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DAL BOSCO A., CASTELLINI C., BERNARDINI M.

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PRODUCTIVE PERFORMANCE AND CARCASS AND MEAT CHARACTERISTICS OF CAGE- OR PEN-RAISED RABBITS

DAL BOSCO A., CASTELLINI C., BERNARDINI M.

Department of Animal Science, Faculty of Agriculture, Borgo XX Giugno, 74 - 06100 Perugia, Italy

ABSTRACT

The effect of housing conditions on productive performance and carcass and meat characteristics were studied on 400 rabbits assigned to 2 homogeneous groups reared differently: in cages or in an indoor pen. Feed intake, live weight and qualitative traits of carcass and meat were recorded. Pen-raised rabbits showed the worst growth performance (27.52 vs 34.19 g weight gain; 4.07 vs 3.71 feed efficiency) and significantly lower carcass weight (1424.45 vs 1716.13 g), perirenal fat (0.84 vs 2.43%), lumbar circumference (19.14 vs 21.40 cm) and meat/bone ratio (4.33 vs 5.34). The *Longissimus dorsi* muscle had a higher moisture content (77.02 vs 75.93%) and a lower WHC (54.04 vs 55.40%). The findings showed a lower degree of commercial maturity in pen-raised rabbits.

INTRODUCTION

The recent consumer interest in meats of high quality and the increasing attention to animal welfare have stimulated the researchers to verify the effect of alternative production systems, which can offer more “natural” conditions than the intensive ones (FERRANTE et al., 1992; PACI et al., 1997; MIRABITO et al., 1999; MORISSE et al., 1999).

Such aspect is of great interest for the domestic rabbit whose behaviour is similar to that of the wild one, as a result of a relatively recent domestication.

In intensive farms the weaned rabbits are generally housed in single or double cages. According to DRESCHER (1992) these systems reduce the social contact of animals and are non-respectful of welfare. On the other hand the collective housing, also at moderate density, could cause social conflicts and aggressions if the rearing is extended more than twelve weeks (BIGLER and OESTER, 1994).

The scarce literature on the alternative production techniques induced us to carry out the present study. The aim was to assess the influence of the rearing system on the productive performance and carcass and meat characteristics of rabbit.

MATERIALS AND METHODS

Animals, housing and diets

The study was carried out in October and November 1999. Four hundred hybrid rabbits reared in an intensive rabbitry in central Italy were weaned at 35 days and immediately divided into 2 homogeneous groups that were housed differently: in cages (2 rabbits/cage - 17 rabbits/m²) or in an indoor pen (10 rabbits/m²). The litter was wheat straw which was periodically changed.

Animals were fed a commercial diet ad libitum with the following characteristics: crude protein 16.5%, crude fibre 16.2%, ether extract 2.5%, digestible energy (DE) 11.0 MJ/kg.

Feed intake and live weight were recorded weekly and feed efficiency was estimated as the ratio between consumption and weight gain.

Rabbit carcass and meat analysis

Rabbits were slaughtered at 84 days of age and the carcass traits were evaluated on 20 animals per group according to BLASCO and OUHAYOUN (1996).

The *Longissimus dorsi* muscles were removed from refrigerated carcasses and trimmed of all external fat and epimysial connective tissue; the parameters analysed were: pH (initial and ultimate), water holding capacity (WHC), shear force and colour.

The pH was measured with a Knick digital pHmeter (Broadly Corp., Santa Anna, CA, USA) after grinding 1 g of muscle in 10 mL of 0.005 M Na-Iodineacetate for 30 sec (KORKEALA et al., 1986). WHC was estimated, according to NAKAMURA and KATOH (1985), by centrifuging 1 g of muscle for 4 min at 1,500 x g and determining the residual water by drying the sample at 70 °C overnight.

Shear force was evaluated on cores (1.25 cm x 2 cm) obtained from the mid-portions of the cooked samples by cutting them perpendicularly to the fiber direction, using an INSTRON, model 1011, equipped with a WARNER-BLATZLER meat shear apparatus (Instron International Ltd., Great Britain). The colour parameters (L*, a*, b*) were evaluated using a tristimulus analyser (Minolta Chroma Meter CR-200; Azuchi-Machi Higashi-Ku, Osaka 541, Japan) with the CIELAB (1976) Colour System.

