Effect of cortisol on submandibular salivary gland

Muhammad T. Taher
Dept. of Anatomy, College of Medicine- Mosul University

Abstract
Histological changes caused by cortisol on submandibular salivary glands were investigated in female rats. Thirty non-pregnant female rats were randomly divided into two groups having equal numbers. Their weights were about 1 kg. The first group was intramuscularly injected for two weeks with 1mg/kg B. wt./day with hydrocortisone sodium succinate i.e. treated group. The second group was kept non-tREATED "control group." Results showed that marked morphological changes were induced. At light microscopical study, the changes in the treated group induced significant shrinkage of mucous and serous acini, distortion in the arrangement of acinar cells with ill-defined cellular outline, pyknosis of the nuclei and the presence of variable size of vacuoles in many acinar cells. Also, our findings showed that great changes were occurred in the diameter of striated ducts as well as in the height of ductal cells of striated ducts. On the basis of these results, it is possible that cortisol may cause severe changes in the cells of submandibular salivary glands of rats.

Introduction
The submandibular glands of man and most other mammals are two pairs of mixed exocrine glands, which secrete both serous and mucous types. Administration of synthetic glucocorticoids may be associated with the development of multitude of complications involving almost all organs, systems and the degree of complication depends on number of factors I.e. length of treatment, time of day of administration, glucocorticoid preparation chosen, route of administration, etc. In rats, the effects of corticosterone on the morphology and histological changes of salivary gland is the subject of several studies. The aim of this study is to investigate the histological changes of the effect of cortisol on submandibular salivary gland in female rats.

Materials and Methods
Thirty non-pregnant female rats weighing 1 kg each were kept in separate plastic cages and were fed ad libitum. The animals were divided into two groups, 15 animals each. The first group was treated for two weeks with 1mg/kg B.wt / day by intramuscular injection of hydrocortisone sodium succinate (Pharma drug production GmbH - Hamburg Germany) in the thigh muscle (Group I). The second group of non-treated animals was kept simultaneously under the same conditions (control group).

Results
The changes caused in the histological appearance of submandibular salivary glands in treated and control rat groups were showed in (Table 1). In treated group, acinar cells of both mucous and serous types had lost their foamy appearance and become irregular in shape, smaller in diameter. Diameter of striated ducts had altered in folded membrane and was apparently smaller than in control glands. It has been noticed that there is a significant decrease in the diameter and height of acini and ductal cells in the treated than in control.

Administration of the drug lasted for two successive weeks, later, the animals were anesthetized and the submandibular salivary glands were dissected, fixed in 10% formalin, processed and stained accordingly by Hematoxylen and Eosin. Morphometric analysis including the diameter of serous and mucous acinar cells, diameter of striated ducts and height of the cell of striated ducts, all were measured with a filar micrometer mounted in place of the eyepiece of a microscope. Statistical analysis between the measured parameters of the treated and untreated groups was done using t-test.

group lead to an increase in the interstitial space, pyknosis of nuclei and the presence of vacuoles inside the cytoplasm of the cells while it differs in their sizes of location from cell to cell (Fig. 1 and 2). In most sections, there were abundance of fat cells with vascularization and increase in the number of blood vessels. A morphological change in the striated ducts represented by atrophy and shrinkage of the ductal cells that lead to change of these cells from columnar to cuboidal cells. Some of the nuclei of these cells showed pyknosis. The most important and clear change is the presence of large space around all striated ducts (Fig. 3).

**Discussion**

The study indicates that treatment of female rats with cortisol results in marked morphological changes in the structure of submandibular salivary gland. This observation was mentioned earlier by other(9). The influence of glucocorticoides on cells of various organs that secretes hormones was broadly studied on major salivary gland of rats(10). However, our findings are in quite agreement with those of previous authors(10). The morphological changes of the treated salivary gland of rats were different from one animal to another, this phenomenon is well-elaborated on a closely related animal i.e mice (11).

The general cortisone effects on the submandibular salivary gland of rats include shrinkage of both mucous and serous acini, ill-defined cellular outlines and pyknosis of the nucleus of both serous and acinar cells. Also, development of vacuole of various sizes in the cytoplasm of acinar cells were also observed. Interestingly, in rats, these changes of salivary gland have been found to be in agreement with the findings obtained after treatment with triamcinolone (5) and after treatment with dexamethasone (12).

Similar findings were elucidated that rat under stress may cause atrophic changes in major salivary glands(10). The presence of vacuoles in the cytoplasm of the treated acinar cells were due to local cellular degeneration. This result is in agreement with similar effect of triamcinolone in the rat parotid gland (5). It can be concluded from this investigation that the cortisol acts mainly on the metabolism of various organs in different ways. Also, the study indicates that the submandibular salivary gland structure is highly and markedly affected by cortisol.

**References**

11- Ricciardi MP, Paparelli A and Pellegrini A. A morph- functional research on the affect of steroid -
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stimulating and inhibiting drugs on


Table (1): Measured parameters of rat’s submandibular salivary gland in treated and non treated groups.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Control Mean ± S.E (in Microns)</th>
<th>Treated Mean ± S.E (in Microns)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter of mucous acini</td>
<td>16.13 ± 1.02</td>
<td>19.37 ± 1.21</td>
<td>P&lt;0.05</td>
</tr>
<tr>
<td>Diameter of serous acini</td>
<td>13.25 ± 1.52</td>
<td>11.81 ± 0.46</td>
<td>P&lt;0.05</td>
</tr>
<tr>
<td>Diameter of striated duct</td>
<td>24.6 ± 2.60</td>
<td>20.11 ± 2.72</td>
<td>P&lt;0.05</td>
</tr>
<tr>
<td>Height of ductal cells of striated ducts</td>
<td>9.8 ± 0.37</td>
<td>1.82 ± 0.48</td>
<td>P&lt;0.05</td>
</tr>
</tbody>
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Fig. 1: Light micrograph of submandibular salivary gland of control (non treated) rat showing scrous and mucous acini.

Fig. 2: Light micrograph of submandibular salivary gland of treated rats showing shrinkage of the acinar cells with ill-defined cellular outlines.
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Fig 3: Light micrograph of submandibular salivary gland of treated rat showing atrophy and shrinkage of ductal cells of striated ducts.