5 : 6

PORK QUALITY AND BACKFAT COMPOSITION OF ENTIRE MALE, CASTRATED AND FEMALE CUBAN PIGS FATTENED WITH A RESTRICTED DIET BASED ON SWILL AND FINAL MOLASSES

Diana Cruz-Bustillo; J.L. Rodriguez*. A. Sànchez and Blanca Barreto

Swine Research Institute. Guatao. Havana. Cuba
*Food Industry Research Institute. Guatao. Havana.Cuba

SUMMARY

Pork quality decreased(P<0,05)slightly(WHC=68,1%) for entire males and ranged less(P<0,01)in extractable fat (7,0% DB)compared to barrows(72,5 and 9,1%,respectively),irrespectively of the slaughter age. The judges found no taint on pork or on fried fat of the entire pigs. Sex did not alter subcutaneous fat composition but the older pigs had less(P<0,05)oleic acid content (48,3%)and more total cholesterol(99,6 mg/100g FT) and fatty acids(P<0,05)palmitic and stearic(21,0 and 12,0% respectively) than pigs slaughtered at 214 days of age (56,4%; 86,9 mg/100g FT; 15,4 and 6,8%, respectively).

It was concluded that pork and fat qualities of CC21 entire male pigs were found acceptable but it is necessary to continue investigating entire male pigs behaviour and carcass,meat and fat quality under the nutritional and climatic conditions of Cuba.

INTRODUCTION

Pork commercial production from entire male pigs has been a controversial subject among researchers and producers during the last decades on account of boar taint.

At present the great majority of commercial slaughter pigs in Spain is not castrated because there is no specific legislation for doing so (Diestre,1986), whereas in the United Kingdom entire males represent approximately 20% of the national pig slaughter(Wood et al, 1983). Therefore, it can be affirmed that the initial fears related to boar taint were exaggerated (Wood and Riley, 1982)and that the faster growing rate, better efficiency and leaner carcasses of entire males are actually more important(Siers,1975; Walker,1978; Desmoulin and Bonneau,1979; Wood and Riley,1982).

Since 1980, Cuban researchers have been concerned with the sensory evaluation of pork coming from entire male pigs.

Several trials were made where roasted pork from purebred entire males fattened on concentrate or on swill and molasses-diets (Sànchez et al.1985) and from boars of seven different genotypes (Cruz-Bustillo et al,1986) was tasted by trained judges in order to detect boar taint and in no case off-flavour was found on the samples tried. Pork quality was also analyzed and no difference was found between entire males, barrows and gilts. A consumer panel of 1000 citizens of Ciudad de la Habana was recently held(Sànchez, unpublished data). The consumers tasted roasted pork samples coming from entire male pigs (ca. 90 kg) and the result was 100% approval even though the consumers were previously informed they were evaluating boar meat.

The purpose of the present investigation was to study meat quality and backfat composition of entire males, barrows and gilts raised in experimental conditions, fattened with the restricted diet used in Cuba for commercial pig production which is based on swill and final molasses and slaughtered at two different ages.

MATERIALS AND METHODS

The animals used in this study were 95 littermates of the CC21 line raised in identical conditions in an experimental station. During the fattening period they were randomly allotted into twelve pens of eight pigs each with two replications per sex and age at slaughter. The pigs were fed the commercial diet used for pig production in Cuba consisting of a mixture (60:40 dry basis) of swill, and final molasses (7,75 kg daily, fresh basis) supplemented with 0.8 kg concentrate. When the pigs reached 214 days of age, half of the animals were transported to the slaughterhouse where they rested with free access to water until next day when they were stunned and slaughtered. The rest of the pigs was slaughtered with 252 days of age in identical conditions.

Samples of longissimus dorsi muscle and of subcutaneous fat taken from the last rib region of every animal were used to analyze meat quality and backfat composition 24 hours after slaughter except initial pH which was measured 1h post mortem.

Final pH, water-holding capacity (paper and press method),hydrosoluble protein,% (Kotik,1974),visual colour and marbling, and extractable fat and humidity (AOAC. 1975) were analyzed on the fresh meat samples. The sensory panel consisted of six trained judges who scored on a 10-point scale where 1 was the worst degree of the attribute and 10 the best, the juiciness, tenderness and taste of roasted pork and the taste of fried fat morsels ("chicharrones").

Water content and Hanus Iodine number (AOAC.1975), peroxide, saponification and acidity indexes (Chechetkin et al, 1984); total cholesterol determined by the Liebermann-Burchard reaction and fatty acid methyl ester compositions were determined in subcutaneous fat.

