

GROWTH, FATTENING AND MEAT QUALITY PARAMETERS AMONG YOUNG PIGS WITH DIFFERENT SNP GENOTYPES OF MELANOCORTIN – 4 RECEPTOR GENE (MC4R)

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The results of researches of absolute and integrated growth parameters, fattening and meat qualities of young pigs of different genotypes according to the receptor gene of melanocortin 4 (Mc4r) are presented, and the level of correlation relations between the features is calculated.

Studies have shown that according to the live weight indices at the 2–4-month of age, the age of reaching a live weight of 100 kg and the thickness of the fat at the 6–7 thoracic vertebrae, the young pigs of the large white breed of the control herd (Druzhba-Kaznacheivka LTD of the Dnipropetrovsk region) meets the requirements of class I and elite class. It was found that young pigs of the genotype AA for the receptor gene of melanocortin 4 (Mc4r) prevails on the peers of the genotype AG on the basis of growth on average by 5.62 %, and on fattening qualities – by 3,09 %. The thickness of the fat at the level of 6–7 thoracic vertebrae is the difference in favor of young pigs of large white breeds of genotype AG of 6.75 %.

The correlation coefficient between absolute and integrated growth rates, fattening and meat qualities in young pigs of different genotypes according to the receptor gene of melanocortin 4 (Mc4r) varied from $-0.863 \pm 0,0958$ (thickness of fat at 6–7 thoracic vertebrae, mm x SI_5 – selection index of fattening and meat qualities of young pigs, points) to $+0,675 \pm 0,1374$ (live weight at 2 months of age, kg x index «intensity of formation» (Δt), points).

Key words: *young piglets, genotype, ontogenesis, integrated growth indices, fattening qualities, correlation.*

It has been established that the important factors influencing the production of high quality pork are the origin of animals, the conditions of their maintenance and feeding, the veterinary safety of farms and industrial complexes. However, the urgent issues concerning the acceleration of the selection process for the increase of polygenic and hereditary signs in pigs are the issues of development and introduction into the production of marker-dependent selection [1–4]. The above determines the relevance and vector of our research.

Goal of research is to investigate the growth rates, fattening and meat qualities of young pigs of different genotypes for the receptor gene of melanocortin 4 (Mc4r), to calculate the level of correlation between signs.

Materials and methods of researchs. The

researchs were conducted in the conditions of a breeding reproducer for the breeding of large white pigs of the «Druzhba-Kaznacheevka» LTD of the Dnipropetrovsk region, the livestock breeding laboratory of the Institute of grain crops of the NAAS and the Genetics Laboratory of the Institute of Pig breeding and AIP NAAS (2017–2018).

The object of the research was young pigs of large white breed of different genotypes for the receptor gene of melanocortin 4 (Mc4r) (AA – I group, AG – II group).

The estimation of young pigs by growth indices in early ontogeny, fattening and meat qualities was carried out taking into account the following absolute values: live weight at birth (kg), at the 2- and 4-month of age (kg), average daily gain of live weight for the period control

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(fattening, g; age of achievement of live weight 100 kg, days, length of cooled carcass, cm; length of the bacon half of the carcass, cm; thickness of fat at 6–7 thoracic vertebrae, mm.

Relative growth of live weight during the period of growing from birth to 4 months of age (1), the intensity of formation (2) and breeding index of fattening and meat qualities (3) were calculated by the following models:

$$K = \frac{W_t - W_0 \times 100}{(W_t + W_0) \times 0,5}, \text{ where:}$$

W_t – live weight at 4 months of age, kg,

W_0 – live weight at birth, kg, [5].

$$\Delta t = \frac{W_6 - W_a}{0,5 \times (W_6 + W_a)} - \frac{W_c - W_6}{0,5 \times (W_c + W_6)}, \text{ where:}$$

W_a – live weight at birth, kg,

W_6 – live weight at 2 months of age, kg,

W_c – live weight at 4 months of age, kg [6].

$$SI_5 = 100 - ((1,13 \times x_1) + (5,13 \times x_4)) \div 3,6), \text{ where:}$$

SI_5 – selection index of fattening and meat qualities of young pigs, points,

x_1 – age of achievement of live weight of 100 kg, days,

x_4 – thickness of pin, mm [7].

DNA-typing of young pigs was carried out at the Genetics Laboratory of the Institute of Pig breeding and AIP NAAS [8, 9].

Biometric processing of the obtained results of research was carried out according to Lakin G. F. method [10].

