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Prevalence of Dehydration Before Training Sessions, Friendly and Official Matches in Elite Female Soccer Players

by
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This study aimed to evaluate and compare the hydration states prior to different sporting events (training sessions, friendly and official matches) in elite female soccer players and relate that to the importance that the player attached to the hydration state as a determinant of sports performance. The hydration state of 17 female elite soccer players (age: 21.5 ± 3 years; body mass: 62 ± 6 kg; body height: 165 ± 9 cm) was determined by measuring their urine specific gravity (USG) prior to three different sports events: training sessions (PT), friendly (PF) and official (PO) matches. The importance that each player attached to the hydration state as a determinant of sports performance was evaluated through a simple questionnaire. An average of 47.05% of the soccer players were severely dehydrated (USG > 1.030), 33.33% were significantly dehydrated (USG > 1.020), 17.64% were mildly dehydrated (USG > 1.010) and 1.96% were euhydrated (USG < 1.010). The average USG was 1.027 ± 0.007 (PT = 1.029 ± 0.009; PF = 1.023 ± 0.010 and PO = 1.030 ± 0.006). Differences were found between urine specific gravity prior to a friendly and an official match (p = 0.03). No relationship was found between urine specific gravity and the importance each player attached to the hydration state as a determinant of sports performance. The results show that dehydration is the most prevalent hydration state of elite soccer players before training sessions, friendly and official matches. Players were most dehydrated prior to official matches, which was unlinked to the players´ perceived importance of hydration for sports performance.

Key words: *dehydration, soccer, hydration, female player.*

Introduction

Women's soccer is gaining popularity, as indicated by the development of important world championships and its inclusion as an Olympic sport. The sports science community has also increased its attention to this discipline. First studies indicated that physiological, metabolic and anthropometric requirements of male and female soccer players were very similar (Davis et al., 1993). Thus, the variables that affect sports performance should also be similar. Dehydration is one of the most studied variables that negatively affect performance in soccer (Bandelow et al., 2010; Maughan et al., 1994; McGregor et al., 1999). Mild dehydration in women can influence the lactate threshold (Moquin et al., 2000) and mood (Armstrong et al., 2012), which may negatively affect performance and health of the athlete.

An athlete´s hydration state depends to a great extent on both the initial hydration state (Wingo et al., 2004) as well as the liquid intake during and after a competition or training sessions (Sawka et al., 2007). Studies on male soccer players show that the majority of players (youth and adult) start training sessions and competitions in a hypohydrated state (Aragón-

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Vargas et al., 2009; Castro-Sepúlveda et al., 2015; Phillips et al., 2014). In these studies different magnitude of pre-exercise dehydration is reported, probably due to environmental factors such as temperature and humidity; the importance of the sports event (training session, friendly or official match); and/or the importance that the athlete attaches to the hydration state as a determinant of sports performance, which is a factor not studied yet. The hydration state can be evaluated using various biological markers among which the most used are plasma osmolality, urine specific gravity or body weight (change before and after exercise), with urine specific gravity (USG) being the marker most commonly used in studies focusing on soccer players (Aragón-Vargas et al., 2009; Castro-Sepúlveda et al., 2015; Phillips et al., 2014).

This study aimed to evaluate and compare the hydration states prior to different sporting events (training sessions, friendly and official matches) in elite female soccer players and relate that to the importance that the player attached to the hydration state as a determinant of sports performance.

Material and Methods

Participants

Seventeen international-level female soccer players were evaluated (age: 21.5 ± 3 years; body mass: 62 ± 6 kg; body height: 165 ± 9 cm; VO_{2max}: 3.25 ± 0.30 L/min; training experience: 6.3 ± 2.3 years). Included were only players with an official contract, that were injury-free and had been undergoing regular training in the previous four weeks. The players were acquainted with the potential benefits and risks that they may incur upon participating in this study. The study was designed in accordance with the Declaration of Helsinki and the protocol was approved by the Finis Terrae University´s ethics committee.

Protocol

The female soccer players were evaluated prior to three sports events: (1) prior to three training sessions (PT), average temperature of 28°C and average humidity of 56%; (2) prior to three friendly matches (PF), average temperature of 30°C and average humidity of 52%; and (3) prior to three official matches (PO), average temperature of 29°C and average humidity of 54%. These evaluations consisted of (a) anthropometric measurements (body mass and height) and (b) hydration status assessment using the urine specific gravity (USG) according to Casa et al. (2000). Players were not informed of the assessment dates and did not receive recommendations on water and food intake in order to evaluate the athletes under normal, "real" conditions.

