Effect of Season on the Morphology and Ovarian Activity of Camel (camelus dromedarius)

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Abstract—This study aimed at examining the effect of season on the morphology of the camel ovary, and in turn, the ovarian activity. For histological investigations, tissue samples were collected from right and left ovaries of 36 non-pregnant adult animals over a span of one year. The samples were fixed and processed for the routine histological sections, stained with haematoxyline and eosin; and with Masson’s trichrome. Ovaries of 24 camels were also weighed and mean weights calculated. Minor changes in the ovarian histology of non-pregnant camel were observed during the rainy season. These were mainly in the pattern of the medullary tubes, large antral follicles and number of leukocytes within the ovarian cortical stroma. The weight of the right and left ovaries and over the seasons was not found to be of noticeable difference. The overall picture is suggestive of an increased ovarian activity during autumn, which indeed the time of the onset of the breeding season without remarkable variation observed in the ovarian weight.

Index Terms — Camel, Histology, Ovary, Season

I. INTRODUCTION

Although the normal histology of camel ovary has been described in details [1-5], the effect of season seemed to have received little attention. Histological investigations on the ovary suggested that female camel is a seasonal breeder [3]; the breeding season being in the spring. Recently, it has been stated that the ovarian activity was found to be higher in spring and winter than summer and autumn seasons [6]. Despite the reports on camel being a seasonal breeder, the available information about the breeding season is inconsistent. Findings based on slaughterhouse material in Egypt [7], Sudan [8] and Saudia Arabia [9] have shown that the camel is a polyoestrous breeder. However, there are certain months during which the ovarian activity is very low while, in others is very high. The ovarian activity with follicular development starts in February / March and ends in about mid August [10]. Furthermore, study based on the difference of the ovarian weight between seasons, revealed that the ovarian activity is higher during the cold seasons of November / December rather than the post rainy seasons of September / November [11]. According to [7], there are high significant differences in the ovarian activity between months as well as seasons of the same year; since most of the activity in Egypt occurs from December to May.

Seasonal effects on camel fertility and ovarian follicular growth have been reported in Morocco [12]. Camels are considered as seasonal breeders with a clear non-breeding season extending from June to October and actual breeding season extending from October to May. A clear geographical variation concerning the timing of sexual activity of the dromedary has been reported in different countries. In Somalia, for example, the breeding season is from April to May [13]. It extends from December to March in Tunisia, October to April in Saudi Arabia [14]. The aim of this study is to examine the effect of season on the morphology of the camel ovary and in turn, the ovarian activity i.e. the onset of the breeding season.

II. MATERIALS AND METHODS

For histological investigation, tissue samples were collected from right and left ovaries of 36 non-pregnant animals over a period of one year, 3 animals per month, obtained from Elbuga’a slaughterhouse west of Omdurman city in the Sudan. The age was in the range of 7-13 years as determined by dentition [15]. Removed ovaries were examined grossly to ascertain of no pathological lesions. They were then divided into two halves by longitudinal incisions through the hilus, medulla and cortex. One half of each ovary was chosen randomly and sliced into three equal parts. All blocks were immersed in different fixatives including 10% formal saline or Bouin’s. Tissues were processed by routine histological technique, dehydrated and embedded in paraffin wax melting point 58-60 °C [16], 5-7 µm thick sections were cut in a rotary microtome and stained with haematoxyline and eosin and with Masson’s trichrome [17]. To determine the ovarian weight, ovaries of camels during transitional periods falling between rainy, winter and summer seasons have been eliminated. The collection therefore limited to 24 camels and accordingly each season was represented by 8 animals. Ovaries were then weighed using a digital laboratory sensitive balance prior to histological processing. The mean ovarian weight in the different seasons was then calculated.
III. RESULTS AND DISCUSSION

Regardless of season, clusters of cells similar to degenerated luteal cells were fairly frequently found embedded in the cortical stroma. Occasionally, these clusters were surrounded by hyalinized connective tissue mass. When treated by haematoxylin and eosin or Masson's trichrome, they all appeared yellowish and spherical to oval in shape with prominent nuclei located eccentrically (Fig. 1). The cells in the peripheral regions and bordering the cortical stroma appeared highly vacuolated with pyknotic nuclei. It has been reported that the interstitial endocrine cells of ovaries of the bitch, queen and rodents could arise from the hypertrophied granulosa cells of the atretic preantral follicles [18]. Occasionally, in the camel, clusters of fat laden lutein cells persist for a time and appeared embedded in the cortical stroma after they replace the regressed corpus luteum [3]. In the present study, similar findings were observed in the camel ovary. Such cells may have a similar role to interstitial gland cells which originated from degenerated follicles of other mammals, as a population of stromal cells with typical characteristics of steroidogenic cells were noted in camel during early and mid stage of pregnancy and disappeared during late pregnancy [5].

