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SHORT COMMUNICATION

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THE GROWTH OF BODY MASS AND LINEAR DEVELOPMENT OF SIMMENTAL HEIFERS OF DIFFERENT CONSTITUTION TYPES IN THE CARPATHIAN PRE-MOUNTAIN REGION

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ABSTRACT

The data about development of Simmental heifers of different constitution types in postnatal ontogenesis in Carpathian region are shown. By the growth of body weight and linear development, animals of high-fermenting type (research group) dominated counterparts of low-fermenting type (control group) by 7–9%. It should be noted also, that animals in the control and experimental groups in postnatal ontogenesis were developed harmoniously. For body weight at 6, 12 and 18 months of age heifers of research group prevailed control counterparts respectively by 7.5; 8.5 and 5.7%.

Key words: heifers of breed, constitution type, postnatal development, body mass, body measurements, body structure indices

INTRODUCTION

To increase the production of high quality milk in the Carpathian region of Ukraine along with the breeding of black and white dairy cows and other perspective cow types we should breed Simmental cattle that gives dairy products of high value and, especially, cheese. It is known, that cheese from Simmental breed is the best in the world. Studies about constitutional features of combined Simmental breed in terms of Carpathian region were not conducted yet. Therefore, assessment of the constitution type of Simmental cattle in the conditions of Carpathian region has theoretical and practical importance yet [Zup et al. 2015]. As is known, the Constitution influences the structure of the body, as well as temperament and economic performance [Khmelnychyi 2007, Chernenko et al. 2016, Shcherbatyi et al. 2017, Karlova et al. 2019]. According to a number of authors, the Constitution is passed by heredity [Milostiviy et al. 2017, Karlova and Lesnovska 2017].

Classical methods for the assessment of such constitution types by are widely used in scientific livestock practices. The aim of our study was to investigate the growth of body mass and linear development of Simmental heifers of different constitution types in Carpathian region.

MATERIAL AND METHODS

Studies conducted by us on the Ukrainian black-motley dairy cattle of different origin allowed us to develop a new method of comprehensive assessment of the type of cattle constitution from a deduction of physiological-selective index [Fedak 2001, 2008].

These methods can be used in cattle breeding, in selecting process by assessing cattle breeds, and genealogy groups. They can also be used in assessing the suitability of animal for meat and milk production.

The individuals with high values of index belong to the high-fermenting constitution type – with high growth intensity (for calves from 6 to 18 months), high milk production (cows of I, II and III lactations) and high body weight (for bull-sires 2 and 3 years old), while lower values of this indicators show, that animals have low intensity of growth, low milk production and body weight.

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Table 1. Body weight in simental heifers of different ages, kg

Tabela 1. Masa ciała u jałówek simental w różnym wieku, kg

Age, months Wiek, miesiące	Groups, M ±m Grupa, M ±m		±to control ±w porównaniu z kontrolną
	Control Kontrolna	Research Doświadczalna	
6	169.2 ±4.48	181.9 ±3.68***	+12.7
12	288.4 ±5.92	313.0 ±4.09***	+24.6
18	375.3 ±9.23	396.7 ±7.82**	+21.4

**P < 0.01; ***P < 0.001.

Table 2. The average daily weight gain of Simmental heifers cattle, g

Tabela 2. Średni dzienny przyrost masy ciała jałówek simental, g

Age, months Wiek, miesiące	Groups, M ±m Grupa, M ±m		±to control ±w porównaniu z kontrolną
	Control Kontrolna	Research Doświadczalna	
7 – 12	662 ±12.0	728 ±10.0	+66
13 – 18	483 ±14.0	465 ±11.0	–18
0 – 18	641 ±15.0	680 ±11.0	+39

The constitution type of Simmental cattle was evaluated according to our physiological selection index [Fedak 2001, 2008]. The control group animals (n = 10) were of low-fermenting constitution type, while in research group (n = 10) respectively – high-fermenting constitution type. Terms of feeding and animal maintenance during the experiment were similar in both control and experimental groups [Bogdanov 2016]. The body weight growth, main body measurements and indexes of the body structure in both control and research group were estimated using methods developed by Siratskyj et al. [2001].

Statistical analysis of obtained results was conducted according to classical methods in agricultural animal science [Plohinsky 1970].

RESULTS AND DISCUSSION

Live weight is one of the integral parameters characterizing animal organism, both exterior and interior. In this study aim was to investigate the growth of live weight gain and linear growth of heifers of different constitutional types of Simmental dairy beef.

The body weight growth of high-fermenting constitution type of heifers and low-fermenting their type is shown in Table 1, which shows that for the body weight in 6, 12 and 18 months of age heifers of research group prevailed control counterparts by 7.5; 8.5 and 5.7%. Similar relationships were shown by Barabash et al. [2002].

Higher live weight resulted in higher average daily weight gain of the animals in the experimental group compared with control counterparts (Table 1).

