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CASO CLÍNICO

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NUTRITIONAL ASPECTS IN THE GRAVES' DISEASE: CASE REPORT

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ABSTRACT

IIntroduction: An increased basal metabolism rate and hyperphagia associated with weight loss are among the main clinical manifestations of hyperthyroidism. However, few literature reports are available regarding the adequacy of calorie consumption based on the energy expenditure of the patient. Case Report: A 24-year-old male patient (weight 61.5 kg, height 1.78 m) with a diagnosis of hyperthyroidism due to Graves' disease and initial hormone values consistent with this disease (free T3=17,6 pg/ml; free T4>6,0 ng/dl; TSH<0,004 IU/ml). Indirect calorimetry was performed in order to estimate real energy expenditure and adequacy of the nutritional conducts adopted during hospitalization. The patient had a resting energy expenditure of 2574 kcal. Conclusion: The present study suggests that the measurement of energy expenditure by indirect calorimetry is an important tool for the evaluation of the energy requirements and diet adequacy of a patient with thyrotoxicosis due to Graves' disease.

Key words: Graves' disease, hypermetabolism, energy expenditure, indirect calorimetry, hyperphagia.

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INTRODUCTION

Graves' disease (GD) is the most common cause of hyperthyroidism and the most common autoimmune disorder in the United States (1). This disease is a common autoimmune cause of hyperthyroidism in which the thyroid gland undergoes lymphocyte infiltration, with an elevation in circulating T lymphocytes and the occurrence of autoantibodies that bind to the TSH receptor (TRAb), with consequent stimulation of gland growth and function (2).

Graves' disease (GD) is characterized by diffuse goiter, thyrotoxicosis, and some organ-specific manifestations including Graves' ophthalmopathy and Graves' dermopathy. Although the production of thyroid-stimulating hormone (TSH) receptor antibodies is thought to be a crucial underlying etiology for this immunological process, the exact etiology of GD is still unknown (3).

The possible factors that trigger this autoimmune process are: genetic susceptibility, constitutional factors (sex hormones and alteration of immunological function), and environmental factors (stress, iodine ingestion, action of infectious agents, low birth weight, selenium deficiency). Genetic predisposition is most likely due to a complex interaction between the several genetic changes and environmental factors. Recent studies have proposed the role of genetic factors to account for 80% of predisposition (4).

Increased basal metabolism is one of the main clinical changes occurring in this disorder, involving increased glucose and lipid oxidation and O_2 consumption. In addition to these changes, there is elevation of protein catabolism which impairs the entire economy of the organism. Clinically, the presence of these changes causes a marked weight loss with a significant reduction of muscle mass and fat mass. In contrast to individuals with consumptive diseases such as neoplasias and infections, patients with thyrotoxicosis present hyperphagia. Notwithstanding this adaptation, the patients are unable to satisfy their energy requirements adequately. Unfortunately, this aspect of the patient care is not objectively evaluated and usually the prescribed diet does not match the patient requirement. The increase in energy intake tends to normalize during treatment with an anti-thyroid agent and an anabolic state starts to appear in association with the decrease in energy expenditure (5).

Considering the treatment, medications or radioactive iodine ablation are generally used, with total thyroidectomy serving as a third-tier approach. Surgical procedures generally include subtotal thyroidectomy, a near-total thyroidectomy, or total thyroidectomy (6). Risks of permanent recurrent laryngeal nerve palsy and permanent hypoparathyroidism are similar in patients who undergo total thyroidectomy versus those who undergo subtotal thyroidectomy. Total thyroidectomy, however, also allows for elimination of all abnormal tissue in the neck and lower recurrence rates for Graves' disease (7).

On this basis, considering that many of these patients are in a state of nutritional risk or undernutrition and that few studies are available in the literature about the nutritional approach used in this disease, the objective of the present case report was to elucidate nutritional aspects such as weight evolution, energy expenditure, appetite, and sensations of hunger and satiety involved in Graves' disease.

CASE REPORT

A 24-year-old male patient, a single mulatto man from Cravinhos, SP, came to the Emergency Service of the University Hospital, Faculty of Medicine of Ribeirao Preto, USP, on 20/05/05, in a condition of thyrotoxic crisis. He then started to receive medical assistance from the Division of Endocrinology and Metabolism of the Medical Center, Faculty of Medicine of Ribeirao Preto, USP.

On the occasion of his third admission to the hospital and considering the symptoms characteristic of Graves' disease, the patient presented, weight loss, nervousness, heat intolerance, fatigue, hand tremors, palpitation, muscle weakness, excessive sudoresis, pruritus, shortness of breath, hyperdefecation, insomnia, restlessness, and emotional lability.

The most outstanding features detected by nutritional physical examination were exophthalmia, atrophy of upper and lower limb muscles, and excavated abdomen. Biochemical exams only revealed reduction of hemoglobin (Hb = 11 g/dl) and hematocrit (Ht = 34.4%) (table 1). In agreement with the clinical picture, thyroid

TABLE 1

Biochemical tests performed during hospitalization.

