

SIGNS OF PRODUCTIVITY OF YOUNG PIGS OF LARGE WHITE BREED AND THEIR RELATIONSHIP WITH UREA CONTENT AND ACTIVITY OF SOME BLOOD SERUM ENZYMES

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The results of studies of fattening and meat qualities of young pigs of large white breed, some biochemical parameters of blood serum (urea content, aspartate aminotransferase (AsAT) activity, alanine aminotransferase (AlAT) activity are presented), as well as the economic efficiency of research results is calculated. The study was conducted in LLC "Druzhba-Kaznacheyivka" of Dnipropetrovsk region, in the Research center of biosafety and ecological control of agricultural resources of Dnipropetrovsk state agrarian and economic university, meat processing plant «Jazz» and Laborator Livestock y of the State institution Institute of grain crops of NAAS of Ukraine. The work was performed according to the research program of NAAS of Ukraine №30 "Innovative technologies of breeding, industrial and organic production of pig products" ("Pig breeding"), state registration number 0116U001247. The object of the study was young pigs of large white breed. Evaluation of animals for fattening and meat qualities was carried out taking into account the following indicators: average daily live weight gain during the control period of fattening, g, age of live weight 100 kg, days, fat thickness at the level of 6-7 thoracic vertebrae, mm, length of chilled carcass, cm, the length of the bacon half of the cooled half-carcass, cm (M.D. Berezovsky, I.V. Kha'tko, 2005). A comprehensive assessment of young pigs for fattening and meat qualities was calculated according to the B. Tailer index (P.A. Vashchenko, 2019), biometric indicators - according to the methods of G.F. Lakin (1990). Economic efficiency of research results was calculated according to the generally accepted technique (Methodology for determining the economic ..., 1983). It was found that the urea content, activity of aspartate aminotransferase (AsAT) and alanine aminotransferase (AlAT) in the serum of young pigs of the experimental group corresponds to the physiological norm of clinically healthy animals and amount to 4.77 ± 0.576 mol/l, 68.11 ± 6.445 units/l, and 4.22 ± 3.209 units/l, respectively. According to the age of reaching a live weight of 100 kg (days), the thickness of the fat at the level of 6-7 thoracic vertebrae (mm) and the length of the chilled carcass (cm) of the specified production group and breed correspond to class I and class "elite". The maximum values of "average daily gain of live weight during the period of control fattening, kg", "length of chilled carcass, cm", "length of bacon half of chilled carcass, cm" and minimum values of "age of live weight 100 kg, days" and "fat thickness per levels of 6-7 thoracic vertebrae, mm" are characterized by animals in which the complex index of fattening and meat qualities (B. Tailer's index) ranges from 157.68 to 182.36 points. The number of reliable relationships between the biochemical parameters of blood serum, fattening and meat qualities of young white pigs is 26.67 %. The cost of additional products obtained from young pigs with B. Tailer index of 157.68 – 182.36 points is equal to +1732.04 UAH/head.

Key words: young pigs, serum biochemical parameters, fattening and meat qualities, complex assessment, index, variability, correlation, economic efficiency

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In order to accelerate breeding work in animal husbandry, traditional and innovative methods of assessing breeding value and selection of highly productive animals are used, namely: by their own productivity, reproductive qualities of sows and breeding boars, fattening and meat qualities of their offspring, selection and evaluation methods, as well as DNA markers.

Thus, the results of studies Oliynichenko E.K. [1] indicate the influence of the marker CTSFg. 22 G>C on the intensity of growth and development of young pigs. The author found that animals of the GG genotype reach a live weight of 100 kg on 6.4 and 4.9 days earlier than analogues of the GC and SS genotypes, respectively. It is proved that the single nucleotide polymorphism of the leptin gene LEP g. 2845 A>T affects the moisture holding capacity of meat and moisture content in the fat of pigs of large white breed of Ukrainian selection. The meat of animals of the AA genotype had a 5.6 and 7.6 % higher moisture holding capacity compared to the meat of animals of the AT and TT genotypes, respectively. The fat of animals of the AA genotype had a lower moisture content by 6.8 % and 19.2 % compared to the AT and TT genotypes, respectively. It was found that SNP CTSFg. 22 C> G is associated with indicators of moisture retention, calcium content, energy value and melting

point of lard.

