

# Morphometrical Study of the Ovary of Local Goats (*Capra hircus*) During Different Stages of Pregnancy

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**ABSTRACT:** Understanding the morphometric differences in goat ovaries between pregnant and non-pregnant individuals can contribute to improving reproductive management and assist in interpreting ovarian-related abnormalities. It may also provide valuable insights into the dynamic changes occurring in the ovary of local goats (*Capra hircus*) during pregnancy. This study aimed to investigate and compare the morphometric features of ovaries in pregnant and non-pregnant goats. Sixteen healthy female domestic goats (*Capra hircus*) were selected to collect organs. The female goats were categorized into two groups: mature, non-pregnant goats (**n = 4**) and pregnant goats with a single pregnancy (**n = 12**). The study found no significant difference in the length of ovaries between non-pregnant and pregnant goats but significant increases in width, thickness, and weight at different gestation stages. The right ovary had more significant weight and dimension in both groups. Additionally, the presence of [CL] during pregnancy, these changes can affect the size, dimensions, and weight of the ovaries.

**Keywords:** Ovary, *Capra hircus*, non-pregnant goats, pregnant goats



## 1. INTRODUCTION

The domestic goat (*Capra aegagrus hircus*) is hollow-horned ruminant subspecies of the wild goat that belongs to mammalian order Artiodactyla, suborder Ruminant, family Bovidae (Cetartiodactyla, Ruminantia). *Capra* is a very contested genus with a highly contested provenance. It belongs to the subfamily Caprinae. (1, 2 and 3). This group of even-toed hoofed mammals, including antelopes, gazelles, sheep, goats, and cow, has formed within the Bovidae family within the last 20 years (1, 4). Goat domestication may have served as a catalyst for innovative Neolithic breeders to domesticate other livestock species, providing them with a considerable cultural and economic advantage. The human populations that domesticated animals initially had a distinct edge over other peoples and quickly spread their way of life throughout the world (5 and 6).

In the past 40 years, sheep and goats have been used in research and education for a number of reasons. Goats can be found all over the world and are very useful and important sources of milk and high-quality meat for many populations. They also have high reproductive rates (7 and 8). In addition, one of the important reasons for choosing goats in scientific research is that they have a natural tendency to adapt physiologically and require less breeding management, and the success of the goat is attributed to its exceptional capacity for adaptation to the challenging mountain environment, acceptance of harsh weather and low-value feed, and adaptable habits (9, 10, 11, 12 and 13).

It is important to know the anatomy and physiology of the female reproductive system in small ruminants for many reasons. The most important of them is that this system is important in determining the animal's reproductive efficiency, annual fertility rate, differences in the female reproductive system between species, and the reproduction rate's economic importance (14, 15, 16, 17, 18 and 19). The female reproductive system of goats consists of the upper tract (ovaries, uterine tubes, uterus, and cervix) and the lower genital tract (vulva and vagina), these organs being concerned with menstruation, coitus, fertilization, pregnancy, and parturition (20). The small, almond-shaped ovaries are located on either side of the pelvic cavity. It is joined by the cranial portion of the broad ligament of the uterus, or mesovarium, a peritoneum wrap that joins the reproductive organs to the abdominal wall (21 and 22). It is a crucial component of the female reproductive system, performing both exocrine and endocrine functions. Unlike the endocrine function, which creates hormones like estrogen and progesterone, the exocrine function carries the ovum from the ovary to the vaginal canal. Secondary sex traits and alterations in the uterine environment that allow for embryo implantation are brought on by the hormones estradiol and progesterone (23).

The ovary is divided into two sections histologically: the cortex, which is located on the exterior, and the medulla (zona vasculosa), which is located on the inside (24, 25 and 26). Numerous follicles in various developmental stages can be found in the ovarian cortex and reticulum threads with collagen surrounding them; only a tiny percentage of them ovulate. After ovulation, the ovary forms the corpus luteum, which secretes progesterone to keep the pregnancy going (23 and 27). The medulla of the ovary is made up of elastic and reticular connective tissue fibres, lymphatic veins, nerves, and blood vessels (28 and 29). This study aims to investigate the morphomatrual characteristics of the ovary of local goats (*Capra hircus*) during different stages of pregnancy.

