

EFFECTS OF AGE AT SLAUGHTER ON CARCASS AND MUSCLE TRAITS, AND MEAT QUALITY PARAMETERS IN PIGS

B  n  dicte Lebre  t, Jean Noblet and Michel Bonneau

INRA, Station de Recherches Porcines, 35590 Saint-Gilles, France

Background

It is widely held by consumers that increasing age of pigs at slaughter could result in an improvement of meat quality. However, increasing age and weight at slaughter leads to heavier carcasses that are not appreciated by the meat industry for fresh meat production. For a given body weight at slaughter, increasing age implies to reduce the growth rate of pigs during the growing - finishing period. This can be achieved through a feed restriction, or through a lower protein or lysine/energy ratio in the diet. Nevertheless, the former has been shown to reduce intramuscular fat (IMF) content (Wood et al., 1996; Candek-Potokar et al., 1998), and can thus alter meat quality (Cannon et al., 1995), whereas the latter increases IMF content and may improve sensory quality, but gives fatter carcasses (Castell et al., 1994; Goerl et al., 1995).

Objectives

The aim of this study was to investigate the effects of a 30 day-increase in age of pigs slaughtered at 110 kg live weight on carcass and muscle traits, and meat quality parameters. Comparatively to pigs fed *ad libitum* a usual growing-finishing diet, increasing age was obtained according to two strategies: (1) restricted feeding level and (2) restricted feeding level and lysine/energy ratio progressively reduced over the experiment, the latter being expected to give the same carcass composition as the *ad libitum* fed pigs.

Materials and Methods

Animals. A total of 30 Duroc x (Large White x Landrace) pigs issued from 5 litters, all free of the halothane gene, were used. At 30 kg live weight, one castrated male and one female from each litter were placed in AL, R1 or R2 groups. The AL pigs were fed *ad libitum* a standard diet (0.95% lysine, 3250 cal DE/g) and R1 pigs received the same diet at 75% of the *ad libitum* level of their littermate in the AL group in order to increase their age at slaughter by 30 days. The R2 pigs received a blend of the standard diet and of a low-protein diet (0.50% lysine, 3100 cal DE/g) in order to get the same decrease in daily gain than in R1 pigs, and the same carcass composition at slaughter than AL pigs. That was achieved by supplying dietary energy equivalent to 84% of the energy intake of AL pigs and lysine calculated to obtain similar daily BW gains in R1 and R2 pigs. Pigs were slaughtered at 110 ± 5 kg live weight after electrical stunning at low voltage.

Carcass and muscle traits. Carcass weight, lean meat content, and backfat thickness (3rd/4th lumbar vertebra (LV) level) were measured on the day of slaughter. The day after, samples of LD (3rd/4th LV) and *biceps femoris* (BF) muscles were taken, trimmed of all external fat and epimysium, and freeze-dried before water, protein ($=6.25 \times$ nitrogen (Dumas, AOAC 7024)), lipid (Folch et al., 1957), collagen ($=7.14 \times$ hydroxyproline (Bergman & Loxley, 1963)) and collagen heat-solubility (Hill, 1966) determinations.

Meat quality parameters. pH1 (45 min. after exsanguination), pH24 and reflectance (Retrolux - 24h after slaughter) were measured on both muscles. 24h after slaughter, a slice of LD (3rd/4th LV) was taken for estimation of drip loss at 3 and 7 days *post mortem* (Honickel, 1987).

Statistical analysis. An analysis of variance (GLM procedure, SAS, 1989), was carried out to determine the effects of diet, sex and litter.

Results and discussions

At slaughter, final age of R1 and R2 pigs was increased by 30 days, due to a decrease in daily gain of 27%, compared to AL pigs. The R1 pigs exhibited a slightly higher feed efficiency ($p=.10$) and a leaner carcass (lower fat depth and higher lean meat content) than AL pigs, as reported by Candek-Potokar et al. (1998), and in accordance with the well established effects of feed restriction on pig performance and body composition (Quiniou et al., 1995). The R2 pigs had a lower feed efficiency and fatter carcasses than R1, but similar carcass traits than AL pigs. Carcass weight and dressing were not different between groups. Thus, the objective of this study, i.e., an increase in age at 110 kg live weight of 30 days in R1 and R2 groups, and a similar carcass composition in R2 than in AL group, has been achieved.

