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Understanding Obesity in Down's Syndrome Children

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Abstract

Introduction

Children and adolescents with Down's Syndrome have a higher risk for obesity. The recognition of physiological and behavioral factors that can increase this risk are crucial for developing personalized plans to approach each individual in order to avoid the gain of excess weight.

Discussion

The physiological factors that explain obesity in these individuals are hypothiroidism, decreased resting metabolic rate, increased leptin levels, masticatory dysfunction, short sature and low levels of lean body mass.

Conclusion

Proper exercise and balances diet are the key to achieve benefits in these individuals.

Keywords Down syndrome; Obesity; Pediatric population; Hypothyroidism

Introduction

Down's Syndrome (DS) is the most common aneuploidy known in humans, occurring 1 time for each 600 to 800 newborns. The average life expectancy of DS has been growing in the last decades, from 35 years to 60 years old nowadays [1-3]. This fact alone implicates in high costs for every health system, which is justified by a greater prevalence of comorbidities in this specific population [4].

These comorbidities may vary from heart diseases, hypothyroidism, orthopedic abnormalities to child obesity [2,5]. Childhood obesity alone is a modern and enormous problem, which is growing in developed as well as in developing countries.

Children and adolescent with DS have a higher risk for obesity. The recognition of physiological and behavioral factors that can increase this risk are crucial for developing personalized plans to approach each individual in order to avoid the gain of excess weight [6].

Obesity in DS, as well as in general population, raises the risk for dyslipidemia, insulin resistance, type 2 diabetes and hypertension. It is known that it is associated with higher risk for gallstones, hepatic steatosis, sleep apnea and certain types of neoplasias. In additon to that, obesity may hinder the care of these individuals, and imply in lower level of quality of life [6].

Approximately 17.1% of children in US are obese, which is a value that some researchers show similar to the DS pediatric population [6]. Some data, however, shows that this percentage may be underestimated, specially for a body composition with higher body fat mass in comparison to individuals without the chromosome trisomy that could not be noted by simple body mass index classification [7].

Down's Syndrome Obesity

The physiological factors that fosters the development of obesity in this population are not fully understood, and deeper discussions are needed to clarify their mechanisms. The main actual etiological explanations and scientific findings are described below:

Hypothyroidism

Thyroid is one of the most important endocrine glands and it is responsible for the production of thyroxine (T4) and triiodothyronine (T3). These two hormones play important roles in cell differentiation, maintain the thermal and metabolic homeostasis, and interfere in the carbohydrate, protein and lipid metabolism. Thyroid hormone production is regulated by thyroid-stimulating hormone (TSH), which is used as a physiological marker of thyroid hormone function. Hypothyroidism is a condition where the T4 and T3 levels are low.

It is a common congenital or acquired condition, specially for autoimmune dysfunction linked to Hashimoto's thyroiditis, in DS children. Prevalence of hypothyroidism in this population is higher than their counterparts and some studies classify it as the second most common medical condition in DS. Clinicians should remain alert to clinical signs of hypothyroidism such as weight gain, tiredness, weakness, somnolence, constipation, delayed growth, hypotonia, dry skin, alopecia; among others [8].

In addition to that, anual TSH levels measurement is indicated by the American Academy of Pediatrics [9], as well as thyroid antibodies analysis. It is important to remember that patients with DS often have elevated TSH (hypothalamic origin), which is called TSH neurosecretory dysfunction. In these cases, there is slight elevation in TSH (5-15 μUI/mL), with normal free T4 and negative thyroid

antibodies, a condition that does not mean elevated risk of progression to hypothyroism [10].

Decreased resting metabolic rate

Studies suggest that euthyroid DS children body at rest burns less amount of calories than their counterparts, and may contribute to the development of obesity [6,9]. Some possible explanation concerns the hypotonia, muscle type, composition and energy balance [11].

Most of the research data is based uppon DS adults. More studies are needed to verify the decreased resting metabolic rate in DS children as a risk factor for obesity in older ages [6,9].

Increased leptin levels

Leptin is a hormone secreted by adipocytes that plays an important role in regulating food intake by stimulating satiety and promoting energy homeostasis via energy expenditure. Typically, increased levels of the hormone correlate with obesity, due to leptin resistance. Studies suggest that pre-pubertal overweight DS children have high levels of leptin, which correlates with increased body mass index and degree of adiposity [12].

Masticatory dysfunction

DS children have issues eating raw fruits and chewing fibrous food. There is a general preference for softer foods, that usually are richer in carbohydrates [6]. Therefore, the high carbohydrate consumption in the daily food intake of these individuals is worrisome. This situation may worsen the tendency of these individuals for constipation (secondary to muscular hypotonia).

Behavioral tendencies

Negativity, impulsivity, oppositional behavior, inattention are behaviors that tend to surface as DS children become older. Those are barriers that prevent necessary dietary and lifestyle changes [6].

