Features of changes in morphometric indicators of ovaries of laying hens during postnatal ontogenesis

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Abstract. The peculiarities of changes in the linear size and weight of ovaries of oviparous hens at different physiological stages of postnatal ontogenesis have been studied. The absolute indicator of the linear size and weight of the egg of hens is characterized by an intensive increase from the first 15 days of postnatal ontogenesis to 35 days, as well as the duration of this condition up to 120 days, physiological maturity, that the highest at 168 days, a decrease in this indicator to 570 days due to the stage of generative extinction of ovarian function at the stages after 168 days, morphometrically established that the coefficient of increase in indicators is higher in weight compared with linear dimensions in the period from 15 to 570 days of postnatal ontogenesis. It was also established that the cytoplasm of the oocyte is homogeneous, weakly basophilic, the nucleus is somewhat shifted to the periphery, the chromatin is in a dispersed state, and the nucleolus is clearly visible in the nucleus. Follicular epithelium is single-layer squamous. The nuclei of epithelial cells are hyperchromatic, flattened, the cytoplasm is weakly basophilic. Around the follicle lies loose connective tissue, the main cellular elements of which are fibroblasts.

1 Introduction

The relevance of the topic. Poultry farming is currently the fastest growing branch of agriculture, providing the population with the largest share of products that are a source of complete animal protein. In-depth study of their functional morphology is important for improving breeding work in poultry farming.

The reproductive organs of poultry differ from those of farm animals in a number of morphophysiological characteristics, and taking into account their biological capacity, rational use can be established on a scientific basis. In this regard, it is basely necessary a comprehensive study of morphofunctional changes occurring in organs in the postnatal ontogenesis of birds.

Poultry farming as a branch of agriculture makes a great contribution to the food security of the country, which is ensured mainly through the use of advanced technologies

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and highly productive breeds and crosses of poultry. At the same time, it is possible to further develop this direction to increase efficiency through the development of new technologies for realizing the genetic potential of poultry. It seems that this can be achieved only by providing a full-fledged diet that is responsible for the needs of the organism in all nutrients [4, 7].

Poultry farming is of great economic importance for the national farming, as it allows providing the population with valuable products at minimal prices in a short period of time. The unit cost of the received products is on average 2-3 times lower than in other branches of livestock farming. Poultry accounts for more than a third of meat and meat products consumption [6].

The following periodization of the postnatal development of crossbred hens Ross-308 is proposed, divided into 7 periods, based on the technological periods of poultry cultivation in poultry farms, taking into account important periods of morphophysiological changes and growth. According to the authors, during the 1st initial (starting) or morphofunctional period of adaptation, the final differentiation of tissues and organs occurs, the live weight of chickens increases and the feather multiplies, a heat exchange system is formed; in the 2nd period of growth, there is a rapid growth of the muscles of the chicken, the thermoregulation regime, the primary plumage grows, the body adapts to the conditions of maintenance and feeding, conditioned reflexes are formed; In the 3rd period, puberty occurs, pelvic bones and internal genitalia actively develop, and the period of puberty begins on the 120th day; The 4th period is defined as the pre-puberty or maturation period, the process of ossification of the skeleton is completed, sex, age and external signs have already been formed, the growth of secondary plumage has been completed; The 5th period is defined as the first spawning period; the 6th period is the second period of egg laying; the 7th period is characterized by the extinction of the functional activity of the organism, metabolic processes slow down and productivity drops sharply [5, 9].

According to the authors, there are 3 important periods in the postnatal ontogenesis of hens:

- The first is from 1 to 10 days, i.e. exposure and adaptation of the hen to the external environment.
- The second important period is from 15 to 20 days of development and is characterized by vaccination time at poultry farms.
- The third period is from the 25th day, begins and ends on the 30th day after hatching and is considered a very important period and is associated with puberty of the bird and changes in food ration [3].

Morphometric changes in the ovaries of laying hens of the Hysex Brown cross were studied, and histological examination of the ovarian section showed an increase in the linear size of ovarian follicles, which indicates that the eggs are preparing for maturation [1-2].

According to the researcher, in the postnatal period of egg production of hens, it was found that the development of the ovary is divided into 5 stages:

- Stage 1 – the beginning of rapid growth from a day to 15 days.
- Stage 2 – the initial differentiation of the ovaries of hens lasting from 15 to 120 days.
- Stage 3 – the completion of the generative function of the ovary lasting from 120 to 210 days.
- Stage 4 – a period of high functional activity of the ovary lasting from 210 to 540
- The 5th stage is the period of cyclic extinction of the generative function of the ovary, lasting from 540 to 570 days [8].

