dry-cured hams

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RIASSUNTO – Aspetti qualitativi del prosciutto di daino (*Dama dama*) – *Su prosciutti ricavati da cosce disossate di daini di due diverse età (18 e 30 mesi) e tenuti al pascolo con o senza integrazione alimentare, sono stati analizzati: composizione centesimale, acidi grassi, sale, indice di proteolisi, Texture Profile Analysis. I dati qualitativi evidenziano poche variazioni fra le 4 classi di animali e sono indici di un prodotto di elevato interesse nutrizionale.*

KEY WORDS: fallow deer, dry-cured hams, supplementary feeding.

INTRODUCTION – Meat processing by drying, after salting or fermentation and before a long ripening period, is an ancient and widespread process, used to preserve meat from spoilage. Among the wide variety of dry meat products made in Europe, the most famous ones are made from pork (Italian and Spanish dry-cured hams, fermented sausages), but other interesting products are obtained from meat of different species: i.e., the "bresaola", from bovine, horse, goat, etc. (Paleari *et al.*, 2002). Deer meat and meat products are interesting in this picture, since they include the high degree of consumers' appreciation for dried products and considering the growing interest for food obtained by natural husbandry and technology. The production of dry-cured hams from red deer, fallow deer and roe deer has a small and commercially highly valuable niche in the market. The raw meat derives especially from hunting, although in the last decades the possibility of using meat from farmed animals, which assures a more constant supply and a higher hygienic quality, has become an interesting reality (Bovolenta *et al.*, 2002). From the experimental farm "A. Servadei" of the University of Udine we got, by the aid of a factory (Wild s.r.l., San Daniele, UD) specialized in game processing, dry-cured hams from animals of two different ages and fed two different diets.

MATERIAL AND METHODS – Thirty-two male fallow deer were slaughtered at either 18 or 30 months of age (18mo and 30mo, respectively) after a 4-month feeding trial on pasture alone or with supplementary feeding (Saccà *et al.*, 2001). All thighs were de-boned. The right thighs were refrigerated for 2 days and cured in a factory specialized in game processing. The pH measured 24 and 48 hrs after slaughtering ranged from 5.4 to 5.7. Thighs were manually salted with a mixture of NaCl and spices (about 3%), refrigerated for 7 days and put in nets. Cooling and drying phases were alternated in the following 49 days, until a weight loss of about 40-45%. Samples from the inner part of each ham were analysed for proximate composition, fatty acids, NaCl and proteolysis index (PI) (A.O.A.C., 2000). Texture Profile Analysis (TPA; Bourne, 1978) was carried out on 10 mm side cubes, subjected to a 50% double compression. Test was performed using an Instron Universal Texting Machine (Instron UTM, 4200) equipped with a 1 kN load cell and a 58 mm diameter flat plug at a head speed of 50 mm min^{-1}. A penetration test on a 10 mm slice was also performed using a cylindrical 10 mm diameter flat ended plunger, at a crosshead speed of 50 mm min^{-1}: the result is the force (in kg) to penetrate the 60 % of the sample height. Data were first analysed by two-way analysis of variance, with diet and age as main effects: since many interactions were found, one-way analysis of variance was performed (4 classes).

RESULTS AND CONCLUSIONS – The two different ages and the two diets affected bucks growth (Saccà *et al.*, 2001) and carcass weight: the latter averaged 21.8, 27.9, 25.6, and 31.7 for 18-mo-pasture, 30-mo-pasture, 18-mo-concentrate, and 30-mo-concentrate deer, respectively. The first group thus produced lighter thighs, and higher thigh weight loss after curing (Table 1). As a consequence of dry-curing, hams show a high percentage of dry matter, composed for the largest part by protein (83-85%) and by small amounts of fat (2-5%): the leanness of venison is indeed well known. The 18-mo-pasture deer produced lower fat hams. The younger deer fed on both diets showed lower PI, as a sign of lower enzymatic activity. The fatty acid composition is peculiar: PUFA level is high and SFA/UFA ratio is low (0.56 on average) when compared with other animals. These characteristics are favourable as regards human health, but make the fat more subject to oxidation: the paucity of total fat makes anyway its composition less significant. A higher level of PUFA, and consequently lower SFA and MUFA, was found in the 18-mo-pasture deer. Grass feeding produced a more favourable n-6/n-3 ratio.

