The effect of growth hormone and thyroid hormones in short stature children male aged 5th years

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Abstract

Linear growth occurs in 3 stages, During fetal and early infant life, growth is largely regulated by nutrition, during childhood by growth hormone (GH) and during puberty by GH and sex steroids. Short stature may be the result of a condition causing growth failure with a growth rate below the appropriate growth velocity for age and lower of thyroid hormones.

The present study showed there was role of thyroid hormones and growth hormone in short stature problems that underlying cause and increased risk for reduced body mass index. Forty children divided into 2 groups were studied. Group I (short stature) consisted of 20 patients (aged 5 years). Group II (control) include 20 children aged 5 years. Hormonal estimation was done including GH,T3, T4, TSH, also study BMI in both groups.

Hormonal profile: There was a significant decrease in serum levels of GH, T3 and TSH (P<0.0001) and insignificant change in the T4 between short stature and control ( P= 0.05). also in this study showed positive correlation(r=0.561, P<0.01) between Growth and T3 hormones and their effect on short stature.

Key words; short stature, Growth hormone, thyroid hormones, insulin growth factor.

Introduction:

Growth hormone (GH or HGH), also known as somatotropin or somatropin, is a peptide hormone that stimulates growth, cell reproduction and regeneration in humans and other animals. It is a type of mitogen which is specific only to certain kinds of cells. Growth hormone is a 191-amino acid, single-chain polypeptide that is synthesized, stored, and secreted by somatotropic cells within the lateral wings of the anterior pituitary gland [1,2]. A number of factors are known to affect GH secretion, such as age, sex, diet, exercise, stress, and other hormones[3]. Young adolescents secrete GH at the rate of about 700 μg/day, while healthy adults secrete GH at the rate of about 400 μg/day[4]. Sleep deprivation generally suppresses GH release, particularly after early adulthood[5]. The effects of growth hormone deficiency vary depending on the age at which they occur. In children, growth failure and short stature are the major manifestations of GH deficiency, with common causes including genetic conditions and congenital malformations. It can also cause delayed sexual maturity. In adults, deficiency is rare[6] with the most common cause a pituitary adenoma, and others including a continuation of a childhood problem, other structural lesions or trauma, and very rarely idiopathic GHD.

Laron and colleagues were the first to describe short stature with characteristic features of isolated GH deficiency.[7,8] The condition is now known as Laron Syndrome (LS). It is a familial disorder with an autosomal recessive form of inheritance. Growth hormone deficiency (GHD), hypothyroidism and Down’s syndrome (DS) are common causes of pathologic short stature[4]. Growth hormone and thyroid hormones are especially important for cell multiplication and bone mineral metabolism [9].

Childhood hypothyroidism causes growth failure, but other features of adult hypothyroidism are often absent, Growth failure may develop insidiously, but is severe once established. In untreated hypothyroidism, complete growth arrest occurs with delayed bone
age, epiphyseal dysgenesis, and immature body proportion. A proportion of patients with T₃ resistance, caused by mutant T₃ receptor β proteins, suffer from growth retardation and developmental abnormalities of bone that reflect tissue hypothyroidism. T₄ replacement induces rapid catch-up growth, although this may be incomplete because bone age advances faster than the increase in height [10].

**Subjects and Methods:**

Twenty short stature children male at fifth years old and twenty as control were included after taking informed written consents from their guardians. The present work was conducted in study of the hormonal profile among children with short stature. In the present study on the hormonal profile, criteria of diagnosis of patients were based on history, clinical examination, midparental height, and hormonal assay. Family history of growth pattern and direct measurement of the parents and calculation of the midparental height were crucial to determine the genetic potential for growth in the child which is reflected in the heights of his parents and relatives.[11] The sex-adjusted midparental height (MPH) was estimated as follows:

MPH range for boys (cm) = (Mother’s height +13) + Father’s height ± 8 / 2 and body mass index (BMI) were expressed as 0.1 Kg and height as 0.5 cm by using the instrument for measurement weight and height BMI=W/H²[12].

