PORK QUALITY FROM A GENOTYPE CONTAINING MOURA BREED SLAUGHTERED BETWEEN 100 AND 130 KG.

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Abstract – The brazilian pork industry aims to obtain a product with low fat, regardless of the parameters of pork quality. The aim of this study was to evaluate the meat quality of pigs from a particular genotype developed for high meat quality, containing 12.5% of the Moura breed, a Brazilian naturalized breed characterized by high fat production. Thus, 122 barrows and gilts with a genetic composition of 29.5% Duroc, 15% Pietrain, 17% Large White, 25% Landrace and 12.5% Moura, slaughtered at 100, 115 and 130kg were evaluated. The pork from barrows showed higher marbling score ($p \leq 0.01$) and lower shear force. The a* value increased linearly in the ham ($p \leq 0.01$) and loin ($p \leq 0.001$) with the rise in slaughter weight, although the visual color scores were not affected ($p \geq 0.05$). The cooking loss increased linearly ($p \leq 0.05$) with the increase in slaughter weight, as well as the dry matter ($p \leq 0.001$). These results suggest that the increase in slaughter weight of pigs of the genetic breed evaluated, can improve parameters which indicate pork quality, such as increasing the intensity of red color.

I. INTRODUCTION

Brazilian pig industry aims to produce lean meat, using for this purpose synthetic lines of pigs with these characteristics all over the country. However, parameters which indicate the pork quality produced by this type of genotype are not taken into consideration. In these genotypes the presence of large amounts of glycolytic fibers that reduce the pH of the meat [9] close to the isoeletric point of the protein, reducing the water holding capacity and causing the exudation of pork [11] have been observed. In pigs lines less efficient for protein deposition, these fibers are found in lower amounts [9], allowing a higher pH and a higher water holding capacity.

In last decades, the Moura breed was no longer used in Brazil due to its high capacity for fat deposition, therefore, there are few information about its use in crosses with other breeds. Beyond of genetics, to evaluate the optimal slaughter weight is fundamental to get a better pork quality, as the increase for weights above 100kg can change parameters such as the intramuscular fat [5], color [8] and tenderness.

The aim of this study was to evaluate the quality of pork from barrows and gilts with a genetic composition of 29.5% Duroc, 15% Pietrain, 17% Large White, 25% Landrace and 12.5% Moura, slaughtered at 100, 115 and 130kg.

II. MATERIAL AND METHODS

One hundred and twenty two pigs (64 barrows and 58 gilts) were sorted in one of three groups for slaughter at 100, 115 or 130 kg (34, 50 and 38 pigs, respectively). The pigs were reared in pens with 4-5 animals separated by sex and fed ad libitum. Forty five minutes after the slaughter the measurement of pH (pH45m) on the loin (*longissimus thoracis*) and ham (*semimembranossus*) was carried out. After 24 hours of cooling at temperature ranging from 2-8ºC, the pH was measured again (pH24h) and samples were collected for further analysis. The marbling score (loin) and subjective color (loin and ham) was performed after 20 minutes of exposure to air, allowing the stability of the pigments [10].

The color was also measured by CIE Lab system (L*, a*, b*) with the aid of a Minolta colorimeter (Minolta Camera Ltda., Japan). The drip loss, cooking loss and shear force followed procedures suggested by the American Meat Science Association [1] and dry matter analysis followed procedures suggested by the Association of Official Analytical Chemists [2].

Data were submitted to analysis of variance, considering the qualitative effects of slaughter weight (SW), sex and the interaction between sex and SW. Orthogonal contrasts of the first and second order were tested. The means obtained for SW and sex vs. SW interaction

were used for polynomial analysis of regression of the second order.

III. RESULTS AND DISCUSSION

The means observed for barrows and gilts are shown in Table 1 and the values obtained in the analysis of variance are shown in Table 2.

Table 1. Means of the pork quality variables from barrows and gilts slaughtered between 100 and 130kg.