Research results. It was established that the young pigs of large white breeds ($n = 57$) are characterized by sufficiently high growth rates in early ontogenesis, fattening and meat qualities: live weight at birth, at 2 and 4 months of age, respectively, 1.50 ± 0.021 ($Cv = 10.69\%$), $21.2 \pm 0,37$ ($Cv = 13.24\%$), $49,1 \pm 1,11$ kg ($Cv = 17.08\%$), the average daily gain of live weight during the control fattening period – $0.568 \pm 0,0031$ kg ($Cv = 4.23\%$), the age of reaching the live weight of 100 kg – $173.4 \pm 0,97$ days ($Cv = 4.23\%$), the thickness of the spit at the level of 6–7 thoracic vertebrae – 22.9 ± 0.31 mm ($Cv = 7.34\%$).

Results of studies of growth rates in early ontogenesis, fattening and meat qualities of young pigs of different genotypes for the receptor gene of melanocortin 4 (Mc4r) are given in

Tables 1 and 2.

Analysis of data in Table 1 indicates that the difference in live weight of young pigs at birth at the 2nd and 4th month of age is 0.03 (td = 0,71; $P > 0.05$), 0,4 (td = 0,53; $P > 0.05$) and 6.9 kg (td = 3.52; $P < 0.001$).

Young pigs of the genotype AA dominated the peers of the genotype AG for the absolute and average daily increments of live weight from birth to 4 months of age, respectively, at 6.9 (td = 3.52; $P < 0.001$) and 0.057 kg (td = 3.56; $P < 0.001$). The difference between the groups according to the "intensity of formation" index (Δt), was 0.097 points (td = 2.42; $P < 0.05$). Indicator "relative gain of live weight from birth to 4 months of age" in animals of experimental groups ranged from 182.75 to 192.27 %.

The established pattern is observed in other age periods (Table 2).

Thus, the difference between the animals of the studied genotypes (AA, AG) at the average daily gain of live weight during the period of control fattening from the date of birth to the achievement of the live weight of 100 kg was 0.017 kg (td = 2.83; $P < 0.01$), the age of achieving the living mass of 100 kg – 5.7 days (td = 3.05; $P < 0.01$).

Young pigs of genotype AG were characterized by a lower index of sphick thickness at the level of 6–7 thoracic vertebrae (1.6 mm; td = 2,67; $P < 0.01$), and according to the selection index, the group I of the same age group exceeded 0,68 points (td = 0.69; $P < 0.05$).

The coefficient of variability (Cv , %) of growth parameters, fattening and meat qualities of young pigs of large white breed of the controlled herd varies from 3.82 (average daily gain of live weight during control feeding (kg) and age of achievement of live weight of 100 kg x days) in animals of the genotype AA) to 15,63 % (absolute growth of live weight from birth to 4 months of age (kg) in animals of the genotype AA).

The calculation of the pair correlation coefficient between absolute and integrated growth rates, fattening and meat qualities in young pigs of different genotypes according to the receptor gene of melanocortin 4 (Mc4r) is given in Table 3. This biometric parameter in the animals of the experimental groups varied from – 0,863 \pm 0,0958 (thickness of spike at the level of 6–7

1. Absolute and integrated growth rates of young pigs in experimental groups

Indicator	Biometric indicators	Genotype	
		AA	AG
		Group	
		I	II
Live weight at birth, kg	n	30	27
	$\bar{X} \pm Sx$	1,51 ± 0,0289	1,48 ± 0,031
	y	0,158	0,164
	$C_v, \%$	10,48	11,07
Live weight at 2 months of age, kg	$\bar{X} \pm Sx$	21,2 ± 0,45	20,8 ± 0,60
	y	2,504	3,167
	$C_v, \%$	11,85	15,22
Live weight at 4 months of age, kg	$\bar{X} \pm Sx$	53,0 ± 1,46***	46,1 ± 1,32
	y	8,042	6,905
	$C_v, \%$	15,17	14,97
Absolute growth of live weight from birth to 4 months of age, kg	$\bar{X} \pm Sx$	51,5 ± 1,46***	44,6 ± 1,32
	y	8,050	6,880
	$C_v, \%$	15,63	15,42
Average daily gain of live weight from birth to 4 months of age, kg	$\bar{X} \pm Sx$	0,422 ± 0,0120***	0,365 ± 0,0108
	y	0,0659	0,0561
	$C_v, \%$	15,61	15,34
Relative growth of live weight from birth to 4 months of age, %	\bar{X}	188,45	187,54
Intensity of formation (Δt), points	$\bar{X} \pm Sx$	0,891 ± 0,0212	0,988 ± 0,0352
	y	0,116	0,183
	$C_v, \%$	13,05	18,53

