in this direction were conducted by Carvajal et al. [Carvajal et al. 2012], who demonstrated differences in body build of volleyball players associated with the position on the field occupied by them. The middle blockers were characterized by considerable fat content in organism and they were the highest. The hitters presented the biggest muscle mass. The similar researches were conducted by Marques et al. [Marques et al. 2009]. The work of Gabbett and Georgieff [Gabbett, Georgieff 2007] shows significant differences between types of body build of volleyball players depending on their sex. Men were higher, heavier and were characterized by bigger strength, power, agility and speed. Above mentioned differences result from human's physiology. Malousaris et al. [Malousaris et al. 2008] focused on somatic build concerning level of training. In their work they showed how big influence has sport level on body composition. Players playing on higher sport level were characterized by bigger content of fat-free body mass and slimmer figure. The similar researches were conducted by Gualdi-Russo et al. [Gualdi-Russo et al. 2001]. However, Gabbett et al. [Gabbett et al. 2007] declared preeminence of technique over anthropometric parameters, as a factor determining achieving high sport level. Nor own work proved relation of body composition with the training level. Coaches building a framework of the team in first place analyze game statistics of a particular player, so in the end effectiveness is the most important. Then, effectiveness depends on a-many factors, i.e. somatic constitution of the athlete, level of motor abilities, level of technique of the player, ability to cooperate with other players on the field, ability to react in the most optimal way on constantly changing game's conditions and mental features of the player (for instance ability to cope with stress or to motivate themselves). As it was shown, there are so many factors influencing effectiveness of the player during the game, that probably it can explain the lack of statistically significant differences between body mass composition of volleyball players representing various sport level.

CONCLUSIONS

Results of the research do not confirm the existence of statistically significant differences in composition of body mass between volleyball players representing various sport level, despite a much larger training load of the players playing in the second division. This factor is seemed to have secondary significance in assessing players' level of professionalism. On the other hand, in the future, it would be necessary to precisely analyze

the level of physical activity of the players undertaken beyond the workouts, and their eating habits.

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