An important addition to this is the search for biological markers of quantitative traits of animals of different sexes, namely interior indicators.

According to the results research of Krasnoshchok O.O. it was proved that three-breed and hybrid young animals had an increased level of protein metabolism in comparison with purebred animals. Pigs of the combination of large white × (Duroc × Hampshire) predominated purebred pigs in terms of total protein by 35.58 %, albumin – 34.53 %, urea – 62.25 %, urea nitrogen – 61.84 %; the predominance of hybrids was established by the content of total protein - by 28.21 %, by the content of globulins – 39.96 %, urea and urea nitrogen – 55.64 and 55.71 %, the activity of AsAT – 37.71 %.

The author notes that the use of Landrace breeders and terminal boars improves the meat qualities of domestic and hybrid pigs, namely: slaughter yield increases by 1.6 – 3.2 %, the area of the "muscle cell" – 7.2 – 13.9 cm², ham weight – 0.7 – 0.8 kg, the thickness of the lard decreases by 6.8 – 7.8 mm [2].

According to Bazhov G.M. and others [3, 4] found high correlations between the content of total protein in the serum and the age of reaching a live weight of 100 kg ($r = -0.41 - -0.62$), the average daily increase in live weight ($r = +0.41 - +0.70$) and

feed costs per 1 kg of gain ($r=-0.55 - +0.65$). The obtained data show that the increase in growth energy is largely due to the high level of protein metabolism. The authors note that the data obtained have some contradictions, taking into account the relationship of protein metabolism with the productivity of pigs of different genotypes. It was found that in young pigs of steppe type (ST) meat breed SM-1 the level of total serum protein is positively correlated with the age of reaching live weight of 100 kg ($r=+0.34 - +0.39$), feed costs per 1 kg of growth ($r=+0.36 - +0.44$) and negative - with the average daily increase in live weight $r=-0.41 - -0.50$).

The urgency and practical significance of the study of the interior of farm animals and the nature of the inheritance of quantitative traits are evidenced by the works of Siratsky J.Z., Fedorovich E.I., Hopka B.M., Fedorovich V.S. and others. [5], Lazareva V.M. [6], Likhach V.Ya. [7], Negreev A., Babushkin V. [8], Khalak V.I. [9], Khalak V.I. et al., [10, 11]. Furata S., Hashimoto T. [12].

The aim of the study was to investigate the fattening and meat qualities of young white pigs, some serum biochemical parameters, urea content, aspartate aminotransferase (AsAT) activity, alanine aminotransferase (AIAT) activity, and to calculate the level of correlations between traits and economic efficiency. research results.

Materials and methods of research. The study was conducted in the breeding breeder for large white pigs LLT "Druzhba - Kaznacheyivka" Dnipropetrovsk region, in the Research center for biosafety and environmental control of agricultural resources Dnipro state agrarian economic university, meat factory "Jazz" and livestock laboratory Institute of grain crops of NAAS of Ukraine. The work was performed according to the research program of NAAS of Ukraine №30 "Innovative technologies of breeding, industrial and organic production of pig products" ("Pig breeding"), state registration number 0116U001247.

The object of the study was young pigs of large white breed. Evaluation of animals for fattening and meat qualities was carried out taking into account the following indicators: average daily gain of live weight during the period of control fattening, g; age of live weight 100 kg, days; fat thickness at the level of 6-7 thoracic vertebrae, mm; length of chilled carcass, cm; length of bacon half of chilled half-carcass, cm [13].

