

## BIOLOGICAL ASSESSMENT OF THE CONSTITUTION OF THE POLISSIAN BEEF CATTLE IN THE CONDITIONS OF THE PRECARPATHIAN REGION

Olga STADNYTSKA<sup>1</sup>, Bogdan GUTYJ<sup>2</sup>, Viktor KHALAK<sup>3</sup>, Vasyl FEDAK<sup>1</sup>,  
Igor DUDCHAK<sup>2</sup>, Miroslava ZMIIA<sup>2</sup>, Ivan SHUVAR<sup>4</sup>,  
Volodymyr BALKOVSKIY<sup>4</sup>, Antin SHUVAR<sup>4</sup>, Hanna KORPITA<sup>4</sup>,  
Nataliia CHYZHANSKA<sup>5</sup>, Larysa KUZMENKO<sup>5</sup>, Viacheslav VAKULIK<sup>6</sup>

<sup>1</sup>Institute of Agriculture of the Carpathian Region NAAS, Obroshino, Ukraine

<sup>2</sup>Stepan Gzhytskyi National University of Veterinary Medicine and Biotechnologies, Lviv, Ukraine

<sup>3</sup>State institution - Institute of Grain Crops, National Academy of Sciences of Ukraine, Dnipro, Ukraine

<sup>4</sup>Lviv National Agrarian University, Dublyany, Ukraine

<sup>5</sup>Poltava State Agrarian University, Poltava, Ukraine

<sup>6</sup>State Agrarian and Economic University, Dnipro, Ukraine

Corresponding author email: stadnytskaolha@ukr.net

### Abstract

*The aim of the study was to investigate the growth of body weight, linear development, physiological and biochemical parameters of the blood of the first cows of Polissian beef breed of different constitution before and after weaning calves in the Precarpathians. To achieve this goal provides for the following tasks: to study the growth of live weight of cows of different types of constitution before and after weaning calves; to study the linear development of first-born cows of different types of constitution before weaning; to study the physiological and biochemical parameters of the blood of first-born cows of different types of constitution before and after weaning calves. In terms of body weight growth, linear development of physiological parameters of the blood of the first-born cows of the experimental group, both before weaning and after weaning calves significantly outperformed control peers, on average by 10-12%. In the Carpathian region, the breeding of Polissya meat breed should use animals with high physiological selection index, compared with analogues with low physiological selection index, it will accelerate the selection process in livestock populations and increase the production of biologically valuable beef in the region.*

**Key words:** body structure indices, cattle breeding, constitution, measurements of the bodies, Polissian beef cows.

### INTRODUCTION

The Polissian beef breed has been created in the Polissya area, at the main breeding farm "Zapovit" ("Testament"). There are a significant number of subsidiary farms in the Polissya region. The breed has been created by complex reproductive breeding of Chernihiv ("ChB -1"), Dnieper ("PM -1") and Znamyansk types ("ZT"). In Polissya beef breed (Boyko, 2006; Kobylins'ka, 2012; Kosyr, 2016; Logosha, 2012; Melnyk, 2010; Speka, 2010; Speka et al., 2011; Azizov, 2011), lines Iris 559, Tonaka 662, Cascadera 530 have been created, final work is underway to approve lines Omar 814, Paketa 93, Liner 65. All line ancestors underwent a two-stage evaluation of their own productivity and

the quality of their offspring and obtained the following results:

- Iris 559: for its own productivity - A-565-1030-8.6-54.0- elite record; by the quality of descendants - B-14530-1070-8.5-52.3-elite-record - 102.2;

- Stuntman 530: for its own performance - A-520-995-8.9-52.0 - elite record; by the quality of descendants - B-7-515-1008-8.5-52.3-elite-record - 101.3;

- Tonak 662: for its own productivity - A-520-935-8.9-52.0 - elite record - 102.8.

Control slaughter of the descendants of these breeders showed that in 15 months they had a slaughter yield of almost 64%, carcass yield - almost 61%, in 18 months - respectively 65-66%, 62-63%, which meet the breed standard.

