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## Geese ovary and oviduct from an Anatomical and Histological point of view.

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### ABSTRACT

The current study was carried out on eight healthy geese from the Iraqi breed of Geese "Anser anser " to detect the anatomical and histological features of the ovary and oviduct, birds were slaughtered then celomic cavity dissected to exposed and study the ovary and oviduct with its relations anatomically, while histologically specimens taken from genital organs were treated by the routine histological technique steps. The adult left ovary of geese was resembled a bunch of grapes consisted of different sizes of ovarian follicles and the left oviduct was a highly convoluted tube subdivided into five pieces: Infundibulum, magnum, isthmus, uterus and vagina. Histologically, the left ovary of goose consist of an outer cortex and inner medulla, with different stages of follicles. The epithelium of tunica mucosa of all regions of oviduct were in the form mucosal folds, lined with pseudo-stratified columnar ciliated epithelium, lamina propria- submucosa contained branched tubular glands in all parts of oviduct except the infundibulum and vagina.

**Keywords:** Geese, ovary, oviduct, anatomy, histology.

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## INTRODUCTION

Geese are considered as one of the most important domestic birds which have high ability of tolerance and are well known for their attractive egg's size and the highest resistance against most avian diseases (1,2). It can be bred in the farms where much of expenses are not needed. They're one of the excellent converters of low quality waste products into high quality animal protein in the form of egg and meat (3). Geese and other avian species such as duck and swans are considered as members of the aquatic bird family (Anatidae) which is classified as one of the three families of the order Anseriformes (waterfowl) (4). The Mesopotamian marshlands in Iraq are one of the most important sites of several migratory birds. If restored, they will become once again a vital strategic stop-over site for millions of water birds migrating between breeding areas in northern Russia and Africa (5). In avian species including the domestic birds, the female embryo has a pair of undifferentiated gonads and mullerian ducts, however, during the course of differentiation only the left ovary and left mullerian duct develop and continues forming the female reproductive system, while, the right one degenerates (6). The mature left oviduct was developed into six regions (infundibulum, magnum, isthmus, uterus, junction region and vagina) (7). The infundibulum forms a strong perivitelline membrane around the egg yolk and the magnum is responsible of the synthesis and secretion of the albumin, whereas the isthmus forms a fibrous membrane around the egg white and the uterus forms the egg shell, finally the vagina the last part helps in pushing the egg out (8). The aim of this study is designated to determine the anatomical and histological features of the geese ovary and oviduct by absolute eyes and light microscope in order to understand the pathological changes in the reproductive organs due to different diseases which affects the morphology of the female genital tract lead to salpingitis, high mortality rate and decrease the productivity .

## MATERIALS AND METHODS

The current study was achieved on eight adult geese, aged (6-9) months, were slaughtered by halal method. In the anatomical study (4) adult birds used, the celomic cavity was opened, the viscera removed to view the reproductive organs to study the macroscopic anatomy, location and description of each part with its boundaries then the reproductive organs dissected out separately on a special sheet to view the external and internal features of each part grossly, and some anatomical parameters such as the length and width of each part were done. While in the histological study the samples taken from the rest birds were treated by using the routine histological technique steps and later stained with Haematoxylin and Eosin, Van Gieson's stains (9). Then stained slides were photographed by the using of camera and light microscope with different powers (4x; 10x; 20x, 40x).

## RESULTS

### Anatomical results:

**Ovary:** The current study revealed that female reproductive system of the geese composed of two parts: the ovary and the oviduct. Grossly, the mature ovary has an irregular surface located in the abdominal cavity, cranially to the caudal extremity of lung and ventrally to the abdominal air sac and related dorsally to the kidney and adrenal gland (Fig. 1). The shape of ovary resembled a bunch of grapes consisted of numerous follicles of different sizes which project from the surface of the ovary and attached by a pedicle (Fig. 2).