Texture traits were similar for the hams of the four groups, although hardness tended to be lower in the supplemented deer, particularly in the 30mo ones: in this group proteolysis index was higher, and this indicates a higher enzymatic activity on the structural proteins of the muscle cell which, in turn, may induce structural changes and affect the texture of the cured meat (Guerrero *et al.*, 1999).

It can be concluded that the four groups of fallow deer (2 diets and 2 ages) did not show strong differences in the characteristics of the derived dry-cured hams: the sole differences were recorded for the younger bucks fed on pasture alone (higher seasoning loss, lower and more unsaturated fat).

It seems interesting to compare dry-cured meat traits with corresponding data available for raw meat (m. *semitendinosus*; Volpelli *et al.*, unpublished data), although it is not possible to state on what muscle the final analyses were performed (Table 2). Processing produced loss of water and re-distribution of dry matter: ash content increased, as a direct consequence of salting, and protein decreased in the dried meat. SFA content decreased after curing; PUFA remained the prevalent class and underwent a slight increase.

Table 1. Seasoning data, chemical composition and texture of dry-cured hams.

Age Diet	18mo Pasture	30mo Pasture	18mo Concentrate	30mo Concentrate	s.e.d.
Thigh initial weight (g)	2820 ^{a}	3525 ^{bc}	3255 ^{b}	3706 ^{c}	261.90
Seasoning loss (%)	45.12 ^{a}	42.64 ^{b}	42.37 ^{b}	40.41 ^{c}	0.9365
Dry matter (%)	56.27	58.48	57.08	57.45	2.7532
Protein (% dry matter)	85.54	83.29	83.78	84.71	2.4401
Fat (% dry matter)	2.57 ^{a}	4.59 ^{b}	4.43 ^{b}	4.09 ^{b}	1.1722
Ash (% dry matter)	13.39	12.69	13.26	12.78	1.3424
NaCl (% dry matter)	9.19	8.50	9.03	8.46	1.2012
Proteolysis index (%)	29.00 ^{a}	31.50 ^{ab}	30.30 ^{a}	33.55 ^{b}	2.3719
SFA (% TFA)	31.77 ^{a}	37.63 ^{b}	36.50 ^{b}	35.65 $^{a\,b}$	3.8097
MUFA (% TFA)	10.42 ^{a}	16.15 ^{b}	11.70 ^{a}	14.96 ^{b}	2.3473
PUFA (% TFA)	57.80 ^{a}	46.23 ^{b}	51.80 $^{a\,b}$	49.39 ^{b}	5.8729
(*n*-6)/(*n*-3)	3.20 ^{a}	3.26 ^{a}	4.47 ^{b}	4.53 ^{b}	0.6099
TPA hardness (kg)	3.36	3.41	3.16	2.99	1.0801
TPA cohesiveness	0.38	0.39	0.39	0.38	0.0330
TPA elasticity (%)	73.10	72.95	73.13	72.64	2.2131
Penetration force (kg)	1.91	2.48	1.82	2.11	0.1015

a,b,c: P<0.05

The dry-cured ham obtained from fallow deer, as well as from other deer, has peculiar sensory traits, which make it appreciated by consumers. Its composition may enhance consumers' interest, since it is characterized by high protein level, very low fat level, prevalence of PUFA. It can thus been stated that dry-cured ham may become one of the products useful to provide different game products on the market; this may also help the establishment and profitability of deer farming.

Table 2. Comparison between raw meat and dry-cured ham traits.

	raw meat	dry-cured ham	s.e.d.
Dry matter (%)	22.76 [a]	57.35 [b]	1.9940
Protein (% dry matter)	90.88 [a]	84.29 [b]	2.0462
Fat (% dry matter)	2.90 [a]	3.96 [b]	1.1389
Ash (% dry matter)	4.92 [a]	12.89 [b]	0.9518
SFA, % TFA	38.24 [a]	35.50 [b]	4.6208
MUFA, % TFA	13.90	13.40	3.6190
PUFA, % TFA	47.87	51.09	7.8074
(*n*-6)/(*n*-3)	4.01	3.89	0.8649

a, b: P<0.05.

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