## 2- METHEDODOLOGY

### 2-1- Collection of Animals

The (16) female healthy domestic goats (*Copra hircus*) used for this study. The female goats divided into (4) mature, non-pregnant and (12) pregnant (single pregnancy). The pregnant goats were divided into three groups according to the gestation period; early gestation (25-35) days, mid gestation (60-70) days and the late gestation period (120-130) days. Determine of the gestation period by they:

**1-The early gestational period:** According to [the macroscopic characterization of the fetus] (30) and (31).

**2- Mid- and late gestation periods:** Was determined gestation periods by using the [CRL] formula  $Y = 2.1 (X + 17)$  where (Y) is the fetus's age and (X) is the fetus's length from crown to anus in cm (32, 33 and 34). The morphomatrual study of the ovary for each one (pregnant and non-pregnant animals) includes shape, colour and location, calculated length, width, thickness and weight. The ovary's length represents the distance between two extremities, while the width is the separation between its attached and free boundaries. The thickness of both ovaries was standard between the medialis and lateralis surface (35 and 36).

### 2-2 Ethical approval

The Research Ethics Committee of the University of Baghdad's College of Veterinary Medicine provided research ethical permission, number P.G/94

### 3- RESULTS

Morphological results revealed that the ovaries vary in appearance according to the animal's condition (pregnant or non-pregnant). The ovaries of non-pregnant goats are small, pink, almond-shaped, and relatively have a glistening surface Fig (1A) but became more irregular in shape, shiny and spongy texture during stages of pregnancy Fig (1B). Pregnant and non-pregnant goat ovaries have two slightly convex borders (attached and free), two extremities (tubal and uterine) that are close to the proper ovarian ligament, and two sides Fig (1A&B).

Several growing different sizes follicles are distributed on the surface of each examined ovary. Distribution of follicles varied in appearance according to reproductive state. Small follicles are few in numbers, various in sizes embedded in the stroma of ovary and not clearly raised above the surface compare to tertiary follicles was appear large, pink protrudes arise from the surface of the ovary in pregnant and non-pregnant . The Graafin follicles are vesicle markedly from the ovarian surface, and it was spherical in shape with thin clear translucent and richly –vascularized wall. Graafin follicles appear large in size and more development in non-pregnant than the pregnant animals. From the follicles that located in the surface of pregnant and non-pregnant goat ovary the atretic follicles, which appear spot dark in colour, a high percentage embedded in the surface of the pregnant goats' ovary during different stages Fig (2A, B).

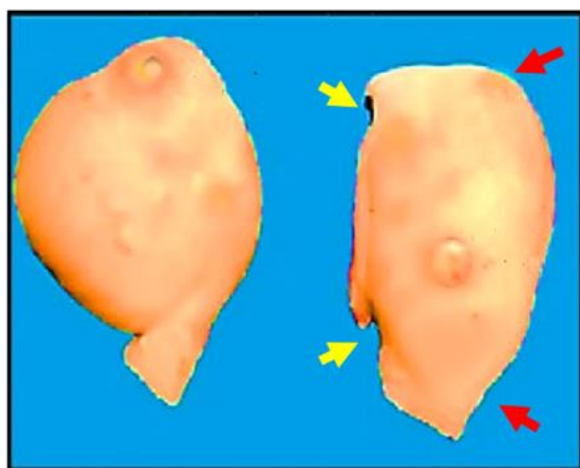
In pregnant goats, in addition to the types of follicles, there are other structures that characterize surface of these ovaries like presence dark pink corpus hemorrhage (early corpus leteum formation), mature corpus luteum was compact rounded body, yellow in colour with a center of fibrous tissue and regression of corpus luteum (final stage) Fig (3).The presence of this stricture gives a clear impression, the ovary surface of the pregnant goats is irregular in shape and colour. The ovary was clearly visible since there was no ovarian bursa (peritoneal sac protecting the ovary) .It's located dorsal and caudal; the apex of the uterine horns in both pregnant and no-pregnant goats Fig (4).