**Oviduct:** The left oviduct in the local geese was a highly convoluted tube of about (39-43) cm in length (table.1), extended from the ovary to cloaca, filled most of the dorsal and caudal part of left side of the celomic cavity, and related to left kidney, spleen and intestine, suspended from the left side of roof of the celomic cavity by thin peritoneal folds which divided by the oviduct into dorsal ligament and ventral ligament of oviduct (Fig.3). The left oviduct was subdivided anatomically into five major pieces: Infundibulum, magnum, isthmus, uterus or shell gland and vagina (Fig.4,5).

**Infundibulum:** The first part of the oviduct which fixed dorsally by the cranial ligament of the infundibulum. Its total length was (5.3±0.6) cm, it involved two parts: funnel part, which had flattened, thin and translucent wall, with its opening the fimbria which faced the ovary followed by the second part: the tubular part which had thicker wall than the funnel portion. The mucosal folds of the tubular part of the infundibulum appeared spirally oriented ridges which started to increase in depth towards the magnum (Fig.4).

**Magnum:** The second part which appeared the longest and the most coiled portion of the oviduct, with average length ( $16.9 \pm 2.2$ ) cm. It can be differentiated from the infundibulum morphologically by the large diameter and thick wall and internally by the presence of irregular and longitudinally arranged mucosal folds, these mucosal folds characterized by their height especially in the cranial part and become smaller near to the isthmus, this may be due to the increase in the thickness of tunica muscularis or the presence of numerous tubular glands during egg production which lead to the secretion of the egg albumin (Fig.6,7).

**Isthmus:** The third part of the oviduct is the isthmus which seemed similar to the magnum but shorter and less coiled than it, with a yellowish color, its length about ( $4.1 \pm 0.6$ ) cm, and its mucosal folds were narrower, thinner than that of magnum and less projecting with longitudinal orientation and separated from the magnum by a junction area which appear thin, bright and narrow constricted translucent zone (Fig.7).

**Uterus:** The fourth part of the oviduct was the uterus or shell gland which located between the isthmus cranially and vagina caudally, with average length ( $6.4 \pm 0.9$ ) cm. It considered the thickest and widest part of the oviduct that beginning in short anterior tubular part and then distended into posterior pouch-like part in order to containment the egg during shell formation period. Its mucosal folds were arranged in longitudinal orientation forming leaf-like lamellae intersected by circular directions (Fig.8).

**Vagina:** The vagina was the shorter part of the oviduct that appeared straight, narrow, S- shaped muscular tube and opened into the cloaca with about ( $2.9 \pm 1.1$ ) cm long. This part didn't play a real role in egg formation but important in the laying of the egg. Its mucosal folds were arranged in longitudinal direction, it consisted of one curvature, (Fig.8).

#### **Histological results:**

##### **Ovary:**

The present study showed that the ovary of goose was consist of an outer cortex which enveloped an internal vascular medulla and numerous ovarian follicles of different sizes present within the cortex, a germinal layer of cuboidal epithelial cells covered the cortex, as well as a thin layer of dense connective tissue fibers forming the tunica albuginea, lies below the epithelium and a stroma of loose connective tissue occurs below the tunica albuginea. On the other hand, internally, the ovary was consist of marginal part the cortex and inner part the medulla without any marks of separation between cortical and medullary layers. Ovarian follicles with different stages of development occur throughout the stroma of the cortex that classified into primordial, primary, secondary and tertiary follicles, as well as the presence of Corpus Luteum (CL) a connective tissue with remnants of blood clots that are gradually removed (Fig.9), The primordial follicle can differentiated from primary follicle from the size, the volume of primary follicle was larger than the primordial follicle and contained a homogenous cytoplasm with fine granules. The secondary follicle occur throughout the middle of the cortex and characterized by bigger follicle contained well developed oocyte which have clear cytoplasm and fine granules with central or eccentric nucleus, while the tertiary and the mature follicles were contain growing oocyte covering by several layers: the theca externa, the theca interna, membrane granulosa and privitelline membrane with rounded nucleus (Fig.10,11), The theca externa is formed from a compact connective tissue that contains groups of pale interstitial (luteal) cells which may also be found, in groups, in the cortical stroma and medulla.

**Oviduct:** The wall of the oviduct in the indigenous geese is consist of several tunicae which arranged from the internal surface to the external surface respectively named: tunica mucosa, tunica submucosa, tunica muscularis and tunica serosa.

