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Original Article

To evaluate the relationship between thyroid dysfunction and childhood obesity

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ABSTRACT:

Background: Thyroid function in paediatric obese individuals has received more attention in recent years. This study was conducted to ascertain the frequency of abnormally increased thyroid-stimulating hormone (TSH) levels in obese children and adolescents from Italy and to determine whether obese children with hyperthyrotropinemia have cardiovascular and metabolic risk factors. **Material and methods:** Overall 100 obese children were recruited in this study. Anthropometric, metabolic as well as hormonal variables had been determined at baseline as well as, in a subgroup of children with hyperthyrotropinemia, after a six month weight loss program. **Results:** It was discovered that hyperthyrotropinemia had been detected among 23 subjects. Body mass index (BMI), z-score ($p = 0.02$), and free T3 (fT3) levels ($p = 0.03$) occurred to be greater in subjects having raised TSH as compared to the cohort with normal TSH. There were no substantial variations in other metabolic parameters among the 2 groups. A positive association among baseline TSH and BMI z-score ($p = 0.0045$) as well as between Ft3 and BMI z-score ($p = 0.0034$) was noticed, while there was no relationship among TSH and lipids. **Conclusions:** It was concluded that a moderate rise of TSH levels, was frequently found in obese children and, in obese children increase of TSH was not associated to metabolic risk factors.

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INTRODUCTION

Obesity is considered a worldwide health problem and its prevalence is increasing steadily and dramatically all over the world [1]. Paediatricians are often involved in the initial evaluation of paediatric obesity and its numerous co-morbidities. Obese individuals are, in fact, at high risk of developing dyslipidemia, hypertension and impaired glucose tolerance, with the consequent increase of their risk of metabolic and cardiovascular diseases [2].

In recent years, there has been an increasing attention to thyroid function in paediatric obese patients [3]. Hypothyroidism has often been thought to be the cause of obesity, and thyroid function tests are still now one of the most commonly performed laboratory analysis in this population. It has been demonstrated by several studies that obese children show higher thyroid-stimulating hormone (TSH) levels than normal weight subjects [3–7], with a higher prevalence of TSH elevation. Isolated hyperthyrotropinemia is a condition characterized by a serum TSH above the statistically defined upper limit of the reference range with normal or slightly high serum free T4 (fT4) and free T3 (fT3) concentration [8].

Hence, this study was conducted to evaluate the relationship between thyroid dysfunction and childhood obesity.

MATERIAL AND METHODS

In total, 100 obese kids were enrolled in the study. There were 70 male individuals and 30 female subjects. Participants with goitre or any thyroid problem were excluded from the trial, as were those who had diabetes or were taking drugs that altered their blood pressure, glucose or lipid metabolism. At the initial visit and in a subgroup of patients with TSH rise after 6 months, anthropometric measurements were evaluated. High-specific solid-phase technique-chemiluminescence immunoassays were used to measure the thyroid hormones (TSH, fT3, and fT4), as well as TPO-Ab and Tg-Ab.For variables with a normal distribution, one-way ANOVA was used to analyse mean differences; for variables with a non-Gaussian distribution, the Kruskal-Wallis test was used. The HOMA-index, lipids, blood pressure, anthropometric measurements, and leptin levels of obese children with isolated hyperthyrotropinemia were compared to those of obese children with normal TSH concentrations.

RESULTS

Table 1: Anthropometric, clinical and biochemical characteristics at baseline of 100 obese children involved in the study.

Variable	Mean ± SD	Range
Number of subjects	100	
Age	11.2±3.6	4.5-15.9
Gender	Males : 70%, females: 30%	
TSH	2.6 ± 1.2	0.2-8.5
fT3	3.8 ± 0.8	1.1-7.1
Ft4	10.3 ± 1.6	6.2-15.9
BMI z-score	2.9 ± 0.7	1.8-5.8

It was discovered that hyperthyrotropinemia had been detected among 23 subjects. Body mass index (BMI), z-score (p = 0.02), and free T3 (fT3) levels (p = 0.03) occurred to be greater in subjects having raised TSH as compared to the cohort with normal TSH. There were no substantial variations in other metabolic parameters among the 2 groups. A positive association among baseline TSH and BMI z-score (p = 0.0045) as well as between Ft3 and BMI z-score (p = 0.0034) was noticed, while there was no relationship among TSH and lipids.

