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# Hydration Knowledge, Fluid Replacement Habit and Hydration Status among Development Athletics Athletes in Malaysian Sports School Pahang

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**Abstract** Objective: This study aims to identify the hydration knowledge, fluid replacement habit and hydration status among development athletics athletes in Malaysia Sports School Pahang. Methodology: Cross-sectional study was conducted among 63 athletes aged 15.6 ±1.7 (male= 51%, female= 49%) that take part in 3 different events (sprinters n=22, field events n=21, long-distance n=20). The hydration knowledge and fluid replacement habit were identified using a validated questionnaire. Meanwhile, the hydration status was assessed before the athletes started their morning training using urine refractometer. Result: The mean score for knowledge and fluid replacement habit were 6.98±1.20 and 6.81±1.30 respectively. The specific gravity (USG) mean score was 1.034±0.045, which indicated for severely dehydrated. More than half of the athletes (57%) were categorized as significantly dehydrated. Next, there was a strong and positive correlation between hydration knowledge and fluid replacement habit score ($r=0.638$, $p<0.0001$). In addition, this study also found there was an inverse correlation between hydration status with hydration knowledge ($r=-0.108$, $p=0.402$) and hydration status with fluid replacement habit ($r=-0.088$, $p=0.492$), but the correlation was small and not significant. Conclusion: The finding of this study identifies the need of education strategy for athletes to improve their knowledge and behavior toward the hydration status. In addition, facilities and infrastructure such as the availability of water dispensers might reduce the risk of dehydration among athletes.

**Keywords** Martial Art Hydration Knowledge, Fluid Replacement Habit, Hydration Status, Urine Specific Gravity

## 1. Introduction

Fluid consumption during training or competition is one of the fundamental strategies to achieve a top-notch result for sports performance. For the athlete to perform at their highest level, they must be adequately hydrated [1]. According to the recent International Olympic Committee (IOC, 2018), dehydration is a state of body water below the average level. It can pose health-related risks to the body as the water loss from the body through sweat, urine, faeces and respiratory system. Base on the International Association of Athletic Event (IAAF), there is a diverse range of track and field events (such as sprint, middle distance run, long-distance run, jump and throw) with various training programs and performance demands.

Furthermore, the physiological differences among individual too cause high variability in the fluid requirement. The dehydration risk for track and field events can be categorized into three, which are low, medium and high risk based on training environment, fluid availability and sweat loss [2].

Malaysia is in the equatorial zone and it received 12 hours of daylight from the morning until evening. According to Malaysia Meteorological Department data, weather condition over the year is between 22-23°C, and it can reach up to a maximum of 31- 34°C. Moreover, the relative humidity ranges from 80% in the morning to 65% in the afternoon [3]. Since the training session still carries out throughout the year, the athlete poses the risk of dehydration if inappropriate rehydration management is not taken effectively [4]. Various international bodies have published guidelines and position statements on hydration for athletes and exercising individuals. American College of Sports Medicine (ACSM), International Olympic Committee (IOC) and International Association of Athletic Federations (IAAF) consistently review and update the hydration recommendation for the athletes' overtime to provide educational information for them [2, 5].

However instead of various guidelines published before, most of athletes did not aware of the sign of dehydration and did not know self-hydration assessment [6-8]. According to a study by [9], college athletes generally say that thirst is a clear sign of the beginning of a hydration regimen, but it is already a state where the body is in a dehydration condition. Therefore, this study aims to identify hydration status, knowledge and habits among development athletic athletes in Malaysia Sports School Pahang

# 2. Methodology

### 2.1. Participants and Study Design

A cross sectional study was conducted among athletics athletes (n=70) who trained and studied at Malaysia Sports School Pahang. They were categorised into three sports events which are sprinting (n=22), distance event (n=21) and field event (n=20). The ethical approval was obtained from Universiti Pendidikan Sultan Idris (UPSI) Ethics Board (REF:2021-0173-01)

### 2.2. Questionnaire: Hydration Knowledge & Habit

This study adopted a questionnaire from [7] with good Cronbach alpha value of 0.74. The questionnaire consists of three sections which include: (1) Part A= demographic information, (2) Part B= 10 true or false statements on hydration knowledge (e.g. of questions: thirst is the best indicator of dehydration, dehydration decreases athletic performance), and (3) Part C= 10 statements on fluid replacement habit in the form of YES or NO (e.g. of questions: athletes should drink sports drink within 2 hours after exercise, monitoring colour of urine is a way an athlete can judge whether she/he is dehydrated). The correct/ appropriate answer was given a score of 1, while no score for wrong/ inappropriate answer.