Urine Specific Gravity (USG)

Participants reported to the laboratory for hydration assessment approximately 60 min before sports events. Upon arrival, they produced and collected a mid-stream sample of urine into a labelled urine collection container. Urine samples were analyzed for USG within 30 min of collection. A portable refractometer was used to determine the USG (Robinar model Spx, USA).

IHAP (Importance of hydration for athletic performance)

Players answered a brief questionnaire before the first USG determination in which on a scale of 1-10 they had to describe the importance of hydration for sports performance, 1 being not important at all and 10 very important. The questionnaire was revised by three experts and submitted to a pilot phase (17 questionnaires). The Cronbach's alpha coefficient and ICC were 0.921 and 0.915 (95%IC: 0.847-0.961), respectively.

Statistical analysis

Descriptive statistics were used to present the percentage distribution of the hydration state. To determine the distribution of the data a Shapiro-Wilk test was performed prior statistical model selection. The Shapiro-Wilk test's results indicated that USG and IHAP variables were normally distributed. Analysis of variance (ANOVA) followed by a Tukey post-hoc test was used to determine differences between PT, PF and PO USG values. The Pearson's coefficient was used to assess correlations between the importance of the hydration status for sports performance and the actual hydration status. Data are presented as means ± standard deviation, median and interquartile ranges in Figure 2. Statistical analysis was carried out using GraphPad Prism 6.0® (Graphpad Software, San Diego, CA, USA). A p-value of < 0.05 was applied.

Results

On average (three different sporting situations) 47.05% of the participants (8 players) were

severely dehydrated, 33.33% (6 players) were significantly dehydrated and 17.64% (2 players) were minimally dehydrated. Only 1 player (1.96%) was well hydrated (Figure 1).

The average USG of the three situations was 1.027 ± 0.007 (PT = 1.029 ± 0.009; PF=1.023 ± 0.010 and PO = 1.030 ± 0.006). PF and PO values differed significantly (p = 0.03) (Figure 2).

The average rating given in the questionnaires was 7.1 ± 2.5. No relationship was found between the USG of PT, PF and PO and IHAP (Table 1).

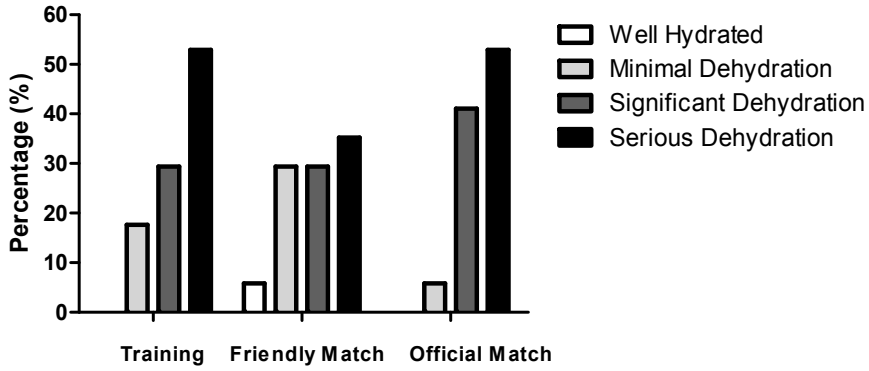

Figure 1

Percentage distribution of the hydration state as indicated by the urine specific gravity (USG) prior to a training session, a friendly and an official match in professional female players. USG classification according to Casa et al. (2000) < 1.010 (well hydrated), 1.010–1.020 (minimal dehydration), 1.021–1.030 (significant dehydration), > 1.030 (serious dehydration).

