EFFECT OF A PRECOMPETITION AND POSTCOMPETITION TRAINING REGIME ON BODY COMPOSITION OF SOCCER PLAYERS

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ABSTRACT

The purpose of this investigation was to document the body composition elements' changes, preparing an initial precompetition and postcompetition training programme of soccer players. Body composition measurements were taken 10 weeks prior to competition, at 2 hours before competition and 4 weeks after competition period (week 14). There were investigated: body height (BH), body mass (BM), body mass index (BMI), body fat mass (BFM), fat free body mass (FFBM), fat free body mass index (FFBMI), body water mass (BWM), water free body mass (WFBM), water free body mass index (WFBMI). Body mass, the percent age of BFM and BWM at all body mass was calculated using the whole body bioelectrical impedance analysis (BIA) with "Tanita" monitor (Japan).
Body mass and body composition values of soccer players varied at precompetition, competition and postcompetition periods. The decreased body mass at competition period by 8.16% is the result of lost body fat mass and body water mass. Fat free body mass index (FFBMI) and water free body mass index (WFBMI) indicate, that soccer players at precompetition and competition period did not use lean tissue, that positively related to the restoration of body composition and water balance at postcompetition period.

Keywords: *body composition, body mass, body fat mass, body water mass.*

INTRODUCTION

Assessment of body composition is a component of the profiles in the health development control programme for soccer players. It is recognized that athletic body weight and composition can be accurately influenced on performance (Malina, 1992). They are two of the many body composition factors which change influence on soccer players' performance: fat mass and total body water. Whole body water mass and fat mass changes in precompetition, competition and postcompetition stages are induced by: 1. physiological stress (exercise); 2. combination of physiological (metabolic) and psychological stress; 3. environment temperature. The dehydration is increased when sweat rate is high, or when fluid supplementation of organism is low (Wemple et al., 1997). Despite marked differences in total body mass and water losses induced by varying exercise protocols, most researchers (Moughan, Leiper, 1994) examining soccer players have induced dehydration using light intermittent exercise in the heat. During the recovery total body water restoration is ultimately a function of proportional water distribution among the body fluid compartments (Greenleaf et al., 1983). To clarify the independent effects of exercise mode and sweating on water balance in total body mass,

researchers (Greenleaf et al., 1983; Houtcooper et al., 2001) compared the results of water and fat percentage in total body mass mode at different exercise profiles.

While preparing for an initial competition without experience in precompetition training, it is unknown as to: 1. the internal stresses imposed on the body of a novice engaging; 2. the physiological stresses associated with precompetition training; 3. how body composition responds to these stresses. Therefore, the purpose of this investigation was to document the body composition elements' (BH, BM, BMI, BFM, FFBM, FFBMI, BWM, WFBMI) changes, preparing for an initial competition, while using a precompetition and postcompetition programme of soccer players' training.

MATERIALS AND METHODS

Twenty six soccer players participated in this study. All athletes provided a written informed consent prior to participation in this study. The training regime of soccer players was 2—3 hours per day, 3 days per week. A 10-week precompetition training programme was used by the subjects. Postcompetition activity consisted of 4-week training (2 h duration, 3 days / week).

Body composition measurements were taken 10 weeks prior to the competition. Before the initiation of this investigation body height (BH), body mass (BM) and body composition components were determined. The percentage of body fat mass (BFM) and body water mass (BWM) at all body mass was calculated using the whole body bioelectrical impedance analysis (BIA).

Bioelectrical Impedance Analysis (BIA). "Tanita" monitor (Japan) was used for the BIA technique. In this method a safe, low-level electrical signal is passed through the body. It is difficult for the signal to flow through fat in the body, but easy to flow through moisture in the muscle and other body tissues. The difficulty with which a signal flows through a substance is called impedance. So the more resistance or impedance the signal encounters, the higher the body fat reading is taken.

Hydration levels in the body may affect body fat readings. Besides this basic cycle of fluctuations in the daily body fat readings' variations may be caused by hydration changes in the body due to eating, drinking, illness, exercising and bathing. Total body water percentage is the total amount of fluid in a person's body expressed as a percentage of their total weight. Approximately 50—65% of the weight of a healthy person is water.

Anthropometry and body composition measures. Standing body height (BH) was measured in centimeters to the nearest millimeter with the head. Body mass (BM) was measured to the nearest tenth of a kilogram using Tanita monitor (Japan). Body mass index (BMI kg / m^2), fat free body mass (FFBM, kg), fat free body mass index (FFBMI, kg / m^2), total body water mass (BWM), water free body mass (WFBM) and water free body mass index (WFBMI) values were calculated for each athlete.

