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STRESS RESISTANCE OF PIGGLES OF DANISH ORIGIN AND THEIR PRODUCTIVITY

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The article presents the results of scientific research on determining the level of stress resistance in piglets of Danish origin, weaned from sows at the age of 28 days. According to the results of the variation series of the live weight test of piglets, the modal class included the II group of weakly responsive animals, which had a stress resistance criterion within ± 0.67 sigma, relative to the individual arithmetic mean values of the sample for this indicator; the III group of highly responsive animals - by -0.67 sigma in the direction of decrease and the I group of resistant animals - by $+0.67$ sigma in the direction of increase. The obtained experimental data indicate that within the normalized distribution of the total livestock, the maximum number of young animals was found to be weakly responsive (group II) to the stress factor (51 animals or 56.7%), the resistant type (group I) is characteristic of a group of animals of 28 animals or 31.1%, while 11 animals or 12.2% were included in the group of highly responsive piglets (group III).

Analyzing the results of the studies, it can be stated that the growth energy of young animals of group M^+ for the period from weaning from mothers to the end of the growing-up period was quite high, compared to peers of groups M^0 and M^- by 62.0 g or 13.9% ($p < 0.05$) and 87 g or 20.6% ($p < 0.01$). At the age of 6 months, the growth rate of the young animals of the M^+ group began to increase again and they exceeded the piglets from the M^0 group by 44.0 g or 5.6% ($p < 0.05$) and individuals from the M^- group by 81.0 g or 10.7% ($p < 0.01$). The improvement of the adaptive capacity to the stress factor in the M^+ group of piglets was also accompanied by a significant increase in the average daily gain over the entire growing period by 39.0 g or 6.3% ($p < 0.05$) and 67.0 g or 11.3% ($p < 0.01$) compared to the young animals from the other groups.

Subsequently, the evaluated young animals were distributed by types of higher nervous activity. The highest level of strength of nervous processes, balance of excitation and inhibition processes, and their mobility were observed in piglets that had a strong balanced mobile type of nervous activity with a high statistical difference of $p < 0.001$ in all cases of comparison with the group identified as weak.

Keywords: stress resistance, growth, piglets, weaning, productivity.



СТРЕСОСТІЙКІСТЬ ПОРОСЯТ ДАНСЬКОГО ПОХОДЖЕННЯ ТА ЇХ ПРОДУКТИВНІСТЬ

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У статті викладено результати наукових досліджень з визначення рівня стресостійкості у поросят данського походження, відлучених від свиноматок у віці 28 діб. За результатами даних варіаційних рядів залікового тестування живої маси поросят до модального класу віднесли II групу слабореагуючих тварин, що мали критерій стресостійкості в межах $\pm 0,67$ сигми, відносно індивідуальних середніх арифметичних значень вибірки за цим показником; до III групи сильнореагуючих – на $-0,67$ сигми у бік зменшення і до I групи стійких – на $+0,67$ сигми у бік збільшення. Одержані дані експерименту свідчать про те, що в межах нормованого розподілу загального поголів'я, максимальну кількість молодняку виявлено слабореагуючим (II група) на дію стрес-чинника (51 голову або 56,7 %), стійкий тип (I група) властивий групі тварин із 28 голів або 31,1 %, тоді як до групи сильнореагуючих поросят (III групи) зарахували 11 голів або 12,2 %.

Аналізуючи результати досліджень можна констатувати, що енергія росту молодняку групи M^+ за період від відлучення від матерів і до кінця періоду дорощування виявилася достатньо високою, порівняно з ровесниками груп M^0 і M^- на 62,0 г або 13,9 % ($p < 0,05$) та 87 г або 20,6 % ($p < 0,01$). У віці 6 місяців інтенсивність росту молодняку групи M^+ розпочала знову збільшуватися і вони переважали поросят із групи M^0 вже на 44,0 г або 5,6 % ($p < 0,05$) та особин із групи M^- – на 81,0 г або 10,7 % ($p < 0,01$). Покращення адаптаційної здатності до стрес-чинника в групі поросят M^+ супроводжувалося й вірогідним збільшенням величин середньодобового приросту в цілому за період вирощування на 39,0 г або 6,3 % ($p < 0,05$) і 67,0 г або 11,3 % ($p < 0,01$) щодо молодняку з решти груп.

