



نادي الإمارات للسيارات والسياحة
Automobile & Touring Club
of the United Arab Emirates

SUPPORTED BY



FIA Institute
for Motor Sport Safety and Sustainability

Research of hydration health & safety issues of motorsport volunteers and officials working in high temperatures



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Credits

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Introduction

Many individuals dehydrate (*dehydration is defined as an excessive loss of body fluid*) during competitive events, even when it's not particularly hot. Dehydration impairs both physical and mental performance and even low levels of dehydration can lead to severe physiological consequences. A loss of 2% bodyweight (just 1 kg for a 50kg person) can increase perceived effort and is claimed to reduce performance by 10-20%. A fluid loss exceeding 3-5% bodyweight reduces performance noticeably and can impair reaction time, judgement, concentration and decision making. Indeed, at around 5% to 6% water loss, one may become groggy or sleepy, and experience headaches or nausea. Severe dehydration can also lead to death.

Many motorsport events, such as those that take place in the United Arab Emirates, are held in extreme high temperatures where the concerns of dehydration and physiological function are normally associated with the sports person, while the effects of dehydration on support staff such as race marshals is often ignored. For example in recent motorsport events held within the UAE, where the average temperature was 50 degrees C, a number of helicopter medevacs were conducted and related to dehydration episodes. This is clearly a significant health and safety issue that needs to be considered and given high priority. Furthermore, there is a plethora of motorsport events that take place across the world that are conducted in extreme high temperatures, and as such a worldwide perspective needs be given to this significant health and safety issue and the dehydration of motor sport marshals, as they are such an integral part of the global success of motorsport events.



Dehydration – the facts

Good hydration is essential for good health and performance. Water is the most essential nutrient as the body can only survive for a few days without it.

Small levels of dehydration can have a negative effect on brain function and physical performance. Even sports people who drink regularly during training often find it difficult to match the losses that occur during exercise. A key point to remember is that we can minimize the effect of dehydration by taking in more fluid before the start of a physical challenge.

DANGERS OF DEHYDRATION

Health can be seriously affected if not enough water is consumed on a daily basis. Individual requirements for fluid are normally based on body weight; however physical exertion will increase these overall requirements. Fluid loss as little as 2% of body weight has been shown to decrease physical work capacity and performance. Body temperature and heart rate increase during physical exertion, and if an individual is dehydrated, the body needs to work harder to regulate body temperature, causing further strain on the heart (Sawka & Coyle, 1999). Even small fluid losses can cause physical work to seem more difficult and the body to tire more quickly. Side effects of dehydration include:

- Poor concentration, co-ordination and reaction time
- Increased body temperature resulting in increased risk of heat stress/exhaustion
- Increased heart strain
- Physical work is perceived as being more difficult
- Increased irritability and anxiety
- Nausea and stomach upset.

WHY IS FLUID IMPORTANT?

Despite the climate we live in, fluid intake is essential for maintaining hydration on a daily basis. Water has a number of functions within the body, circulation of nutrients around the body, the removal of waste products and, very importantly, helping to keep our body temperature stable.

The human body consists of approximately 55 to 65% water and is found in all parts of the body. Muscles are made up of approximately 70% water and it also makes up a large part of our blood. We lose fluid through a variety of different ways, most notably sweating and urination, with smaller losses through breathing and faecal losses. Water loss can also be increased through breathing when the air is very dry. Sweat losses will depend on a number of factors including body weight, genetic predisposition, protective clothing, the environment, the intensity and duration of the physical challenge. Research has shown that sweat rates can range between 0.5 to 2.0 litres per hour over a range of different environments (Bergeron, 2003; Broad et al, 1996). There is considerable variability of sweat losses between individuals, so individual preparation is necessary.

Overview of research by ATCUAE

In 2012 the Automobile & Touring Club of the UAE (ATCUAE) undertook a scientific research study into the problem of officials' hydration at motor sport events. With officials and volunteers being number one priority of ASNs and event organizers, Dr. Mohammed Ben Sulayem, ATCUAE President and FIA Vice-President – Sport, initiated this research to contribute to the safety and wellbeing of those servicing the needs of motorsport events held in extreme weather conditions.

Funded in part by the FIA Foundation's Motor Sport Safety Development Fund, the study investigated the difficulties faced by individuals working in extreme heat using the example of UAE motor sport officials. The Motor Sport Safety Development Fund was set up in 2008 as a charitable fund to help progress and improve safety, training and education in motor sport worldwide. The FIA Institute manages the programmes of the Fund on behalf of the FIA Foundation. This includes the Officials Safety Training Programme under which this activity is being conducted.

The series of investigative studies were carried out by the Motorsport Knowledge Institute (MKI), a division of the Automobile & Touring Club of the UAE (ATCUAE), in conjunction with its academic partners at the University of Ulster.

