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GROWTH DYNAMICS AND SKIN-FUR COVER OF GALLOWAY AND ABERDEEN ANGUS CATTLE FREE-RANGED IN THE REGION OF THE TOWN OF TROYAN

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Abstract

Data are presented on the dynamics and distribution of cattle's skin-fiber cover of two groups of Galloway and Aberdeen Angus heifers, free-ranging beef breeds in the region of Troyan, Central Balkan Mountains. The measurements of the skin thickness in the neck region, at the top of the elbow joint and at the middle of the last rib were recorded during two seasons of the year in (mm), and the weight, structure and percentage of different categories of fur fiber cover - aspen, transitional and down in (g) were also determined. Skin thickness measurements were made using a caliper (caliper) during the summer and winter seasons. The weight of the fur per 1 cm² of fur fibercover was analyzed using an analytical balance and the length of the fur fiber with a ruler in (cm). We determined the structure of the cattle's skin-fiber cover by % ratio fur fiber cover. During the winter period, the studied cattle significantly increased the thickness of the skin, the length and thickness of the fur fiber coat and the amount of down fluffy fiber coat. The animals have adapted well to the technology of rearing in the temperate - continental, mountainous climate of the region of the town of Troyan.

Key words*: adaptation, heifers, growth, skin, technology.*

INTRODUCTION

The structure and morphological features of the cattle's skin fiber cover play an essential role in their adaptation to low and high temperatures. A number of studies have found inter-breed, seasonal and age differences in skin thickness and fur cover structure (Cherekaev, 2010; Tsyrendorzhiev & Lumbunov, 2013; Pozdnykova et al., 2015; Markov et al., 2022; Nascimento-Barreto et al., 2024).

The ability of animals to maintain equilibrium with the environment is directly related to the ability to trigger thermoregulatory mechanisms - morphological, physiological and humoral, acquired during the evolutionary process of development (Facanha, 2016).

Beef cattle are susceptible to heat and cold stress if they are unable to dissipate or synthesize (heat release) heat during elevated or depressed ambient sed temperatures. Factors that influence this are the availability of shade or shelter, the microclimate of the environment and feeding management (Edwors-Collawoy, 2021)

According to Nenov (1983) within a species, different breeds, and within a breed, different individuals have different abilities towards acclimatization. The parameters of breed adaptive ability vary within a narrower range than that of species.

Using morphological methods, the age and breed suitability of cattle to cold and heat acclimatization can be assessed. Intense deposition of subcutaneous fat and an increase in the density and length of the fur cover are prerequisites for increased heat exchange and are genetically determined each species and breed (Cherekaev et al., 2009; Markov et al., 2020).

The aim of the present study was to investigate the dynamics of the cattle's skin-fur cover expansion in heifers of two beef cattle breeds-Galloway and Aberdeen Angus, during their adaptation to rearing technology in the area of the town of Troyan, Central Balkan Mountains.

MATERIALS AND METHODS

The object of our study were heifers of the meat breeds Galloway and Aberdeen Angus, raised freely in the Experimental Base (farm) of the Research Institute of Mountain Stockbreeding and Agriculture - Troyan, Central Balkan Mountains.

The homeland of both breeds studied is Scotland. From there they are distributed all over the world, including Europe. They are medium-sized animals with good physique and black coloration of the skin and fur covering of various shades. Individuals of the Galloway breed are morphologically distinguished by longer body length and longer fur.

In order to study the adaptive processes occurring in the organism of the animals studied by the method of analogues, two groups were formed, taking into account breed, age and live weight, of 7 animals each. Group I, heifers of the Galloway breed and Group II, heifers of the Aberdeen Angus breed. The animals were about 18 months old, group I with a live weight of 309 kg and group II with a live weight of 314 kg, fed normally and monotypically.

We reported skin thickness measurements at the neck, at the top of the elbow joint, and at the midpoint of the last rib in (mm), and also determined the weight, texture, and percentages of the different categories of fur fiber cover-aspen, transitional, and down-in (g).

Skin thickness measurements were made using a caliper (caliper) during the summer and winter seasons.

We analyzed fur weight using an analytical balance and fur fiber cover length using a ruler in (cm). We determined the structure of the fur cover by % fur fiber ratio.

The data were processed by the method of variance statistics and presented in tables and figures.

RESULTS AND DISCUSSIONS

In any beef cattle rearing technology, natural and climatic factors are of major importance. The region of Troyan town and the studied experimental base (farm) are located in Lovech region in the Central geographical region of Bulgaria, where the average annual air temperature is +9.8℃, the average annual precipitation is 767 mm, and the average number of days with snow coverage is 42. Winter is long and accompanied by moderate frosts and snowfalls. The coolest month is February, with average temperatures of –11.2°C. Strong north-westerly winds are also typical of the region.

The results of the study show that skin thickness demonstrates differences by breed traits and seasons of the year (Table 1).

