

ANATOMOHISTOLOGICAL STUDY REGARDING THE OVARY AND OVIDUCT IN DIFFERENT AGE GROUPS IN THE CHICKEN (*GALLUS DOMESTICUS*)

**Alexandra Blendea¹⁾, Iuliana Cazimir²⁾, N. Cornilă²⁾, Irina Irimescu¹⁾,
A. Damian¹⁾**

¹⁾Faculty of Veterinary Medicine, UASVM Cluj-Napoca,
3-5Mănăştur Street, Cluj-Napoca, Romania, catedra1mv@yahoo.com

²⁾Faculty of Veterinary Medicine, UASVM Bucharest,
105 Splaiul Independentei, sector 5, Bucharest, Romania

Abstract

Introduction: The importance of the study of the chicken's genital apparatus coincides from an economical point of view with the acquirement of one of the main avian products for which this bird is selected: the egg. In birds only the left ovary and oviduct are developed. The mature ovary has a grape-like shape, suspended from the ceiling of the abdominal cavity, immediately under the cranial extremity of the kidneys. The oviduct is long and flexuous, leading from the ovary to the cloacae.

Material and Methods: The research was carried out on the ovaries and oviducts harvested from 15 chickens of various ages (56 to 126 days) that were dissected using common techniques in the Comparative Anatomy Laboratory of the FVM Cluj-Napoca. The samples were also histologically prepared and examined using regular optical microscopy.

Results and Conclusion: Following the examinations, we have noticed that in the first group age, the ovary has a smooth surface, at 98 days, its surface becomes uneven, while at 126 days, it completes its development, acquiring its classical grape-like shape. The 56 days and 98 days old oviduct cannot be divided into segments; only the 126 days old oviducts displays macro and microscopic segmentation. In conclusion, results indicate that the ovary and oviduct of chickens reach maturity at the ages of 126 days, when the birds become ready to produce eggs.

Key words: chicken, reproduction, ovary, oviduct, age

INTRODUCTION

Biological features of birds, such as reproductive features, lend a great economical importance, mirrored by the ever growing weight of aviculture as a branch of animal breeding. The importance of the study of the female bird reproductive organs merges, from an economic point of view, with obtaining the most important product from poultry selected in this direction - the EGG. The latter, besides its reproductive importance, has a high nutritional value, being the only complete food besides milk (7). By its

reproductive value, the egg contributes to the procurement of the other main poultry product – MEAT. Poultry meat is obtained from breeds specialized in this direction, turkey, duck, geese, pearl hen and pigeon breeds.

In order to achieve these goals, to increase egg laying populations (which leads to egg and poultry meat production growth), an important emphasis lays on the knowledge of bird reproductive organs' morphology. The study of ovaries development in poultry is a necessary base for researching the increase of egg production and the intensification of their exploitation.

With regards to the existent literature, studies in the last years have paid little attention to the structure of the ovary and oviduct of the *Gallus Domesticus* species.

This study represents a systematic and detailed analysis of these aspects through the usual anatomical and histological investigative methods. **The ovary** has the shape of a cluster of grapes, suspended from the ceiling of the abdominal cavity, on the ventral face of the cranial lobe of the kidney, and it is composed of ovisacs in various stages of development. The main function of the ovary is to produce ovules. The ovary also plays a role in the secretory activity, producing proestrogens and estrogen hormones. The ovaries are suspended in the abdominal cavity by means of the peritoneal serosa, forming meso-folds (prolongations of the broad ligament of the uterus). The ovary is sheltered and anchored by the ovarian bursa, which is heavily innervated and vascularized.

The oviduct – only the left one is present and it stretches from the ovary to the cloacae. During the egg laying season it can reach 60-70 cm in length. It is suspended in the abdominal cavity by a strong dorsal meso-fold. It has five distinct segments, each of them with a specific role in egg production. The cranio-caudal order of succession for these segments is: *the pavilion (Infundibulum)*; *the glandular segment (Magnum)*; *the middle segment (Isthmus)*; *the terminal segment (Uterus)* and *the vagina*. The functions of the oviduct are: sperm depositing and spermatozoid transportation, fecundation, forming of the egg's components, transportation of the egg during the shaping process, oviposition.

