USE OF DOUBLY-LABELLED WATER TO MEASURE THE ENERGY EXPENDED BY SOLDIERS TRAINING FOR JUNGLE WARFARE

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The Australian Army needs to know the energy expended by groups of soldiers engaged in various forms of vigorous physical training, eg SCUBA diving, parachuting and training for jungle warfare. With this information, entitlements to food can be matched with measured energy outputs.

Until recently, two main methods have been used to estimate the energy expenditure (EE) of free-living subjects. The intake/balance technique involves measuring total food energy intake and changes in body fat over the study period. Therefore, EE = energy intake - change in body energy. This method is accurate only for long study periods (months). Short term estimates of EE have usually involved use of the factorial method. A detailed record is made of the activities of subjects and the energy cost of each activity is determined by indirect calorimetry. This is invasive and is inappropriate if subjects are not able to be observed continually, eg SCUBA Divers.

Recently, the first use of the doubly-labelled water (DLW) method (Lifson and Mclintock, 1955) with human subjects was described by Schoeller and van Santen (1982). The method involves giving subjects water labelled with the stable isotopes deuterium and oxygen-18. Determination of the elimination rates of these isotopes allows estimation of carbon dioxide production and therefore of EE.

The DLW technique was used to estimate the EE of four members of a platoon (n=34) training for jungle warfare at Land Command Battle School. Average daily EE was estimated to be 19060 kJ. A factorial estimate was conducted to validate the DLW method against a recognised standard technique. The factorial result was 18980 kJ. An intake/balance study was also conducted; because the study was only for 7 days, the results allowed us to conclude only that EE was greater than 17830 kJ.

This is the first time the DLW method has been used with human subjects in Australia.

It was concluded that the DLW technique is non-invasive, accurate, and is the best field method for estimating EE.

LIFSON, N. and McLINTOCK, R. (1955). J. Theoret. Biol. 12: 46.
SCHOELLER, D.A. and VAN SANTEN, E. (1982). J. Appl. Physiol.: Respirat. Environ. Exercise Physiol. 53 (4): 955.

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