At ages of 7–12 and 13–18 months heifers of research group prevailed control counterparts respectively by 9.97 and 6.08%. At ages 13–18 months average daily live weight gain of research group heifers prevailed control group analogues respectively by 3.87%. As we see from Table 2, in different age periods in control and experimental groups it was different intensity of weight gain of animals.

This indicates a rhythmical growth of heifers' weight in postnatal ontogenesis. There is such a law: animals, that lag behind at certain ages, try to make up its development in later period when nutrition is improved, what actually occurs in animals of the control group aged 13–18 months. From birth to 18 months heifers of research group had gains of 680, and their control counterparts – respectively 641 grams.

Live weight not fully characterizes the development of animals, this figure is complemented by the measurements of the body articles, which assesses linear growth of individuals. To characterize linear growth, in livestock practice are used basic measurements, which in general can show in detail the development of the animals.

Main body measurements of experimental Simmental animals are shown in Table 3.

Height at withers in heifers at 6, 12, 18 months prevailed control research group peers respectively by 0.40;

Table 3. The body measurements of Simmental heifers, cm

Tabela 3. Pomiary ciała jałówek simental, cm

Measurements – Pomiary	Groups, M ±m – Grupa, M ±m		±to control ±w porównaniu z kontrolną
	Control – Kontrolna	Research – Doświadczalna	
	6 months – 6 miesięcy		
Height – Wysokość	99.9 ±0.13	100.3 ±0.7*	+0.4
Height in buttocks – Wysokość w pośladkach	104.2 ±0.19	104.7 ±0.18**	+0.5
Chest depth – Głębokość klatki piersiowej	45.0 ±0.20	45.3 ±0.15	+0.3
Splay body length – Długość korpusu	103.9 ±0.17	104.8 ±0.18**	+0.9
Breast width in blades – Szerokość piersi w ostrzach	31.5 ±0.20	31.8 ±0.25	+0.3
Width in the hip joints – Szerokość w stawach biodrowych	31.6 ±0.21	31.8 ±0,24	+0.2
Width in clubs – Szerokość w klubach	33.7 ±0.30	34.5 ±0.31	+0.8
Circumference of the chest under the shoulder blades – Obwód klatki piersiowej pod łopatkami	127.2 ±0.14	128.6 ±0.17**	+1.4
Circumference of metacarpus – Obwód śródręcza	14.6 ±0.11	14.8 ±0.12	+0.2
	12 months – 12 miesięcy		
Height – Wysokość	110.6 ±0.70	112.9 ±0.50**	+2.3
Height in buttocks – Wysokość w pośladkach	118.7 ±0.10	118.7 ±0.12	0
Chest depth – Głębokość klatki piersiowej	55.1 ±0.11	55.5 ±0.13	+0.4
Splay body length – Długość korpusu	121.9 ±0.18	123.5 ±0.20**	+1.6
Breast width in blades – Szerokość piersi w ostrzach	37.1 ±0.30	38.5 ±0.30**	+1.4
Width in the hip joints – Szerokość w stawach biodrowych	39.3 ±0.15	41.1 ±0.19***	+1.8
Width in clubs – Szerokość w klubach	39.8 ±0.13	40.9 ±0.18***	+1.1
Circumference of the chest under the shoulder blades – Obwód klatki piersiowej pod łopatkami	156.7 ±0.25	159.3 ±0.30**	+2.6
Circumference of metacarpus – Obwód śródręcza	17.2 ±0.40	17.4 ±0.20	+0.2
	18 months – 18 miesięcy		
Height – Wysokość	119.0 ±0.30	120.8 ±0.35**	+1.8
Height in buttocks – Wysokość w pośladkach	125.5 ±0.20	127.8 ±0.30**	+2.3
Chest depth – Głębokość klatki piersiowej	61.6 ±0.40	61.6 ±0.20	0
Splay body length – Długość korpusu	133.3 ±0.40	135.8 ±0.41**	+2.5
Breast width in blades – Szerokość piersi w ostrzach	42.0 ±0.20	42.4 ±0.15	+0.4
Width in the hip joints – Szerokość w stawach biodrowych	45.3 ±0.17	45.6 ±0.18	+0.3
Width in clubs – Szerokość w klubach	44.0 ±0.44	44.0 ±0.50	0
Circumference of the chest under the shoulder blades – Obwód klatki piersiowej pod łopatkami	172.5 ±0.30	173.1 ±0.20	+0.6
Circumference of metacarpus – Obwód śródręcza	18.3 ±0.17	18.9 ±0.18**	+0.6

*P < 0.05; **P < 0.01; ***P < 0.01.

2.08; 1.50%. In the above mentioned ages similar pattern is noted by such indicator as the height in the buttocks. For breast deepness of heifers at 6 and 12 months the experimental group prevailed control peers respectively 0.67 and 0.72%. For the spit length of the trunk at all ages, research group animals prevailed their control counterparts by 1.49–1.78%.

