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Influence of slaughter weight on growth and carcass characteristics of Alentejano pigs

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SUMMARY – To study the effects of slaughter weight on growth and carcass characteristics of Alentejano pigs, thirty pigs were used. 20 kg LW animals were allocated in individual pens outdoors and fed a commercial diet (15% CP, 3100 Kcal DE) offered at 85% *ad libitum*. Pigs were sequentially slaughtered in groups (n=5) with an average BW of 40, 70, 80, 90, 100 and 110 kg. The growing period, feed intake, feed: gain and feed cost per Kg gain increased significantly ($P<0.05$) with the increase of slaughter weight, but commercial yield of carcass decreased (51.7% at 40 kg, 45-45.6% at 70-80 kg and 41.5-42.9 at 90-110 kg). Lean percentage of ham decreased slightly (53.8 to 43.1%) and fat increased strongly (15.9 to 32.1%) with the increase of slaughter weight. Results suggested that the most desirable slaughter weight would be between 90-100 kg.

Keywords: Alentejano pig, slaughter weight, growth, carcass characteristics.

RESUME – "Influence du poids d'abattage sur les performances de croissance et les caractéristiques de la carcasse chez le porc Alentejano". Trente porcs Alentejano ont été utilisés. A 20 kg de poids vif les animaux ont été placés en cages individuelles en plein air et nourris avec un aliment commercial (15% PB et 3100 kcal E.D.) distribué à 85% de *ad libitum*. Les porcs ont été abattus (n=5) à un poids vif moyen de 40, 70, 80, 90, 100 et 110 kg. Le poids d'abattage a affecté de façon significative ($P<0,05$) le gain moyen quotidien et l'indice de consommation. Le rendement commercial de la carcasse a diminué avec l'augmentation du poids d'abattage (51,7% à 40 kg, 45,0-45,6% à 70-80 kg et 41,5-42,9% entre 90-110 kg). Le pourcentage de maigre du jambon a diminué faiblement (53,8 contre 43,1%) et le pourcentage de gras a augmenté fortement (15,9 contre 32,1%) avec l'augmentation du poids d'abattage. Les résultats suggèrent que le porc Alentejano devrait être abattu à un poids de 90-100 kg.

Mots-clés : Porc Alentejano, poids d'abattage, performances de croissance, caractéristiques de la carcasse.

Introduction

The Alentejano pig is an autochthonous breed reared in the south of Portugal. This breed derives from the primitive *Sus scrofa mediterraneum*, which colonised the Iberian Peninsula in the sixth millennium B.C. These unselected pigs have poor productive traits, but a very good adaptation to the environment that allows the extensive production system and the use of natural feeding sources such as the grass and the acorns. Until the second half of the 20th century the Alentejano pig was the most important Portuguese swine breed and the main economic product in the majority of the "montados" (oak woods). In the traditional production system pigs were slaughtered with 120-150 kg and with 18-24 months of age. Their meat was used mainly for the elaboration of dry cured meat products of high quality (Nunes, 1993).

The period between 1950 and 1990 was marked by the dramatic decrease in the Alentejano pig population and the strong development of exotics swine breeds and the intensification of the production systems. A new interest in Alentejano breed began during the 1990s with the formation of producer association (UNIAPRA), the regulation of the quality of the products (PDO Presunto de Barrancos), the development of the industrial sector and the attitude of the consumers about questions such ecological animal production, animal welfare or quality of the meat (Freitas *et al.*, 2004).

Today there is a growing interest towards the use of autochthonous pig breeds reared under sustainable and ecologically friend production systems (López-Bote, 1998) and the market of fresh meat had became one of the targets of Alentejano pig producers. In recent years a number of scientific studies about the characteristics of meat and dry meat cured products of Alentejano pigs fattened at acorns have been carried out (Nunes, 1993; Neves *et al.*, 1996; Freitas, 1998). However, there is a little information about the characteristics of fresh meat productive system. The knowledge of the most favourable slaughter weight is essential to improve profitable Alentejano pig fresh meat production.

