

## Histomorphological features of Rabbit Uterine Tube During Estrous Phases

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### ABSTRACT

Microscopic features of the adult rabbit uterine tube during estrous cycle were studied. Twenty rabbit uterine tube were used. Rabbits were collected from local market. Sections from uterine tube infundibulum, ampulla and isthmus were prepared for histological study. Lengths and widths of various parts were obtained from the right tube.

Ampulla formed the longest part, isthmus was narrowest segment and connected to the uterus. The infundibulum was with fimbriae. Epithelial lining was with few types of cells, and were; ciliated; non-ciliated secretory (peg cells) and basal cells were also demonstrated. The type of epithelial cells was pseudostratified epithelium. In the ampullary mucosa, large number of primary branches at the follicular phase was observed. Ciliation was more at the follicular phase than luteal phase. While secretory cells during follicular was less than that at luteal phase.

### Introduction

The role of oviduct in the reproduction has a clear situation from the points of creation of gametes transports and passage, the end stages of male gamete maturation, an important site in fertilization, early developmental stages of embryo transport, and provide environmental and nutritional support during early embryonic development [1, 2, 3].

The mammalian oviduct lining epithelium is of many cell types; ciliated, non-ciliated secretory, basal and peg cells [3]. These cell types go through various changes related to the hormone concentration alteration during the estrous cycle [4]. The ciliated cells help in gamete movement and transport, while the secretory type importance is through their secretory activities in functions of sperm and early stages of embryonic development [5]. Most oviduct secretion is by time of fertilization [6].

The aim of the present study was to demonstrate and describe the morphological and histological changes which occur in rabbit oviduct during estrous cycle.

### Materials and Methods

#### Samples' collection

Twenty uterine tubes of locally bred adult rabbits were collected. Rabbits were 4-5 months of sexually age. Right uterine tubes were cut, after sacrificed washed in Saline solution and fixed in 10% formalin. Fixed samples were dehydrated, cleared and paraffin

embedded. Sections of 4  $\mu$ m thickness were stained with Haematoxylin and eosin.

#### Morphological measurements:

Lengths of different uterine tube parts were measured separately. These are included the length of infundibulum, ampulla and isthmus using a digital caliber. And the uterine tube was weighed using an electronic balance. Stages of estrous cycle estimation were selected from the presence of ovarian follicles and corpus luteum.

#### Histological measurements:

These measurements were included a number of mucosal folds and their heights. The epithelial thickness and the number and types of lining cells of both follicular and luteal stages were also measured. These measurements were made using an ocular and stage micrometer (0.01mm Japan).

#### Statistical analysis:

Data were analyzed and presented as means and standard deviations, using SPSS.

### Results and Methods

#### A. Morphological measurements:

The uterine tube is a part of female reproductive system which receives the Oocyte and provide a good situation for fertilization. The results showed that the uterine tube was tortuous, whitish to fleshy color and flexible organ with narrow lumen [7]. The uterine tube tortuousness is related to pre and reproductive

life [8]. The minimum uterine tube length in the present work was 5 cm, and the maximum was 5.57 cm. this variation was related to the reproductive period. This is in agreement to what was recorded by Devi, et.al [9].

Uterine tube in this study showed four distinct parts which were the infundibulum, ampulla, isthmus and intramural portion, which were similar to the results of other studies recorded by [7, 9].

#### 1. Infundibulum:

The infundibulum was a funnel-shaped with obvious fimbrae and a short narrow part, the neck. This funnel shaped measured  $1.31 \pm 0.21$  cm in length, and the fimbrae was  $0.51 \pm 0.12$  cm in length. These processes (fimbrae) play an important role in fertilization [8]. The caudal constricted neck part of the infundibulum control the uterine tube abdominal opening and is responsible in ovum catch up [8].

Mean number of uterine tube fimbrae was 14 and in other times was 8 only. This is attributed to the phases of the estrous cycle and uterine tube changes occur in the morphology and architectural. Eweka, et.al [9] found changes in the number of fimbrae process in their study also.

#### 2. Ampulla:

This part was the longest and formed more than half of the total uterine tube length and was about  $2.8 \pm 0.5$  cm. the length and the width of the ampulla is related to its function [10].

#### 3. Isthmus:

This is formed the narrowest part and has connection with the uterus and measured about  $0.70 \pm 0.12$  cm. the isthmus is considered as a control point or sphincter to control the uterine tube opening, which agree with what was mentioned by Crow, et.al [11].

#### 4. Intramural part:

This part is inserted and embedded in the uterine wall and has a length of  $0.30 \pm 0.10$  cm.

#### 5. Weight of uterine tube:

Mean uterine tube weight in the present work was  $2.5 \pm 0.31$  gram.

