Hyperthermia[1]

Hyperthermia results when the core temperature of the body (heart, lungs and brain) elevates above 99.5°F. "Hyper" means "elevated" and "thermia" refers to temperature. Hence hyperthermia refers to an elevated body temperature. It should not be confused with hypothermia which is a low temperature of the body. Physiologically, the body is designed to handle heat stress and it results in a systematic shutdown of the body to maintain the core temperature of the body for as long as possible. If untreated hyperthermia can cause death. Hyperthermia is divided into two types: heat exhaustion and heat stroke. Heat stroke is life threatening and people who have survived heat stroke, often have permanent thermoregulatory damage.

Heat Exhaustion – Heat exhaustion is "compensative" meaning that the body attempts to compensate for the stress and return the body to normal operating temperature. Generally, heat exhaustion results when the body is above 99.5°F and below 105.1°F. Heat Exhaustion is caused by the body overheating. Usually, it is sun related.

Heat exhaustion and dehydration are closely related. They have similar symptoms: Prolonged and profuse sweating, muscle cramps, clammy skin, nausea and disorientation (Figure 1). The difference is that with heat exhaustion, the body is no longer able to control its temperature. Water losses are significant (Figure 2). The body in a "hot environment" can easily lose 3.5 quarts of water a day, mostly through sweating. Add exercise and water losses can easily exceed a gallon of water a day. In its attempt to cool the body, it is easy to see how the body can easily become dehydrated.

Figure 1: Core Temperatures versus Symptoms of Hyperthermia (Heat Exhaustion and Heat Stroke) [1]

Core Temperature	Symptom/Comment
105.1°F	**Heat Stroke:** (Note: Heat stroke is life threatening) 1) Sweating stops 2) Victim's skin turns pink or red
99.5°F to 105.1°F	**Heat Exhaustion:** (Note: similar symptoms to dehydration) 1) Prolonged and profuse sweating 2) Muscle cramps 3) Clammy skin 4) Nausea 5) Disorientation

Source: Fear, G., and Mitchell, J., (1977). Fundamentals of Outdoor Enjoyment, Tacoma, Washington: National Search and Rescue.

Treatment for heat exhaustion is two-fold. First, remove the victim from the source of the overheating. Usually, this is the sun. This means moving the victim to the shade. Second, replenish water and electrolytes. As noted in Figure 2, water losses can be significant and need to be replenished.

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A fever and heat exhaustion have overlapping temperature ranges. Heat exhaustion is caused by environmental factors, external to the body. Other than for the heat stress, the body is operating normally. In contrast, a fever is purposely caused by the body to kill pathogens. Normally, a fever is the result of an illness.

Heat Stroke – Heat stroke usually occurs when the temperature of the body rises above 105.1°F. Heat stroke is "decompensatory" where the body can no longer compensate and literally shuts down. In simple terms, it is crashing and crashing quickly. Heat stroke is life threatening and death can easily result. People who have experienced heat stroke and recovered often have permanent thermoregulatory damage.

The differences in symptoms between heat stroke and heat exhaustion are readily evident (Figure 1). With heat exhaustion, the victim is sweating profusely. Their skin is clammy. With heat stroke, sweating stops. The sweating mechanism has stopped. The victim's skin turns pink or red. This is due to the body shunning the hot blood to the extremities in an attempt to keep the core temperature cooler. Physiologically, it is a process similar to hypothermia. The victim is in a life threatening situation. They must be cooled down immediately with water, ice or whatever is available. Move them to shade and out of the sun. Since long-term damage can occur, seek medical assistance.

Figure 2: Hydration Requirements [1,2]

Normal water losses per day due to:	Hot Temperature			Heavy Exercise[2]		
	ml	quarts	% of Total	ml	quarts	% of Total
Sweating	1,400ml	1.48	43%	5,000ml	5.28	76%
Respiration	250ml	.26	7	650ml	.68	10
Urination	1,200ml	1.27	36	500ml	.53	8
Skin (insensible loss)	350ml	.37	11	350ml	.37	5
Defecation	100ml	.10	3	100ml	.10	1
TOTALS:	**3,300ml**	**3.48**	**100%**	**6,600ml**	**6.97**	**100%**

[1.] Source: *SOLO's 2010 Wilderness First Responder Review*. P.O. Box 3150, Conway, New Hampshire: SOLO, p.57.
[2.] The table is organized by heavy exercise.

References:

Fear, G., and Mitchell, J., (1977). Fundamentals of Outdoor Enjoyment, Tacoma, Washington: National Search and Rescue.

Kauffman, R. (1995). *Boating Fundamentals: A Manual of Boating Safety*. Arlington, Virginia: National Recreation and Park Association, 126 pp.

Source: *SOLO's 2010 Wilderness First Responder Review*. P.O. Box 3150, Conway, New Hampshire: SOLO, p.57.