

# Research Journal of Pharmaceutical, Biological and Chemical Sciences

## Morphological Features And Age Dynamics Of The Formation Of The Claw Horn In Cattle.

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### ABSTRACT

The histological and morphometric characteristics of the claw horn in cattle of the black-and-white breed of different genotypes for Holstein breed are presented, taking into account the age dynamics of its formation. The object of the study was calves of the black-and-white breed and goshtinized black-and-white counterparts with blood proportions of 1/2 or 3/4 Holstein breed, at 6, 12 and 18 months of age. The hooves of the fore and hind limbs were examined with an assessment of their level of abrasion, as well as a morphometric estimate of the growth of the horn, the degree of vascularization, the characteristics of unformed connective tissue, loose fibrous connective tissue, the leaf layer of the hoof horn, the structure of the tubes and the glazing layer on the cross section of the hoof. By 6 months of Holstein calves, 3/4 of the blood volume, the size of the horn of the forelimbs prevailed in comparison with the control analogues (purebred black-and-white calves) by 0.5 mm, and over the control analogues 1/2 of blood was 0, 8 mm, at 12 months of age, the prevalence was 1.8 and 1.0 mm, respectively. Similar changes in the analysis of the claw horn of the hind limbs are observed from 12 months of age. In Holstein calves, 3/4 of the blood share reliably ( $P \geq 0.95$ ) has more horn tubes, the superiority over purebred analogs and Holstein calves 1/2 of the blood share was 4.0 and 1.3 mm<sup>3</sup>, respectively. Consequently, Holsteinized cattle 3/4 share of blood content has greater durability of the hooves, pronounced resistance to abrasion and penetration of moisture into the structure of the hoof layer, which is an important factor for picking the herd.

**Keywords:** holsteinization, claw horn, histology of hooves, vascularization of hooves, black-and-white breed.

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## INTRODUCTION

A high level of mechanization of production processes is a key factor for achieving intensive cattle rearing in conditions of large livestock farms [2]. However, for large livestock animals, the risk of a variety of diseases of non-communicable etiology increases, sometimes becoming widespread [1, 3, 4, 7]. Of this group of diseases, the injuries of the extremities are of the greatest relevance, which ultimately has a negative effect both on the organism of the animal as a whole and on its productive indicators, leading to significant economic losses. As many researchers indicate, the stress effect of technogenic factors in cattle-breeding premises is more pronounced as damage to the hooves, which complicates the relationship of the organism with the external environment [9, 13]. The nature and course of metabolic processes, growth activity, and the level of body reactivity are illustrated by many constitutional parameters, the most significant of which are: the growth feature, the strength of the claw-horn, the features of its histological structure, and the influence of genetic factors on these indicators [5, 8, 10, 11, 12, 14, 15].

The purpose of research is to establish the characteristics, age dynamics and histostructure of the claw horn, to determine its morphometric parameters in purebred black-and-white calves and Golshtinized analogues with blood proportions of 1/2 and 3/4.

## MATERIALS AND METHODS

Studies conducted at the department of normal and pathological anatomy and physiology of animals of Gorsky State Agrarian University. Histological studies were performed on calves of 10 months of age, determined the number of horn tubes per 1 mm<sup>2</sup> of its area, the thickness of the walls of horn tubes, as well as the degree of vascularization of the base of the hoofed rim and hoofed corolla. The studied material was fixed in a 10% formalin solution, paraffin sections 5-6 μm thick were stained with Mallorihematoxylin-eosin, morphometric parameters were determined using an orculus micrometer by magnification x15 and x40 objective. To determine the age dynamics of the growth of the claw horn, monthly measurements of the degree of abrasion on the hind and fore limbs were carried out. The resulting digital material was processed by the method of variation statistics.

## RESULTS AND DISCUSSION

In purebred calves, the size of the claw horn of the forelimbs was 53.5 mm, by 12 months the increase was 5.3 mm, by 18 months the average for the group was 65.0 mm, that is, from the initial value it increased by 11.5 mm. In calves 1/2, the initial value of the size of the claw horn of the forelimbs averaged 52.2 mm in the group, while by the age of 12 months it increased by 7.5 mm and was 59.7 mm, that is, more than with similar dynamics in control calves by 2.2 mm. By the age of 18 months, the size of the forelimb hoof horn in calves ½ of the proportion of blood was 68.8 mm, that is, an increase from the initial value was 15.2 mm, while the same indicator in the control group was 11.5 mm that is, the difference is 3.7 mm in favor of calves 1/2 share of blood. Thus, the erasability of the ungulate of the forelimb is more pronounced in calves of the control group.

The growth pattern of the claw horn of the hind limbs was manifested by the following picture. At the age of 6 months, in calves of the black-and-white breed, its size was 46.8 mm, by 12 months - 50.2 mm, and by 18 months - 59.2 mm, that is, the increase occurred in the following dynamics : by 12 months by 3.4 mm and by 18 months - 12.4 mm. In turn, this growth in calves 1/2 of the proportion of blood was characterized by the following picture: at 6 months - 47.0 mm, at 12 months - 52.0 mm and at 18 months - 59.5 mm, that is, from 6 to 12 months, the horned hoof of the hind limb increased by 5.0 mm, which is more than 1.6 mm in calves of the control group compared to the same indicators. From 6 to 18 months, the claw horn in calves ½ of the proportion of blood increased within 12.5 mm. This value is similar in calves of the control group, amounting to 12.4 mm. However, if from 12 months to 18 months the size of the hoofed horn of the hind limb in calves of the control group increased by 0.9 mm, then in calves analogs ½ the proportion of blood by 7.5 mm.

A comparative analysis of the growth dynamics of the claw horn in calves 1/2 and 3/4 of the blood fraction in Holstein breed and their control analogs is shown in the following picture. So, in calves 3/4 the proportion of blood by 6 months the size of the claw horn of the forelimb was 53.0 mm, which is less than 0.5 mm in the control analogues and larger than analog calves in analogs 0.8 mm. By 12 months, the hooves of the forelimb claws in calves 3/4 for bleeding amounted to 59.8 mm, that is, increased by 6.8 mm from the initial value, which is 1.8 mm more than in calves counterparts of the control group and calves analogues ½ share of blood by 1.0 mm.

By the age of 18 months, the size of the claw horn of the forelimb in calves of 3/4 blood was 68.8 mm, which is significantly more than 0.8 mm in comparison with the calves of the control group. At the same time, in calves 3/4 of blood by the age of 18 months, the size of the claw horn of the forelimbs increased by 15.8 mm, from the initial value, which is 4.3 mm more than the black-and-white counterparts and is similar to that of analogs 1/2 share of blood.

At 6 months of age, the size of the claw horn of the hind limbs in calves 3/4 of the blood was 46.4 mm, which is less than 0.2 mm in calves of black-and-white breed and 1.4 mm less than in calves 1/2 share of blood. However, by the age of 12 months, in calves 3/4 of the blood volume, the size of the claw horn of the hind limbs already averaged 52.4 mm, which is 2.2 mm more than in the analogue calves of the control group. At the same time, the growth of hooves in calves of 3/4 of the proportion of blood from 6 to 12 months left 0.6 mm - this is more than in calves of the black-and-white breed by 2.1 mm and 1.0 mm compared to calves 1/2 share of blood.

**Table 1: Age dynamics of growth of the claw horn in calves of different genotypes, sm(n=5)**

Age, months	purebredblackandvariegated		1/2 bloodshare		3/4 bloodshare	
	forelimbs	hindlimbs	forelimbs	hindlimbs	forelimbs	hindlimbs
Upto 6 months	5,35±0,15	4,68±0,26	5,22±0,22*	4,70±0,19	5,30±0,27	4,64±0,22
Upto 12 months	5,88±0,18	5,02±0,23	5,97±0,18	5,20±0,18*	5,98±0,34	5,24±0,25
Upto 18 months	6,50±0,20	5,92±0,19	6,80±0,11**	5,95±0,35	6,88±0,34**	6,16±0,27*

Confidencelevel: P<0,95 - \* P<0,99 - \*\*.

