EFFECT OF SELECTION FOR GROWTH RATE ON CARCASS AND MEAT COMPOSITION IN RABBITS

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ABSTRACT

Effect of selection for growth rate on carcass and meat chemical composition in rabbit was studied. Animals from a control (C) group (7th generation, *n*=60) and a selected (S) group (21st, *n*=60) were bred contemporarily and slaughtered at 63 days of age. Liveweight and carcass weight was higher for the selected group, but there were no differences in dressing out percentage. Selected animals were better conformed. The hind part percentage was lower in the selected group, although selection did not affect the percentage of the other parts of the carcass and most of the viscera. Meat to bone ratio in the hind leg and therefore in the carcass did not differ between groups. Selected animals showed a higher percentage of dissectible fat and it seems that have a higher fat percentage in the meat of the hind leg, that leads to a lower moisture content.

Key words: selection, growth rate, carcass composition, chemical composition, rabbit.

INTRODUCTION

Commercial rabbit meat is usually produced on a three-way cross. Males and females from two lines selected for litter size are mated in order to obtain crossbred females. These females are subsequently mated with terminal sires from lines selected for growth rate. The later selection may affect carcass and meat quality.

There are few studies about the effect of selection for growth rate on carcass composition and meat chemical composition in rabbit. Usually, studies compare lines selected for this character with other lines (OZIMBA and LUKEFAHR, 1991; PLA *et al.*, 1998; GÓMEZ *et al.*, 1998), but the differences found could be due to the different genetic origin of the lines and not to the effect of selection for growth rate. BLASCO *et al.* (1990) compared a line selected for growth rate with results obtained in this line some generations before, using as a control group a line selected for litter size (a trait not correlated with growth rate). LARZUL *et al.* (2000) and LARZUL *et al.* (2001) compared the carcass composition of two lines of rabbits divergently selected for body weight.

A preliminary study by PILES *et al.* (2000) found an effect of selection only in dissectible fat percentage in the carcass and fat percentage in meat of the hind leg with 7 generations of selection. The aim of this study is to evaluate the effect of selection for growth rate on carcass composition and meat chemical composition in the same line of rabbits, comparing a group of animals selected by growth rate with an unselected control group 14 generations later. Biochemical, quality and texture characteristics of the meat of these rabbits have been studied by RAMIREZ *et al*. (2004).

MATERIALS AND METHODS

Animals

The experiment was carried out with 120 rabbits, originated from line R, a synthetic line selected for growth rate between 4 and 9 weeks of age at the Universidad Politécnica de Valencia. Animals came from two groups: Control (C) and Selection (S), with 60 animals in each group. In the 7th generation of selection, embryos were recovered and vitrified. Later, embryos were devitrified and transferred. Offspring of the animals obtained from these embryos formed group C, in order to avoid the effect of vitrification-devitrification. Group S was formed with offspring of the 21st generation and both groups were bred contemporarily under the same conditions.

After weaning at 28 days of age, animals were placed in collective places of 8 kits and fed *ad libitum* with a standard diet (composition as a percentage of dry matter: moisture, 9.37%; crude protein, 14.81%; ether extract, 3.23%; crude fibre, 16.47%; ash, 8.17%). At 63 days of age, animals were weighted and slaughtered. Slaughterhouse was close to the farm, so stress caused by transport was minimal. No fastening was practised. After 30 minutes in a ventilated area, carcasses were cooled in a refrigerated chamber at 3ºC.

Carcass and meat variables

At 24 postmortem, carcasses were transported to the laboratory, weighted to obtain the Chilled Carcass Weight and butchered according to the norms of the WRSA (BLASCO and OUHAYOUN, 1996). Dorsal length, thigh length and lumbar circumference were measured. Head, liver, kidneys, the set of thoracic organs and the inguinal fat were removed and weighted in order to obtain the Reference carcass weight. Perirenal fat and scapular fat were also removed and weighted. After the Technological Division the weight of fore legs, thoracic cage, loin part and hind part obtained was measured. One of the hind legs was dissected and meat and bone were weighted in order to obtain the meat to bone ratio.

Dressing out percentage (chilled carcass x100/live weight) and length to circumference ratio, (dorsal length + thigh length)/lumbar circumference, were calculated. Head, liver, kidney, thoracic viscera and reference carcass were expressed as percentage of the chilled carcass weight. Scapular fat, perirenal fat and dissectible fat, fore legs, thoracic cage, loin part and hind part were expressed as a percentage of the reference carcass weight.

Protein, fat and moisture percentages of the meat of the hind leg were determined by NIR spectroscopy (PLA *et al.*, 2004).

Statistical analysis

Least square means were calculated, using the General Linear Model Procedure of the SAS package (SAS INST. INC., CARY, NC) in a model that includes group as a fixed effect.

RESULTS AND DISCUSSION

Tables 1 and 2 show the liveweight and the main characteristics of the carcass. Liveweight at 63 days of age was higher for group S, confirming that selection has been successful, as PILES *et al.* (2000) observed previously when groups differed only in 7 generations of selection. However, for these authors differences between groups in weight disappear for the chilled and reference carcass, while results of this work show a higher weight of both carcasses for group S. These results agree with LARZUL *et al.* (2000) and LARZUL *et al.* (2001), which found differences not only in liveweight but also in carcass weight for two groups of rabbits divergently selected for growth rate. However, there were no differences in dressing out percentage, which agrees with PILES *et al.* (2000), LARZUL *et al.* (2000) and LARZUL *et al.* (2001).