	30/03/07	02/04/07	09/04/07	20/04/07	01/05/07	Reference Values
Red blood cells	4,49	4,89	4,96	4,78	-	4,3 – 5,7.10^6 /μ L
Hemoglobin	11,0	12,0	12,1	11,6	-	13,5 – 17,5 g/dl
Hematocrit	34,4	37,4	38,6	36,8	-	39 – 50 L
White blood cells	4,3	7,4	12,9	13,0	-	3,5 – 10,5 . 10^3 /μ L
Platelets	136	141	147	154	-	150.000 – 450.000
Glucose	-	74	71	-	-	70 – 100 mg/dl
Creatinine	0,4	0,5	0,4	0,5	0,7	0,7 – 1,5 mg/dl
Urea	26	36	26	16	44	10 – 50 mg/dl
Sodium	138	140	137	136	134	135 – 145 mmol/L
Potassium	4,0	4,2	4,1	3,7	5,9	3,5 – 5,0 mmol/ L
Total Calcium	10,3	-	-	-	-	8,4 – 10,5 mg/ dl
Albumin	4,1	-	-	-	-	3,5 – 4,8 g/dl
ALT	25	-	-	-	-	Até 41 U/L
AST	29	-	-	-	-	Até 38 U/L

function data revealed significant elevation of thyroid hormones and suppression of TSH levels (table 2). The creatinine/height ratio was also calculated for the evaluation of muscle mass, revealing 98% muscle adequacy, corresponding to eutrophy.

During hospitalization, changes in weight were detected with a tendency to weight gain (figure 1). The remaining anthropometric parameters were evaluated on two different occasions and are listed in Table 3. Analysis of body composition was performed when the patient had shown a 4.8% weight gain leading to a weight of 65 kg. The results of bioelectric impedance were: 83% lean mass (54.7 kg), 17% fat mass (10.3 kg) and 61% total body water (41.1 kg). Dietary evaluation revealed expressive food intake characterized by a large volume especially during the main meals, with a predominant use of products of high energy density. During hospitalization, the patient received a high-protein, high-calorie and low-sodium (1 g salt/meal) diet and a nutritional supplement by the oral route in a volume of 300 ml at three different times of day, for a total of 4050 kcal/day, with 535 g (52.8%) carbohydrates, 161 g (15.9%) protein and 137.3 g (30.5%) lipids.

The energy requirements of the patient were first estimated using the Harris Benedict equation (8) which considers the variables weight, height and age. The equation permitted the calculation of a basal energy expenditure of 1636 kcal and of a total energy expenditure in the range of 2145 to 3300 kcal, according to the addition of the injury factor suggested of 1.3 to 2.0.9 However, the patient repeatedly complained of increased appetite and the need to increase his energy supply.

On this basis, we opted to perform indirect calorimetry in order to determine the real energy expenditure in this situation of hypermetabolism, with a resting energy expenditure of 2574 kcal being obtained. By adding the injury factor suggested in the literature for Graves' disease (9) was obtained a 3345 to 5150 kcal. After this

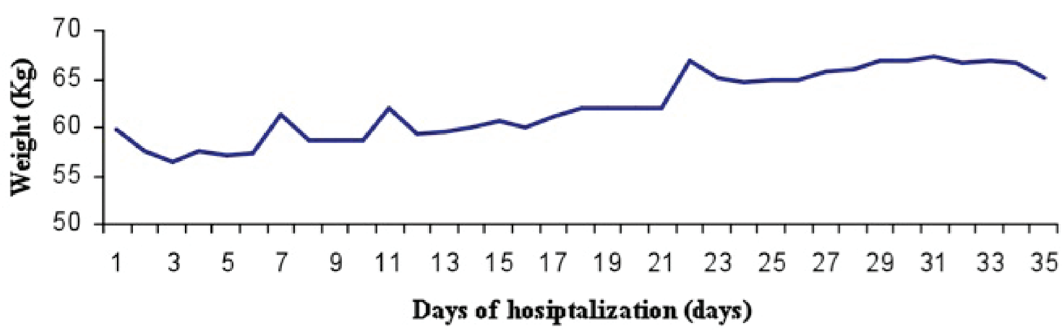
TABLE 2

Biochemical values related to thyroid function.

	22/03/07	11/04/07	20/04/07	03/05/07	Reference Values
Free T_3 pg/ml	17.6	2.2	2.9	9.1	1.5 – 4.1 pg/ml
Free T_4 ng/dl	>6.0	1.9	1.0	5.9	0.7 – 1.7 ng/dl
TSH IU/ml	<0.004	<0.004	0.006	<0.004	0.3 – 4.0 IU/ml

FIGURE 1

Weight evolution during 35 days of hospitalization.



exam, the energy supply was adjusted in order to satisfy the maximum energy expenditure of the patient and thus to contribute to weight gain.

The patient stayed in the hospital for 35 days for compensation of his signs and symptoms, followed by treatment with radioactive iodine with the Endocrinology staff of this Hospital and the nutritional counseling was completed.

