

# Characteristics of changes in postnatal ontogenesis of the compact substance thickness of the stylopod bones of coral sheep

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**Abstract.** The dynamics of changes in the absolute indicators of thickness of dorsal, palmar and plantar compact matter of stylopod bones of Karakol sheep during postnatal ontogeny were studied. The absolute dimensions of the thickness of the dorsal, palmar and plantar compact matter of the shoulder and femur, regardless of the living conditions of Karakol sheep, slightly increased in connection with the period of receiving mother's milk from the first 3 days to 3 months of postnatal ontogeny, and remained almost unchanged at the 6 and 12 month stages, the period of physiological maturity of animals, i.e. 18 months, was found to show the highest rate compared to other studied ages; In the stages of postnatal onto-genesis of black sheep after 18 months, the physiological changes in the bones observed in connection with their first postpartum period, as well as due to the expansion of the marrow space of the bones, the absolute indicators of the thickness of the dorsal, pal-mar and plantar compact substances of the shoulder and thigh bones were observed to decrease; In connection with the morphofunctional state of the micro anatomical structures of the tubular bones and the level of the weight force applied to them, the absolute parameters of the thickness of the pal mar and plantar compact matter of the shoulder and femur at the studied stages of the postnatal ontogeny of black sheep were higher than this indicator of the dorsal compact matter, and also dorsal, pal-mar, plantar compact matter is noted to be thicker in the femur than in the humerus; The absolute indicators of the thickness of the dorsal, pal-mar, plantar compact matter of the shoulder and femur bones in the studied physiological stages of postnatal development were observed to be slightly higher in Karakol breed sheep in the mountainous region compared to those in the desert region, in connection with the geographical relief and natural conditions of the regions.

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## 1 Introduction

Bones provide not only a support and protective function in the body, but also the continuity of the exchange of mineral substances. The formation and development of bones takes place in direct contact with the internal and external environment of the body. In the rational and correct use of animals, it is important to take into account their biological and morphofunctional capacity. Postnatal ontogeny of animals is directly related to natural living conditions, geographical relief and skeletal location.

Foreign and foreign scientists have conducted many scientific studies to determine the different characteristics of the bones of the front legs of mammals according to the species and breeds of animals. Interests in this field are certainly justified and are used as valid information in veterinary-sanitary and forensic examination of animal products. Also, the results of such studies can help to assess the overall condition of the animal organism [2, 4-5, 8].

In young organisms, due to the predominance of bone formation over resorption, the skeleton grows and grows and develops unevenly at different physiological stages of postnatal ontogenesis. Determining bone tissue stratification and ossification points and ostesynthesis by X-ray examination is the most reliable indicator of biological age of an organism. Knowing the process of growth and development of bones creates an opportunity for an individual approach to the examination of the body [9].

The investigations of some researchers are devoted to the structural adaptogenesis of the musculoskeletal system in mammals in connection with different types of locomotion, in particular, the genotypic characteristics of the growth dynamics of the linear dimensions of individual bones of the skeleton in Kazakh white-headed calves were determined at different physiological stages of postnatal ontogeny of animals [3, 6].

The development of bones in animals is influenced by their storage conditions. The growth rate of bone structures is particularly affected by movement activity. Non-continuous daily exercise ensures an increase in bone volume and weight. In this case, the density of osteons in the dense substance increases, and the symptoms of osteoporosis begin to disappear, and the blood supply to the bone is restored. Symptoms of hypodynamia are negative for bone growth and symptoms of bone necrosis and osteomalacia appear [10].

According to the authors, the bones that make up the skeleton are made of plate-like bone tissue, in which the diaphysis of tubular bones is made of compact (dense) material, and the epiphysis is mainly made of porous material [7].

The morphofunctional properties of the compact substance of the diaphyseal part of the femur of animals with different types of movement were studied, and it was determined that the weight of the supporting force falls on different areas of the compact substance. In other words, in sheep belonging to the group of walkers in the phalanx, it is noted that the weight of the supporting force falls more on the caudal area of the compact substance of the bone [1].

The study of the dynamics of changes in the bones of the legs of Karakol sheep in different physiological stages of postnatal ontogenesis, which are bred in regions with different natural conditions, in particular, geographical relief, gives the opportunity to use them effectively and correctly, taking into account the biological characteristics of sheep belonging to this breed.