У подальшому оцінений молодняк розподілили за типами вищої нервової діяльності. Найвищий рівень сили нервових процесів, зрівноваженість процесів збудження і гальмування, їх рухливість відмічався у поросят, які мали сильний зрівноважений рухливий тип нервової діяльності за високої статистичної різниці $p < 0,001$ в усіх випадках порівняння до групи, виділених як слабких.

Ключові слова: стресостійкість, приріст, поросята, відлучення, продуктивність.

Introduction. Before the start of the full-scale war in Ukraine, the breeding of new specialized breeds of pigs of foreign selection, which are characterized by increased metabolism in the body, high fattening and meat qualities, which are realized under certain technologies of keeping and feeding systems of animals (Hao Y. et al., 2021; Ramirez B.C. et al., 2022; Chaly O.I. et al., 2023). Extensive work has been carried out on the development of methodological principles for their assessment and further



improvement (Karpovsky V.I. et al., 2012). However, as practice has proven, animals with high genetic potential for productivity are the most sensitive to the effects of negative external stressors (O'Connor E.A. et al., 2010; Čobanović N. et al., 2020). The response of the pig body to stress is reflected in productivity losses (Munsterhjelm C. et al., 2010; Campbell J. et al., 2013; Sutherland M.A. et al., 2014; Bankole T. et al., 2024), reduced reproductive capacity (Mayorga E.J. et al., 2020), weakened natural resistance (Stovbetska L. et al., 2021), behavioral disorders (Gonzalez-Rivas P.A. et al., 2020), deterioration of product quality indicators (Gonzalez-Rivas P.A. et al., 2020; Serviento A.M. et al., 2020), leads to a significant increase in livestock waste (Poroshynska O.A. et al., 2020), and, as a result, these farms suffer significant economic losses.

In addition to the main technological stresses in pig farming, military operations can be a powerful stress factor in certain regions of Ukraine in recent years. The negative consequences of war-induced stress have been repeatedly exacerbated in farms located close to the epicenter of active hostilities and engaged in raising young animals - one of the most vulnerable and less protected groups in industrial pork production technology, especially during the weaning period, which is reflected, first of all, in the intensity of their growth (White H.M. et al., 2008; Dokmanovic M. et al., 2017). In this context, the assessment of stress provoked by weaning piglets from sows comes to the fore (da Fonseca de Oliveira A.C. et al., 2019; Lange A. et al., 2020). It is worth noting that during the "weaning crisis" period, piglets experience uneven growth rates, which is directly related to the impact of other technological stress factors and the corresponding reaction of animals to them (Skaperda Z. Et 2019; Vyslotska L. et al., 2021). Of course, when growing young animals, more and more attention should be paid to the selection of stress-resistant animals in order to obtain competitive products and constantly develop new methods and improve production technologies to reduce the harmful effects of stress on animals. However, these issues require thorough scientific generalization. Therefore, the unresolved nature of a number of problems, the urgency of which has increased in the conditions of modern threats, determined the relevance and decisively influenced the relevance of the work carried out.

The purpose of the research is to determine the level of stress resistance and productivity of piglets of Danish origin under the influence of the stress factor "weaning crisis".

Materials and methods. The scientific and economic experiment was conducted in the production conditions of the PP AF "Svitanok" of the Novovodolazha district of the Kharkiv region. Stress resistance was determined using the method of V.A. Kovalenko et al., improved by O. M. Tsereniuk during the "weaning crisis" period, which lasted 15 days. The total duration of the experiment was 182 days.

To organize the experiment, a technological group of 90 heads was selected from the total population of suckling piglets. The principle of normalized deviation was used to distribute the piglets into experimental groups. The young were weaned at the age of 28 days. The piglets were weighed individually: at weaning, 4, 9 and 15 days after it, then the stress resistance criterion was calculated based on the sum of the differences in the absolute values of live weight in these reference periods and the livestock was divided into groups.

As a result of processing the data of variation series of the test of absolute live weight gains of piglets 15 days after weaning them from sows, the modal distribution class was assigned to group II of weakly reacting animals (M^0), which had a stress resistance criterion within ± 0.67 sigma; to group III of strongly reacting animals (minus variant M^-) – by -0.67 sigma in the direction of decrease, and to group I of resistant animals (plus variant M^+) – by $+0.67$ sigma in the direction of increase.



Animals of all experimental groups were kept in the same room according to generally accepted technology. The conditions of care for piglets were the same and met sanitary and zootechnical requirements. Production premises were vacated each time in the case of regular sanitary treatment and the need to fill the next technological cycle with young animals, while adhering to the principle of "everything is empty, everything is occupied".