Short stature

There is no consensus about how to define overweight and obesity in children with short stature. The usage of specific growth charts can be helpful to screen and asses nutritional status ad to provide indication of how growth of an individual child compares with peers of the same age and sex with DS [12].

DS patients have lower stature when compared to people of the same age without trisomy, so their energy and micronutrient needs are also lower than those of the rest of the population. This fact may hinder the understanding of the amount of food intake needed by these children caregivers, aggravating the weigth gain.

Low levels of lean body mass

DS children show lower lean body mass if compared to their counterparts [7]. In 2008, Ferrara et al evaluated the genotype of children and adolescents with and without SD. With this study they aimed to evaluate the α estrogen receptor gene (ERα). This is associated with two important polymorphisms: Pvull and Joana Pereira Xbal. The ERα gene has the function of mediating the effects of estrogens in the distribution of body fat. The authors noted that there was an association between the absence of the Xbal polymorphism and the prevalence of obesity in both groups [13]. They also verified that the prevalence of homozygosity for the absence of XbaI was higher in the DS group [13]. These results demonstrate that this genotype may be important in the development of obesity in DS. Early incentive to exercise is of clear benefit to the DS individuals both in terms of cardiovascular and neuromuscular responses [14].

Management

The prevention of excess weight gain and promotion of weight loss is the key fundamental promotion needed to manage obesity in any individual. Helping children become more active begins by counseling families to limit sedentary activities such as watching television and identify barriers to increase activity. The recommendations to families have to account the cardiac and musculoskeletal issues associated with this chromosomal trisomy [8].

When they are born, children with DS have anatomical and structural differences that make them susceptible to potential food problems. Some of these differences are: reduced production of saliva, macroglossia, small oral cavity, poor coordination for sucking and swallowing, among others . It is also very common to present periodontal disease and consequent loss of dentition. In this sense, the first intervention at nutritional level should be the detailed research of the main difficulties that the DS patients present in their diet, adapting the diet, if necessary [15].

Breastfeeding of all children is very important both for the baby and for the mother, because: It decreases the incidence and/or severity of infectious diseases, decreases the probability of children suffering from various pathologies (diabetes mellitus, lymphoma, leukemia, food allergies, hypercholesterolemia, overweight, obesity), improves cognitive development and promotes the creation of a bond between mother and child [15].

During the period in which children with DS have food difficulties, parents reveal feelings of guilt, anxiety, stress, worry, frustration, impotence, among others. It is very important that during this stage there is a multidisciplinary team of professionals capable of supporting and guiding these parents, especially after birth and during breastfeeding. It is intended not only to ensure sufficient nutritional support, but also to help create and maintain the mother-child bond and to overcome the suffering and frustration surrounding the birth of a disabled baby.

The phase of food diversification in these children occurs later, and usually with foods that are easy to chew. Health professionals should assist the parents with the progression in the texture of the diet, which presents benefits for the development of the oral cavity of the child.

A balanced diet is indicated to all DS children. Caloric restriction to promote weight loss is recommended due to their decreased metabolic rate. Nutritionists may assist with family education, specially in those individuals with food restrictions such as celiac disease.

One of the main characteristics that has manifested itself in DS since birth is muscle hypotonia, which promotes less flexibility. On the other hand, as a consequence of muscular hypotonia, these individuals present a risk increased for the development of hip dysplasia, with risk of dislocation [14].

Despite all the limitations, it is advisable to practice physical exercise adapted to the individual capacities of each SD patient. There are recommendations that demonstrate the need for these individuals

to develop strength, muscular endurance and cardiorespiratory endurance, in order to provide: strengthening of the joints, reduction of the risk of respiratory infections and reduction of muscle hypotonia [14].

Anaerobic exercises promote an increase in muscle mass and consequent boost in strength, improves coordinative responses and provides increased tonicity with increased basal metabolism. Consequently, it increases caloric expenditure and decreases body fat.

Conclusion

Obesity as a singular disease is one of the greatest actual challenges and to achieve success in its treatment the set of scientific data and the patient individualization are needed. This is not different in DS children population, that with proper exercise and nutrition-based interventions may have a greater chance to live a better and healthier life.

Nutritional treatment should include: food education, balanced and healthy food choices and exercise. Food education should be provided to parents from the birth of the child with DS as a preventive measure. However, more studies are needed, with more representative samples to evaluate not only the etiology of obesity in DS, but also nutritional interventions, without jeopardizing the health of these individuals.

Exercise is extremely important in reducing body weight as it provides a decrease in body fat. Therefore children with Down Syndrome should be encouraged to practice physical exercises to promote the development of lean mass and help in caloric expenditure.

The training of health professionals sensitive and able to perceive the specific needs and interventions of these individuals is essential to ensure that the quality of health care is the same for all people with or without disabilities.

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