## 2 Materials and methods

Scientific investigation of stylopodium bones obtained from Karakol sheep belonging to the 3-day, 3-, 6-, 12-, 18-, 24-, 36-, 60-month stages of postnatal ontogenesis, reared in the farms of the desert area - Nishon district, Kashkadarya region and highland - Nurota

district, Navoi region carried out on some age-related, clinically healthy and moderately obese animals were selected for sampling. Shoulders and femurs of some age-related black sheep were taken for the purpose of the tests.

General morphological methods were used in processing bones and determining their morphometric parameters.

All numerical data obtained as a result of scientific investigations were subjected to mathematical processing according to the method of E.K. Merkureva.

To determine the dynamics of bones depending on age, the growth coefficient was

determined  $K = \frac{V_t}{V_0}$  by the formula developed by K.B. Svechin: K – growth factor; W- is the absolute index of the bone of an adult animal;  $V_0$  - is the initial index of the bone.

### 3 Results and Discussion

It was noted that the thickness of the dorsal, palmar and plantar compact matter of the stylopodial bones of Karakol sheep reared in the desert and mountainous regions of Uzbekistan, during the period from the first day of postnatal ontogenesis to 60 months, shows specific characteristics related to the anatomo-topographical characteristics of the bones and their living conditions.

Dynamics of changes in the thickness of the humerus compact matter during the postnatal ontogeny of Karakol sheep. The absolute indicator of the thickness of the dorsal compact substance of the humerus of Karakol breed sheep in the desert region is  $0.1 \pm 0.01$  cm in the first 3 days of postnatal ontogenesis, and this indicator gradually increases up to 18 months of age, and in 3 months –  $0.13 \pm 0.01$  cm ( $K=1.32$ ;  $p<0.03$ ), at 6 months –  $0.14 \pm 0.01$  cm ( $K=1.09$ ;  $p<0.03$ ), at 12 months –  $0.16 \pm 0.01$  cm ( $K=1.11$ ;  $r<0.03$ ), and at 18 months –  $0.17 \pm 0.01$  cm ( $K=1.06$ ;  $r<0.03$ ). This bone index slightly decreases from 24 months compared to 18 months, i.e. at 24 months - to  $0.14 \pm 0.01$  cm ( $K=0.83$ ;  $r<0.02$ ), at 36 months –  $0.13 \pm 0.01$  cm ( $K=0.93$ ), and at 60 months it decreased to  $0.12 \pm 0.01$  cm ( $K=0.94$ ;  $r<0.03$ ). It was found that the growth coefficient of the absolute indicator of the thickness of the dorsal compact substance of the humerus increases up to 1,21 times during the period from 3 days to 60 months of postnatal ontogeny of sheep.

The absolute index of the thickness of the palmar compact substance of the humerus increased rapidly from 3 days to 3 months of postnatal ontogeny of black sheep in the desert region, from  $0.12 \pm 0.01$  cm to  $0.17 \pm 0.01$  cm ( $K=1.43$ ;  $r<0.03$ ), to continue this state without major deviations until the next 18 months, and at 6 months –  $0.18 \pm 0.01$  cm ( $K=1.06$ ;  $r<0.03$ ), at 12 months –  $0.21 \pm 0.01$  cm ( $K=1.15$ ;  $r<0.03$ ), and at 18 months –  $0.21 \pm 0.01$  cm ( $K=1.0$ ). This bone index decreases in later youth compared to 18 months, i.e. at 24 months –  $0.16 \pm 0.01$  cm ( $K=0.8$ ;  $r<0.03$ ), at 36 months –  $0.16 \pm 0.01$  cm, At the age of 60 months, it was observed to be  $0.15 \pm 0.01$  cm. It was noted that the coefficient of growth of the absolute indicator of the thickness of the palmar compact substance of the humerus increases up to 1.25 times during the period from 3 days to 60 months of postnatal ontogeny of sheep.

The absolute index of the thickness of the dorsal compact substance of the humerus of Karakol sheep raised in the highland region increases steadily from the first 3 days of postnatal ontogenesis to 18 months, and at 3 days –  $0.13 \pm 0.01$  cm, at 3 months –  $0.15 \pm 0.01$  cm ( $K=1.17$ ;  $r<0.03$ ), at 6 months –  $0.16 \pm 0.01$  cm ( $K=1.07$ ;  $r<0.03$ ), at 12 months –  $0.18 \pm 0.01$  cm ( $K=1.11$ ;  $r<0.03$ ), and at 18 months –  $0.19 \pm 0.01$  cm ( $K=1.08$ ;  $r<0.03$ ). This indicator of the shoulder bone decreases from 24 months compared to 18 months and at 24 months –  $0.16 \pm 0.01$  cm ( $K=0.84$ ;  $r<0.03$ ), at 36 days –  $0.15 \pm 0.01$  cm ( $K=0.93$ ;  $p<0.04$ ), and at 60 months –  $0.14 \pm 0.01$  cm ( $K=0.97$ ;  $p<0.04$ ). It was observed that the coefficient of

growth of the absolute indicator of the thickness of the humerus dorsal compact substance reaches 1.12 times during the period from 3 days to 60 months of postnatal development of black sheep.

The absolute indicator of the thickness of the palmar compact substance of the humerus of Karakol sheep in the highland region is  $0.16 \pm 0.01$  cm in 3-day-old lambs, and this indicator increases without major deviations until the 18th month of postnatal ontogeny, that is, at 3 months –  $0.19 \pm 0.01$  cm ( $K=1.19$ ;  $r<0.03$ ), at 6 months –  $0.2 \pm 0.01$  cm ( $K=1.06$ ;  $r<0.04$ ), at 12 months –  $0.22 \pm 0.01$  cm ( $K=1.08$ ;  $r<0.03$ ), and at 18 months –  $0.23 \pm 0.01$  cm ( $K=1.05$ ;  $r<0.02$ ). This bone index decreases significantly in the later stages of postnatal development and at 24 months –  $0.19 \pm 0.01$  cm ( $K=0.82$ ;  $r<0.04$ ), at 36 months –  $0.18 \pm 0.01$  cm ( $K=0.96$ ;  $r<0.04$ ), and at 60 months –  $0.17 \pm 0.01$  cm ( $K=0.93$ ;  $r<0.03$ ). It was determined that the coefficient of growth of the absolute indicator of the thickness of the humerus palmar compact substance is 1.06 times during the period from the first 3 days of postnatal ontogeny of sheep to 60 months.

The dynamics of changes in the thickness of femur compact matter during postnatal ontogeny of Karakol sheep. The absolute indicator of the thickness of the dorsal compact substance of the femur of black sheep in the desert region increased from the first 3 days of postnatal ontogenesis to 18 months, from  $0.14 \pm 0.01$  cm to  $0.17 \pm 0.01$  cm at 3 months ( $K=1.23$ ;  $r$  up to 0.03), at 6 months - up to  $0.19 \pm 0.01$  cm ( $K=1.1$ ;  $r<0.02$ ), at 12 months - up to  $0.2 \pm 0.01$  cm, at 18 months - 0, It was noted that it increases to  $0.22 \pm 0.01$  cm ( $K=1.1$ ;  $r<0.02$ ). This indicator of the femur does not change significantly at the stages of development after 18 months, that is, at 24 months - by  $0.19 \pm 0.01$  cm ( $K=0.87$ ;  $r<0.02$ ), at 36 months - by  $0.17 \pm 0.01$  cm ( $K=0.9$ ;  $r<0.03$ ) cm, at 60 months it was equal to  $0.15 \pm 0.01$  cm ( $K=0.87$ ). It was found that the coefficient of growth of the absolute indicator of the thickness of the dorsal compact material of the femur increases up to 1.07 times from the first 3 days of postnatal ontogeny of sheep to 60 months.

The absolute index of the thickness of the plantar compact substance of the femur gradually increases from 3 days to 18 months of the postnatal ontogeny of black sheep reared in the desert area and is  $0.15 \pm 0.01$  cm at 3 days, and  $0.18 \pm 0.01$  cm at 3 months. It was found that it reaches  $0.2 \pm 0.01$  cm ( $K=1.25$ ;  $r<0.03$ ), at 6 months -  $0.2 \pm 0.01$  cm ( $K=1.08$ ;  $r<0.04$ ), at 12 months –  $0.22 \pm 0.01$  cm ( $K=1.11$ ;  $r<0.03$ ), and at 18 months –  $0.24 \pm 0.01$  cm ( $K=1.09$ ;  $r<0.03$ ). This indicator of the femur imperceptibly increased to  $0.2 \pm 0.01$  cm ( $K=0.83$ ;  $r<0.03$ ) at 24 months, to  $0.19 \pm 0.01$  cm ( $K=0.94$ ) at 36 months up to 60 months –  $0.17 \pm 0.01$  cm ( $K=0.92$ ) was observed. It was noted that the coefficient of growth of the absolute indicator of the thickness of the volar compact material of the femur increased up to 1.17 times during the period from the first 3 days to 60 months of postnatal development of sheep.

