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ASSESSING PRE-GAME HYDRATION IN UNIVERSITI PERTAHANAN NASIONAL MALAYSIA FOOTBALL CLUB (UPNM FC) PLAYERS

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ABSTRACT

Hydration status is a critical determinant of athletic performance, particularly in high-intermittent sports like football, where even mild dehydration can impair endurance, cognitive function, and increase the risk of injury. The purpose of this study was to investigate pre-game hydration status in Universiti Pertahanan Nasional Malaysia Football Club (UPNM FC) football players. A total of nineteen athletes (n=19; Age: 21 ± 1.5, Height: 1.71 ± 6.6 m, Weight: 65.6 ± 10.6 kg) volunteered to participate in this study. Pre-game hydration status was assessed using Urine Color Chart (UCC) and Thirst Scale (TS) measurement, taken immediately before the match. The results showed the urine color chart was 4.4 ± 1.5 suggests that on average, players were moderately dehydrated prior to the game. Thirst score of 3.74 ± 0.9 suggests that players were also experiencing moderate to high thirst levels before gameplay indicates physiological signal that typically occurs after the body has already started to experience fluid loss. Nevertheless, no significant correlation was found between UCC and TS (r =-.082, $p > 0.05$). At this point, it can be concluded that UPNM FC players were already in a state of mild dehydration even before the competitive match. This finding suggests that UPNM FC players should hydrate earlier and more consistently before matches, therefore the team could potentially reach optimal hydrated state and likely enhance performance and reduce fatigue and injury risk.

Keywords: dehydration status, soccer, male, youth, student-athletes

INTRODUCTION

Football, or soccer, is undoubtedly the most popular team sport and is recognized as one of the most followed and played sports (Atan & Kassim, 2020). Consequently, the volume of research conducted across various sports science disciplines related to football has significantly increased, as evidence-based findings are essential for helping athletes and coaches achieve optimal performance (Delves et al., 2021). Football demands a combination of aerobic and anaerobic fitness, technical skills, tactical awareness, and mental sharpness (Bangsbo et al., 2006). Research plays a critical role in identifying optimal training methods, developing skill enhancement strategies, and designing conditioning programs that improve players' endurance, agility, speed, and decision-making (Atan & Kassim, 2019). These factors collectively contribute to enhanced on-field performance. However, dehydration issues

have often been neglected in the context of sports, particularly in the football setting. Despite its significant impact on performance and health, the importance of proper hydration is frequently overlooked by athletes, coaches, and sports organizations. This neglect can lead to increased risks of dehydration-related injuries, impaired physical performance, and diminished cognitive function.

Studies on football players in tropical regions, such as Malaysia, are particularly crucial due to the elevated heat and humidity they encounter (Kurdak et al., 2010). A significant concern for Malaysian football players, especially at the youth level (i.e., grassroots, school, and varsity), is that both training and match play occur in hot and humid environments. For example, Atan et al. (2019) reported that mean temperatures during U16 Malaysia youth football training sessions averaged 30.2 ± 1.1 ℃, with relative humidity at 68.0 ± 8.4%. These conditions make players more susceptible to dehydration and heat-related injuries (Atan et al., 2019). Dehydration is defined as a condition resulting from the excessive loss of fluid from the body (McCubbin et al., 2020). A body mass loss of 2% or more due to fluid deficits can significantly impair physical performance (Ganio, et al., 2011), reduce endurance (Mohr et al., 2006), and hinder cognitive function such as short-term memory, attention, and lower concentration that impaired decision-making skills (Zhang et al., 2019). In football, quick thinking and accurate decision-making are essential for success on the field. Players must continuously assess dynamic game situations, anticipate opponents' moves, and make split-second decisions on passing, positioning, and shooting. This cognitive agility allows teams to adapt fluidly to the play, create scoring opportunities, and maintain defensive stability. Furthermore, the adverse effects can negatively impact football skill performance, sprinting ability, reaction time all of which are critical for effective decision-making on the field (McGregor et al., 2017). In addition, dehydration significantly increases the risk of heat-related illnesses (Rowland, 2008). Dehydration reduces sweating capacity by up to 40%, which compromises the body's ability to dissipate heat during exercise (Alvarado, 2005). Consequently, this reduction in cooling efficiency can lead to speed up fatigue during physical activity to muscle cramps and more severe conditions such as heat exhaustion and heat stroke, which are not only painful but also potentially life-threatening and requiring immediate medical attention.

