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UNDERSTANDING THE CURRENT HEAT STRESS INITIATIVE AND ITS IMPACT ON THE WORKFORCE

Darin M. Dillow
Capitol Technology University

Dr. Tyler Asher
Capitol Technology University

Abstract

Hot climates and the corollary heat stress injuries and incidents have always existed in the United States in some form and have presented themselves as a problem within workplaces across the country. The Occupational Safety and Health Administration has several standards but none that specifically target the reduction of heat stress injuries. In September 2021, the current administration recognized the need for better worker protections in these scenarios and has proposed new initiatives to address the problem. This article examines the recent initiative and considers whether it reaches far enough to address the issue of heat stress within the workplace fully.
Keywords: Heat, Climate, Injuries, Initiatives, Stress

Introduction

Doing something for employees is better than doing nothing at all. But do we truly know when we are helping the employees stay safe while on the job? For years, employers have told workers to drink water to stay hydrated, and that guidance is well-intentioned and can help, but it doesn't go far enough to fully protect workers from heat stress injuries. In September 2021, the White House issued a statement that read in part, "New initiatives at OSHA and across agencies will enhance workplace safety, build local resilience, and address disproportionate heat impacts" (White House Press Secretary, 2021). While this statement and further guidance help bring awareness to the current problem, more specific direction and accompanying enforcement activities are needed for these efforts to amount to change. The crux of the new proposed standard is, in short, water, rest, and shade. While all three of these items help address

heat stress, they cannot act alone as the human body needs replenishment in a more robust form than water alone.

Understanding the Need Beyond Water

Consuming water to fight dehydration is and always will provide some degree of benefit. According to an article published by the U.S. Geological Surveys, up to sixty percent of the human body is water (U.S. Geological Surveys Group Water Science School, 2019). Further, the report states that the average male needs to consume nearly three liters of water each day. In comparison, the average female needs to consume an average of two liters per day to replenish loss from normal functions and activities. Therefore, water is an absolute necessity and should not be ignored in the workplace.

The concern is when humans pass the threshold of regular activity. That is, once they exert more energy than they would in a normal routine, the body temperature begins to rise, and dehydration becomes a greater risk.

Water does not offer the essential minerals that are required to quickly rehydrate a worker. Electrolytes are needed in addition to water to help the human physiology maintain a state of Euhydration. As an employee begins to sweat, loss of water occurs. Accompanying this loss of water is also a loss of crucial electrolytes that the body needs to function correctly. One of the most noticeable electrolytes lost during the natural cool-down process is sodium. A study published in the journal Temperature states that the sweat flow rate must be considered when determining sodium loss (L.B., 2019).

In 2008, Buono et al. reported data providing insight to the physiological mechanism responsible for the relation between sweat flow rate and sweat [Na] and [Cl]. They found that as the forearm sweating rate increased (from ~0.25 to 0.82 mg/cm2/min), the rate of Na secretion in primary sweat increased proportionally more than the rate of Na reabsorption along the duct. Within this ***range in sweating rate***, which was stimulated via a progressive increase in exercise intensity (from 50% to 90% HRmax), sweat [Na] increased from 19 ± 5 to 59 ± 10 mmol/L. The important point is that the absolute rate of Na reabsorption actually increased continuously with increases in sweating rate. However, the percentage of secreted Na that was reabsorbed in the duct decreased with a rise in sweating rate. That is, at the lowest sweating rate 86 ± 3% of the secreted Na was reabsorbed, while at the highest sweating rate only 65 ± 6% of Na was reabsorbed from the duct. Therefore, the faster the primary sweat travels along the duct the smaller the percentage of Na that can be reabsorbed. (Baker, 2019, p. 228)
This reaffirms the need for a sodium-based rehydration product to be used in addition to simple water.