MATERIAL AND METHODS

The study was performed on ovaries and oviducts sampled from 15 chickens (*Gallus domesticus*), Leghorn breed, of various ages. We have studied the evolution of the ovary and oviduct, in dynamic until the beginning of

oviposition. The usual euthanasia protocols were used, in the Comparative Anatomy Laboratory of the Faculty of Veterinary Medicine of Cluj-Napoca. The isolation of the reproductive organs requires a rapid opening of the abdominal cavity. We have sampled, as soon as possible after the euthanasia, pieces from the ovary and the oviduct, initially extracted intact to view their macroscopic aspect, then histologically examined. The samples extracted for histological examination were immediately immersed in neutral buffered formalin and Boiun liquid.

RESULTS AND DISCUSSION

The ovary at 56 days

Initially, during the embryonic stage, the ovary develops symmetrically, but soon, the right ovary and oviduct suffer an involution process, so than at the time of the hatching, they present involution processes.

Anatomy: The mass of the ovary weights approximately 0,40g. The ovary presents a solid mass, with a granulated aspect, containing ovary follicles that are not visible to the naked eye (Fig 1). At this age, the ovary is vascularized, as it is noticeable at the tip of the arrows in the image below (Fig 2).

Histology: the surface of the ovary is uneven, with visible prominences separated by grooves, sometimes branched. Secondary hollows begin to appear. A small part of the vascular area remains at the level of the ovarian pedicle. The ration is 2 to 1 (fig. 4).

In the cortex of the ovary there are numerous primary follicles and scarce secondary follicles. The demarcation between the cortex and the medulla is poorly drawn. Visible on the left of the figure 3, there is the ovary with its ovisacs, and on the right, the pavilion of the oviduct.



Fig. 1 – The ovary at 56 days



Fig.2 – The ovary at 56 days

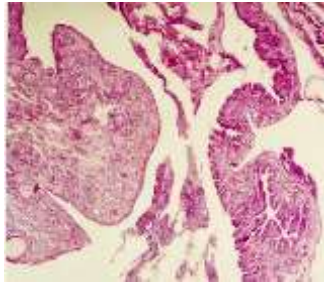


Fig.3. The ovary (left) and the pavilion of the oviduct

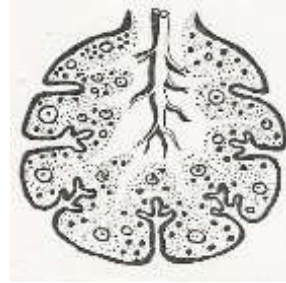


Fig. 4 (right) - 56 days, HE, ob.4x

The ovary at 98 days

Anatomy: The mass of the ovary weights approximately 0,46g. It has an irregular shape, a pale pink color, and is situated on the roof of the abdominal cavity, attached through a serous meso-fold, cranially de anterior lobe of the corresponding kidney. The ovisacs have a whitish color and the size of a grain of pepper. Fig. 6

Histology: The unevenness of the ovarian surface continues to amplify. The prominences gain in height, while the grooves separating them become deeper. Secondary prominences attach themselves to the main ones. They are smaller than the primary ones. At this age, the ovary's structures are defined. The ration between the two areas is approximately 6 to 1(fig.5).

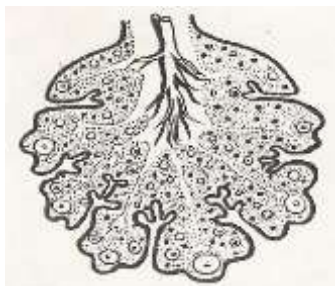


Fig. 5 – Diagram - the ovary 98 days



Fig. 6 The ovary anatomy at 98 days

On the histological section, one can notice and ovisacs with primary ovarian follicles and developing ones. The vascularized area presents a lax conjunctive tissue and blood vessels. There is also a nervous ganglion in the ovarian pedicle (fig.7).