The primary mechanism for dehydration in football is multifaceted, involving substantial fluid loss due to sweating, hydration strategies that include both pre- and post-exercise fluid consumption (Atan et al., 2019) and environmental conditions (Leão et al., 2022). Numerous studies have investigated hydration status across various climates, consistently demonstrating that youth football players often begin training sessions and match play in a dehydrated state. For instance, previous study reported that players in diverse settings frequently entered games without adequate hydration. In Brazil, players were found to be in a hypohydrated state before match play in conditions averaging 31.0 ± 2.0 °C, replacing only about 50% of their sweat loss (Da Silva et al., 2012). Similarly, Spanish youth players during a training camp exhibited a hydration deficit, with temperatures averaging 27.2 ± 2 °C and relative humidity around 57% ± 9%. These findings underscore the urgent need for effective hydration strategies to ensure players are adequately prepared for the physical demands of football, regardless of the environment (Atan et al., 2019).

Although the National Athletic Trainers' Association (NATA) had proposed a proper hydration strategy (Casa et al., 2021), football players often struggle to maintain adequate fluid intake. To address this, regular hydration assessments should be conducted to closely monitor athletes' hydration status, ensuring they meet the necessary levels to optimize performance and reduce the risk of dehydration-related issues. Hydration status can be assessed through various methods, such as urine specific gravity (USG) which offers more precise insights into hydration levels (Hamouti et al., 2012) and body weight measurements (Armstrong et al,, 2012). Nevertheless, it was found that unavailability of equipment such as hand-held refractometer may limit the investigation of the hydration status among athletes. This is especially important at lower levels of play, such as school or varsity levels. Given the limitations associated with assessing hydration status, the aim of this study is to investigate pre-game hydration status in UPNM FC football players by using the cost-effective measure to provide quick feedback on hydration status which is the urine color chart (UCC) and thirst scale to assess an individual's perception of their thirst level, which can provide insights into their hydration status. This study on the pre-game hydration status of UPNM FC players holds significant implications for improving athletic performance, enhancing player safety, and informing best practices in sports hydration, particularly in the context of Malaysia's unique environmental challenges.

METHODOLOGY

Participants

Data were collected from nineteen (n = 19) players from UPNM FC (Height: 1.71 ± 6.6 m, Body Mass: 65.6 ± 10.6 kg) who volunteered to participate in the study. Participants were instructed to prepare for the study as they would for a regular football match, including their usual nutrition and exercise routines. Written informed consent was obtained from each participant after they were thoroughly briefed on the study's benefits and potential risks. The study protocol was approved by the University Research Ethics Committee.

