Resting energy expenditure and nutrition status clinical assessment in children with moderate to severe Crohn’s disease treated of total enteral nutrition

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Abstract

Growth retardation and malnutrition is a very common complication of Crohn’s disease (CD) in children, while the role of resting energy expenditure (REE) for malnutrition is unclear in paediatric CD. Total enteral nutrition (TEN) with a liquid formula can suppress gut inflammation, induce remission and improved growth in active CD. The aim of this study was to assess the REE and to characterize the nutrition status before and after 6 weeks TEN in children with moderate to severe CD. We selected 20 children with at least moderately active disease (Pediatric Crohn’s disease activity index > 30). Nutritional status was assessed for height, weight, and lean body mass, and REE was measured with indirect calorimetry. REE assessed after an overnight fast was significantly higher in CD patients than in controls when related to body mass (p < 0.05) and lean body mass (p < 0.05). Analysis showed the significant increase the REE over the six weeks of TEN when related to body mass (33.8 ±/− 6.8 and 35.5 ±/− 5.6; p < 0.05). We concluded that TEN seems to be an effective treatment for active CD which may have both an important effect in suppressing bowel inflammation and prevent disease relapse.

Key words: malnutrition in children, resting energy expenditure, total enteral nutrition

Introduction

Growth retardation and malnutrition is a very common complication of Crohn’s disease (CD) in children. Active CD can be effectively treated by providing all of the patient’s nutritional requirements in the form of a nutritionally balanced liquid formula [3, 6]. Such total enteral nutrition (TEN) with a liquid formula can suppress gut inflammation and induce remission in active CD. This treatment does not merely alleviate symptoms and enhance the patient’s nutritional status, but it is also clear that it actually suppresses intestinal inflammation and can even prevent relapse [1, 4, 7]. The mechanism of action is unknown [8]. TEN is frequently used in children with CD because excessive corticosteroid usage can suppress growth and growth impairment is very common in pediatric CD, even without corticosteroid usage [2, 5].

The aim of the study

The aim of this study was to assess the REE and to characterize the nutrition status before and after 6 weeks TEN in children with moderate to severe CD.

Patients and methods

Twenty children with CD were recruited from the Children’s Memorial Health Institute, Warsaw. They all had at least moderately active disease with Pediatric Crohn’s disease activity index (PCDAI) > 30. All patients were placed on an total enteral nutrition regiment with Nutrison Standard (Nutricia) in hospital and next at home. TEN was continue 6 weeks, each infused 1400–2200 ml. This provided approximately 50 kcal/kg/day. Only clear water were allowed orally.

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for this 6 weeks period. Each child was assessed at the time of recruitment and after six weeks of TEN (14 children), or sooner if withdrawn early from the study (6 children). Together with clinical assessment, anthropometric measurements (weight, height, lean body mass) were obtained, and PCDAI was determined. Laboratory blood investigations included full blood count and platelets, erythrocyte sedimentation rate (ESR), C reactive protein (CRP), and serum albumin. Lean body mass (LBM) is an estimation of how much one weigh without the body fat - how much the bones, organs and muscles weigh. As the other factors are assumed to be relatively static, by monitoring LBM one can get a fairly accurate estimate of the amount of muscle he or she is gaining or losing.

Additionally REE (indirect calorimetry) were measured twice, before therapy and after 6 weeks (14 patients). Patients were withdrawn from their allocated treatment if there were persistent severe symptoms, if they had not experienced a marked improvement in symptoms after three weeks, or if the patient and/or family asked to withdraw. Six patients were withdrawn (4 – treatment failure, 2 – patients request). The control group consisted of 18 healthy children, aged 15.1 ±1.8 years.

**Power calculation and data analysis**

The primary end point was the proportion achieving remission with the assigned treatment. Remission was defined as a PCDAI <10 at the time of finishing TEN. Secondary analyses were performed on changes in anthropometry, PCDAI subscores, and blood indices to explore the possible mechanisms of action of the two treatments. No end point analyses were performed other than those presented. All outcome analysis was based on “intention to treat”.

**Results**

*Resting energy expenditure (REE)*

REE assessed after an overnight fast was significantly higher in CD patients than in controls when related to body mass (33.8±6.7 and 28.1±1.4 kcal/kg, respectively; p < 0.05) and LBM (40.3±6.4 and 33.8±3.3 kcal/kg, respectively; p<0.05). Analysis showed the significant increase in REE over the six weeks of TEN (Fig. 1) when related to body mass (33.8±6.8 and 35.5±5.6; p<0.05).

**PCDAI response to the interventions**

Based on intention to treat analysis, remission (PCDAI<10) was achieved in 40% of patients. There was a significant reduction in PCDAI at the time of finishing TEN (p<0.001 for each).

**Analysis of specific changes**

To explore the factors responsible for reductions in PCDAI, changes in individual PCDAI clinical symptom parameters in our group were examined. Analysis of the PCDAI symptom subscores showed a significant reduction in abdominal pain, an improvement in “well being” and reduction in diarrhea. The anthropometric changes in our patients were also analyzed. We obtained a significant increase in weight, weight for height and LBM (p<0.05). Change in nutrition parameters after 6 weeks TEN were respectively weight (kg) +5.7; weight for height +0.6; LBM (kg) +4.8. The various laboratory indices were compared as objective indicators of disease activity. We recorded significant rise in haemoglobin, erythrocytes and significant reduction in platelet and CRP. No significant change in ESR and albumin were observed. Table 1 presents changes of specific parameters.

**Discussion**

Children with CD are particularly susceptible to malnutrition which can lead to reduced respiratory muscle strength, increased risk of infection, poor wound healing and impaired normal body function. Other common complication
is growth retardation and elevated REE. REE is the amount
of calories required for a 24-hour period by the body dur-
ingen a non-active period and is useful to prevent under and
overfeeding of individuals, especially in the acute care hos-
pital setting. In our study we analyzed effects of using TEN
due to assess its influence on nutritional and energy status
of patients with CD. In order to obtain objective results, REE
were measured indirectly with a metabolic cart and was
compared with healthy controls. Our analysis showed that
during 6 weeks lasting refeeding, there was an increase in
REE, which is consistent with studies of other investigators.
In this study we also associated conventional TEN
with a significantly high remission rate (40%). It led to a
reduction in PCDAI – significant reduction in diarrhea,
abdominal pain, an improvement in “well being” were ob-
served. Moreover, TEN was associated with a significant
rise in haemoglobin and erythrocytes as well as reduction in
platelet and CRP. No changes occurred in ESR and albumin.
Our report has proved a common perception that nutritional
supplementation may have both an important effect in sup-
pressing bowel inflammation and prevent disease relapse [4].
It seems, therefore that TEN is an effective treatment for ac-
tive CD but unfortunately adherence to this method is often
difficult, and the treatment may have significant psychosocial
consequences for both child and family. While most children
accept TEN at first presentation, some may be reluctant to
receive repeated courses of treatment when relapses occur,
and most eventually receive corticosteroid therapy.

Acknowledgements
This manuscript was supported by the project 3248/B/
P01/2007/33 financed by Polish Ministry of Sciences and
Higher Education.

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