Annals of Clinical and Medical Case Reports

ISSN 2639-8109

Case Report

Resting Energy Expenditure in Anorexia Nervosa: A Case Report in Two Monozygotic Twins

Delsoglio M, Djaafar S and Pichard C*

Geneva University Hospital, Unit of Clinical Nutrition, Rue Gabrielle Perret-Gentil 4, 1205 Geneva, Switzerland

Volume 3 Issue 3- 2020

Received Date: 18 Feb 2020

Accepted Date: 15 Mar 2020

Published Date: 21 Mar 2020

2. Key words

Energy expenditure; Fat mass; Fat-free mass; Anorexia nervosa; Monozygotic twins

1. Abstract

1.1. Introduction: Little is known about resting energy expenditure (REE) in patients with anorexia nervosa (AN) during refeeding and after recovery, due to the metabolic, body composition and physical activity changes.

1.2. Methods: We present the case of a young female AN patient followed for 6-months during refeeding and her monozygotic twin sister, currently healthy after having recovered from anorexia nervosa 5 years ago. We measured their (mREE) and respiratory quotient by indirect calorimetry, and their body composition by bio- impedance analysis.

1.3. Results: After 6 months refeeding the AN patient gained 4.6 kg of fat mass (FM) and lost 3.3 kg of fat-free mass (FFM), resulting in no weight gain and a decrease of mREE compared to the baseline. Her twin sister showed a progressive increase of both FFM (2 kg) and FM (1.5 kg), however her mREE stayed unchanged and lower than predicted.

1.4. Conclusion: This case highlights the negative impact of hyperactivity on body weight control during the treatment of AN and calls the attention to the association between fat-free mass and REE in former AN patients. The atypical low mREE we assessed, implies the role of other factors than fat-free mass in determining energy expenditure, and underlines the importance of measuring it to accurately define the individual caloric requirements.

3. Introduction

Anorexia nervosa (AN) is characterized by restricted energy intake, an intense fear of gaining weight and disturbed body image. Severe food restriction causes changes in energy metabolism and body composition, with a loss of both fat mass and fat-free mass, the latter being one of the major determinants of resting energy expenditure (REE) [1]. Patients diagnosed with AN have been shown lower REE compared to individuals with normal body weight or constitutionally thin [2, 3]. However, after weight restoration, REE of recovered-anorexic patients was found to be comparable to those of control subjects [4].

This case reports the evolution of REE and body composition in a young AN patient after 3 and 6 months of refeeding, as well as the relationships between these parameters, compared to those of her monozygotic twin sister, currently healthy after having recovered from AN.

4. Materials & Methods

A 27-year old woman was admitted to the psychiatric day hospital for an evaluation and was diagnosed with a restrictive type AN. Her body weight was 39.5 kg, with a body mass index (BMI) of 15.4 kg/m2, and a weight loss of 6 kg in the last 10 months. The patient presented amenorrhea, a pronounced body image disorder and a relatively intense physical activity (2 to 3 hours walking per day).

During teenage years, a previous medical care to restore her weight resulted unsuccessful, because of an absence of a concomitant psycho-behavioral therapy.

The patient was submitted to a multidisciplinary psychiatric and psychotherapeutic outpatient care, individually and in group, for one year. It was found that, this anorexia was part of a global complex of anxio-depressive disorder, focused in particular on her professional environment. The patient took part in the treatment program for 6 months. The AN patient has a monozygotic twin sister,

***Corresponding Author (s):** Claude Pichard, Head, Clinical Nutrition, Geneva University Hospital, Rue Gabrielle-Perret-Gentil 4, 1211 Geneva, Switzerland, Tel: +41 (0)22 372 9345; Fax: +41 (0)22 372 9363, E-mail: Claude.Pichard@unige.ch*

Citation: Pichard C, Resting Energy Expenditure in Anorexia Nervosa: A Case Report in Two Monozygotic Twins. Annals of Clinical and Medical Case Reports. 2020; 3(3): 1-3.

who suffered of AN between the ages of 13 and 23 years old. The twin sister is currently healthy and has an active lifestyle. During the 6 months we followed them up, she intensified the amounts and types of physical exercise and increased energy intakes from 1800 kcal/d to 2500 kcal/d. We measured their REE by indirect calorimetry (Q-NRG®, Cosmed, Italy), and their body composition using 50 kHz tetrapolar bioelectrical impedance analysis (Nutriguard®, Data Input, Germany) one week, three and six months after the AN patient started refeeding.