The best bull' calves of the Iris 559 line at the age of 15 months had an average live weight of 495 kg, average daily gains (from 8 to 15 months) - 1196 g on average; in the line of Cascade 530 figures were 506 kg and 1121 g, respectively; Tonaka - 462 kg and 981 g.

The ancestors of the created lines - Omar 814, Package 93, Liner 85 also passed a two-stage evaluation:

- Omar 814: for its own productivity - A-545-1037-8.8-52.0-elite-record; by the quality of descendants - B-9-522-1025-8.6-52.0-elite-record - 101.6;

- Package 93: for its own performance - A-520-1015-8.6-52.0-elite-record; by the quality of the descendants of B-9-502-985-8.7-52.0 - elite record;

- Liner 65: on own productivity - A-525-1020-8.5-52.0 - elite-record; by the quality of the descendants of B-15-495-995-8.6-52.0 - elite record. Control slaughter of Omar 814 offspring showed that they had a slaughter yield of 64% at 15 months, carcass yield of 61%, at 18 months - 66 and 62%, respectively, which corresponds to the parameters of the Polissian beef breed standard. In terms of body structure, Polissian beef breeds are close to the Aberdeen Angus of American selection: long, broad-bodied, with a large head and short neck, deep chest, well-developed back of the torso, have relatively low limbs, light color.

Animals of Polissian beef breed are characterized by the following indicators: live weight of newborn calves - 28-34 kg, bull' calves at weaning at 8 months -260-303 kg, heifers - 240-280 kg, bull' calves at 18 months - 540-604 kg, heifers - 410-450 kg, physiologically mature bulls 1055-1150 kg, adult cows - 560 - 600 kg, first-born cows - 460-525 kg, cows of the second calf - 500-625 kg, the third calf - 550-645 kg.

Indicators of meat productivity of Polissian beef breed are as follows: growth rate of bulls on cultivation - 1064-1250 g, carcass weight of bulls at 18 months - 330-370 kg, carcass yield - 63-64%, slaughter yield - 65%, content bones in the carcass - 14-15%, meat quality - 4-5 points, fertility, ease of calving - 4.5-5.0 points, feed consumption per kilogram of live weight gain - 6.0-7.5 feed units, The yield of calves per 100 cows - 85-93 heads (Boyko, 2006).

Simultaneously with the derivation of the lines, selection work was carried out to establish families. The lines are based on the families in which the mothers of the future successors of the lines are received. Through families, some lines enrich others with heredity.

Today, the Polissian beef breed has more than 3,000 breeding stock, more than 5 lines and 18 families have been approved. Animals of this breed are bred mainly in farms of Zhytomyr, Rivne and Lviv regions. Breeding work with Polissian beef breed at this stage is carried out in the direction of accelerated genetic improvement of the population from high fertility, intensive live weight gain, good meat forms, meat quality and adaptation of animals to climatic and environmental conditions Polissya and the Precarpathian region.

The development of beef cattle breeding is important for increasing beef production in Ukraine, including the Carpathian region. A number of meat breeds are bred in the Precarpathian region: Limousine, Simmental, Polissya, Volyn, Aberdeen-Angus. All these breeds are very well adapted to the conditions of the Precarpathian region. The study of biological and zootechnical laws of these breeds is of great scientific, economic and practical value in the Precarpathian region

The assessment of beeg breeds in the Precarpathian region according to the type of constitution on the basis of physiological selection index is carried out for the first time. This process makes it possible to speed up the selection process when breeding beef breeds by an average of 4-5 years. The use in the breeding process of animals with a high physiological and breeding index, compared with low physiological and breeding index, makes it possible to increase beef production by 8-10% (Fedak, 2011). This development is also of practical importance for improving the quality of beef cattle in the Precarpathian region.

The aim of the study was to investigate the growth of body weight, linear development, physiological and biochemical parameters of the blood of the first cows of Polissian beef breed of different constitution before and after weaning calves in the Precarpathians.

To achieve this goal provides for the following tasks:

- to study the growth of live weight of cows of different types of constitution before and after weaning calves;
- to study the linear development of first-born cows of different types of constitution before weaning;
- to study the physiological and biochemical parameters of the blood of first-born cows of different types of constitution before and after weaning calves.