#### 3-1-Dimensions

The dimensions of the left ovary in non-pregnant was ( $1.88 \pm 0.02$ ) cm in length, width was ( $1.54 \pm 0.04$ ) cm, thickness was ( $3.8 \pm 0.28$ ) cm, and weight was ( $0.68 \pm 0.01$ ) g respectively (Table 4-1). Right ovary measurements are as follows: length ( $2.11 \pm 0.04$ ) cm, width ( $1.23 \pm 0.02$ ) cm, thickness ( $5.08 \pm 0.07$ ) cm, and weight ( $0.73 \pm 0.02$ ) g (Table 1). No statistically significant difference ( $P > 0.05$ ) was noticed for the length of ovaries between non-pregnant and pregnant goats (Table 1). However, it was observed that the dimensions of the ovaries, including its width, thickness, and weight, exhibited significant differences ( $P < 0.05$ ) throughout gestation in comparison to non-pregnant and no significant differences ( $P > 0.05$ ) in the dimensions of the ovaries between mid and late gestation period (Table 1).The data also show a notable dissimilarity ( $P < 0.05$ ) in the measurements of the right ovary's weights and dimensions relative to the left ovary in both non-pregnant and pregnant goats (Table 1).



**Figure (1A)** Macrograph of medial view of the right (R) and left (L) ovary in non-pregnant goats shows two extremities = black star, attached border = yellow arrows, free border = red arrows



**Figure (1B)** Macrograph of ovary in pregnant goats during different stage of pregnancy shows two extremities = black star, attached border = yellow arrows, free border = red arrows

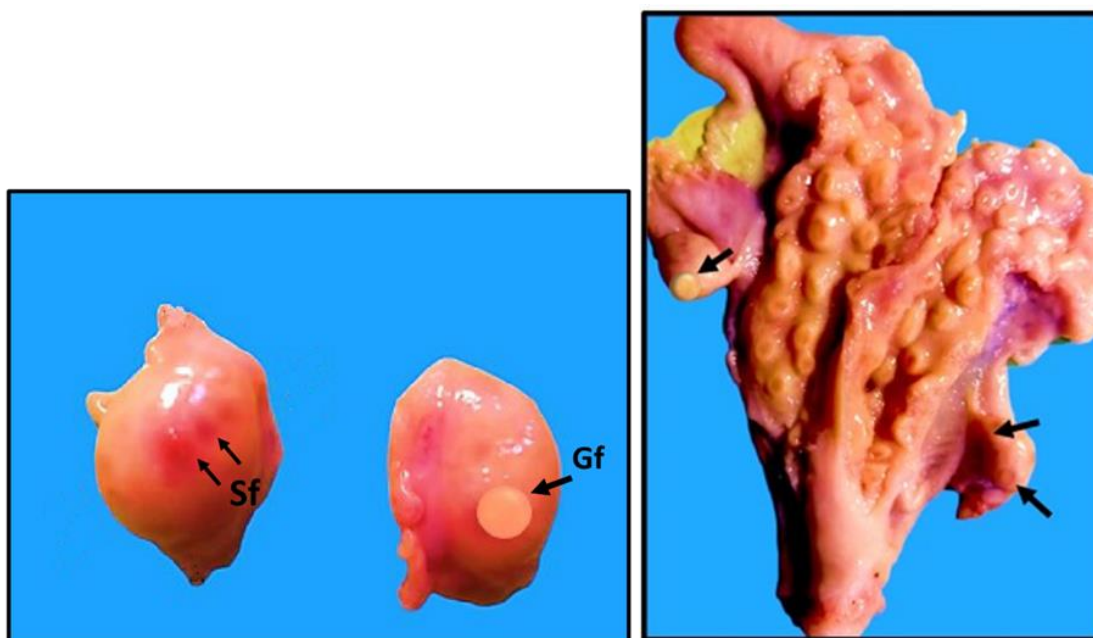


Figure (2A) Macrograph of the ovary in non pregnant goats shows. small follicles (Sf) , Griffin follicles (Gf) ,