The purpose of the study. The purpose of this research is to study the features of changes in the morphometric parameters of the ovaries of laying hens at the postnatal stages of ontogenesis in the period from the beginning to the end of egg laying.
2 Materials and methods

The research work was carried out in the laboratory of the Department of Animal Anatomy, Histology and Pathological Anatomy of the SamSUVLB. As the objects of the study were taken 15, 35, 85, 120, 168, 280, 420 and 570-day-old laying hens. Hens were slaughtered, exsanguinated, left ovaries were removed from birds and weighed on analytical scales.

Digital data of macro- and micrometric indicators obtained as a result of the study were processed by methods of variational statistics using Microsoft Excel computer programs.

To determine the dynamics of morphometric size changes depending on age, the growth coefficient was calculated. The growth factor was determined by dividing the morphometric parameters of the ovaries of older hens by the corresponding indicators of younger hens, and the entire studied period of postnatal ontogenesis was determined by the formula developed by K. B. Svechin:

\[ K = \frac{V_t}{V_0} \]  

(1)

K – growth rate; \( V_t \) – the absolute indicator of the morphometric size of the ovary of an adult hen; \( V_0 \) – the initial indicator of the morphometric size of the ovaries.

3 Results and Discussion

As the result of the scientific research, it was determined, that only the left ovary is developed in hens. This condition is typical for most representatives of domestic birds. The ovary is suspended on a short mesentery in the lumbar region of the abdominal cavity and is covered with intestinal loops from above.

As well, it was noted that the morphometric parameters of the ovaries at different physiological stages of postnatal ontogenesis of laying hens demonstrate specific dynamics.

It was found that, the absolute indicator of the ovary length of laying hens increases intensively from the 15th to the 35th day of postnatal ontogenesis from 3.44 ± 0.05 cm to 4.42 ± 0.14 cm, or its growth coefficient during this period is 1.28 times, and this condition continues in stages until the next 168 days. That is, this indicator is Day 85 increases to 7.92 ± 0.26 cm (K=1.79; p <0.03), on day 120 - to 8.15± 0.18 cm (K=1.02; p <0.02), and on 168 days - to 8.44± 0.27 cm (K=1.03; p <0.03). It is noted that this indicator of the ovary does not change significantly at the studied stages of postnatal ontogenesis after day 168 and on day 280 is equal to 8.24± 0.2 cm (K=0.97; p <0.03), on day 420 - 8.21±0.18 cm (K=0.99), on day 570 - 8.13±0.17 cm (K=0.99; p <0.03). It was found that during the period from the 15th to 570 days of postnatal ontogenesis of hens, the growth coefficient of the absolute indicator of ovarian length increased to 2.36 times.

It was determined, that the absolute indicator of the width of the ovary gradually increases from the 15th to the 168th day of postnatal ontogenesis of hens, that is, this indicator on the 15th day was 5.58 ± 0.13 cm, on the 35th day - 6.8± 0.19 cm (K=1.21; p<0.03), by 85on the 14th day - 8.18± 0.2 cm (K=1.2; p <0.02), on the 120th day - 9.7±0.16 cm (K=1.18; p<0.03), and on the 168th day – 12.94± 0.22 cm (K=1.33; p<0.03).

There was a decrease in this indicator of the ovary after the 168th day of postnatal ontogenesis of hens, i.e. in the period of postphysiological maturity, namely on the 280th day - up to 12.5 ±0.15 cm (K=0.96), on the 420th day - up to 7.9±0.25 cm (K=0.63), by 570–day 1 – up to 7.78± 0.23 cm (K=0.87).
It was noted, that the growth coefficient of the absolute indicator of the width of the ovary of laying hens increases to 1.39 times during the period from the 15th to 570th day of postnatal ontogenesis.