By 18 months, the average size of the horn of the horn of the hind limbs in calves 3/4 of the blood was 61.6 mm, which is significantly more than 2.4 mm in calves of the control group and 2.1 mm in comparison with calves 1 / 2 shares of blood. In turn, by the age of 18 months, the size of the claw horn of the hind limbs increased from the initial value by 15.2 mm, which is more than the growth in calves of the control group by 2.8 mm and by 2.7 mm than in calves 1/2 the proportion of blood. In general, from the age of 12 months to 18 months in calves 3/4 of the blood volume, the size of the claw horn increased by 9.2 mm, while in the calves of the control group by 9.0 mm, and in calves 1 / 2 shares of blood per 7.5 mm (Table 1).

Thus, the presented growth dynamics of the claw horn in calves of the black-and-white breed of different genotypes indicates a more pronounced abrasion of the hoof, both the front and hind limbs in purebred calves. At the same time, the growth pattern of the claw horn of the forelimbs in calves 1/2 and 3/4 of the blood share is the same, and the erasability of the claw horn of the hind limb is more pronounced in calves 1/2 the proportion of blood.

The established growth dynamics of the claw horn testifies to the stability of metabolic processes in Holsteinized calves.

The histological structure of hoofs is the main prerequisite for its durability. In order to study the histology of the claw horn, the number of horn tubes per 1 mm<sup>2</sup> of its area, the thickness of the walls of the horn tubes, and the degree of vascularization of the base of the skin of the hoofed rim and the hoofed corolla were determined. These figures were investigated in cattle 10 months of age. During the study, a greater number of horn tubes were found in calves with 1/2 and 3/4 of the blood fraction compared to control analogues and their reliable quantitative superiority in animals was 3/4 of the blood. The wall thickness of the horn tubules of the claw horn in the studied groups of animals was in the same values with an insignificant and unreliable superiority of this indicator in calves 1/2 and 3/4 of the blood content over purebred analogs (Table 2).

**Table 2: The histological structure of the ungulate**

indicators	Group		
	purebredblackandvariegated	1/2 bloodshare	3/4 bloodshare

Number of horn tubes per 1mm <sup>2</sup>	28,7±1,4	31,4±2,4	32,7±2,5*
The thickness of the walls of the cornea, mkm <sup>2</sup>	25,2±1,3	25,7±2,8	26,0±2,0
Area of vessels, mkm <sup>2</sup>	20,4±0,8	21,2±1,2	24,7±1,7

The formation of the structural components of the ungulate horn depends, as indicated by many researchers, depends on the anatomical features of the structure and the degree of its blood supply [7]. A high degree of vascularization of the basis of the skin of the ungulate rim and the ungulate corolla was determined in calves of all groups. However, the most dense vascular network is established in calves with 3/4 of the proportion of blood, compared with analogs of 1/2 of the blood and purebred calves. So the microcirculatory area of 3/4 calves in the proportion of blood was 24.7 μm<sup>2</sup>, which is 3.5 and 4.3 more than the analogs of 1/2 of the proportion of blood and purebred calves, respectively. It should be noted a slight superiority of the degree of blood supply to the base of the skin of the hoof horn in calves with a blood fraction of 1/2 over purebred analogs, which was 0.8 μm<sup>2</sup> (Table 2).

**CONCLUSION**

The established histological structure of the claw horn in the studied groups indicates its greater strength and resistance to abrasion in calves - hybrids over purebred analogs, especially calves with 3/4 of blood. This is due to the large number of horny tubes and the thickness of their walls, which determines the level of their strength and less lability of changes in the structure of the hoofed horn, its resistance to moisture penetration, especially when kept on wet concrete.

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