LITTER SIZE AND SEX EFFECTS ON SOME QUALITY TRAITS OF KID MEAT

Todaro M.[1], Corrao A.[2], Lanza M.[3], Giaccone P.[1], Schinelli R.[2], Priolo A.[3],
[1]Dip. S.En.Fi.Mi.Zo. – Sezione di Produzioni Animali – Università di Palermo, Italy
[2]Istituto Zooprofilattico Sperimentale della Sicilia "A. Mirri" – Palermo, Italy
[3]Dip. D.A.C.P.A. – Sezione di Produzione Animale – Università di Catania, Italy

Background

Perceptions of meat quality vary from country to country and among ethnic and age groups. In Italy only "capretto" meat (obtained from suckling kids to produce a carcass weight of 6-10 kg with pink flesh) is highly appreciated by consumers, whereas, in other countries such as India, the Chevron meat (obtained from older animals with a carcass weight of 16-22 kg) is particularly preferred.
Consumers are also in search of low-fat, low calorie, healthful meat sources and are willing to try new types of meats in an effort to control fat/calorie consumption. Warmington and Kirton (1990) stated that compared to sheep and cattle, knowledge of yield and quality of goat meat is limited. These workers concluded that there are a large number of goat breeds in the world, but few objective, comparative data exist.

Objectives

The objective of this paper is to explore genetic factors influencing carcass characteristics, edible yield, meat tenderness and composition of kids raised in the Nebrodi mountains in North-East Sicily.

Methods

Forty young kids, 20 males and 20 females, of Nebrodi goat population, raised in the Nebrodi mountains in Sicily, were mated at 47 d of age. Kids were fed with maternal milk and housed indoors in group boxes. After a 12-h fasting all kids were slaughtered following traditional procedures. After chilling at 4°C for 24 h, carcasses were butchered to commercial cuts. The pelvic limb of each carcass was dissected into muscle, fat, bone and other tissue; the muscle obtained was immediately homogenised and lyophilised and, successively, analysed to determine dry matter, fat, protein and ash in accordance with official procedures (AOAC, 1990). Methyl esters of the fatty acid component of the neutral triglycerides, prepared according to the transesterification method in a vial at ambient temperature for 30 min by means of m-trifluoromethyl-phenyl-trimethylamonium hydroxide (Meth-Prep II, Alltech) 0.2 N in methanol, were analysed in GC/FID (Todaro et al., 2002). At 24 h after slaughter, samples of M. *longissimus dorsi* (LD) muscle, taken from the loin, were placed in polyethylene bags, frozen at –20 °C and kept for about 4 months. Then they were thawed for 24 h at 4 °C. Meat colour was determined following the Commission International de l'Éclairage colour convention (CIE, 1986) using a Minolta CM 2002 spectro-colorimeter (illuminant, D_{65}). Muscle samples three centimetres in thickness were stored for 2 h at 4°C on a polystyrene tray and overwrapped with polyethylene film to allow blooming. Hue angle, $\tan^{-1}$ (b*/a*), and Chroma, the square root of $a^{*2} + b^{*2}$ were also calculated. Cooking loss was calculated by weighing samples held in plastic bags and immersed in water at 75°C until the internal temperature of the meat reached 75°C, as monitored with a probe. The bags were then placed under cold running water for 30 min. after which the cooked meat was patted dry with paper towels and reweighed. The same samples were also used for shear force determination. Three strips (1 X 1 cm) were removed from each sample parallel to the muscle fiber axis and sheared perpendicular to this axis using an Instron 4411 apparatus equipped with a Warner-Bratzler shearing device. The cross head speed was 100 mm/min. Data were analysed by the least squares procedure of the GLM program of the SAS software (1991). A fixed model of litter size and sex class and appropriate interaction was utilised. No significant litter size x sex class interactions were noted for carcass traits evaluated in this study, therefore only main effects will be discussed.

Results and discussion

The Nebrodi kids showed an heavier birth weight compared to other breed reared in Sicily (Liotta et al., 2000; Todaro et al., 2000). At the birth, male kids resulted statistically heavier than females, such differences remain for the final live weight, slaughter weight, EBW and carcass weight (Table 1). Litter size influenced statistically only birth weight; the twin kids subsequently recovered minor the weight to the birth, probably for the good milk availability of dam. Female kids showed higher kidney and pelvic fat than males. The pelvic limb tissue composition showed that females had higher muscle percentage than males (Table 2). From the point of view of the muscle chemical composition, Nebrodi kid meat could result well appreciated by the consumers for its low fat; these results are similar to those reported for Girgentana kids (Todaro et al., 2002). Statistically significant differences were found between single and twin kids, as the twins showed lower ether extract and higher protein percentage. Fatty acids composition of pelvic limb fat (Table 3) was in accordance with the international literature (Banskalieva et al., 2000); the unsaturated/saturated fatty acids ratio and the softness index confirmed the high meat quality of these kids. Meat from male kids had a better water holding capacity as indicated by a lower cooking loss compared to female animals (Table 4). Differences in cooking losses are often linked to different muscle fat content but in our case no difference in muscle fat content occurred between male and female animals. Ultimate pH was higher in male than female animals but was for all the animals in a range of good quality. This difference could be linked to a higher susceptibility to stress of males compared to females (Scerra et al., 2001).

