



## Hot Weather and Heat Safety Guidelines (updated 24/07/2021)

Rowing training and rowing regattas taken often part in the warmer season of the year and therefore rowers are exposed to warm climates. These climates impose a health risk on rowers and in case of regattas, also on spectators. Organizers and other responsible persons should be prepared to evaluate the potential risks and to make precautions.

The **main medical problems** in warm and hot environments are related to:

- Air temperatures
- Air humidity
- Heat radiation from sun and warm environments
- Exercise induced heat production
- Impaired heat loss (clothing, ventilation, hydration)

The **main strategies** to prevent heat induced illnesses are:

- Acclimatization
- Adequate hydration
- Adequate sodium intake
- Postponement of exercise to cooler time periods of the day.

### 1. Basic Medical Issues

High intensity exercise in a hot environment with associated fluid loss and elevation of body temperature can lead to:

#### a. Dehydration

Dehydration occurs when one loses more fluid than it is taken. The body doesn't have enough water and other fluids to carry out its normal functions. Symptoms of dehydration are thirst, dark-coloured urine, fatigue, dizziness, and confusion. Dehydration may cause heat injury, urinary and kidney problems, seizures, and low blood volume shock (hypovolemic shock).

#### b. Heat Cramps

Heat cramps are painful, involuntary, brief muscle spasms that usually occur during heavy exercise in hot environments. Fluid and electrolyte loss often contribute to heat cramps.

#### c. Heat Exhaustion

Exposure to high temperatures, particularly when combined with high humidity, and strenuous physical activity, can lead to body overheating causing heat exhaustion. Possible heat exhaustion signs and symptoms include cool, moist skin, heavy sweating, faintness, dizziness, fatigue, weak, rapid pulse, low blood pressure upon standing, muscle cramps, nausea and headache. Without prompt treatment, heat exhaustion can lead to heat stroke, a life-threatening condition.

#### **d. Exertional Heat Stroke**

Exertional heat stroke is a medical emergency defined as life-threatening hyperthermia (core body temperature  $\geq 40.5^{\circ}\text{C}$  ( $105^{\circ}\text{F}$ )) and central nervous system (CNS) dysfunction (encephalopathy) and additional organ and tissue damage (e.g. acute kidney injury, liver injury, rhabdomyolysis). It is one of the top three causes of sudden death in athletes. Morbidity and mortality are more strongly linked to duration, rather than degree, of hyperthermia; hence, the “cool first, transport second” principle should be applied.

The heat related problems start always with dehydration and accompanied by body core temperature elevations. Exercise further increases heat load of the body. With increased core temperature, energy demands for temperature regulation increase and this further depletes energy resources, particularly glucose stores, additionally, sodium is lost by sweat. These conditions are prepositions for heat induced illnesses. However, it should be mentioned, in case of excessive thermal load, heat exhaustion and exertional heat stroke may occur without dehydration.

- **Any collapsed athlete with elevated rectal temperature above  $> 40.5^{\circ}\text{C}$  ( $105^{\circ}\text{F}$ ) is considered exertional heat stroke and medical emergency, should be followed an emergency protocol for cooling, rehydration and medical supervision in the medical centre<sup>1</sup>.**
- **Any collapsed athlete which does not recover within 5 min should be transported to medical centre or designed area for cooling and rehydration.**

The important heat related illnesses are represented in appendix with the causes and pathophysiological problems, the clinical signs and symptoms, and simple rules for treatment.

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<sup>1</sup> Hosokawa Y, Racinais S, Akama T, et al. Br J Sports Med. doi:10.1136/ bjsports-2020-1038  
Heat, heat stroke and safety guidelines  
World Rowing Sports Medicine Commission updated 2021-07-24

## 2. Hot Weather Risk Evaluation

For the risk evaluation in warm or hot environments, ambient (air) temperatures, the relative air humidity and the heat radiation from sun and warm environments have to be considered.

Ambient temperature is a simple tool for weather evaluation. Biological effects can be better assessed when relative humidity is known and, if radiation is considered. Dry air enables cooling by evaporation, whereas with increased humidity the temperature effects are increased. Similar, high heat radiation increases thermal load further. The **Wet Bulb Globe Temperature (WBGT)** allows to determine the biological effective temperatures and is preferred. WBGT can be measured with affordable effort and is used at World Rowing events. It is recommended, to measure 1 m above water level from a pontoon.

In general, four of risk levels can be considered according to the ambient temperature and WBGT (Table 1).