5. Results

Twins' body characteristics and body composition during the 6 months follow-up are shown in Table 1.

After 3 months refeeding, the AN patient gained 2.2 kg of fat mass and lost 0.7 kg of fat-free mass. After 6 months, she gained 4.6 kg of fat mass and lost 3.3 kg of fat-free mass compared to the baseline. The twin sister showed a progressive increase of both fat-free mass (2 kg) and fat mass (1.5 kg) in 6 months, reflecting the increment of physical activity and energy intake.

REE measured by indirect calorimetry (mREE) and predicted by the Harris-Benedict formula (pREE) are presented in Table 2.

Table 1. Body characteristics and composition measured by bioelectrical impedance analysis.

	AN patient			Twin sister		
Follow-up, months	0	3	6	0	3	6
Body weight, kg	39.2	40.7	40.2	52.2	53.3	55.7
BMI, kg/m²	15.4	15.7	15.5	19.4	19.8	20.7
Fat mass, kg	2.6	4.8	7.2	12.2	12.5	13.7
Fat-free mass, kg	36.6	35.9	33	40	40.8	42

Table 2. Energy expenditure measurements.

	AN patient			Twin sister		
Follow-up, months	0	3	6	0	3	6
pREE (kcal/d)	1209	1216	1197	1329	1334	1349
mREE (kcal/d)	927	949	875	1110	1141	1180
mREE/kg (kcal/kg/d)	23.6	23.3	21.8	21.3	21.4	21.2
mREE/Fat-free mass (kcal/kg/d)	25.3	26.4	26.5	27.8	28.8	28.1
Respiratory quotient	0.86	0.80	0.76	0.74	0.74	0.74

The AN patient's mREE increased of 22 Kcal/d after 3 months refeeding compared to the baseline, but decreased of 74 Kcal/d after 6 months, as consequence of fat-free mass loss. As expected, her mREE was lower than predicted by the Harris-Benedict formula (76%, mean difference 290±28 Kcal/d) and to her twin sister's (mean difference 227±68 Kcal/d). Interestingly, her twin sister's mREE was lower than predicted (85%, mean difference 198±37Kcal/d) and despite the gain of fat-free mass during the 6 months, it did not differ much com- pared to the baseline.

6. Discussion

Similarly to previous investigations [5, 6], our case showed that the AN patient's mREE was lower than predicted. After 3 months refeeding, she gained 2.2kg of fat mass, but no changes in fat-free mass were observed, resulting in unmodified mREE. On the contrary, the loss of fat-free mass after 6 months refeeding lead to a decrease in mREE. Despite the refeeding program, the patient showed no weight gain, probably due to the hyperactivity that we were not able to control. Physical activity during the course of AN has been reported an important modulator of body composition restoration. Available data suggest that maintained hyperactivity is an indicator of poor outcome and can impair weight gain, while programmed and personalized physical activity can be beneficial for the restoration of body composition [7, 8].

Different studies reported a similar respiratory quotient in AN patients and healthy controls, however we measured a higher respiratory quotient in the patient during the first months. This may be explained as consequence of the refeeding, which implies a replenishment of glycogen stores and a reduction in fat catabolism [9, 10].

A REE similar to predicted and to healthy controls was described in recovered AN, mainly due to weight and fat-free mass restore [11]. Surprisingly, our case evidenced that mREE in the twin sister was 85% predicted. A possible explanation could be a still active suppression of energy expenditure in response to the past physiologic adaptation to energy restriction, or the role of other factors than fat-free mass in the determination of her REE. Among the factors known to modify the REE, heredity may explain the low REE we measured. The influence of genetic factors on resting metabolic rate has been studied in obese twins' pairs and a significant level of resemblance in energy expenditure was reported in individuals genetically related by descent [12, 13]. This case report is unique so far as, up to now, REE in anorexic twins' sisters has been unexplored. Contrary to other studies, it outlines a lower energy expenditure in the former AN subject rather than similar to predicted, implying the effect of a down-regulating undetermined factor.

