DIFFERENCES IN QUANTITY AND COMPOSITION OF INTRAMUSCULAR FAT IN SELECTED MUSCLES OF THE PIGS

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INTRODUCTION

Currently, much attention is paid to monitoring of meat quality and intramuscular fat content in pure breeds but also in hybrid pig breeds (Holková et al., 1993). Another factor that contributes to the formation of intramuscular fat is the weight of pigs. Studies on the heritability of meat quality characteristics show the parameters with a low coefficient of heritability (<0.15). An exception is the intramuscular fat, which achieves the parameters h2 = 0.29. Readings give the possibility of selection for this indicator (BAHELKA et al., 2006). The research carried out in Slovakia show that boars reached about 0.50 % higher proportion of intramuscular fat than proportion measured in gilts (2.00%) (BAHELKA et al., 2006).

The research conducted in the Czech Republic on various breeds to determine the proportion of intramuscular fat were on average results achieved by Large White 1.16%, min. 0.47 and max. 2.47 (MIKULE, 2008). From further research in order to show the average values 1.68 % in Large White (Holková, 1993). In Spanish Iberian breeds after rigor mortis where was found the chemical composition of the protein value reached 16.21 (g/100g), fat content reached 2.68 (g/100g) and fatty acids of which consisted of palmitic acid (C16): 14 , 16 % stearic acid (C18): 3.13 %, oleic acid (C18: 1 n-9): 26.56 %, linoleic acid (C18: 2 n-6): 51.30 % and linolenic acid (C18 : 3, n-3): 1.65 %. The statistical evidence supporting the race to achieve Iberian level (P <0.05) (ESTÉVEZ, 2003, Inmaculada et al., 2006, KANG et al., (2011) indicate that the fatty acid composition of muscle is controversial.

OBJECTIVES

The objective of the experiment was to analyze the chemical composition and physical parameters of quality and simultaneously to characterize the proportion of fatty acids in intramuscular fat in selected muscles of pigs in both sexes.

MATERIAL AND METODS

The experimental work consists of experiments which included 10 pcs Large White breeds, it was 5pcs boars and 5pcs gilts. Evaluation of the experiment and sampling was conducted at the slaughterhouse and the Laboratory of Experimental Center of the Department od Animal husbandry where pigs were slaughtered. Whole group of pigs was pre-selected based on DNA analysis of genetic markers RYR-1 and consisted only of dominant homozygotes. DNA analysis was carried out in collaboration with the Department of Breeding Biology. Samples weighing 100 g were taken from three selected muscles of the carcase and it was the adductor muscles, musculus semimembranosus and musculus longisimus thoracis et lumborum. After rigor mortis 24 hours at 2 C were muscle samples taken and homogenized and stored at - 18 C. Indicators of chemical composition in selected pork muscles carcase in Large White was determined by the method FT IR Nicolet apparatus 6700th. We analyzed the total protein content in g/100 g, intramuscular fat content in g/100 g of total water content in g/100 g of sample and the energy value in KJ/100g samples. The individual groups of fatty acids were determined from 50 g of muscle homogenate in adductor muscle, musculus semimembranosus and musculus lumborum et thoracis longisimus by GC gas chromatography in the laboratory, Institute of Chemistry Faculty of Natural Sciences in Bratislava..

RESULTS

Chemical composition pork and fatty acids composition of the intramus cular fat in selected muscles of the pigs

muscule		*Musculus adductor*			*Musculus semimembranosus*			*Musculus longissimus thoracis et lumborum (mlt)*		
Traits		**barrows (n=5)**	**gilts (n=5)**	**Total (n=10)**	**barrows (n=5)**	**gilts (n=5)**	**Total (n=10)**	**barrows (n=5)**	**gilts (n=5)**	**Total (n=10)**
Total water (g/100g)	$\bar{x}$	75,2	75,52	75,41	72,34	73,58	73,08	73,9	74,61	74,33
	s	0,73	1,08	0,92	1,73	1,53	1,65	0,79	0,52	0,7
Protein (g/100g)	$\bar{x}$	22,23	22,37	22,31	20,88	21,99	21,54	23,38	23,69	23,57
	s	0,69	0,74	0,69	1,5	0,55	1,12	0,46	0,52	0,5
Intramuscular fat (g/100g)	$\bar{x}$	1,93	1,48	1,66	5,59	3,55	4,36	2,12	1,43	1,7
	s	0,3	0,56	0,51	2,55	1,75	2,23	0,63	0,4	0,6
Energy value (KJ/100g)	$\bar{x}$	471,02	443,84	454,71	563,08	530,23	543,37	481,73	475,38	477,92
	s	18,22	29,25	27,98	86,42	78,88	78,96	8,5	17,08	14,03
MCFA	$\bar{x}$	0,3	0,29	0,3	0,17	0,22	0,2	0,39	0,37	0,38
	s	0,04	0,06	0,05	0,01	0,08	0,07	0,01	0,06	0,04
LCFA	$\bar{x}$	98,42	98,36	98,39	99,31	98,82	99,02	98,76	98,29	98,48
	s	0,2	0,33	0,27	0,21	0,72	0,61	0,14	0,46	0,43
VLCFA	$\bar{x}$	0,18	0,24	0,22	0,17	0,28	0,24	0,14	0,27	0,22
	s	0,07	0,1	0,09	0,07	0,15	0,13	0,04	0,14	0,13
SAFA	$\bar{x}$	38,28	36,75	37,36	38,08	36,38	37,06	39,93	38,35	38,98
	s	1,49	1,56	1,65	0,55	3,56	2,81	1,55	3,09	2,6
MUFA	$\bar{x}$	46,66	46,06	46,3	55,09	51,59	52,99	50,63	46,8	48,33
	s	1,97	5,6	4,34	1,95	9,48	7,38	2,3	6,93	5,69
PUFA	$\bar{x}$	13,96	16,09	15,24	6,48	11,35	9,4	8,73	13,78	11,76
	s	2,77	4,2	3,68	1,57	6,8	5,73	1,52	4,79	4,51
Esen-FA	$\bar{x}$	11,03	12,78	12,08	5,22	8,96	7,46	6,94	10,81	9,26
	s	2,34	2,85	2,67	1,36	4,61	4,02	1,26	3,41	3,31
3-w FA	$\bar{x}$	0,56	0,7	0,65	0,43	0,64	0,56	0,45	0,65	0,57
	s	0,18	0,14	0,17	0,15	0,25	0,24	0,14	0,26	0,23
6-w FA	$\bar{x}$	12,8	14,73	13,96	5,58	10,2	8,35	7,76	12,5	10,6
	s	2,57	4,04	3,5	1,46	6,5	5,47	1,39	4,51	4,23
Trans-FA	$\bar{x}$	3,07	3,09	3,08	2,73	2,97	2,87	2,88	3,09	3,01
	s	0,1	0,22	0,17	0,08	0,24	0,22	0,08	0,27	0,23
Cis-FA	$\bar{x}$	42,6	41,96	42,21	51,13	47,55	48,98	46,8	42,82	44,41
	s	1,82	5,35	4,14	1,86	9,19	7,18	2,24	6,69	5,54

