Histological study of ovaries of female golden hamster (*Mesocricetus auratus*)

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**Abstract**

This study was carried out in order to investigate the histological structure of ovaries of the golden hamster (*Mesocricetus auratus*). Ovaries were obtained by laparoscopic surgery and were then divided into two sections and fixed in buffered formalin for histological sectioning technique. In histological examinations the ovary was composed of two main zones, cortex and medulla. The surfaces of the ovaries were lined by simple cuboidal or columnar epithelium, germinal epithelium. The tunica albuginea consisted of connective tissue fibers and cells in the cortex, as well as interstitial cells. Primary, secondary, Graffian follicles, corpus luteum and atretic follicles were seen in the cortex of ovaries. Mean diameters of these follicles varied between 9.5 and 62.37 μm. Medulla consisted of loose connective tissue which contained blood and lymph vessels of varying sizes. The length, width, thickness and weight of the right and left ovaries were almost the same.

**Key word:** Golden hamster, ovary, histology

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**المخلاصة**

أخبرت هذه الدراسة من أجل التحري عن التركيب النسيجي للمبيض الهمستر الذهبي تم الحصول على المبيض من خلال عملية فتح المنطقة البطنية قطعت المبيض إلى جزئين وثبت بمحلول الفورمالين من أجل تهيئةها للتقطيع النسيجي. أظهر الفحص المجهري أن المبيض يتكون من مناطق نموية هما القشرة والثroat. أما طول المبيض فكانت مربحة بظاهرة نموية أو غذائية هي الظاهرة المرئية. تحتوي الخلايا البيضاء للقشرة على الياك وخلايا النسيج الضام والقشرة لخلايا الينية والحواصل المبيضية الأولية والثانوية والحواصل كراف والجسم الصغير والحواصل المضخة. يتألف معدل قطر هذه الحواصل ما بين 9.5 إلى 62.37 ميكرومتر. أعطت التسجيلات الميكروية نتائج فيزيولوجية على أوعية نموية وفموية وعظام مختلفة. ان طول وعرض ووزن المبيض الهمستري وعرض المبيض الذهبي والسيطر كان متوازي تقريبا في جميع حيوانات التجربة.

**الكلمات المفتاحية:** الهمستر الذهبي، المبيض، التركيب النسيجي

**Introduction**

Rodents represents the largest and most diverse group of mammals with over 1700 different species (Besselsen, 2002). The reproductive cycles of golden hamster (*Mesocricetus auratus*) have some unique features when compared with rat and mouse. In that the corpus luteum in the ovarian cycle always begins to show signs of histological regression at 3 days after ovulation and almost completely disappear at the next ovulation. Also, the follicle-stimulating hormone (FSH) surge during the pre-ovulatory period is clearly separated into two peaks in these animals unlike female rat in which the FSH surges almost overlap (Arai *et al.* 2005). In mammals, follicle morphology and its proliferation are regulated strongly and are characteristic for each species (Edson *et al.*, 2009). These known facts were recently illustrated in a comparative study between mouse, hamster, pig and human by Griffin *et al.* (2006), which showed that follicle morphology, size, diameter of oocyte and granulosa cell proliferation are strongly regulated and are fixed genetically. Furthermore, the species showed significant differences in the mentioned parameters but the latter were specific for each species. As well as, the ovulation rate and litter size are under genetic control (Fabre *et al.*, 2006) and in most mammalian species studied so far, the apoptotic pathway results in follicular atresia in the ovary (Jensen *et al.*, 2006; Espinosa, *et al.*, 2011).
Materials and Methods
Ten females of Golden hamsters (*Mesocricetus auratus*) about 100 g mean weight were anesthetized by diethylether and then sacrificed. Then, abdominal cavity was opened and ovaries were removed. First, length, width, weight and thickness of ovaries were measured by Vernier. Then, ovaries were fixed by 10% formalin. Samples were processed by routine histological methods. Paraffin ovarian blocks were sectioned as serial sections with 5 μm thickness. The sections were stained by Hematoxylin & Eosin. The obtained ovaries tissue slides were studied by light microscope. Diameters of follicles were measured by using ocular micrometer.