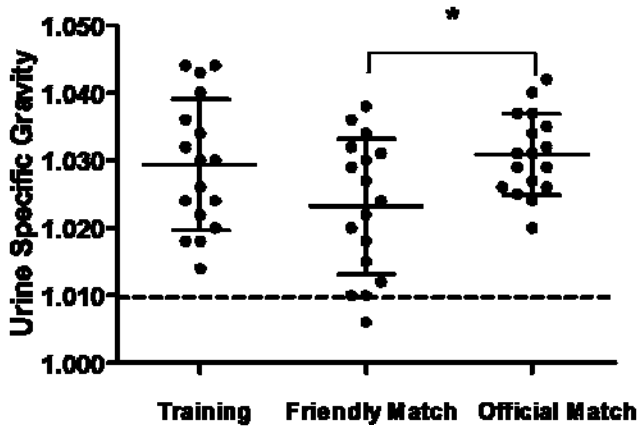

Figure 2

*Differences in urine specific gravity prior to a training session, a friendly and an official match in professional female soccer players. The data are presented as median and interquartile ranges, the dotted line represents the upper limit of euhydration. * Significant difference between conditions, p < 0.05.*

Table 1

The relationship between the importance of hydration status for sports performance and actual hydration status measured prior to a training session, a friendly and an official match in professional female soccer players.

	Hydration Status (USG)					
	Training		Friendly Match		Official Match	
IHAP (score)	r = 0.26	p = 0.30	r = 0.16	*p* = 0.51	r = -0.07	*p* = 0.76

IHAP; Importance of hydration for athletic performance (questionnaire results)

Discussion

The principal finding of our study is that only 2% of elite female soccer players attended training, friendly or official matches in a euhydrated state (USG < 1.010). Furthermore, the assessed players attended official matches in a worse hydration state than either training sessions or friendly matches.

Gibson et al. (2012) evaluated 34 young, female soccer players and showed that 45.4% of them attended training sessions hypohydrated (USG >1.010). In our study, 100% of players attended training sessions hypohydrated (USG >1.010). This difference can be explained by the fact that in the Gibson et al.'s study there were much lower temperatures when compared to the present study (9.8°C vs 28°C). Kilding et al. (2009) evaluated 13 professional female soccer players prior to two friendly matches and indicated average USG of 1.014 ± 0.005 and 1.011 ± 0.005, respectively (both corresponding to minimal dehydration); in the present study average friendly match USG was 1.023 ± 0.010 (corresponding to significant dehydration). We attribute these discrepancies to the difference in temperature in each study and possibly to different hydration strategies.

We previously reported dehydration levels of professional Chilean soccer players (n = 156) among whom only one subject (0.6%) was well hydrated (USG < 1.010), 14 subjects (9%) were minimally dehydrated (USG 1.010 – 1.020), 120 subjects (76.9%) were significantly dehydrated (USG 1.021 – 1.030) and 21 subjects (13.5%) were severely dehydrated (USG > 1.030) (Castro-Sepúlveda et al., 2015). These data are similar to the ones reported here for female soccer players, differing only in a larger proportion of male players in the severely dehydrated category. This concurs with Eijsvogels et al. (2013) who showed that men suffered a greater loss of body mass after exercising and therefore became more dehydrated than women. This is due to hormonal and body composition differences between men and women resulting in different sweat rates. It is thus indispensable to evaluate hydration states of men and women separately.

Notably, the assessed players attended official matches in a more dehydrated state than friendly matches or training sessions. It was expected that for an official match, players would be better prepared from a nutritional perspective, which includes hydration, than for a friendly match or a training session. This discrepancy could be due to more stress induced by an official match than either a friendly match or a training session. This in turn could modify the normal liquid consumption and reduce the sensation of thirst (Baker et al., 2014). Alternatively, the elevated dehydration rates prior to an official match could be a consequence of the previous days. Lack of a relationship between the IHAP and USG shows that it is not enough to simply explain the advantages and disadvantages of hydration for performance and therefore, other strategies must be employed.

In women, a mild dehydration state lowers the lactate threshold so that it is reached at a lower work load (Moquin et al., 2000), reducing performance in intermittent sports such as soccer (Bangsbo et al., 2007). Furthermore, mild dehydration may negatively affect mood in women, reducing stamina and increasing the sensation of fatigue, headaches and a loss of concentration, what again reduces performance (Armstrong et al., 2012). These data suggest that 98% of the assessed players started their training sessions, friendly and official matches with reduced prospects to perform at their peak.

Conclusions

To conclude, the results of the present study show that dehydration is the most prevalent hydration state in elite female soccer players before training sessions and friendly as well as official matches. The highest dehydration rates were found before official matches, which is unrelated to the perceived importance of hydration for performance. This high incidence of dehydration may not just negatively affect physical performance, but may also increase the risk of injury and heat illnesses.

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