



The Science of Sweat

Thermoregulation – When our core body temperature rises we excrete sweat onto the surface of our skin. Our body heat is transferred to the fluid on the skin and it evaporates removing the heat from the body and cooling us. The fluid we sweat not only removes water from our bodies, but also electrolytes such as:

- Sodium
- Chloride
- Potassium
- Magnesium

Continued effective sweating is imperative for effective thermoregulation. Replacing fluid and electrolytes lost through sweating maintains homeostasis, aids performance and wellbeing and allows sweating to continue.

Hydration & Performance

Dehydration represented as % of initial body weight

- + 1% to -1% = Well hydrated
- 1% to -3% = Minimal dehydration
- 3% to -5% = significant dehydration
- > -5% = Serious Dehydration
- 15% to -20% = Probable death

American College Sports Medicine (ACSM) suggests the goal should be the avoidance of dehydration to any greater than 2% body weight fluid loss. Understandably, dehydration will be of greater chance and also of greater significance in hotter conditions.

*There are instances where high achieving athletes have significantly higher dehydration than 2% body weight loss, however consider that significant dehydration and electrolyte imbalance are likely to have negative effects on welfare and performance in most instances.

Hypohydration prior to exercise increases physiological strain, reduced performance. 1.5 – 2% dehydration reduced performance in 1500m, 5km, 10km track races (Armstrong et al. 1985)

In temperatures > 30°C, 2-7% dehydration consistently reduced endurance performance. For exercise duration > 90mins performance reduced with dehydration > 2% in temperate and hot conditions. (Cheuvront et al. 2003)

Even 50% replacement of fluid loss (orally) of a 4% dehydration during a 20min break was effective in increasing exercising capacity when compared to no rehydration. (Casa et al. 2000)

Accuracy and performance in a soccer dribbling task was impaired 5% at 2.4% dehydration. (Mcgregor et al 1999)

Cricket bowling accuracy was impaired at 2.8% dehydration (speed unaffected) (Devlin et al. 2001)

Performance in a soccer specific fitness test was worsened by 2.4% dehydration without supply of fluids vs fluid supplied group (0.7% dehydration). (Edwards et al. 2007)

In occupational settings (Bates et al. 1996), a dehydration of 1 – 2% of body weight resulted in a 6 to 7% reduction in physical work rate. A dehydration of 3 – 4% of body weight resulted in a 22% to 50% reduction in work rate, for “moderate” and “hot” environments respectively.

Mental performance (mental function, visual-motor skills and arithmetic tests) begins to decrease at 2% dehydration and thereafter is proportional to the degree of further dehydration. Sustained attention, error rate, response time, and task accuracy were all negatively affected during heat exposure, even when sedentary.

Physiology of Dehydration

Cardiac

- Decreased blood plasma volume
- Decreased blood pressure
- Decreased stroke volume
- Results in increased heart rate for given work output
- Overall greater cardiac demands / stress
 - *Heart rate increase 3-5bpm for every 1% dehydration (Montain et al.1992)

Thermoregulatory

The inability to dissipate heat effectively through decreased sweat rate and reduced skin blood flow results in heat stress due to not being able to lower core body temperature.

Adequate fluid intake **before, during and after** activity and effective cooling methods can help avoid the negative effects of dehydration.

*Every 1% dehydration results in core temperature rising 0.15 – 0.

What is a Sweat Test?

A sweat test is an exercise based test designed to understand how much fluid someone loses through their sweat (sweat rate) and how also much sodium (sweat sodium concentration or how “salty” your sweat is).

This information can assist in performance, well-being and recovery by being used as the basis for hydration and electrolyte replacement strategies pre, during and post exercise.

Using the TSL mobile app and the TSL sweat kit information and sweat samples are recorded and then sent to the Sweat Lab for analysis.

Whether performing the test on yourself or under the guidance of a TSL accredited practitioner, all that is required is a minimum of approximately 30 minutes of “race-pace” or appropriate intensity exercise / work.

Someone’s sweat profile (rate & electrolyte concentration) is highly individual and can be affected by:

- Type of activity
- Exercise duration
- Exercise intensity
- Environment
 - temperature
 - relative humidity
 - radiant heat / exposure
 - inside / outside – air movement
 - wind
- Clothing / Protective Equipment
- Pre-exercise hydration status
- Ability to replace fluids during exercise
- Dietary electrolyte intake (eg. Sodium)
- Level of heat acclimatisation

- Body composition
- Age
- Fitness level
- Genetics

Who is a Sweat Test For?

A sweat test is suitable for anyone who sweats and is interested in personalising their hydration strategies. Some of our clients include:

- Athletes, teams & squads
 - Elite / Professional
 - Amateur
 - Development / Teenage
 - Recreational / weekend warriors
- Gym / health training enthusiasts
- Occupational settings
 - Tradies
 - Miners
 - Manufacturing
- Military servicemen and women
- Emergency services / First Responders
 - Firefighters
 - Police
 - Paramedics

If you identify as someone who sweats a lot or you suffer from physiological issues such as cramping, lethargy, muscle spasms or loss of coordination, or perhaps mental concentration or decision-making ability a sweat test may assist in understanding why, and also lead to strategies to help rectify those issues.

Why do a Sweat Test?

- You suffer from cramp on occasions where you're sweating a lot.
- You've had issues with dehydration (or over-hydration/hyponatremia) during races/competitions or at the workplace.
- You struggle to maintain your performance in hot environments, or when your sweat losses are higher.
- You struggle to recover after longer training sessions or races in hot weather.
- You're a serious athlete who is looking for marginal gains that can be a game-changer in terms of your performance.

Dehydration and electrolyte imbalance can contribute to declining physical performance, impaired cognitive ability and reaction time, overall wellbeing and result in symptoms such as headaches, nausea, lethargy, loss of coordination, muscle & heat cramps.

Whether trying to perform at your best in the sporting arena, train hard for improvements or if you or your workers are on the tools looking after your hydration and electrolyte replacement is of high importance.

Sweat rates and sweat sodium concentration are highly variable amongst individuals and cannot be predicted by any other means other than measurement and analysis. The hydration and electrolyte replacement strategy that is

suitable for one of your peers may completely inappropriate for you due to the amount of sweat lost and how “salty” that sweat is.

Merely using “average” sweat rates and sweat sodium levels as the basis for replacement can be highly irrelevant and problematic. The American College Sports Medicine (ACSM) recommends that best practice is to devise individual fluid and sodium replacement strategies for athletes. This is only achievable once individual sweat losses are measured.

When Should You do a Sweat Test?

Someone’s sweat profile will change throughout the year due to their level of heat acclimatisation, change in fitness level or body composition and also due to major dietary changes amongst other factors. Sweating is a mechanism to cool the body and maintain core body temperature. Effectively the body can become better at dissipating heat through sweating and can also adapt to how much sodium is lost.

Whilst the TSL app has the ability to predict how your sweat profile will change in different temperatures, we still recommend considering performing separate sweat tests particularly in Winter and Summer and also if there are any other major changes in diet, fitness, training or other major body changes.