**Infundibulum:** was divided into funnel and tubular parts. The funnel part was expanded with long finger-like projections which represent the fimbria, that lined with pseudo stratified columnar ciliated epithelium (Fig.12a). The lamina propria of the funnel part involved loose connective tissue and highly enriched with blood vessels but free of tubular glands (Fig.12b). While at the tubular region, the mucosal folds were long and branched into primary and secondary folds, each of them lined by pseudo stratified columnar ciliated epithelium with loose and vascularized lamina propria, the muscularis mucosa consist of two layers of smooth muscle fibers; inner circular and outer longitudinal (Fig.13,14).

**Magnum:** the longest part of the oviduct, had well-developed tubular glands that produced the albumin. The mucosal folds were numerous and variable in size than those of the infundibulum, branched into primary and secondary folds, lined with pseudo stratified columnar ciliated secretory epithelium, The lamina propria-submucosa contained branched tubular glands and the tunica muscularis-mucosa contain inner circular and outer longitudinal smooth muscle layers (Fig.15,16).

**Isthmus:** its mucosal folds were arranged longitudinally, branched into primary and secondary folds, lined with pseudo stratified columnar ciliated epithelium, the lamina propria-submucosa contained branched tubular glands similar to those of magnum but shorter and fewer that secrete the shell membranes, tunica muscularis better developed than the magnum's and composed of thick inner circular and thin outer longitudinal, (Fig.17,18).

**Uterus:** its mucosal fold were longer, narrower and branched into primary and secondary had the appearance of leaf-like lamellae, lined with pseudo stratified columnar ciliated secretory epithelium (Fig.19). The lamina propria-submucosa had loose and well vascularized connective tissue spares between the branched tubular glands, tunica muscularis was thicker and well vascularized than the previous anterior parts to provide the necessary amounts of calcium during egg production, composed of thin outer longitudinal and relatively thicker inner circular smooth muscles incomparable to the other parts (Fig.20).

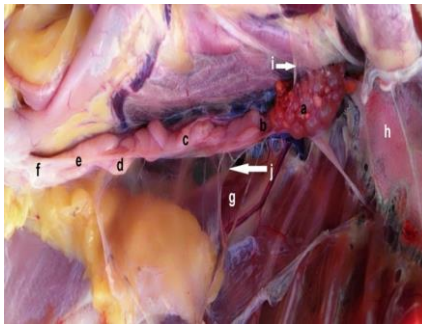
**Vagina:** was a short and narrow part, its mucosa was arranged as numerous tall and narrow primary folds that carrying small secondary folds, lined by pseudo stratified columnar ciliated epithelium, lamina propria-submucosa was lack of tubular glands, tunica muscularis was well developed particularly the circular layer which represent the thickest part of the vaginal wall forming the vaginal sphincter, as well as, the outer longitudinal smooth muscle fibers, serosa made of loose connective tissue (Fig.23,24).



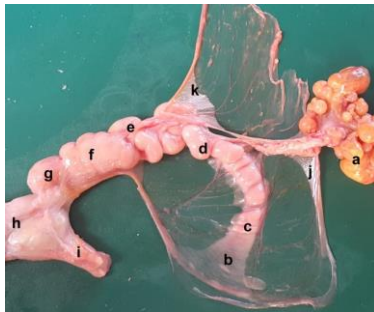
**Fig 1: Photograph showed:** a- ovary b- magnum c- isthmus d- uterus e-vagina f- large intestine g- lung h- left kidney i- cloaca.



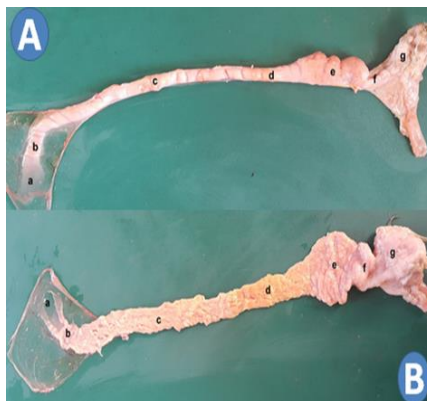
**Fig 2: Photograph of Ovary (gross morphology) showed numerous rounded follicles with varying size project from the surface of the ovary and attaché by a pedicle.**



**Fig 3:** a- ovary b-funnel part of infundibulum c-tubular part of infundibulum d-magnum e-isthmus f-uterus g- vagina h-cloaca i-large intestine j-cranial ligament k- ventral ligament of oviduct.