### B. Histological measurements:

#### 1. Infundibulum:

The infundibulum mucosa was with many finger like processes, which was subdivided into primary, secondary and tertiary branches (fig.1). This is related to infundibular function, in receiving and transporting the ova from the ovary to the ampulla [7]. A number of processes are less at the follicular phase than the secretory. The epithelial lining of this part was pseudostratified ciliated columnar epithelium (fig.2). This epithelium contained many cell types, which were ciliated, non-ciliated secretory and basal cells. This is supported by the work of Ewek, et.al, [9]. The ciliated was slightly elongated, darkly stained and centrally located nucleus. The non-ciliated secretory cells were slightly large cell, pale staining cytoplasm, and with an ovoid nucleus. The third cell type was the basal cells, with slightly round small nucleus and clear cytoplasm, located at the base of the previous

types (fig. 2). This is also supported by the study of Eweka, et.al [9]. No glands were observed.

In the infundibulum, the mean number of ciliated to secretory cells at the follicular phase were 18:6, while it was about 8:18 during the luteal phase (table-1). This means that the number of secretory cells: ciliated at the follicular stage was less, while it was high at the luteal phase. This result is supported by Mokhtar [3], who mentioned high number of ciliated compared to secretory at the follicular stage in bovine.

A significant increase in the length and a number of mucosal folds during follicular phase was observed (table-1).

Epithelial thickness was significantly increased during luteal phase. Mokhtar [3] also more number of branches and folds were found during follicular phase.

#### 2. Ampulla:

Many branches were observed in the mucosa of the ampulla. These branches were finger like with primary, secondary and tertiary processes. Some of which were interconnected to appear as separate chambers in the section.

The mean number of primary branches at the follicular phase was 18, while it was only 11 at the secretory phase. This was also comparable to the results of Mokhtar, when he found the number of primary branches at the follicular stage more than that at the secretory stage in bovine [3].

Large number of ciliated cells were recorded at the follicular phase  $\rightarrow$  than secretory  $\rightarrow$  and was 15:10 (fig.4)  $\rightarrow$ . Also Mokhtar [3] in his study recorded larger number of cilia at the follicular phase compared to the secretory phase. The lining epithelium was made by pseudostratified epithelium with three cell types (fig. 4).

Ciliated cells were more at the follicular phase in the infundibulum and gradually decreased in the ampulla, this is related to the function of estrogen which cause the development of more cilia at the former part compared to the later. Also it is concerned with the function of cilia in transporting the ovum from the infundibulum to the ampulla, where fertilization occurs [12, 13].

Secretory cells during follicular to luteal phases were less at the infundibulum than the ampulla, while secretory cells during luteal phase at the ampulla were more in number compared to the infundibulum. These variations are related to the function and importance of sections during the two phases [14].

#### 3. Basal cells

Basal cells were obvious and located at basal part of both infundibulum and ampulla. These cells are undifferentiated cells, which are stem cells to produce both ciliated and secretory cells. These cells were with darkly stained nuclei and clear cytoplasm. This was seen by Gordan & Gasanova [15] in the mammalian *Chaetophractus villous*, and Ozen, et. Al [16] in Angora sheep.

**4. Lamina propria and muscular layer:**

These two layers were without obvious changes. The lamina propria was formed by loose connective tissue with collagen fibers which were abundantly distributed. While the muscularis consisted of bundles of smooth muscle fibers contained many blood vessels and nerves. This what has been seen by Rajiput & Sharma [16].

**5. Isthmus:**

Isthmus was with wavy lumen. Lining epithelium was made by simple columnar epithelium, in some

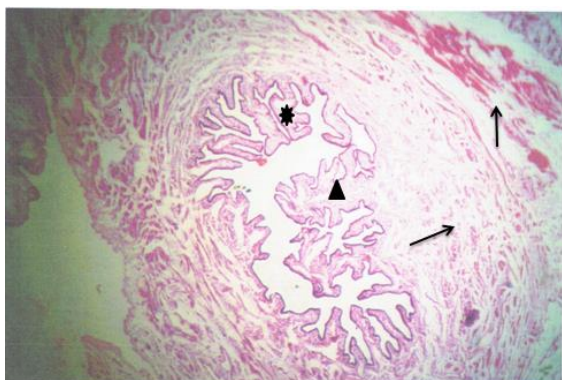
sections looked as pseudostratified. Columnar cells were with cilia and others contained no cilia.

**Conclusion**

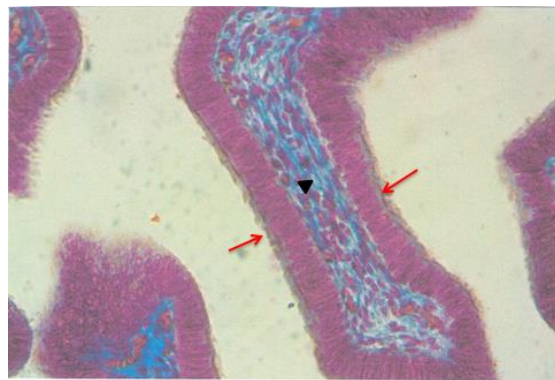
Rabbit uterine tube composed of four parts. It is surrounded with three tissue layers, mucosa, muscularis and serosa. The mucosa contained many folds and a system of branches. Uterine tube is lined by pseudostratified epithelium with three cell types. Changes in the number of ciliated and secretory cells were obvious during the follicular and luteal phases in both of infundibulum and ampullary regions during the estrous phases.

