

BREATHING RATES FOR INFANTS 0-6 MONTHS OF AGE FOR USE IN EXPOSURE ASSESSMENT

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Breathing rates normalized to body weight (L/kg-day) for infants 0-6 months of age were estimated for use in exposure assessment. Data were compiled from the literature on directly measured minute ventilation rates (ml/kg-min), energy intake and energy expenditure. The energy data were used to derive breathing rates from the metabolic balance equation, $V_e = H \cdot V_Q \cdot E$, of Layton (1993). For this equation, V_e is ventilation rate (vol/kg-time), E is energy expenditure or intake (kcal/kg-time), and H (kcal/L O₂) and V_Q (unitless) are empirically derived values relating oxygen consumption to energy and volume of inhaled air, respectively. Energy expenditure (EE) was measured with indirect calorimetry or the doubly labeled water method. Energy intake (EI) was estimated by multiplying breast milk or formula intake (g/kg-day) by caloric content (kcal/g) and adding the energy intake of supplemented foods or liquids. EI measures incorporate 24-hour energy for basal metabolism as well as energy for active movements while sleeping and awake, food-induced thermogenesis, and tissue growth, and may assume 100% digestibility. On the other hand, the doubly labeled water method did not measure energy for tissue growth and indirect calorimetry did not measure energy for tissue growth or activity. Directly measured ventilation rates did not incorporate the increased breathing rates of physical activity. To derive representative daily breathing rates the following adjustments were made: (1) EI measures were multiplied by a digestibility constant of 92%, (2) ventilation rates and energy associated with activity were added to direct measurement and indirect calorimetry estimates, respectively, and (3) tissue growth energy was added to doubly labeled water and indirect calorimetry measures. The studies were combined to give estimated daily breathing rates of 549, 595, 582, 569, 512, 471, 437, and 498 L/kg-day at approximate ages of 0.0-0.5, 1.0, 1.5, 2.0, 3.0, 4.0, 5.0, and 6.0 months, respectively.