Statistical analysis

A linear model (SAS/STAT, 1990 - procedure GLM) was used to evaluate the effect of housing system (cage vs pen). Statistical significance of differences was assessed by the t-test (SAS/GLM option PDIFF).

RESULTS AND DISCUSSION

Pen-reared rabbits showed the worst productive performance with significantly lower feed intake, weight gain and slaughter weight; they had a significantly higher feed efficiency and mortality (Table 1). The reduction of feed intake and the increase in mortality were mainly due to the consumption of a large amount of wheat straw, as observed *in vivo* and through the autopsy of several dead rabbits. Also MORISSE et al. (1999) obtained a lower weight gain in rabbits raised on straw litter vs wire netting and ascribed this fact to a presumable straw ingestion.

Table 1 – Productive performance of cage- and pen-reared rabbits

		CAGE	PEN	DSE
Weaning weight	g	759	752	98
Slaughter weight	“	2718B	2321A	358
Weight gain	g/day	39.98B	32.02A	6.19
Feed consumption	“	126.86b	112.01a	11.25
Feed efficiency		3.17a	3.50b	0.98
Mortality	%	2.5A	14.5B	*10.25

*X² value. n: 400;

A..B: P<0.01; a..b: P<0.05.

Also the slaughter traits were worst in the pen-reared rabbits: the carcass weight, perirenal fat, lumbar circumference and meat/bone ratio were significantly lower. The fore part was less

developed, while the hind part was proportionally heavier, presumably because of using it more. Also drip loss was higher.

The *Longissimus dorsi* muscle had a higher moisture content and a lower WHC (Table 2).

Table 2 – Carcass and *Longissimus dorsi* traits of cage- and pen-reared rabbits

		CAGE	PEN	DSE
Chilled carcass weight	g	1716.13B	1424.45A	55.70
Dressing out	%	63.14b	61.37a	4.19
Drip loss	“	1.70a	2.15b	1.13
Head	“	9.65	9.77	0.79
Kidney	“	0.94	1.03	0.06
Liver	“	5.22	4.98	0.71
Perirenal fat	“	2.43B	0.84A	0.76
Dorsal length	cm	38.60b	37.28a	0.71
Lumbar circumference	“	21.40B	19.14A	1.22
Meat/bone ratio		5.34b	4.33a	0.73
Fore part	%	37.21B	34.87A	1.58
Intermediate part	“	21.01	22.11	2.96
Hind part	“	41.78a	43.02b	2.41
Moisture	%	75.93a	77.02b	1.74
pHi		6.34	6.28	0.91
pHu		6.04	6.03	0.15
WHC	%	55.40b	54.04a	1.05
Shear Force	kg/cm ²	3.07	3.53	0.59
Colour				
L*		46.56	47.92	3.96
a*		4.26B	2.89A	1.83
b*		0.56	0.67	0.44

n: 40; A..B: P<0.01; a..b: P<0.05.

The higher moisture content accounts for the greater water loss of carcass and meat. Among the other traits redness was significantly different with the lower value being in the pen-raised rabbits. This could be the result of a more intensive respiration of the muscle fibre that causes a reduction of oxymyoglobin (redder) in myoglobin (XICCATO et al, 1999). The welfare conditions of pen-reared animals appeared very good and no abnormal behaviour was observed.

The above results indicated that pen-reared rabbits of the same age are leaner and less mature than those raised in cages.

The reduction in the slaughter weight (14.6%) was equal to that observed by VAN DER HORST et al. (1999), comparing wire pen vs cage-reared animals. The lower feed intake found in the

present trial reduced the growth rate because the energy requirement of these animals, as a result of more movement, probably had a higher value.

This situation prolonged the development of the earlier tissues (digestive tract and skeleton) with detriment of the later (muscle and fat) as observed by PRUD'HON et al., (1970); therefore the dressing out percentage, amount of fat, meat/bone ratio and WHC were inferior, while the moisture content and drip loss were superior.

The growth and the carcass and meat traits could be improved by preventing ingestion of the straw. The use of wire netting floor instead of straw litter could represent a valuable alternative assuring also better health and welfare conditions (MORISSE et al. 1999). The possibility of administration a more energetic feed and/or extending the rearing period should be verified too.

The eventually higher expenses for labour and feed will be compensated for no-cost for cages and a higher sale price consequent to superior product quality.

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