The feeding rations of the experimental young animals were prepared in accordance with detailed norms and adjusted for the growing periods, taking into account the age, growth intensity, chemical composition and nutritional value of the feed. Group feeding, twice a day: morning and evening, drinking - ad libitum, with free access to drinkers. For feeding, standard compound feeds were used, manufactured in accordance with a specific production period. Compound feeds for experimental animals were fed in the form of dry feed.

Live weight was determined by the results of individual weighing of animals in the morning before feeding at weaning, at the age of 4; 9; 15; 61; 122 and 182 days, with a measurement accuracy of ± 0.1 kg. Based on the weighings, the total gain for the period and the average daily gain in live weight were calculated.

As an additional test for assessing the stress resistance of piglets, the parameters of the higher nervous system were determined based on the results of the analysis of the processes of formation, excitation, inhibition of motor-food conditioned reflexes when changing the stereotype of feeding circumstances (using powdered milk-enriched compound feed) and the speed of developing an orienting reaction (Karpovsky, V.I., 2012). The reaction of young animals to changes in technological conditions was expressed in conventional units - from one to four. The study was conducted over five consecutive days, with a time expenditure of 20 minutes for each animal. For a more objective distribution of experimental animals into groups by type of higher nervous activity, in the same individuals it was determined once more with an interval of 2 days after the main testing under similar conditions of the experiment. After comparing the ethological observation data obtained in this way, the young animals were assigned to one of four groups, according to the types of higher nervous activity. The first group included piglets with a strong balanced mobile type of higher nervous activity, the second - strong balanced inert, the third - strong unbalanced and the fourth group - with a weak type.

The obtained results of experimental studies were processed biometrically, by methods of variational statistics using electronic spreadsheets of a Pentium/4 personal computer and a package of modern applied licensed programs Statistika, SPSS 15.0, MS Excel spreadsheets, 2003. The difference between the values of the compared indicators of the experimental groups was considered probable when achieving three levels of probability $*p < 0.05$; $**p < 0.01$; $***p < 0.001$.

Research results: When evaluating the results of the individual distribution of the experimental livestock according to the stress resistance criterion, it is worth pointing out its significant variability depending on the group (Table 1).

In particular, within the normalized distribution of the total livestock, the maximum number of young animals was found to be weakly responsive (M^0) to the stress factor (51 animals or 56.7%), the resistant type (M^+) was characteristic of a group of animals consisting of 28 animals or 31.1%, while 11 animals or 12.2% were included in the group of highly responsive piglets (M^-).



Table 1

Distribution of experimental young animals by stress resistance

Group	Distribution of piglets by stress resistance criterion	
	heads	%
I – M ⁺ (resistant)	28	31,1
II – M ⁰ (weakly reactive)	51	56,7
III – M ⁻ (strongly reactive)	11	12,2
Total	90	100,0

Young animals of Danish origin with different stress tolerance showed quite high fattening rates during the first six months of rearing, however, in certain age periods, the variability of their values between groups was directly due to the unequal rate of response to weaning from mothers (Table 2).

Table 2

Changes in live weight of young animals of different types of stress resistance,

$$\text{kg } (\bar{x} \pm S_{\bar{x}})$$

Indicator	Group		
	I – M ⁺ (resistant)	II – M ⁰ (weakly reactive)	III – M ⁻ (strongly reactive)
Live weight of piglets, kg:			
at weaning	7,84±0,32	7,56±0,18	7,80±0,38
on the 4th day after weaning	8,62±0,52	7,84±0,22	7,67±0,41
on the 9th day after weaning	9,93±0,55*/**	8,37±0,34	8,21±0,65
on the 15th day after weaning	12,52±0,63*/**	9,72±1,14	8,58±0,94
at the age 2 months	24,11±0,72*/**	21,86±0,57	21,34±0,69
at the age 4 months	58,72±1,28*/**	55,24±0,91	53,41±1,46
at the age 6 months	109,74±2,51*/**	103,55±2,12*	99,49±1,54

Note. *p<0.05; **p<0.01 – probability of difference in relation to the distribution group M⁰ and M⁻