Fat was extracted with a chloroform-methanol(2:1) mixture in order to perform the gas-liquid chromatographic analysis of methyl esters while for the rest of the chemical analyses, backfat samples were melted at 100 C. For the determination of the fatty acid methyl esters two identical glass columns packed with 5% DEGS in Diatomite CQ 100-200 mesh were used.

A Factorial experiment with a completely randomized design in which sex, slaughter age and their interaction were used to analyze the data.

RESULTS AND DISCUSSION

No significant interactions were evident in the statistical analysis of the data. Dressing percentage (Table 1) was lower for entire male carcasses on account of the reproductive tract which represented approximately 1% of the carcass weigth.

Water-holding capacity was evidently lower for pork from entires compared with their littermates. In 1985 Barton-Gade found that meat quality of intacts was slightly worse than their barrow or gilt littermates; but Kempster and Cuthbertson (1982)had reported that this was characteristic of lean pigs irrespectively of the sex. The lower marbling score and extractable fat for pork from intact male pigs corresponded to their leaner carcasses which agrees with previous findings (Campbell and King,1982; Wood and Riley,1982).

Age at slaughter affected muscle extractable fat content of the older animals being 1,8% fatter and having 1,4% less water content than their younger littermates.

Table 2 shows the results of the sensory evaluation of roasted pork and "chicharrones". The judges found that the taste of roast coming from barrows or gilts was slightly better than that from entires although the latter was also scored moderately good. On the other hand, the panelists scored the taste of "chicharrones" from entire males or from barrows higher than those from gilts. This result is surprising because 5 androst-3ene-16one, which has been proved to be one of

the causes of boar taint. is liposoluble.

However it has been reported (Desmoulin and Bonneau. 1981)that androstenone levels must exceed lug/g in fat for boar taint to be detected by man.

Other authors have reported off-flavour in entire male carcasses but there has always been another factor which could have influenced as for example excessive leanness (Kempster and Cuthbertson. 1982); hypermuscular breeds (Bonneau et al. 1979) and high slaughter weights (Desmoulin and Bonneau. 1981; Desmoulin et al. 1983). However. Malmfors and Lundstrom(1983) reported. in a review concerning this subject. that consumers in general accept boar meat even though the attitude towards this type of pork is very variable and in occasions some even prefer boar meat compared to barrows or gilts.

Lean from animals slaughtered with 252 days of age was found juicier and more tender than the other sexes which corresponds with findings for meat from fat animals (Cruz-Bustillo. 1982). Judges scored the lean from older animals tastier than their younger littermates. but "chicharrones" taste was significantly worse in older animals.

Table 3 shows the composition of subcutaneous fat where it is evident that sex did not affect its quality. Fat from entire males presented a higher water content compared with that from barrows or gilts. Barton-Gade(1985) found 4% more water in backfat from intact male pigs compared with barrows. Wood and Enser (1982) had similar results and reported that this could be a consequence of different stages of development of fat.

Age at slaughter evidently affected backfat composition.The older pigs presented less percentage extractable fat than the younger ones. This could be a characteristic of leanness if we consider that diet restriction was more severe for the older animals. Iodine value was slightly lower in fat from pigs slaughtered with 252 days of age. The Iodine values obtained are characteristic of firm fat and the fact that older animals presented firmer fat in this experiment is in agreement with previous results with other breeds and under different nutritional conditions (Martin et al. 1972; Scott et al. 1981). In previous studies, Cruz-Bustillo and Ramos (1982) found firm fat (Iodine no. 50-57%) in barrows fed a similar diet to the one used in this experiment. These authors concluded that both the composition of dietary fat and the sub-tropical climate of Cuba favoured the deposition of saturated fatty acid in backfat of commercial pigs approximately 95 kg liveweight.

The heavier pigs had a higher cholesterol content in subcutaneous fat than the lighter ones. This finding agrees with the high rate of lipogenesis of the former which causes the synthesis of saturated fat (Jeremiah. 1981).

The results of the gas-liquid chromatography of backfat fatty acid methyl esters are shown in Table 4.

