Original Research Article

Assessment of hydration status among construction workers using sweat rate

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Abstract

Background: All the cells in human body need water to carry out their function properly. Water or any fluid consumed by an individual is one of the key factors that determines the hydration status. Whenever the ambient temperature is more than the body temperature, water promotes the release of heat from the body. The construction workers are exposed to direct sunlight and are more prone for heat related illness (Occupational Heat Stress). During prolonged work periods in the heat, the high sweat rates leads to progressive dehydration. **Aim:** To assess the hydration status among construction workers using sweat rate. **Materials and Methods:** This study was carried out during winter (month of December) and involved 50 male construction workers aged 30-60 years, from a construction site in Chengalpet, Tamil Nadu, South India. This study included environmental heat assessment using Wet Bulb Globe Thermometer (WBGT) monitor. Sweat rate was calculated using the Canadian sports association method. **Results:** This study revealed that 52% of the construction workers studied had a high sweat rate, 18% of the workers had a moderate sweat rate and 30% of workers had a low sweat rate. **Conclusion:** The calculated sweat rate was high in more than 50 % of the construction workers in our study, which if continued to progress could have lead to dehydration and other serious health disorders like renal failure. A proper plan should be made to minimize the sweat rate by taking rest in between the work and by providing fluids during work.

Keywords: heat stress, hydration, sweat rate

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Introduction

All the cells in human body need water to carry out their function properly. A person living in a temperate climate must consume at least 1.5 liters of water per day**.** Water or any fluid consumed by an individual is one of the key factors in determining the hydration status.[1] Body water has a higher role in limiting the body temperature on exposure to cold or warm environment.

Whenever the ambient temperature is more than the body temperature, water promotes the release of heat from the body. Sweating helps in the evaporation of water from the surface of the body which in turn will decrease the body temperature. Scientists have predicted that ambient temperature may increase at a much higher rate which can lead to heat waves more frequently in future.[2] People who are working in a hot environment are exposed to excessive heat which may be an

additional load on the body that may alter the body functions.[3] The construction workers are exposed to direct sunlight and are more prone to develop heat related illness.[4] Indoor & outdoor work without air conditioning is already a major heat strain in India. Physical labour and poor working conditions have huge health impacts on the working population in India. The combination of heat stress, dehydration and physical activity impose a challenge for physical adjustment, with potential risk of ensuing heat related injuries and disorders, e.g., heat cramp, heat exhaustion, heat syncope. During prolonged work periods in the heat, the high sweat rates leads to progressive dehydration.[5]

Since it has been well documented that loss of fluids through sweating can lead to dehydration which has a detrimental effect on productivity, strategies to minimize the effects of dehydration have also been well studied.[6] Fluid and electrolyte loss due to excessive sweating is a serious risk to health. Fluid replacement is extremely important to replace sweat loss.[7] Guidelines for the fluid replacement are often conflicting. The amount of fluid lost due to sweating should be calculated to replace the fluid loss.[8] An ideal fluid replacement beverage for industrial use should have significant sodium content with minimum carbohydrate and it should be easily available and affordable.

Sweat rate was measured in previous studies as it can tell about the hydration status of the individual. Occupational heat stress is a major health issue with several potential negative health and well-being outcomes. There are limited studies conducted on assessment of hydration status in construction workers in South India. Hence the present study focuses on the calculation of sweat rate for assessment of hydration status in construction workers. The aim of this study was to assess the hydration status among construction workers using sweat rate.