**Fig 4:** showed: a- ovary b- infundibulum c- magnum d- isthmus e-uterus f-vagina g- left kidney h- lung i- ventral ligament of oviduct j- dorsal ligament of oviduct.



**Fig 5 A,B:** oviduct showed: a- funnel part of infundibulum b-tubular part of infundibulum c- magnum d- isthmus e-uterus f-vagina g- cloaca.





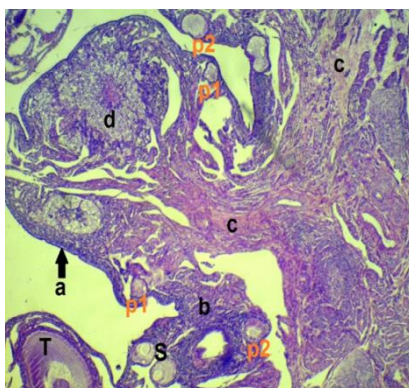
**Fig 6: Photograph showed: a- funnel part of infundibulum b- mucosal folds of tubular part of infundibulum c- mucosal folds of magnum.**



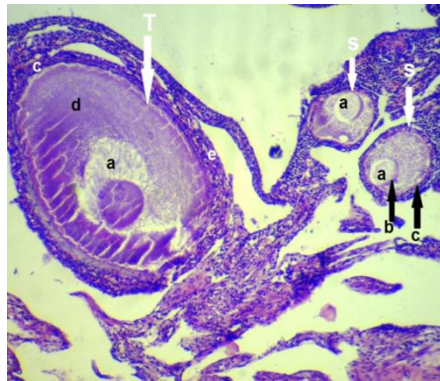
**Fig 7: Photograph showed: a- mucosal folds of magnum b- translucent zone between magnum and isthmus c- mucosal folds of isthmus.**



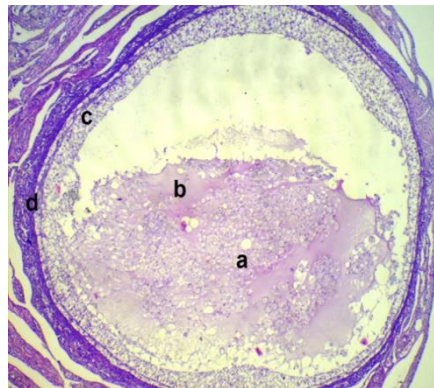
**Fig 8: Photograph showed: a- mucosal folds of isthmus b- mucosal folds of uterus c- mucosal folds of vagina d- curvature e- cloaca f- large intestine.**



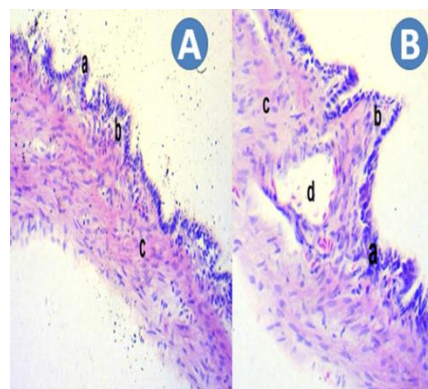
**Fig 9:** Histological section in the ovary showed: a- Germinal epithelium b- Cortex contain different stages of follicles: p1- primordial follicle p2- primary follicle S- secondary follicle T- tertiary follicle c- medulla d- corpus luteum (H&E stain 40 X).



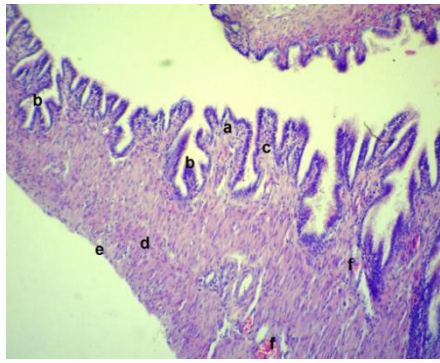
**Fig 10:** Histological section in the ovary showed: S- secondary follicle T- tertiary follicle a- Oocyte b- zona pellucida c- granulosa cells d- antrum e- theca cells (H&E stain 100 X).