As expected, piglets that were assigned to the M⁺ group were heavier than their peers from the M⁰ and M⁻ groups. In particular, on the fourth day after weaning, their advantage over the latter was 9.9 and 12.4%. A characteristic feature of changes in live weight during this period is its increase in young pigs M⁺, while in the group of piglets M⁻ the studied indicator even decreased. At the same time, quantitative statistically significant differences in live weight between young pigs of these groups began to appear from the 9th day after weaning by 18.6% (p<0.05) and 21.0% (p<0.05), respectively, reaching maximum values at the age of 15 days - by 28.8% (p<0.05) and 45.9% (p<0.01) and 13.3% in favor of young pigs resistant to stress. It is noteworthy that at the age of 6 months the difference between the groups significantly decreased and amounted to only 6.0% (p<0.05) and 10.3% (p<0.01). The decrease in live weight in animals M⁻, compared with peers from other groups, is a natural result of their weaker adaptation to the stress factor.

Similar advantages in terms of live weight are also characteristic of young animals assigned to the M⁰ group compared to peers from the M⁻ group. In particular, the average indicator of their live weight on the 15th day after weaning from their mothers exceeded



the latter by 13.3%, while in the subsequent months of growing the difference between these groups decreased to 4.1% at the age of 6 months, although it was statistically significant ($p < 0.05$).

The absolute live weight gains of piglets, taking into account the distribution group by stress resistance during rearing, also differed: from 15 days after weaning and until reaching 2 months of age, the live weight gain of animals in the M^+ group was 11.6 kg or 1.9 times, in the M^0 group - 21.1 kg or 2.2 times, and in the M^- group - only 12.8 kg or 2.5 times. In general, from weaning to 6 months of age, the total weight gain of young animals assigned to the M^+ group increased by 101.9 kg or 14.0 times, in the M^0 group - by 96.0 kg or 13.7 times, and in the M^- group - by 91.7 kg or 12.8 times.

Weaning of piglets from mothers also affected the growth energy of young animals. In terms of average daily live weight gains in piglets of all groups, there is a natural age-related increase in the period from weaning to reaching the age of 6 months. It is noteworthy that the general trend regarding the nature of their formation depending on the distribution group and live weight parameters of young animals is preserved (Table 3).

Table 3

Dynamics of average daily live weight gains of young animals of different stress resistance, ($\bar{x} \pm S_{\bar{x}}$)

Indicator	Group		
	I – M^+ (resistant)	II – M^0 (weakly responsive)	III – M^- (strongly responsive)
Average daily gain for the period, g:			
from weaning to 2 months of age	509±14,24*/***	447±19,61	422±20,08
from 2 to 4 months of age	567±15,95*	547±12,27	526±11,34
from 4 to 6 months of age	836±18,79*/**	792±9,68*	755±14,82
from weaning to 6 months of age	662±13,53*/**	623±10,37	595±14,76
Feed consumption per 1 kg of live weight gain for 6 months of the experiment, EKO	3,93	4,67	4,84

Note. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$ – probability of difference in relation to the distribution group M^0 and M^-

Considering the results presented in the table, it can be stated that the growth energy of the young animals of the M^+ group for the period from weaning from mothers to the end of the growing-up period was quite high, compared with the peers of the M^0 and M^- groups by 62.0 g or 13.9% ($p < 0.05$) and 87 g or 20.6% ($p < 0.01$). Therefore, the effect of stress on the piglets' organism during this period is maximum. In the period from 2 to 4 months of age, the average daily gains in piglets of all groups further increase, but the pace of this process slows down to minimum values and the difference between the young animals of the M^+ and M^0 groups has only the character of a tendency to increase and is 20.0 g or 3.7%, while between the piglets of the M^+ and M^- groups it is at the level of 41 g or 7.8% and acquires the lowest level of statistical significance ($p < 0.05$). At the age of 6 months, the growth rate of the young animals of the M^+ group began to increase again and they exceeded the piglets from the M^0 group by 44.0 g or 5.6% ($p < 0.05$) and individuals from the M^- group by 81.0 g or 10.7% ($p < 0.01$). The improvement of the adaptive capacity to the stress factor in the M^+ group of piglets was also accompanied by



a significant increase in the average daily gain over the entire growing period by 39.0 g or 6.3% ($p < 0.05$) and 67.0 g or 11.3% ($p < 0.01$) compared to the young animals from the other groups.

Piglets of group M^0 , although inferior to their peers assigned to group M^+ during the growing period, also differed from their peers of group M^- in terms of average daily live weight gains: at 2 months – by 25.0 g or 5.9%, at 4 months – by 21.0 g or 4.0%, at 6 months – by 37.0 g or 4.9% ($p < 0.05$) and during the growing period – by 28.0 g or 4.7%.

