Ovidius University Annals, Series Physical Education and Sport / SCIENCE, MOVEMENT AND HEALTH., Issue 2 suppl. 2010
Our JOURNAL is nationally acknowledged by C.N.C.S.I.S., being included in the B+ category publications, 2008-2010.Indexed in: INDEX COPERNICUS JOURNAL MASTER LIST, DOAJ DIRECTORY OF OPEN ACCES JOURNALS, SOCOLAR

ALTERATION IN BODY COMPOSITION OF FEMALE PLAYERS IN A THIRD LEAGUE VOLLEYBALL BOUT

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ABSTRACT

Purpose: In this study, we aimed to investigate the effects of single bout of volleyball on body composition in female players of third league.

Methods: Nineteen professional female players that play volleyball in two clubs in Turkish Third League were enrolled in the study. Prior to one league match (pre-exercise) bioelectric impedance analyzes (BIA) were performed using a bioelectric impedance analyzer. After the final period (3rd set) of match was ended, bioelectric impedance analyzes were repeated (post-exercise) in female players of two teams that are named as Diyarbakirspor and Diskispor. Seventeen bio-impedance parameters of body composition were measured. The results of each team before and after match were compared. Because the parameters measured by bioelectrical impedance analysis related to body water affected by water drinking during a match we investigated only some electrical parameters of BIA such as resistance, reactance, phase angle, body capacitance and basal metabolic rate.

Results: The results of the study showed that basal metabolic rate decreased in the Diskispor Team after the mathc ($p<0.05$). Other bioelectrical parameters such as resistance, reactance, phase angle, body capacitance were not found to be significant in Diskispor Team ($p>0.05$). However, only the reactance was found significant in the Diyarbakirspor Team, which is the winner of the match ($p<0.05$).

Conclusison: In conclusion, some bioelectrical parameters can be an indicator of the performance of the sportsman in teams.

Keywords: Volleyball, sports, exercise, body composition, bioelectric impedance

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Introduction

Contemporary sports imply huge training volumes, with thus an increasing danger of overloading. The timely detection of the state of overloading in the organism as a whole or in skeletal muscles presents a difficult and complicated problem[1,2]. In the last decades, the sport of volleyball has become popular all over the world. During the normal conditions or exercise, body water and electrolyte balance are essential to optimal physiological function and health[2,3].

Bioelectric impedance analyze (BIA) is commonly used in clinical settings and field studies for estimating body composition parameters such as total extracellular, intracellular water compartments**,** fat mass, body mass, resistance, reactance, body capacitance and basal metabolic rate. However, it is

possible to measure some electrical properties of matter such as resistance, reactance, phase angle, body capacitance and basal metabolic[2,4,5]. The application of the bioelectric impedance analysis (BIA) method is growing in popularity because it is safe, noninvasive, rapid, portable, inexpensive, easy to use, and amenable for laboratory, clinical, and field assessment of human body composition. Recently, great advances were made in the art of accurately measuring the electrical properties of matter[6]. However, giving the definition of some BIA parameters such as resistance, reactance, phase angle, body capacitance and basal metabolic rate would help to understand physics of BIA.Resistance and reactance are terms from physics which are part of the complex field of materials and their effects on electricity. Resistance is the ratio of electrical potential (voltage) to the current in a material. A material with low resistance conducts well, while a material with high resistance conducts poorly. Phase angle is proportional to the ratio of reactance and resistance. Phase angle is an indicator of cellular health and integrity. Body capacitance is the total energy storage capacity of the body cell mass compartment. Basal metabolic rate (BMR) is the number of calories metabolized at rest during 24 hours.As it is known, approximately seventeen parameters can be measured by bioelectrical impedance analysis. However, most of the parameters are related to body water affected by water drinking during a match. Because of difficulties to prevent drinking water during a match analysis the parameters affected by water intake were not evaluated in this study. Therefore, the purpose of this study is to investigate some of the electrical parameters of BIA such as resistance, reactance, phase angle, body capacitance and basal metabolic rate in two third league volleyball team

