

REGRESSION ANALYSIS FOR VENTILATION ESTIMATION DURING HUMAN EXPOSURE UNIT EXPERIMENTS

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Determination of minute ventilation ($V'E$) is important for quantifying the ventilated volume during exposure unit experiments (expo). Unfortunately face masks which allow the determination of the ventilated volume cannot always be worn. Therefore we investigated a regression model based on parameters measured during laboratory and exposure experiments.

Material and Methods:

Sixteen subjects (28.5 ± 5.1 years) were included. The exposure protocol consists of four rounds (each 30 min) of exercise (15 l/min/m^2) followed by rest. Each situation was further divided into a non-steady-state and steady-state phase. Heart frequency (Hf) and breath frequency (Bf) from exposures were compared with laboratory data (lab). Regression analyses were performed for each subject and situation, and ventilated volume based on laboratory measurements was compared with literature data.

Results:

Average values of Hf (lab: $87.4 \pm 24.1 \text{ min}^{-1}$; expo: $87.2 \pm 16.4 \text{ min}^{-1}$) and of Bf (lab: $17.8 \pm 3.7 \text{ min}^{-1}$; expo: $18.2 \pm 3.8 \text{ min}^{-1}$) were not different ($p > 0.05$). Estimated ventilated volume during exposure ($3054.1 \pm 507.5 \text{ l/4h}$) was lower ($p < 0.05$) than the theoretical ventilated volume ($4190.1 \pm 585.7 \text{ l/4h}$) based on literature data. Correlations between height, weight and ventilated volume were found ($r > 0.75$).

Discussion:

Determination of minute ventilation for quantifying the total ventilated volume during exposure experiments can be performed with regression models, if laboratory data are available.