Against the background of the assessment of young animals of different types of stress resistance, a clear manifestation of sexual dimorphism was established, and, as a result, boars, regardless of their normalized distribution into groups, naturally exceeded gilts in terms of growth intensity from weaning to 6 months of age by an average of 5.8%.

Most domestic and foreign experts believe that the level of stress resistance of pigs kept in large industrial complexes directly depends on the typological features of higher nervous activity. That is, they must be resistant to technological stresses, have a quick and adequate reaction to external stimuli, and belong to a strong balanced mobile type of higher nervous activity. Such animals are distinguished by higher growth intensity and digestibility coefficients of feed nutrients, they have a faster process of forming meat productivity and improving product quality.

For an in-depth justification of this position, we determined the typological features of higher nervous activity in piglets of different types of stress resistance when transferring them to the finishing shop. Piglets, which are characterized by a strong balanced mobile type of higher nervous activity, during the observation period behaved confidently, calmly moved along the passage of the room to the feeder, immediately found it and from the first or second attempt began to consume compound feed without paying attention to the experimenter, almost did not react to the conditioned stimulus and did not show aggression. Young pigs with a strong balanced inert type were somewhat more cautious, but also calmly moved along the passage of the room, approached the feeder later (from the second to the fourth attempt), consumed compound feed willingly (from the first or second attempt), also almost did not react to the conditioned stimulus and the experimenter and did not show aggression. Animals with a strong unbalanced type behaved completely differently: they moved quickly along the passage to the feeder, carefully watching the experimenter, consumed the compound feed excitedly and reluctantly immediately approaching the feeder or on the third attempt, some individuals pushed or gnawed it during feeding, reacted strongly to the conditioned stimulus with a shudder. Piglets with a weak type moved slowly and timidly along the passage of the room with a characteristic sound of danger or stopped altogether, some of them had to be urged, they approached the feeder on the fourth to sixth attempt, consumed the compound feed cautiously, rather reluctantly and not immediately (on the third to fifth attempt), carefully watched the experimenter, reacted quite excitedly to the conditioned stimulus, refusing the feed and moving away from the feeder, sometimes urination or defecation was noted in them.

Based on the assessment, piglets of different stress resistance were distributed by types of higher nervous activity in the following ratio (Table 4).

The results of visual observations show that 34 heads (37.8%) of the total number of piglets have a strong balanced mobile type, 28 heads (31.1%) - strong balanced inert, 9 heads (10.0%) - strong unbalanced and 19 heads (21.1%) - weak.



Table 4

Distribution of experimental young animals by types of higher nervous activity

Type of higher nervous activity	Distribution of experimental young animals by types of higher nervous activity	
	heads	%
Strong balanced mobile	34	37,8
Strong balanced inert	28	31,1
Strong unbalanced	9	10,0
Weak	19	21,1
Total	90	100,0

As part of the study of conditioned reflex activity, the following were directly taken into account: the strength of nervous processes, the balance of excitation and inhibition processes, the mobility of nervous processes (Table 5).

Table 5

Typological parameters of higher nervous activity of young animals, mind. units, $(\bar{X} \pm S_{\bar{x}})$

Type of higher nervous activity	Level of nervous processes		
	strength	balance	mobility
Strong balanced mobile	3,76±0,17***	3,88±0,09***	3,93±0,15***
Strong balanced inert	3,11±0,08***	2,92±0,06***	2,57±0,19***
Strong unbalanced	1,84±0,12*	1,68±0,14	1,82±0,28*
Weak	1,34±0,20	1,49±0,13	1,09±0,16

Note. * $p < 0.05$; *** $p < 0.001$ – probability of difference in relation to the group of weak young animals

Analysis of the features of individual assessment of young animals indicates a different norm of their reaction to weaning from sows. The highest level of strength of nervous processes, balance of excitation and inhibition processes, their mobility was observed in piglets that had a strong balanced mobile type of nervous activity with a high statistical difference $p < 0.001$ in all cases of comparison to the group identified as weak and amounted to an average of 3.86 conventional units.

