

# Persistent Hypermetabolism and Longitudinal Energy Expenditure in Critically Ill Patients with COVID-19

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## Introduction:

A hallmark of severe COVID-19 infection is respiratory failure, prolonged systemic inflammatory response syndrome (SIRS) and subsequent mechanical respiratory support. Data on energy expenditure (EE) beyond 7-10 days for this patient population is unknown. Information on EE is necessary for optimal nutritional support and improved outcomes. The objective of this study was to assess longitudinal measured resting energy expenditure (mREE) via indirect calorimetry (IC) in intubated COVID-19 patients.

## Methods:

Data was collected from March through May, 2020. IC was conducted every 72 hours on stable intubated COVID-19 patients for up to 21 days. For validity, steady state had to be achieved for at least 20 minutes. IC measurements were compared to Harris Benedict equations (HBE). For calculations, actual body weight (ABW) was used for non-obese individuals (BMI < 30) and both actual and adjusted body weight (AdjBW) was used for subjects with BMI ≥ 30 (obese).

## Results:

Data was assessed from 22 ICU patients who tested positive for COVID-19. The average age was 58 years old with 59% male, 54% African American/Black, 32% Caucasian/White and 14% Hispanic. Mean BMI was 30.8 and 55% of patients had a BMI ≥ 30. During the 21-day study period, average ventilator days were 14.4 and mortality was 14%.

Prone positioning was used in 2.4-8.6% of patients. Paralysis with a neuromuscular blocking agent was used in 1.7–8% and average SOFA score ranged from 9 to 9.5 during the 21-day period.

### Observed Energy Expenditure Data:

Median mREE in kcal/day	Days 0-7	Days 7-14	Days 14-21	p value
All Patients (kcal/day)	1568	1830	2789	<0.05
Median mREE in kcal/kg/day				
ABW non obese	19.2	26	29	<0.05
ABW obese	17.5	21	31.5	<0.05
AdjBW Obese	20	26.3	32.5	<0.05
ABW All Patients	19	26	30.4	<0.05

ABW: Actual Body Weight; AdjBW: Adjusted Body Weight mREE: measured Resting Energy Expenditure

This data represents a progressive hypermetabolic phenotype that is typical after one week of intubation. Standard predictive equation of approximately 20 kcal/kg is a reasonable approximation for the first week ICU stay in COVID 19 patients, with mREE increasing up to 32.5 kcal/kg/day in the weeks thereafter.

## Discussion:

The COVID-19 metabolic phenotype may be unique from other previously described ICU models of metabolic response. The hypermetabolism noted is prolonged and seemingly independent of organ failure.

## Conclusion:

There is progressive hypermetabolism and considerable variation in mREE in the critically ill COVID 19 patient. In an effort to provide more accurate energy assessment and nutrition delivery guidance in care of the critically ill COVID-19 patient, it is suggested that personalization of nutrition care be instituted, including the use of IC.

Study Summary Prepared by Nestlé Health Science.

The complete study can be accessed at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7521195/>