Effects Of Selected Hormones And Obesity On Collagen Metabolism

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Abstract:
Back ground: The majority of obese persons have hyperinsulinemia and disturbances in the secretion of melatonin, catecholamine and pituitary, thyroid, adrenal and gonadal hormones. These hormones play an important role in the regulation of collagen metabolism either by acting directly or by influencing insulin like –growth factor (IGF-1) production.

Aim: The objective of this paper was to assess whether and to what degree, the changes in serum level of insulin, insulin like growth factor -1 (IGF-1) and obesity may influence collagen metabolism.

Patients and methods: A total of 100 subject were studied, 50 subject were obese and their mean of body mass index was (BMI) 33±2 and 50 subject were non-obese with their mean of BMI 22.5±2.1, all subject were apparently healthy. Collagen metabolism was evaluated indirectly from the measurement of selected markers of collagen biosynthesis procollagen type one (PCIP). Which was estimated in the serum using
radioimmunoassay (RIA) method, by the same method each of IGF-1 and insulin was determined in the serum.

Results: Obese subject had a significantly higher values for PCIP when compared with non-obese subject (160.2 ± 75.3 vs. 135.3 ± 27.4 p < 0.05), as well as obese subject showed significant increase in the concentration of insulin and IGF-1(40.8 ± 10.8 vs. 7.2 ± 3.3),(80.5 ± 15.0 vs. 35.5 ±8.5).

The proportion of obese subject with high PCIP value of 250 ng/ml correspond to 90th percentile was 40% of obese subject, IGF-1 abnormalities was seen in 15% of obese subject and those non-obese subject had 20% abnormal value according to same percentile 90th.

Conclusion:
It can be concluded from the present study that increased collagen metabolism related to obesity in general and to hormonal (IGF-1 and insulin) disturbances in particular.

Introduction:
It has been demonstrated that hormones play an important role in the biosynthesis and degradation of collagen which is the main constitute of most connective tissues. Of all the humeral factors insulin like growth factor-1 (IGF-1) and its binding proteins, especially low molecular weight binding proteins (LMWBP) play the major role in the regulation of collagen metabolism.(1,2,3) The role which insulin, parathyroid hormone, calcitonin, catecholamine, and hormones of the pineal, thyroid, adrenal cortex and gonads play in the regulation of collagen changes is also significant.(4,5,6,7)

In the case of obesity, complex disturbances of the secretion and action of hormones are frequently observed, especially of those which play a main role in regulation of collagen changes.(8) Secondary changes in the level of biochemical markers of collagen biosynthesis such as carboxyterminal propertied of type 1 procollagen (PICP) may be a reflection of such disturbances.(9)

Patients And Methods:
This study includes 100 subject, 50 of them were obese their mean age ranged between (20-38 years) with a mean BMI (33 ± 9.2 kg / m²). The reminder were non obese subject their mean age ranged between (20- 38 years) they were apparently healthy subjects and have normal weight with mean BMI (22.5 ± 2.1 kg / m²) chosen from the relative of the obese subject. None of the subject had complications or disease potentially influencing collagen metabolism.

Collagen metabolism was evaluated indirectly from the measurement of propeptides of type of type 1 (PICP) in the serum. Serum was also used in the determination of each of IGF-1 and insulin concentration in studied subject.

Radioimmunoassay (RIA) technique was used in the measurement of PICP, IGF-1 and insulin level. Radioimmunoassay (RIA) kits were obtained from Diosorin, still water Minnesota, USA. Data were expressed as mean S.D. Results were evaluated using the
Students t-test for paired data Conventional methods were used for correlation and regression analyses.

Percentage value was used to evaluate the effect of IGF-1 and obesity on collagen metabolism.

