Indirect Calorimetry: From Expired CO_2 Production, Inspired O_2 Consumption to Energy Equivalent

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Abstract

This paper emphasizes the methodology of data collection of indirect calorimetry, including establishment of steady state conditions and the standards in which the values are presented**.** It also aims to describe in details the calculations of VO2, VCO2, Resting Energy Expenditure (REE) and Respiratory Quotient (RQ). The trial is registered with ClinicalTrials.gov number NCT02072694.

Keywords: Indirect calorimetry; Energy expenditure; Oxygen consumption; Calibration; Respiration; Metabolism

Introduction

The indirect calorimetry can be understood as a non-invasive measurement of energy produced by the organism through quantifying the volumes of consumed oxygen and produced carbon dioxide (V_{o2} and V_{co2}, respectively) by the oxidation of substrates [1].

The calorimeters commercially available calculate V_{o2} and V_{co2} through equations using concentrations of O_2 and CO_2 concentrations in the inhaled air (FIO_2 and $FICO_2$) and exhaled air (FEO_2 and $FECO_2$), respectively, and the inhaled (VI) and exhaled (VE) lung volumes of air per minute [2,3].

While the software acquired with the calorimeter provides all results, understanding how the calculations from which the values of V_{o2}, V_{co2} and Resting Energy Expenditure (REE) are obtained could be challenging even for experts in this field. Therefore, this report shows how the data provided by the calorimeter could be used to compute those values, since the establishment of steady state conditions, once seldom papers clearly demonstrate it.

Materials and Methods

Subject

A 34 years-old healthy female volunteer, BMI 18.7 kg/m^2, with

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