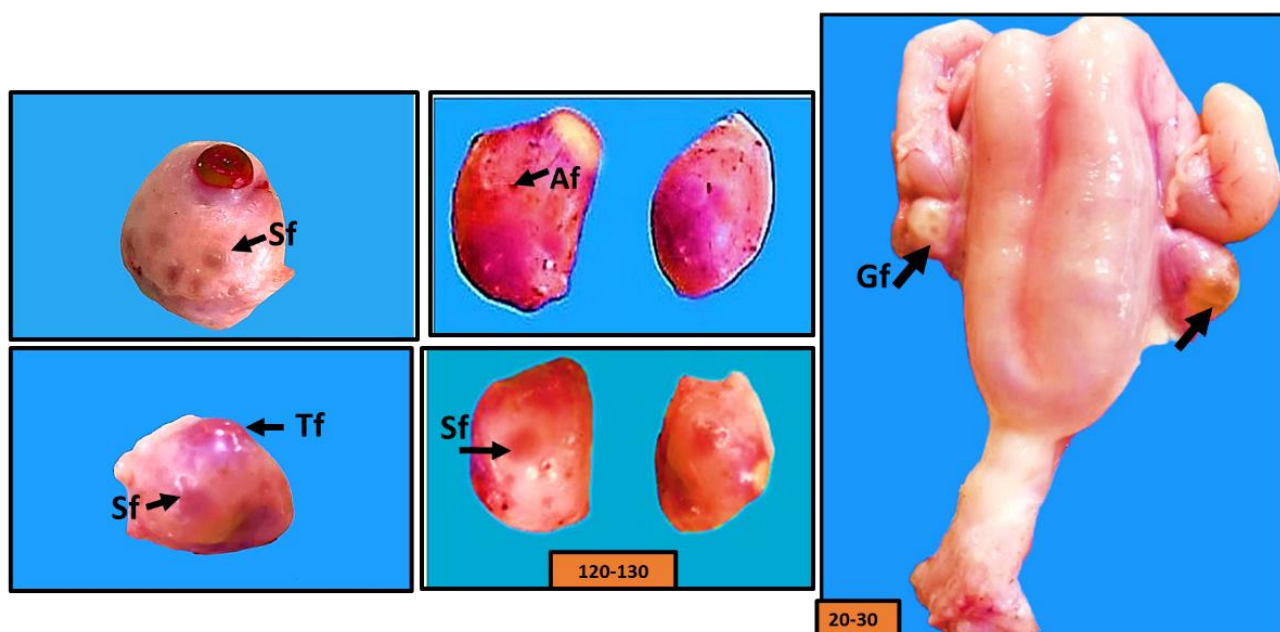
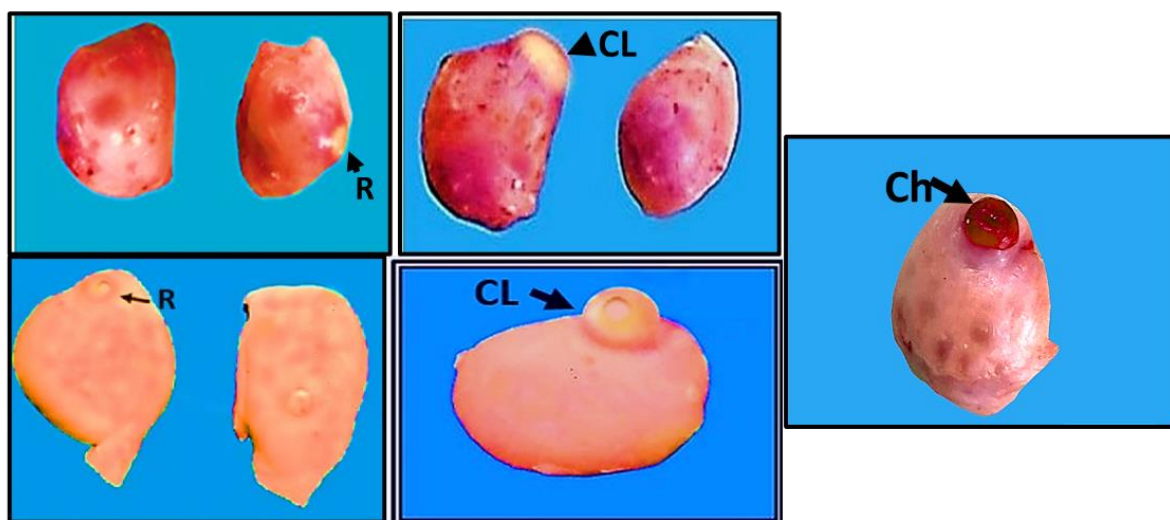
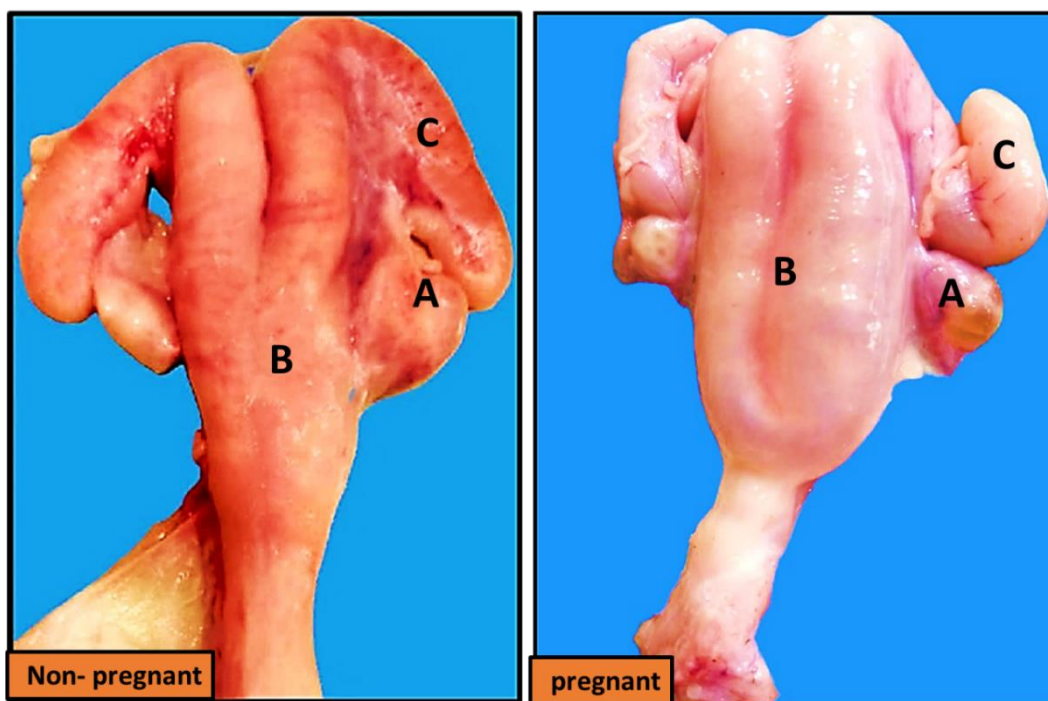


