Clinical question.

General: What is the best treatment for a victim of heat exhaustion or heat syncope?

PICO Format: In victims with heat exhaustion or heat syncope (P) what treatment (I) as opposed to no treatment (C) decreases/resolves symptoms (O)?

Is this question addressing an intervention/therapy, prognosis or diagnosis? Intervention

State if this is a proposed new topic or revision of existing worksheet: New Topic

Conflict of interest specific to this question

Do any of the authors listed above have conflict of interest disclosures relevant to this worksheet? Yes, Intellectual interest

Search strategy (including electronic databases searched).

Cochrane Reviews, DARE, and CENTRAL: “heat exhaustion” OR “heat syncope” OR “heat fainting” AND “treatment” OR “first aid” OR “management”

Medline, PubMed, PubMed Central, CINAHL, and Pre CINAHL: same search terms as above

MESH Terms:
- Blood Circulation*
- Drinking*
- Exercise*
- Body Water/*metabolism
- Dehydration/*physiopathology
- Stress, Physiological/physiopathology
- Energy Metabolism*
- Hemodynamics*
- Heat Exhaustion/*physiopathology
- Heat Exhaustion/enzymology
- Water-Electrolyte Imbalance/blood
- Heat Exhaustion/*etiology
- Occupational Exposure/*adverse effects

- State inclusion and exclusion criteria

Inclusionary items: heat exhaustion, heat syncope, heat fainting, and heat illness

Exclusionary items: special populations (i.e cystic fibrosis, multiple sclerosis, musculoskeletal diseases, seizures), animals, pharmacological treatment, cooling for performance studies, fainting in non heat situations, non peer reviewed studies, missing abstract manuscripts, and studies not directly answering the question

- Number of articles/sources meeting criteria for further review:

26 articles currently meet criteria for review. Of these 8 were LOE 2, 10 were LOE3, 8 were LOE5.
## Summary of evidence

### Evidence Supporting Clinical Question

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<tr>
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<th>Costrini 1979 A</th>
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<td>Armstrong, 1988 C</td>
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<td>Nash 1985, A</td>
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<td>Brown 1947 A</td>
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<td>Hadad 2004 E</td>
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<td>Castellani, 1997 D</td>
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**Level of evidence**

- **A** = EHE/EHSnc- water depletion
- **B** = EHE/EHSnc- salt depletion
- **C** = EHE/EHSnc- circulatory insufficiency
- **D** = Relief of symptoms/etiology via oral rehydration
- **E** = Relief of symptoms/etiology via cooling
### Evidence Neutral to Clinical question

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**Level of evidence**

### Evidence Opposing Clinical Question

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**Level of evidence**
REVIEWER’S FINAL COMMENTS AND ASSESSMENT OF BENEFIT / RISK (please include implementation considerations including at a minimum training, environment and availability):

There is no controlled research on the treatment of heat exhaustion and heat syncope. The only studies that involve management of the heat illnesses are observational studies or case studies at running events or occupational individuals (miners, military). The rest of the studies are prospective or retrospective studies examining the etiology of the heat illnesses. Even though the studies do not directly look at treatment, by understanding the etiology and attempting to address these factors, a treatment plan can be developed.

Heat exhaustion is defined as the inability to continue exercise in the heat because of cardiovascular insufficiency. Observation studies and case reports have indicated water depletion as a factor contributing to heat exhaustion(Costrini 1979, Kark 1996, Donoghue 2000, Donoghue 2000, Donoghue 2000). Observational studies have also shown salt depletion as a contributing factor to heat exhaustion(Costrini 1979, Kark 1996, Donoghue 2000, Donoghue 2000, Donoghue 2000). Some of these studies also observed rehydration through either oral or IV fluids and documented a resolution in symptoms. It can be assumed because the water and sodium depletion was addressed in the fluids administered. No studies have been done to see if individuals would have recovered without fluids. However it is known from a controlled study, that physiological strain is higher in individuals who are not provided fluids during exercise. It might be assumed the same is relevant during recovery. Randomized controlled studies have examined oral versus IV and have shown that oral is just as beneficial as IV to provide fluids to help rehydrate individuals(Castellini 1997, Kenefick2000, Kenefick 2007, Riebe1997, Marehs 2001, Armstrong 1997).

