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PHYSIOLOGICAL RESPONSES AND LIFERAFT MICROCLIMATES DURING A FOUR DAY SURVIVAL TRIAL IN 20-MAN CANOPIED RAFTS IN TROPICAL WATERS

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To survive when water is scarce one must excrete as little water as possible, and above all one must not sweat. Liferaft survivors seek to achieve these aims by eating a ration that minimises the solutes to be excreted in the urine, and by using inflatable rafts that have a double-skinned canopy to shade them from the sun. This paper reports measurements of physiological responses and raft microclimates that were made during a Combined Services evaluation of liferaft rations on Darwin harbour (latitude 12° S).

Fifty-four volunteer soldiers and sailors occupied four 20-man liferafts, 10-15 men to a raft, for four days. Average weather conditions were air temperature 28.8°C, vapour pressure 17 mm Hg (relative humidity 57%), wind speed 3.2 m s^{-1}, and mean radiant temperature 47.2°C. The men were not acclimatized to heat. On each day except the first (when they ingested nothing) they drank 500 ml water and ate 128 g of either glucose, barley sugar, or fudge. In contrast to the 8 subjects of an earlier investigation (Glaser & Hervey 1950), they did not wet their shirts. All three rations, and both Services, were evenly represented within each raft. Physiological and biochemical measurements were made on shore on each day of the trial.

During the four days afloat dehydration and energy metabolism caused an average loss of body mass of 6.2% (4.6 kg), and a reduction of 0.4-1.0 mm in skinfold thickness. Heart rate measured while supine increased by 7 beats min^{-1}, and standing heart rate increased by 31 beats min^{-1}. Oral temperature rose by 0.25°C. One day after resuming their normal diet men had regained half their lost body mass and skinfold thickness, and their heart rates had returned to normal. Analysis of variance showed that although there were no significant differences between rations, heart rate differed significantly between rafts and services - a finding which might mistankenly have been attributed to the rations had the more convenient design of a single ration per raft been adopted.

Measurements made every 3 h inside and outside the rafts confirmed that their canopies gave excellent protection from the sun, but also showed that they caused a fivefold reduction in the breeze over the occupants, and a small increase in air temperature and humidity. Five commonly-used indices of heat stress gave conflicting answers as to the resultant effect on sweat loss and hence survival time. Predicted sweat losses - which agreed with measured weight losses - indicated that without the canopies men would have deydrated 4-5 times more rapidly.

Besides confirming the effectiveness of the raft canopy and the liferaft ration in prolonging survival, the results illustrate the problems of interpretation that could result from (1) the uncritical use of heat-stress indices, and (2) the use of operationally-convenient experimental designs which confound differences between treatments with differences between rafts.

[Glaser E M, Hervey G R (1950) First report on survival trials in the tropics. London: Medical Research Council, R. N. P. 50/631].