**Table 1.:** Risk evaluation related to ambient temperature and Wet Bulb Globe Temperature (WBGT)

<b>AMBIENT TEMPERATURE</b>	<b>WBGT</b>	<b>RISK OF THERMAL INJURY</b>
<b>Below 25° C (77°F)</b>	<b>21° - 24.9° C (69.8° - 76.9° F)</b>	<b>Low</b>
<b>25° – 31.9° C (77.1° - 89.5° F)</b>	<b>25° - 27.9° C (77° - 82.3° F)</b>	<b>Moderate</b>
<b>32° – 37.9°C (89.6° - 100° F)</b>	<b>28° - 31.9° C (82.4° - 89.5° F)</b>	<b>High</b>
<b>38°C and above (&gt;100°F)</b>	<b>32°C and above (&gt; 89.6°F)</b>	<b>Extreme</b>

For risk evaluation use the “**Heat Stress Adviser**” (*J. Coyle, Tulsa, USA based on a Sports Medicine Australia checklist for planning sports events*) that may be downloaded from the site: [https://www.zunis.org/sports\\_p.htm](https://www.zunis.org/sports_p.htm) or the OSHA-NIOSH Heat Safety Tool from CDC <https://www.cdc.gov/niosh/topics/heatstress/heatapp.html>.

## 3. Regatta Cancellation / Postponement

Weather follows local and seasonal circumstances which can be included in the planning, but also actual weather changes can lead to adaptations in race programs. Races can be held early in the day or postponed in the evening to avoid cancellation due to hot weather forecast. With heat warnings, mitigation procedures should be communicated and enforced. Weather may require that regatta programs may be amended. A strategy could be to remove high-risk groups (children, masters) from the program. particularly when there was no acclimatisation to heat (e.g. first hot days of a season) or fitness is low.

## 4. Safety and Heat Mitigation Measures

**Safety measures** have to be taken when hot weather is to be expected.

### a. Shade and cooling facilities

- i. For regattas in warm months, shaded rest areas (buildings, tents, natural shade) have to be provided.
- ii. Cool and/or air-conditioned rooms are recommended, when warm weather with temperatures higher than 32°C (89.6°F) are expected.
- iii. Fans to enhance air movement in rooms and resting areas are recommended when room temperatures exceed 25°C (77°F).

### b. Medical centre and first aid provisions

- i. **Rescue and first aid teams** should be trained and equipped for diagnosis and treatment of temperature related illnesses and problems.
- ii. **Facilities for intravenous infusion and intravenous fluids** (e.g. Ringer-Lactate solution, 0.9% sodium solution) have to provide at the medical centre. Provide sufficient rehydration, in case of severe collapse, heat exhaustion or heat stroke, 1 L should be infused initially within 15 mins and then continued.
- iii. **For cooling, crushed ice, water and fans** should be provided at the medical centre.
- iv. **Room facilities** of the medical centre should be air conditioned when dry air temperatures higher than 32°C (89.6°F) are expected.

### c. Organization, training, racing and related measures

- i. **Teams should be advised to train in the morning and evening hours**, when warm weather with ambient temperatures higher than 32°C (89.6°F) are expected.
- ii. **Racing course should be closed for training** (usually during the hottest part of the day; 11:00 am - 3:00 pm), when dry air temperatures exceed 38°C (>100°F) or WBGT exceeds 32°C (> 89.6°F).
- iii. **Regular official and umpire rotation** should be considered when dry air temperatures exceed 32°C (89.6°F) or WBGT more than 28°C (82.4°F)
- iv. **Clothing worn** by umpires, officials and volunteers should also be adjusted to temperature.
- v. **Provision of extra water for wetting face, clothes and hair should be provided at the regatta course** (e.g. when the water of the course is polluted) when dry air temperatures exceed 32°C (89.6°F) for athletes, visitors and officials.

### d. Drinking water and fluid supply

- i. At regattas in warm months, free access to drinking water should be provided to athletes.
- ii. If tap water is drinkable, an official certificate of health authorities should be provided specifying the hygienic quality.
- iii. The total amount of free water provided by organizers should be at least 2 L/day, when dry air temperatures exceed 32°C (89.6°F) additional 1 L/day should be provided. 1 L can be provided at the meals.
- iv. Organizers are advised to find a suitable place for the coaches to give water to the crews after racing.
- v. Organizers are advised to have water in the rescue launches but to be given out in case of emergency and to provide water near to the victory ceremony.
- vi. If the OCs would have a sponsor for mineral water then this water is available to the teams for free and distributed through a certain system.