*** $P < 0,001$.

2. Feeding and meat qualities of young pigs of different genotypes for the receptor gene of melanocortin 4 (Mc4r)

Indicator (sign), units of measurement	Biometric indicators	Genotype	
		AA	AG
		Group	
		I	II
Average daily increment of live weight during the period of control fattening, kg	n	30	27
	$\bar{X} \pm Sx$	0,576 ± 0,0040**	0,559 ± 0,0046
	y	0,022	0,024
	$C_v, \%$	3,82	4,29
Age of achievement of live weight 100 kg, days	$\bar{X} \pm Sx$	170,2 ± 1,19**	175,9 ± 1,45
	y	6,518	7,550
	$C_v, \%$	3,82	4,29
The thickness of the pin is at the level of 6–7 thoracic vertebrae, mm	$\bar{X} \pm Sx$	23,7 ± 0,40	22,1 ± 0,45
	y	2,199	2,370
	$C_v, \%$	9,28	10,68
SI_5 – breeding index of fattening and meat qualities of young pigs, points	$\bar{X} \pm Sx$	12,47 ± 0,727	13,15 ± 0,686
	y	3,987	3,568
	$C_v, \%$	31,97	27,13

** $P < 0,01$.

thoracic vertebrae, mm x SI₅ – selection index of fattening and meat qualities of young pigs, points) to + 0.675 ± 0,1374 (live weight at 2

months of age, kg x index" intensity of formation" (Δ t), points).

3. The level of correlation between absolute and integrated growth rates, fattening and meat qualities of young pigs of different genotypes for the receptor gene of melanocortin 4 (Mc4r)

Indication		Group			
		I		II	
		Biometric indication			
x	y*	r ± Sr	tr	r ± Sr	tr
Live weight at birth, kg	1	-0,233 ± 0,1833	1,27	-0,173 ± 0,1861	0,93
	2	-0,106 ± 0,1879	0,56	-0,074 ± 0,1885	0,39
Live weight at 2 months of age, kg	1	0,394 ± 0,1737 ^a	2,27	0,675 ± 0,1374 ^c	4,84
	2	-0,044 ± 0,1888	0,23	0,112 ± 0,1878	0,60
Live weight at 4 months of age, kg	1	-0,427 ± 0,1709 ^a	2,50	-0,452 ± 0,1686 ^a	2,68
	2	-0,113 ± 0,1878	0,60	0,056 ± 0,1887	0,30
Average daily increment of live weight during the period of control fattening, kg	1	0,145 ± 0,1870	0,78	0,187 ± 0,1856	1,01
	2	0,634 ± 0,1461 ^c	4,34	0,429 ± 0,1707 ^a	2,51
Age of achievement of live weight 100 kg, days	1	-0,161 ± 0,1865	0,86	-0,180 ± 0,1859	0,97
	2	-0,628 ± 0,1471 ^c	4,27	0,410 ± 0,1724 ^a	2,38
The thickness of the pin is at the level of 6–7 thoracic vertebrae, mm	1	-0,025 ± 0,1889	0,13	-0,0002 ± 0,18901	0,001
	2	-0,863 ± 0,0958 ^c	9,00	-0,768 ± 0,1210 ^c	6,35

* 1 – the index "intensity of formation" (Δ t), marks; 2 – SI₅ – breeding index of fattening and meat qualities of young pigs, marks, and - P<0,05; c - P<0,001.

Relative coefficients of pair correlation between the characteristics in animals of groups I and II are established between the following pairs of signs: live weight at 2 months of age, kg x index "intensity of formation" (Δ t), marks (+ 0,394 ± 0,1737 – +0,675 ± 0,1394), live weight at 4 months of age, kg x index "intensity of formation" (Δ t), points (-0,427 ± 0,1709 – -0,452 ± 0,1686), average daily gain of live weight in the period of control fattening, kg x SI₅ – selection index of fattening and meat qualities of young pigs, points (+0,634 ± 0,1461 – +0,429 ± 0,1707), age of achievement of live weight 100 kg, days x SI₅ – selection index of fattening and meat qualities of young pigs, marks (-0,628 ± 0,1471 – +0,410 ± 0,1724) and the thickness of the spit at the level of 6–7 thoracic vertebrae, mm x SI₅ – selection index of fattening and meat qualities of young pigs, marks (-0,863 ± 0,0958 – -0,768 ± 0,1210).