The research was carried out from April through to December 2012. A total of 315 data sets were taken from a mixed cohort of subjects from 17 nationalities. Marshals and officials were of a mixed age (average age 46 + 12 years) and sex (male and female), and were exposed to the same level of heat and humidity for the same amount of time at each event. Bottled water was freely available for each marshal to consume, and there was no restriction placed on the amount of fluid consumed.

The objectives set for this review placed an emphasis upon the evaluation of dehydration of three different motorsport events (2012 Abu Dhabi Desert Challenge (the round of the FIA Cross-Country Rallies World Cup), 2012 Formula 1™ Etihad Airways Abu Dhabi Grand Prix and 2012 Dubai International Rally (final round of the Middle East Rally Championship) and subsequent recommendations of how to prevent dehydration among the officials performing physical work in extreme temperatures.

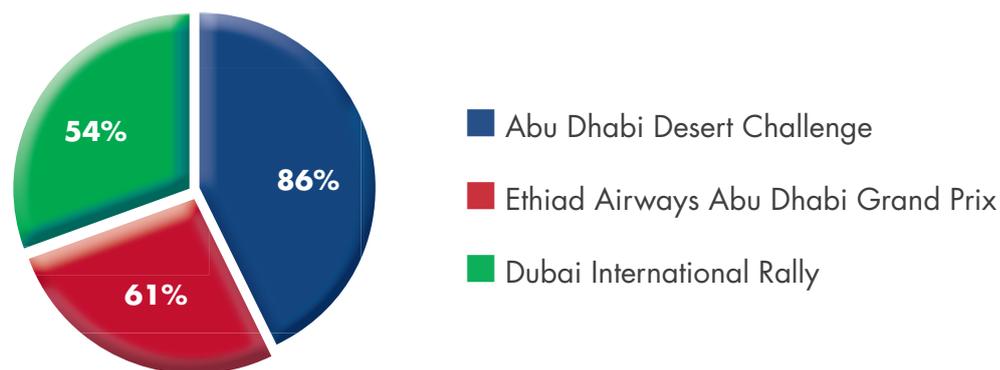


Summary of ATCUAE research findings

The findings of this research were significant as they provide evidence of severe to extreme dehydration in motorsport marshals working in hot and humid climates.

In brief, the main findings (no the full data set) from this research are as follows:

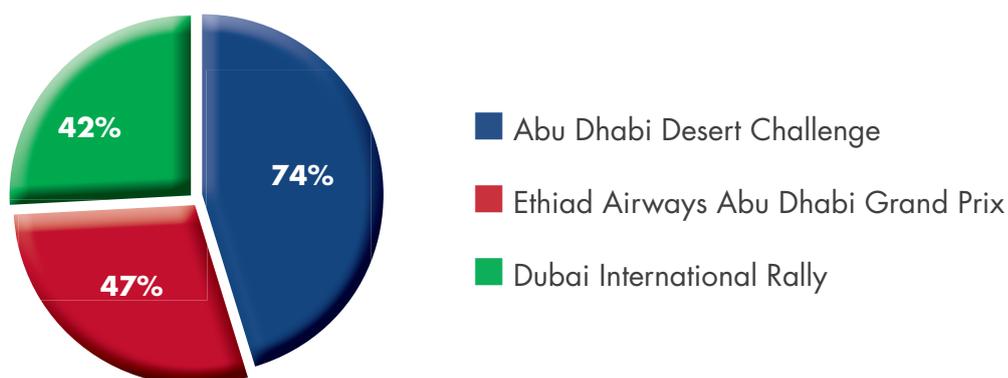
Figure 1. The effect of high temperature on urine osmolality at each event



The above figure represents the % of marshals with severe to extreme dehydration at each event.

These statistics confirms the presence of severe to extreme dehydration in motorsport marshals working in high temperature environments.

Figure 2. The effect of high temperature on urine colour at each event



The above figure represents the % of marshals with severe to extreme dehydration at each event.

These statistics confirms the presence of severe to extreme dehydration in motorsport marshals working in high temperature environments.

Motorsport marshal and official responsibilities to offset dehydration

It is critically important that each marshal and official takes responsibility for their own level of hydration. Following is a summary overview of what to drink, how much to drink and how each individual can monitor their own personal hydration.

HOW MUCH FLUID DO MARSHALS REQUIRE?

Fluid intake needs to be specific to each marshal and it is influenced by many factors including body size, environmental conditions and clothing. Marshals over 18 years are recommended to take 35mls per kg of body weight. For example, a marshal weighing 80kg, will need 2800mls (2.8 litres) on a daily basis above usual loss. Please see table 1 for approx fluid intake depending on bodyweight.

Table 1. Fluid intake requirements based on individual body weight

Bodyweight (kg)	Recommended fluid intake (milliliters)
55	1925
60	2100
65	2275
70	2450
75	2625
80	2800
85	2975
90	3150
95	3325
100	3500

The easiest way to calculate usual water loss is to take your weigh before and after heat exposure. Any fluid losses should be replaced as soon as possible.