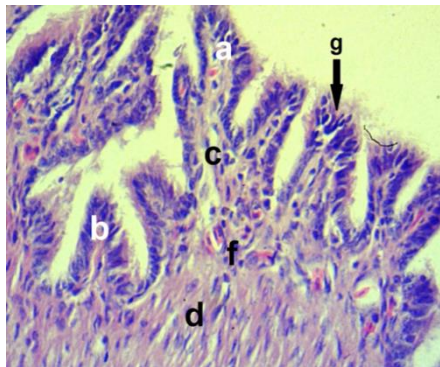
**Fig 11:** Histological section in mature follicle showed: a- Growing Oocyte b- Antrum c- Granulosa cells d- Theca follicular cells (H&E stain 40 X).



**Fig 12 A,B:** funnel part of infundibulum showed: a- pseudo stratified columnar ciliated epithelium b- lamina propria c- muscularis mucosa d- blood vessel (A: H&E stain 200 X) ; (B: H&E stain 400 X).



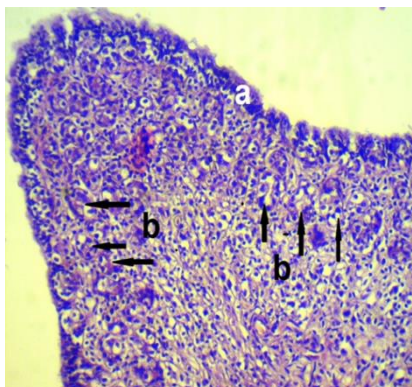
**Fig 13:** Histological section in tubular part of infundibulum showed: a- primary fold b- secondary fold c- lamina propria d- muscularis mucosa e- tunica serosa f- blood vessels (H&E stain 100 X).



**Fig 14:** tubular part of infundibulum showed: a- primary fold b- secondary fold c- lamina propria d- muscularis mucosa e- serosa f- blood vessels g- pseudo stratified columnar ciliated epithelium (H&E stain 400 X).



**Fig 15:** Histological section in magnum showed: a- primary fold b- secondary fold c- lamina propria d- inner muscularis mucosa e- outer muscularis mucosa f- serosa (H&E stain 40 X).

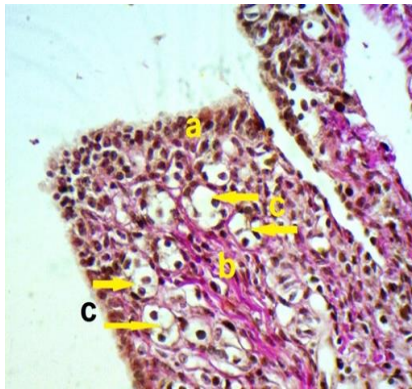




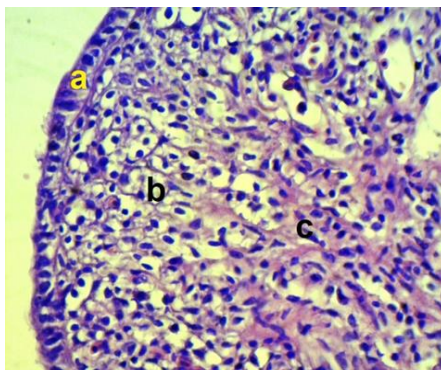
**Fig 16: magnum showed: a- pseudo stratified columnar ciliated epithelium b- lamina propria filled with branched tubular glands (arrowheads) (H&E stain 200 X).**