Comprehensive assessment of young pigs for fattening and meat qualities was calculated by the formula:

$$lv = 100 + (242 \times K) - (4.13 \times L) \quad (1)$$

where: lv - complex index of fattening and meat qualities (B. Tailer index), score; K - average daily live weight gain, kg; L - fat thickness at the level of 6-7 thoracic vertebrae, mm; 4.13 - constant coefficients [14].

Serum biochemical parameters in 5-month-old animals, urea content, aspartate aminotransferase (AsAT) activity, alanine aminotransferase (AIAT) activity were studied according to the generally accepted method [15].

The economic efficiency of the research was calculated by the formula:

$$E = \Pi \times \frac{C \times \Pi}{100} \times \Pi \times K, \quad (2)$$

where: E - cost of additional products, UAH; Π - purchase price per unit of output, according to existing prices in force in Ukraine; C - average productivity of animals; P - the

average margin of the main product (%), which is expressed as a percentage per 1 head when applying a new and improved selection achievement compared to the productivity of animals of basic use; Π - constant coefficient of reduction of the result, which is associated with additional costs for profitable products (0.75); K - the number of farm animals of new or improved breeding achievement, heads [16]. Conditions for feeding and keeping young pigs met zootechnical standards.

The pairwise correlation coefficient (r) between the characteristics of performance and biochemical parameters of blood serum, the error of the pairwise correlation coefficient (S_r) and the criterion of reliability of the pairwise correlation coefficient (t_r) were calculated by the formulas:

$$r = \frac{\sum xy - \frac{\sum x \cdot \sum y}{n}}{\sqrt{C_x \cdot C_y}}, \quad (3);$$

$$S_r = \sqrt{\frac{1 - r^2}{n - 2}}, \quad (4);$$

$$t_r = \frac{r}{S_r}, \quad (5)$$

The strength of the correlation between traits was assessed on the Chaddock scale (quoted by A.V. Sidorov et al. [17]) (Table 1).

Table 1

Chaddock scale for grading the strength of the correlation

The value of the correlation coefficient	Correlation strength
0.1-0.3	weak
0.3-0.5	moderate
0.5-0.7	noticeable
0.7-0.9	high
0.9-0.99	very high

Biometric processing of the obtained research results was carried out according to the method of G.F. Lakin [18].

Results of the research. Laboratory studies of serum of young pigs showed that the urea content is 4.77 ± 0.576 mmol/l ($Cv=34.13\%$), the activity of aspartate aminotransferase (AsAT) – 68.11 ± 6.445 u/l ($Cv=2.98\%$), alanine aminotransferase (AIAT) activity – 44.22 ± 3.209 u/l ($Cv=21.77\%$). These biochemical parameters of blood serum correspond to the physiological norm of clinically healthy animals of this species.

It has been established that the animals of the controlled herd are characterized by rather high indicators of fattening and meat qualities. Thus, the average daily increase in live weight of nimals during the control fattening period is 788.7 ± 10.78 g ($Cv=9.17\%$), the age of reaching a live weight of 100 kg – 177.3 ± 0.78 days ($Cv=2.98\%$), fat thickness at the level of 6–7 thoracic vertebrae – 20.7 ± 0.32 mm ($Cv=10.36\%$), length of chilled carcass – 96.5 ± 0.31 cm ($Cv=1.71\%$), length of bacon half of the cooled carcass – 85.5 ± 0.58 cm ($Cv=3.54\%$). The complex index of fattening and meat qualities ranges from 126.13 to 182.36 points.

The results of studies of biochemical parameters of blood serum, fattening and meat qualities of young pigs of different intrabreeding differentiation according to the B. Tailer index showed that the maximum productivity was characterized by young pigs, in which the complex index ranged from 157.68 to 182.36 points (Table 2).

Thus, animals of group I predominated class II peers at

the age of reaching a live weight of 100 kg for 13.3 days (td=8.29, P<0.001), the average daily increase in live weight during the period of control fattening – 103.0 g (td=2.44, P<0.05), fat thickness at the level of 6–7 thoracic vertebrae –

4.6 mm (td=6.67, P<0.001), length of chilled carcass – 2.2 cm (td=4.58, P<0.001), the length of the bacon half of the chilled carcass – 3.0 cm (td=2.77, P<0.01), the complex index of fattening and meat qualities – 28.88 points (td=10.61, P<0.001).