7. Conclusion

This case highlights the negative impact of hyperactivity on body weight control during the treatment of AN. A personalized physical activity program, combined to refeeding, should be considered to promote the restoration of body composition in AN patients. This case also calls the attention to the association between fat-free mass and REE in former AN patients. The atypical low mREE

we assessed, implies the role of other factors than fat-free mass in determining energy expenditure, and underlines the importance of measuring it to accurately define the individual caloric requirements.

References

1. Dellava JE, Policastro P, Hoffman DJ. Energy metabolism and body composition in long-term recovery from anorexia nervosa. Int J Eat Disord. 2009; 42(5):415-21;10.
2. Kosmiski L, Schmiege SJ, Mascolo M, Gaudiani J, Mehler PS. Chronic starvation secondary to anorexia nervosa is associated with an adaptive suppression of resting energy expenditure. J Clin Endocrinol Metab. 2014; 99(3): 908-14; 10.
3. Bossu C, Galusca B, Normand S, Germain N, Collet P, Frere D, et al. Energy expenditure adjusted for body composition differentiates constitutional thinness from both normal subjects and anorexia nervosa. Am J Physiol Endocrinol Metab. 2007; 292(1): E132-7;10.
4. Platte P, Pirke KM, Trimborn P, Pietsch K, Krieg JC, Fichter MM. Resting metabolic rate and total energy expenditure in acute and weight recovered patients with anorexia nervosa and in healthy young women. Int J Eat Disord. 1994; 16(1): 45-52; 10.
5. Cuerda C, Ruiz A, Velasco C, Breton I, Camblor M, Garcia-Peris P. How accurate are predictive formulas calculating energy expenditure in adolescent patients with anorexia nervosa? Clin Nutr. 2007; 26(1): 100-6; 10.
6. El Ghoch M, Alberti M, Capelli C, Calugi S, Dalle Grave R. Resting Energy Expenditure in Anorexia Nervosa: Measured versus Estimated. J Nutr Metab. 2012; 2012: 652932; 10.
7. Achamrah N, Coeffier M, Dechelotte P. Physical activity in patients with anorexia nervosa. Nutr Rev. 2016; 74(5): 301-11;10.
8. Blinder BJ, Freeman DMA, Stunkard AJ. Behavior Therapy of Anorexia Nervosa . Effectiveness of Activity as a Reinforcer of Weight Gain. Am J Psychiat. 1970; 126(8): 1093-&.
9. Winter TA, O'Keefe SJ, Callanan M, Marks T. The effect of severe undernutrition and subsequent refeeding on whole-body metabolism and protein synthesis in human subjects. JPEN-Parenter Enter. 2005; 29(4): 221-8.
10. Vaisman N, Rossi MF, Corey M, Clarke R, Goldberg E, Pencharz PB. Effect of Refeeding on the Energy-Metabolism of Adolescent Girls Who Have Anorexia-Nervosa. European Journal of Clinical Nutrition. 1991; 45(11):527-37.
11. Van Wymelbeke V, Brondel L, Marcel Brun J, Rigaud D. Factors associated with the increase in resting energy expenditure during refeeding in malnourished anorexia nervosa patients. Am J Clin Nutr. 2004; 80(6): 1469-77; 10.
12. Fontaine E, Savard R, Tremblay A, Despres JP, Poehlman E, Bouchard C. Resting metabolic rate in monozygotic and dizygotic twins. Acta Genet Med Gemellol (Roma). 1985; 34(1-2): 41-7;10.
13. Bouchard C, Tremblay A, Nadeau A, Despres JP, Theriault G, Boulay MR, et al. Genetic effect in resting and exercise metabolic rates. Metabolism. 1989; 38(4): 364-70; 10.