PERFORMANCES AND MEAT QALITY OF LEPRINO VITERBESE BREED RABBIT, BRED WITH THREE DIFFERENT HOUSING SYSTEM.

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Background

Rabbit meat consumption is important in Italy, Spain and France and in these Country different breeding systems and diets were studied, besides the increased interest in animal welfare have spurred the study of less intensive rearing systems (Dalle Zotte, 2002).
Many investigations have been carried out to study the effects of alternative housing systems on performances, meat quality and welfare of rabbit, but the results have often in conflict, (Di Lella et al. 1999, Dal Bosco et al. 2002); besides some hybrids don't adapt to extensive system, while the Leprino Viterbese has shown good performances. The Leprino Viterbese is a hybrid obtained crossing meat breeds (70 % New Zealand White; 10% Belgian Hare; 10% local breed; 5% English Lup) and Viterbo local breed. Its name derives from particular colour of fur and morphological characters that remember hare.
This hybrid is peculiar for its rusticity that allows it to be raised in extensive conditions and for the image of healthiness transmitted to the consumer by its expect.

Objectives

The aim of this work is to investigate the effects on the meat quality of three housing systems and compare the performances of Leprino Viterbese with industrial hybrid bred in intensive system.

Materials and methods

The experiment was carried out on 68 male rabbits, 51 of Leprino Viterbese and 17 of industrial hybrid, intensively reared in cages (Hi). The Leprino Viterbese animals were divided in three housing type: 17 open air (Va), 17 on the turf with mobile cages(Vt) and 17 intensively reared in cages (Vi).
The Leprino Viterbese animals, after weaning, were randomly assigned to the three experimental groups and fed the same growth food.
The industrial hybrids (Hi) were reared with the same food given to Leprino Viterbese rabbits, and the experimental animals were chosen randomly in an industrial farm which bred, in the same time and intensively, the Vi rabbits.
The animals were slaughtered at the same live weight, reaching in the average 2480 g of live weight at 89 days of age.
The carcasses were aged for 24 hours at 3°C, then they were weighed without liver and dissected to separate and to weigh the *longissimus thoracis et lumborum* muscle (LD), the thigh, the kidney fat and shoulder fat.
The thighs were dissected in order to estimate percentages of lean meat, bone and fat. On thigh the s*emitendinosus* muscle weight and length and femur length were determined.
To perform the physical and chemical analysis, both LD were divided in five samples for water holding capacity (WHC), shear force (WBS) on raw and cooked meat, colour and chemical analysis.
WHC was performed using the Grau and Hamm method (Hamm 1986).
Shear force was measured on raw and cooked meat (in water bath at 75°C for 30'), by a Warner Bratzler device mounted on Instron 1011, on 3 cores for each animal of square section 1x1 cm (Chrystall et al. 1994).
Colour coordinates were measured at four points on the surface of muscle split in horizontal. After exposure to oxygen for 1 hour, lightness (L*), redness (a*), yellowness (b*) were determinate with CIEL*a*b* System and from the colour coordinate, hue angle (H = arctang b*/a*) and chrome ($C=(a^{*2}+b^{*2})^{1/2}$) were calculated according to Cassens *et al. (*1995), using D65 illuminant with spectrophotometer Minolta CM-2600d. In the same time visual reflectance spectra (R%) between 360-740 nm (by steps of 10 nm) were measured, in this paper only the points with significantly differences among groups were referred.
The analysis of variance with GLM procedure of statistical package of SAS using a monofactorial model (housing types) was performed. The analysis included also contrast test for differences between genotypes

within the same housing type (intensive breeding, Vi *versus* Hi) and between extensive and intensive breeding (Va and Vt *versus* Vi and Hi). Finally correlation between WHC, WBS and visual reflectance spectrum was performed.