Materials and Methods

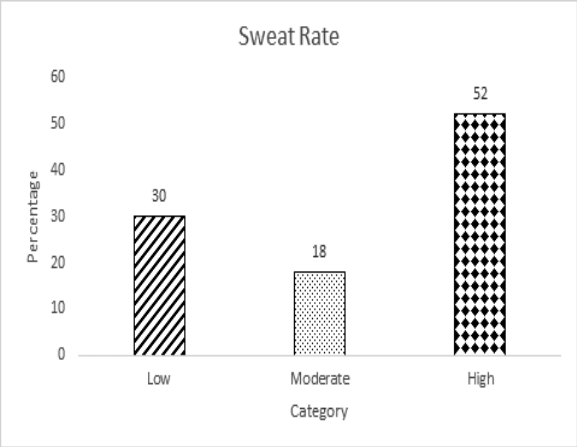
This was a cross-sectional study done in 50 construction workers (age group 30-60 years) in Chengalpet, Tamil Nadu, South India. All the male workers from the work site were included in this study and none of them were excluded, which eliminated selection bias. This study was carried out during winter (month of December). This study was approved by the Institutional Ethics Committee of Sri Ramachandra University. Informed consent was obtained from the study participants. This study included environmental heat assessment using WBGT (Wet Bulb Globe Thermometer) monitor.[9]

Sweat rate was calculated using Canadian sports association method.[8] The body weight was measured before the start of work activity (accuracy of 0.1kg). Volume of fluids to be ingested during the activity was measured (in ml) and placed in water bottle. Time was noted during the start of work using stopwatch. The workers were asked to drink fluid as usual. At the end of the work, the volume of fluid left in the bottle was noted. The duration of work was noted. Post work activity body weight was noted (after ensuring that all wet clothes were removed). The values were entered in the formula and sweat rate was calculated and interpreted as per the Canadian Sports Association formula.[8] Statistical analysis was done using SPSS software version 11.6.

Results

The age group of our study participants was in the range of 30-60 years. Heat stress measurements (WBGT) ranged from 23.8 °C to 28.2 °C. The sweat rate is divided into three categories of low, moderate and high as per the standard guidelines. Our study revealed that about 52% of the workers had a high sweat rate (>0.75 L/hr), 18% of the workers had a moderate sweat rate (0.5 to 0.75 L/hr) and 30% of the workers had a low sweat rate (<0.5 L/hr), as shown in Figure 1.

Figure 1: Analysis of the sweat rate of the construction workers



Values expressed as percentages of the construction workers who had a low (<0.5 L/hr), moderate (0.5 to 0.75 L/hr) and high (>0.75 L/hr) sweat rate; sweat rate in L/hr being calculated and interpreted as per the Canadian Sports Association formula.[8]

Discussion

This study was conducted during winter season (December) which had low ambient temperature when compared to summer. Around 50% of the construction workers in our study had a high sweat rate due to heat exposure during the work process which is significantly a health concern for the workers as these workers could be more prone for dehydration.

A decrease in sweating may occur as the core body temperature continues to rise and the skin is completely wet.[10] The impact will be more in summer as the ambient temperature is high during summer. The situation is further complicated when a worker is wearing protective clothing.

During sweating, salt is lost at about 4 grams per liters for unacclimatised workers and 1 gram per liter in acclimatized workers and prolonged exposure to heat and/or prolonged exercise almost always causes hypohydration.[11] This is because of excessive heat exposure which increases the core body temperature which in turn causes increase in blood flow to skin to dissipate the excess heat from the body.[12] As a result, the sweat rate will be increased.[8] A proper plan should be made to minimize the sweat rate by taking rest in between the work and by providing fluids during work.

The limitations of the study include the fact that only male construction workers from a single construction site were involved in the study. Summer and winter comparison was not done. The study will be repeated in summer to check the hydration status and also the study will be conducted in other occupational sectors. Such studies will provide insight to the management which would help them in implementing necessary interventions and also in protecting the workers health.

Conclusion

This study which was conducted with an aim of assessing the hydration status among construction workers in a selected construction site in Chengalpet, Tamil Nadu, South India, using sweat rate revealed that the calculated sweat rate of more than 50% of the construction workers was high. A proper plan should be made to prevent dehydration and minimize the sweat rate by ensuring that workers take rest in between their work and by providing fluids during work.

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Conflicts of interest: Nil

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