

HYDRATION KNOWLEDGE, ATTITUDES AND PRACTICES AMONG UNIVERSITY ATHLETES AND RECREATIONAL SPORTS PLAYERS IN THE KLANG VALLEY

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ABSTRACT

Hydration plays an important role in athletic performance and in prevention of heat stroke and injuries. Lack of hydration knowledge may lead to dehydration that can impair performance and health. This cross-sectional study aimed to determine the associations between hydration knowledge, attitudes and practices, and predictors of hydration practices among university athletes and recreational sports players in the Klang Valley. A total of 193 university students aged 18-24 years old participated in the study, with 79 of them being university athletes and 114 were recreational sports players (engaged in sports for at least 4 hours per week). Anthropometric measurements were conducted. Body fat percentage and muscle mass were measured using a bioelectrical impedance analysis (BIA) machine. Physical activity level was assessed using the International Physical Activity Questionnaire-Short Form (IPAQ-SF). Hydration knowledge, attitudes and practices were obtained through a self-administered questionnaire. Majority of the participants were male (84.5%) and the most common type of sports played was basketball (42%). The mean physical activity level was 10,990.54±3,987.05 MET-mins/week. The mean body fat percentage and muscle mass was 19.64±5.83% and 30.62±4.31 kg, respectively. The prevalence of having insufficient knowledge on hydration was 20.7%. University athletes had higher scores on hydration knowledge, attitudes, and practices than recreational sports players ($p<0.001$). Hydration knowledge ($r=0.730$, $p<0.001$) and attitudes towards hydration ($r=0.688$, $p<0.001$) were positively associated with hydration practices. Sex ($B=1.046$, $p<0.001$), age ($B=0.190$, $p=0.003$), muscle mass ($B=0.136$, $p<0.001$), body fat percentage ($B=-0.890$, $p<0.001$), hydration knowledge ($B=0.060$, $p<0.001$), and attitudes towards hydration ($B=0.051$, $p=0.024$), were significant predictors of hydration practices. Thus, providing knowledge on hydration and inculcating positive attitudes towards hydration may improve hydration practices among university athletes and recreational sports players.

Keywords: Hydration Knowledge, Attitudes towards Hydration, Hydration Practices, University Athletes, Recreational Sports Players

INTRODUCTION

Optimal hydration is crucial in ensuring peak athletic performance as well as for the overall health and well-being (Judge et al., 2021). Water plays an important role in regulating body temperature and lubrication of muscles and joints (Lorenzo et al., 2019). Proper hydration helps to enhance sport performance, prevent injury, and improve circulation, muscles flexibility and cognitive functions, throughout a practice or competition (Lorenzo et al., 2019). On top of that, sufficient fluid consumption also helps to promote recovery and improve agility (Judge et al., 2021). A good hydration strategy should include adequate water consumption before, during and after the practice or competition (Judge et al., 2021).

Dehydration due to fluid loss during exercise can hamper an athlete's physical capabilities leading to poor sports performance (Judge et al., 2021). The loss of fluids can occur through sweating, respiration, and urinary excretion, particularly during a prolonged or intensive physical activity event (Armstrong, 2021). Studies have shown that dehydration can detrimentally affect various aspects of athletic performance including endurance performance, cognitive functions, mood states, perceptual response as well as strength and power performance (Dube et al., 2022). The risk of dehydration is high in countries with tropical climate and high humidity (Magee et al., 2017) like in Malaysia. Esa et al. (2015) found that 85% of Malaysian national athletes competing in the weight category sports (combat sports, and power and strength) were significantly dehydrated. They also found that most of the athletes had poor knowledge, attitudes, and behaviours on hydration. Higher hydration knowledge was associated with higher attitudes score and higher percentage of body weight changes after exercise (Esa et al., 2015).

Recreational sports players are individuals who engage in athletic activities for fun and to improve health, physical fitness and socialization (McKinney et al., 2019; Kenefick & Cheuvront, 2012). Recreational sports include a broad range of activities from dancing to running, hiking and cycling (Kenefick & Cheuvront, 2012). Although recreational sports tend to be physically and mentally less stressful than competitive sports, many recreational sports players train and compete in casual sporting events in a highly competitive manner (Kenefick & Cheuvront, 2012). Hydration remains important regardless of the degree of commitment to the sports (Kenefick & Cheuvront, 2012).