Results and discussion

Carcass weight was similar for the groups (1406.4 g in the average), because the animals have been slaughtered at fixed live weight (2500 g about). The groups, fed with same diet, reached the prefixed weight at similar age (89 days in average). Also if carcass had similar weight subcutaneous and internal sites showed different fat deposition (table 1), in fact industrial hybrid (Hi) had low fat in perirenal deposition (9.14 g), compared to the others, particularly to Va group, that showed the highest value (16.01 g), in addition to the housing effect, the two genotypes (Leprino Viterbese and industrial hybrid) had different perirenal fat. The Leprino Viterbese is more precocious than the other and therefore it tends to fatten more, while the rabbits reared extensively didn't show slower maturity as reported in in Margarit et al. (1999), when comparing classic cages with mobile cages on grass. The animals bred on open air (Va) showed a highest development on *longissimus thoracis et lomborum* weight (86.84 g), differing significantly only by Vt group (77.89 g), while the rabbits bred in intensive way had intermediate values and they didn't differ significantly from the two extensive groups. The LD weight, however was lower than that reported in Pla et al. (1996) for different genotypes. The greater body development of the group Va was confirmed also by the thigh weight, but differed significantly only by Hi (193.9 g vs 185.5 g) and was similar to the other Leprino Viterbese groups. Difference between genotypes within the same housing type was noticed, but with low significance (P=0.09). The length of femur showed the housing effect, in fact the animals bred in intensive way have developed less leg bone (9.16 cm vs 8.88cm of Va and Vt groups vs Vi and Hi), mainly due to the less physical activity.
The dissection of the thigh didn't show high differences for meat and bone percentage, but rabbits intensively bred were significantly leaner compared to the others(2.27% in average between Vi and Hi, versus 3.01% in average between Va and Vt of total fat). The general carcass fattiness of the rabbit extensively bred probably depends of genotypes and climatic influence too (Dalle Zotte, 2002).
Meat quality (table2) was influenced particularly by housing types; in fact only the water holding capacity showed little difference (P=0.07%) between the genotypes bred in intensive way.
Difference was relevant in WHC between Hi group and the others bred in an extensive way (19.68% vs 14.26% average between Va and Vt), the value of Vi was intermediate. Shear force on raw and cooked meat showed similar trend among groups. Generally the LD of rabbit bred in intensive system were significantly more tender (1.66 kg in average between the two groups in raw meat and 1.65 kg in cooked one), while Vt group was tougher than others (2.13 kg and 2.25 kg for raw and cooked meat respectively).
Animals of Hi group showed highest lightness (Dal Bosco et al., 2002; Hernàndez et al., 1998), significantly different by Vt group (56.79 vs 54.68) probably, latter group integrated the diet with blades of grass and the meat became less light and more red also if had the lower value of Hue than other groups.
The visual reflectance spectra had different trends among groups near the 470 nm and 560 nm, isobestic point for deoximyoglobin and oximyoglobin, end in Soret pick (420nm) as reported in figure 1 and in table2.

At 420 nm the curves showed different trends for intensive system compared to extensive system, while in 470nm and 560 nm significantly differences were found only between Vt and Hi.
Limited correlation was found between WHC and different data of visual spectrum reflectance (Figure 2), while the correlation coefficients were significant in all considered points after 450 nm between WBS on cooked meat and reflectance value at different wavelength, reaching maxima values after 610nm.
Also for the rabbit the spectrum of reflectance can discriminate the groups and indicate the difference in physical quality of meat.

Conclusions

The housing system influences the carcass and meat quality. Particularly the meat of industrial hybrid is different compared to Leprino Viterbese bred on the turf with mobile cages, latter therefore shows distinct characteristics of rusticity required by consumer that consider this characteristics correlated with healthiness and animal welfare.