Table 1. Skin thickness by seasons, in mm(X+s)

Indicators	Galloway (n = 7)	Aberdeen Angus (n = 7)
Summer (August)		
On the neck	4.9±0.41	4.1±0.65
On the top of the elbow joint	3.21±0.76	2.88±0.43
In the middle of the last rib	8.7±0.92	7.9±1.01
Winter (February)		
On the neck	5.4±0.85	4.65±0.66
On top of the elbow joint	3.89±0.93	3.3±д.65
In the middle of the last rib	9.3±0.17	8.7±1.02

$P \leq 0.05$ – significant differences

The analysis of the data obtained shows that heifers of the Galloway breed showed the thickest skin during the two seasons studied. During the summer period, the skin at the midpoint of the last rib was 0.8 mm, or 9.6% ($P \leq 0.05$), thicker than that of the Aberdeen Angus animals (Figure 1).

During the winter period, skin thickness in the body regions studied increased in both studied beef cattle breeds, with well-differentiated breed characteristics. In Galloway cattle, skin thickness increased by 9.6%, midway down the last rib , while in Aberdeen Angus heifers this increase was 6.7% (Figure 2). Similar trends were observed in the other body regions of the animals examined.

The cattle's fur cover is derived from the skin and has a similar structure and function. During the summer period, the fur cover contributes to the fight against heat stress and high temperatures and heat. When animals adapt to low and high temperatures, especially in winter, it plays an important role in regulating the heat exchange between the organism and the

environment, especially in rain, fog, drizzle, snow, etc. As animals adapt to high and low temperature conditions, changes occur in the structure of the fur cover (Table 2).

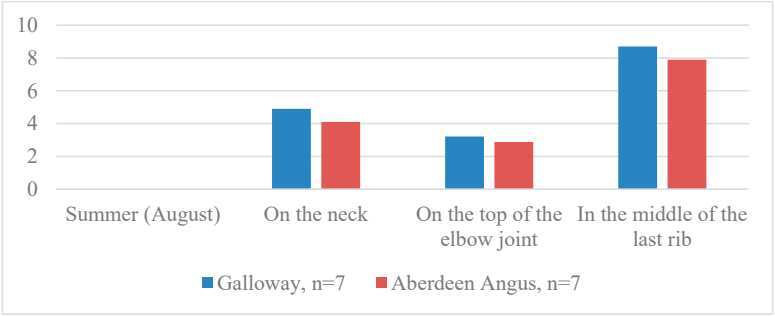

Figure 1. Skin thickness by Summer

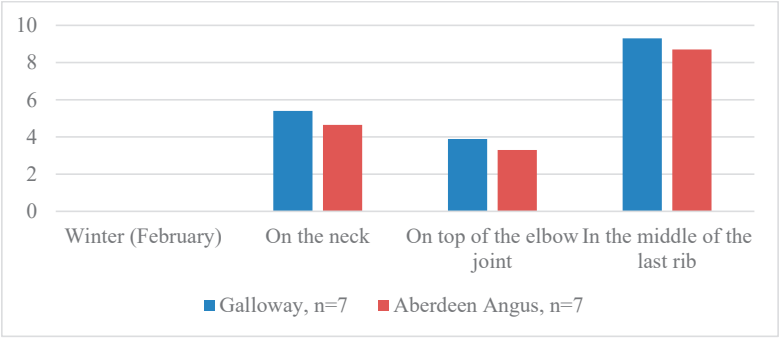

Figure 2. Skin thickness by Winter

Table 2. Characteristics of cattle's skin cover by season (X±SEM)

Indicators	Galloway (n = 7)	Aberdeen Angus (n = 7)
Summer (August)		
Fur cover weight per 1 cm², g	21.57±1.0**	20.3±1.12**
Length, cm		
Aspen fur fibercover, %	6.04±0.12*	5.98±0.19
Transitional fur fiber cover, %	4.47±0.16	4.01±0.14**
Fluffy fur fiber cover, %	3.01±0.19*	2.87±0.21
Ratio, %	100	100
Aspen fur fibercover, %	33.4	32.6
Transitional fur fiber cover, %	36.2	34.8
Fluffy fur fiber cover, %	30.4	31.6
Winter (February)		
Weight of fur cover per 1cm², g	24.75±1.45**	23.21±1.22**
Length, cm		
Aspen fur fiber cover, %	7.25±0.22*	5.98±0.31
Transitional fur fiber cover, %	4.87±0.12**	4.56±0.11**
Fluffy fur fiber cover, %	3.23±0.23	3.12±0.21*
Ratio, %	100	100
Aspen fur fiber cover, %	21.5	20.6
Transitional fur fiber cover, %	16.1	21
Fluffy fur fiber cover, %	62.4	58.4

*P ≤ 0.05 - significant differences; **P ≤ 0.01 - distinct significant differences; ***P ≤ 0.001 - very significant differences.

It was found that the weight of fur cover obtained from 1 cm² of fur from the last rib was higher in both sampling seasons in the Gawei breed by 6.26% and 6.64% ($P \leq 0.01$) compared to that obtained from Aberdeen Angus cattle (Figure 3). Higher values were also obtained for fur fiber length as well as % turnout fluffy fur fiber cover relative to other fur fiber cover.