Despite having various published guidelines about hydration for athletes and active individuals, most athletes did not aware of the sign of dehydration and did not know about self-hydration assessment (Malik et al. 2022). Similarly, among recreational marathon runners in China, over half of them were at risk of dehydration due to lack of knowledge (Zhang et al., 2025). Only 21.5% the recreational marathon runners were aware of the daily water intake recommendation, and about half of them knew the importance of rehydration after exercise and the colour of healthy urine (Zhang et al., 2025). Among university football players in Perak, 36% were found to have poor to very poor hydration knowledge (Jusoh & Salim, 2019), while among adolescent handball athletes, only 22.4% correctly identified the statement "If you are not thirsty, then you must not be dehydrated" as false (Jusoh et al., 2021). Hydration knowledge score was found to be positively associated with fluid replacement habit score among athletics athletes in Malaysian Sports School in Pahang (Malik et al., 2022). However, there was no significant association found between hydration knowledge and hydration status among the athletics athletes (Malik et al., 2022). Another study by Jusoh (2014) showed that despite having a good knowledge in hydration, some athletes did not practice proper fluid intake to maintain hydration. Understanding the role of knowledge and attitudes towards hydration practices served as an important step in ensuring that athletes and active individuals are well-hydrated throughout their exercise. Therefore, this study aimed to determine the associations between hydration knowledge, attitudes towards hydration, and hydration practices among university athletes and recreational sports players in the Klang Valley. This study also examined the differences in hydration knowledge, attitudes and practices between university athletes and recreational sports players, which are lacking in the previous local studies. By including body composition and determining predictors of hydration practices, this study provides a comprehensive examination on hydration practices among active individuals in Malaysia.

METHODOLOGY

This cross-sectional study aimed to determine the associations between hydration knowledge, attitudes and practices, and predictors of hydration practices among university athletes and recreational sports players in the Klang Valley.

Participants

This study utilised a convenience sampling method, where university athletes and recreational sports players aged 18 to 24 years old were conveniently recruited from five selected universities (one government and four private universities) in the Klang Valley. University athletes are defined as students who participate in organised sports competition and representing their university or college in sporting event at the university or collegiate level. While recreational sports players are defined as students who engage in sports for at least 4 hours per week for fun and for own physical and social wellness (McKinney et al., 2019).

Screening

To ensure that all participants in this study were students who actively participated in sports, first, using a self-reported questionnaire, they were asked if they participated in sports for at least 4 hours per week. To verify this information, they were then further screened for their physical activity level using the International Physical Activity Questionnaire-Short Form (IPAQ-SF) (Craig et al., 2017). The questionnaire assessed physical activity in the past seven days. It consists of seven items pertaining to the type, frequency and duration of physical activity that includes walking, moderate-intensity exercises, and vigorous-intensity exercises. The total Metabolic Equivalent of Task (MET)-minutes per week were calculated based on the formula, MET-mins/week = minutes of activity/day x number of days/week x MET values (walking = 3.3; moderate-intensity activity = 4.0; vigorous-intensity = 8.0). Only participants with a total MET-mins/week of 600 and above were included in the study.

Instruments

Socio-demographic background that includes age, sex, ethnicity, level of involvement in sports, and main type of sports played, was obtained through a questionnaire. Height was measured using a stadiometer (SECA 213, Germany). Weight, body fat percentage and muscle mass were assessed using a bioelectrical impedance analysis (BIA) machine (Omron Karada Scan HBF-375, Japan). Body mass index (BMI) was calculated using the formula $BMI (kg/m^2) = weight (kg) / height (m^2)$ and classified based on the WHO BMI classification for the Asian population (Nishida et al., 2004).

Knowledge, attitudes, and practices on hydration (Hydration KAP) was assessed using a self-administered questionnaire adapted from Esa et al. (2015). The knowledge section of the questionnaire consists of 17 true or false questions regarding hydration. Each correct answer was given a score of 1 and a 0 score was given for a wrong answer. Total score was calculated by total score obtained / 17 x 100. Higher score indicates higher knowledge on hydration. A score of < 60 indicates inadequate hydration knowledge.

