Physical Inactivity is a Type of Stress Resulting in Thyroid Gland Dysfunction

Ahmadi R*, and Tavakoli P

Abstract—Studies show that physical inactivity can influence functions of body glands. The main aim of this study was to determine the effects of physical inactivity on thyroid gland function in rats. Male Wistar rats were randomly divided into control and immobilized (8h/days for 8 days) animals of 10 in each group. After 8 days, blood samples were collected using cardiac puncture method. Following serum collection, TSH, T3 or T4 levels were measured by radioimmunoassay method. Data were statistically analyzed and compared between groups using ANOVA. The results indicated that serum T3 or T4 levels were significantly increased in immobilized rats compared with control animals (P<0.001). Serum level of TSH was not significantly changed compared with control rats. Our findings show that immobilization enhances thyroid function.

Keywords— Immobilization, T3, T4, TSH, Rat.

I. INTRODUCTION

THYROID normal function is vital for cell metabolism, normal growth and development [1]. Alteration in serum levels of thyroid hormones can lead to various disorders indicating the importance of biomedical aspects of these hormones [2]. A variety of types of stresses and conditions including sedentary lifestyle, nicotine [3], diet [4] and other factors influence thyroid hormones secretion. In this respect, study on the effects of physical inactivity on thyroid hormones is of great importance.

Humans and animals are constantly faced with various stressors in their lives, which can be both physiological and psychological [5]. Many studies demonstrate that stress of physiological or psychological origin results in considerable changes, either directly or indirectly, in serum level of many hormones including pituitary, adrenal and thyroid hormones [6]. Physical inactivity as a restraint stress is also a physiological stress which has been reported to influence many aspects of endocrine system including thyroid function [7]. However, there are reports showing that immobilization stress as short term does not influence thyroid function [5].

The reports coming from studies conducted to elucidate the effects of physical inactivity as restraint stress on thyroid function are still conflicting, so, the present study was carried out to show the effects physical inactivity as restraint stress on serum levels of TSH, T3 or T4 in male rats through applying immobilization.

II. MATERIAL AND METHODS

A. Animals

Adult male Wistar rats weighting 200±30g were purchased and raised in our colony from an original stock of Pasteur institute (Tehran, Iran). The temperature was at 23±2 °C and animals kept under a schedule of 12h light: 12h darkness with free access to water and standard laboratory chow.

B. Protocol of Study

Male Wistar rats were randomly divided into control and immobilized animals (8h/day for 8 days) of 10 in each group. For immobilizing the animals, a standard restrainer was used. After 8 days blood samples were collected using cardiac puncture method. The blood samples were kept 15 minutes at room temperature. In order to obtain serum, samples were centrifuged at 2500 rpm for 20 min. After separation of serum, levels of TSH, T3 or T4 were measured using commercially available kits [IMMUNOTECH A, BECHMAN COULTER/REF 2121].

C. Statistical Analysis

All values are presented as mean±SEM. Statistical significance was evaluated by one-way analysis of variance (ANOVA) using SPSS 19. Significance was measured using Games-Howell significant for the exact P values and significant differences are noted in the results. Differences with P<0.05 were considered significant.

III. RESULTS

The results indicated that serum T3 or T4 levels were significantly increased in immobilized rats compared with control animals (P<0.001). Serum level of TSH was not significantly changed compared with control rats. (Table I and Fig I).

Table1. Serum T3, T4 or TSH level in male rats

<table>
<thead>
<tr>
<th>Group</th>
<th>TSH (uU/ml)</th>
<th>P</th>
<th>T3 (uU/ml)</th>
<th>P</th>
<th>T4 (uU/ml)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>0.001±0.013</td>
<td></td>
<td>73.2±0.58</td>
<td></td>
<td>3.65±0.20</td>
<td></td>
</tr>
<tr>
<td>Immobilized</td>
<td>0.001±0.013</td>
<td>N.S</td>
<td>0.58±0.022</td>
<td>&lt;0.001</td>
<td>5.28±0.20</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

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Fig. 1. Serum T3 and T4 levels in control and immobilized rats. * indicates significant difference compared to control group.

IV. DISCUSSION

The results of current research show that the serum T3 and T4 levels increased in immobilized rats compared with control animals. In line with this finding, there are reports indicating that immobilization, as a stress condition, has a capability to alter serum level of various hormones [8]. Hypothalamic-pituitary axis can be influenced by several types of stresses [9], [10]. Studies also show that stress of various types can enhance excitatory amino acids levels in brain[11] that may lead to hyperactivity of glands controlled by brain chemicals including thyroid gland. Activation of the pituitary-thyroid axis was also found in experiments with rhesus monkeys exposed to acute immobilization stress [12]. The reports also indicate that serum levels of thyroid hormones is enhanced in acutely immobilized animals [13].

V. CONCLUSION

We have shown that immobilization and physical inactivity is a type of stress that can lead to thyroid gland dysfunction, according to which, the role of physical activity on thyroid gland normal function is demonstrated.

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REFERENCES