Carcasses of group S showed a lower length to circumference ratio, which leads to a better conformation respect to the group C. Although PILES *et al.* (2000) did not find differences in percentage of the different viscera in the carcass, in this work kidney percentage was significantly different between groups, showing the group S a higher value than the group C (1.33% respect to 1.23%). This difference would be irrelevant from the point of view of the carcass composition, but no conclusions can be reach respect to changes in the physiology of the animal. Selection did not affect liver and thoracic viscera percentage. Differences found between groups for the lveweight and chilled and reference carcass weight disappear when the reference carcass is expressed as a percentage of the chilled carcass.

According with results found by PILES *et al.* (2000), selection did not affect fore legs and thoracic cage percentage, just as the loin part percentage respect to the reference carcass. Group S showed a lower hind part percentage (36.75% respect to 37.45%) but these differences may be irrelevant for the carcass composition. Meat to bone ratio did not differ between groups, therefore considering that this relation is a good predictor of the meat to bone ratio of the whole carcass (HERNÁNDEZ *et al.*, 1996) selection did not affect this ratio neither in the leg nor in the carcass. This was expected, because animals were slaughtered at the same age, which is approximately coincident with the same degree of maturity. When two groups of animals are compared at the same degree of maturity their relative carcass composition are very similar (BUTTERFIELD, 1988).

Results obtained in this experiment showed a higher percentage of fat of the reference carcass in group S, both scapular and perirenal fat, which means a higher fattening of selected animals. These results agree with LARZUL *et al.* (2003) that found a positive correlation between perirenal fat and body weight in rabbits. In pigs, as feed intake increases, fat and protein deposited increases but, over a point of feed intake, deposition of protein stops and the extra-feed consumption goes into the production of fat (WHITTEMORE, 1993). If this mechanism holds also in rabbits, the higher percentage of dissectible fat in the group S may be due to the higher feed intake of group S respect to group C (SANCHEZ *et al.*, 2004). However, PILES *et al.* (2000) observed a lower fat content of dissectible fat deposits in the group selected.

Table 1. Least square means (LSM) and standard errors (se) of the liveweight (g), chilled carcass weight (g) and main chilled carcass components (%) respect to the chilled carcass weight for the groups Control (C) and Selection (S)

	LSM		se	sig.
	C	S		
Liveweight	2263	2485	33	***
Chilled carcass weight	1230	1348	21	***
Dressing out percentage	54.31	54.14	0.30	ns
Length to circumference ratio	2.02	1.98	0.01	*
Head percentage	8.63	8.36	0.07	*
Liver percentage	6.83	7.25	0.18	ns
Kidneys percentage	1.23	1.33	0.02	***
Thoracic viscera percentage	2.70	2.61	0.04	ns
Reference carcass percentage	79.83	79.60	0.25	ns

ns: no significant; *: P<0.05; ***: P<0.001

Table 2. Least square means (LSM) and standard errors (se) of the reference carcass weight (g) and main reference carcass components (%) respect to the reference carcass weight for the groups Control (C) and Selection (S)

	LSM		se	sig.
	C	S		
Reference carcass weight	983	1075	18	***
Scapular fat percentage	0.63	0.78	0.03	**
Perirenal fat percentage	1.51	1.68	0.06	*
Dissectible fat percentage	2.16	2.55	0.07	***
Fore legs percentage	28.75	29.06	0.16	ns
Thoracic cage percentage	12.73	12.41	0.19	ns
Loin part percentage	31.37	31.49	0.15	ns
Hind part percentage	37.45	36.75	0.17	**
Meat to bone ratio	5.47	5.48	0.06	ns

ns: no significant;*: P<0.05; **: P<0.01; ***: P<0.001

Table 3 shows the chemical composition of meat from the hind leg. Fat percentage seems to be higher in the selected group, according with the results obtained for the dissectible deposits. These results agree with GONDRET *et al.* (2003) that found a higher intramuscular lipid percentage in lines selected for growth rate. It could be explained by a slightly positive genetic correlation between average daily gain and the intramuscular fat that was observed before by MAIGNEL *et al.* (2003) in pigs. However, results differ with PILES *et al.* (2000) that found a lower fat content in meat of animals of group S. There were no differences in protein percentage and due to the higher fat percentage of the meat of the hind leg, group S shows lower moisture percentage than the group C.

Table 3. Least square means (LSM) and standard errors (se) of the chemical composition of meat from the hind leg for the groups Control (C) and Selection (S)

	LSM		se	sig.
	C	S		
Moisture percentage	74.51	74.22	0.10	*
Protein percentage	20.97	20.95	0.05	ns
Fat percentage	2.97	3.20	0.10	†

ns: no significant; †: P<0.10; *: P<0.05;

CONCLUSIONS

Selection for growth rate had a correlated response, not only in liveweight at 63 days of age but in chilled and reference carcass weight. Dressing out percentage has not been affected. Selection seems to produce animals more conformed, as length to circumference ratio has increased. Most of the different parts of the carcass have not changed by selection, and meat to bone ratio in the hind leg and subsequently in the carcass has not been affected. Finally, selection has produced an increase of dissectible fat and fat percentage in meat.

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