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PRODUCTIVE QUALITIES OF YOUNG PIGS WITH DNA MARKERS
ПРОДУКТИВНІСТЬ МОЛОДНЯКУ СВИНЕЙ З УРАХУВАННЯМ ДНК-МАРКЕРІВ

The analysis of fattening and meat qualities of young pigs Peitrain breed depending on polymorphism by genotype by genes RYR1 and MC4R showed that the best fattening qualities were in young heterozygous genotype AGNn that has the lowest age of achieving a live weight of 100 kg due to higher average daily growth . The GGnn and GGNn genotypes have minimum bacon thickness and the highest exterior estimate.
Keywords: productivity, pigs, polymorphism, gen, genotype, RYR1, MC4R.

Аналіз продуктивних ознак молодняку свиней породи п'єтрен в залежності від поліморфізму за генотипами за генами RYR1 та MC4R показав, що найкращими відгодівельними якостями відзначається молодняк гетерозиготного генотипу AGNn, який має найменший вік досягнення живої маси 100 кг за рахунок підвищених середньодобових приростів. Найменша товщина шпику та найвища оцінка екстер'єру притаманна генотипам GGnn та GGNn.
Ключові слова: продуктивність, свині, поліморфізм, ген, генотип, RYR1, MC4R.

Introduction. The major QTL genes (quantitative trait loci - loci of quantitative traits), which pigs estimate is carried out in Ukraine are: rianodyn receptor gene RYR1, prolactyn receptor PRLR, estrogen receptor ESR1 and melanokortyn receptor MC4R [1-8].

In pig breeding undesirable genetic phenomenon causing significant economic loss is a mutation in the rianodin receptor gene RYR1. The economic value of mutant animals by RYR1 gene has reduced through impaired meat quality, increased their deaths rate during transporting and raising, decreased resistance to impact of negative factors. However, stress-susceptible pigs are characterized by better development of the carcass dorsal part, reduced fat containing and generally higher meat performance compared to stress resistant animals. Therefore, intensive breeding to enhance meatiness of carcasses as a rule is not accompanied by improvement of pork quality and can be associated with a decreasing animals adaptive qualities[1-8].

Melanokortyn receptor associated with the digestion regulation, nutrients assimilation, energy balance control and, consequently, an increase of live weight gain . Melanokortyn receptor (MC4R or PRUM) is one of few genes that are used in genetic diagnostics. This gene mutation in the code 298 results in replacement of aspartic acid (Asp) to asparagines (Asn), which leads to fattiness [8]. Today in Ukraine the analysis of pigs genotypes by melanokortyn MC4R receptor gene has not widely used in breeding yet. The aim of our researches was to examine polymorphism by the MC4R gene in Landrace and Large White breeds and and to identify relationships between animal genotypes and their fattening qualities.

Thus, there are many works about the distribution of the mutant allele RYR1 and melanokortyn MC4R receptor gene in swine populations of different breeds[1-8]. However, there aren't enough publications about the distribution of alleles RYR1 and MC4R genes in pigs of Peitrain breed ADN French selection as a fundamentally new breed for Ukraine.

Material and methods of the researches. Scientific industrial experiment was conducted under the condition of breeding Peitrain pigs reproducer "Artsyz meat company" in Artsyz district, Odesa oblast, the slaughter and meat quality evaluation was conducted at the own meat processing plant of this company, laboratory (DNA researches, physics and chemical meat qualities) -at the Pig Breeding Institute named after O. V. Kvasnytskyi UAAN.

Slaughter and meat pigs qualities were determined during young pigs slaughter with a live weight of 100 kg, respectively at the age of 165 days from the birth accordance with the requirements "Methodologies of boars and sows evaluation due to offspring quality in the conditions of breeding centers and reproducers" [9]. Morphological composition of carcasses was determined by right half-carcasses deboning and meat, fat and bones weighing [9]. Biometric parameters determination was performed by the method of N.A. Plohynskyi.

The results of the researches. RYR1- gene mutation responsible for pigs stress-susceptibility is present in the animals genome of Peitrain breed French selection «ADN». Animals with heterozygous genotype Nn have better growth and development indicators compared with animals with homozygous genotype nn. Thus, during the experiment it was found that heterozygous animals had bigger live weight in different ages (Table 1). At the age of 2 months pigs with genotype Nn by RYR1- gene tended to advantage over pigs of the same age with homozygous genotype nn on 0.39 kg or 1.71 %, at the age of 4 months pigs with genotype Nn by RYR1- gene are significantly dominated over pigs of the same age with homozygous genotype nn 1.7 kg or 2,88% (P> 0,99), at the age of 6 months this benefit amounted to 1.16 kg or 1,04% (P> 0, 99), at the age of 8 months to 2.06 kg or 1.43 % (P > 0.99).