## MATERIALS AND METHODS

The research was conducted at the "Bilak" farm in the Sambir district of the Lviv region on the first-born cows of the Polissian beef breed after the first calving before weaning and after weaning the calves. There were 10 cows in the experimental and control groups.

Materials of growth of live weight of cows, the basic measurements of sexes of a body, indices of a structure of a body and the basic biochemical indicators of blood of cows for 2-3 and 7-8 months of lactation of various type of the constitution are given. The type of constitution was performed according to the physiological-selection index developed by us. The control group included cows with a low physiological selection index (103.66 units), in the experimental group with a high physiological selection index (140.37 units) (Fedak, 2008).

Biochemical parameters of the blood of experimental first-born cows before and after weaning calves of different types of constitution were performed according to the generally accepted methods in biological practice of Vlizlo (2012).

Statistical processing of research materials was performed in Microsoft Office Excel and Microsoft Office Word.

## RESULTS AND DISCUSSIONS

Live weight of cows in the experimental group (Table 1) was higher than in the control group by 5.6%. Thus, animals with a high physiological selection index of the type of constitution (experimental group) had higher growth energy than analogues with a low physiological selection index of the type of constitution (control group).

In terms of height at the withers (Table 2), the cows of the experimental group outperformed the control analogues by 1.3%, and in terms of height in the buttocks - -2.6%, respectively. Thus, in terms of altitude measurements, the cows of the experimental group significantly outperformed the control analogues.

In terms of breast depth, cows of the experimental group outperformed the control analogues by 10.4%. In terms of breast width, the animals of the experimental group also outperformed the control peers by 4.4%. Thus, in terms of volumetric measurements, the animals of the experimental group have rather large advantage over control analogues.

According to the oblique length of the body, the animals of the experimental group outperformed the control analogues by 2.8%.

The chest girth (behind the shoulder blades) was higher in animals of the experimental group by 1.8% compared with control counterparts.

The width in the hip joints and in the clubs was higher in animals of the experimental group by 3.5 and 3.2%.

By their lower back development, the cows of the experimental group outperformed the control analogues (vertical and horizontal half-girth of the buttocks) by 1.6 and 5.75.

The animals of the experimental group outperformed the control analogues by 2.1%.

The main body structure indices of Polissian beef breed corresponded to the breed standard (Table 3).

According to the indices of distension, pelvic, thorax, beating, overgrowth and bone of the animals of the experimental group slightly outperformed control counterparts.

According to the long-legged and thoracic indices, there is some advantage of control animals over experimental analogues.

In general, both experimental and control animals developed harmoniously, the front and back of the torso were proportional.

An important object of study of the interior of livestock is the morphological and biochemical composition of blood (Table 4), because in fact this substance plays an important role in the body and due to a number of different internal and external factors can change significantly and can predict at different stages of ontogenesis their future performance.

This report presents the biochemical parameters of the blood of the first cows of Polissian beef breed, which is bred in the Precarpathians.

The content of erythrocytes in the blood of cows of the experimental group outperformed the control peers by 6.4%, and the content of hemoglobin, respectively - 6.4%.

In terms of protein metabolism in the serum of animals of the experimental group also outperformed the control analogues.

Thus, the protein content in the serum of experimental animals outweighed the control animals by 5.3%. The activity of reamination enzymes in blood serum was also higher in cows of the experimental group compared with control analogues.

According to the content of total, residual and protein sulfhydryl groups of cows of the experimental group prevailed control by 7.4%, 1.1% and 5.8%.

The content of total, reduced and oxidized glutathione in the blood of the experimental groups was higher than in the control by 4.8%, 3.8% and 8.3%.

Redox processes in the blood of the experimental group were also higher compared to control counterparts, as evidenced by the activity of catalase in the blood. Thus, the cows of the experimental group outperformed the analogues of the control group in catalase activity by 8.1%.

Thus, in terms of body weight growth, linear development and physiological and biochemical parameters of the blood of animals of the experimental group significantly outperformed control counterparts. This indicates that in experimental animals the metabolic processes were more intense than in control analogues, as evidenced by the live weight of animals.

Table 5 presents the live weight of cows after weaning calves. It should be noted that the live weight of the experimental animals was 5.8% higher than that of control counterparts. Animals of both the control and experimental groups

significantly exceeded the breed standard by 8.16 and 14.47%, respectively.

The main measurements of bodies characterize the linear development of animals. In our studies, as can be seen from the Table 6 in altitude measurements of cows of the experimental group prevailed control analogues by 2.91-3.18%. In terms of chest width and depth, individuals of the experimental group had an advantage over control analogues. It should be noted that the oblique length of the body of cows of the experimental group after weaning outperformed the control peers by 2.90%. In terms of volumetric measurements of the articles, there is also an advantage of the cows of the experimental group over the control peers. Higher skeletal development was found in cows of the experimental group compared with control counterparts.

Thus, the linear development of the cows of the experimental group obviously outperformed analogues of the control group. A similar pattern was observed for live weight of cows.

Indices of body structure of experimental animals are shown in the Table 7.

The main indices of body structure in animals of the control and experimental groups were within the physiological norm and corresponded to the breed standard according to these indicators

The interior performance of experimental animals characterizes the biochemical components of the blood (Table 8).

According to the morphological parameters of the blood there is a probable advantage of the animals of the experimental group over the control analogues and this difference is 9.0-11.0%.

In terms of protein metabolism in the blood of experimental cows, there is also a significant advantage of animals of the experimental group over control peers.

Redox processes in the blood of cows were more intense in animals of the experimental group, compared with control counterparts and this difference was 10.0-12.0%.

Table 1. Live weight of first-born cows of Polissian beef breed before weaning calves, kg

Indicators	Groups (M + m)		± to control
	Control (n = 10)	Experimental (n = 10)	
Live weight of cows at 2-3 months of lactation	505.11 ± 1.10	529.11 ± 1.55*	+ 24.0
Breed standard by live weight, I class	450	450	-
± to standard	+55.11	+79.11	-

Table 2. The main measurements of the bodies of the Polissian beef breed before weaning calves, cm

Measurements	Groups (M ± m)		± to control
	control (n = 10)	experimental (n = 10)	
Cows at 2-3 months of lactation			
Height at withers	125.8±0.11	129.5±0.13**	+ 3.7
Height in the lower back	132.8±0.14	136.4±0.17****	+ 3.6
Chest depth	63.4±0.20	66.3±0.21****	+ 2.7
Oblique body length	144.3±0.15	148.4±0.16****	+ 4.1
Chest width	45.0±0.13	46.9±0.14	+1.9
Width in the hip joints	49.4±0.18	51.0±0.19*	+ 1.6
Width in clubs	46.9±0.20	50.1±0.22***	+ 3.2
Chest girth behind the shoulder blades	184.5±0.40	188.9±0.45****	+4.4
Half girth of the back - vertical	162.0 ±0.99	174.8±1.05*	+12.8
Half girth of the back - horizontal	109.5±0.66	115.8±0.77*	+6.3
Wrist girth	18.7±0.11	19.3±0.14	+0.6

Table 3. Indexes of body structure of Polissian beef breed before weaning calves, %

Indexes	Groups (M ± m)		± to control
	control (n = 10)	experimental (n = 10)	
Cows at 2 - 3 months of lactation			
Leg length	49.7	50.6	+0.9
Lengthiness	113.3	114.5	+ 1.2
Pelvic-thoracic	92.8	95.1	+ 2.3
Pectoral	68.2	70.2	+ 2.0
Muscles structure	127.3	127.4	+ 0.1
Overgrowth	104.1	105.2	+ 1.1
Bones' structure	14.5	14.7	+ 0.2