**Results:**

Table-1 shows that obese subject had significantly higher mean values of BMI, PICP, IGF-1 and insulin. Differences in mean values between obese subject and non-obese subject were assessed by student t-test.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>non obese subject (BMI ≤25 kg/m²)</th>
<th>Obese group (BMI ≥30 kg/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. investigated</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td><strong>BMI</strong> kg/m²</td>
<td>22.5 ± 2.1</td>
<td>*33 ± 9.2</td>
</tr>
<tr>
<td><strong>IGF-1</strong> nmol/L</td>
<td>35.5 ± 8.5</td>
<td>80.5 ± 15.0 *</td>
</tr>
<tr>
<td><strong>PICP</strong> ng/ml</td>
<td>135.5 ± 27.4</td>
<td>160.2 ± 75.3 *</td>
</tr>
<tr>
<td><strong>Insulin</strong> µI.U/ml</td>
<td>7.2 ± 3.3</td>
<td>40.8 ± 10.8 *</td>
</tr>
</tbody>
</table>

*p<0.05

Significantly increase level of serum PICP, IGF-1 and insulin was demonstrated in studied obese subject (Table-1-).

A significant association was found between the level of terminal propeptid (PICP) and the indicator for body mass (BMI) (Table-2-).

Changes in the levels of the examined marker of collagen metabolism correlated positively with IGF-1 and insulin. In general, higher values of correlation indicators were found in studied obese subject.

Table (2): Correlation between the levels of selected hormonal factors (IGF1 and insulin) and carboxyterminal propeptid of type 1 procollagen (PICP) in obese subject. The values are correlation (r).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Obese subject (n = 50)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PICP</td>
<td>0.40*</td>
</tr>
<tr>
<td>BMI</td>
<td>0.50*</td>
</tr>
<tr>
<td>IGF-1</td>
<td>0.49*</td>
</tr>
</tbody>
</table>

*p<0.05

Selected percentiles for hormones (IGF-1 and insulin) and collagen biosynthesis marker PICP are presented in Table -3-.

The percentages in Table-3- was used in one hand, to evaluate the influence of obesity on collagen metabolism, on other hand it shows the influence of studied hormones (IGF-1 and insulin) on collagen metabolism.

Table (3): Selected percentiles for studied hormones (IGF-1 and insulin) and collagen biosynthesis marker.
Obese subject with high concentration of IGF-1 (100.0 nmol/L), its percentage (15\%) which is less percentage in compare to obese subject with high concentration of PICP (250.0 ng/ml) its percentage (40\%). Proportion of obese subject with high PICP (250.0 ng/ml, 40\%) were significantly greater than obese subject with insulin abnormalities (60 µI.U/ml, 20\%).

Discussion:
Collagen metabolism in obese subject and the association between obesity and disturbances of hormone secretion, which are thought to be important factors in the regulation of the process.

The present study has demonstrated a significantly increased level of procollagen-1 in obese subject which was correlated significantly with BMI. It can be postulated that secondary increase in collagen metabolism may result from complex hormonal and metabolic disturbances associated with obesity. In all obese subjects studied the high levels of insulin and IGF-1 were accompanied by elevated concentration of collagen biosynthesis marker.

Clinical and experimental investigations underline the important role of humoral factors in the regulation of collagen metabolism. It is known that IGF-1 and its binding proteins and the interactions between them represent one of the main mechanisms in the regulation of collagen biosynthesis. In addition to IGF-1, insulin, androgens, melatonin, epinephrine, thyroid and glucocorticoid hormones are also factors which stimulate this process but it should be emphasized that most of listed hormones act on the collagen metabolism through the IGF-1 biosynthesis. In addition the hormones, the dietary intake are another important factor in the modification IGF-1 biosynthesis. The changes in collagen biosynthesis marker concentration may arise directly or indirectly from secondary metabolic and hormonal disturbances. From the obtained results it may be postulated that the variations in the level of IGF-1 and insulin play a major role in the modulation of collagen metabolism in obese subject.

A procollagen type 1 value of 250.0 ng/ml correspond to 90\% percentile was in 40\% of obese subject whereas IGF-1 concentration of 100.0 nmol/L correspond to 90\% percentile in 15\% of obese subject and insulin concentration of 60 µI.U/ml correspond to 90\% percentile was in 20\% of obese subject.

In summary, in the term obesity, collagen metabolism is primarily dependent on obesity whereas collagen metabolism less dependent on the change of growth hormone like insulin factor.

References:


