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Changes in the Morphometric Indicators of the Girdle Bones of Chickens During Postnatal Ontogenesis

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Annotation: The dynamics of changes in the linear dimensions and weight of the wing girdle bones of laying hens in postnatal ontogenesis has been studied. It was found that the absolute values of the linear size and mass of the wing belt bones increase intensively from the first day of postnatal ontogenesis to 16 days of age, and this condition continues until the physiological period of chickens, i.e. up to 168 days, and at this age is higher than in chickens of other ages, and the intensity of growth from 280 days to At 570 days of age, it slows down due to the intensification of the egg-laying process. There was an increase in the mass of the growth coefficient of the absolute parameters of the scapula, clavicle and coracoid bones compared with their linear sizes at the physiological stages of postnatal ontogenesis.

Key words: birds, chickens, wings, bone, shoulder blade, clavicle, coracoid, postnatal ontogeny, absolute index, length, width, weight, growth factor.

Relevance of the Topic. Poultry farming is one of the most efficient, highly profitable, and promising sectors of animal husbandry. In addition to performing a support-mechanical function in the body, bones are also one of the organs that ensure the proper regulation of mineral metabolism. The morphology of bones in the skeletal system of poultry exhibits certain differences based on their location and functional characteristics. The skeletal system performs support-mechanical functions due to the presence of calcium and phosphorus compounds in its composition. Additionally, bones serve as the primary reservoir for calcium, phosphorus, and several other macro- and microelements, which play a crucial role in maintaining uninterrupted metabolic processes in the body.

The bones of poultry differ from those of agricultural animals in terms of their morphology, mechanical properties, and chemical composition. During different physiological stages of postnatal ontogenesis, the formation and development of the locomotor-support system in poultry occur under the influence of both internal and external environmental factors. The amount of these differences is higher in younger individuals compared to older ones [5].

In the chicken embryo, the ossification of long bones occurs unevenly, with the process beginning precisely from the central point of the bone diaphysis. It has been determined that the peripheral parts of the bone always remain cartilaginous to ensure further growth [6].

On the fifth day of incubation, the knee joint remains cartilaginous, and the ossification of the bone diaphysis begins on the sixth day. The accumulation of mesenchymal tissue at the site of the kneecap occurs between the sixth and seventh days, followed by its transformation into cartilage on the tenth day. The ossification process of the kneecap, however, takes place only after the chick hatches from the egg, as scientifically established [7].

The ossification point of tubular bones begins in the middle of the cartilaginous stage. As the bone matrix undergoes rapid calcification, a thin layer starts to be covered by the inner perichondrium—the periosteal cells. Between the diaphysis and this layer, hypertrophied and degenerating chondrocytes are located, surrounded by a mineralized cartilage layer. This layer forms the periosteal bone collar. Once the primary bone collar is clearly established, it begins to receive blood supply from different points [168; 55-63].

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Electron microscopy studies of endochondral ossification in chickens reveal that pericellular sheaths form around osteoblasts, consisting of a fine amorphous substance and partially collagen fibrils. This material, known as osteoid, is prepared for bone mineralization [6].

Research on the development of wing and leg bones in meat-type chicken embryos was conducted from the seventh to the twenty-first day of incubation. The authors report that the initial primary ossification centers appear on the ninth day of incubation. The timing of cartilage formation and the ossification process is considered crucial. By the nineteenth day of incubation, ossification centers are completed in all skeletal bones except for the radius, ulna, and carpal bones. Researchers assessed bone development by comparing the ratio of bone thickness to width [1].

Significant differences were observed in the length of axial and peripheral skeletal bones between sexes from the twelfth to the nineteenth day of incubation. The absolute and relative measurements of these bones were found to be lower in female embryos compared to male embryos. According to the author, fluctuations in the absolute and relative bone length occur at different stages of ontogenesis in embryos of different sexes [2].

According to researchers, there is a correlation between the live weight of egg-laying chickens and the qualitative characteristics of their eggs. This relationship is particularly evident at 28 days of age when chickens are grouped by live weight, influencing the subsequent stages of development, including the weight of egg albumen and the outer shell membrane. A correlation has also been found between the live weight of hens and the qualitative characteristics of their offspring's eggs [4].

Scientific studies on the development of the poultry skeleton indicate that chickens grow and develop actively until 60 days of age, during which the skeletal system increases by 65–70% relative to body weight, while overall body weight increases by 40%. By four months of age, skeletal growth is completed, although internal remodeling continues. As chickens age, their skeletal weight decreases by a factor of two [1].

Research has established that ossification centers in the breastbone of poultry appear on the 20th day of postnatal development. The keel bone's strength reaches 116 g/mm², increasing ninefold between days 20 and 75. From days 75 to 140, the transverse growth of the breastbone concludes, while longitudinal growth slows down. The bone mass doubles, but in sexually mature chickens, skeletal weight decreases, a phenomenon linked to egg formation [6].

The chicken skeleton differs from that of agricultural animals. The thoracic cage consists of seven thoracic vertebrae and seven pairs of ribs. Externally, it is short, high, and cone-shaped, with the base of the cone directed caudally. The first and second vertebrae are connected by a saddle-shaped joint, while the bodies of the second, third, fourth, and fifth vertebrae are fused. The sixth vertebra is flexibly connected to the adjacent vertebra, and the seventh is fused with the lumbosacral bone. The dorsal spinous processes form a continuous ridge [4,7].