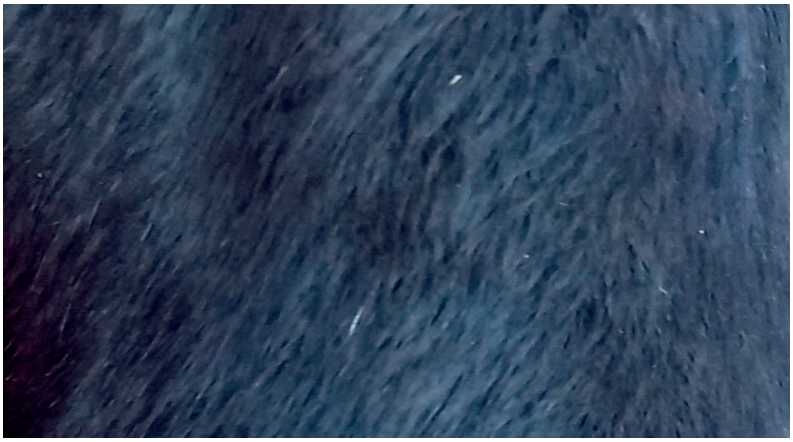

Figure 3. Skin-Fur Cover Aberdeen Angus (source: Research Institute of Mountain Stockbreeding and Agriculture, Troyan)

In terms of the length of the different categoria of fur fiber fibres, the animals of the Galloway breed (Figure 4) outperformed the Aberdeen Angus breed compared with them.

Figure 4. Skin-Fur Cover Galloway (source: Research Institute of Mountain Stockbreeding and Agriculture, Troyan)

The structure of the cattle's fur fiber cover was determined by % fur fiber ratio. While the percentage ratio of the aspen and transitional fur fibers was approximately the same, the down fur fibers showed a superiority of the individuals of the Gawei breed over the representatives of the Aberdeen Angus breed by 3.95% in summer and by 6.88% in winter.

Our results correspond with those obtained by (Pozdnykova et al., 2015; Nascimento-Barreto et al., 2024) and in some respects complement them.

CONCLUSIONS

In both seasons studied, Galloway beef cattle had thicker skin and denser fur cover compared to Aberdeen Angus cattle. During the winter, both beef breeds increase the thickness of the skin and hair cover, as well as the amount of

fluffy fibers. This is a suggestion of good adaptability in the temperate, continental mountain climate of the Troyan area.

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REFERENCES

Cherekaev, A. K., Shakirov, N., Khazipov, G., & Kayumov, I. (2009). Beef cattle breeding of Tatarstan breeds, technologies, herd management. *Kazan, Fen*, 129-132.

Cherekaev, A., Shakirov, S., Khazipov, N., Kayumov, F., Gamarnik, N., Amerkhanov, K., Nurgdinov, M., Valeev G., Tagirov G., Gibaduplina F., Malikov, M., Khabibuplin, F., Kamalov, F., Zagirov, I., & Nurgaev, M. (2010). *Meat cattle breeding: breeds, technologies, herd management*. Moscow, RU: Kolos Publishing House, 220-223.

Edwors-Collawoy, L., Caitlin, C., Caitlin, N., Bigler, E., Eugle T., Wagner J., & Clark, D. (2021). Impacts of shude on cattle well-beiding in the beef supply chain. *J. Anim. Sci., 99*(2), doi: 10.1093/jas/skaa375.

Facanha, D. (2016). Produced by milk and responses from the Holaudea shallow waters in a warm environment.. *Acta veterinaria*, 56-60.

Markov, N., Stoycheva, S., Banchva, T., Mickov L., Atanasov, B., & Adamov, N. (2022). Growth Dinamics on the skin and coat in Normandian and Simmental cattle during adaptation to the farming technology in southwest term past of Bulgaria. *Macedonian Veterinary Review*, *46*(1), 1-5

Markov, N. (2020). Characteristics of skin thickness and growth dynamics of hair-coat covering of meat cattles according to the season. *Scientific Papers. Series D. Animal Science*, *LXIII*(2), 205-211.

Nascimento-Barreto, A., Jacintho, A., Junior, W., Pereira, A., Cista, L., Brandao, F., Romanelo, N., Azedo, G., & Garcia, A. (2024). Adaptive integumentary features of beef cattle raised on afforested or non-shaded tropical pastures. *Scientific Reports*, *14*(1), 16951. doi: 10.1038/s41598-024-66675-w.

Nenov, C. (1983). *Hygiene and technologies for industrial cattle breeding*. Sofia, BG: Zemiztat Publishing House.

Pozdnykova, V., Soboleva, O., Smirnova A., & Bravilova, E. (2015). The dynamics of skin and hair coat of cattle in adapting to resource-conserving technology. *Kostroma State Agricultural Academy*, 4 (Ru).

Tsyrendorzhiev, C., & Lumbunov, S. (2013). Interior peculiarities and adaptive qualities of Hereford heifers in conditions of Transbaikalia. *Dairy and Meat Cattle Breeding*, 5, 10-12.