The section on attitudes towards hydration consists of 17 statements, with 13 being positive statements and 4 negative statements. Participants rated their level of agreement to each statement on a 5-point Likert scale, ranging from strongly disagree to strongly agree. For each positive statement that supports hydration, participants received 5 points for “strongly agree”, 4 points for “agree”, 3 points for “neutral/don’t know”, 2 points for “disagree”, and 1 point for “strongly disagree”, and the points were reversed for negative statements (e.g., 1 point for “strongly agree”, 5 points for “strongly disagree”) (Esa et al., 2015). Total score was calculated by summing up the total points obtained. Higher total score indicates more positive attitudes towards hydration.

Hydration practices were assessed based on 16 yes or no statements. A score of 1 was given for each appropriate/correct practice of hydration and a score of 0 was given for each inappropriate/wrong practice

of hydration (Esa et al., 2015). Total score was calculated and higher score indicates higher hydration practices. The internal consistency (Cronbach's α) of the Hydration KAP questionnaire in this study was 0.787.

Procedures

Ethical approval was obtained from UCSI University Institutional Ethics Committee (IEC-2023-FAS-0018). A pre-testing was conducted prior to the data collection to determine the understandability of the questionnaires and the overall flow of the study. Data collection was conducted from December 2023 to March 2024. Participants were recruited at various sporting events at the selected universities. They were screened for eligibility using the IPAQ-SF questionnaire. Only those with MET-mins/week ≥ 600 were included in the study, and proceeded with the anthropometric and body composition measurements, and a self-administered questionnaire on hydration knowledge, attitudes, and practices.

Statistical Analysis

Data were analysed using IBM SPSS Statistics version 25. All univariate analysis was conducted using descriptive statistics. Independent samples t-test was used to determine the differences in hydration knowledge, attitudes, and practices between university athletes and recreational sports players. Pearson's correlation was conducted to determine the association between hydration knowledge and hydration practices, as well as the association between hydration attitudes and hydration practices. Multiple linear regression was conducted using the stepwise method to determine the contributions of socio-demographic background, body composition, hydration knowledge, and hydration attitudes towards hydration practices. All data were checked for normality (skewness and kurtosis between -2 and +2 *SD*). For the multiple linear regression analysis, normality, linearity and homoscedasticity of residuals were determined through visual examination of the scatterplot of predicted value against residuals. Significance level was set at $p < 0.05$.

RESULT AND DISCUSSION

A total of 193 university students aged 18 to 24 years old participated in the study. The mean age was 22.07 \pm 1.38 years old and majority of the participants were male (84.5%). Among them, 40.9% were university athletes and 59.1% were recreational sports players. Most of them played basketball (42.0%). Table 1 shows the socio-demographic background of the participants.

Table 1. Socio-demographic Background of Participants ($n=193$)

No.	Socio-demographic Background	Frequency	Percentage (%)
Gender			
1	Male	163	84.5
	Female	30	15.5
Age (year)			
2	18 – 21	67	34.7
	22 – 24	126	65.3
Ethnicity			
3	Malay	14	7.3
	Chinese	170	88.1
	Indian	9	4.7
Level of Involvement in Sports			
4	University Athletes	79	40.9
	Recreational Sports Players	114	59.1

Main Type of Sports Played			
5	Basketball	81	42.0
	Badminton	53	27.5
	Volleyball	22	11.4
	Rugby	22	11.4
	Swimming	15	7.7

Table 2 shows physical activity level (PAL) and body composition of the participants. The mean PAL was $10,990.54 \pm 3,987.05$ MET-min/week. The mean BMI was 23.63 ± 1.88 kg/m². Although 43.5% of them were overweight and 24.9% were obese, most of them (60.1%) had a normal body fat percentage (<20% for male and <30% for female).

Table 2. Physical Activity Level and Body Composition ($n=193$)

No.	Variable	Mean	SD	Frequency	Percentage (%)
1	Physical Activity Level				
	Total MET-min/week	10,990.54	3,987.05		
2	Body Composition				
	BMI (kg/m²)	23.63	1.88		
	BMI Category				
	Underweight (<18 kg/m ²)			2	1.0
	Normal (18.5-22.9 kg/m ²)			59	30.6
	Overweight (23.0-24.9 kg/m ²)			84	43.5
	Obese (≥ 25.0 kg/m ²)			48	24.9
	Body Fat Percentage (%)	19.64	5.83		
	Body Fat Percentage Category				
	Normal (Male < 20%; Female < 30%)			116	60.1
Over (Male > 20%; Female > 30%)			77	39.9	
	Skeletal Muscle Mass (kg)	30.62	4.31		

Table 3 shows the distribution of the hydration knowledge, attitudes, and practices scores. The mean score for knowledge was 72.33 ± 11.96 , with 20.7% of the participants had insufficient knowledge on hydration. The mean score for attitudes and hydration practices was 60.93 ± 6.37 and 10.96 ± 2.10 , respectively.