In animals with a strong balanced inert type, the values of the studied indicators are higher, respectively by 1.77; 1.43 and 1.48 conventional units against young animals with a weak type of higher nervous activity, with the same high level of statistical significance ($p < 0.001$ in all cases of comparison). Piglets with strong unbalanced and weak types of nervous activity were characterized by almost the same value of these indicators. However, in the group of young animals classified as strong unbalanced type, they were higher by 0.50 ($p < 0.05$); 0.19 and 0.73 ($p < 0.05$) conventional units. In the group of animals with weak type of nervous activity, the values of the studied indicators were minimal and equaled on average 1.31 conventional units.

At the same time, young animals with strong balanced mobile type of higher nervous activity are characterized by increased mobility and balance and reduced strength of nervous processes. Piglets with strong balanced inert type, on the contrary, were characterized by higher strength of nervous processes and their balance, but lower their mobility. In representatives of the strong unbalanced type, the processes of balance of excitation and inhibition were weaker, while their strength and mobility were higher.



Nervous processes in piglets with a weak type have the least mobility, and the balance of excitation and inhibition processes prevails over their strength. Therefore, as the reactivity of piglets decreases, both the strength of nervous processes, the balance of excitation and inhibition processes, and their mobility naturally decrease.

The strength of the stress factor "weaning crisis" depended, first of all, on the closeness of the connection between stress resistance and types of higher nervous activity of piglets, determined under the influence of another stress factor - transfer to the growing-up shop (Table 6).

Table 6

The relationship between types of stress resistance and higher nervous activity in the experimental young, %

Group	Type of higher nervous activity							
	strong balanced mobile		strong, balanced inert		strong, unbalanced		weak	
	heads	%	heads	%	heads	%	heads	%
I – M ⁺ (stable)	19	67,9	9	32,1	–	–	–	–
II – M ⁰ (weakly reactive)	15	29,4	19	37,3	7	13,7	10	19,6
III – M ⁻ (strongly reactive)	–	–	–	–	2	18,2	9	81,8

Comparison of the data presented in the table gives grounds to state that among the stable animals, 19 animals (67.9%) were registered with a strong balanced mobile type of higher nervous activity and 9 animals (32.1%) with a strong balanced inert type, while piglets with strong unbalanced and weak types of nervous activity were not noted among these animals. Among the animals that react poorly to stress, 15 animals (29.4%) were registered with a strong balanced mobile type, 19 animals (37.3%) with a strong balanced inert type, 7 animals (13.7%) with a strong unbalanced type and 10 animals (19.6%) with weak types. Strongly reactive young animals were represented by 2 heads (18.2%) with strong unbalanced and 9 heads (81.8%) with weak types of nervous activity.

Scientific practice has proven, and numerous studies have confirmed, that the nature of the adaptive reaction of animals to the action of any stress factors is reflected in their productivity. The results of determining the live weight of piglets of different types of nervous activity are presented in Table. 7.

The obtained data give reason to believe that among the total number of experimental piglets of different stress resistance, individuals classified as strong balanced mobile and strong balanced inert types of higher nervous activity grew more intensively. Moreover, the advantage in increasing live weight occurred at all stages of their growth. While these differences between young animals with strong unbalanced and weak types are not significant. In particular, at 2 months of age, the difference in live weight between these animals was greater, respectively, by an average of 2.5 and 3.9 kg or 11.6 and 19.0% ($p < 0.01$) and 0.7 and 2.1 kg or 8.1 and 10.0% in favor of the first two groups. Subsequently, the difference between the distribution groups by this indicator increased. In particular, at 4 months of age, when the second phase of growing came to an end, piglets with a strong balanced mobile type of higher nervous activity exceeded their peers who had a strong balanced type by 3.7 kg or 1.2%, a strong unbalanced type by 5.2 kg or 9.5%, and a weak type by 7.5 kg or 14.5% ($p < 0.01$). In turn, the advantage



in terms of increasing live weight on their side at 6 months of age increased and amounted to 9.1 kg or 8.9%; 11.9 kg or 11.9% and 14.3 kg or 14.7%, respectively ($p < 0.05$).