The present study, inserted in the Project Agro "Optimization of the Alentejano swine production in order to improve meat quality" aimed to investigate the influence of the slaughter weight on growth performances and carcass characteristics of Alentejano pig in order to improve fresh meat production

Materials and methods

A total of thirty castrated Alentejano pigs were used in this study. Following the traditional management system, all pigs (males and females) were castrated after weaning (60 days old). With 20 kg LW animals were allocated in individual pens (1 x 2 m) at outdoor and fed a commercial diet (15% crude protein, 3100 Kcal DE). This feed was offered at 85% of *ad libitum* to prevent excessive carcass adiposity in a single daily meal (9.00 h). The animals were weekly weighed before their morning meal and each experimental group daily feed allowance was adjusted for the following week.

After 24h fasting the pigs were sequentially slaughtered in groups (n=5) with an average BW of 40, 70, 80, 90, 100 and 110 kg. Pigs were killed by electro narcosis and bleeding at the Sousel municipal slaughterhouse (Sousel, Portugal).

After slaughtering, the carcasses were split longitudinally and weighed with head and flare fat and kidneys (hot carcass weight). The carcass yield was calculated as the ratio between slaughter weight and cold carcass weight. Carcass length was measured as the distance from the first rib to the pubic symphysis. Back fat thickness was measured on 6 cm of the dorsal midline at three anatomical sites: between the 3rd and 4th lumbar vertebrae, the last rib and between the 3rd and 4th ribs. To measure the area of loin, muscle was exposed by perpendicular cuts at the three related anatomical sites and muscle area traced using acetate paper.

The left hand side of the carcass was divided into commercial cuts according to the Portuguese Norm (NP-2931) and commercial yield (% of high value meat cuts) calculated. Legs were further dissected into separable lean, fat bone and skin.

Statistical analyses were performed by a one-way ANOVA with the statistical software SPSS for windows. Means comparison was made by SNK test and differences were considered significant when $P \leq 0.05$.

Results and discussion

All the pigs remained in good health throughout the experimental period and no diet refusals were detected. No differences between castrated males and castrated females were found at any slaughter weight neither in growth performances nor in carcass characteristics. Therefore, both castrated males and females were considered together in results.

The effects of slaughter weight on growth performance are presented in Table 1. As expected slaughter weight had a significant effect ($P < 0.05$) on the growing period, feed intake, feed:gain and feed cost/kg gain.

Table 1. Influence of slaughter weight on growth performances

Slaughter weight (kg)	40	70	80	90	100	110
Growing period (days)	180 ^a	256 ^b	275 ^c	297 ^d	324 ^e	360 ^f
Daily gain (g/day)	285 ^a ± 8	407 ^{bc} ± 4	422 ^c ± 5	419 ^c ± 5	412 ^{bc} ± 8	387 ^b ± 8
Feed intake (kg)	50 ^a	147 ^b	198 ^c	262 ^d	336 ^e	432 ^f
Feed: Gain	4.46 ^a ± 0,1	4.64 ^{ab} ± 0,1	4.76 ^{ab} ± 0,1	5.05 ^{bc} ± 0,1	5.37 ^c ± 0,1	5.98 ^d ± 0,1
Feed cost / kg gain (€)	1.13 ^a ± 0,1	1.17 ^{ab} ± 0,1	1.20 ^{ab} ± 0,1	1.27 ^{bc} ± 0,1	1.35 ^c ± 0,1	1.51 ^d ± 0,1

Different superscripts across rows indicate significant differences ($P < 0.05$).