It was found, that the absolute mass index of the ovary of laying hens increases intensively from the first 15 days to the 35th day of postnatal ontogenesis in proportion to its linear dimensions from 3.42 ± 0.1 g to 5.58 ±0.17 g, or during this period its growth coefficient increases to 1.63 times, and this process gradually increases to 168 days of development, that is, on the 85th day it rises to 8.18±0.3 g (K=1.46; p<0.02), on the one hundred and twentieth day – to 9.6±0.05 g (k=1.17; p <0.03), on the 168th day – to 14.06±0.23 g (K =1.46; p <0.03). There was a significant decrease in this indicator of the ovary at the stages after 168 days of postnatal ontogenesis, i.e. on the two hundred eighth day the indicator decreased to 12.36±0.2 g (K=0.88), on the 420th day it practically did not change (13.06±0.3 g; K= 1.05), and on the 570th day it decreased to 8.7± 0.27 g (K = 0.66).

Consequently, the absolute indicators of the linear size and weight of the ovaries of laying hens demonstrate characteristic morphological features in connection with the functional and physiological processes occurring in their organism.

As a result of our histological studies aimed at studying the peculiarities of changes in the histological structure of the ovary at different physiological stages of postnatal ontogenesis of hens, it was determined, that cytoplasmic oocytes are homogeneous, weakly basophilic, the nucleus is slightly displaced, chromatin is in a scattered state, the nucleolus is clearly visible in the nucleus, the follicular epithelium is single-layered, smooth.

It was found that the nuclei of epithelial cells are hyperchromic, flat, the cytoplasm is weakly basophilic, connective tissue lies around the follicle, their main cellular elements are fibroblasts.

It was noted that the thickness of the follicle wall is not constant, the perivitelline membrane is clearly visible on the upper and side walls of the follicles, it is a narrow structureless, but hyperchromic line and acts as an illuminated zone between it and the follicular epithelium.

Fig. 1. Histological picture of the hen ovary. Age group – 35 days. Hematoxylin-eosin staining (×400). 1 – cortical layer, 2 – immature follicle, 3 – vascular layer.
As a result of research, it was found that the follicular epithelium is single-layered, single-row, sometimes double-row, contains small pieces of chromatin in round nuclei located almost in the center of the cells.

The internal appendage consists of three layers, that is, the muscle layer is located closer to the oocyte, which is represented by two types of myocytes - one with a filamentous and hyperchromic nucleus, the other with a smooth, transparent karyoplasm and chromatin. Fragments are combined with a karyolemma, there is a dense network of collagen fibers in this layer, clusters are visible.

The inner additional shell consists of three layers, that is, closer to the oocyte is the muscle layer, which is represented by two types of myocytes – one with a filamentous and hyperchromic nucleus, the other with a sickle–shaped, transparent karyoplasm, and pieces of chromatin with a karyolemmous junction, dense thin fibrous bundles of collagen fibers can be seen in this layer. The next layer consists of thickened fibroblasts firmly attached to collagen fibers, the last layer is a vascular layer consisting of porous fibrous connective tissue containing a large number of collagen fibers, where many vessels can be located: arterioles, venules, venous and lymphatic sinuses. visible. The next layer consists of thickened fibroblasts firmly attached to collagen fibers, the last layer is a vascular layer, which consists of loose fibrous connective tissue containing a large number of collagen fibers, where can be seen a lot of vessels: arterioles, venules, venous and lymphatic sinuses.

**Fig. 2.** Histological picture of the hen ovary. Age group – 85 days. Hematoxylin-eosin staining (×400). 1 – cortical layer, 2 – immature follicle, 3 – various stages of follicle development.

### 4 Conclusion

- Absolute indicators of the linear size and weight of the ovaries of laying hens increase intensively from the first 15 to the 35th day of postnatal ontogenesis, and this condition lasts up to 120 days due to the period of their puberty, and the highest indicator corresponds to the period of physiological maturity, i.e. 168 days.
- Morphometric parameters of the ovaries of chickens after the 168th day of postnatal ontogenesis decrease to the 570th day due to the stage of generative extinction of ovarian function.

- It was found that the growth coefficient of morphometric indicators of the ovaries of chickens is higher in weight compared to linear sizes from the 15th to the 570th day of postnatal ontogenesis.

- The cytoplasm of the ovarian oocyte is homogeneous, weakly basophilic, the nucleus is slightly displaced, chromatin is scattered, the nucleolus in the nucleus is clearly visible, the follicular epithelium is single-layered smooth, the epithelial nuclei are hyperchromic, flat, the cytoplasm is weakly basophilic, pore connective tissue lies around the follicle. It has been established that its main cellular elements are fibroblasts.

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