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Comparison of carcass and meat characteristics of three rabbit lines selected for litter size or growth rate

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Abstract

Rabbits from three synthetic lines were compared. Line V and A were selected for litter size at weaning and line R was selected for growth rate between weaning and slaughter time. Forty animals of each line were slaughtered at 9 week of age. Comparisons between lines were made using Bayesian statistical techniques. Line R had a higher meat/bone ratio, higher loin percentage and higher ultimate pH of *M. Longissimus lumborum* (LL) than A and V, but lower dressing out and lower hind part percentages. Some differences between lines in carcass and meat colour were found. No differences were found for percentage of released water of LL and for the activity of energy metabolic enzymes. At present, rabbit carcasses are not costed according to their retail cuts or meat/bone ratio, but dressing out percentage is taken into account, thus breeding companies should be concerned about lower carcass yield of lines selected by growth rate.

Keywords: Rabbit; Line comparison; Bayesian statistics; Meat quality

1. Introduction

Rabbit meat represents 1.2% of total meat produced in the EU, a figure similar to the 2.5% of lamb and goat meat (FAO Stat, 2004). About three quarters of all this meat is produced in Italy, Spain and France. Selection programs in rabbit commercial schemes are based on three way crosses in which two lines are selected for litter size and one line is selected for growth rate (Baselga & Blasco, 1989; Lebas, Coudert, Rochambeau, & Thébault, 1996). Although commercial lines are now often synthetic lines, lines selected for litter size are derived from medium size breeds (normally of White New Zealand and Californian origin) and lines selected for growth rate are often derived from large size breeds. Between lines meat quality comparisons have then a double interest. On one hand it is easier to find differences in meat quality than when comparing lines with similar origins, and on the other hand, genetic variation between lines can be used for further research to find major genes or to create new synthetic lines having genetic variation for traits in which within line variation is exhausted. Several studies have been published on breed comparisons, for carcass traits in rabbits since the pioneering work of Rouvier (1970) on carcass traits and Ouhayoun (1989) on meat quality traits, but few studies on lines selected for different traits have been published. Pla, Hernandez, and Blasco (1996), Gomez, Baselga, Rafel, and Ramon (1998) Pla, Guerrero, Guardia, Oliver, and Blasco (1998) compared lines selected for litter size or growth rate, but they compared the lines at the same weight, thus at different states of maturity. To compare animals at the same commercial weight may be useful for practical commercial purposes, but Taylor (1985) established that lines or breeds should be compared at the same stage of maturity; otherwise attributed line differences may only be due to the fact that they were measured at a different points in the growth curve. Rabbit is a good experimental model for meat carcass and quality because it is possible to perform experiments more rapidly and at a lower cost than in other species. Given the short generation interval of rabbit selection programs (between six and nine months), lines selected

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for growth rate rapidly diverge from lines selected for litter size, thus it is interesting to evaluate these lines after a large number of generations of selection, at the same stage of maturity.

The variation in meat quality also depends on the muscle metabolic type. Several studies point out that oxidative muscles are more tasty and juicy (Valin, Touraille, Vigneron, & Ashmore, 1982). Glycolytic metabolism could be enhanced by selection for rapid growth and improved muscularity (Ashmore, Tompkins, & Doerr, 1972). In fact, Ouhayoun and Delmas (1983) found that rabbits with a higher average daily gain presented a higher glycolytic activity that could impair meat quality. However, Hernández, Aliaga, Pla, and Blasco (2004) found that selection for growth rate did not affect the metabolic enzyme activities in rabbit.

Recently, Blasco (2005) has proposed Bayesian statistics and Monte-Carlo Markov Chain (MCMC) as a new and powerful tool for meat quality analyses. In classical statistics, a significant difference does not provide an exact measurement of the evidence provided by the data. A *P*-value cannot be interpreted as a measure of significance because when repeating the experiment, the *P*-value changes. An advantage of Bayesian procedures is that we have an exact account of the evidence provided by the experiment. Thus, the probability of differences between lines being higher than 0 can be for example 0.94 or 0.89, and we still can consider that we have evidence enough of these differences for our purposes.

