DRINKING BEHAVIOUR AND VOLUNTARY DEHYDRATION IN MEN SWEATING HEAVILY IN STRENUOUS OCCUPATIONAL WORK IN HOT WEATHER

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Dehydration results in impaired thermoregulatory and circulatory function, leading to loss of performance and increased risk of heat illness in prolonged heavy exercise or hot work. Yet, there do not appear to be effective physiological or behavioural mechanisms that ensure that drinking replaces sweat losses as they occur. This paper analyses 170 observations of water intakes and sweat losses made over 3 summer fire seasons on 30 male Australian bushfire fighters of age (mean and range) 26 (18-45) y and body mass 71.4 (51.7-105.0) kg. The observations arose from carefully conducted fluid balance studies that measured changes in body mass, food and water intake, and urine excretion, while the firefighters were engaged in fire suppression activities. On some days the firefighters worked on fires, on other days they performed the same work in the absence of fire. The firefighters were aware of the importance of preventing dehydration, and ample water supplies were readily available to them while they worked. For the 170 observations total work sweat losses were (mean and range) 2155 (615-4459) g, and sweat rates were 1127 (456-2373) g h^{-1}. The rate of water intake (drinking) averaged 453 (0-1352) g h^{-1} , which replaced 41 (0-96) % of sweat loss. Regression analysis revealed a significant but weak association between drinking rate and sweat rate (r= 0.55, P<0.0001). An increase in sweat rate of 1,000 g h^{-1} was associated with an increase in water intake of 350 g h^{-1}, and conversely of 650 g h^{-1} (about 0.9% body mass per hour) in the rate of dehydration. Because the percentage of sweat replaced varied so widely (0-96%), individual drinking behaviour was investigated in nineteen firefighters for whom there were from five to nine days of observation. Individual correlations between drinking rates and sweat rates (r) averaged 0.63 (0.01-0.98). Two apparently distinct patterns of drinking behaviour were identified. In ten men (52%) the correlation between drinking rates and sweat rates (r) was>0.75 (P<0.10) suggesting that their water intakes were consistently associated with their sweat losses. Based on their individual regressions, at a standardised sweat rate of 1200 g h^{-1} these men's sweat replacements averaged 42 (24-57)%. In the other 9 men there were much weaker individual associations between water intake and sweat loss, although similar levels of sweat replacement of 43 (25-66)% were observed. The highest drinking rates observed in individuals averaged 812 (407-1305) g h^{-1}, and the highest rates of individuals' sweat replacement averaged 62 (37-96) %.

Conclusion: Water intake and sweat loss appeared to be moderately to strongly associated in some men, while in others there was little or no association. Regardless of the pattern of individual drinking behaviour, water intakes failed to match sweat losses.

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