#### e. Personal recommendations

- i. **Adequate hydration:** The base fluid need of athletes is 2 L/day and increases with exercise time (1 L/hour) and air temperatures (1 L/per 5°C temperature increase above 25°C). For hydration, water, hypotonic and isotonic fluids may be used.
- ii. **Radiation** from the sun or from hot cars or in hot rooms enhances negative effects of hot temperatures. Shade provides shelter.
- iii. Athletes in direct sunlight should wear **sun caps** which may be wetted with water.
- iv. **Clothing** should be of fabrics that minimize heat storage and enhance sweat evaporation. Light coloured, loose fitting clothes, made of natural fibres or composite fabrics with high absorption properties, that provide for adequate ventilation are recommended.
- v. **Sleep and rest enhance temperature tolerance.**
- vi. **Alcohol and drugs decrease temperature tolerance.**
- vii. **UV Sun blockers** decrease radiation damage of the skin and reflect also radiation. This decreases thermal load.
- viii. **Lying down after races** in warm environments may have negative effects on circulation and may provoke collapses. Rowers are advised to cool themselves with water after the races.

#### f. Acclimatization

- i. Acclimatization of the participants includes the rowers as well as the umpires, other officials and volunteers and is the most important measure to prevent heat related illnesses.
- ii. Preparation for exercise under hot conditions should include a period of acclimatization to those conditions, especially if the athlete is travelling from a cool / temperate climate to compete under hot / humid conditions.
- iii. Acclimatization to hot environments takes usually 7 to 10 days.

#### g. Information on health risks

- i. Participants or officials at a high risk of heat illness should be informed by medical staff in case of extreme weather conditions.
- ii. Risk is increases in medical conditions including asthma, diabetes, pregnancy, heart conditions and epilepsy. Some medications and conditions may need special allowances.

**Table - Heat stress disorders: cause and problems, signs and symptoms, treatment**

Heat stress disorder	Cause and problem	Signs and symptoms	Treatment and prevention
<b>Heat cramps</b>	Failure to replace salt lost through sweating Wrong training time (e.g. midday) Wrong training suit (dark coloured and nonbreathable) Electrolytes disbalance	Painful and involuntary muscle spasms	Re-hydration Supplementation of electrolytes, e.g. sodium chloride Appropriate clothing
<b>Hyperventilation</b>	Overbreathing Low blood CO <sub>2</sub> level Blood vessels narrowing Decreased tissue perfusion Often found in subjects with low training status and of young age	Dizziness Tingling around lips Carpopedal spasm Loss of consciousness	Slow, deep breathing Re-breathing from paper bag Breathing exercises to practice before training in heat and during warming up on water
<b>Heat exhaustion</b>	Excessive heat strain with inadequate water intake Failure to replace water loss Orthostatic hypotension Wrong training suit (dark coloured and nonbreathable) Increased humidity Cardiovascular problems (inadequate o venous return) Reduced skin perfusion Increased sweating	Weakness Unstable gait Fatigue Wet, clammy skin Headache > nausea > collapse	Rest in shade Cooling with water, shower Re-hydration Pre-activity proper hydration Supplementation of sodium chloride and carbohydrates Use of protective equipment i.e. hat / cap Use sunblocker
<b>Physical exhaustion and dehydration</b>  <b>Heat exhaustion combined with physical exercise</b>	Excessive work in heat High Tc > 40°C (> 103°F)	Excessive fatigue Weight loss Increased haematocrit	Rest in shade Cooling with water, shower Measure rectal temperature until Tc is < 39° C (102° F) Re-hydration (1 L minimum) Pre-activity proper hydration Supplementation of electrolytes, e.g. sodium chloride and carbohydrates Use of protective equipment i.e. hat / cap Use sunblocker
<b>Exertional heat stroke</b>  <b>Heat stroke is a medical emergency</b>  <b>Follow guidelines</b>	Multisystem, life-threatening illness Damage to or dysfunction of multiple organ systems is frequent High Tc > 40,5°C (105°F)	Shivering Mental status changes Irrational behaviour > delirium Convulsions Loss of consciousness	Aggressive and rapid cooling Cold-water immersion Ice packs Wrap in wet sheets and fan Measure rectal temperature until Tc is < 39° C (102°F) Intravenous re-hydration, 1 L in 15 mins and then continuing Consider early transport - ready for cardiopulmonary resuscitation - in hospital.
Classic heat stroke  <i>Rare in sports</i>	Elderly and patients with serious underlying diseases Closed rooms Chronic dehydration	Mental status changes Irrational behaviour > delirium Convulsions Loss of consciousness	Intravenous re-hydration, 1 L in 15 mins and then continuing Consider early transport - in hospital.
Legend of used abbreviations: CO <sub>2</sub> - carbon dioxide, Tc - core temperature; °C – Celsius degree, °F – Fahrenheit degree			