Table 1

The live weight of experimental animals with different ages, kg

Age, months	Groups of animals with different genotypes by RYR1-gene			
	RYR-1Nn (n=20)	Cv,%	RYR-1 nn (n=9)	Cv,%
2	23,17±0,20	3,97	22,78±0,22	2,89
4	60,70±0,30**	2,21	59,00±0,29	2,46
5	86,30±0,34**	2,80	84,55±0,47	2,67
6	112,60±0,38**	2,53	111,44±0,52	2,13
7	133,80±0,46**	2,56	131,66±0,47	2,07
8	146,50±0,42**	2,30	144,44±0,60	2,25

*P>0,95; ** P≥0,99.

Studying indicators of growth regularities replacement young animals of different genotypes (Table 2) it was found that the average daily gain of heterozygous animals Nn by RYR1 gene in the period from 2 to 8 months had increased animals with homozygous genotype nn by RYR1 gene on 9.28 g. For relative growth gain differences was absent, but the forming intensity was present in animals mutant gene carriers on 0.04. Voltage growth index was on 0.06 higher than in animals with homozygous dominant genotype. However, the uniformity of growth (Ip) in no carriers recessive allele animals was higher on 0.02.

Young pigs of heterozygous genotype Nn by RYR1 gene previously reached a live weight of 100 kg on 2.54 days or 1.51% with less feed on 0.06 feed. units. or 1.95%. Young pigs of homozygous genotype nn by RYR1 gene had less thickness of bacon on 0.15 mm or 1.55% (lifetime score) and increased performance of exterior assessment on 0.11 points or 2.33%.

In addition, young pigs of homozygous genotype nn by RYR1 gene tended to increased "muscle cells" area on 4.33 cm2 or 8.6 % at less thickness of bacon upon the 6^{th} -7^{th} chest vertebra to 0.34 mm or 3.52% at (post slaughter evaluation).

Studying the carcass morphological structure we can observe the tendency of meat content preference on 0.9 %, with a low fat content on 1.0 % and almost the same bones content. Between these genotypes it was found the tendency of fattening , slaughter and meat qualities preferences in this or that genotype as the differences between genotypes are statistically improbable .

The results of physics and chemical meat and fat analysis of pigs Peitrain breed (table 3) with different genotype by RYR1-gene indicate a lack of significant difference between the groups, but only the tendency of all meat parameters preferences (pH, tenderness, water-retaining capacity, colour intensity, losses during heat

treatment, dry matter content, protein, fat, ash and energy values) and fat parameters preferences (hygroscopic moisture, melting temperature).

Table 2

Performance evaluation of growth regularities replacement youngs

Indicators	Groups of animals with different genotypes by RYR1-gene	
	RYR1Nn (n=20)	RYR1 nn (n=9)
Live weight at the age of 60 days , kg	23,17±0,20	22,78±0,22
Live weight at the age of 180 days, kg	112,60±0,58**	111,44±0,53
The average daily gain (60-180 days), g	745,21±5,27	733,89±4,17
The relative gain (60-240 days) ,%	145,38	145,50
The intensity of animal's formation (Δt)	0,14	0,18
Indices of voltage growth (In)	0,61	0,67
Uniformity of growth (il)	0,39	0,37
Age for achieving a live weight of 100 kg , days	165,90±0,90	168,44±0,98
Feed expenses, feed unit / kg gain	3,02	3,08
Thickness of bacon , mm	9,70±0,23	9,55±0,53
Evaluation of exterior, points		
-the development of the longest back muscles	4,72±0,09	4,83±0,12
-the development of the front and rear hams	4,72±0,09	4,83±0,12
Slaughter yield ,%	73,33±0,67	73,67±0,89
Half- carcass length , sm	94,67±0,33	95,00±0,57
Thickness of bacon upon the 6^{th} -7^{th} chest vertebra, mm	9,67±0,33	9,33±0,33
"Muscle cells " area cm2	50,33±1,85	54,66±0,88
Morphological carcass composition ,%:		
- meat	72,67±0,67	73,57±0,53
- fat	14,67±0,33	13,67±0,58
- bones	12,66±0,33	12,76±0,33

Table 3

The results of physics and chemical analysis of meat pigs with different genotype Peitrain breed by RYR1- gene (n = 3)

Genotype by RYR1- gene	pH	Tenderness, sec	Water-retaining capacity,%	Colour intensity units. extracted . x 1000	losses during heat treatment ,%
RYR1Nn	5,83±0,04	13,20±0,97	58,00±1,00	68,67±4,83	16,75±0,87
RYR1nn	5,72±0,05	12,22±0,76	57,33±1,66	64,06±3,77	17,46±0,99
TS*	5,20-5,80	8,30-12,20	53,00-64,00	51,00-82,00	-

