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ORIGINAL ARTICLE

# Impact of high fat low carbohydrate enteral feeding on weaning from mechanical ventilation



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## KEYWORDS

Respiratory failure;  
Nutritional support;  
Mechanical ventilation

**Abstract** *Introduction:* Diet can affect the outcome of mechanical ventilation in patients with chronic respiratory failure.

*Aim of the work:* To compare the effect of a high fat, low carbohydrate enteral feeding to a standard iso-caloric enteral feeding on arterial carbon dioxide tension and ventilation time in patients with type II respiratory failure secondary to pulmonary disease requiring mechanical ventilation.

*Subjects and methods:* One hundred patients with type II respiratory failure secondary to pulmonary disease requiring mechanical ventilation who could be enterally fed in the respiratory intensive care unit of Ain Shams University Hospitals were enrolled in this study. They were divided randomly into:

Group A: included fifty patients who received standard iso-caloric feeding with carbohydrates (53.3%), fats (30%) and proteins (16.7%).

Group B: included fifty patients who received iso-caloric high fat low carbohydrate feeding with carbohydrates (28.1%), fats (55.2%) and proteins (16.7%) also through the Ryle tube.

*Results:* Group B had 16% decrease in arterial carbon dioxide tension, 8% decrease in the minute volume at weaning, and spent on average 62 h less on mechanical ventilation.

*Conclusion:* A nutritional regimen with a high fat content may reduce ventilatory requirements and therefore reduce the duration of mechanical ventilation.

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## Introduction

The relationship between pulmonary diseases and nutrition is significant. Malnutrition and its associated adverse pulmonary

effects can directly affect outcomes in the individual with pulmonary disease. The use of nutrition support is common for these patients as a supportive or therapeutic measure [1].

Recent nutrition surveys in hospitals continue to suggest that 40–50% of patients, particularly those in the intensive care unit, have a moderate degree of malnutrition [2].

Nutritional support is essential for mechanically ventilated patients to meet their energy requirements and to maintain or

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even to enhance their muscle strength for facilitating ventilator weaning [3].

Carbon dioxide production may be determined in part by the composition of enteral or parenteral nutrition, which in turn may affect the weaning process [4].

Published reports of respiratory failure precipitated by high carbohydrate feeding have drawn attention to the carbohydrate and fat content of the patient's diet. In patients with chronic or acute retention of carbon dioxide (Hypercapnia), one goal of dietary therapy is to decrease carbon dioxide production. High carbon dioxide production can precipitate acute respiratory failure in patients with chronic pulmonary disease and can complicate weaning in ventilator dependent patients. Because the complete combustion of fat yields less carbon dioxide than combustion of either carbohydrate or protein, a high fat diet may be preferable for patients with pulmonary disease [5].

### Aim of the work

The aim of this work is to compare the effect of a high fat, low carbohydrate enteral feeding to a standard isocaloric enteral feeding on arterial carbon dioxide tension and ventilation time in patients with type II respiratory failure secondary to pulmonary disease requiring mechanical ventilation.

### Subjects and methods

This study took place in Ain Shams University Hospitals in the period from October 2006 till September 2009.

One hundred patients with type II respiratory failure secondary to pulmonary disease requiring mechanical ventilation who could be enterally fed in the respiratory intensive care unit of Ain Shams University Hospitals were enrolled in this study.

The patients were randomly allocated into two groups:

Group A: included fifty patients who received standard isocaloric feeding with carbohydrates (53.3%), fats (30%) and proteins (16.7%) through Ryle tube according to W.H.O. September 1998.

Group B: included fifty patients who received iso-caloric high fat low carbohydrate feeding with carbohydrates (28.1%), fats (55.2%) and proteins (16.7%) also through Ryle tube.

The diagnosis of respiratory failure type II secondary to pulmonary disease was made on clinical and radiological basis and mechanical ventilation was initiated according to American thoracic society criteria 2004 [6].

On admission data were collected as regards:

- Age,
- Residence,
- Occupation,
- Smoking history,
- History of cardiac, liver, renal, thyroid or gastrointestinal disease,
- History of alcoholism, drug addiction, malignancy or tuberculosis,
- History of the respiratory illness.

Thorough clinical examination was performed.

The following investigations were done:

- (1) Fasting and two hours postprandial blood sugar.
- (2) Serum creatinine, blood urea nitrogen.
- (3) Serum SGOT, SGPT, total bilirubin, direct bilirubin and total proteins.
- (4) Prothrombin time and partial thromboplastin time.
- (5) Complete blood picture with a differential white blood cell count.
- (6) Erythrocyte sedimentation rate.
- (7) Baseline arterial blood gases.
- (8) Chest-X-ray.
- (9) Electrocardiography.

Patients were assessed using the simplified acute physiology score (SAPS II) system [7] which includes the following fifteen items:

- (1) Age in years.
- (2) Heart rate.
- (3) Systolic blood pressure in mmHg.
- (4) Arterial oxygen tension in mmHg/fraction of inspired oxygen.
- (5) Urinary output.
- (6) Body temperature in degree centigrade.
- (7) Blood urea nitrogen in mg/dl.
- (8) White blood cell count/mm<sup>3</sup>.
- (9) Serum potassium in mmol/dl.
- (10) Serum sodium in mmol/dl.
- (11) Serum bicarbonate level in meq/l.
- (12) Serum bilirubin in mg/dl.
- (13) Glasgow coma scale.
- (14) Chronic disease.
- (15) Type of admission.

All patients included in the study had SAPS II score less than 39.5 as this is the cutoff point below which patients have the same severity of illness and become more likely to survive during the period of mechanical ventilation till weaning [8].

Patients were excluded from the study if they were found to have Diabetes mellitus, Nephrotic syndrome, Hepatic failure and Malabsorption syndrome.

The study was given ethical approval by the chest department of Ain Shams University Hospitals.

### Nutrition

The feeding regimen was only commenced after a stable ventilatory state had been achieved at which patient was hemodynamically stable and did not require change of ventilator y parameters till weaning. Water was administered via a Ryle tube for 12 h before commencing the enteral feed in order to avoid gastric distention, vomiting and sepsis as patients were given muscle relaxant at the start of mechanical ventilation.

Patients were then allocated randomly into two groups to receive:

- (1) The standard iso-caloric feed according to W.H.O. 1998 that supplies 4300 kcal. which included the following daily aliquots per patient:

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