Studies on the linear dimensions and weights of wing and leg bones in different chicken crosses have shown that, while the stylopod and zeugopod bones of "Lohmann Brown" classic and "Lohmann Brown LSL" chickens do not differ in linear measurements, their absolute weights are higher in "Lohmann Brown LSL" chickens. Additionally, due to their placement and functional role in the skeleton, the third toe bone has higher linear and weight values compared to other toe bones [2].

Scientific research has been conducted on the dynamics of changes in the linear dimensions and weights of the tibia in broiler chickens at different physiological stages of postnatal ontogenesis. The absolute length and weight of this bone increase significantly from the first day to the 14th day of postnatal development. Until the 35th day of development, the growth coefficient of bone weight is higher than that of its length. Additionally, the bone parameters in probiotic-treated chickens were found to be superior compared to those in the control group [3].

Research objective: tuxum yo‘nalishidagi tovuqlar postnatal ontogenezi bosqichlarida qanot suyaklarining morfometrik xususiyatlarini o‘rganishdan iborat.

Materials and Methods: The scientific research was conducted in the laboratory of the Department of Animal Anatomy, Histology, and Pathological Anatomy at SamDVCHBU. The study involved egg-laying chickens at different ages: 1, 16, 35, 85, 120, 168, 280, 420, and 570 days. The chickens were slaughtered and bled, and their wing and leg bones were separated from the body and weighed using an analytical balance. The linear dimensions and weights of the bones were measured according to standard morphometric methods.

The numerical data obtained from the macro- and micrometric measurements were processed using variation statistical methods in Microsoft Excel. To determine the dynamics of morphometric changes with age, the growth coefficient was calculated. The growth coefficient was determined by dividing the bone parameters of older chickens by the corresponding parameters of younger chickens. The entire postnatal ontogeny period was analyzed using a formula developed by K.B. Svechin: $K = \frac{V_t}{V_0}$.

K – Growth coefficient

Vt – Absolute value of bones in older chickens

V0 – Initial bone measurement value

Research Results. The girdle bones of poultry wings (forelimbs) differ from those of agricultural animals, with well-developed scapula, clavicle, and coracoid bones. In egg-laying chickens, the absolute values of the linear dimensions and weights of the wing girdle bones exhibit a distinct dynamic pattern at different physiological stages of postnatal ontogenesis.

The absolute indicator of the length of the coracoid bone of chickens is 1.29±0.04 cm on the first day of postnatal ontogenesis, and this indicator increases rapidly until the next 168-day stage and reaches 1.94±0.02 cm (K=1.49; p<0.02) at 16 days, and 2.78±0.08 cm at 35 days. (K=1.43; p<0.03), at 85 days - up to 3.4±0.07 cm (K=1.22; p<0.03), at 120 days - up to 5.12±0.06 cm (K=1.51), at 168 days - up to 7.46±0.15 cm (K=1.45), as well as in the next studied young people slowing down, i.e. in 280 days – It was found to be 7.38±0.13 cm, at 420 days - 7.3±0.2 cm, at 570 days - 7.26±0.21 cm (K=0.99). It was observed that the coefficient of growth of the absolute index of bone length increased up to 5.62 times from 1 day to 570 days of postnatal development of chickens.

The absolute index of the width of the coracoid bone increases rapidly from the first day of postnatal ontogeny of chickens to 16 days, from 0.37±0.01 cm to 0.96±0.01 cm (K=2.59; p<0.02), and the process of rapid growth of this index continues until the next 168 days, that is, at 35 days - up to 1.54±0.02 cm (K=1.6;p<0.03), at 85 days - up to 2.33±0.03 cm (K=1.51; p<0.02), at 120 days - up to 3.38±0.09 cm (K=1.45), at 168 days - 5.72±0.07 cm (K=1.69; p<0.04), and up to 570 days it was found to be almost unchanged compared to 168 days and equal to 5.62±0.08 cm at 280 days, 5.44±0.08 cm at 420 days, and 5.34±0.1 cm at 570 days. From 1 day to 570 days of postnatal development of chickens, it was noted that the coefficient of growth of the absolute index of coracoid bone width is up to 14.43 times.

The absolute weight of the coracoid bone of chickens, according to its linear dimensions, increases from 0.16±0.01 g to 0.57±0.01 g from the first day of postnatal ontogenesis to 16 days, or an increase in the growth coefficient by 3.56 times during this period, continuing this state in stages until 168 days of age and increasing to 1.42±0.03 g (K=2.49; p<0.02) g at 35 days, 1.92±0.02 g (K=1.35;) at 85 days, 2.33±0.03 g (K=1.21; p<0.02) at 120 days, and 3.88±0.06 g (K=1.66; p<0.03) at 168 days. and it was observed that it does not change significantly until 570 days, i.e. it is 3.86±0.05 g at 280 days, 3.74±0.07 g at 420 days, and 3.68±0.07 g at 570 days. The coefficient of growth of the absolute index of the weight of the coracoid bone was recorded to increase up to 23 times from the first day of postnatal development of chickens to the period of 570 days.

Conclusion:

1. The absolute values of the linear dimensions and weight of the wing girdle bones in egg-laying chickens showed rapid growth from the first day to day 16 of postnatal ontogenesis. This growth

continued until day 168, when the values were observed to be higher compared to other age groups, marking the physiological maturity of the chickens.

2. From day 280 to day 570 of postnatal ontogenesis in chickens, the growth rate of the linear dimensions and weight of the wing girdle bones slowed down. This deceleration was observed to be related to the intensification of the egg-laying process.

3. During the physiological stages of postnatal ontogenesis, the growth coefficient of the absolute parameters of the coracoid bones in egg-laying chickens was observed to be higher in weight than in linear dimensions.

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