Muscle chemical composition was greatly influenced by feeding regimen. The R1 pigs exhibited a lower IMF content than AL pigs, particularly in LD, in agreement with Wood et al. (1996) and Candek-Potokar et al. (1998) for a feeding restriction of 20% and 25% of the *ad libitum* level, respectively. On the opposite, R2 pigs showed a higher IMF content than AL pigs, particularly in LD, in accordance with the results of Castell et al. (1994) and Goerl et al. (1995) on the influence of a decrease in lysine or protein/energy ratio of the diet on LD traits. Since meat sensory properties and particularly juiciness are positively related to IMF content (Cannon et al., 1995), the variations in IMF content observed in our study may influence eating quality. Water and protein contents were similar between R1 and AL groups, as previously shown by Wood et al. (1996) and Candek-Potokar et al. (1998). The R2 pigs exhibited lower protein content in LD and BF, and lower water content in LD, as observed by Castell et al. (1994) and Goerl et al. (1995) in LD. Collagen content and heat-solubility of both muscles were similar in the three groups, as reported by Wood et al. (1996), whereas Candek-Potokar et al. (1998) showed a decrease in LD collagen content with feed restriction.

Meat quality parameters (pH1, pH24, reflectance and drip loss) were not affected by the feeding regimen, in accordance with Castell et al. (1994), Goerl et al. (1995) and Candek-Potokar et al. (1998), while Wood et al. (1996) reported a lower drip loss in LD of restricted pigs.

Conclusions

The two feeding regimens carried out in this study allowed to increase age at slaughter of pigs by 30 days at 110 kg live weight, compared to *ad libitum* fed pigs. Feed restriction increased carcass leanness and decreased IMF content, whereas feed restriction combined with a progressively decreased lysine/energy ratio in the diet led to a similar carcass composition, but a higher IMF content than *ad libitum* feeding. Thus, our results suggest that for a given live weight, increasing age at slaughter of pigs may have some positive or negative influence on sensory properties, depending on the feeding regimen applied to reduce the growth rate of animals.

Literature

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Influence of the feeding regimen on performance, carcass and muscle traits, and meat quality parameters

Growth and carcass traits	AL	R1	R2	rsd	Sign. ^a
Number of animals	8	10	8		
Final weight (kg)	110.6	109.9	110.2	1.73	NS
Final age (days)	164.0 a	195.2 b	196.4 b	4.44	***
Daily gain (kg d ⁻¹)	0.909 b	0.672 a	0.648 a	0.031	***
Feed cons (kg d ⁻¹)	2.44 c	1.75 a	1.89 b	0.084	***
Feed efficiency	0.36 ab	0.38 b	0.35 a	0.021	*
Carcass weight (kg)	87.7	85.5	86.3	2.05	NS
Dressing (%)	79.4	78.0	78.5	1.01	NS
Back-fat thickness (mm)	17.7 b	14.8 a	17.3 b	1.79	**
Lean meat content	58.3 a	60.3 b	58.1 a	1.41	**

Muscle traits and meat quality parameters	LD					BF				
	AL	R1	R2	rsd	Sign	AL	R1	R2	rsd	Sign.
Water	74.14 a	73.96 a	73.56 b	1.496	*	74.97	74.94	74.25	1.94	NS
Lipid	1.77 b	1.39 a	2.52 c	0.37	***	2.06 ab	1.74 a	2.20 b	0.355	*
Protein	22.87 b	22.98 b	22.29 a	0.41	***	21.79 b	22.11 b	21.31 a	0.313	***
Collagen	0.51	0.47	0.44	0.115	NS	0.86	0.85	0.82	0.062	NS
Col. solubility (%)	20.6	21.2	19.0	2.28	NS	19.1	18.6	18.7	2.39	NS
pH1	6.42	6.47	6.33	0.20	NS	6.41	6.39	6.29	0.285	NS
pH24	5.51	5.48	5.47	0.07	NS	5.62	5.58	5.59	0.056	NS
Reflectance	40.2	39.2	44.5	5.55	NS	36.4	36.0	39.3	5.22	NS
Drip loss (%) 3 d.	6.46	5.93	6.92	2.06	NS	-	-	-	-	-
Drip loss (%) 7 d.	9.46	8.79	9.84	1.42	NS	-	-	-	-	-

^a *** : p<.001; ** : p<.01; * : p<.05; † : p<.10; NS : p>.10. Means within row affected different letters differed significantly (p<.05).