Experimental Design

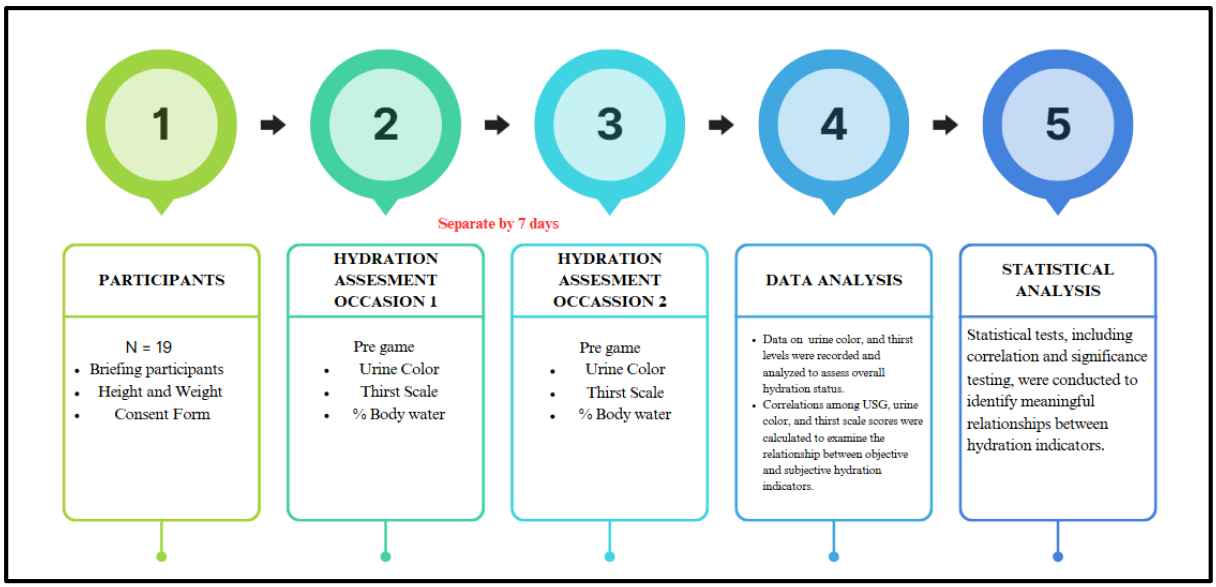

Fig 1: Data Collection Procedure

The hydration assessment was conducted during two official Liga Institut Pengajian Tinggi (IPT) 2022 home games for UPNM FC which was separated by 7 days. The sample size (n = 19) was chosen as it represents all players within this team who were willing and able to participate, providing a complete snapshot of hydration practices within this group.

The hydration indicator was measured using the cost-effective method, which is urine color. Urine color has been found to be a reliable (Armstrong et al., 2012) and valid (Cheuvront et al., 2010) indicator of hydration status, particularly in field conditions where more sophisticated equipment may not be available. Hydration status was determined using the Urine Color Charts (UCC) (see Figure 2). Approximately one hour before the game, participants provided a urine sample. In the privacy of a toilet, each participant voided a small sample of midstream urine into a container. The investigator then assessed the urine color using the UCC and recorded the result immediately. Hydrated urine color is light yellow or close to clear area and vice versa the color is dark and near to light brown. The assessment of urine color was performed by a single evaluator to ensure the results is accurate and reliable. After analysis, the urine samples were discarded, and the containers were disposed of in hazardous waste containers. Following the urine sample collection, participants self-reported their thirst levels using a subjective thirst scale (1–7) to further assess their perceived hydration needs before the match.The TS is a scale that using seven point (1–7) Likert scale that provided verbal anchors of 1, "Not Thirsty at All"; 2, "Not Thirsty"; 3, "Not Very Thirsty"; 4, "Neutral"; 5, "Thirsty"; 6, "Very Thirsty"; and 7, "Very, Very Thirsty".

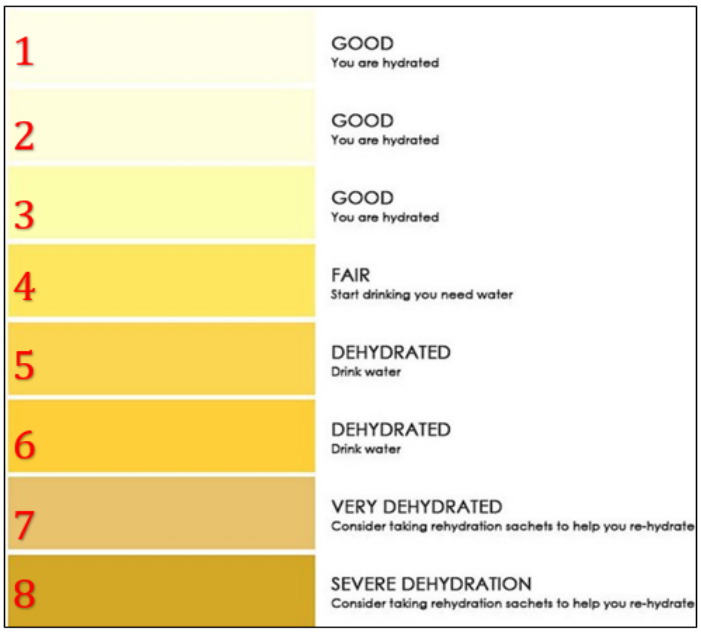

Fig. 2: Urine Color Chart for Hydration Measurement.