DISCUSSION

Obesity is one of the most important health risks of our time. The prevalence of obesity has increased worldwide since the mid 1970s. According to the National Health and Nutrition Examination Survey, obesity affected 32.2% of adults in 2003–2004 and reached a peak in subjects in the fifth decade of life (9). Obesity is associated with an increased risk of diabetes, dyslipidemia, kidney disease, cardiovascular disease, all-cause mortality, and cancer. Thus, severe obesity is an important cause of premature mortality among middle-aged adults (10). Moreover, obesity, especially central obesity, is linked to many endocrine abnormalities (11), including thyroid dysfunction (12). This is not surprising because T3 regulates energy metabolism and thermogenesis and plays a critical role in glucose and lipid metabolism, food intake, and the oxidation of fatty acids.

Thyroid dysfunction is associated with changes in body weight and composition, body temperature, and total and resting energy expenditure independently of physical activity. Moreover, weight gain often develops after treatment of thyroid dysfunction (13). Both subclinical and overt hypothyroidism are frequently associated with weight gain, decreased thermogenesis, and metabolic rate (13, 14). In a recent cross-sectional, population-based study of 27,097 individuals above 40 yr of age with body mass index (BMI) of at least 30.0 kg/m2, subclinical and overt hypothyroidism correlated with a higher BMI and a higher prevalence of obesity in both smokers and nonsmokers (14). It has been noted that small variations in serum TSH caused by minimal changes in L-T4 dosage during replacement therapy are associated with significantly altered resting energy expenditure in hypothyroid patients.(15) These studies support the clinical evidence that mild thyroid dysfunction is linked to significant changes in body weight and likely represents a risk factor for overweight and obesity.

In our study, it was discovered that hyperthyrotropinemia had been detected among 23 subjects. Body mass index (BMI), z-score (p = 0.02), and free T3 (fT3) levels (p = 0.03) occurred to be greater in subjects having raised TSH as compared to the cohort with normal TSH. There were no substantial variations in other metabolic parameters among the 2 groups. A positive association among baseline TSH and BMI z-score (p = 0.0045) as well as between Ft3 and BMI z-score (p = 0.0034) was noticed, while there was no relationship among TSH and lipids.

R.K. Marawah et al(16) had studied prevalence of thyroid diseases in children. In his study among diagnosed 122 children, 11.47 % male children and 83.52 % female children affected.

Meena P. Desai et al (17) had studied autoimmune thyroid diseases in childhood. Total 174 infant and children diagnosed by hormonal estimation and clinical presentation having thyroid diseases. Study carried out by Meena Desai shows prevalence of congenital hypothyroidism 46%

Umeshkapil et al (18) had studied total 1254 children between age group of 6-12 years for the prevalence of Iodine Deficiency Disorders in children. M:F ratio in their study was 1:2.9. Meena Desai 3 had studied total 154 infant and children for the prevalence of congenital hypothyroidism and autoimmune thyroid disorder. M:F ratio in her study was 1:3.4.

In a study conducted by Bassem H et al, medical records of 191 obese and 125 nonobese children (younger than 18 years old) were reviewed. Data about age, sex, body mass index, TSH, thyroid functions, thyroid antibodies, thyroid size, and medications were collected. It was discovered that 6 obese patients had Hashimoto disease and TSH values from 0.73 to 12.73 mIU/L; they were excluded from the study analyses. Of the remaining 185 obese subjects, 20 (10.8%) had TSH levels >4 mIU/L, but no control subject measurement exceeded this TSH value. The highest TSH concentration in an obese study subject was 7.51 mIU/L. When obese children with TSH levels >4 mIU/L were classified in a third group, the mean TSH in the rest of the obese children was comparable with that in the control group (1.98 ± 0.84 [SD] and 1.95 ± 0.80 mIU/L, respectively; post hoc analysis of variance, P = .945). Obese subjects with increased

TSH values had a mean body mass index similar to that for obese subjects with normal TSH levels (34.98 ± 6.12 [SD] and 34.29 ± 7.84 kg/m2, respectively) (19).

CONCLUSION

It was concluded that a moderate rise of TSH levels, was frequently found in obese children and, in obese children increase of TSH was not associated to metabolic risk factors.

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