Table 4. Biochemical parameters of Polissian beef breed before calving

Blood indicators	Groups (M ± m)		± to control
	control (n = 10)	experimental (n = 10)	
The number of erythrocytes in the blood, 10 <sup>12</sup> liters	6.43 ± 0.13	6.85 ± 0.09**	+ 0.42
The content of hemoglobin in the blood, g/l	109.0 ± 1.5	118.0 ± 1.7**	+ 9.0
The content of total protein in blood serum, g/l	75.2 ± 0.8	86.9 ± 3.5**	+ 11.7
ACT activity in serum, units/l <sup>-3</sup>	34.18 ± 0.44	40.82 ± 0.29***	+6.64
ALT activity in blood serum, units / l <sup>-3</sup>	23.17 ± 0.50	28.11 ± 1.24***	+ 4.94
The content of total sulfhydryl groups in the blood, g <sup>-3</sup> / l cysteine	611.7 ± 10.1	657.3 ± 8.8**	+ 45.6
The content of residual sulfhydryl groups in the blood, g <sup>-3</sup> / l cysteine	143.4 ± 4.0	160.8 ± 4.0***	+ 17.4
The content of protein sulfhydryl groups in the blood, g <sup>-3</sup> / l cysteine	6015.0 ± 290.0	6375.0 ± 110.0	+ 360.0
The content of total glutathione in the blood, g <sup>-3</sup> / l	457.3 ± 4.2	480.9 ± 2.8**	+ 23.6
The content of reduced glutathione in the blood, g <sup>-3</sup> / l	379.2 ± 2.6	393.7 ± 3.6**	+ 14.2
The content of oxidized glutathione in the blood, g <sup>-3</sup> / l	82.4 ± 3.2	94.8 ± 1.9	+ 12.4
Catalase activity in the blood, g <sup>-3</sup> H <sub>2</sub> O <sub>2</sub> / liter	9.22 ± 0.13	9.78 ± 0.05*	+ 0.56

Table 5. Live weight of the first-born cows of the Polissian beef breed after weaning calves, kg

Indicators	Groups (M + m)		± to control
	control (n = 10)	experimental (n = 10)	
Live weight of cows at 7-8 months of lactation	482.68 ± 2.41	513.11 ± 2.78***	+30.43
Breed standard by live weight, I class	450	450	-
± to standard	+32.68	+63.11	-

Table 6. The main measurements of the Polissian beef breed cows' bodies after weaning calves, cm

Measurements (cows at 7-8 months of lactation)	Groups (M + m)		± to control
	control (n = 10)	experimental (n = 10)	
Height at withers	122.3±0.12	126.2±0.16*	+3.9
Height in the lower back	129.3±0.15	134.1±0.17**	+4.8
Chest depth	61.2±0.19	64.4±0.11*	+3.2
Oblique body length	141.2±0.16	145.5±0.17*	+4.3
Chest width	41.7 ± 0.12	45.3±0.14*	+3.6
Width in the hip joints	46.3±0.19	49.4±0.14*	+3.1
Width in clubs	44.1±0.18	49.3±0.20*	+5.2
Chest girth behind the shoulder blades	180.9±0.30	186.7±0.50*	+5.8
Half girth of the back - vertical	157.9±0.80	168.0±0.99**	+10.1
Half girth of the back - horizontal	107.3±0.55	111.0±0.78*	+3.7
Wrist girth	18.0±0.09	18.9±0.13*	+0.9

Table 7. Body structure indices of Polissian beef cows after calving, %

Indexes	Groups (M + m)		± to control
	control (n = 10)	experimental (n = 10)	
cows at 7 - 8 months of lactation			
Leg length	48.97	49.80	+0.83
Lengthiness	115.03	115.35	+0.32
Pelvic-thoracic	92.28	94.58	+2.30
Pectoral	68.12	70.40	+2.28
Muscles structure	128.13	128.32	+0.19
Overgrowth	104.51	106.15	+1.64
Bones' structure	14.72	15.01	+0.29

