



## THE HYDRATION STATUS OF MALAYSIA'S YOUNG MALE SOCCER PLAYERS DURING COMPETITIVE SEASON

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### ABSTRACT

*Purpose: The purpose of this study was to examine the preexercise hydration status and to assess body mass (BM) loss (kg) of young male soccer player's (age 15.6 ± 0.4) training in a hot and humid environment. Methods: Twenty male soccer players (n = 20, 55.3 ± 8.4 kg) from Sekolah Sukan Bukit Jalil (SSBJ), Malaysia had volunteered to participate in this study. Measurements of hydration status were taken on two occasions during competitive season. Urine sample was collected and handheld refractometer was used to assess the urine specific gravity (USG). Body weight was monitored before and after training session. The results showed that the participants were within the normal range of hydration status (1.016 ± 0.01). No significant difference was observed between measurements in USG (1.016 ± 0.01 v 1.017 ± 0.01, p > 0.05) and BM loss (kg) (0.20 ± 0.5 vs. 0.24 ± 0.3, p > 0.05). Conclusion: In conclusion, this study indicates that the participants have an effective hydration strategy during the training session in competitive season.*

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### Introduction

Soccer is the most popular game worldwide. There are almost 120 million registered soccer players including male, female and children with many millions more play in non-organized soccer recognized all over the world (Alvarado, 2005). Soccer's growth in popularity over the years has seen a similar increase in the amount of research conducted in a myriad of sports science disciplines. Many research involving soccer have largely been based on the physiology of soccer, nutrition and performance, biomechanical factors, psychological aspects, factors associated with injury and the effect of ergogenic aids (Reilly & Doran, 2003). The acceptance of these disciplines is unsurprising considering the performance-enhancing role that it can offer to elite soccer coaches or trainers who are continuously searching for a competitive edge against opposition teams (Carling, Bloomfield, Nelsen, & Reilly, 2008).

More than ever, participation in soccer amongst young players is booming all over the world. FIFA has reported a 7% growth in participation, from 18 million in 2000 to 22 million, in 2006 (Kunz, 2007). From 2006 statistics, 18.7 million players are recognized as male youth players with approximately 3.3 million registered female players (Kunz, 2007). Despite the overwhelming popularity of soccer in youth sports, the information investigating adolescents' hydration status is significantly lesser than adults

(Capranica, Tessitore, Guidetti, & Figura, 2010). This study is driven by the essential need to gain accurate knowledge regarding the demands of performance, so it can be used to manage physical and physiological demands of the player (Bloomfield, Polman, & Donoghue, 2007).

During prolonged soccer match play, young players may have disadvantages compared to adults due to the transition period from childhood to puberty (Naughton, Farpour-Lambert, Carlson, Bradney, & Van Praagh, 2000). Prior maturation, various physiological differences are observed and expected in young football players (relative to adults) (Naughton et al., 2000). These include substrate utilisation, reduced reserves of muscle glycogen, lower aerobic and anaerobic capacity, and less well-developed thermoregulatory processes (Timmons, Bar-Or & Riddell, 2003; Alvarado, 2005; Rosenbloom, Loucks & Ekblom, 2006; Riddell, 2008). Considering the physiological discrepancies in thermoregulatory processes (Alvarado, 2005) young players may have disadvantages compared to adults due to thermoregulatory responses. The main purpose of thermoregulation is to maintain body temperature to prevent overheating and overcooling (Powers & Howley, 2001). Adolescents have anatomic and physiologic characteristics which have been considered to impair thermoregulatory responses (Rowland, 2008). This includes diminished sweating capacity, high ratio of body surface area to mass and lower cardiac output (Rowland, Hagenbuch, Pober, & Garrison, 2008). Perspiration was found to be an utter cooling agent for children under the heat during non-exercise activity, nevertheless when exercise stress was added, this system was unable to work as effectively during non-exercise stress (Sinclair, Crowe, Spinks, & Leicht, 2007). It was found that adult perspiration rate is 40% greater than children (Rosenbloom et al., 2006) and is directly influenced by smaller sweat glands (Sinclair, Crowe, Spinks, & Leicht, 2007) and lower sensitivity to the sweating mechanism (Falk et al., 1991). Furthermore, children have larger surface area to mass than adults which allows the skin to absorb heat from the external environment and put more stress upon thermoregulation (Stratton, Reilly, A. Mark Williams, & Richardson, 2004). Also, lower cardiac output and blood volume contribute to redirection of blood flow during exercise. This forces muscles and skin to work as they compete for blood supplies, which would worsen the thermoregulatory process (Sinclair et al., 2007). Therefore, particular care must be taken whilst preparing and later conducting any sporting activities for adolescents as they are more vulnerable to heat illnesses especially when exercising in hot and humid conditions (Rowland, 2008).