All patients and control children were well matched for age, sex and socioeconomic status. They were selected from outpatient clinics of Al-Zahraa hospital for pediatrics in Al Najaf city Selected patients and control children were subjected to the following careful history taking including personal data, prenatal, natal and post natal, obstetric and family history. A detailed family pedigree.

Serum T₃, T₄ and TSH levels by immunoassay methods (ELISA kits from Monobind, USA). Also growth hormone by immunoassay methods HGH Kit(Cat≠1901 Z).

Data was analyzed using SPSS version 14 and by using Megastat.

**Result:**

A total of 40 children, 20 of them were referred for evaluation of GH deficiency (short stature) and twenty were control.

Table 1 report serum GH, TSH, T4 and T3 levels in short stature and control groups, there was no significant differences (P= 0.05) in serum T₄ between short stature and control groups, whereas there was significant differences (P<0.0001) in serum GH, TSH and T3 also in BMI between short stature and control groups.

<table>
<thead>
<tr>
<th>Groups</th>
<th>GH g/ml±SD</th>
<th>TSH u/l±SD</th>
<th>T₄ mol/l±SD</th>
<th>T₃nmol/l±SD</th>
<th>BMI kg/cm²±SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>short stature</td>
<td>1.11-0.5</td>
<td>2.10-1.04</td>
<td>75.97-12.35</td>
<td>1.02-0.35</td>
<td>12.12-1.15</td>
</tr>
<tr>
<td>control</td>
<td>5.55-1.87</td>
<td>1.12-0.95</td>
<td>82.7-15.8</td>
<td>1.66-0.32</td>
<td>16.78-1.595</td>
</tr>
<tr>
<td>P.Value</td>
<td>0.000</td>
<td>0.000</td>
<td>N.S</td>
<td>.000</td>
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</tbody>
</table>

Table I: Hormonal profile for the two studied groups.
Figure 1 show a positive correlation between serum levels of GH and T3 for the short stature group(r=0.561, P<0.01).

**Figure1:** Show the correlation between Growth and T3 hormones

![Graph showing correlation between GH and T3](image)

**Discussion:**

In this study all patients parents were normal in their height. Table 1 show significant decrease in serum growth hormone between short stature children and control this result agree with [13,14,15]. Importance of GH like other peptides and protein hormones GH binds to the cell membrane associated receptors on the surface of target cells. The sites of action of GH are ubiquitous.[16] It exerts pleotropic effects on growth and metabolism and it causes growth of almost all tissues of the body that are capable of growing.[17] GH action requires dimerization of two receptors with a single GH moiety and subsequent activation of a complex cascade of tyrosine kinases. GH stimulates production of Insulin-like growth factor-I (IGF-I) after its attachment to the cell receptors.[18] IGF-I further exerts the actions characteristic of GH. Growth hormone deficiency may occurs when the pituitary gland fails to produce sufficient levels of growth hormone. It can be caused by a variety of factors, but in many cases the cause is unknown (idiopathic GHD). In some children, failure or reduction in growth hormone secretion is congenital, and may be accompanied by other pituitary hormone deficiencies. Other children have genetic mutations such as GH-1 gene mutation (which leads to isolated GHD) or Prophet of Pit-1 (PROP-1) gene mutations which may lead to multiple hormone deficiency including GHD. In others, growth hormone deficiency is acquired as a result of: trauma, either at birth or later in childhood [19].

Our study also recorded the thyroid hormones (T3, T4, TSH) it was found that, when comparing these levels with the control group, there was a significant decrease in the serum levels of both T3 and TSH, no significant in T4 in the short stature group as compared with control group children table1. this result agree with [20,21,22,14,23]. TSH and normal serum free thyroxine T4 concentrations or overt (high serum TSH and low serum free T4 concentrations). Whatever its cause hypothyroidism in children can have deleterious effects on growth, pubertal development, Reduced thyroid hormone binding might be explained by abnormal hepatic function with reduced formation of any combination of thyroid- hormone binding globulin (TBG), albumin, or pre albumin, which all carry thyroid hormones in the circulation, as well as GH insufficiency is generally presumed to be of hypothalamic or pituitary origin, but the hypothyroidism was generally accompanied by elevated TSH levels and, therefore, seems to be of thyroidal origin, although hypothalamic-pituitary dysregulation leading to abnormal central responsiveness[24].