Table 2

Biochemical parameters of blood serum, fattening and meat qualities of young pigs of different intrabreed differentiation according to the B. Tailer index

Indicator, units of measurement	Biometrics indicator	B. Tailer index		
		lim		
		157.68-182.36	126.13-141.33	
		groupe		
		I	II	
<i>biochemical parameters of blood serum</i>				
Urea content, mmol/l	n	3	6	
	$\bar{X} \pm S\bar{x}$	5.50±0.378	5.05±0.385	
	$\sigma \pm S\sigma$	0.65±0.266	0.94±0.271	
	$C_v \pm S_{C_v}, \%$	11.81±4.840	18.61±5.378	
Aspartate aminotransferase (AsAT) activity, units/l	$\bar{X} \pm S\bar{x}$	57.3±9.261	73.5±8.069	
	$\sigma \pm S\sigma$	16.04±6.573	19.76±5.710	
	$C_v \pm S_{C_v}, \%$	27.97±11.463	26.89±7.771	
	$\bar{X} \pm S\bar{x}$	42.33±7.125	45.16±3.745	
Alanine aminotransferase (AIAT) activity, units/l	$\sigma \pm S\sigma$	12.34±5.057	9.17±2.650	
	$C_v \pm S_{C_v}, \%$	29.15±11.946	20.31±5.869	
	<i>fattening and meat qualities</i>			
	Average daily gain of live weight during the period of control fattening, g	n	I	II
$\bar{X} \pm S\bar{x}$		844.3±36.11	741.3±21.96	
$\sigma \pm S\sigma$		29.77±6.659	17.32±3.874	
$C_v \pm S_{C_v}, \%$		3.52±0.787	2.33±0.521	
Age of reaching live weight 100 kg, days	$\bar{X} \pm S\bar{x}$	168.7±1.17	182.0±1.10	
	$\sigma \pm S\sigma$	3.89±0.870	3.81±0.852	
	$C_v \pm S_{C_v}, \%$	2.30±0.514	2.09±0.467	
	The thickness of the fat at the level of 6-7 thoracic vertebrae, mm	$\bar{X} \pm S\bar{x}$	18.3±0.63	22.9±0.31
$\sigma \pm S\sigma$		2.11±0.472	1.08±0.241	
$C_v \pm S_{C_v}, \%$		11.53±2.579	4.71±1.053	
The length of the cooled carcass, cm		$\bar{X} \pm S\bar{x}$	97.7±0.25	95.5±0.42
	$\sigma \pm S\sigma$	0.50±0.111	1.04±0.232	
	$C_v \pm S_{C_v}, \%$	0.51±0.114	1.08±0.241	
	Length of bacon half of chilled carcass, cm	$\bar{X} \pm S\bar{x}$	87.0±0.81	84.0±0.73
$\sigma \pm S\sigma$		1.63±0.364	1.78±0.398	
$C_v \pm S_{C_v}, \%$		1.87±0.418	2.11±0.472	
Comprehensive index of fattening and meat qualities (B. Tailer index), score		$\bar{X} \pm S\bar{x}$	164.20±2.186	135.32±1.645
	$\sigma \pm S\sigma$	7.25±1.621	5.70±1.275	
	$C_v \pm S_{C_v}, \%$	4.41±0.986	4.21±0.941	

The difference between the animals of these groups in the urea content is equal to 0.45 mmol/l (td=0.84, P>0.05), the activity of aspartate aminotransferase (AsAT) – 16.2 units/l (td=1.31, P>0.05), alanine aminotransferase (AIAT) activity – 2.83 u/l (td=0.35, P>0.05).

The coefficient of variation of biochemical parameters of blood serum, fattening and meat qualities of young pigs of the experimental groups ranges from 0.51 to 29.15 %.