DISCUSSION

There is great interest in the study of the etiopathogeny of Graves' disease, in which nutritional factors are involved. A relevant point is that maternal prenatal undernutrition, a condition detected in the medical history of the present patient, is associated with lower thymus and spleen weight that may cause early maturation of the thymus resulting in a decline of suppressor T cells (10). Another aspect is related to excessive exposure to iodine since some food industries still practice excessive iodination of their products even after the implementation of the policy of salt iodination (11).

Nutrition team gave priority to three points for a definition of the nutritional conduct during his hospitalization: 1) defining and satisfying the requirements for macro- and micronutrients, 2) minimizing the sensation of hunger, and 3) obtaining a recovery of nutritional status.

The estimate of energy expenditure is the starting point for the definition of the nutritional requirements and can be obtained by indirect calorimetry or can be estimated with predictive equations. The Harris-Benedict equation estimates the resting expenditure with a precision of ±10% in 80% to 90% of normal individuals (12). The recommendation to use correction factors does not improve the predictive power and frequently causes an under- or overestimated. In addition, in the case of Graves' disease, the wide range of this factor (1.3 to 2.0) hampers an individualized nutritional treatment. Thus, when using a predictive equation, it is important to know whether the equation predicts the basal expenditure, under resting conditions or total, the population from which the equation was obtained, and the factors that alter its predictive capacity (13).

Another method that can be used for this estimate is indirect calorimetry, which is much more precise than calculations based on mathematical equations. However, indirect calorimetry must be performed under rigorous conditions: the individual must be in an environment with controlled temperature of about 23 °C and should be evaluated 8 to 12 hours after food ingestion and the practice of physical activity, at rest and awake (14). All of these criteria were obeyed in the present case. Even though it is a cumbersome exam difficult to be applied on a large scale basis, it became possible to elucidate and quantitate the real increase of expenditure and thus to determine an adequate planning.

Usually, after this dietary plan, the patient continued with hunger and with difficulty in reaching satiety because some the activity of the sympathetic component is increased in hyperthyroidism. On this basis, the increase in sympathetic tonus and the decrease in tryptophan availability for serotonin synthesis by the brain may directly stimulate the ingestion of carbohydrates by activating postsynaptic adrenergic receptors in the brain of hyperthyroid patients (15).

So the main diet therapy adaptations introduced in order to reduced the hyperphagia of the present patient

TABLE 3

Anthropometric evolution of a patient with hyperthyroidism due to Graves' disease after 12 and 26 days of hospitalization.

Variables	1st Evaluation – 10/04/07		2nd Evaluation – 24/04/07	
	Adequacy	Classification	Adequacy	Classification
AC (cm)	21	Severe depletion	23	Moderate depletion
AMC (cm)	19.4	Moderate depletion	20.6	Moderate depletion
TSF (mm)	5	Severe depletion	7.5	Moderate depletion
WC (cm)	76.5	Absence of risk of complications	85.5	Absence of risk of complications

AC = arm circumference (cm); AMC = arm muscle circumference (cm);
TSF = tricipital skin fold (mm); WC = waist circumference (cm).

were: fractionation of the diet into 6 to 7 meals/day, use of high-calorie and high-protein meals with frequent monitoring by biochemical exams, and daily observation of diet ingestion and acceptance by the patient.

In general, weight loss is a very common clinical sign in Graves' disease. In most cases, the appetite of the patients does not increase in a manner sufficient to compensate for the enormous energy expenditure imposed by the disease, although the range of weight alteration is variable and depends on age (16).

Finally, the present study indicates that the possible nutritional changes occurring in hyperthyroidism due to Graves' disease should be targeted by early intervention and by studies of energy expenditure, protein requirements and changes in hunger. The calorimetry technique seems to be the most appropriate tool for the determination of the energy requirements of the patients. Further studies are needed to fully determine the contribution of adequate nutritional treatment to the evolution of these patients.

RESUMEN

Introducción: El aumento del metabolismo basal, hiperfagia asociada con pérdida de peso son algunas de las principales manifestaciones clínicas que ocurren en el hipertiroidismo. Sin embargo, hay pocos estudios disponibles acerca de la necessidad y del gasto energético del paciente. Caso clínico: Varón de 24 años de edad con 61,5 kg de peso y estatura de 1,78 m, con el diagnóstico de hipertiroidismo por enfermedad de Graves (T3 libre = 17,6 pg/ml; T4 livre >6,0 ng/dl; TSH <0,004 IU/ml) y con los siguientes síntomas: pérdida de peso, aumento de apetito y hiperactividad. La calorimetría indirecta se realizó para estimar el consumo energético real para definir la conduta nutricional durante la hospitalización. El gasto energético basal fue de 2574 kcal. Conclusión: El presente estudio sugiere que la medición del gasto energético por calorimetría indirecta es una herramienta importante para la evaluación de las necesidades de energía y la adecuación de la dieta de un paciente con tirotoxicosis por enfermedad de Graves. Se necesitan más estudios para determinar el impacto de esta conducta en la evaluación de la respuesta al tratamiento del hipertiroidismo.

Palabras clave: enfermedad de Graves, hipermetabolismo, gasto energético, calorimetría indirecta, hiperfagia.

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