The absolute index of the thickness of the dorsal compact substance of the rear bone of Highland lambs from the first 3 days of postnatal ontogenesis to 18 months of age and from 3 days to 3 months of age increased from  $0.14 \pm 0.01$  cm to  $0.17 \pm 0.01$  cm ( $K=1.23$ ;  $p<0.02$ ) at 6 months –  $0.2 \pm 0.01$  cm ( $K=1.15$ ;  $p<0.02$ ) to 12 months –  $0.22 \pm 0.01$  cm ( $K=1.15$ ;  $p<0.02$ ) = 1.1;  $p<0.04$ ), an increase of  $0.24 \pm 0.01$  cm was noted at 18 months. This bone index is up to  $0.21 \pm 0.01$  cm ( $K=0.88$ ) at 24 months of postnatal development, at 36 months - up to  $0.2 \pm 0.01$  cm, at 60 months –  $0.17 \pm 0.01$  cm ( A decrease to  $K=0.84$ ) was observed. It was found that the growth factor of the absolute index of the thickness of the dorsal compact substance of the hind bone increased up to 1.19 times in the period from 3 days to 60 years of postnatal ontogeny of sheep.

The absolute index of the thickness of the plantar compact material of the femur of Karakol sheep reared in the Highland region increased rapidly until the first 3 months of postnatal ontogenesis, from  $0.15 \pm 0.01$  cm to  $0.21 \pm 0.01$  cm ( $K=1.4$ ;  $p<0.04$ ), almost unchanged at 6 and 12 months ( $0.22 \pm 0.01$  cm), at 18 months the highest index compared to

other ages ( $0.28 \pm 0.01$  cm,  $K=1.23$ ;  $r < 0.03$ ) was found to manifest. This indicator of the femur in 24-month-old sheep slightly decreased compared to 18-month-old sheep ( $0.23 \pm 0.01$  cm;  $K=0.83$ ), and did not change significantly in 36- and 60-month-old sheep (respectively,  $0.22 \pm 0.01$  cm,  $K=0.95$ ;  $0.2 \pm 0.01$  cm,  $K=0.92$ ) was observed. It was noted that the coefficient of growth of the absolute index of the thickness of the plantar compact material of the femur increased up to 1.33 times during the period from 3 days to 60 months of postnatal ontogeny of sheep.

## 4 Conclusion

- The absolute dimensions of the thickness of the dorsal, palmar and plantar compact matter of the stylopodial bones, regardless of the living conditions of the Karakol sheep, from the first 3 days of postnatal ontogenesis to the 3rd month of postnatal ontogeny, there is a slight increase in connection with the period of milk intake, and it does not change almost at the 6th and 12th month stages, physiological adulthood period, that is, at 18 months, it was found that it shows the highest rate compared to other ages.
- In the stages of postnatal ontogenesis of black sheep after 18 months, the physiological changes in the bones observed in connection with their first postpartum period, as well as due to the expansion of the marrow space of the bones, there was a noticeable decrease in the thickness of the dorsal, palmar and plantar compact substances of the shoulder and thigh bones.
- In connection with the morphofunctional state of the microanatomical structures of tubular bones and the level of the weight force falling on them, the absolute indicators of the thickness of the palmar and plantar compact matter of the shoulder and femur at the studied stages of the postnatal ontogeny of black sheep are higher than this indicator of the dorsal compact matter, dorsal, palmar, plantar compact substances were noted to be thicker in the femur than in the humerus.
- The absolute parameters of the thickness of the dorsal, palmar, plantar compact matter of the shoulder and hip bones in the studied physiological stages of postnatal development were observed to be slightly higher in Karakol breed sheep in the mountainous region compared to those in the desert region, in connection with the geographical relief and natural conditions of the regions.

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