Variabl	Target slaughter weight (kg)					
	100		115		130	
	B	G	B	G	B	G
			Loin			
pH45m	6.30	6.46	6.46	6.39	6.48	6.26
pH24h	5.71	5.75	5.77	5.72	5.77	5.73
Cor	3.42	3.23	3.36	3.55	3.39	3.10
Mar	2.25	2.00	2.64	2.23	2.50	1.90
L	45.97	46.66	46.73	46.34	46.69	47.26
a	3.18	3.63	3.42	3.87	4.27	4.24
b	3.35	3.76	2.64	1.51	2.52	1.51
DL	3.54	3.66	3.30	3.00	2.61	4.58
CL	35.69	36.55	36.84	37.71	36.04	38.78
SF	3.16	3.25	3.14	4.27	3.14	3.17
DM	24.87	24.52	25.26	25.28	27.34	26.32
			Ham			
pH45m	6.36	6.50	6.52	6.45	6.41	6.31
pH24h	5.81	5.84	5.81	5.76	5.76	5.73
Cor	3.67	3.77	3.86	3.77	3.78	3.60
L	43.65	43.62	44.78	44.53	45.53	45.13
a	5.26	5.98	6.02	5.77	7.09	6.88
b	3.13	3.63	3.23	1.85	3.75	2.02
DL	2.19	2.47	2.17	2.62	2.50	3.46

B=Barrows; G=Gilts; pH45m=pH 45 minutes; pH24h=pH 24 hours; Cor=Subjective color score; Mar=Subjective marbling score; DL=Drip loss (%); CL=Cooking loss (%); SF=Shear force (Kgf); DM=Dry matter (%).

Sex influenced the marbling score of the loin, which was higher in barrows. This result is expected because the barrows have lower capacity for protein deposition due to the lack of testicular steroids.

The largest amount of intramuscular fat in barrows is also responsible for the lower shear force in this sex [7]. Higher b* values in barrows in the loin and ham contradict results reported in literature [6, 8]. However, the absence of an effect of sex for L* and a* values agree with results observed by the authors cited. As reported by Correa *et al.* [6] the subjective color was not affected by gender.

Table 2. Levels of Type I error for sex, SW and the interaction sex x SW of pork quality variables from barrows and gilts slaughtered between 100 and 130kg.

Variable	P-value		
	Sex	SW	Sex x SW
pH45m	0.205	0.527	0.002
pH24h	0.344	0.707	0.086
Cor	0.296	0.297	0.086
Mar	0.001	0.152	0.630
L	0.502	0.406	0.497
a^E	0.064	<0.001	0.351
b	0.011	<0.001	0.019
DL	0.076	0.447	0.012
CL	<0.001	0.009	0.012
SF^E	0.049	0.046	0.019
DM	0.007	<0.001	0.026
pH45m	0.625	0.016	0.042
pH24h	0.234	0.006	0.175
Cor	0.518	0.549	0.571
L	0.676	0.024	0.936
a	0.782	<0.001	0.280
b	0.001	0.044	0.002
DL	0.038	0.080	0.518

SW=Slaughter weight; pH45m=pH 45 minutes; pH24h=pH 24 hours; Cor=Subjective color score; Mar=Subjective marbling score; DL=Drip loss (%); CL=Cooking loss (%); SF=Shear force (Kgf); DM=Dry matter (%).

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The interaction between sex and SW for pH45m and loin drip loss ($p \leq 0{,}042$) indicate that these variables were affected differently in barrows and gilts. Other studies report no effect of sex on pH45m or pH24h [5, 6, 8], drip loss [3, 6], dry matter [6] and cooking loss [5, 8].

The values obtained by regression analysis are shown in Table 3. None of the variables had quadratic effect (p>0.07). The increased SW resulted in linear decrease in pH45m and pH24h in the ham, as well as in pH45m in the loin of females. In the loin of the barrows, the pH increased with the SW. However, although significant, the relationship of SW with pH was very low (R^2 between 4.86 and 8.90), showing a small variation in this range of weight.

The pH45m values were slightly higher than those reported in literature for animals slaughtered at similar weights, ranging from 5.98 to 6.30 [6, 8], which could be due to differences in genotype and in environmental and management condition between studies. Nevertheless, no DFD characteristics (final pH greater than 5.9) occurred.

The reduction of drip loss in barrows and increase in gilts as the SW increased can be explained by the raise in pH45m in barrows and decrease in gilts. However, the slope of the equations for drip loss was low, as the R^2 value of the model (4.66%), suggesting little influence of SW on this variable.

The same effect was observed in shear force, which showed a slight linear decrease with SW (R^2=3.82%). The cooking loss increased with SW, contrasting results observed by Cisneros *et al*. [5] and Correa *et al*. [6].

The increase in dry matter as the increase in SW was also reported by Beattie *et al.* [3], which may suggest greater amount of fat in samples. The increase of the a* values in the loin and ham indicate more intense red color in the heavier animals and may facilitate the marketing of pork fresh from animals slaughtered at higher weights. The increase in red intense color may be due to the higher content of myoglobin in heavier animals [8].