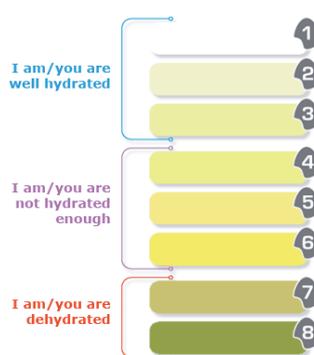
Small and frequent intakes of fluid tend to be better tolerated than taking a lot at one time.

HOW CAN MARSHALS MONITOR THEIR OWN DEHYDRATION?

Hydration can be measured in several ways. Weighing yourself before and after heat exposure is an easy and quick method to assess fluid balance and can be used as a very simple method of determining bodily fluid loss (although it does have limitations). Food/fluid intake and bowel function may need to be accounted for. However it is a good self-monitoring tool, especially if used in conjunction with other monitoring tools as outlined below.

Urine colour (dark), smell (strong) and volume (small) can also tell if a marshal is dehydrated. With regards urine colour, a simple urine/pee chart may be used to examine hydration status (see example below). Measuring the concentration of solutes in urine is another useful tool to measure hydration. This is done using a urine osmometer (which is a small hand held device) and a sample of the marshals' urine. Each marshal and/or governing body of motorsport needs to determine the method or methods that suit them best, and try to use them on a regular basis.

Figure 3.
Urine colour chart
(ACSM, 2007)



WHAT SHOULD MARSHALS DRINK TO PREVENT DEHYDRATION?

Sweating causes the loss of electrolytes (salts) and water from the body. Drinking fluids can prevent dehydration and rehydrate a marshal. Sports drinks have the added benefit of easily providing energy, usually in the form of carbohydrates, and replacing electrolytes lost through sweat. Carbohydrate is an important energy source for muscles, and it will also help water absorption so long as it is at the right concentration.

Hypotonic drinks are drinks where the carbohydrate concentration is very low or absent (< 2%). Examples are sports waters (< 2g carbohydrate per 100mls) or very dilute squash or sports drinks. These may be useful for those marshals who are monitoring their weight and restricting calorie intake, or where fluid intake is a priority (warm conditions), as well as where rapid rehydration is required. Isotonic sports drinks are made to have a concentration (osmolality) close to body fluids. This means that the body absorbs the fluid and energy more readily than pure water. There is usually 6 to 9% of carbohydrate (6 to 9 g per 100mls) and some sodium added to these drinks. These can be made up at home, or there are a variety of commercial ones available to buy.

Alternatively, and if sports drink are not available it is advised to drink plain water.

Marshals should not consume a lot of coffee, any alcohol or any form of drink stimulant, as these can actually lead to dehydration.

RECOMMENDATIONS FOR PRACTICAL HYDRATION TIPS

- If you are well hydrated you should be producing urine every couple of hours.
- Urine that is clear in colour and not strong in smell typically indicates that you are well hydrated. However if you take a vitamin supplement or sports drinks the B-Vitamins can cause your urine to be a bright yellow colour. Consider consulting with a urine/pee chart to determine hydration status.
- Drink a wide range of fluids, water, sugar free dilute squash, fruit juices, soup and sports drinks. Water will also be obtained from foods; for example, fruit and vegetables that have high water content. If you are drinking a lot of sugary drinks you need to be careful with your teeth. Brush and floss regularly and rinse the mouth out with water after consuming these drinks.
- Alcohol and caffeine consumption can increase urine output and delay full rehydration (ACSM, 2007). Drinking alcohol in excess means you are less likely to be drinking appropriate fluids required to rehydrate.

Motorsport organisational responsibilities to offset dehydration

It is imperative that organisations offer structured advice on how best to offset dehydration. Following is an outline of the role of the National Sporting Authority (ASN) and the Chief Medical Officer (CMO) in achieving adequate hydration status within motorsport marshals and officials.

THE ROLE OF THE ASN

- Provide bottled water and make it freely available to offset dehydration
- Provide electrolyte salts and make them freely available to promote rapid rehydration
- Provide adequate toilet facilities
- Take responsibility to deliver bottled water to marshals when required
- Provide sun shade for marshals when required
- Distribute guidelines on the importance of adequate hydration
- Distribute guidelines and recommendations of when and what to drink

THE ROLE OF THE CMO

- Provide increased awareness and briefing on the importance of the amount, type and timing of fluid consumption to offset a severe episode of dehydration
- Encourage routine hydration monitoring (through the use urine colour charts for example)
- Provide advise on proper clothing to prevent dehydration
- Encourage voluntary fluid intake at all times

Overall summary

The content of this document is supported by research conducted within the ATCUAE and supported by the FIA institute. The document provides evidence that dehydration occurs in marshals attending UAE motorsport events and highlights the importance of proper hydration for motorsport preparation within any global motorsport event. In order to ensure that health is adequately maintained and skill performance is enhanced, it is essential that motorsport marshals avoid dehydration by having a well thought-out, individualized and appropriate hydration programme.

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