Steel Mill Study Utilizing Sodium Electrolyte versus Water for Rehydration and Reduction in Fluid Loss

In 2021, a study was conducted at three large steel mill factories owned by different corporations throughout the country. In the study, employees working normal shifts were

offered regular water, and then the same employees were offered a sodium-based electrolyte beverage. Results were tracked by measuring the fluid loss for each employee in an eight-hour shift. (Results do not consider worker-added personal protective equipment and physical job exertion.)

Mill Located in Central Mid-West United States:

Ambient Temp.	Total Fluid Consumption (mL)	Water (mL)	Sodium Based Electrolyte Beverage (mL)	Calculated Fluid Loss Total (mL)	Percentage Fluid Loss
95°F	427.5	177.5	250	500	86%
95°F	755	400	355	750	101%
95°F	2920.5	1500	1420.5	3000	97%
95°F	3542.25	1500	2042.25	4500	79%

Mill Located in the Northeastern United States:

Ambient Temp.	Total Fluid Consumption (mL)	Water (mL)	Sodium Based Electrolyte Beverage (mL)	Calculated Fluid Loss Total (mL)	Percentage Fluid Loss
101°F	460	60	400	500	92%
101°F	730	330	400	750	97%
101°F	2308	600	1708	3000	77%
101°F	4542.5	2766.5	1776	4500	101%

The results shown above present a compelling argument that although water is essential, sodium electrolytes are needed to reduce the amount of fluid lost when employees are working in hot or semi-hot atmospheres.

Rest and Shade

Thermoregulation is the body's system to control its internal core temperature. The average body temperature for most individuals is 98.6 degrees Fahrenheit. As our bodies cool or heat up, thermoregulation begins the process of regulating the core temperature back to the normal range.

The brain, more specifically the hypothalamus, controls thermoregulation. If the hypothalamus senses internal temperatures growing too hot or too cold, it will automatically send signals to the skin, glands, muscles, and organs. For example, if the body is generating heat during high-level exercise or if the external ambient temperature is elevated enough to cause a rise in the core temperature, afferent signals to the hypothalamus result in efferent signals to the cells of

the skin to produce sweat. Sweating is one mechanism the body can use to cool itself as heat is lost through the process of sweat evaporation. (Osilla, Marsidi, & Sharma., 2021)
Once again, hydration is key to controlling the body's core temperature. Although the standard that is being discussed currently incorporates rest and shade as two components for combatting heat stress, it is actually hydration that is the most important. Once the hypothalamus signals that the body temperature is beginning to elevate, the individual is already heading into a dehydrated state. Rest and shade will take longer to provide any benefit, especially if the ambient or atmospheric temperature is above average (i.e., > 68–76 degrees Fahrenheit). The issues must be treated before they start, which is to say that the core system must be hydrated to stem potential problems.

Dehydration can also cause ischemia or edema, which can affect the brain or other vital organs. Ischemia is a condition that causes the brain and other vital organs to receive an insufficient blood supply. This can lead to complex issues such as confusion or disorientation. Thus, workers exposed to an elevation in body core temperature can experience ischemia, which could lead to injuries or fatalities as workers may not be able to make cohesive decisions. Accordingly, the consequences of heat stress and dehydration are a risk for the employee who is experiencing the condition, but the actions of the affected employee can put the entire work crew at risk.

Rest and shade can indeed be beneficial but only as a precursor. Once dehydration has begun to set in, rest and shade will take much longer to have beneficial effects for those who are affected.

Conclusions

Dehydration is a genuine concern for workers and employers. The effects can be deadly and are often ignored until consequences arise. Bringing attention to the need for a new standard to keep workers safe is always good and should be commended. However, setting a bar that doesn't go far enough does not help to solve the problem but rather masks the issue.

Water, rest, and shade all have positive impacts on worker safety. However, the proposed standard should include a sodium-based electrolyte beverage component to increase its effectiveness. Heat stress cases, heat syncope, and potential fatalities will continue to be discussed until a more aggressive stance is taken in the initiative. Doing something is better than doing nothing, but as a standard is to be proposed, it should include all options to ensure the proper safety and health of the entire workforce.

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