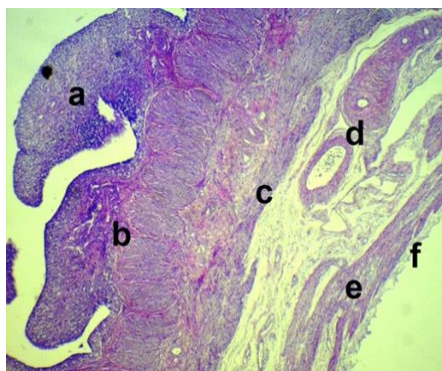
**Fig 17: isthmus showed: a- primary fold b- secondary fold c- lamina propria d- muscularis mucosa (Van-Gieson's stain, 40X).**



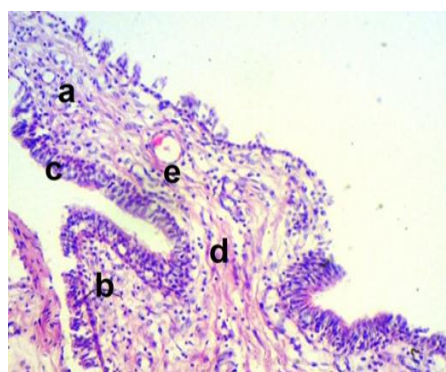
**Fig 18: Histological section in isthmus showed: a- pseudo stratified columnar ciliated epithelium b- lamina propria c- sub mucosa filled with branched tubular glands (arrowheads) (Van- Gieson's stain, 200 X).**



**Fig 19: uterus showed: a- pseudo stratified columnar ciliated epithelium b- sub mucosa filled with branched tubular glands c- lamina propria (H&E stain 400X).**



**Fig 20:** Histological section in uterus: a- leaf-like mucosal folds b- lamina propria c- inner muscularismucosa with d- blood vessels e- outer muscularis f- serosa (H&E stain 40 X).



**Fig 21:** Histological section in vagina showed: a- primary fold b- secondary fold c-lamina propria-sub mucosa with d- blood vessel (H&E stain 200 X).

### DISCUSSION

#### Anatomical Discussion:

**Ovary:** The current study revealed that female reproductive system of the geese composed of two parts: the ovary and the oviduct. In general, most of the avian species including geese, only the left ovary and oviduct are functional, although the right one is present embryologically, it degenerates during development and become vestigial in the adult birds (10), but this observation was dis agreement with (11,12) who mentioned that brown kiwi and birds of prey have two functional ovaries. The irregular surface and location of ovary is contrast to findings of (13) in fowl, (14) in pigeon, (7) in duck. The shape of ovary is parallel to that mentioned previously by (15) in Emu.

**Oviduct:** The length of the left oviduct in the local geese and its extension are comparable to that reported by (16) in turkey hen, (7) in Malard duck; (17) in Duck. The anatomical divided is parallel to that of the domestic fowl(18), (19) in rhea birds; (20) in pegagan duck. Infundibulum: The first part of the oviduct involved two parts: funnel part, followed by the second part: the tubular part with spirally oriented ridges mucosal folds, these results were in agreement with (21) in the ostrich; (15) in Emu; (17) in balady duck. Magnum: The longest and the most coiled portion of the oviduct, with irregular and longitudinally arranged mucosal folds, were coincides with (12) in the laying hen; , (7) in Malard duck.

**Isthmus:** which seemed similar to the magnum but shorter with a yellowish color, and mucosal folds narrower, thinner these findings were parallel to that previously reported by (19) in rhea birds; (17) in balady duck, but this result was disagree with (15) in the Emu, who mentioned that the isthmus and magnum were of the same size.

**Uterus:** or shell gland considered the thickest and widest part of the oviduct with longitudinal orientation mucosal folds, the dorsal surface of the uterus was fixed by dorsal ligament of the oviduct. These results were similar to that reported by (22) in laying hen; (21) in the ostrich.

**Vagina:** The vagina was the shorter part of the oviduct that appeared straight, narrow, S-shaped muscular tube and opened into the cloaca with longitudinal direction mucosal folds, similar to that mentioned by (7) in Malard duck but disagree with (17) who reported that mucosal folds in the balady duck were transversally arranged. It consisted of one curvature, similar to the domestic fowls as mentioned by (18) and turkey hen (16) but two curvatures were present in the balady duck (17); and three curvatures in rhea birds (19).