The medulla presents vegetative neurons, blood vessels and lax conjunctive tissue, and the cortex is filled with ovarian follicles in different stages of evolution (fig.8)

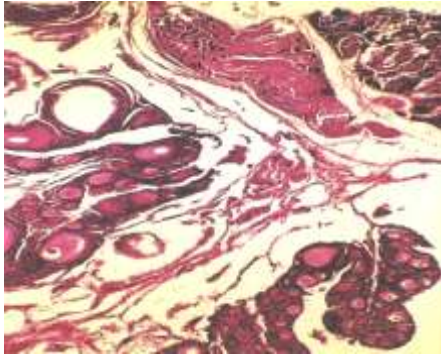


Fig.7. The ovary – 98 days, HE, ob.4x

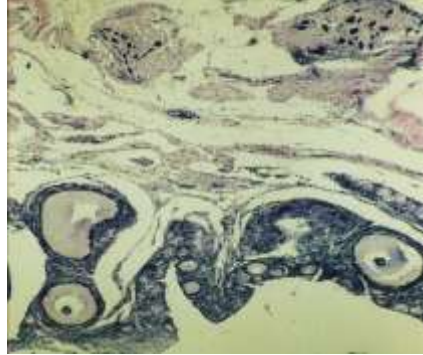


Fig.8. The ovary – 98 days, HEA, ob.4x

The ovary at 126 days

Anatomy: The ovary maintains its topography until this age, before the evolution of the first gestation. It has a round shape of different sizes, and each ovisac contains a future yolk and the oocyte of the future egg, in different development stages. The ovisacs have a yellow to orange color and are attached to the base of the ovary through a serous pedicle. At the age of 126 days it is completely developed (Fig. 9, 10).



Fig. 9 The ovary at 126 days



Fig. 10 The ovary at 126 days

Histology: The prominences continue to grow in height and width, while the indentations on the surface of the ovary become deeper, and the smaller prominences are better separate (Fig. 11).

A follicle is almost ready for ovulation. In birds there is no follicular antrum. Inside an ovisac, the mature follicles occupy the deep area, while the primary and primordial follicles are situated superficially (fig. 11, 12) .

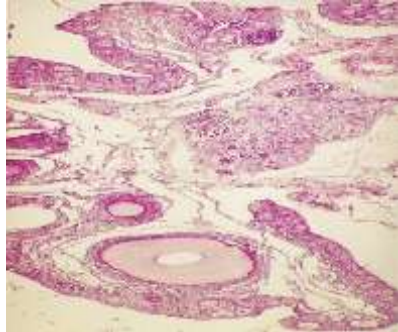


Fig.11. The ovary – 126 days,

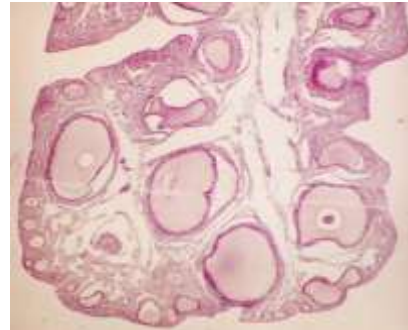


Fig.12. The ovary – 126 days,

The oviduct

The examination of the oviduct has been made at the age of 56, 98 and 126 days after the hatching.

At the age of 56 days

Histology: there are no distinctive segments of the oviduct yet. Thus we have taken 3 samples: from the cranial, the middle and the caudal third of it. Each segment sample has a wall structure represented by: mucosa, musculosa and serosa. In the cranial segment, the mucosa (fig.13) presents large thick folds. The axis of the fold is formed only of conjunctive tissue. The middle segment (fig.14) has shot folds, sometimes branched ones. In the caudal segment, the lymphoid cells of the oviduct's chorion. In the caudal segment, lymphoid cells from the oviduct's mucosa chorion appear much more numerous (fig.15).