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Table 1 - Performances at dissection of rabbit carcass

	Carcass weight (g)	Perirenal fat (g)	LD weight (g)	thigh weight (g)	Femur lemgth (cm)	Meat %	Bone %	Fat %
Va	1410.6	16.01a	86.82 a	193.9a	9.09ab	78.8	17.8	3.31 a
Vt	1408.5	13.46a	77.89 b	191.9ab	9.24a	78.9	18.4	2.72ab
Vi	1399.3	14.25a	83.06 ab	192.3ab	8.78b	79.4	18.3	2.31b
Hi	1408.1	9.14b	83.79 ab	185.5b	8.98ab	79.6	18.2	2.24b
Means	1406.4	13.23	82.87	190.9	9.02	79.2	18.2	2.65
Root MSE	76.20	4.901	12.471	11.76	0.577	1.79	1.42	1.095
Vi *vs* Hi	ns	**	ns	0.09	ns	ns	ns	ns
Va, Vt *vs* Vi, Hi	ns	*	ns	ns	*	ns	ns	**

NOTE different letters mean significantly differences for P<0.05;

Table2 - Physical quality and colour on *Longissimus thoracis and lomborum*

	WHC	WBS (kg) on raw	WBS (kg) on cooked	L*	C	H	420nm	470nm	560nm
Va	13.93^{b}	1.95^{ab}	1.91^{ab}	55.01^{ab}	10.42	80.35^{ab}	7.66^{b}	27.04^{ab}	19.83^{ab}
Vt	14.59^{b}	2.13^{a}	2.25^{a}	54.68^{b}	10.33	79.58^{b}	7.65^{b}	25.29^{b}	19.12^{b}
Vi	15.42^{ab}	1.63^{b}	1.58^{b}	55.77^{ab}	9.39	85.00^{a}	8.59^{a}	26.29^{ab}	19.85^{ab}
Hi	19.68^{a}	1.78^{b}	1.71^{b}	56.79^{a}	9.30	85.17^{a}	8.88^{a}	27.37^{a}	21.05^{a}
Means	15.64	1.88	1.86	55.81	9.86	82.52	8.19	26.51	19.96
Root MSE	4.093	0.392	0.536	2.766	2.470	8.036	1.164	2.824	2.360
Vi *vs* Hi	0.07%	ns	ns	ns	ns	ns	ns	ns	ns
Va, Vt *vs* Vi, Hi	ns	***	***	ns	ns	**	**	*	ns

NOTE different letters mean significantly differences for P<0.05;

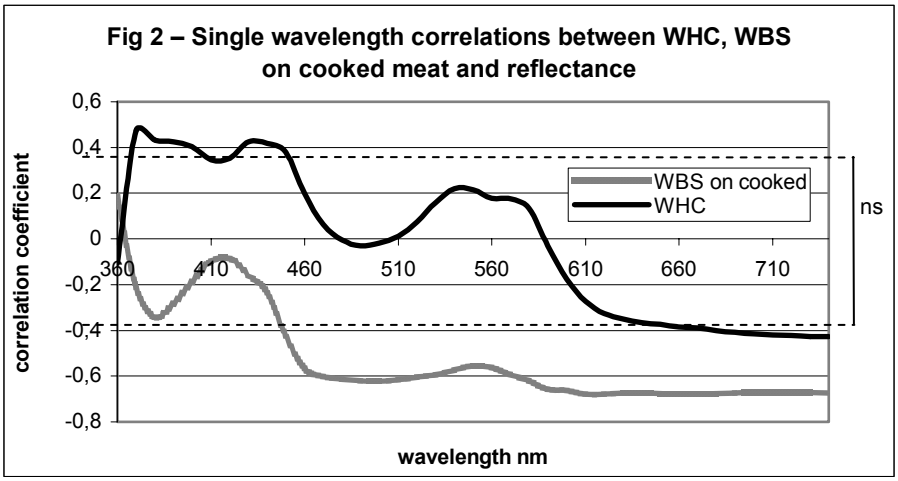

Figure 1- Visual reflectance spectra in some points with significantly difference between groups