Previous research has proposed the importance of hydration or fluid replacement in football at any climate, but can be more detrimental in hot and high humidity areas (Casa et al., 2000; Maughan, King, & Lea, 2004; Monteiro, Guerra, & Barros, 2003). Evidence showed that weight loss of greater than 2% resulting from dehydration can cause loss of concentration, fatigue, and increase heart rate and for a more severe case, circulatory collapse (Smith, 1992) and impair football performance (Monteiro et al., 2003). Research in adults has shown that in intermittent high intensity shuttle running exercise in the no-fluid condition resulted in 5% deterioration in football skill performance (Mcgregor, Nicholas, Lakomy, & Williams, 1999). Furthermore, heart rate, perceived exertion, serum aldosterone, osmolality, sodium and cortisol levels were also higher in the no-fluid relative to the fluid trial (Chamari et al., 2005). Given that children adapt less well to exercise in heat and other physiological disadvantages, fluid replacement strategy may assist in prevention of dehydration. In agreement with this, the National Athletic Trainers' Association (NATA) claimed that proper hydration during exercise assists in thermoregulation, cardiovascular function, fluid volume status, muscle functioning as well as exercise performance (Casa et al., 2000). Therefore, it is proposed that football players should drink pre-exercise, during half time break and/or when they have the opportunity during breaks in a game. Various studies have shown that young football players were in a hypohydrated state before training or competition. For instance, Silva et al. (2011) had investigated 20 professional football players in hot and humid environment ( $33.1 \pm 2.4^{\circ}\text{C}$ ,  $43.4 \pm 3.2\%$ , respectively). Hydration status was measured using USG and BM changes were recorded before and after training sessions. It was found that young players began the days of training mildly hypohydrated (USG > 1.020) and fluid intake did not match fluid losses. For this reason, further investigations are required to fully understand the hydration status of young football players who train under different climate.

Studies on the hydration status of Malaysia young soccer players are limited. Given the limitations associated with assessing young soccer players in Malaysia, this study aims to examine the pre-exercise hydration status and to assess BM loss (kg) of young male soccer player's on typical training days during competitive season.

## Methods

### **i. Participants**

The data was collected on twenty ( $n = 20$ ) players from Sekolah Sukan Bukit Jalil (SSBJ) (Height  $1.67 \pm 0.4$  m, BM  $55.3 \pm 8.4$  kg) who volunteered to participate in the study. Participants were asked to record dietary intake (24 hour before the first assessment) and required to replicate the same diet prior to second assessment. Written consent form was obtained from the participant's parents/guardian after being thoroughly informed the benefits and potential risks of the study as all the participants were under the age of 18 ( $15.6 \pm 0.4$  years).

### **ii. Experimental Design**

Data was collected during the competitive season (May-June 2016). All participants BM measurement and USG were recorded in two sessions separated by seven days. Upon arrival, participants were required to empty their bladders. In the privacy of a toilet, participant voided a small sample of midstream urine into a container before the training session. The investigator established the volume of the urine and recorded the specific gravity immediately using a hand-held refractometer (Sur- Ne Atago Co. Ltd, Japan). Urine samples were flushed down to the toilet immediately after the analysis with containers being disposed in hazardous waste containers. Prior to analysis and at the start of each test, a researcher calibrated the refractometer by placing distilled water on the glass as the sample, and adjusting the scale to read 1.000, or calibrate with a flathead screwdriver if necessary.

Electronic weighing scales (HV200KGL NTEP, Industrial Balance, USA) were used to determine BM. The BM measurement were taken prior to and immediately after completion of training session (toweled dry). The participants were weighed with minimal clothing and with shoes removed. Participants were asked to stand in the centre of the scale's platform with their weight distributed evenly on both feet without support. The BM was recorded to the nearest 0.1 kg. The participants were allowed to drink (approximately 200 to 400 mL as suggested by National Athletic Trainers Association) as in their normal training routine. A weather station (ETHG-912; Oregon Scientific, USA) was used to record the temperature and humidity during trials. Mean temperatures and relative humidity recorded were  $30.2 \pm 1.1^\circ\text{C}$ ,  $68.0 \pm 8.4\%$  respectively.