Fig.13 the oviduct- cranial segment

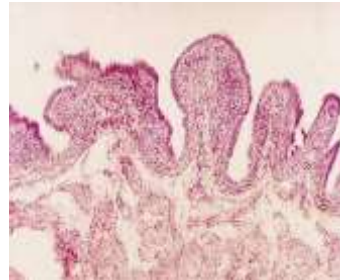


Fig.14. the oviduct - middle segment

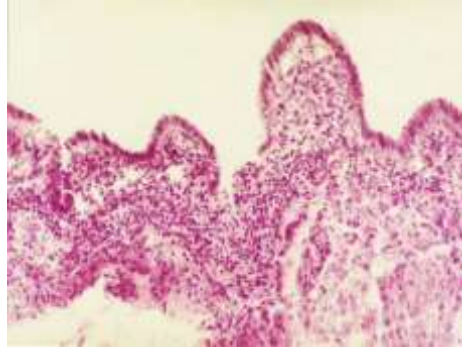


Fig.15 the oviduct – caudal segment

Anatomy: the oviduct at this age is not developed, has the shape of thin and flexuous tubes. It stretches from the ovary until the cloacae, where it opens. It is suspended from the abdominal cavity's wall by two meso-folds. The oviduct-cloacae orifice is closed by a hymen.

The oviduct at the age of 98 days

Anatomy: At this age the segments of the oviduct are still not distinctive macroscopically. The oviduct grows a lot in length and girth. The Segments of the oviduct begin to differentiate (Fig 17).

Histology: In the cranial and middle segments, the folds of the mucosa have a relatively even and unbranched aspect (Fig. 17 and 18). The folds of the mucosa begin to branch. The oviduct musculosa is well defined (Fig.19)



Fig 16- the oviduct at 98 days

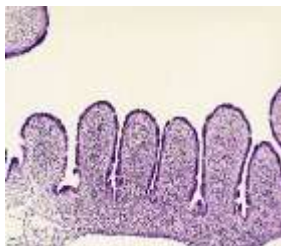


Fig.17. cranial oviduct



Fig.18. middle oviduct



Fig.19. caudal oviduct

The oviduct at the age of 126 days

Anatomy: The five segments of the oviduct are fully developed at this age. The two meso-folds that suspend the oviduct to the abdominal walls are also present and have a length of approximately 60-70 mm.



Fig 20 – the oviduct at 126 days



Fig.21 the oviduct completely formed

Histology: The five segments of the oviduct present the complete development off all of the wall's structures. The mucosa of the pavilion appears extremely creased, presenting richly branched folds. Smooth muscular fibers begin to organize in two layers (fig.22). The magnum or albuminogen chamber occupies a large part of the oviduct's length. The walls of the magnum are thicker, due to the growth of the mucosa. The mucosa is folded, presenting primary folds. The musculosa of the magnum is well represented. The folds of the magnum mucosa are thicker and more scarce (fig. 23). In Fig 24 - isthmus, the oviduct's diameter decreases, and through the isthmus' glands the egg shell is produced. Fig.25 - the uterus or the shell chamber presents itself as a dilated segment of the oviduct in which the calcareous shell is produced. Calcium is transported through the blood, which explains the presence of a rich vascular plexus in the wall of the uterus. Fig. 26- In the vagina, the mucosa is strongly folded, well developed.