The mean square of two-factor analysis of variance

Traits		Muscule A FA = 2	Sex B FB=1	Interakcia AB FAB=2	error e fe = 78	Significant
Total water (g/100g)	MS	14.099	3.972	0.562	1.303	MA:MLT^{+} MA:MSM^{+++} MLT:MSM^{+}
	F	10.818^{+++}	3.048	0.431		
Protein (g/100g)	MS	10.729	1.908	0.641	0.605	MA:MLT^{+++} MA:MSM^{+} MLT:MSM^{+++}
	F	17.726^{+++}	3.152	1.058		
Intramuscular fat (g/100g)	MS	25.595	8.128	1.766	1.613	MA:MSM^{+++} MLT:MSM^{+++}
	F	15.864^{+++}	5.038^{+}	1.095		
Energy value (KJ/100g)	MS	20871.796	3524.690	467.354	2519.553	MA:MSM^{+++} MLT:MSM^{++}
	F	8.284^{++}	1.399	0.185		
SFA	MS	10.161	18.499	0.017	5.751	
	F	1.767	3.217	0.003		
MUFA	MS	121.138	50.353	7.604	36.881	MA:MSM^{+}
	F	3.285^{+}	1.365	0.206		
PUFA	MS	91.251	115.869	6.429	19.665	MA:MSM^{++}
	F	4.640^{+}	5.892^{+}	0.327		
Esen-FA	MS	56.853	69.910	3.389	9.656	MA:MLT^{+} MA:MSM^{++}
	F	5.888^{++}	7.240^{+}	0.351		
MCFA	MS	0.086	0.000	0.003	0.003	MA:MLT^{++} MA:MSM^{+++} MLT:MSM^{+++}
	F	28.034^{+++}	0.014	1.013		
LCFA	MS	1.228	0.832	0.149	0.189	MA:MSM^{++} MLT:MSM^{++}
	F	6.496^{++}	4.402^{+}	0.790		
VLCFA	MS	0.001	0.074	0.003	0.012	
	F	0.111	6.045^{+}	0.278		
3-ω FA	MS	0.024	0.249	0.003	0.041	
	F	0.600	6.141^{+}	0.086		
6-ω FA	MS	84.553	101.764	6.030	17.794	MA:MSM^{++}
	F	4.752^{+}	5.719^{+}	0.339		
Trans-FA	MS	0.132	0.180	0.031	0.039	MA:MSM^{+}
	F	3.351^{+}	4.584^{+}	0.791		
Cis-FA	MS	122.831	53.913	7.982	34.357	MA:MSM^{+}
	F	3.575^{+}	1.569	0.232		

CONCLUSION

Finally, we conclude that the quantitative content of intramuscular fat in pigs of different muscles is different as well as qualitatively different structure in its composition and content of matte acids either in terms of chain length or number of double bonds and their isomers. As regards the content of intramuscular fat in muscle, we can conclude that most of fat is in a musculus semimbranosus and least in musculus adductor, in contrast, total protein was highest in musculus longissimus thoracis and smallest in musculus semimembranosus. The total water content was found highest content in musculus semimembranosus and least in musculus longisimus thoracis. The content of fatty acids with medium chain was the largest in musculus longisimus thoracis and also the content of saturated fatty acids was greatest just intramusculárnom fat in this muscle. The content of essential fatty acids, omega 3 and omega 6 fatty acids was greatest in the musculus adductor. The content of fatty acids with long to very long chain, the largest in the musculus semimembranosus.

In general we can conclude that gilts had a lower intramuscular fat compared to barrows and a higher proportion of total protein and total water in the monitored muscles. As for the chain length fatty acids we found in barrows abundant fatty acids of medium to long-chain compared to gilts in which the highest occurrence of fatty acids with long to very long chain. The incidence of essential fatty acids is higher in gilts compared to barrows and also the presence of 3 and omega 6 fatty acids is higher in the intramuscular fat of gilts compared to barrows.

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