In spite of a slight difference in myristic acid content. fatty acid composition was not significantly altered by sex. a fact that does not agree with previous findings (Jonsson and Wismer-Pedersen. 1974; Bonneau et al. 1979; Wood and Enser. 1982; Wood and Riley. 1982; Desmoulin et al. 1982; Yen et al. 1982; Wood et al. 1983; Barton-Gade. 1985). Although not significantly different. linoleic acid content was higher in boars and barrows than in gilts. a result consistent

Age at slaughter increased oleic acid content in the backfat of the heavier animals. In 1982. Wood and Enser proved that a stricter restriction in feed intake would increase insaturated fat deposition. In this experiment. oleic acid increased due to a reduction of palmitic and stearic acids. Linoleic acid did not increase substantially with age and it could be suggested that changes occurring in fatty acid composition could be dued to the diet since the major fatty acids are synthesized by the animal while the concentration of linoleic depends almost totally on the diet. Besides. if the values of the individual fatty acids are compared with those obtained in commercial pigs fed swill. final molasses and a protein source (Cruz-Bustillo and Ramos. 1982).it is evident that in the present study the values of the saturated acids were much lower and oleic acid much higher than those previously obtained (palmitic:23.6 to 33.6%: stearic:14.9 to 23.9 %; oleic:28.9 to 37.7%).

In general, it is concluded that pork quality from entire males. barrows and gilts was within the normal range in both slaughter ages while the restriction in the diet could have altered the composition of the subcutaneous fat of the pigs, irrespectively of sex. However, the integral study of entire male pigs fed the diet used in commercial pig production in Cuba must continue.

REFERENCES

A.O.A.C. Official Methods of Analysis of the A.O.A.C. 12th Edition. Washington. D.C. (1975)

Barton-Gade. Patricia. 36th Ann. Mtg. EAAP. Halkidiki. Greece. Sept. 30 to Oct. 3. 8 pp. (1985)

Bonneau. M.; D. Desmoulin et B.L. Dumont. Ann. Zootech. 28(1):53-72(1979)

Campbell. R.G. and R.H. King. Anim. Prod. 35:177-184 (1982)

Cruz-Bustillo. Diana; A. Sànchez. Blanca Barreto. G. Trùjillo y F.J. Diègues. IV Evento Cientifico Univ. Habana. Noviembre. (1986)

Cruz-Bustillo. Diana. Tèsis en opciòn al grado cientìfico de Candidato a Doctor en Ciencias . CNIC. Ciudad de la Habana. Diciembre (1982)

Cruz-Bustillo. Diana y R. Ramos. Cienc. Tèc. Agric. Ganado Porcino 5(2):37-55 (1982)

Chechetkin. A.V.; V.I. Voronianski y G.G. Pokusay. Prácticas de bioquímica del ganado y aves de corral Ed. MIR. Moscù. Versiòn española (1984)

Desmoulin. B. et M. Bonneau. Journeès Rech. Porcine en France. 335-340 (1981)

Desmoulin. B. et M. Bonneau. Techni-Porc 2(3):15-25 (1979)

Desmoulin. B.; J. Donnart et M. Bonneau. 28th Eur. Mtg. Meat Res.Workers. Madrid. Sept. 5-10. 8 pp. (1982)

Desmoulin. B.; J.P. Girard. M. Bonneau et A. Frouin. Journeès Rech. Porcine en France. 15:177-192 (1983)

Diestre. A. Jornadas Tècnicas INCORPORC-5. Salòn de la Feria de Mèrida. 30 de mayo al 2 de junio (1986)

Jeremiah. L.E. J. Anim. Sci., Suppl 1:218(Abstr. 229) (1981)

Jonsson. P. and J. Wismer-Pedersen. Livest. Prod. Sci. 1:52-66 (1974)

Kempster. A.J. and A. Cuthbertson. Proc. 33rd. Ann. Mtg. EAAP. Leningrad. 10 pp. (1982)

Kotik. T. Roczn. Inst. Prz. Mies. XI:47-52 (1974)

Malmfors. Birgitta and Kerstin Lundstrom. Livest.Prod. Sci. 10:187-196 (1983)

Martin. A.M.; H.T. Fredeen. G.M. Weiss and R.B. Carson J. Anim. Sci. 35(3):534-541 (1972)

Sànchez. A.; Blanca Barreto y Diana Cruz-Bustillo. X Concurso de las BTJ. Ciudad de la Habana (1985)

Scott. R.A.; S.G. Cornelius and H.J. Mersman. J. Anim. Sci. 53(4):977-981 (1981)

Siers. D.G. J.Anim. Sci. 41(2):522-526 (1975)

Walker. N. Rec. Agric. Res. 26:7-10 (1978)

Wood. J.D. and J.B. Riley. Anim. Prod. 35:55-63 (1982)

Wood. J.D. and M. Enser. Anim. Prod. 35:65-74 (1982)

Wood. J.D.; M. Enser and A.V. Fisher. Proc. 29th Eur. Mtg. Meat Res. Workers. Italy. 2:614-620 (1983)