The second body weight and composition was determined for the soccer players 2 hours before competition and 4 weeks after competition. Any excess fluid will be eliminated by the kidneys before the body composition analysis.

Before competition and during postcompetition period the diet was not controlled and accurate food of caloric and water intake could not be ascertained for caloric and nutritional analysis.

Statistical analysis. Values are reported as mean ± standard deviation. Significance was set at $p < 0.05$.

RESULTS

The table below lists the body composition changes at three periods of training — precompetition, competition and postcompetition. At the initiation of the study (week 0) BW was 75.9 ± 7.7 kg. There was a major reduction in BW to 63.7 ± 7.1 kg two hours before the competition, and then an increase to 72.7 ± 7.4 kg four weeks after the competition. The body mass index (BMI) was 24.01 ± 1.0 kg / m^2 at precompetition; 22.05 ± 1.1 kg / m^2 — two hours before the competition (week 10) and then increase to 23.0 ± 0.87 kg / m^2 — after the competition (14 weeks of experience).

The percentage of body fat changed markedly, from an initial 12.78 ± 1.2% predicted training value to a minimum of 11.55 ± 1.8% during 10 weeks to the competition and to a maximum of 13.529 ± 2.3% after the competition. Fat free body mass index (FFBMI) values at precompetition period were 20.94 ± 1.3 kg / m^2, at competition period — 19.51 ± 1.0 kg / m^2 and at postcompetition were 19.89 ± 1.1 kg / m^2. Total body water mass (BWM) percentage at 2 hours prior the competition was 59.92 ± 1.8% versus

Table. **Age and body composition elements of soccer players at precompetition, competition and postcompetition periods of training**

Indicators / Time periods	Age, years	Body height, cm	Body mass, kg	BMI, kg / m^2	Body fat mass, kg	Body fat mass, %	FFBM, kg	FFBMI, kg / m^2	Body water mass, %	Body water mass, kg	WFBM, kg	WFBMI, kg / m^2
Precompetition (week 0)	19.94 ± 2.5	178.6 ± 4.2	75.9 ± 7.7	24.01 ± 1.0	9.70 ± 2.6	12.78 ± 1.2	66.2 ± 6.9	20.94 ± 1.3	61.12 ± 2.2	46.00 ± 1.12	29.9 ± 2.1	9.46 ± 1.1
2 hours before competition (week 10)			69.7* ± 7.1	22.05 ± 1.1	8.036* ± 1.93	11.53 ± 1.8	61.66* ± 6.3	19.51 ± 1.0	59.92 ± 1.8	41.76* ± 0.75	28.06 ± 2.3	8.87 ± 0.87
Postcompetition (week 14)			72.7 ± 7.4	23.00 ± 0.87	9.82 ± 2.1	13.529 ± 2.315	62.88 ± 5.99	19.89 ± 1.1	60.78 ± 2.1	44.6 ± 0.93	28.1 ± 2.0	8.89 ± 1.3

Note. * — $p < 0.05$ at comparison of precompetition and competition periods' values.

61.12 ± 2.2% at the initiation of the study (week 0) and 60.78 ± 2.1% at post competition periods (week 14).

The result comparison of water free body mass (WFBM) and water free body mass index (WFBMI) values at the three periods of training regime of soccer players reported, that these results were slightly smaller at the competition period, than the range for values at the initiation of the study (week 0).

DISCUSSION

Soccer is an endurance sport that consists of moderate activity levels interspersed with intermittent high intensity bursts, leading to high rates of metabolic heat production and sweating. Even when the weather is hot, significant sweat loss occurs leading to a degree of dehydration and to body mass composition elements' changes (Maugham, Leiper, 1996). Aerobic energy production plays an essential role during soccer training and matches and lipid stores are intensively utilized (Bangsbo, 1996). Thus, the intensive metabolism and sweating during precompetition, competition and postcompetition training periods changed body composition elements (Greenleaf et al., 1983). The little levels of body fat mass, optimal level of water mass and FFBM and WFBM for soccer players influence successful performance within the competition and body mass structure are very significant determinants of competitive success of soccer players. FFBM, FFBMI, WFBM, WFBMI may advantageously affect performance, requiring translocation of body mass, such as in running, jumping or rotation of the body around an axis (Houtkooper, 2001; Sinning, 1996; our unpublished data, 2005).