The lack of SW effect on marbling score may be due to the subjectivity of visual analysis. A similar result was reported by Cisneros *et al*. [5], who found no effect of SW in marbling score, although the intramuscular fat content have increased linearly with SW.

Finally, it should be emphasized that the slaughter was carried out at different moments. Thus, variable such as drip loss, cooking loss and color may be affected by other factors, besides the SW.

Table 3. Parameters of regression analysis of pork quality variables from barrows and gilts slaughtered between 100 and 130kg

Variable	Linear effect of SW (value/kg		Model	
	B	G	R^2	SE
		Loin		
pH45m**	0.004	-0.005	8.90	0.2
pH24h	NS	NS	-	-
Cor	NS	NS	-	-
Ma	NS	NS	-	-
L	NS	NS	-	-
a**		0.019	7.74	0.9
b**	-0.021	-0.065	23.92	1.28
DL**	-0.027	0.017	4.66	1.83
CL*	0.024	0.052	18.64	1.79
SF*	-0.003	-0.004	3.82	1.12
DM*	0.070	0.045	35.62	1.02
		Ham		
pH45m*	-0.001	-0.005	6.00	0.20
pH24h**		-0.0017	4.86	0.10
Cor	NS	NS	-	-
L	NS	NS	-	-
a***		0.0364	13.34	1.33
b**	0.018	-0.051	18.23	1.43
DP	NS	NS	-	-

NS, *,**,***= not significant, (P≤0,05), (P≤0,01) and (P≤0,001) for the model, respectively; SW=Slaughter weight; SE=Standard error; pH45m=pH 45 minutes; pH24h=pH 24 hours; Cor=Subjective color score; Mar=Subjective marbling score; DL=Drip loss (%); CL=Cooking loss (%); SF=Shear force (Kgf); DM=Dry matter (%)

IV. CONCLUSION

The results suggest that the increase in slaughter weight of pigs from the genotype evaluated in this study, between 100 and 130kg, can improve parameters of pork quality, such as increase in redness. Though, more studies are necessary to evaluate the variation of intramuscular fat and pH with the increase of slaughter weight in pig crossed with Moura breed.

REFERENCES

1. American Meat Science Association - AMSA. (1995). Research guideliness for cookery sensory and instrumental tenderness measurement of fresh meat. Chicago .

2. Association of Official Analytical Chemists - AOAC. (1995). Official Methods of Analysis. AOAC, Washington, DC.
3. Beattie, V. E., Weatherup, R. N., Moss, B. W., Walker, N. (1999). The effect of increasing carcass weight of finishing boars and gilts on joint composition and meat quality. Meat Science 52: 205-211.
4. Candek-potokar, M., Zlender, B., Lefaucheur, L., Bonneau, M. (1998). Effects of age and/or weight at slaughter on longissimus dorsi muscle: biochemical traits and sensory quality in pigs. Meat Science 48: 287-300.
5. Cisneros, F., Ellis, M., Mckeith, F. F, Mccaw, J., Fernando, R. L. (1996). Influence of slaughter weight on growth and carcass characteristics, commercial cutting and curing yields, and meat quality of barrows and gilts from two genotypes. Journal of Animal Science 74: 925-933.
6. Correa, J. A., Faucitano, L., Laforest, J. J., Rivest, J., Marcoux, M., Gariépy, C. (2006). Effects of slaughter weight on carcass composition and meat quality in pigs of two diferente growth rates. Meat Science 72: 91-99.
7. Huff-lonergan, E., Baas, T. J., Malek, M., Dekkers, J. C. M., Prusa, K., Rothschild, M. F. (2002). Correlations among selected pork quality traits. Journal of Animal Science 80: 617-627.
8. Latorre, M. A., Lázaro, R., Valencia, D. G., Medel, P., Mateos, G. G. (2004). The effects of gender and slaughter weight on the growth performance, carcass traits, and meat quality characteristics of heavy pigs. Journal of Animal Science 82: 526-533.
9. Lefaucheur, L., Lebret, B., Ecolan, P., Louveau, I., Damon, M., Prunier, A., Billon, Y., Sellier, P., Gilbert, H. (2010). Muscle characteristics and meat quality traits are affected by divergent selection on residual feed intake in pigs. Journal of Animal Science 89: 996-1010.
10. National Pork Producers Council - NPPC. (1999). Pork quality Standards. Des Moines, IA.
11. Price, J., Schweigert, B. S. (1987). The science of meat and meat products. Westport, Connecicut: Food & Nutrition Press.