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Title: Energy expenditure and fluid production in hyperbaric He-O₂ environments using doubly labeled water

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Abstract: Energy expenditure (EE), carbon dioxide production (rCO₂), water turnover (rH₂O), and urine production (UP) were measured to determine nutrient requirements of U.S. Navy divers during saturation dives. Parameters were measured in a normal surface environment (n = 10) and in 0.56 MPa (n = 9) and 3.17 MPa (n = 11) helium-oxygen environments. Daily EE, rCO₂, and rH₂O were measured with the doubly labeled water method for 10-14 days in each environment. Daily UP was determined by 24-h urine collection for 5- to 10-day periods in each environment. Divers consumed a mixed diet composed of 30% calories from fat, 15% protein, and 55% carbohydrate. Both EE and rCO₂ increased significantly relative to surface conditions at 0.56 MPa (13 +/- 4% and 11 +/- 4%) and 3.17 MPa (14 +/- 4% and 11 +/- 3%), but there was no difference between dives. Water turnover was not significantly affected by the hyperbaric environment. UP was significantly greater than surface conditions at 0.56 MPa (53 +/- 19%) but not at 3.17 MPa (38 +/- 18%). Increased EE is attributed to thermal stress caused by the helium-oxygen environment.

Increased UP may have been caused by decreased evaporative water loss.

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