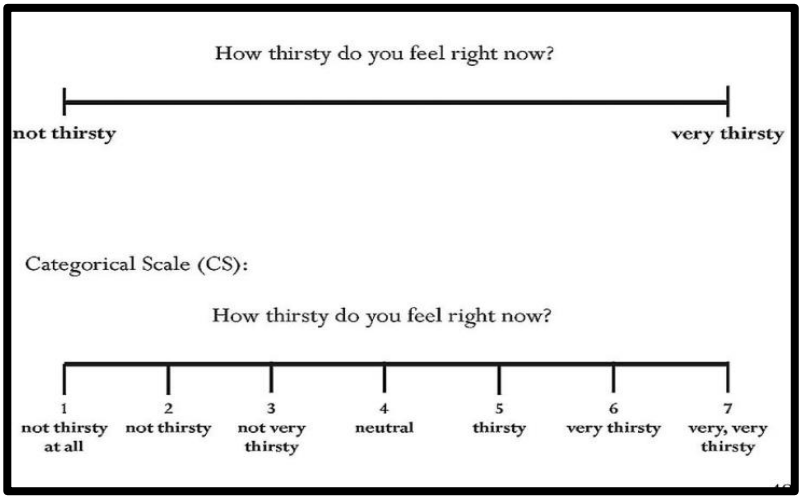

Fig. 3: Thirst Scale

The percentage of body water (% BW) was also measured using a Bioelectrical Impedance Analysis BIA) (Model Tanita UM-081). Participants were weighed with minimal clothing and shoes removed. They were instructed to stand in the center of the scale's platform, ensuring their weight was evenly distributed on both feet without any support. The % BW assessment was conducted to determine the amount of water present in a participant's body as a percentage of their total body weight. Monitoring % BW is valuable for detecting early signs of dehydration especially in athletes engaging in strenuous physical activity.

Statistical Analysis

All data were tested for normality distribution and are reported as means ± standard deviations. Pearson Correlation Coefficients was used to determine whether the relationship between UCC, TS and % BW. All statistical analyses were performed with SPSS software (version 20.0, SPSS Inc, Chicago, IL) with the level of significance set at $P \leq 0.05$.

RESULTS

Table 1: Mean and Standard Deviation of the Participants

	Assessment 1	**Assessment 2**	**Mean ± SD**
Urine Color Chart	4.4 ± 1.3	4.3 ± 1.6	4.3 ± 1.5
Thirst Scale	3.7 ± 0.9	3.8 ± 0.8	3.7 ± 0.9
% Body Water	60 ± 15	59 ± 14	59.4 ± 15

The data in Table 1 provides an overview of hydration status among UPNM FC players across two assessments separated by 7 days apart. Three key measures were analyzed: the UCC, TS, and % BW.A slight decrease was observed from Assessment 1 to Assessment 2 in UCC, suggesting minimal variation in hydration levels over the week. This consistency may indicate similar hydration practices among the players. The results indicate that, based on the UCC values, participants fell into a borderline range between fair and a dehydrated state. This suggests that while their hydration was not optimal, they were not severely dehydrated. However, the color levels on the UCC imply that hydration strategies may need to be emphasized or adjusted to ensure players consistently maintain a more fully hydrated state, especially before and during competitive play.

The TS measures subjective feelings of thirst, where higher values generally indicate greater perceived thirst and possibly a need for more fluid intake. The players reported an average thirst level over both assessments, with a slight increase in Assessment 2. The near-constant thirst values imply a consistent level of perceived thirst, which might reflect players' hydration awareness or regular hydration habits.

In this study, the players' % BW averaged 59.4 ± 14.4 which falls within the typical range for adult males (55-65%). This range suggests that, on average, the participants maintained a normal hydration status. The standard deviation, however, indicates considerable individual variability, meaning some players may still fall outside this ideal range. Monitoring and individualized hydration strategies could help address these variations to ensure all players maintain optimal hydration levels.

Urine Color Chart and Thirsts Scale

The relationship between the UCC and the TS was examined using the Pearson Correlation Coefficient. The analysis yielded a weak negative correlation ($r = -0.08$, $n = 19$, $P > 0.05$), indicating no statistically significant relationship between the two variables.

Urine Color Chart and Percentage of Body Water

The analysis of the relationship between the UCC and % BW using the Pearson Correlation Coefficient revealed a weak negative correlation ($r = -0.20$) between the two variables. With a sample size of 19 and a p-value greater than 0.05, this result is not statistically significant. This finding suggests that there is no meaningful relationship between UCC and % BW in this sample, indicating that variations in urine color do not correspond consistently with changes in body water percentage.

Percentage of Body Water and Thirsts Scale

The relationship between % BW and TS was also examined in this study. The analysis revealed a weak positive correlation ($r = 0.10$, $n = 19$, $P > 0.05$), indicating a very small and positive relationship between the two variables. However, the correlation was not statistically significant, as the p-value was greater

than 0.05. This suggests that, while there is a slight tendency for higher body water percentages to be associated with slightly higher thirst levels, the relationship is weak and not strong enough to reach statistical significance. Therefore, based on this data, it cannot be concluded that there is a meaningful or reliable association between % BW and perceived thirst (TS) in this sample of players. Further research with a larger sample size or different measurement methods might be needed to explore this relationship in greater depth.