Observational studies (and expert opinion) have shown that circulatory insufficiency is present in almost all forms of heat exhaustion and heat syncope (most likely because of the water and/or salt depletion)(Costrini 1979, Kark 1996, Shahid1999, Holtzhausen 1994, Armstrong 1997). The replacement of water and salt will most likely address this factor by increasing plasma volume and cardiac output. As well, any form of cooling may encourage peripheral vasoconstriction resulting in an increase in central volume and cardiac output. Numerous controlled studies support various methods of cooling that are successful in aiding in evaporation and therefore peripheral vasoconstriction(Donoghue 2000, Hadad 2004, Richards 1979, Mitchell 2001, Kielblock 1986). When core body temperature decrease is not the primary objective, many methods could be used such as fans, dousing/spraying, and ice packs. One observation study also documented the environmental conditions when EHE (Exertional Heat Exhaustion occurred to report how warm/hot environments increase the incidence of EHE, most likely contributing to the water/salt depletion and circulatory insufficiency (Donoghue 2000). Therefore, cooling may help in this factor as well. Having the individual lie down and elevate the feet, may also encourage blood return and help with cardiac output to address circulatory insufficiencies.

Heat syncope is defined as a fainting episode in the heat caused by cardiovascular insufficiency (blood pooling in the extremities). Since the etiology is very similar to heat exhaustion, the same treatment plan can be used. However, it is important to note, that a well hydrated person can have heat syncope due to a quick cessation of exercise or standing for long periods of time causing the blood pooling.

Acknowledgements:

Government and world health organization recognition of signs and symptoms of EHE and EHSnc and the etiology of water and sodium depletion.

An observational study of soldiers marching in the desert. Noted the soldiers did not recover from heat exhaustion by simply resting or cooling, that rehydration was necessary for resolution of symptoms.

An observation study of subjects running on a treadmill. Documented the s/s associated with exhaustion. Of which, s/s of circulatory insufficiency were common (increased heart rate, dizziness). Supports addressing circulatory issues.

A well supported case study. Reveals significant water and salt depletion in the heat exhaustion victim. Supporting the need to treat these factors.

Well designed controlled study. Supports the use of oral rehydration to decrease physiological strain. Even though focused on post exercise, still provides insight into the recovery period.

An observational study of soldiers marching in the desert. Made the correlation between heat exhaustion and dehydration (3-11% body water losses). Supports the use of oral rehydration with fluids.

Solid research design. Results suggest when treating with a NaCl solution, that there is no benefit of choosing intravenous fluids over oral rehydration.

An observational study in the military. Revealed EHE patients are dehydrated, sodium depleted, and has circulatory insufficiencies.

A prospective study of occupational subjects (miners). Revealed that subjects were dehydrated at time of heat exhaustion and that the use of IV fluids to rehydrate resolved symptoms.
A prospective study using occupational subjects (miners). Revealed environmental temperature is correlated with heat exhaustion.

A prospective study of occupational subjects (miners). Revealed that subjects were dehydrated at time of heat exhaustion and that the use of IV fluids to rehydrate resolved symptoms. Also revealed that warm/hot environmental conditions are correlated with heat exhaustion.

A review of cooling methods (specifically to heat stroke). Discusses that that evaporative cooling methods such as fans and spraying result in vasoconstriction, which is helpful to increase central volume and cardiac output. These methods are useful when core body temperature is not a concern.

An observational study of runners. Revealed EHE victims are dehydrated, sodium depleted, and have circulatory insufficiencies.


An observation study of military personnel. Revealed that heat exhaustion patients were dehydrated, sodium depleted, and have circulatory insufficiencies.

Solid research design. Results support that when treating with a NaCl solution there is no difference between intravenous or oral rehydration methods.

Solid research design. Results support that when treating with a NaCl solution, there is no difference between intravenous and oral rehydration methods.

Solid research design. Results support when using a NaCl solution, there is not a difference between intravenous and oral rehydration methods.


Good research design. Results suggest that the oral rehydration is better than IV at decreasing sensations of thirst.


A well designed study. A combination of ice bags and air had the highest cooling rate and aided in evaporation.


Fan and mister cooling were no more effective than passive cooling in cool air. Cooling rates were sufficient and aided in evaporation.


A strong discussion on how both dehydration and sodium depletion together and separate play a role in circulatory insufficiencies (decrease in plasma volume, changes vascular resistance, decrease in cardiac output, increases in heat rate)


An observation study of runners. All heat exhaustion cases were treated with rehydration (via IV fluids) and 90% were able to leave the finish line medical tent on their own. Supports the use of oral rehydration with a NaCl solution.


A well controlled treatment study. EHE patients were treated with various cooling methods to aid in evaporation and fluids for rehydration. All had successful resolution of symptoms.


Solid research design. Results suggest that when treating with a NaCl solution, use of oral rehydration may be of benefit to decrease perceptual sensations in the dehydration victim.


A retrospective study of pilgrimage heat exhaustion victims. Reveals circulatory insufficiencies are correlated with heat exhaustion.