Figure (2B) Macrograph of the ovary in pregnant goats shows. Griffin follicle (Gf) ,tertiary follicle (Tf) , Small follicles (Sf) , atretic follicles (Af)



**Figure (3) Macrograph of the ovary in pregnant goats shows corpus hemorrhage(Ch) corpus luteum(CL), regression of corpus luteum (R)**



**Figure (4) Macrograph of female genital system in pregnant (early gestation period) and non-pregnant goat showing A- ovary, B- uterus, C- uterine horn**

**(Table. 1).** The morphometric measurements of the right & left ovary in pregnant and non-pregnant goats

Total number of ovaries= 32

Non-pregnant = 8 ovary

Pregnant = 24 ovary

\* Different latter denote significant differences ( $p \leq 0.05$ ), Similar latter denote no significant differences ( $p \geq 0.05$ )

\* Capital latter denote to the vertical statistical reading in the dimension of right and left ovary between pregnant and non- pregnant goats

\* Small latter denote to the horizontal statistical reading in the dimension between right and left ovary in non- pregnant and during different stage of pregnancy

Groups	Length of ovary(cm)		Width of ovary(cm)		Thickness of ovary(cm)		Wight of ovary (cm)	
	Left	Right	Left	Right	Left	Right	Left	Right
Non - pregnant	1.88±0.02 <b>Aa</b>	2.11±0.04 <b>Aa</b>	1.54±0.04 <b>Aa</b>	1.23±0.02 <b>Ab</b>	3.8±0.28 <b>Aa</b>	5.08±0.07 <b>Ab</b>	0.68±0.01 <b>Aa</b>	0.73±0.02 <b>Ab</b>
M1 (early gestation period)	1.75±0.14 <b>Aa</b>	2.13±0.05 <b>Ab</b>	1.82±0.08 <b>Ba</b>	1.87±0.17 <b>Ba</b>	6.15±0.41 <b>Ba</b>	6.97±0.12 <b>Bb</b>	1.23±0.04 <b>Ba</b>	1.77±0.02 <b>Bb</b>
M2 ( mid gestation period)	1.45±0.1 <b>Aa</b>	2.25±0.10 <b>Ab</b>	1.24±0.01 <b>Ca</b>	1.50±0.12 <b>Cb</b>	7.32±0.10 <b>Ca</b>	7.57±0.14 <b>Ca</b>	1.56±0.13 <b>Ca</b>	1.81±0.06 <b>Cb</b>
M3 ( late gestation period)	1.75±0.08 <b>Aa</b>	2.20±0.10 <b>Ab</b>	1.52±0.04 <b>Ca</b>	1.35±0.02 <b>Cb</b>	7.42±0.17 <b>Ca</b>	7.02±0.06 <b>Cb</b>	1.26±0.08 <b>Ba</b>	1.79±0.02 <b>Bb</b>
LSD	0.268		0.249		0.601		0.189	