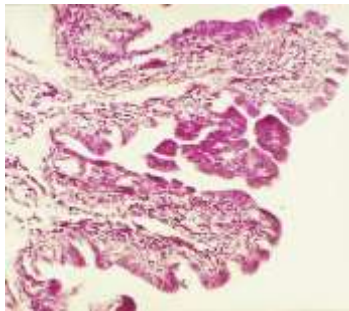


Fig.22 oviduct: the pavilion, 126 days, H



Fig.23 oviduct: the magnum, 126 days, HE,

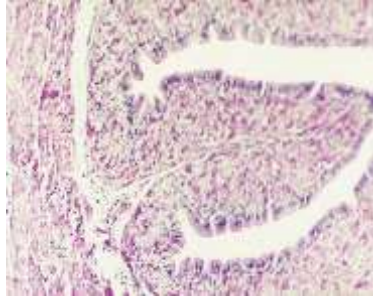


Fig.24 oviduct: isthmus, 126 days, HE, 10x

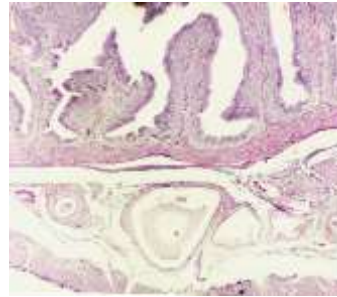


Fig. 25 oviduct: uterus, 126 days, HE, 10x

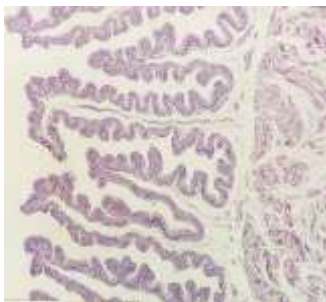
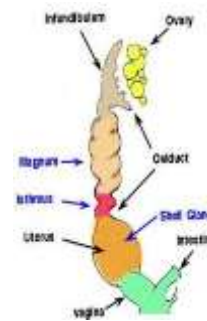


Fig. 26 the oviduct - vagina , 126 days, HE, Ob 10x



CONCLUSIONS

A) histology: Following the histological examination of the ovaries and oviducts sampled from chickens of different age groups, we have assessed that:

In the first days after hatching, the ovary has a smooth surface; the parenchyma and the vascular area are not distinctively delimited.

At 56 days from hatching, the surface of the ovary is uneven, lined by primary and secondary grooves, and the ration between the areas is 3to 1.

At 98 days from hatching on the surface of the ovary there are marked lines, with visible primary and secondary grooves, the ovarian follicles are numerous, the ration is inversed at 5 to 1;

At 126 days from hatching, the ovary is completely formed. It has a grape cluster shape with follicles in different stages of development. The interstitial gland is prominent, and the ration between the areas is 6 to 1 (parenchyma/vascular area).

The oviduct at 56 and 98 days is an even tube, without distinctive functional segments.

The oviduct slowly gains the functional structure of the mucosa, so that only after 100 days from hatching its segments can be differentiated.

The oviduct at 126 days presents the macroscopic and microscopic features of its segments (infundibulum, magnum, isthmus, uterus, and vagina).

B) anatomy Following the examination of the ovaries we have noticed:

At 56 days, the ovary presents a solid mass, with a granulated aspect, with no noticeable blood vessels.

At 98 days, the weight of the ovary slightly increases by comparison to the 56 days stage, and the development of the other elements is insignificant.

The ovary at the age of 126 days reaches sexual maturity, when it is ready for egg laying, its vascularization and innervation become visible, and so do the ovarian follicles.

The oviduct at the age of 56 days, and 98 days respectively, has the shape of a homogenous tube, without functional segments.

Only at the age of 126 days, the segments of the oviduct can be characterized macroscopically as: the infundibulum, the magnum, the white isthmus, the uterus and the vagina.

REFERENCES

Artan E., Daglioglu S. – Relationship between ovar and oviduct in the domestic hen. – Istanbul Univ. Vet. Fat. Derg. 1984, 10.1.17-28.

Aurel DAMIAN, Ioan POPOVICI, Ioana CHIRILEAN – *Tratat de Anatomie Comparată*, Editura Academicpres Cluj-Napoca 2003

Bunaciu P. Maria Bunaciu, Dojană N. – *Reproducția păsărilor*, Ed. Printech, București, 2009

Cornilă N., Manolescu N. *Structura și ultrastructura organelor la animalele domestice*, Ed. Creres, București, 1995

Federova, N. N. (1987): Growth and development of the reproductive system in White Leghorn hens in different lighting systems. *Sbornik Nauchnych Trudov. Moskovskaya Veterinarnya Akademiya*;

Gheție V., Chișescu St., Coțofan V., Hillebrabd A. – *Atlas de Anatomia de las Aves domesticas*, Editorial Acribia, Zaragoza, Espana, 1981, 1985.

<http://www.hiroshima-u.ac.jp/en/gsbs/research/kachikuseitai/>

Kar, A. B. (1947): Studies on the ligaments of the oviduct in the domestic fowl. *Anat. Rec.*