Chemical analysis of meat, fat		
Indicators	Genotypes by RYR1-gene	
	RYR1Nn	RYR1nn
Results of meat chemical analysis		
Moisture, %	74,27±0,67	74,32±0,74
Dry matter, %	25,71±0,70	25,68±0,81
Protein, %	22,94±0,51	23,26±0,53
Fat, %	1,67± 0,24*	1,34± 0,22
Ash, %	1,10± 0,03	1,08± 0,02
Energy value, fecal	109,58	107,82
Results of fat chemical analysis		
Hygroscopic moisture, %	8,73±0,54	9,75±0,73
Melting point, °C	32,30±0,25	32,39±0,27
Number of refraction	1,461	1,461

* - Technological standards

Fattening and meat qualities of young pigs Peitrain breed depending on the genotype by MC4R gene were shown in Table 4, young pigs with heterozygous genotype AG by MC4R gene tended to benefits in live weight indicators at the age of 2 months. Further by leveling differences in terms of live weight, which was almost equal at the age of 6 months, between different genotypes by MC4R gene there were no differences in performance of achieving 100 kg live weight , average daily gain. However, young pigs of homozygous genotype GG by MC4R gene had lower feed costs per gain unit on 0.13 feed. units. , had thinner bacon on 0.88 mm or 8.24 % (lifetime score) and increased performance assessment of exterior on 0.54 points or on 12.10 % (all young pigs of homozygous genotype GG by MC4R gene without exception, received the highest score for the longest back muscle development and the front and rear hams).

Analysis of fattening and meat young pigs qualities of Peitrain breed depending on polymorphism by genotype by RYR1 and MC4R genes showed that the best fattening qualities were in young pigs heterozygous genotype AGNn that have the lowest age of achieving a live weight of 100 kg due to higher average daily growth . GGnn and GGNn genotypes have the least thickness of the bacon and the highest exterior assessment.

Table 4

Fattening and meat qualities of young pigs Peitrain breed depending on genotypes by MC4R genes

Indicators	Genotypes by MC4R gene		
	AA	AG	GG
n	-	13	16
Live weight at the age of 60 days , kg		23,15±0,28	22,96±0,19
Live weight at the age of 180 days, kg		112,38±0,43	112,13±0,48
Age for achieving a live weight of 100 kg , days		166,15±0,99	166,56±0,81
The average daily gain (60-180 days), g		743,59±4,47	742,96±4,22
Feed expenses, feed unit / kg gain		3,12	2,99
Thickness of bacon , mm		10,69±0,26**	9,81±0,14
Evaluation of exterior, points			
-the development of the longest back muscles		4,46±0,12	5,00
-the development of the front and rear hams		4,46±0,12	5,00
Note : ** P≥0,99 (reliability of the difference was calculated to the desired GG genotype)			

Fattening and meat qualities of young pigs Peitrain breed depending on polymorphism by genotypes by RYR1 and MC4R genes

Indicator	$\overline{X} \pm s_{\overline{x}}$
Genotype GG nn (n=5)	
Age for achieving a live weight of 100 kg , days	167,80±0,86
Average daily gain (60-180 days), g	731,67±4,85
Thickness of bacon, mm	8,40±0,40
Exterior evaluation, points	
- the development of the longest back muscle	5,00
- the development of the front and rear hams	5,00
Genotype GG Nn (n=11)	
Age for achieving a live weight of 100 kg , days	166,00±0,65
Average daily gain (60-180 days), g	748,11±3,14*
Thickness of bacon, mm	9,00±0,13
Exterior evaluation, points	
- the development of the longest back muscle	5,00
- the development of the front and rear hams	5,00
Genotype AG nn (n=4)	
Age for achieving a live weight of 100 kg , days	167,00±0,81
Average daily gain (60-180 days), g	744,91±3,98
Thickness of bacon, mm	11,00±0,41**
Exterior evaluation, points	
- the development of the longest back muscle	4,62±0,24
- the development of the front and rear hams	4,62±0,24
Genotype AG Nn (n=9)	
Age for achieving a live weight of 100 kg , days	165,78±0,63
Average daily gain (60-180 days), g	752,67±3,02**
Thickness of bacon, mm	10,56±0,34*
Exterior evaluation, points	
- the development of the longest back muscle	4,38±0,14
- the development of the front and rear hams	4,38±0,14

Conclusions

It was recommended to use DNA swine diagnostics by RYR1 and MC4R genes as an additional selection criteria breeding pigs of Peitrain breed for improving reproductive, fattening and meat qualities.

It was recommended to form a special line in the herd of Peitrain breed to produce breeding animals with homozygous genotypes AA, GG by MC4R gene (for 100% of the desired allele inheritance).

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