Most previous study stated the GH. is most frequently quoted mechanism of changes in thyroid hormone levels is GH-mediated increase of peripheral T4 to T3 deiodination [25]GH may increases the peripheral deiodination of T4 to T3 and this is supported by the findings from some studies that showed an increase in T3 and the reduction in serum T4 concentration after GH therapy[25,26].
proved that, in children with neglected congenital hypothyroidism, even after long period of hypothyroidism, L-T4 replacement improved the growth rate, leading to a partial recovery of GH-IGF-I axis.[21] proved differences were found between the improvement of the growth rate in the patients with normal thyroid function and in those with even transient hypothyroidism.

Our study show significant decrease in BMI as compared with control this agree with[14],this decline in BMI belong to changing in their hormonal profile(GH ,TSH,T4,T3),these may cause development growth impairments, [28] Growth failure (height below 3rd percentile) occurs in children who do not secrete sufficient amount of GH.

The present study showed a positive correlation between the serum level of growth hormone and the T3 hormone for the short stature group (r = 0.561, p < 0.01) figure1. The most frequently quoted mechanism of changes in thyroid hormone levels is GH-mediated increase of peripheral T4 to T3 deiodination[29], and this result reflected that Thyroid hormone T3 is essential for normal skeletal development. Childhood hypothyroidism results in growth arrest, delayed bone age, epiphyseal dysgenesis and short stature[10,30,31]. also Thyroid hormones are essential for brain maturation, and for brain function throughout life. The actions of thyroid hormone during development are different, in the sense that they are required to perform certain actions during specific time windows. Thyroid hormone deficiency, even of short duration may lead to irreversible brain damage, the consequences of which depend on the specific timing of onset and duration of thyroid hormone deficiency [33].

Conclusions:

The incidence of short stature during childhood due to growth hormone defeciency and the negative effect of even transient thyroid hormone deficiency on growth rate should be taken into account and their effect on BMI in them.

References


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تأثير هرمون النمو وهرمونات الغدة الدرقية في الأطفال الذكور الذين تتراوح أعمارهم بين قصر القامة سنوات 5

يحدث النمو الخطي في 3 مراحل، وخلال الحياة الجنينية والرضع في وقت مبكر، وينظم نمو إلى حد كبير من التغذية، خلال مرحلة الطفولة من هرمون النمو (GH) وخلال فترة البلوغ التي كتبها GH والمنشطات الجنسية. قد يكون قصر القامة نتيجة لحالة النسبي في نمو النمو مع معدل نمو أقل من سرعة النمو المناسبة لأعمارهم وأقل من هرمونات الغدة الدرقية.

وأظهرت هذه الدراسة كان هناك دور هرمونات الغدة الدرقية وهرمون النمو في المشاكل الكامنة وراء قصر القامة لأن السبب زيادة خطر لمؤشر كتلة الجسم انخفاض. تم دراسة أربعين الأطفال مقسمة إلى مجموعات 2، المجموعة الأولى (قصر القامة) تتألف من 20 مريضا (الذين يتراوح أعمارهم بين 5 سنوات). المجموعة الثانية (السيطرة) وتشمل 20 طفلا تتراوح أعمارهم بين 5 سنوات. وقد تم تقدير الهرموني بما في ذلك GH، TSH، T4، T3، BMI في كلا المجموعتين. وتغير TSH (P <0.0001) T3 و تأثيره على T4 بين قصر القامة (ص = 4.560، P <0.01) بين النمو وهرمونات T3 وتأثيرها على قصر القامة.