### **iii. Statistical Analysis**

All data were tested for normality distribution and are reported as means  $\pm$  standard deviations. Paired sample t-test was used to determine whether there were any differences between measurements. All statistical analyses were performed with SPSS software (version 16.0, SPSS inc, Chicago, IL) with the level of significance set at  $P \leq 0.05$ .

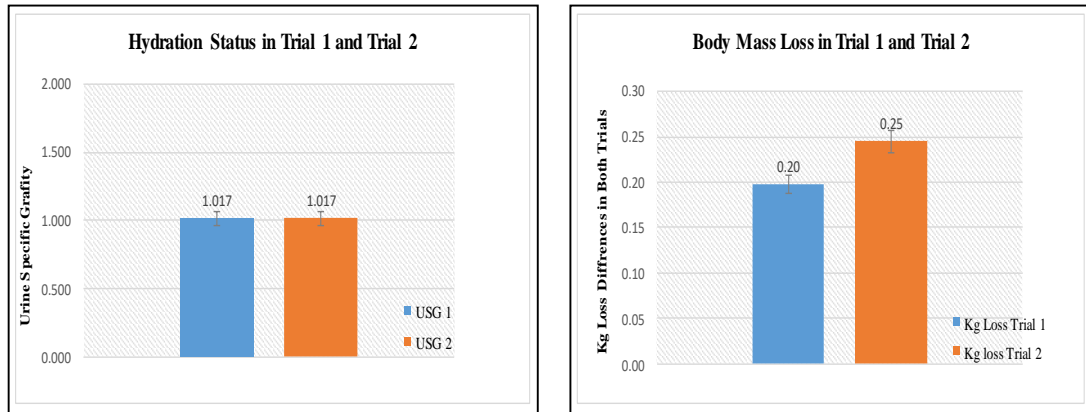
## **Results**

### **i. Hydration Status**

A paired-samples t-test was conducted to evaluate the USG. There was no a significantly increase from Week 1 ( $M=1.02$ ,  $SD = .008$ ) to Week 2 ( $M = 1.02$ ,  $SD = .005$ ),  $t(19) = -.215$ ,  $p > .05$  (two-tailed). The mean increase in USG score was  $-.0008$  with a 95% confidence interval ranging from  $-.005$  to  $.004$  (Figure 1). The results appear that participants are within the normal range of hydration status ( $1.016 \pm 0.01$ ). This indicate that participants have an effective hydration strategy prior to the protocols.

### **ii. Body Mass Loss (kg)**

A paired-samples t-test was conducted to evaluate BM loss between trials. There was no significant difference from Week 1 ( $M=.195$ ,  $SD = .499$ ) to Week 2 ( $M = .230$ ,  $SD = .536$ ),  $t(19) = -.330$ ,  $p > .05$  (two-tailed) (Fig. 1). The mean increase in BM loss score was  $-.035$  with a 95% confidence interval ranging from  $-.257$  to  $.187$ .



**Fig. 1 The Hydration and body mass status in both trials**

## Discussion

The primary aim of this study was to examine the pre-exercise hydration status and to assess BM loss (kg) of young male soccer players on standard training days during the competitive season. This is inaugural study on hydration status among Malaysian young soccer players. The main findings reported that the participants were within the normal range of hydration status (USG  $1.016 \pm 0.01$ ). It was suggested by National Athletic Trainers' Association (NATA) USG 1.020 is classified as significant dehydration and (Casa et al., 2000)  $> 1.030$  is serious dehydration. It is highly recommended that an athlete should begin exercising in well hydrated condition for few reasons such as to maintain physiologic function and to prevent from heat illness (heat cramps, heat exhaustion or heat stroke) (Casa et al., 2000) and to maintain athletic sports performance (Mcgregor et al., 1999). From this data, it indicates that these players have sufficient hydration knowledge and practice effective hydration strategy. It is important to note that these players were constantly monitored by the coaches and sport nutritionist who are responsible to monitor their hydration level. They were advised to consume about 400 mL of water during training sessions and have free access to fluids.

