

CONTRIBUTION OF BODY SWEAT LOSS TO INCREASE IN UNDERGARMENT WEIGHT DURING IMMERSION SUIT LEAK TESTING

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The assessment of leakage into an immersion suit typically involves the weighing of a dry standard undergarment assembly prior to the subject undertaking the chosen leak test, be it swim, wave or simulated helicopter underwater escape. The difference in weight between the dry undergarments and the aftertest garments plus any free-standing water in the suit is normally taken as the leak and expressed in millilitres. The objective of the study was to determine the contribution of body sweat loss to the overall weighed leakage during a 20 minute swim test conducted at water temperatures of 24°C and 16.7°C.

Nine subjects wore a standard clothing assembly and a helicopter passenger immersion suit constructed from impermeable material. The immersion suit covered the entire body surface with the exception of the hands and face. Subjects were weighed immediately before and after the test on a Sauter ED 2100 Digital Scale. After entering the water, the subjects, three abreast and 1 metre apart, swam on their backs for a period of 20 minutes. Measurements of oxygen consumption ($\dot{V}O_2$), were made during the swim tests and the $\dot{V}O_2$'s at 24°C and 16.7°C were 1.6 ± 0.35 l/min and 1.68 ± 0.38 l/min. Respiratory and metabolic weight losses were determined from the standard equations of Mitchell et al (1972). Sweat loss was then calculated from the change in body weight minus the respiratory and metabolic losses. The results are shown below.

A 20 minute swim test covering a distance of 300-400 metres at a $\dot{V}O_2$ of 1.67 l/min⁻¹ resulted in the subjects sweating. At the water temperature of 24°C failure to allow for the contribution from sweat loss to the increase in undergarment weight over the recognised limit of leakage of 200g could result in an overestimate of 66g. In this case the corrected median increase in undergarments of 175g may be reduced to 142g at 24°C and from 180g to 131g at 16.7°C. The percentage contribution from body sweat loss to increase in undergarment weight should therefore be considered if a swim test is adopted as a leak test, particularly if undertaken in water temperatures as reported in this communication.

Mitchell, J W; Nadel, E R & Stolwijk, J. 1972. Respiratory weight losses during exercise. J. Appl. Physiol. 32, 474-476.

TEST	1 Change in undergarment weight (g)	2 Change in body weight (g)	3 $m_e + m_r$ (g)	4 Sweat loss (g)	5 Corrected undergarment weight (1-4)(g)	6 % contribution of 4 to 1
20 min swim at 24°C	175	90	35	58	142	33
20 min swim at 16.7°C	180	80	38	33	131	18

Undergarment weight changes and contribution to body weight loss from respiratory, metabolic ($m_e + m_r$) and calculated sweat losses. Values as medians as data on $n=9$ was negatively skewed.