### 2.3. Urine Refractometer: Hydration Status

Urine refractometer was used to measure the urine specific gravity (USG) of athletes (Atago Pen Urine SG Hendheld). A small amount of urine was dropped into urine refractometer for analysis of hydration status. It utilizes the refractive index method to measure the specific gravity of urine. The specific gravity of urine varies according to concentration which can determine the hydration status of sample taken. Below are the USG reading classifications:

**Table 1.** USG reading classification

| USG Reading | Classification |
|---|---|
| < 1.010 | Well Hydrated |
| 1.010 – 1.019 | Minimally Hydrated |
| 1.020 – 1.029 | Significantly Dehydrated |
| > 1.030 | Severely Dehydrated |

### 2.4. Procedure

The athletes were invited to participate in this study through their coaches. The session with athletes was conducted based on their sports categories and availability. During the first session, they were instructed to complete the hydration questionnaire and the anthropometry measurements were conducted. Next, they were required to collect their first and early morning urine in the provided urine container. The container was labelled with unique code representing the participants and their sports categories. A few drops of urine were placed into urine refractometer to analyze the hydration status. Statistical analyses were performed using SPSS (version 23, IBM). Analysis of variance (ANOVA) was performed to test the mean difference between 3 athletics groups. While, Pearson Correlation test was performed to analyse the correlation between hydration knowledge, fluid replacement habit and USG score. The significant difference for the r-value was set at $p<0.005$.

### 2.5. Data Analysis

There were 63 athletic athletes (mean age: 15.6±1.7 years) who voluntarily participated in this study; 50.8% were males while 49.2% were female. They were categorized based on sports categories which were sprinter (n=22, 34.9%), filed event (n=21, 33.3%) and long-distance (n=20, 31.7%).

Table 3 shows that sprinter athletes had the highest

knowledge score followed by long-distance and field events, but no significant differences were found (p=0.772). A similar trend of the score was found for fluid intake habits, where sprinter athletes got higher marks than other athletics sports but no significant difference of score was found (p=0.378).

Table 4 also indicated the athletes' hydration status based on sport categories, where only 4.8% of athletes were categorized as well hydrated as none of them form field event. Most of the athletes were found significantly dehydrated (57%, n=36). Unfortunately, 20.6% of athletes were categorized as severely dehydrated, which comprises 20.6, 20, and 19% from sprinter, long distance, and field events respectively.

Table 5 shows there was a strong positive and significant correlation between hydration knowledge and fluid intake habit (r=0.638, p<0.05). This table shows that as the hydration knowledge and fluid intake habit increased, the urine specific gravity score improved. However, these inverse correlations were not significant (r=-0.108, p=0.402; r=-0.088, p=0.492) respectively.

**Table 2.** Demographic, Weight & Height

| Variables | All (n=63) | Sprinter (n=22) | Field Event (n=21) | Long Distance (n=20) |
|---|---|---|---|---|
| Age, mean(SD) | 15.6±1.7 | 15.3±1.6 | 15.8± | 14.3±1.4 |
| Male, n(%) | 32 (50.8) | 10 (45.5) | 6 (28.6) | 16 (80) |
| Female, n(%) | 31(49.2) | 12 (54.5) | 15 (71.4) | 4 (20) |
| Weight, mean (SD) | 56.7±2.2 | 54.1±1.4 | 64.5±3.4 | 58.0±3.2 |
| Height, mean (SD) | 165.3±1.6 | 164.3±1.5 | 169.5±1.6 | 163±1.3 |

**Table 3.** Hydration Knowledge, Hydration Intake Habit and USG Value between Sports Categories. Values are Mean ±SD

| Variables | All | Sprinter | Distance Event | Field Event | p-values |
|---|---|---|---|---|---|
| Hydration knowledge (mean, SD) | 6.98 (±1.20) | 7.18 (±0.96) | 6.90 (±1.37) | 6.86 (±1.28) | 0.772 |
| Fluid intake habit (mean, SD) | 6.81 (±1.39) | 7.05 (±1.13) | 6.45 (±1.61) | 6.86 (±1.28) | 0.378 |

*Mean difference is significant at p<0.05

**Table 4.** Athletes Hydration Status Based on Sport Categories –USG Value and Percentage

| | All | Sprinter | Distance Event | Field Event | p-values |
|---|---|---|---|---|---|
| USG (mean, SD) | 1.034 (±0.045) | 1.024 (±0.006) | 1.035 (±0.056) | 1.044 (±0.0560) | 0.348 |
| Well hydrated (%) | 4.8 | 4.5 | 10 | 0 | |
| Minimally hydrated (%) | 17.5 | 13.6 | 10 | 28.6 | |
| Significantly dehydrated (%) | 57.1 | 59.1 | 60 | 52.4 | |
| Severally dehydrated (%) | 20.6 | 22.7 | 20 | 19 | |