Results

**Figure(1):** hamster ovary cortex(C) is the covering germinal epithelium, a simple cuboidal epithelial cells. TA, is the tunica albuginea(40x)

**Figure(2):** Interstitial cells(Ic); they are simple tubular glands in the cortex of the ovary. A (10x). B(40x)
Figure (3): Small blood vessels in ovary cortex (40x)

Figure (4): Small blood vessels and capillaries in ovary medulla (40x)

Figure (5): Primary follicle (pf), a single squamous to cuboidal cell layer arranged around the oocyte
Figure (6): secondary follicle, more two cuboidal cell layer arranged around the oocyte

Table (1): Macroscopic measurements of the right and left ovaries

<table>
<thead>
<tr>
<th>Ovary position</th>
<th>Length (mm) (mean ± SE)</th>
<th>Width (mm) (mean ± SE)</th>
<th>Thickness (mm) (mean ± SE)</th>
<th>Weight (gm) (mean ± SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right</td>
<td>5.2 ± 1.1</td>
<td>1.73 ± 1.9</td>
<td>3.3 ± 0.5</td>
<td>1.3 ± 0.3</td>
</tr>
<tr>
<td>Left</td>
<td>4.71 ± 1.57</td>
<td>1.29 ± 2.1</td>
<td>2.8 ± 0.6</td>
<td>1.1 ± 0.1</td>
</tr>
</tbody>
</table>

Table (2): Number and size of the different types of follicles in right ovary of golden hamster

<table>
<thead>
<tr>
<th>Follicle type</th>
<th>Number (mean ± SE)</th>
<th>size (μm) (mean ± SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>primary</td>
<td>271 ± 41.03</td>
<td>30.44 ± 2.1</td>
</tr>
<tr>
<td>secondary</td>
<td>117 ± 50.6</td>
<td>56.30 ± 2.3</td>
</tr>
<tr>
<td>Graffian</td>
<td>5.8 ± 0.3 a</td>
<td>62.37 ± 1.77</td>
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</tbody>
</table>

Table (3): Number and size of the different types of follicles in left ovary of golden hamster

<table>
<thead>
<tr>
<th>Follicle type</th>
<th>Number (mean ± SE)</th>
<th>size (μm) (mean ± SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>primary</td>
<td>263 ± 45.87</td>
<td>9.5 ± 1.2</td>
</tr>
<tr>
<td>secondary</td>
<td>137 ± 38.77</td>
<td>36.89 ± 3.32</td>
</tr>
<tr>
<td>Graffian</td>
<td>7.1 ± 0.3 a</td>
<td>40.56 ± 0.5</td>
</tr>
</tbody>
</table>
Discussions

The ovary was surrounded by a thick adipose connective tissue that was removed during histological tissue processing procedure. Hamster ovaries were observed as grape-shaped in histological sections as supported by (Karimi et.al.,2014). Histologically the ovary was covered by single layer of a simple cuboidal epithelial layer that it is called the germinal epithelium, ovary capsule, was irregular dense connective tissue that called tunica albuginea that was poorly vascularized, figure(1). As seen in the microscope, the golden hamster ovary was composed of two recognized regions, the outer one called cortex and the inner one called medulla. The cortex comprised from a loose connective tissue with collagen fibers and some blood vessels, figure(3). And it was rich with different types of the ovarian follicles; primary follicles, figure(5), secondary follicles figure (6) and Graffian follicles. Also there was a type of simple tubular glands called interstitial cells, an aggregations of cells that have the ability to secret androgens, figure(2). Medulla was comprised from vascularized loose connective tissue with few collagen fibers, as seen in figure(4). A number of studies (Hafez,1970; Delman and Brown,1981; William,1986 and Ozdemir and Dinc,2002) have been reported these findings for the ovaries of many domestic and laboratory animals, which have exocrine and endocrine functions.

Results revealed that right ovary was bigger than left ovary in all the measured dimensions, table(1). A study of Ozdemir et al (2005) reported that length, width, and thickness of the ovary of porcupine (Hystrix cristata) were almost the same for right and the left ovary.

Table (2) explains the number and size of follicles in both right and left ovaries. The number of follicles and condition of oocytes are very important parameters, that can be used for evaluation of animals' fertility. Number of primordial follicles has variation in different species of animals, as they were reported 2,500 in mice, 10,500 in cattle, and 210,000 in swine (Telfer,1996). Number of follicles in cyclic animals is greater than in uncyclic once, as they were reported 12,663 in cyclic river buffalo and 10,132 in uncyclic buffalo (Totay,et.al.,1992). A study was pointed out that the natal follicles count in beef cows and heifer was influenced by weight and age. They were stated that the number of the natal follicles (Graffian follicles) was increased to 5 years of age and then begins to decline, so this may indicate that a decrease in fertility due to the decline of ovarian reserve may begin earlier than previously through in the beef cows (Cushman et al.,2009) Therefore, right and left ovaries of hamsters have equal activity for ovulation, contrary to many mammals for example cow, horse, and etc (Eurell et.al.,2006).

The previous studies measuring follicle diameter have been carried out on different animals and it was found to be: 18-300 μm in guinea pig (Ozdemir and Dinc,2002), 100-399 μm in mouse (Numazawa and Kawashima, 1982) and 0.1-0.8 mm in rat (O’shea, 1970). In the present study the follicle diameter has been measured as 9.5-62.37 μm.

In conclusion, it was determined that the morphology of ovaries and its constituent cell types were similar to those described for other rodents.

References

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