#### 4- DISCUSSION

Morphological results revealed that the ovaries varied in size and appearance according to the animal's condition (pregnant or non–pregnant). It was small and a bean in shape in non-pregnant while almond or appear irregular in shape, shiny and spongy texture in pregnant. This is due to decrease development of follicles and absent corpus lutum in non-pregnant compare to pregnant goats , this fact agreement with the (35) in Sahelian goats, (36 and 37 ) postulated the ovaries in non-pregnant affected by the low level of oestradiol -17  $\beta$  hormone , and the low level of aromatase. This enzyme converted androgens to estrogens with the main one being oestradiol (38).

Different sizes follicles are distributed on the surface of pregnant and non-pregnant but varied in appearance .This finding was consistent with (39) who suggested that pattern of follicular growth increase during early pregnancy than the other stages. From the follicles that located in the surface

of pregnant and non-pregnant goat ovary the atretic follicles, which appear dark spot in colour, a high percentage embedded in the surface of the pregnant goats than the non-pregnant. This explanation was supported by recent studies (40) suggesting that a counting basal secretion of LH, but in the absence of the true ovulatory LH surge because of suppression of GnRH secretion by inhibitory neuronal mechanisms may be the cause of the overgrowth of some follicles without ovulation. These suggestion pertinent to the occurrence of the atretic follicles seen and more in pregnant in the study. In pregnant goats, in addition to the types of follicles, presence CL at the different stage development gives a clear impression, the ovary surface of the pregnant goats is irregular in shape and colour. This result is identical to what he concluded (41) in sheep and (42) in goats.

The morphological results revealed, no statistically significant difference ( $P>0.05$ ) was noticed for the length of ovaries between non-pregnant and pregnant goats. In goats, the length of the ovaries may be controlled by hormonal processes unaffected by pregnancy. The lack of changes in ovarian length between non-pregnant and pregnant goats may be due to hormonal regulation of ovarian development and function, this agreement with the (43). However, it was observed that the dimensions of the ovaries, including its width, thickness, and weight, exhibited significant differences ( $P<0.05$ ) throughout gestation in comparison to non-pregnant and no significant differences ( $P>0.05$ ) in the dimensions of the ovaries between mid and late gestation period. This explanation was supported by recent studies (44, 45, 46, 47 and 48) postulated that, these variations between pregnancy and non-pregnancy could be attributed to the different regulation of gene expression, which is connected to a number of reproductive processes, including the growth of follicles, corpus luteum formation, hormone secretion, luteinization and pregnancy maintenance.

The data also show a notable dissimilarity ( $P<0.05$ ) in the measurements of the right ovary's weights and dimensions relative to the left ovary in both non-pregnant and pregnant goats. This study's findings are consistent with those reported by (49) for the ewe, (50) for Bengal goats, (35) for Sahelian goats, (51) for Andhra Pradesh goats and (52) for Kano brown doe-goats and disagree with those reported by (53). Factors such as hormonal regulation, genetics and individual variation can affect ovarian activity

## 5- CONCLUSION

The findings of this study have successfully determined the fundamental measurements of the distinct sections of the female reproductive system in pregnant and non-pregnant (*Copra hircus*) goats. This data will be valuable in identifying and diagnosing various anomalies in the reproductive tract. The morphological findings indicated that the dimension and colour of the ovaries differed between pregnant and non-pregnant goats, depending on the animal's physiological state. In addition, this finding substantiates the observation that the right ovary has greater activity than the left in both pregnant and non-pregnant goats.

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