The objective of this paper is to compare carcass and meat characteristics of rabbits from lines selected for litter size or growth rate a large number of generations, using Bayesian techniques.

2. Materials and methods

2.1. Animals

Rabbits from three synthetic lines were used in the experiment. Line A has a New Zealand origin, line V is a blend of New Zealand and California origins and line R was formed by mixing commercial hybrids used as terminal sires. Line V and A were selected for litter size at weaning for 30 and 33 generations, respectively. Line R was selected for growth rate between weaning (at 4th week of age) and slaughter time (9th week of age) for 24 generations in the farm of the Univesidad Politécnica de Valencia.

Forty animals of each line were reared in collective cages ($50 \times 80 \times 33$ cm) with eight rabbits per cage from weaning to slaughter at 9 weeks of age. Animals were fed ad libitum with a commercial diet (barley and wheat as the primary grains, wheat bran, barley straw, and alfalfa hay as the fiber source) formulated for growing rabbits (16% crude protein, 15.5% fiber, 3.4% fat). Animals were slaughtered at the abattoir on the farm, thus they did not suffer stress due to transport. Animals were electrically stunned and bled, without fasting.

2.2. Carcass characteristics

Carcasses were prepared according to the norms of the World Rabbit Science Association (WRSA) (Blasco & Ouhayoun, 1996) by removing the skin, the distal parts of the tail, fore and hind legs, urinogenital organs and the digestive tract. Hot carcasses were suspended in a ventilated area for 30 min, and then were chilled at 3–4 °C until 24 h post-mortem. The head, liver, lungs, thymus, trachea, oesophagus, heart and kidneys, were then removed to obtain the "reference" carcass, containing only meat, fat and bone.

The following traits were recorded: LW, live weight; CCW, chilled carcass weight; RCW, reference carcass weight (carcass without head and organs); HW, head weight; LvW, liver weight; KiW, kidneys weight; LHW, thymus, trachea, oesophagus, lung and heart weight; DFaW, dissectible fat weight of the chilled carcass (inguinal, IFaW; perirenal, PFaW; and scapular SFaW).

Reference carcasses were divided into technological joints as the WRSA indicates (Blasco & Ouhayoun, 1996). Joints obtained were weighed and consisted of: FLW, fore legs; TW, thoracic cage; LoW, loin; HPW: hind part. From the hind part a hind leg (HLW) was carefully dissected to separate bone (HLBW) from the edible meat (HLMW).

The following were calculated: DoP, dressing out percentage (100 times CCW/LW); the weights of the following tissues as a percentage of CCW; HP, head %; LvP, liver %; KiP, kidneys %; LHP, set of thoracic viscera %; DFaP, dissectible fat %; IFaP, inguinal fat %; PFaP, perirenal fat %; SFaP, scapular fat %; FLP, fore legs %; TP, thoracic cage %; LoP, loin %; HPP, hind part % and the M/B, meat to bone ratio of the hind leg (HLMW/HLBW).

Colour in the CIELAB space (L^* a^* b^*) of the carcasses was measured on loin surface at the 4th lumbar vertebra of the left side at 24 h post-mortem using a CR300 Minolta Chromameter.

2.3. Meat quality variables

The muscle pH was measured at 24 h post-mortem in LL (pHu LL) at the level of the 4th lumbar vertebra of right side with a Crison MicropH 2001 (Crison instruments, Barcelona, Spain), using a combined electrode penetrating 3 mm.

Water holding capacity was measured on a sample from loin meat (7th lumbar vertebra). A sample of intact meat weighing 300 ± 5 mg was placed on a previously desiccated and weighed (0.0001 g accuracy) 7-cm disk of Whatmann No. 1 filter paper. After weighing, the paper with meat was placed between two Plexiglas plates and a load of 2.25 kg was applied for 5 min. The damp paper filter was rapidly weighed after accurately removing the compressed meat. The mean of two replicates were used in analysis. The percentage of released water (PRW) was calculated as ratio percent of weight of released water (damp filter paper weight − dry filter paperweight) to intact meat.