With the increase of slaughter weight an increase of the growing period was observed. Pigs slaughtered at 110 kg had needed more 27 and 63 days than those slaughtered at 100 and 90 kg respectively. Average daily gain increased until 80 kg slaughter weight and decreased after this weight, mainly in pigs slaughtered at 110 kg (285, 407, 422, 419, 412 and 387 g/day, respectively at 40, 70, 80, 90, 100 and 110 kg slaughter weight). Feed intake increased significantly ($P<0.05$) and feed conversion efficiency deteriorated ($P<0.05$) with the increasing of slaughter weight. Pigs slaughtered at 110 kg had the poorest feed:gain value. Feed cost / kg gain increased significantly ($P<0.05$) with the slaughter weight. Pigs slaughtered at 110 kg had the highest cost.

Growth performances at different live weight intervals are presented in Table 2. Daily gain increased until 70-80 kg live weight (from 285 to 480 g/day) and then decreased, first slightly (426 g/day at 80-90 kg) and after more marked (314 g/day at 100-110 kg). Values of feed conversion ratio showed a constant decrease throughout life, which was more marked from 80 kg. Therefore feed cost / kg gain increased dramatically at the end of fattening phase (100-110 kg).

Table 2. Growth performances at different live weights

Interval weight (kg)	20-40	40-70	70-80	80-90	90-100	100-110
Daily gain (g/day)	285 ^a ± 8	407 ^c ± 4	480 ^d ± 12	426 ^c ± 16	411 ^c ± 33	314 ^b ± 19
Feed: Gain	4.46 ^a ± 0.1	4.64 ^a ± 0.1	5.16 ^a ± 0.1	6.11 ^b ± 0.1	6.86 ^c ± 0.1	7.82 ^d ± 0.1
Feed cost / kg gain (€)	1.13 ^a ± 0.1	1.17 ^a ± 0.1	1.30 ^a ± 0.1	1.54 ^b ± 0.1	1.73 ^c ± 0.1	1.97 ^d ± 0.1

Different superscripts across rows indicate significant differences ($P<0.05$).

Daily gain increased until 70-80 kg live weight (from 285 to 480 g/day) and then decreased, first slightly (426 g/day at 80-90 kg) and after more marked (314 g/day at 100-110 kg). Values of feed conversion ratio showed a constant decrease throughout life, which was more marked from 80 kg. Therefore feed cost / kg gain increased dramatically at the end of fattening phase (100-110 kg).

The effects of slaughter weight on growth performance are in agreement with many other reports (De Pedro, 1987; Freitas, 1998; Mayoral *et al.*, 1999).

Carcass characteristics are presented in Table 3. As expected, a clear increase ($P<0.05$) of hot carcass weight was observed with the increase of slaughter weight. Yield carcass increased from 40 to 70 kg but values of pigs slaughtered from 70 to 110 kg were not statistically different. Carcass length increased slightly ($P<0.05$) with the increase of slaughter weight.

Table 3. Effect of slaughter weight on carcass characteristics

Slaughter weight (kg)	40	70	80	90	100	110
Hot carcass weight (kg)	32.8 ^a ± 0.3	56.6 ^b ± 0.4	65.3 ^c ± 0.1	74.2 ^d ± 0.5	81.3 ^e ± 0.8	88.3 ^f ± 1.3
Yield carcass (%)	77.8 ^a ± 0.3	79.8 ^b ± 0.4	81.5 ^{bc} ± 0.1	82.3 ^c ± 0.5	80.9 ^{bc} ± 0.8	80.1 ^b ± 1.0
Carcass length (cm)	68.0 ^a ± 0.1	71.0 ^b ± 0.1	73.9 ^c ± 0.1	73.2 ^c ± 0.1	72.3 ^{bc} ± 0.1	75.6 ^d ± 0.1
Back fat thickness (cm)	1.60 ^a ± 0.1	3.21 ^b ± 0.3	4.13 ^c ± 0.2	5.10 ^d ± 0.1	5.56 ^d ± 0.3	5.30 ^d ± 0.3
Loin muscle area (cm ²)	15.5 ^a ± 0.8	17.9 ^b ± 0.9	18.5 ^b ± 1.0	20.0 ^b ± 1.1	20.1 ^b ± 0.8	20.4 ^b ± 0.9
Commercial yield (%)	51.7 ^d ± 0.8	45.0 ^{bc} ± 0.6	45.6 ^c ± 1.0	42.9 ^{ab} ± 0.7	41.5 ^a ± 0.7	42.6 ^{ab} ± 0.5

Different superscripts across rows indicate significant differences ($P<0.05$).