The histological features of the ovary during different seasons showed little change. Medullary tubes, considered as vestigial remnants of the mesonephric tubules, were seen in more than seventy percent of the number of ovaries examined. This in accord with earlier findings given by [1], medullary tubes were observed in about four out five ovaries examined and were either empty or contained secretion. In the present study, medullary tubes were enclosed by connective tissue and lined by either cuboidal or flattened epithelial cells and their lumina were either empty and
dilated or narrow and contained secretion. The narrow lumina were lined by cuboidal cells whereas empty ones were lined by either flattened or cuboidal cells. These variations in histological features are closely linked with season. In autumn, the medullary tubes possessed narrow lumina containing secretion and were lined by cuboidal epithelial cells with prominent cytoplasmic processes (Figs. 2 and 3). In winter and summer the medullary tubes with large empty lumina were predominant (Fig. 4). It has been suggested that medullary tubes may not be vestigial embryonic structures but could fulfill an active endocrine function [1]. The present findings in which the medullary tubes appeared more active during autumn, lend support to this suggestion. Further immunohistochemical studies are needed to consolidate this assumption.

Figure 1. A photomicrograph of section in the cortical interstitial tissue (C) showing an island of the spherical cells with eccentric nuclei (arrows). H&E. X250.

Figure 2. A photomicrograph of section in the ovarian medulla showing Medullary tubes with narrow lumina (L) containing secretion. H&E. X250.

Figure 3. Higher magnification of section showing the secretion (arrows) in the lumen of medullary tubes. H&E. X500.

Compared to other two seasons, leukocytes were more numerous within the cortical stroma during autumn and some eosinophils were found in the medullary tissue. Lymphocytes were more in population than other
leukocytes. In pregnant camel, it has been suggested that the presence of large number of leukocytes during pregnancy is needed to preserve the ovarian milieu [5]. This as well may be applicable to the present findings, as leukocytes were seen more frequently during autumn than in other seasons probably due to high ovarian activity.

Haemorrhagic follicles were frequently observed in the ovarian cortex with slight increase in number during autumn. They were characterized by hyalanized hypertrophied theca layer and a large amount of red blood cells filling the antrum while a small amount was deposited among the atretic granulosa layer cells. Previous studies indicated that the camel is considered as induced ovulator and therefore normally only ovulates in response to mating [19, 20]. Moreover, the follicular growth occurs in regular waves during breeding season [21]. Ultrasonographic studies revealed that in the absence of mating or ovulation inducing, mature follicles start to regress. According to the studies, the overlarge anovulatory follicles could be divided into 5 categories including thick walled structure with blood clot and fibrin strands within the cavity (haemorrhagic follicles) [22]. Such atretic follicles have been observed in the present study mainly in autumn. Hence, it may be reasonable to assume that the presence of such large follicles, especially during autumn is indicative of higher ovarian activity in this season.

The average weight of the left ovary was found to be 4.4±.32 and the right ovary was 3.9±.25; the weights of the right and left ovaries in summer, winter and autumn are shown in Table 1. The mean ovarian weight of adult non pregnant camel has been reported as 5.6 ± 1.2 gm [23], 4.6 ± 1.4 gm [4]. These results were more or less similar to the findings of the present study. Interestingly, high ovarian weight (12.60±1.41 and 12.69±2.08 gm for left and right ovary respectively) has been reported in Pakistan [24]. In the local climatic conditions in Nigeria, a significant seasonal variation was noted in the weight of both ovary and follicular fluid, since the ovarian weight is higher in the cold dry season, November/December, than during post rainy season, September/ October, and this variation could be attributed to the increase in the ovarian activity during the cold dry season [11]. Similarly, the ovarian weight in the camel was found to be significantly affected by season [24, 25]. This does not seem to agree with the present findings which showed that the ovarian weight was not significantly affected by season. The differences in the results concerning the ovarian weight could be attributed to environmental factors and difference in breeds [25].

The present investigations dealing with the non-pregnant camel showed that the difference in weight between the right and left ovary was insignificant. These findings are in accord with Musa (1979) [20] and Tibary &Anouassi (1997) [26] who recorded no real difference in activity between both ovaries, and the pregnancy rate was similar whether ovulation occurs on the left or right ovary. Controversially, a number of reports stated that the left ovary was heavier than the right one [27, 28].

### Table 1. The weights (gm ± standard deviation) of the right and left ovaries in different climatic seasons

<table>
<thead>
<tr>
<th>Season</th>
<th>Left Ovary</th>
<th>Right Ovary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autumn</td>
<td>4.89±0.66</td>
<td>4.17±0.40</td>
</tr>
<tr>
<td>Winter</td>
<td>3.90±0.38</td>
<td>3.40±0.47</td>
</tr>
<tr>
<td>Summer</td>
<td>4.40±0.59</td>
<td>4.10±0.41</td>
</tr>
<tr>
<td>Overall</td>
<td>4.40±0.32</td>
<td>3.90±0.25</td>
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</tbody>
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### IV. CONCLUSION

There were little changes in the ovarian histology of non-pregnant camel during the different seasons in Sudan. These were mainly during rainy season including the differences in the pattern of the medullary tubes, large antral follicles and proportion of leukocytes within the ovarian cortical stroma. The overall picture is suggestive of an increased ovarian activity during autumn, which indeed the time of the onset of the breeding season without any major effect on the weight of ovaries.

### V. REFERENCES

[1]. Shehata R. (1964). Medullary tubes in the ovary of the camel and other mammals. The Veterinary Record; 76: 750-753.