Comparison the body composition changes during 10-week precompetition periods indicate that BM (69.7 ± 7.1 kg) and BFM (11.53 ± 21.8%) were lower 2 hours prior to the competition compared to the initial (week 0) values (75.9 ± 7.7 kg and 12.78 ± 1.2% BFM) or the 4-week postcompetition values (72.7 ± 7.4 kg and 13.529% BFM). Decreasing BW and the decrease of fat and water stores but not FFMI and WFBMI of soccer players at the 10-week precompetition period will result in a loss of fat tissue and water. These changes suggest that soccer players: 1. use minimally or did not use lean tissue for the subjects at the time before the competition; 2. minimal loss in lean body mass and higher loss of BFM and BWM during precompetition period; 3. a very effective precompetition training programme. Our data indicate, that maintaining lean tissues mass of soccer players suggests the adequate training programme to be ensured and cautiously taken to avoid excessive physiologic stresses on the body during the precompetition training period.

CONCLUSIONS

1. Body weight and body composition values of soccer players varied at precompetition, competition and postcompetition periods.
2. Decrease of body weight at competition period by 8.16% is the result of a lost body fat and water mass, but not lean body mass.
3. Fat free body mass index (FFBMI) and water free body mass index (WFBMI) indicate, that soccer players at precompetition and competition periods did not use lean tissue, that positively related to the restoration of body composition and water balance at postcompetition period.

REFERENCES

Bangsbo, J. (1994). Energy demands in competitive soccer. *Journal of Sports Sciences*, 12, S 5—12.

Greenleaf, J. E., Brock, D. J., Keil, L. C., Morse, J. T. (1983). Drinking and water balance during exercise and heat acclimation. *Journal of Applied Physiology*, 54 (2), 414—419.

Houtkooper, L., Mullins, A., Going, B., Brown, C. H., Lohman, T. C. (2001). Body composition profiles of elite American heptathletes. *International Journal of Sport Nutrition and Exercise Metabolism*, 11, 162—173.

Malina, R. M. (1992). Physique and body composition: Effects of performance and effects on training, semistarvation, and overtraining. In K. D. Brownell, J. Rodin and J. H. Wilmore (Eds.), *Eating, Body Weight, and Performance in Athletes* (pp. 94—114). Philadelphia.

Maugham, R. J., Leiper, J. B. (1994). Fluid replacement requirements in soccer. *Journal of Sports Sciences,* 12, Special Issue, S 29—34.

Sinning, W. E. (1996). Body composition in athletes. In A. F. Roche, S. B. Heymsfield, T. G. Lohman (Eds.), *Human Body Composition* (pp. 257—273). Champaign, IL.: Human Kinetics.

Wemple, R. D., Moracco, T. S., Mack, G. W. (1997). Influence of sodium replacement on fluid ingestion following exercise-induced dehydration. *International Journal of Sport Nutrition*, 7, 104—116.

TRENIRUOČIŲ REŽIMO ĮTAKA FUTBOLININKŲ KŪNO KOMPOZICIJAI PRIEŠ VARŽYBAS IR PO JŲ

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SANTRAUKA

Tyrimo tikslas — nustatyti futbolininkų kūno kompozicijos atskirų elementų pokyčius treniruočių laikotarpiu prieš varžybas ir po jų.

Atskiri kūno masės komponentai buvo ištirti 10 savaičių prieš varžybas, prieš 2 valandas iki varžybų ir 4 savaičių pereinamuoju laikotarpiu po varžybų.

Buvo tiriama: kūno ilgis (BH), kūno masė (BM), kūno masės indeksas (BMI), riebalų masė (BFM), kūno masė be riebalų (FFBM), kūno masės be riebalų indeksas (FFBMI), vandens masė (BWM), kūno masė be vandens (WFBM) ir kūno masės be vandens indeksas (WFBMI). Kūno masė, riebalų ir vandens masės procentas nuo bendrosios kūno masės buvo nustatomi naudojant bioelektrinio impedanso (BIA) metodą ir „Tanita“ monitorių (Japonija).

Futbolininkų kūno masės komponentai kito treniruočių laikotarpiu prieš varžybas ir po jų. Kūno masė prieš varžybas buvo sumažėjusi 8,16% dėl riebalų ir vandens masės pokyčių. Kūno masės be riebalų indeksas (FFBMI) ir kūno masės be vandens indeksas (WFBMI) rodo, kad tirtų futbolininkų „sausi“ kūno masės audiniai nekito prieš varžybas, ir tai teigiamai veikė kūno kompozicijos ir vandens pusiausvyros atkūrimą per treniruotes po varžybų.

Raktažodžiai: kūno kompozicija, kūno masė, riebalų masė, vandens masė.

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