Method

Nineteen professional female players that play volleyball in two clubs in Turkish third league League were enrolled in the study. Informed consent was taken from each subject and, Helsinki Recommendations was regarded**.** These subjects were questioned about the performance and the health problems. Physical parameters such as age and height were noted. Prior to one league match (pre-exercise) bioelectric impedance analyzes were performed using a portable bioelectric impedance analyzer (Bioimpedance Analyzer, BIA 450, BIODYNAMICS, USA). After the final period (3rd set) of match was ended (post-exercise), bioelectric impedance analyzes were repeated for all subject that they participated in a period of match by substitution with each other. Just before impedance analyzes, subjects were weighed and then they lied face up on a bench in a supine position. Two pairs of sensor electrodes (ecg pads) were placed on the subject's right hand and wrist, and right foot and ankle. A cable was connected between the analyzer and the sensor electrodes. Using the analyzer's keypad, the patient's gender, age, height, and weight (determined at this time) are entered. 50 kHz alternating electric current was applied to current electrodes and, bioelectric impedance parameters were recorded by means of voltage electrodes in accordance with the manufacturer's instructions[2, 5]. When a test was performed, a printout was generated. From the recorded parameters, body mass index (kg/m2), body capacitance (pF), resistance (Ohm), reactance (Ohm), body cell mass (kg), extracellular mass (kg), lean body mass (kg), fat mass (kg), and basal metabolic

rate (cal) were evaluated. All players had free access to water intake at the break times of match.

Results

The results of the study showed that basal metabolic rate decreased in the Diskispor Team after the match ($p<0.05$). Other bioelectrical parameters such as resistance, reactance, phase angle, body capacitance were not found to be significant in Diskispor Team ($p>0.05$). However, only the reactance was found significant in the Diyarbakirspor Team, which is the winner of the match ($p<0.05$). The results of two teams are given in Table 1 and Table 2.

Table 1. The results of Diskispor Team Before and after the match

Diskispor Team					
Parameters		**N**	**MEAN**	**SD**	**P**
Phase angle	Before match	10	6,33	0,6	**P>0,05**
	After match		6,23	0,6	
Body capacitance (pF)	Before match	10	574,1	74,44	**P>0,05**
	After match		564,7	71,67	
Resistance (Ohm)	Before match	10	616,27	44,32	**P>0,05**
	After match		625,97	47,75	
Reactance (Ohm)	Before match	10	6872	5,71	**P>0,05**
	After match		69,74	5,76	
Basal metabolic rate (Cals)	Before match	10	1276,5	131,09	**P<0,05**
	After match		1254,6	136,84	

Table 2. The results of Diyarbakirspor Team Before and after the match

Diyarbakirspor Team					
Parameters		**N**	**MEAN**	**SD**	**P**
Phase angle	Before match	9	6,7	0,42	**P>0,05**
	After match		6,6	0,52	
Body capacitance (pF)	Before match	9	618,66	50,48	**P>0,05**
	After match		611,66	56,36	
Resistance (Ohm)	Before match	9	604,82	33,22	**P>0,05**
	After match		596,26	30,79	
Reactance (Ohm)	Before match	9	72,03	7,24	**P<0,05**
	After match		69,11	6,74	
Basal metabolic rate (Cals)	Before match	9	1559,55	190,42	**P>0,05**
	After match		1560,11	198,67	

Discussion and conclusion

In the human body, low resistance is associated with large amounts of fat-free mass. High resistance is associated with smaller amounts of fat-free mass. Reactance is the effect on an electrical current caused by a material's ability to store energy. Reactance is seen as a time delay between an applied electrical potential and current. A material that stores energy readily has high reactance, and causes a large delay in the current. A material that stores energy poorly has low reactance and causes a small delay in

the current. In the human body, high reactance is associated with large amounts of body cell mass (intracellular mass). Low reactance is associated with smaller amounts of body cell mass. Phase angle is an indicator of cellular health and integrity. Research in humans has shown that the relationship between phase angle and cellular health is increasing and nearly linear. A low phase angle is consistent with an inability of cells to store energy and an indication of breakdown in the selective permeability of cellular membranes. A high phase angle is consistent with large quantities of intact cell membranes and body cell mass. Body capacitance is the total energy storage capacity of the body cell mass compartment. A high capacitance is an indicator of large quantities of intact cellular membranes. A low capacitance indicates lower quantities of intact cellular membranes. Capacitance is determined by the number and quality of cell membranes contained within the body cell mass compartment. Basal metabolic rate (BMR) is the number of calories metabolized at rest during 24 hours (L.E Armstrong, AND Y. Epstein 1999,http://www.biodyncorp.com/product/450/450.HTml, S. Dasdag, M.Z Akdag, M.S., CElik 2008).In our study, because the parameters measured by bioelectrical impedance analysis related to body water affected by water drinking during a match we investigated only some electrical parameters of BIA such as resistance, reactance, phase angle, body capacitance and basal metabolic rate. However, the results of the study showed that basal metabolic rate decreased in the Diskispor Team after the match ($p<0.05$). Other bioelectrical parameters such as resistance, reactance, phase angle, body capacitance were not found to be significant in Diskispor Team ($p>0.05$). However, only the reactance was found significant in the Diyarbakirspor Team, which is the winner of the match ($p<0.05$). In conclusion, some bioelectrical parameters can be an indicator of the performance of the sportsman in teams.

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