The results of calculating the coefficients of pairwise correlation between the biochemical parameters of blood serum, fattening and meat qualities of young pigs of the experimental group are shown in table 3.

This biometric indicator ranges from -0.637±0.1682 (alanine aminotransferase (AsAT) activity × average daily live weight gain during the control fattening period) to +0.736±0.1477 (alanine aminotransferase (AIAT) activity × age

of 100 kg live weight). Significant correlations were also established between the following pairs of traits: urea content × length of chilled carcass (+0.394±0.1408, $t_r=2.80$) and urea content × length of bacon half of chilled carcass (+0.589±0.1088, $t_r=5.41$).

The results of the calculation of the economic efficiency of the use of young pigs of different intra-breed differentiation according to the complex index of fattening and meat qualities (B. Tailer index) are given in Table 4.

It was found that the maximum increase in additional products on the indicator "average daily gain of live weight during the period of control fattening, g" was obtained from animals of group I - +6.58 %. The cost of additional products obtained from young pigs of this group is +1733.4 UAH, provided that the selling price of young pigs to processing enterprises in the region at the time of the study was 44.5 UAH / kg.

Table 3

Pairwise correlation coefficient between serum biochemical parameters, fattening and meat qualities of young pigs of the experimental group

Signs		Biometrics indicators		The strength of the Cheddock correlation
x	y	r±Sr	tr	
Urea content, mmol / l n	1	+0.266±0.1549	1.72	weak
	2	-0.161±0.1623	0.99	weak
	3	-0.191±0.1606	1.19	weak
	4	+0.394±0.1408**	2.80	moderate
	5	+0.589±0.1088***	5.41	noticeable
Aspartate aminotransferase (AsAT) activity, units/l	1	-0.637±0.1682***	3.79	noticeable
	2	+0.736±0.1477***	4.98	high
	3	+0.338±0.2054	1.65	moderate
	4	-0.033±0.2181	0.15	-
	5	-0.217±0.2130	1.02	weak
Alanine aminotransferase (AIAT) activity, units/l	1	-0.278±0.2096	1.33	weak
	2	+0.141±0.2160	0.65	weak
	3	+0.162±0.2153	0.75	weak
	4	+0.110±0.2169	0.51	weak
	5	+0.333±0.2058	1.62	moderate

Note: 1 - average daily gain of live weight during the period of control fattening, g; 2 - age of achievement of live weight of 100 kg, days; 3 - fat thickness at the level of 6-7 thoracic vertebrae, mm; 4 - length of chilled carcass, cm; 5 - length of bacon half of chilled carcass, cm, ** - P<0.01; *** - P<0.001

Table 4

Economic efficiency of research results

Group	n	Gradations of B. Tyler's index	Average daily gain of live weight for the period of control fattening, g	Allowance products, %	Cost of additional products, UAH/head*
General sample	23	126.13 – 182.36	788.7±10.78	-	-
II	12	126.13-141.33	741.3±21.96	-6.00	-1579.37
I	11	157.68-182.36	844.3±36.11	+6.58	+1733.40

Note: * - the selling price of young pigs on the date of the research was UAH 44.5. per 1 kg of live weight

Conclusions

1. It was found that the biochemical parameters of blood serum (urea content, mmol / l, aspartate aminotransferase activity (AsAT), units / l, alanine aminotransferase activity (AIAT), units/l) correspond to the physiological norm of clinically healthy young pigs at 150 days of age.

2. Young pigs of large white breed of the controlled herd at the age of reaching live weight of 100 kg (days), fat thickness at the level of 6-7 thoracic vertebrae (mm), length of chilled carcass (cm) corresponds to class I and elite class.

3. Maximum indicators "average daily gain of live weight during the period of control fattening, kg", "length of chilled

carcass, cm", "length of bacon half of chilled carcass, cm" and minimum values "age of live weight 100 kg, days" and "thickness fat at the level of 6-7 thoracic vertebrae, mm" are characterized by animals in which the complex index of fattening and meat qualities (B. Tyler's index) ranges from 157.68 to 182.36 points.

