A SURVEY ON CARCASS AND MEAT CHARACTERISTICS OF ISCHIA RABBITS RAISED IN PITS

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ABSTRACT

The aim of the paper was to investigate the carcass and meat characteristics of Ischia rabbits raised in pits, according to the traditional island technique. Fourteen animals, fed grass and field beans as protein source, were slaughtered at 4.5 months of age, on average. After slaughter, skin, distal legs and tail, urinary bladder and gastrointestinal tract were removed and weighed to obtain the "commercial carcass", chilled at 4°C for 24 h. The head, lungs, thymus gland, trachea, heart, liver and kidneys were removed to obtain the "reference carcass" from which the muscles of hind legs and the *Longissimus dorsi* (LD) muscle were removed. One hour and 24h after slaughter the pH was measured on LD and *Biceps femoris* muscles. The right hind leg and the LD muscle were used to measure colour while on the left LD muscle the water holding capacity (WHC) was determined. After calculating the meat to bone ratio, the meat obtained from dissection of the left hind leg was used for chemical composition. Our results show that rabbits raised in pits, both due to their genetic type breed and the particular breeding technique adopted, is small (average weight at slaughter 1286 g ± 169) and has a low hot dressing percentage (52.9 % ± 3.5) due to the high percentage of the gastrointestinal tract (26.4 % ± 3.5). Nevertheless, it is possible to note a good pH decrease and WHC, as well as a similar meat chemical composition to those of other genetic types raised for meat production.

Key words: rabbit raised in pits, carcass characteristics, meat quality.

INTRODUCTION

Until ten years ago, prior to intensive breeding, rabbits were commonly raised in pits at a family scale on the island of Ischia (southern Italy). The pits, about 2 metres deep, had a surface area of 3 – 4 m^2 and one or two burrows initially dug by the breeder and then by rabbits. Beside the burrow entrance were two stakes against which a board was placed. Secured by the stakes, the board closed off access, thereby preventing the rabbits from

escaping inside the burrows and allowing their easy capture (NIZZA and BARBATO, 2003). In the burrows there is a habitat which perfectly matches the typical requirement of the species and, indeed, rabbits spend most of their time there, coming out only to feed. In the pits the grey rabbit found on the island and called “Ischia rabbit” was raised. The animals were small at slaughter (live weight around 1.5 kg) and were highly prized for their meat characteristics.

Recent consumer interest in organic food that provides greater assurances not only for human health but also for animal welfare, has led to the revival of this ancient – but still valid - breeding method. Currently, due to the small number of animals from local populations, in the pits other genetic types have also been bred (Burgundy Fawn, New Zealand White, Californian, etc.). However, diet follows the ancient tradition and is based primarily on grass found on the island and on farm products and by-products.

This paper gives the preliminary results of a study conducted in our department in order to evaluate the carcass and meat characteristics of Ischia rabbits raised in pits.

MATERIAL AND METHODS

The investigations were conducted at a farm on the island of Ischia (Bay of Naples, Italy) on 14 female rabbits raised in pits according to island tradition. The animals received daily grass and field beans as protein source. On average at 4.5 months of age, the animals were slaughtered and, according to recommendations by BLASCO *et al.* (1992), the following weights were recorded: full and empty gastrointestinal tract; skin; distal legs and tail; urogenital tract with empty bladder. From the remaining carcass (commercial carcass or CC), weighed before and after refrigeration at 4°C for 24 h, head; liver; the whole heart, lungs, oesophagus, trachea and thymus gland; kidney free of perirenal fat were dissected and weighed. From the resulting “reference carcass” (RC) the hind legs and the *Longissimus dorsi* (LD) muscle were separated. Some hind leg muscles (*Adductor magnus, Rectus femoris, Semimembranosus accessorius, Semitendinosus, Vastus lateralis, Gluteus maximus*) were also dissected and subjected to colour measurements using a Hitachi U3000 spectrophotometer with integrator sphere. Lightness (L*), redness (a*) and yellowness (b*) were determined (CIE, 1976). With a Hanna portable instrument, mod. HI 9025, equipped with electrode FC 230C, the pH of LD and *Biceps femoris* (BF) muscles was measured 1 h and 24h *post mortem*. In order to estimate the water holding capacity (WHC) four methods were used to simulate the different handling to which the meat may be subjected. The followed procedures, normally used for bovine meat, were appropriately modified. On sections of LD muscles (size mm 25 x 25 x 5) the weight losses were evaluated after:

1. refrigeration at 4° C for 48 h in a container with grate as indicated by LUNDSTROM and MALMFORS (1982);
2. cooking on a hot plate at 300°C until the core temperature of 70°C is reached (WHEELER *et al.,* 1990);
3. cooking in a bain-marie in a polyethylene bag at 70°C for 15 minutes (GAULT, 1985);
4. pressure for 10 minutes according to GRAU and HAMM (1957), measuring the weight losses.

The left hind leg was used to evaluate the percentage of meat (M) and bone (B), and the meat to bone ratio was then calculated according to PARIGI-BINI *et al.* (1992a) as follows:

M/B = (raw hind leg weight – bone weight)/ bone weight. The meat resulting from hind leg dissection was ground, freeze-dried, and then used to determine the content of water, fat and ash (AOAC, 1984). By difference, the percentage of protein was calculated.

RESULTS AND DISCUSSION

Table 1 shows (average ± standard deviation) the age and live weight as well as measurements at slaughter and after 24 h of refrigeration of the examined rabbit carcasses. As noted, despite the age (16 – 20 weeks), weight at slaughter is very low (1286 g ± 169), attributed to the genetic origin of the rabbits and the breeding technique.

Table 1. Measurements at slaughter, at carcass dissection and meat to bone ratio

		Average	SD
Slaughter age	*months*	4.50	0.39
Slaughter weight (SW)	*g*	1286	169
Hot carcass weight	"	677	61.4
Commercial carcass weight (CCW)	"	655	58.7
Drip Loss	*%*	3.18	0.15
Hot dressing out	*% of SW*	52.9	3.47
Cold dressing out	"	51.3	3.51
Gastrointestinal tract	"	26.4	3.54
Empty gastrointestinal tract	"	11.7	1.28
Skin	"	11.9	1.25
Distal legs and tail	"	3.9	0.35
Reference carcass (RC)	*% of CCW*	78.1	2.31
Head	"	11.3	1.23
Liver	"	6.4	0.75
Kidney	"	1.4	0.19
Thymus, trachea, oesophagus, lung and heart	"	2.3	0.32
Carcass length	*cm*	28.2	1.14
Carcass circumference	"	12.3	0.47
Meat to bone ratio		4.85	0.50

The dressing percentages were very low compared with those (59.9 and 56.9 % of slaughter weight, respectively for hot and cold dressing percentages) reported on female hybrid rabbits selected for intensive breeding by PARIGI-BINI *et al.* (1992a). This was partly due to the high incidence of the gastrointestinal tract (26.4%): the fibre-rich diet causes greater encumbrance and then induces greater development of the gastrointestinal tract. In the present paper the skin incidence (15.8% SW) showed a slightly lower percentage in respect of the data reported by PARIGI-BINI *et al*. (18.9% SW for hybrid female rabbits; 1992a) and SZENDRO *et al.* (19.2 % SW; 1998), but was higher than those found by NIZZA and MONIELLO (13.9 % SW; 2000). Also LOPEZ *et al.* (1992) found in commercial cross-bred rabbits skin percentages of 14.8% SW. There were greater differences in the head percentage (11.3% of CC weight) which is considerably higher than the values reported by the above authors (PARIGI-BINI *et al*. 1992a: 8.1%;

