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VARIATIONS OF TOTAL BODY WATER CHANGES IN FOOTBALL PLAYERS DURING RUNNING‡

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SUMMARY

Sweat loss, causing total body water changes, is an important issue of many sports activities. Changes of total body water (TBW) in 11 football players during their shuttle run tests were evaluated in this report. Pre- and post-test body composition parameters of participants were measured. Variations in TBW changes, detected by the end of the tests allowed dividing all participants into two groups: group A (n=5) included those who lost at least 100 ml of fluid and group B (n=6) of those who had traces of TBW changes. Statistical analysis of differences between groups through t-test revealed higher parameters of body surface area (BSA), body mass index (BMI) and TBW in group B in comparison with group A. It is suggested that athletes from group B, who had bigger size than their group A counterparts, had higher basal metabolic rate, which may result in higher TBW. Lack of TBW loss in group B during the test was probably related to the body's attempt to preserve the thermo-cooling effect of water. Further research will help to better address issues of body water loss in athletes during running.

Key words: Total body water, shuttle run test, sweat, football, exercise

ÖZET

FUTBOLCULARDA KOŞU SIRASINDA
TOTAL VÜCUT SIVISI DEĞİŞİMİ FARKLILIKLARI

Total vücut sıvıları değişimine yol açan ter kaybı birçok spor etkinliğinde önemli bir sorundur. Bu çalışmada total vücut sıvısı kaybı değişiklikleri 11 futbolcuda mekik koşuları sırasında değerlendirildi. Test öncesi ve sonrasında katılımcıların vücut bileşimi parametreleri ölçüldü. Test sonunda gözlenen total vücut sıvısı değişimleri katılımcıların en az 100 ml kaybeden A (n=5) ve daha az kayba uğrayan B (n=6) gruplarına ayrılmasını sağladı. Grup verileri arasında istatistiksel analiz sonucu

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grup B'nin daha yüksek vücut yüzey alanı, vücut kitle endeksi ve total vücut ağırlığı değerlerine sahip olduğunu ortaya koydu. Bu durum, daha büyük vücut ölçülerindeki grup B üyelerinin daha yüksek bazal metabolizma ve total vücut sıvısı değerlerine sahip olduklarını düşündürdü. Grup B'de total vücut sıvı kaybı yoksunluğu muhtemelen vücudun suyun soğutucu etkisini sakınma girişimiyle ilişkiliydi. İleri düzeydeki çalışmalar koşu sırasında sporcularda total vücut sıvısı kaybı konusunu daha iyi açıklamaya yardımcı olacaktır.

Anahtar sözcükler: *Total vücut sıvısı, mekik koşusu testi, ter, futbol, egzersiz*

INTRODUCTION

Running is a frequent action in many sports activities. Although sweat loss is a necessary reaction of heat regulation in athletes during physical activity, excessive loss leads to fatigue and decreased running performance, and the need for adequate water intake is established (4). Although the effects of different factors like clothing, fitness level, exercise intensity and environmental conditions on sweat rate during running was admitted by previous research, some data indicated variations of body water loss between athletes even under identical exercise and environmental conditions (9).

On the other hand, the association between heat regulation and body size and body composition has been observed since the 1950s, when Bernstein and colleagues (1) characterized surface area as an important and reliable parameter in studies about heat production and heat loss in the general population. Similar anthropometric data for health assessment (6) allows suggesting that body size and composition can play a role in body water loss differences in athletes during running. The present study was undertaken to test the hypothesis that body size and body water content is a strong determinant of body water loss in athletes during running.

MATERIAL AND METHODS

This study measured body size and body composition before and following endurance tests in 11 randomly selected football players from 1st and 2nd Football Leagues of North Cyprus. The average age of athletes was 21.1 ± 3.6 years old, and their average sports experience was 9.6 ± 3.2 years. The revised form (8) of the 20-meter shuttle run test (SRT) by Leger and Lambert (7), including progressive intensity was

adapted as the endurance test protocol. Tests and measurements were carried out at the indoor Sports Centre of the School of Physical Education and Sports, Near East University, Nicosia, in May 2005.