Table 3. Hydration Knowledge, Attitudes and Practices ($n=193$)

No.	Variable	Mean	SD	Frequency	Percentage (%)
	Hydration Knowledge Score	72.33	11.96		
1	Knowledge Category				
	Insufficient (score < 60)			40	20.7
	Sufficient (score \geq 60)			153	79.3
2	Hydration Attitudes Score	60.93	6.37		
3	Hydration Practices Score	10.96	2.10		

Note: Possible min-max score for knowledge is 0-100, for attitudes is 17-85, and for practices is 0-16.

University athletes were found to have a significantly higher score on hydration knowledge ($M=83.25$, $SD=7.66$) compared to recreational sports players ($M=64.76$, $SD=7.85$) ($t=16.26$, $p<0.001$). Scores on hydration attitudes and practices were also higher among university athletes than recreational sports players ($p<0.001$) (Table 4). This finding was similar to the findings by Zhang et al. (2025), where hydration knowledge and practices were poorer among “Not Certified” runners than “Public Elite” runners in China. A study among professional and non-professional football players in Greece found that both professional and non-professional football players had poor knowledge on hydration, but the prevalence of dehydration was slightly higher among non-professional football players (Papaoikonomou et al., 2025). Most athletes received dietary suggestions and hydration plan from their coaches (Cherian et al., 2020), while for non-athletes, their sources of information on hydration mostly came from their family and friends, and social media (Zhang et al., 2025).

Table 4. Differences in Hydration Knowledge, Attitudes and Practices between University Athletes and Recreational Sports Players

No.	Variable	University Athletes ($n=79$)		Recreational Sports Players ($n=114$)		t	p
		Mean	SD	Mean	SD		
1	Hydration Knowledge Score	83.25	7.66	64.76	7.85	16.26	<0.001
2	Hydration Attitudes Score	66.80	4.64	56.87	3.67	16.58	<0.001
3	Hydration Practices Score	13.08	0.96	9.50	1.25	21.44	<0.001

Note: Possible min-max score for knowledge is 0-100, for attitudes is 17-85, and for practices is 0-16.

Higher hydration knowledge score was associated with higher hydration practices score ($r = 0.730$, $p < 0.001$). Similarly, higher hydration attitudes score was associated with higher hydration practices score ($r = 0.688$, $p < 0.001$). Table 5 shows the associations between hydration knowledge, attitudes, and practices among university athletes and recreational sports players in this study.

Table 5. Associations between Hydration Knowledge, Attitudes and Practices ($n=193$)

No.	Variable	Hydration Practices	
		r	p
1	Hydration Knowledge	0.730	<0.001
2	Attitudes towards Hydration	0.688	<0.001

Higher hydration knowledge was also found to be associated with higher fluid intake behaviour among athletic athletes in a sports school in Pahang (Malik et al., 2022). Esa et al. (2015), however, found that hydration knowledge was not associated with hydration practices, but was positively associated with hydration status as measured by percentage of body weight changes after exercise. As noted by Amawi et al. (2024), there are limited studies that examined the association between hydration knowledge and hydration practices as most of the studies assessed general nutrition knowledge, rather than hydration knowledge. Thus, this study added a valuable finding to the existing literature. For most athletes, coaches are their main source of nutrition information (Cherian et al., 2020). Although majority of coaches recognized the importance of hydration and encouraged proper hydration behaviours among their athletes, some of them did not provide access to drinking during training (Guiama et al., 2025).

A study among endurance sports athletes at the National University of Malaysia (UKM), also found a positive association between hydration attitudes and hydration practices (Sedek et al., 2015). A positive attitude towards hydration can act as a motivator that encourages athletes to prioritise hydration in their daily routines. Athletes who perceived hydration as advantageous and conducive to their performance are more inclined to follow proper hydration practices, such as tracking fluid intake, looking for water resources, and incorporating hydration strategies into their training routine (Sedek et al., 2015).