#### **Histological Discussion:**

**Ovary:** The present study showed that the ovary of goose was consist of an outer cortex which enveloped an internal vascular medulla and numerous ovarian follicles of different sizes present within the cortex, similar description reported by (23) in chicken but disagreement with (3) in duck who mentioned that ovary consisted of simple squamous epithelium with patches of cuboidal epithelium. Internally, the ovary was consist of marginal part the cortex and inner part the medulla without any marks of separation similar findings were reported by (24) in duck and (25) in Japanese quail. Ovarian follicles with different stages of development occur throughout the stroma of the cortex that classified into primordial, primary, secondary and tertiary these were in consonance with the finding of (26) in fowl; (3) in Duck. The description of primordial , primary , secondary , tertiary, mature follicles and theca externa were in agreement with that previously mentioned by (12); (14) in the pigeon; (23) in chicken.

**Oviduct:** The wall of the oviduct in geese is consist of several tunicae named: tunica mucosa, tunica submucosa, tunica muscularis and tunica serosa.

**Infundibulum:** was divided into two parts: funnel lined with pseudo stratified columnar ciliated epithelium similar to that reported by (27) in birds although (28) in turkey hen mentioned that the epithelium of the infundibulum was variable from simple cuboidal in the upper part into ciliated simple columnar in the middle and lower end. The lamina propria of the funnel part was in agreement with that of (23) in birds but disagreement with (17) in the balady duck who mentioned that both of the funnel and neck regions had tubular gland. While the mucosal folds of the tubular region, were long and branched into primary and secondary folds, similar findings were reported by (29); (30) in the hen.

**Magnum:** the longest part of the oviduct, had well-developed tubular glands that produced the albumin. lined with pseudo stratified columnar ciliated secretory epithelium, these results were parallel to that mentioned by (23) in birds, (31) in ostrich; (32) in turkey and pigeon. The length of the magnum and the volume of its mucosal folds may explain the secretion of albumin in this part due to the development of its branched tubular glands in comparison with the other parts.

**Isthmus:** its mucosal folds were arranged longitudinally, branched into primary and secondary folds, lined with pseudo stratified columnar ciliated epithelium, these information were declared previously by (18) in the domestic fowls; (23) in chicken; (19) in rhea birds. **Uterus:** its mucosal fold were longer, narrower and branched into primary and secondary had the appearance of leaf-like lamellae, lined with pseudo stratified columnar ciliated secretory epithelium similar findings reported by (33) in the laying hen and duck; (34) in the Japanese quail, (34) in the Japanese quail; (23) in birds.

**Vagina:** was a short and narrow part, its mucosa was arranged as numerous tall and narrow primary folds that carrying small secondary folds, lined by pseudo stratified columnar ciliated epithelium, similar results also found by (19) in rhea birds; (23) in chicken.

**Table (1): The length of the component of Female genital system.**

Parameters	Minimum	Maximum	Mean		Std. Deviation
	Statistic	Statistic	Statistic	Std. Error	Statistic
Age (month)	6.00	9.00	7.3000	.53852	1.20416
Infundibulum (cm)	4.60	6.30	5.3400	.30100	.67305
Magnum (cm)	14.80	20.10	16.9600	1.00329	2.24343
Isthmus (cm)	3.30	5.10	4.1000	.29155	.65192
Uterus (cm)	5.61	7.90	6.4260	.42421	.94857
Vagina (cm)	1.00	4.01	2.9920	.52689	1.17816

**Table (2): The length of the component of Female genital system**

Parameters		Infundibulum	Magnum	Isthmus	Uterus	Vagina
Age	Pearson Correlation	.999**	.996**	.844	.985**	.649
	Sig. (2-tailed)	0.000	0.000	0.072	0.002	.236
	Number	5	5	5	5	5

\*\* . Correlation is significant at the 0.01 level (2-tailed).

Table (2) revealed positive correlation between age and the length of infundibulum (p value =.000), Magnum, (p value =.000),and uterus (p value =.002), Statistical Analysis: Data shown as the mean ± SD .Statistical analysis performed using SPSS version 16 software. Pearson correlation test used for non-categorical data . The level of Significance was (P<0.05).

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