Conclusions

1. It was established that according to the main growth indices (live weight at the 2- and 4-th month of age), fattening (age of reaching a live weight of 100 kg, days) and meat qualities

(thickness of the fat at 6–7 thoracic vertebrae, mm) young animals of pigs of a large white breed of a controlled herd meet the requirements of class I and elite class. Given the differentiation of animals for the genome of the melanocortin 4 receptor (Mc4r), the young pigs of the genotype AA prevail over the peers of the AG genotype by growth rates by an average of 5,62 %, and of fattening qualities – by 3,09 %. By signs on average 3,53 %. For meat qualities (thickness of the spike at the level of 6–7 thoracic vertebrae, mm) difference in favor of young pigs of large white genotype AG genotype is 6,75 %.

2. The number of reliable connections (P<0,05 – P<0,001) between absolute and integrated growth parameters, fattening and meat qualities in young pigs of different genotypes for the receptor gene of melanocortin 4 (Mc4r) is 41,70 %.

3. An effective way of evaluating growth rates, fattening and meat qualities in young pigs is to use the "Intensity of Formation" (Δ t), and the breeding index of fattening and meat qualities of young pigs (SI₅).

Використана література

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Халак В. І. Показники росту, відгодівельні і м'ясні якості молодняку свиней різних генотипів за геном рецептора меланокортину 4 (MC4r). *Зернові культури*. 2019. Т. 3. № 1. С. 127–132.
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Наведено результати досліджень абсолютних та інтегрованих показників росту, відгодівельних і м'ясних якостей молодняку свиней різних генотипів за геном рецептора меланокортину 4 (MC4r), розраховано кореляційні зв'язки між ознаками.

Дослідження показали, що за живою масою у 2- та 4-місячному віці, віком досягнення живої маси 100 кг і товщиною шпигу на рівні 6–7 грудного хребця молодняк свиней великої білої породи підконтрольного стада (СТОВ «Дружба-Казначейка», Дніпропетровська область) відповідає вимогам I класу та класу еліта. Встановлено, що молодняк свиней генотипу AA за геном рецептора меланокортину 4 (MC4r) переважає ровесників генотипу AG за ознаками росту в середньому на 5,62 %, відгодівельними якостями – на 3,09 %. За товщиною шпигу на рівні 6–7 грудного хребця різниця на користь молодняку свиней великої білої породи генотипу AG становить 6,75 %.

Коефіцієнт парної кореляції між абсолютними та інтегрованими показниками росту, відгодівельними і м'ясними якостями у молодняку свиней різних генотипів за геном рецептора мелано-

кортину 4 (*Mc4r*) варіював у межах від $-0,863 \pm 0,0958$ (товщина шпика на рівні 6–7 грудного хребця, мм Ч СИ₅ – селекційний індекс відгодівельних і м'ясних якостей молодняка свиней, балів) до $+0,675 \pm 0,1374$ (жива маса у 2-місячному віці, кг Ч індекс «інтенсивність формування» (Δt), балів).

Ключові слова: молодняк свиней, генотип, онтогенез, інтегровані показники росту, відгодівельні якості, кореляція.

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Халак В. И. Показатели роста, откормочные и мясные качества молодняка свиней разных генотипов по гену рецептора меланокортина 4 (*Mc4r*). Зерновые культуры. 2019. Т. 3. № 1. С. 127–132.

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Приведены результаты исследований абсолютных и интегрированных показателей роста, откормочных и мясных качеств молодняка свиней различных генотипов по гену рецептора меланокортина 4 (*Mc4r*), рассчитан уровень корреляционных связей между признаками.

Исследования показали, что по показателям живой массы в 2 и 4 месяца, возрастом достижения живой массы 100 кг и толщиной шпика на уровне 6–7 грудного позвонка молодняка свиней крупной белой породы подконтрольного стада (СООО «Дружба-Казначеевка», Днепропетровская область) соответствует требованиям I класса и класса элита. Установлено, что молодняк свиней генотипа AA по гену рецептора меланокортина 4 (*Mc4r*) преобладает ровесников генотипа AG по признакам роста в среднем на 5,62 %, откормочным качествам – на 3,09 %. По толщине шпика на уровне 6–7 грудного позвонка разница в пользу молодняка свиней крупной белой породы генотипа AG составляет 6,75 %.

Коэффициент парной корреляции между абсолютными и интегрированными показателями роста, откормочными и мясными качествами в молодняка свиней различных генотипов по гену рецептора меланокортина 4 (*Mc4r*) варьировал в пределах от $-0,863 \pm 0,0958$ (толщина шпика на уровне 6–7 грудного позвонка, мм Ч СИ₅ – селекционный индекс откормочных и мясных качеств молодняка свиней, баллов) до $+0,675 \pm 0,1374$ (живая масса в 2-месячном возрасте, кг Ч индекс «интенсивность формирования» (Δt), баллов).

Ключевые слова: молодняк свиней, генотип, онтогенез, интегрированные показатели роста, откормочные качества, кореляция.