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Our Thirst Mechanism and ANP

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research ARTICLE

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—Kerry Dinon

Anyone working, playing, or exercising in a cold environment runs the risk of dehydration. The amount of fluid lost can add up to 8% of his/her body mass. This loss is due to several factors, which include the amount of fluid consumed, fluid lost through respiration, and fluid lost as sweat. Exposure to cold also stimulates diuresis, or urination, which further increases losses of body fluid. One of the reasons for this increase in urination is the prompting action of the hormone atrial natiuretic peptide, or ANP.

When exposed to cold, the body will constrict blood vessels under the skin of the lower arms and legs in order to prevent too much heat being lost from the body. This action, termed *peripheral vasoconstriction*, moves blood to the core of the body. The increase in central blood volume does two things to the body. First, it increases the volume of blood entering the heart and the amount the heart stretches during contraction. The stretch, particularly of the atria chamber of the heart, stimulates the release of ANP. Second, the increase in central fluid volume and release of ANP signal the kidneys that there is too much fluid and that this condition needs to be corrected. This leads to the kidneys releasing fluid through diuresis. Therefore, due to the body's belief that it is experiencing an increase in blood volume, the intake of more fluid is not perceived to be necessary, even when fluid is needed. So, people don't tend to get thirsty when either at rest or when exercising in the cold.

Because cold exposure increases fluid losses, it stands to reason that when people are in the cold, they may become dehydrated. From a review of research in this area, I formulated the following research question: Will cold exposure increase ANP levels in individuals who are already dehydrated?

The Study

Nine physically fit college-age males were subjects for my study. Each subject underwent four experimental trials, taking place under the following conditions:

- dehydrated in a cold environment
- dehydrated in a room temperature environment
- normally hydrated in a cold environment
- normally hydrated in a room temperature environment

To reach the dehydration state, each subject lost about 3–4% of his body weight by exercising in the heat (90°F), and was not allowed to consume any fluids overnight. To determine whether a subject was adequately hydrated, we conducted a simple test by looking at the color of the subject's urine. If the urine was a light yellow color, the subject was ready for that portion of the trial.

Each trial was performed early in the morning after each subject consumed a set breakfast and small glass of juice. The cold environment was set at 36°F and the room temperature environment was set at 65°F. The subject was put in each environment for thirty minutes to get acclimated to the environment and then, after the acclimation state, he exercised for thirty minutes in that specific environment.

Drink up!

The results from this study show that ANP levels become elevated in a cold environment whether a person is resting or exercising. This means that even when a person is dehydrated, exposure to the cold can stimulate ANP, increase diuresis, and cause further dehydration. This response, combined with the previous finding that the sensation of thirst is 40% lower for a person in the cold even when dehydrated (1), shows that maintaining hydration is very important when you know you will be exposed to the cold for an extended period of time. In a cold environment, adequate fluid should always be consumed to reduce the risk of becoming severely dehydrated.

Future Research

I enjoyed doing this experiment because, as part of my major, I focused on the body's physiological responses to exposure in different environments. The valuable data I collected may be helpful for further research. For example, dehydrated subjects could be exposed to a cold environment for a longer period of time to see if there is an increase in urination leading to higher levels of ANP and further dehydration. Also, dehydrated subjects could be given a dosage of salt to see if the salt increases their perception of thirst while in the cold. Future research of this sort would be very valuable, and the information obtained could be especially useful for individuals who work in cold environments.

I would like to thank Dr. Robert Kenefick for being such an inspiration to me, and for being a great mentor. Thanks also to Dr. Edwards for helping me analyze the samples, and to the subjects who volunteered for this experiment.

References

1. Kenefick RW, Hazzard MP, Mahood NV, and Castellani JW. Thirst sensations and AVP responses at rest and during exercise-cold exposure. *Med Sci and Sports Exerc.* 1528-1534 (2004).

Author Bio

***Kerry Dinon**, a September 2005 graduate of the University of New Hampshire, has already achieved one of her career goals, "to have a career I love." After completing her studies in kinesiology and exercise science, Kerry accepted a position as an exercise physiologist in the cardiac and pulmonary rehab unit at St. Joseph's Hospital, where she previously completed a three-month internship. She explains that her research experience, which was funded by the Undergraduate Research Opportunities Program (UROP), has contributed greatly to her current role "because I get to tell my patients exactly what happens to their bodies in a cold environment, and why it is not recommended to them." Not a single moment of the research process was unsatisfactory to Kerry. "The most satisfactory part is the knowledge and great experience of learning that I gained from this project," she says. Kerry lives in Townsend, Massachusetts.*

Mentor Bio

*Dr. **Robert Kenefick**, is an associate professor of kinesiology in the school of Health and Human Services at UNH. According to Dr. Kenefick, Kerry was very enthusiastic about her undergraduate research experience, and he was pleased to act as her mentor. In his opinion, however, "because of [her] knowledge base, confidence, and responsibility, the project became less of a student-mentor situation, and more of a professional working collaboration." Dr. Kenefick was impressed not only with her hard work and sense of responsibility, but also with her command of the material. "Her presentation (at the school of Health and Human Services' Grimes Research Competition) was no different from one at a professional conference." Dr. Kenefick received the prestigious UNH Faculty Excellence award in 2005.*