In contrast, many studies had reported that young soccer players were hypohydrated pre-training and pre-competition (Arnaoutis et al., 2013; Da Silva et al., 2012; Nicholas, Tsintzas, Boobis, & Williams, 1999; Williams & Blackwell, 2012) in both environmental conditions (hot and cold). Da Silva et al., (2012) examine the pre-game hydration status of elite young soccer players competing in a match played in the heat ( $31.0 \pm 2.0$  °C) in 15 male players (age  $17.0 \pm 0.6$  years). They conclude that, native tropical soccer players were in hypohydrated in pre-game and only replaced about 50% of the sweat loss. In different environmental conditions ( $11.0 \pm 1.2$  °C), 14 from 21 male professional youth soccer players (age  $17.1 \pm 0.7$  years) were found to be hypohydrated before commencing a training and only replaced  $46\% \pm 88\%$  of the sweat loss (Williams & Blackwell, 2012). Meanwhile Arnaoutis et al., (2013) investigate 107 young male soccer players (age  $13.2 \pm 2.6$  years) during a training session of a summer camp. Surprisingly, 88.7% of the players were hypohydrated (USG  $\geq 1.020$ ) based on a morning urine sample in environmental temperature 27.0 °C. Besides USG, BM loss (kg) may be a useful indicator to measure hydration status. This can be done by measuring pre exercise body weight – post exercise body weight. Minimal dehydration ranged from -1 to -3 % loss of body weight and  $> 5\%$  is serious dehydration. In this present study, participants lose about  $0.22 \pm 0.4$  kg from BM. This is low compared to Brazilian players that played in similar climate (temperature  $31.0 \pm 2.0$  °C, relative humidity  $48.0 \pm 5.0\%$ ) that loses about  $1.08 \pm 0.55$  kg (Da Silva et al., 2012).

Similar to this present study, these players have several opportunities to rehydrate during a training session (Da Silva et al., 2012; Williams & Blackwell, 2012). Despite unlimited access to fluids, these players did not drink sufficient volumes and allowed involuntary dehydration (Arnaoutis et al., 2013). There were various possible factors that caused this. First, the hypohydration experienced by the players may not suffice to stimulate the thirst mechanism to drink, especially in cold environment. Second, water palatability will also encourage the consumption (Maughan, 1998) and third proximity to bottles may influence fluid replacement (Da Silva et al., 2012). Therefore, it is really important for coaches and sport-scientists to promote and guide effective strategy for fluid replacement during pre/post training or

competition. Recommendations from NATA suggested fluid replacement should match sweat and urine losses. To ensure proper hydration pre-exercise, athlete should consume about 500 to 600 mL of water 2 to 3 hours prior to exercise and about 200 to 400 mL during exercise. They also advised to promote young players to drink sufficient amount, water bottles to be easily accessible, prepare drinks based on athletes flavour preferences and fluid temperature to be prepared around 10 to 15°C (Casa et al., 2000). In real soccer match-play, rehydration occur at specific times , therefore, it is advisable for players to drink prior to the match , during the half time break and post game (Monteiro et al., 2003).

Water may be considered the best way for rehydration during exercise but, considering the loss of electrolytes (such as sodium, potassium, calcium, magnesium) and glycogen stores during soccer match-play (Maughan, 1998), carbohydrate-electrolyte (CHO-E) may offer more advantages than consuming water alone. Consumption of CHO-E beverages has been shown to increase the concentration of blood glucose, enhance oxidation of exogenous CHO, and spare muscle glycogen (Monteiro et al., 2003). Regardless of the mechanism of action CHO-E ingestion has shown to delay fatigue and improve soccer performance. Indeed, the consumption of sugar-sweetened beverages in young soccer players is still debatable (Larson, Dewolfe, Story, & Neumark-Sztainer, 2014). Possible adverse effects of CHO-E ingestion include dental erosion associated with high citric acid content (Care, 2011) as well as excess calorie intake and weight gain (Larson et al., 2014). As consumption of sports drinks increase, it is important to investigate the impact of sports drinks among young athletes. Therefore, coaches and parents can educate their players/ children about the appropriate consumption of sports drinks. Given the little evidence available, more research is warranted in CHO-E ingestion by using valid and reliable protocols whilst studying sample of soccer players from various ages.

## Conclusion

The current study showed that participants were in normal hydration status during soccer practice as they were closely monitored by coaches and support staff on the level of their hydration status. This indicates that they have an effective fluid replacement strategy. In conclusion, it is important to educate young athletes about the importance of hydration and mandate rehydration during practices and competitions.

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