Table 7

Formation of live weight of young animals of different types of nervous activity, kg ($\bar{x} \pm S_{\bar{x}}$)

Indicator	Type of nervous activity			
	strong balanced mobile (n = 34)	strong, balanced inert (n = 28)	strong, unbalanced (n = 9)	weak (n = 19)
Live weight of piglets, kg at the age of:				
2 months	24,35±0,90**	22,51±0,58	21,82±1,03	20,46±0,86
4 months	59,69±2,02**	56,03±1,58	54,51±1,73	52,15±1,42
6 months	111,74±5,94*	102,60±4,09	99,82±2,94	97,41±3,97

Note. * $p < 0.05$; ** $p < 0.01$ – probability of difference in relation to the group of weak young animals

Quite a clear variability in growth during these age periods of growth was also characteristic of the young animals included in the group with a strong balanced inert type of higher nervous activity. Analysis of changes in their live weight at 2 months of age proves that they, while inferior in this indicator to their peers with a strong balanced mobile type of higher nervous activity, had a stable, but at the same trend, advantage over representatives of the group with a strong unbalanced type by 0.7 kg or 3.2% and young animals of a weak type by - 2.1 kg or 10.0%. While ontogenetic differences in live weight values between these distribution groups at 4 months of age were 1.5 kg or 2.8% and 3.9 kg or 7.4%, respectively. During the final phase of fattening, the process of increasing live weight intensified and the difference between these groups increased to 2.8 and 5.2 kg or 2.8 and 5.3%, respectively.

In contrast, among peers who had strong unbalanced and weak types of nervous activity, the age difference in fluctuations in live weight was insignificant: its increase ranged only from 1.4 kg to 2.4 kg or from 2.4% to 6.6%.

During the period of growing up and fattening, the total increase in live weight of young animals, which were classified as a group with a strong balanced mobile type of higher nervous activity, increased by 87.4 kg or 4.6 times, strong balanced inert - by 80.1 kg or 4.6 times, strong balanced mobile - by 78.0 kg or 4.6 times, weak - by 77.0 kg or 4.8 times.

The growth intensity of experimental piglets can be judged by the values of changes in average daily live weight gains (Table 8).

In the process of processing the results, it was established that the growth rates of young animals of different groups increased as their age increased. Against this background, piglets with a strong balanced mobile type of higher nervous activity were significantly better in all periods of growing. Evaluating the average daily gains in live weight in the age dynamics of changes, their natural increase was recorded in the period from 2 to 4 months from 29.0 g to 59.0 g or from 5.3% to 11.3% ($p < 0.01$). Their high growth rate was maintained during the fattening period from 90 g to 160.0 g or from 11.8% to 23.1 ($p < 0.001$). The leading position in terms of the manifestation of higher adaptive capacity to the action of a stress factor in piglets classified as a group of a strong unbalanced type of nervous activity during this period was also strengthened in relation to young animals, which are characterized by a strong unbalanced type and the difference



in the studied indicator between them also became statistically significant ($p < 0.01$). In the age interval from 2 to 6 months, an increase in growth intensity in these animals was recorded within the range from 60.0 g to 85.0 g or from 9.4% to 13.5%. Despite the superiority of piglets with a strong balanced mobile type of nervous activity over the rest of the groups in terms of average daily live weight gains, statistically significant significance for this indicator was registered only for young animals with a strong unbalanced and weak types ($p < 0.05$ in both cases of comparison).

Table 8

The level of average daily live weight gains of young animals of different types of nervous activity, ($\bar{x} \pm S_{\bar{x}}$)

Indicator	Type of nervous activity			
	strong balanced mobile (n = 34)	strong, balanced inert (n = 28)	strong, unbalanced (n = 9)	weak (n = 19)
Average daily gain for the period, g:				
from 2 to 4 months of age	579±11,75**	550±12,14	536±19,22	520±14,63
from 4 to 6 months of age	853±12,51**/**	763±16,84	743±26,77	693±27,90
from 2 to 6 months of age	716±19,48**/*	656±23,73	639±22,51	631±28,95

Note. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$ – probability of difference in relation to the group of strong unbalanced and weak young animals

Piglets with a strong balanced inert type of higher nervous activity also stood out with higher average daily live weight gains compared to animals characterized by a strong unbalanced type: during growing by 14.0 g or 2.6% and during fattening - by 20.0 g or 2.7%. This also caused a general increase in the level of average daily live weight gains during the research by 17.0 g or 2.7%. In young animals with a strong unbalanced type of nervous activity, the growth intensity increased not only compared to animals with a strong unbalanced type, but also compared to individuals of a weak type. In particular, in the period from 2 to 4 months of age, the level of average daily gains in them increased by 30.0 g or 5.8%, from 4 to 6 months of age - by 70.0 or 10.1%, and for the total period of research - by 25.0 g or 4.0%. Since the intergroup differences in the growth energy of young animals in these age periods are insignificant, they turned out to be unreliable when statistically processing the results.