Pre- and post-test measures included (i) body weight and total body water assessments made by bio-impedance-based weight scale, (ii) body fat content assessment made by skinfold calliper according to the Jakson-Pollak method (5), and core temperature assessment made by Gentle Temp 510 Omron digital thermometer. Sweat loss was evaluated from changes in total body water following the SRTs. Body height was measured by means of a stadiometer. Use of heart rate monitors (Polar Inc.) during SRTs allowed assessing caloric expenditure. All participants were asked to avoid heavy eating and stop drinking 6 h before their tests. Temperature, moisture and atmospheric pressure of the Sports Centre were continuously measured by an aneroid device through the tests. Results were statistically analyzed with an Excel program.

RESULTS

The 11 footballers who participated in the study completed the SRT in 9.1 ± 0.9 min on the average, displaying a VO_2max value of 44.6 ± 3.6 ml/min/kg. Core temperature of athletes did not change significantly through the test (36.74 ± 0.33 ºC vs. 36.75 ± 0.52 ºC for pre- and post-tests respectively, $p>0.05$), however body water changes differed among them.

Table 1. Body composition parameters in athlete groups.

Parameter	Group A	Group B
BSA, m^2	1.76 ± 0.06	1.94 ± 0.17*
BMI, kg/m^2	21.8 ± 0.9	23.8 ± 2.6
Weight, pre-test, kg	64.7 ± 3.5	76.3 ± 11.2
Weight, post-test, kg	63.6 ± 3.3	75.3 ± 11.2*†
Total body water, pre-test, l	36.2 ± 1.9	43.0 ± 6.2*
Total body water, post-test, l	35.9 ± 1.9	42.9 ± 6.4*†

BSA: body surface area, BMI: body mass index
*: $p<0.05$ between groups; †: $p<0.05$ between groups for pre-/post-test changes

Total body water (TBW) loss has been calculated from water content differences between pre- and post-test results. Variations in body water loss in sportsmen allowed dividing them into two groups. Those who had ≥ 100 ml of body water loss by the end of the test formed group A (n=5), and those who had less than 100 ml of body water decrease, were included in group B (n=6). The above mentioned

criterion was adopted from Guyton (4). Mean ± standard deviations of body composition parameters of both groups along with their corresponding t-test results are presented in Table 1 and Figure 1.

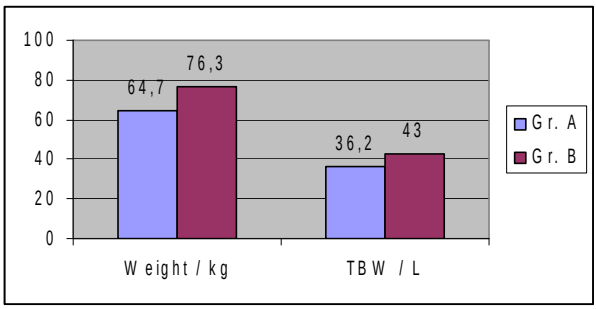

Figure 1. Differences in body weight and total body water in groups A and B ($p<0.05$).

Statistical analysis of results revealed higher scores for body composition parameters in group B in comparison with group A. In spite of higher body water content in group B before the SRT, players from this group had lower water loss during their tests (0.08 ± 0.17 litres of water in group B versus 0.19 ± 0.03 litres of water in group A). On the other hand, there were no statistically significant differences in groups related to body fat content (8.7 ± 3.3% in group A and 9.8 ± 4.6% in group B, $p>0.05$) and core temperature values at the end of the test (36.8 ± 0.5 °C in group A and 36.8 ± 0.6 °C in group B, $p>0.05$).

DISCUSSION

Body compositions presented in this report were obtained by the bioelectrical impedance analysis technique, reliability and validity of which is established (2,3). The similar levels of experienced running intensity and comfortable environmental conditions allowed athletes feel similar rates of sweating, and amount of TBW loss. However, those who had higher anthropometric parameter scores and higher water content lost less water in comparison with those who had lower values for BSA and TBW (See Table 1 and Fig. 1).

It is suggested that sportsmen from group B had higher basal metabolic rate in comparison with group A, and as result of this possible higher basal metabolism, they had higher TBW. Lack of TBW loss in group B during the shuttle run test is probably related to the body's attempt to preserve the thermo-cooling effect of water.

In conclusion, the present observations obtained under the similar exercise and environmental conditions suggest that athletes may display two different patterns of body water loss. Potential "over sweaters" have lower BSA and TBW, so they need even more adequate water intake to delay dehydration. On the other hand, sportsmen with higher body surface area and total body water content possess less potential for sports-related excessive sweating, and so they may need to be cautious about excessive water intake to avoid over-hydration.

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