A Comparison between Restraint Stress and Hookah Smoke on Thyroid Function in Rats

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Abstract- Studies show that smoke or restraining can influence physiological functions of thyroid gland. The main aim of this study was to determine the effects of restraint stress or hookah smoke on thyroid function in rats. Male Wistar rats were randomly divided into control, hookah smoking, and restrained animals of 5 each group. After 6 weeks blood samples were collected using cardiac puncture method. Following serum collection, levels of TSH, T3 or T4 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 hookah smoking rats compared with control animals (P<0.001 and P<0.01, respectively). Serum level of TSH was not significantly changed in hookah smoking or restrained animals compared with control rats. Our findings show that hookah smoke enhances thyroid function appeared in increased serum level of T3 or T4; therefore, the effects of hookah smoking on hyperthyroidism induction is of importance.

Keywords-- Restraint Stress, Hookah Smoke, Thyroid

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 life style, nicotine [3], diet [4] and other factors influence thyroid hormones secretion. In this respect, study on the effects of smoking with restraint stress 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]. 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].

Tobacco smoking is also another common health risk factor leaving hazardous effects on endocrine system including pituitary function, adrenal secretions and thyroid function [8]. Effect of smoking on body is mainly mediated through pharmacological action of nicotine and also toxins such as thiocyanate existing in smoke [9], [10]. Tobacco is commonly consumed in different ways including cigarette, pipe, cigar and hookah smoking. Hookah tobacco smoking usually involves heating flavored tobacco with charcoal and inhaling the resulting smoke after it has passed through water [11]. Hookah smoking is an unhealthy habit growing worldwide annually and is going to put the world health in danger [12]. Research demonstrates that numerous toxic agents, including carcinogens, heavy metals, other particulate matter and nicotine are efficiently delivered through hookah smoking [13].

The present study was carried out to show the effects of hookah smoke and restraint stress on serum levels of TSH, T3 or T4 in male rats.

II. MATERIAL AND METHODS

A. Animals

Adult albino (Wistar) rats weighting 200 -250g were purchased and raised in our colony from an original stock of Pasteur institute (Tehran, Iran). The temperature was at 20-29°C and animals kept under a schedule of 12h light: 12h darkness (light on at 08: 00 a.m.) with free access to water and standard laboratory chow. Car taken to examine the animals for general pathological symptoms. In all experiments, attention was paid to the regulations of local authorities for handing laboratory animals.

B. Protocol of Study

This work was conducted in laboratory complex of HIUA (Hamedan-Iran). Male Wistar rats were randomly divided into control, hookah smoking, and restrained animals of 5 in each group. For hookah smoke exposure to animals, a glass box in a cube shape (aquarium shape) with the size of 30 × 40 × 80 cm for keeping the rats, and a hood over the aquarium-shaped box to evacuate the extra smoke to the environment was designed and applied[15]. Total daily exposure time was 100 minutes. Standard restrainer was used to restrain animals as per previous studies [16]. After 6 weeks, blood samples were collected using cardiac puncture method. 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

Statistical significance was evaluated by one-way analysis of variance (ANOVA) using SPSS 19. Significance was measured using Fisher’s least significant for the exact P values and significant differences are noted in the results. Differences with P<0.05 were considered significant.

III. RESULTS

Table I shows the serum levels of TSH, T3 and T4 in male rats.

<table>
<thead>
<tr>
<th>Animal</th>
<th>TSH ng/ml±SD</th>
<th>T3 ng/ml±SD</th>
<th>T4 ng/ml±SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>0.01±0.001</td>
<td>76±2.48</td>
<td>2.04±0.35</td>
</tr>
<tr>
<td>Hookah smoking</td>
<td>0.02±0.004</td>
<td>91.22±0.64</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Restrainted</td>
<td>0.01±0.001</td>
<td>73.26±0.7</td>
<td>3.67±0.13</td>
</tr>
</tbody>
</table>

Statistical analysis suggests that serum level of TSH is not significantly changed in all experimental groups compared to control animals. Serum level of T3 and T4 was not significantly changed in restrained rats compared with control animals but was significantly increased in hookah smoking rats compared with control animals (P<0.001 and P<0.01, respectively).

IV. DISCUSSION

In this study, we found that hookah smoking has no significant effect on serum TSH hormone. This finding is consistent with results of previous studies in which it has been shown that cigarette smoking has no effect on TSH level in some cases [14]. In contrast to our finding there are other studies indicating a decrease in TSH levels in smokers compared to non-smokers [15].

Our findings also indicated a significant increase in T3 or T4 serum levels in smoking animals. Aligned with these results, there are studies showing that thiocyanate, a main toxic component existing in tobacco, influences thyroid gland function.[16]. In contrast to these findings, some researchers indicate that injection of nicotine does not affect the level of thyroid hormones [17]. The mechanism by which smoking leaves its effects on thyroid function is unknown, but it seems that thiocyanate affect iodine uptake by the thyroid [16] and also leaves its effects on thyroid function is unknown, but it seems there is correlation between concentrations of thiocyanate and immobilization stress [19]. It sounds that because of raised adaptive mechanisms in animals enduring restraint stress, thyroid function is not significantly changed [5].

V. CONCLUSION

Conclusively our findings indicate that hookah smoking results in hyperactivity of thyroid gland. According to our finding, clinical attention to thyroid dysfunction in hookah smoking people is of great importance.

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