*Mean difference is significant at p<0.05

**Table 5.** Pearson Correlation Coefficient: Knowledge, Fluid Intake Behaviour and Urine Specific Gravity

| Variables | Hydration Knowledge | | Fluid Intake Behaviour | | Urine Specific Gravity | |
|---|---|---|---|---|---|---|
| | r-value | p-value | r-value | p-value | r-value | p-value |
| Hydration Knowledge | 1 | | 0.638 | 0.000** | -0.108 | 0.402 |
| Fluid Intake Behaviour | 0.638 | 0.000** | 1 | | -0.088 | 0.492 |
| Urine Specific Gravity | -0.108 | 0.402 | -0.088 | 0.492 | 1 | |

**Correlation is significantly as p<0.05

## 3. Discussions

This study identifies the hydration knowledge, fluid replacement habit and hydration status among athletics athletes in SSMP. The result shows that athletes who have a good score on hydration knowledge and fluid replacement habit did not necessarily have a good hydration status, as more than half of them were categorized as significantly dehydrated (USG mean = 1.034). This finding indicates that knowledge is not the only factor that contributes to the hydration status. According to [10], rather than knowledge, lack of implementation of hydration plan could lead to dehydration problem. This study observed that athlete's daily life schedule is constrained by the opportunity to have a good rehydration plan.

The finding found the prevalence of dehydration prevailed more in on-field event category (jumper and thrower) (USG mean= 1.044) compared to the other categories. This result matches those observed in an earlier study conducted by [11] on the fluid need for training, competition, and recovery for track-and-field athletes. There are three categories of hydration risk for athletics events: low-risk event, moderate risk event, and high-risk event. Sprint and field were categorized as low-risk dehydration, while long-distance was categorized under high-risk event. The field event category, especially jumper athletes will strive to stay as light as possible by being minimally dehydrated their bodies [11]. They believe this state of the body can improve their performance. One percent weight loss from the total body weight has not affected the development of muscle force production. Therefore, the practice of being hydrated to no more than one percent significantly improves the jumper's performance. This is mainly for the jumper and none of the other sports was reported.

Sprint category athletes are categorized under the low-risk dehydration group. Their USG reading among the lowest (mean = 1.024) indicate better hydration status compared to others athletics event. A possible explanation for this result may be due to the nature of their training structure that consists of interval training. For example, in research conducted by [12], a sprinter will usually go through 15 minutes warm-up and followed by a repetitive 50-200 meter sprint with short rest during one-hour sessions. Sometimes, they will have to perform the footwork drill together with 400 meters sprints. Thus, they have a lot of opportunities to rehydrate between the interval session.

This study observed that the sprinter team was less dehydrated while field event athletes were severely dehydrated. It is shown that drinking habit might be influenced by teammates. If teammates did not have awareness of drinking water and remind each other to do the same, all of them were prone to being dehydrated too. Based on [13], adolescent behavior is influenced by their peers. This showed how different groups of adolescents will have a different style of decision-making and habit. As the athletes tend to spend time together according to their sports categories, they will have similar decision-making and habits.

On the other side, another primary factor that contributes to the significant loss of water was during outdoor training. According to [4] high temperature (>30°C) causes an increase sweating rate. All SSMP athletes went through two training sessions per day, which are morning and evening, the rate of water loss is even greater. In the evening, the temperature in Malaysia could easily reach between 30-34°C.

Other than knowledge, other factors that increase the risk of dehydration are infrastructure and facilities [14]. Water dispenser is one of the simple facilities yet able to have an impact on athlete's hydration status. The lack or absence of a water dispenser, especially in the location that they trained for (for example, tract reduces the opportunity of the athletes to rehydrate. This situation can be observed in this study, and the only opportunity to drink water is if they bring their water bottle to the training site, otherwise they need to get a drink at their dining hall which is quite far from their training location. This limitation might be one of the factors why the hydration status among athletes not so encouraging. Therefore, water accessibility is critical in ensuring athletes can have high drinking water chances.

## 4. Conclusions and Recommendations

This is the first hydration study conducted among athletics Sports in Malaysia Sports School Pahang. This research tried to fill the gap that occurred especially among development athletics athletes in Malaysia. Future studies should be carried out among other sports categories and implement proper inter focuses on a program that focuses on hydration. In conclusion, the finding of this study identifies the need for education strategy for athletes to improve their knowledge and behavior toward the hydration status. Besides, facilities and infrastructure such as the availability of water dispensers might reduce the risk of dehydration among athletes.

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