Table 4. Indices of body structure of Simmental heifers (6–12 months), %

Tabela 4. Indeksy budowy ciała jałówek simental (6–12 miesięcy), %

Indexes – Wskaźniki	Groups, M ±m – Grupa, M ±m		±to control ±w porównaniu z kontrolną
	Control – Kontrolna	Research – Doświadczalna	
6 months – 6 miesięcy			
Long-leg – Długa noga	54.9	54.8	–0.1
Stretch rate – Szybkość rozciągania	104.0	104.5	+0.5
Pelvis-breast – Pierś miednicy	93.4	92.2	–1.2
Chest – Skrzynia	70.0	70.2	+0.2
Compactness – Zwartość	122.4	122.7	+0.3
Outgrowness – Outgrowness	104.3	104.4	+0.1
Bone volume – Objętość kości	14.6	14.7	+0.1
12 months – 12 miesięcy			
Long-leg – Długa noga	49.8	51.2	+1.4
Stretch rate – Szybkość rozciągania	110.2	109.4	–0.8
Pelvis-breast – Pierś miednicy	93.2	94.1	+0.9
Chest – Skrzynia	66.8	69.9	+3.1
Compactness – Zwartość	128.5	129.0	+0.5
Outgrowness – Outgrowness	105.1	107.3	+2.2
Bone volume – Objętość kości	15.5	15.4	–0.1
18 months – 18 miesięcy			
Long-leg – Długa noga	48.2	49.0	+0.8
Stretch rate – Szybkość rozciągania	112.0	112.4	+0.4
Pelvis-breast – Pierś miednicy	95.4	96.3	+0.9
Chest – Skrzynia	68.2	68.8	+0.6
Compactness – Zwartość	127.4	129.4	+2.0
Outgrowness – Outgrowness	105.4	105.8	+0.4
Bone volume – Objętość kości	15.4	15.6	+0.2

Research heifers aged 6, 12, 18 months, for breast width in blades dominated control group respectively by 3.77; 0.95; 0.65%. A similar pattern is noted by such indicator as width in the hip joints. In the above listed periods of investigations by width in clubs animals of the experimental group prevailed control counterparts respectively by 2.76; 2.37; 2.76%.

Heifers of research group at 6, 12, 18 months for breast girth dominated control peers respectively by 0.94; 1.10; 1.66%.

Thus, by the main body articles, which characterize the exterior, in high-fermenting constitution type of animals (experimental group) in postnatal ontogenesis dominated analogues of low-fermenting type (control group).

The indexes of the body structure in postnatal ontogenesis evaluate the development of some articles of the body relative to the others. In our studies of these indicators we have not seen significant benefits of research groups animals over control counterparts (Table 4).

Long-leg index shows, that in postnatal ontogenesis in tested animals depth of chest increased stronger than the height at the withers, as this index decreased from 61.7 to 50.9%.

Total development of animals in the age aspect is actually visible from the increasing of stretch rate index, which rose from 102.0 to 113.5%.

From 6 to 18 months of age pelvis-breast index was increasing in animals of control and experimental groups. This indicates that the front and rear of the body evolved proportionally.

Chest volume index characterizes the development of the animals' chest. In postnatal ontogenesis in experimental animals value changes of this index has wavy character. In some age periods of development it is higher

in other – lower. This testifies the rhythmicity of the chest of animals in control and experimental groups.

Compactness index of heifers in the control and experimental groups increased from 6 to 18 months of age. This indicates that in postnatal ontogenesis in experimental animals the volume of the chest and body length were developing proportionally.

Measurements of the height of experimental animals in postnatal ontogenesis had rectilinear increase nature, as shows the index. In animals aged 6 months it made 104.0–102.8% and in 18-month-old – 104.0–108.0%.

For bone volume index in postnatal ontogenesis significant fluctuations in tested animals were not found. Thus, the indices of body structure indicate that animals of control and experimental groups in postnatal ontogenesis developed harmoniously and proportionally.

CONCLUSIONS

In postnatal ontogenesis animals of high-fermenting type by body weight and linear development are dominating over low-fermenting counterparts, indicating higher levels of synthetic and metabolic processes in individuals of high-fermenting type.

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MASA CIAŁA I ROZWÓJ CECH LINIOWYCH JAŁÓWEK RASY SIMMENTAL W RÓŻNYCH TYPACH KONSTYTUCJI W REGIONIE PRZEDGÓRSKIM

STRESZCZENIE

Przedstawiono dane dotyczące rozwoju jałówek simental różnych typów konstytucji w ontogenezie poporodowej w regionie karpackim. Przy wzroście masy ciała i rozwoju liniowym zwierzęta w typie oddechowym (grupa badawcza) zdominowały zwierzęta w typie limfatycznym (grupa kontrolna) o 7–9%. Należy również zauważyć, że zwierzęta w obu grupach rozwijały się harmonijnie. Masa ciała jałówek z grupy badawczej w wieku 6, 12 i 18 miesięcy była większa od masy ciała jałówek z grupy kontrolnej, odpowiednio o 7,5, 8,5 i 5,7%.

Słowa kluczowe: jałówki simentalskie, typy konstytucji, rozwój postnatalny, masa ciała, pomiary ciała, wskaźniki budowy ciała

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