**Table (1) A number of folds, ciliated and secretory cells, and epithelial heights of rabbit uterine tube during follicular and luteal phases of estrous cycle**

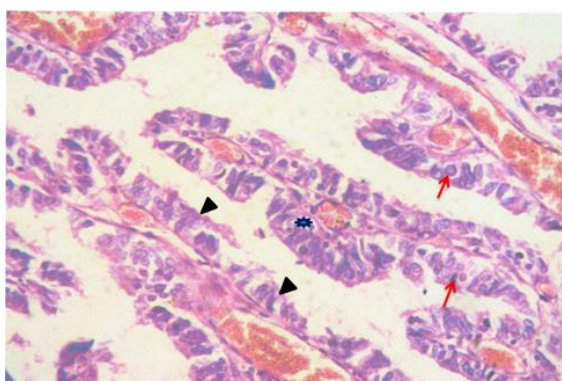
| Uterine tube parts | Estrous Stages | Folds number | Ciliated cells | Secretory cells | Epithelial heights |
|--------------------|----------------|--------------|----------------|-----------------|--------------------|
| Infundibulum       | Follicular     | 24.21 ± 3.10 | 18.52 ± 2.61   | 06.50 ± 1.22    | 23.32 ± 2.71       |
|                    | Luteal         | 19.11 ± 2.50 | 08.62 ± 2.31   | 18.41 ± 0.33    | 28.62 ± 1.81       |
| Ampulla            | Follicular     | 18.22 ± 4.32 | 15.64 ± 2.23   | 10.33 ± 0.51    | 26.12 ± 2.84       |
|                    | luteal         | 11.10 ± 3.20 | 07.30 ± 2.11   | 15.70 ± 1.62    | 29.73 ± 3.61       |



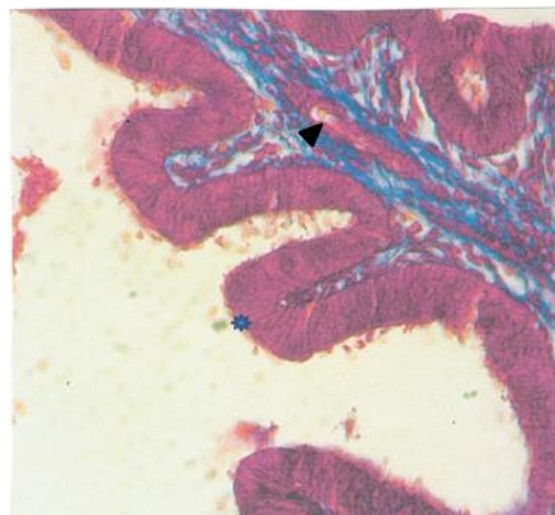
**Figure (1) Infundibular mucosa of rabbit at follicular stage, with mainly primary branches (\*), epithelium lining (▶), muscularis (→), and adventitia (↑). (H & E. x20).**



**Figure (3) Rabbit ampulla during follicular phase. Large number of cilia (→) in the lining epithelium, and lamina propria (▶). (Masson trichrome stain. X400).**



**Figure (2) Pseudostratified lining epithelium of rabbit ampulla. Ciliated (→), non- ciliated secretory (▶) and basal cells (\*). (H & E. x400).**



**Figure (4) Rabbit ampulla during luteal phase. Lining cells with less cilia (\*), lamina propria (←) and with blood vessels (▶) (Masson stain. X400)**

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## المظاهر الشكلية النسيجية لقناة البيض في الارانب خلال الدورة الشبقية

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## الملخص

تهدف هذه الدراسة لتبيان المظاهر الشكلية والنسيجية المجهرية لقناة البيض في الارانب خلال الدورة الشبقية. استخدم عشرون قناة بيض في هذه الدراسة. وتم جمع الارانب في السوق المحلية. اخذت وحضرت مقاطع نسيجية من اجزاء قناة البيض، النهاية القمعية، الانبولة والبربخ. حيث قيست طول الاجزاء المختلفة من قناة البيض الايمن.

كانت الانبولة اطول اجزاء قناة البيض والبربخ كان اضيقهم واتصلت بالرحم مباشرة. النهاية القمعية كانت تحتوي على بروزات اصبعية. البطانة الطلائية احتوت على عدة انواع من الخلايا، مهدبة، غير مهدبة - افرازية (peg cells)، اضافة الى خلايا قاعدية.

كانت البطانة الطلائية من النوع الطباقى الكاذب. وجدت اعداد كبيرة من التفرعات الاولى للتراكيب الاصبعية في الطبقة المخاطية في الانبولة خلال الدور الحويصلي. اعداد الاهداب الموجودة كان اكثر من الدور الحويصلي اكثر مما في الدور الافرازي. بينما اعداد الخلايا الافرازية خلال الدور الحويصلي كان اقل مقارنةً بالدور الافرازي.