4. The number of reliable connections between the biochemical parameters of blood serum, fattening and meat qualities of young pigs of large white breed is equal to 26.67 %.

5. The cost of additional products obtained from young pigs with a B. Tyler index of 157.68 – 182.36 points is equal to +1733.40 UAH/head.

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Ознаки продуктивності молодняку свиней великої білої породи та їх зв'язок з вмістом сечовини та активністю деяких ферментів сироватки крові

Наведено результати досліджень відгодівельних та м'ясних якостей молодняку свиней великої білої породи, деяких біохімічних показників сироватки крові (вміст сечовини, активність аспаратамінотрансферази (АсАТ), активність аланінамінотрансферази (АлАТ), а також розраховано економічну ефективність результатів досліджень. Дослідження проведено в СТОВ «Дружба – Казначейка» Дніпропетровської області, у Науково-дослідному центрі біобезпеки та екологічного контролю ресурсів АПК Дніпропетровського державного аграрно-економічного університету, м'ясокомбінаті «Джаз» та лабораторії тваринництва Державної установи Інститут зернових культур НААН України. Робота виконана згідно програми наукових досліджень НААН України №30 «Інноваційні технології племінного, промислового та органічного виробництва продукції свинарства» («Свинарство»), номер державної реєстрації 0116U001247. Об'єктом дослідження був молодняк свиней великої білої породи. Оцінку тварин за відгодівельними і м'ясними якостями проводили з урахуванням наступних показників: середньодобовий приріст живої маси за період контрольної відгодівлі, г, вік досягнення живої маси 100 кг, діб, товщина шпигу на рівні 6–7 грудних хребців, мм, довжина охолодженої туші, см, довжина беконної половини охолодженої півтуші, см (М. Д. Березовський, І. В. Хатько, 2005). Комплексну оцінку молодняку свиней за відгодівельними і м'ясними якостями розраховували за індексом Б. Тайлера (П. А. Ващенко, 2019), біометричні показники – за методиками Г. Ф. Лакіна (1990). Економічну ефективність результатів досліджень розраховували за загальноприйнятою методикою (Методика определения экономической ... , 1983). Встановлено, що вміст сечовини, активність аспаратамінотрансферази (АсАТ) та аланінамінотрансферази (АлАТ) у сироватці крові молодняку свиней піддослідної групи відповідає фізіологічній нормі клінічно здорових тварин і дорівнюють $4,77 \pm 0,576$ моль/л, $68,11 \pm 6,445$ од/л та $44,22 \pm 3,209$ од/л відповідно. За віком досягнення живої маси 100 кг (діб), товщиною шпигу на рівні 6–7 грудних хребців (мм) та довжиною охолодженої туші (см) тварини зазначеної виробничої групи та породи відповідають I класу та класу «еліта». Максимальними показниками «середньодобовий приріст живої маси за період контрольної відгодівлі, кг», «довжина охолодженої туші, см», «довжина беконної половини охолодженої туші, см» та мінімальними значеннями «вік досягнення живої маси 100 кг, днів» і «товщина шпигу на рівні 6-7 грудних хребців, мм» характеризуються тварини, у яких комплексний індекс відгодівельних та м'ясних якостей (індекс Б. Тайлера) коливається у межах від 157,68 до 182,36 балів. Кількість достовірних зв'язків між біохімічними показниками сироватки крові, відгодівельними та м'ясними якостями молодняку свиней великої білої породи дорівнює 26,67 %. Вартість додаткової продукції, яку одержують від молодняку свиней з індексом Б. Тайлера 157,68 – 182,36 балів дорівнює +1732,04 грн./гол.

Ключові слова: молодняк свиней, біохімічні показники сироватки крові, відгодівельні та м'ясні якості, комплексна оцінка, індекс, мінливість, кореляція, економічна ефективність

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