NIZZA and MONIELLO, 2000: 8.03%; SZENDRO *et al.*, 1998: 10.7%; LOPEZ *et al.,* 1992: 9.8 % of CC weight).
Our results are due to the low weight at slaughter as described by SZENDRO *et al.* (1998). In a study to evaluate the effect of live weight at slaughter on carcass characteristics, the authors observed that head percentage is inversely related to weight at slaughter. Given the small size of this island genotype, also carcass length (28.2 cm) and circumference (12.3 cm) are lower than those reported by BERNARDINI BATTAGLINI *et al*. (1995) on some commercial hybrids (35.9 and 19.4 cm, respectively). On the other hand, the length/circumference ratio, in our case equal to 2.3, if compared with those reported by the above authors (between 1.7 and 1.9), indicates a longer, thinner carcass shape.
The meat to bone ratio is lower (4.85) than those (8.56) reported by PARIGI-BINI *et al*. (1992a) but is practically the same as that reported by PILES *et al*. (2000) for commercial hybrids slaughtered at 9 weeks (5.03). Because the rabbits reach a good body maturity at 90 days (BERNARDINI BATTAGLINI *et al.*, 1995), the obtained results could be attributed to their genetic origin and the particular rearing technique.
Table 2 shows the pHu of BF and LD muscles. The measured pH values were similar to those reported by BLASCO and PILES (1990) and confirms that the pH is independent of carcass weight, at least when the animal exceeds 100 days old (HULOT and OUHAYOUN, 1999). Because the muscular pH is strongly related to meat quality (LAWRIE, 1985), good pH values mean good meat quality.

Table 2 . Muscle pHu and L*a*b* measurements

	Longissimus dorsi	*Hind leg muscles*[1]
pHu	5.57±0.10	5.73±0.07[2]
L*	53.87±3.34	52.43±3.26
a*	-0.58±1.43	-2.70±1.53
b*	10.47±1.73	7.51±1.87

[1]average of values from 6 muscles: *adductor magnus, rectus femoris, semimembranosus accessorius, semitendinosus, vastus lateralis, gluteus maximus.*
[2]measurement conducted on *Biceps femoris* muscle.

Table 2 also shows the colour parameters (L*; a*; b*) of LD muscle and that of the major hind leg muscles. Compared to those reported by DALLE ZOTTE *et al.* (1995) for hybrid female rabbits (55.2, 2.70 and 1.16, respectively for L*, a* and b*) the lightness is very similar, but, for both muscle areas considered, a* is negative (then the colour tends to green) and b* is higher.
Table 3 shows the results of water holding capacity measurements in LD sections. On a Provisal hybrid DAL BOSCO *et al*. (1997) found oven cooking losses between 28.9 and 32.0% in the *Longissimus lumborum* muscle; DALLE ZOTTE *et al*. (1995) reported cooking losses in a bain-marie (22.0%) lower than those which we detected.

Table 3. Water holding capacity

		Average±SD
LUNDSTROM and MALMFORS (1982)	%	31.4±3.4
Cooking in a bain-marie GAULT, 1985	"	30.2±4.4
Cooking on a hot plate WHEELER *et al.* (1990)	"	23.9±2.6
Pressure GRAU and HAMM (1957)	"	14.4±2.2

Table 4 reports the results of the chemical composition of hind leg meat.

Table 4. Chemical composition of meat

		Average	SD
Moisture	%	76.4	1.79
Protein	"	20.5	1.61
Fat	"	1.9	0.46
Ash	"	1.2	0.04

In respect of the data reported in the literature (PARIGI-BINI *et al.*, 1992b; NIZZA AND MONIELLO, 2000; SZENDRO *et al.*, 1998), the water content is two percentage points higher probably due to the low fat content. Instead, the protein and ash content are in line with the results of the other authors.

CONCLUSIONS

Our results show that Ischia rabbits raised in pits, despite being small and having low dressing out percentages, provide meat with a good pHu and WHC. Moreover, the meat chemical composition is quite similar to those of other genetic types reared for meat production. Other studies are under way in our laboratories to determine the quality of intramuscular fat, and meat cholesterol and collagen content. This research will supply further information on the nutritional proprieties of meat from rabbits raised in pits.

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