The back fat thickness (average of measurements at 3rd and 4th lumbar vertebrae, last rib and between the 3rd and 4th ribs) of pigs slaughtered at 40 kg (1.60 cm) was significantly lower ($P<0.05$) than that observed in pigs slaughtered at 70 Kg (3.21 cm), 80 kg (4.13 cm) and 90-110 kg (5.10-5.56 cm). Values measured at pigs slaughtered between 90 and 110 kg were similar. These values were higher than those reported for selected pig breeds (Giles *et al.*, 1981; Affentranger *et al.*, 1996) but similar of those reported for nom selected pig breeds such Alentejano pigs (Freitas *et al.*, 1996) and Iberian pigs (De Pedro, 1987; Mayoral *et al.*, 1999).

Loin muscle area (average of measurements at 3rd and 4th lumbar vertebrae, last rib and between the 3rd and 4th ribs) increased only slightly with the increase of slaughter weight (15.49 to 20.24 cm²). Values of pigs slaughtered between 70 and 110 kg were similar and significantly higher than those observed in pigs slaughtered at 40 kg. The results showed that Alentejano pigs have a limited genetic potential for lean gain.

Commercial yield (% of high value meat cuts) decreased with the increase of slaughter weight (51.7% at 40 kg, 45-45.6% at 70-80 kg and 41.5-42.9% at 90-110 kg). The decrease of commercial yield of carcass with the increase of slaughter weight was due to a decrease of the proportion of primal cuts such the ham, the foreleg and the loin and an increase of the proportion of fat cuts of less value such the lard and the belly.

Table 4. Effect of slaughter weight on tissue composition of ham

Slaughter weight (kg)	40	70	80	90	100	110
Ham weight (kg)	4.4 ^a ± 0.1	6.9 ^b ± 0.1	8.0 ^c ± 0.2	8.8 ^d ± 0.2	10.0 ^e ± 0.2	10.6 ^f ± 0.2
Lean (%)	53.8 ^c ± 0.8	51.9 ^c ± 0.6	46.2 ^b ± 0.7	44.8 ^{ab} ± 1.2	42.6 ^a ± 0.7	43.1 ^a ± 0.5
Fat (%)	15.9 ^a ± 0.8	19.2 ^b ± 1.2	26.2 ^c ± 0.6	28.1 ^c ± 1.8	32.6 ^d ± 0.6	32.1 ^d ± 1.4
Bone (%)	21.1 ^b ± 0.9	15.8 ^a ± 0.6	16.1 ^a ± 0.4	15.3 ^a ± 0.2	14.1 ^a ± 0.7	14.5 ^a ± 0.2

Different superscripts across rows indicate significant differences (P<0.05).

Tissue composition of ham was significantly (P<0.05) affected by slaughter weight (Table 4). Percentage of lean decreased slightly (53.8 to 43.1%) and fat increased strongly (15.9 to 32.1%) with the increase of slaughter weight. These results were in accordance with the evolution of back fat thickness and commercial yield of the carcass.

Conclusions

The results showed that Alentejano pigs have a high capacity for fat deposition and a limited genetic potential for lean gain. The increase of live and carcass weight is due mainly to an increase in fat deposition. A slaughter weight between 90-100 Kg seems to be the more adequate in order to reduce costs without affected significantly carcass characteristics. However, further research should be carried out to evaluate the effects of slaughter weight on meat quality and to determine the optimal slaughter weight for improve Alentejano pig fresh meat production.

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