Table 8. Biochemical parameters of blood of Polissian beef cows after calving

Blood indicators	Groups (M + m)		± to control
	control (n = 10)	experimental (n = 10)	
The number of erythrocytes in the blood, 10 <sup>12</sup> liters	6.10±0.12	6.65±0.10*	+0.55
The content of hemoglobin in the blood, g/l	109.0±0.99	114.2±1.2**	+5.2
The content of total protein in blood serum, g/l	68.9±0.90	82.6±3.4*	+13.7
ACT activity in serum, units / l <sup>-3</sup>	31.01±0.30	37.05±0.30*	+6.04
ALT activity in blood serum, units / l <sup>-3</sup>	21.11±0.40	26.90±1.11*	+5.79
The content of total sulfhydryl groups in the blood, g <sup>-3</sup> / l cysteine	592.4±9.8	629.5±7.7*	+37.1
The content of residual sulfhydryl groups in the blood, g <sup>-3</sup> / l cysteine	143.5±3.5	152.1±3.5*	+8.6
The content of protein sulfhydryl groups in the blood, g <sup>-3</sup> / l cysteine	5885.0±190.0	6179.0±100.0*	+294.0
The content of total glutathione in the blood, g <sup>-3</sup> / l	428.3±3.8	448.7±2.8*	+20.4
The content of reduced glutathione in the blood, g <sup>-3</sup> / l	348.3±2.4	369.7±3.5*	+21.2
The content of oxidized glutathione in the blood, g <sup>-3</sup> / l	73.3±2.9	89.3±1.7**	+16.0
Catalase activity in the blood, g <sup>-3</sup> H <sub>2</sub> O <sub>2</sub> / liter	8.66±0.14	9.16±0.04*	+0.50

Thus, according to the main biochemical parameters of blood, the animals of the experimental group significantly outperformed the control analogues, which also affected the growth of live weight and linear development of individuals.

## CONCLUSIONS

In terms of body weight growth, linear development of physiological parameters of the blood of the first-born cows of the experimental group, both before weaning and after weaning calves significantly outperformed control peers, on average by 10-12%.

In the Carpathian region, the breeding of Polissya meat breed should use animals with high physiological selection index, compared with analogues with low physiological selection index, it will accelerate the selection process in livestock populations and increase the production of biologically valuable beef in the region.

## REFERENCES

- Azizov, S.P. (2011). Some issues of organization and efficiency of animal husbandry. *Economics of agro-industrial complex*, 4, 12–15.
- Boyko, A.A. (2006). *Formation of meat productivity in animals of the created large-scale exterior type of polissya meat breed: author's ref. dis. for science. degree of Dr. s.-g. science: special. 06.02.01 "Breeding and selection of animals"*.
- Fedak, V.D. (2008). Physiological and biochemical parameters of blood of local bulls of Ukrainian black-spotted dairy cattle and Ukrainian meat breeds of different types of constitution. *Breeding and genetics of animals*, 42, 295–302.
- Fedak, V.D. (2011). Physiological and biochemical basis for the formation of productive traits in cattle. *Theoretical and practical recommendations*, 19.
- Kobylins'ka, A.M. (2012). Slaughter qualities of bulls of Polissya meat breed in a zone with different level of radiation pollution. *Visnyk Sumskoho natsionalnoho ahrrarneho universytetu. Seriya "tvarynnytstvo"*, 10 (20), 142-144.
- Logosha, R.V. (2012). Meat cattle breeding of Ukraine: state, tendencies and directions of its intensification. *Collection of scientific works of VNAU. Series: Economic Sciences*, 1(56), 90–96.
- Melnyk, Y.F. (2010). Formation of productivity of animals of different breeds of cattle in ontogenesis (on materials of the conducted breed test): *author's ref. dis. for science. degree of dr. s.-g. Science: special. 06.02.01 - breeding and selection of animals*, 38 p.
- Speka, S.S. (2002). Polissya meat breed of cattle: *author's ref. dis. for science. degree of dr. s.-g. science: special. 06.02.01 - breeding and selection of animals*, 35 p.
- Speka, S.S., Shalovilo, S.G., & Boyko, A.A. (2011). The state of the meat industry and justification of the feasibility of creating a large type in the Polissya meat breed. *Scientific Bulletin of LNUVMiBT S. Z. Gzhysky*, 4 (50), 301–305.
- Vlizio, V.V. (2012). *Laboratory research methods in biology, animal husbandry and veterinary medicine: handbook*, 759 p.