DISCUSSION

The study of the pre-game hydration status of UPNM FC players provides valuable insights into the players' physiological preparedness before competitive football matches. Hydration is a crucial factor influencing athletic performance, as it affects endurance, strength, and overall energy levels. Therefore, a comprehensive assessment of the hydration status of UPNM FC players is essential to ensure optimal performance during matches. The findings of the study reveal that the players' hydration status falls between fair and dehydrated conditions, which suggests that many athletes may not be adequately hydrated before their games. This could potentially impact their performance, as dehydration can lead to fatigue, decreased concentration, and increased risk of injury. The results highlight the need for improved hydration practices, especially considering the possible consequences of inadequate fluid intake before competitions.

Studies have consistently shown that a significant proportion of athletes, including those in professional and collegiate sports, arrive at training sessions or competitions in a hypohydrated state. For example, research by Volpe et al. (2009) indicated that approximately 50% of athletes were dehydrated before physical activity. A more specific example comes from a study on Brazilian jiu-jitsu competitors, where 94.1% of athletes were found to exhibit dehydration symptoms before competitions, as reported by Bueno et al. (2023). However, in a survey examining athletes' hydration knowledge, attitudes, and behaviors, results showed that athletes were generally knowledgeable about hydration and more likely to drink fluids before reaching dehydration. However, some athletes relied solely on thirst as an indicator of hydration status, which is not always accurate. This highlights a gap in understanding, as thirst alone may not reliably reflect hydration needs in all situations (Judge et al., 2021). These findings highlight the widespread issue of hypohydration in athletes, underlining the need for effective hydration strategies before exercise to maintain performance and prevent adverse health effects. One effective way to manage hydration is by consistently monitoring hydration status using cost-effective tools like the UCC. This simple method can help athletes quickly assess their hydration levels without relying solely on subjective feelings of thirst, which may not always accurately reflect true hydration needs. By using such tools, athletes can stay proactive about their hydration and reduce the risk of dehydration. Moreover, the UCC has shown to correlates moderately with USG and urine osmolality (ranging from 0.73 to 0.84) depending on the population and methods used (Wardeenar et al., 2021).

Indeed, no study is without limitations, there are several limitations to consider from this current investigation. The research is aimed at understanding trends within the UPNM FC rather than generalizing across broader populations which can limit the larger sample. Since hydration studies involve specific protocols, participant recruitment is generally challenging, making a sample size of 19 players reasonable and feasible to see the trend of hydration status. However, with a small sample size of 19 participants, statistical power is limited. A weak or insignificant correlation in this present study could be the result of insufficient statistical power, reducing the ability to find significant correlations. A larger sample size might yield a different result (Belasco et al.,2020). Moreover, Both UCC and TS are subjective and may lack the sensitivity required to detect more nuanced changes in hydration status. The UCC relies on visual inspection of urine color, which can be influenced by factors like lighting or the individual’s ability to perceive color. Similarly, the TS depends on an individual's subjective experience of thirst, which may not always accurately reflect hydration status (Edwards et al., 2020). These limitations could contribute to the absence of a strong correlation with % BW, a more objective measure.

Indeed, hydration status is multifactorial, involves more than just thirst or urine color but also electrolyte levels, kidney function, and individual physiological responses (Edwards et al., 2020).

Hydration status is a multifactorial condition that other variables, may play significant roles but aren't captured by these methods. This complexity further explains the lack of a strong relationship between the tools.

From these findings, it is suggested that for future studies should aim to include a larger, more diverse sample to increase statistical power and ensure that results are more generalizable to different populations (Edwards et al., 2020). Studies with a broader range of participants could help establish stronger, more reliable correlations between hydration assessment tools. To overcome the limitations of subjective tools like UCC and TS, future research could incorporate objective hydration assessments, such as urine osmolality, USG or blood plasma osmolality, to cross-validate findings. These methods could provide more accurate and precise measures of hydration status. Additionally, controlling for recent food or fluid intake could minimize the confounding effects of external factors. By addressing these limitations and expanding upon the current findings, future research can help refine our understanding of hydration status and improve the tools used to monitor it.

CONCLUSION

This present study sought to understand and quantify the hydration status among UPNM FC football players. At this point, it can be concluded that athlete's constantly in hypohydrated prior to training and competitive setting. Therefore it is important to educate athletes about the importance of consistent hydration practices and understanding their body's signals of thirst. This could include training on recognizing the signs of dehydration early and using simple tools like UCC and TS regularly as part of hydration monitoring routines. Also, athletes should develop consistent hydration habits, including consuming fluids throughout the day and adjusting intake based on environmental conditions and physical activity levels.

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