Yen. H.; J. Lu and Ch. Kuo. J. Agric. Assoc. China. New Series No.119. Sept:51-63 (1982)

TABLE 1. DRESSING PERCENTAGE AND LEAN QUALITY OF ENTIRE MALES, BARROWS AND GILTS WITH TWO DIFFERENT SLAUGHTER AGES

	Sexual Type				Slaughter age, days		
	B	G	E	S.E.	214	252	S.E.
Dressing percentage (1),%	75,1a	75,2a	72,7b	0,4 ***	74,0	74,6	0,4
Initial pH	6,2	6,2	6,2	0,04	6,3	6,1	0,03 **
Final pH	5,5	5,5	5,5	0,02	5,5	5,4	0,02 *
Hydrosoluble protein, %	2,5	2,4	2,3	0,1	2,4	2,4	0,04
WHC(2), %	72,5a	73,4a	68,1b	1,1 *	70,4	72,2	0,4
Marbling score	1,8a	1,7ab	1,4b	0,1 *	1,7	1,6	0,1
Colour	2,8	2,8	2,7	0,1	2,8	2,7	0,1
Extractable fat, %	9,1a	8,8a	7,0b	0,4 **	7,4	9,2	0,3 ***
Water content, %	72,8	72,7	73,2	0,3	73,6	72,2	0,2 ***

(1) Head off (2) WHC:Water-holding capacity B:Barrows G:Gilts E:Entire males
* P<0.05 ** P<0.01 *** P<0.001

Table 2. SENSORY PANEL EVALUATION OF ROAST AND "CHICHARRONES" FROM ENTIRE MALES, BARROWS AND GILTS WITH TWO DIFFERENT SLAUGHTER AGES

Sensory attribute(1)	Sexual type				Slaughter age, days		
	B	G	E	S.E.	214	252	S.E.
Juiciness	7,2	7,1	7,3	0,2	6,8	7,7	0,1 **
Tenderness	7,3	7,1	7,4	0,2	7,0	7,6	0,2 **
Flavour of roast	7,9a	7,8a	7,2b	0,2 *	7,5	7,8	0,1 *
Flavour of "chicharrones"	8,3a	7,8b	8,1ab	0,1 *	8,3	7,8	0,1 ***

(1) Scores from 1 to 10 where 1 is the worst degree of the attribute and 10 the best.
* P < 0,05 ** P < 0,01 *** P < 0,001

Table 3. SUBCUTANEOUS FAT COMPOSITION OF ENTIRE MALES, BARROWS AND GILTS WITH TWO DIFFERENT SLAUGHTER AGES

	Sexual type				Slaughter age, days		
	B	G	E	S.E.	214	252	S.E.
Water content, %	7,3b	8,4b	9,5a	0,4 **	8,7	8,1	0,3 **
Extractable fat, %	95,4	94,1	93,9	0,3	95,0	93,7	0,3 *
Iodine No. %	49,8	46,9	47,2	2,1	50,9	45,0	1,7
Peroxide No., meq/100g	4,6	3,9	4,4	0,5	4,4	4,2	0,4
Saponification No., mg KOH/g	194	197	199	3,4	198	196	2,8
Acidity Index, mg KOH/g	3,7	3,8	4,1	0,2	4,8	3,0	0,1 ***
Total cholesterol, mg/100g FT	92,9	91,9	95,1	2,8	86,9	99,6	2,3 ***

* P < 0,05 ** P < 0,01 *** P < 0,001

Table 4. FATTY ACID COMPOSITION OF SUBCUTANEOUS FAT FROM THREE SEXUAL TYPES OF PIGS SLAUGHTERED WITH TWO DIFFERENT AGES.

Fatty acid, % of the total	Sexual Type				Slaughter age, days		
	B	G	E	S.E.	214	252	S.E.
C 14:0	2,7a	1,8b	1,5b	0,2 *	1,5	2,6	0,2 **
C 16:0	16,5	20,4	17,7	1,8	21,0	15,4	1,5 *
C 16:1	2,8	2,8	2,6	0,3	2,6	2,8	0,2
C 18:0	8,4	10,8	9,0	1,6	12,0	6,8	1,3 *
C 18:1	53,1	51,0	52,9	2,9	48,3	56,4	2,4 *
C 18:2	9,6	7,8	9,8	0,8	8,5	9,7	0,6
C 18:3	2,5	2,0	2,2	0,5	2,0	2,5	0,4
C 20:0	0,9	0,6	0,4	0,2	0,4	2,6	0,2 **

* P < 0,05 ** P < 0,01 *** P < 0,001