The relationship between the type of nervous activity and the intensity of growth in piglets with a strong unbalanced type was expressed to the smallest extent in relation to peers with a weak type and the difference found between them was: from 2 to 4 months of age 16.0 g or 3.1%, from 4 to 6 months of age – 50.0 g or 7.2% and from 2 to 6 months of age – 8.0 g or 1.3%, however, it did not acquire statistical significance between them.

Discussion. With the introduction of intensive pork production technologies, the problem of stress phenomena, especially at an early age of piglets, is becoming increasingly acute (Poroshynska O.A. et al., 2020; Lange A. et al., 2020). Piglets after weaning from their mothers react quite strongly to changes in environmental conditions and get used to new ones after a certain time. Their ability to adapt is closely related to changes in productive qualities (Munsterhjelm C. et al., 2010; Campbell J. et al., 2013; Sutherland M.A. et al., 2014; Bankole T. et al., 2024). In this case, stress is considered as an adaptation syndrome and occurs when the body's protective functions are mobilized to the action of external stressors (Gonzalez-Rivas P.A. et al., 2020; Serviento A.M. et al.,



2020). However, a generalization of domestic literature sources in which studies have been initiated on assessing the stress resistance of piglets in the early period of postnatal growth indicates insufficient attention by scientists, who only fragmentarily reveal the essence of this phenomenon, which in turn encourages the experimental development of appropriate techniques.

Within the framework of the conducted research, the peculiarities of the formation of live weight and growth intensity of young pigs of Danish origin were detailed depending on stress resistance and types of higher nervous activity, assessed during weaning and reaching 6 months of age. It was found that the growth energy of young pigs of the M^+ group for the period from weaning from mothers to the end of the growing-up period was quite high, compared with peers of groups M^0 and M^- by 62.0 g or 13.9% ($p < 0.05$) and 87 g or 20.6% ($p < 0.01$). In the period from 2 to 4 months of age, piglets of all groups further increase in average daily gains, however, the pace of this process slows down to minimal values and the difference between young pigs of groups M^+ and M^0 has only the character of a tendency to increase. At the age of 6 months, the growth rate of the young pigs of the M^+ group began to increase again and they exceeded the piglets from the M^0 group by 44.0 g or 5.6% ($p < 0.05$) and individuals from the M^- group by 81.0 g or 10.7% ($p < 0.01$). The improvement of the adaptive capacity to the stress factor in the M^+ group of piglets was also accompanied by a significant increase in the average daily gain over the entire growing period by 39.0 g or 6.3% ($p < 0.05$) and 67.0 g or 11.3% ($p < 0.01$) compared to the young pigs from the other groups. The obtained data extend the published results (White H.M., et al., 2008; Sutherland M.A. et al., 2014; Stovbetska L. et al., 2021).

When distributing piglets taking into account the types of higher nervous activity and using the motor-food method, it was found that 34 heads (37.8%) of piglets from the total number have a strong balanced mobile type, 28 heads (31.1%) - a strong balanced weighted inert, 9 heads (10.0%) – strong unbalanced and 19 heads (21.1%) – weak. Analysis of the features of individual assessment of young animals indicates a different rate of their response to weaning from sows. Piglets classified as resistant are characterized by an almost maximum yield of individuals of a strong balanced mobile type of higher nervous activity, which react less to transfer to the finishing shop with a decrease in productivity and have a higher adaptive suitability for industrial pork production technology. The highest level of strength of nervous processes, balance of excitation and inhibition processes, and their mobility were observed in piglets that had a strong balanced mobile type of nervous activity with a high statistical difference of $p < 0.001$ in all cases of comparison with the group identified as weak. A similar picture of changes in eating behavior in pigs in connection with technological stresses is reported (Danchuk O.V. et al., 2020).

Therefore, the conducted studies do not exhaust the entire depth of the problem, but within the framework of its initial implementation, farm specialists should take into account not only their stress resistance, but also the types of higher nervous activity for the purpose of directed management of the weaning process of piglets.

Conclusions:

1. Weaning piglets from their mothers is a heavy functional load on their body, which is accompanied by growth retardation. The most susceptible to the action of the stress factor were young animals classified as group M^- .

2. The level of stress resistance of young animals is directly related to the typological features of higher nervous activity. Piglets classified as resistant are characterized by an approximate maximum yield of individuals of a strong balanced mobile type of higher nervous activity, which react less to transfer to the growing-up shop



with a decrease in productivity and have a higher adaptive suitability for industrial pork production technology.

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