Table 6 shows the factors contributed towards hydration practices among university athletes and recreational sports players in this study. Being male ($B=1.046, p<0.001$), older age ($B=0.190, p=0.003$), higher muscle mass ($B=0.136, p<0.001$), lower body fat percentage ($B=-0.890, p<0.001$), higher hydration knowledge ($B=0.060, p<0.001$), and more positive attitudes towards hydration ($B=0.051, p=0.024$), were associated with higher hydration practices ($F=71.376, p<0.001$). All of these factors contributed to about 69.7% of the variance in hydration practices, with hydration knowledge being the highest contributor (53.3%).

Table 6. Factors Contributed towards Hydration Practices ($n=193$)

No.	Variable	<i>B</i>	<i>SE</i>	<i>p</i>	<i>R</i>	<i>R</i> ²	ΔR^2
1	Constant	-4.282	1.844				
2	Hydration knowledge score	0.060	0.011	<0.001	0.730	0.533	0.533
3	Muscle mass (kg)	0.136	0.031	<0.001	0.796	0.633	0.100
4	Sex (male)	1.046	0.274	<0.001	0.805	0.648	0.014
5	Body fat percentage (%)	-0.089	0.020	<0.001	0.823	0.677	0.029
6	Age (years)	0.190	0.063	0.003	0.830	0.689	0.012
7	Attitudes towards Hydration Score	0.051	0.023	0.024	0.835	0.697	0.008

Hydration knowledge and attitudes towards hydration remain as factors that contributed to the hydration practices of the participants. Athletes with higher level of knowledge and awareness on the importance of hydration are more likely to follow hydration plans (Cheuvront and Kenefick, 2014). Coach's recommendations may influence athlete's perception and attitudes towards hydration (Loew et al., 2022). Insufficient breaks to consume fluid during practice and lack of lavatory facilities also demotivated athletes from drinking water (McCauley et al., 2012). Thus, it is important to improve knowledge on hydration not only to athletes but also to their coaches.

In this study, males were found to have better hydration practices than females. This may be due to their higher total body water than females (Lu et al., 2023), which may cause them to feel thirsty more frequently, thus stimulating them to drink. Men need to drink at least 3.7 litre of water daily to be considered as having an adequate water intake, while women need at least 2.7 litre of water per day (IOM, 2005). This study also

found that hydration practices improved with age. This is similar to the findings by Zhang et al. (2025), where older marathon runners tend to drink more consistently than younger runners. Young adults tend to rely on the thirst sensation as primary basis for fluid intake (Zhang et al., 2025).

Higher muscle mass was associated with higher hydration practices, while higher body fat percentage was associated with lower hydration practices. Water helps in aiding muscle function and wellness, thus athletes and active individuals with more muscle mass tend to favour hydration to sustain their active lifestyle (Lorenzo et al., 2019). Among healthy adolescents in Spain, water intake was also found to be negatively associated with body fat mass and positively associated with muscle mass (Laja García et al., 2019). However, there is a lack of studies that examined the association between body composition and hydration practices among athletes and active individuals, limiting the discussion. Hence, more studies are needed to confirm this association.

CONCLUSION

Hydration knowledge and attitudes towards hydration are important factors that contribute towards hydration practices among university athletes and recreational sports players. Both athletes and coaches should have adequate knowledge and awareness on the importance of hydration on sports performance and health. Thus, providing knowledge on hydration and inculcating positive attitudes towards hydration may improve hydration practices among athletes and active individuals. Body composition also plays an important role in hydration. Therefore, future research should examine the association between water intake and hydration status of athletes and non-athletes with different body composition.

LIMITATIONS

The use of convenience sampling and cross-sectional design of this study served as its main limitations. The findings of this study cannot be used to imply causation due its cross-sectional nature. This study also used self-reported questionnaires, which may be subjected to memory and social desirability biases, thus the results should be interpreted with cautions. Majority of the participants in this study were males and were of Chinese ethnicity, thus not representative of the Malaysian university student's population. Nevertheless, this study has filled the knowledge gap in hydration practices among active individuals in this country.

AUTHORS' CONTRIBUTION

Nurliyana Abdul Razak: Conceptualized the study and drafted the manuscript.

Chian Chin Yi: Conducted the data collection and data analysis.

All authors read and approved the final manuscript.

CONFLICT OF INTEREST

The authors have no conflict of interest. No financial resources were available to support this study.

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