Pertinent literature

AOAC, 1990. DC: Association of Official Analytical chemists, Washington, USA. ASPA, 1991. Ed. ISMEA, Roma, Italy. Banskalieva, V., Sahlu, T., Goetsch, A.L., 2000. CIE, Commission International de l'Éclairage. 1986. Colorimetry (2nd ed.). Publication CIE 15.2. Vienna: CIE. Small Rum. Res., 37, 255-268. Liotta L., Chiofalo V., Zumbo A., Muraca L., Baricco G., Chiofalo L., 2000. Proc. 7th International Conference on Goats, Tours, France. SAS, 1991. User's Guide: Statistics, Version 8.1 Edition 1991. SAS Inst., Inc., Cary, NC. Scerra, V. Caparra, P., Foti, F., Lanza, M., Priolo, A., 2001. Small Rum. Res., 40, 51-56. Todaro M., Console A., Giaccone P., Genna G., 2000. Atti SIPAOC, Vietri sul Mare, Salerno, Italy. Todaro M., Corrao A., Barone C.M.A., Schinelli R., Occidente M., Giaccone P., 2002. Small Rum. Res., in press. Warmington, B.G., Kirton, A.H., 1990. Small Rum. Res., 3: 147-165.

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Table 1. Growth performance, slaughter and dissection data according to sex and litter size (LSM).

	Sex		Litter size		SE
	Male	Female	Single	Twin	
N° of observations	10	10	10	10	
Living data					
Birth weight (kg)	4.11 a	3.86 b	4.16 A	3.82 B	0.083
Age (d)	47	47	47	47	0.237
Final live weight (kg)	11.27 A	10.56 B	10.98	10.85	0.198
Daily gain (g/d)	151 a	141 b	144	148	3.101
Slaughter data					
Slaughter weight (kg)	10.11 A	9.40 B	9.66	9.85	0.171
Empty Body Weight (EBW) (kg)	9.65 A	8.93 B	9.27	9.31	0.170
Carcass weight (kg)	5.72 A	5.27 B	5.48	5.51	0.110
Net warm dressing percentage (%)	0.59	0.59	0.59	0.59	0.003
Hide (% of EBW)	10.56	10.16	10.22	10.49	0.244
Head (% of EBW)	7.76	7.87	7.73	7.89	0.101
Internal organs[1] (% of EBW)	4.98	5.07	4.96	5.09	0.071
Limbs (% of EBW)	1.47	1.46	1.46	1.46	0.040
Dissection data					
L.D. pH determined after 24 h	5.66	5.64	5.66	5.64	0.016
Right side (RS) (kg)	2.77 A	2.54 B	2.64	2.67	0.054
Kidney and Pelvic fat (% of RS)	1.53 A	2.06 B	1.75	1.84	0.148
Loin (% of RS)	8.73 a	9.34 b	9.27	8.80	0.206
Pelvic limb (% of RS)	28.77	28.98	29.53 A	28.23 B	0.294
Shoulder (% of RS)	20.08	20.16	20.33	19.91	0.281
Neck, steaks, brisket (% of RS)	31.21 A	29.63 B	29.86 a	30.98 b	0.445

Within a raw different letters stand for significant differences, P≤0.05 and P≤0.01 (capital letters). [1] Lungs, trachea, heart, liver

Table 2. Tissue composition and meat chemical composition of the pelvic limb, according to sex and litter size (LSM).

	Sex		Litter size		SE
	Male	Female	Single	Twin	
Tissue composition (% of Pelvic Limb)					
Bone	21.60	21.24	21.43	21.42	0.290
Muscle	53.84 a	55.73 b	54.82	54.74	0.620
Fat	11.61	11.43	11.57	11.46	0.485
Other tissues	10.04 A	8.53 B	9.49	9.09	0.404
Chemical composition (% of DM)					
Dry matter (DM)	22.78	22.91	22.81	22.88	0.146
Ether extract	4.91	5.09	5.30 a	4.70 b	0.182
Protein	89.94	89.32	89.17 a	90.10 b	0.317
Ash	5.33	5.32	5.36	5.30	0.026

Within a raw different letters stand for significant differences, P≤0.05 and P≤0.01 (capital letters).

Table 3. Fatty acid composition of pelvic limb fat, according to sex and litter size (g of fatty acid / 100 g of meat fat; LSM).

Fatty acid (g/100 g of fat)	Sex		Litter size		SE
	Male	Female	Single	Twin	
Saturated Fatty Acids	33.71	32.67	33.84	32.54	0.760
Unsaturated Fatty Acids	34.40	35.03	35.17	34.26	0.800
Mono-unsaturated Fatty Acids	28.74	29.62	29.47	28.89	0.770
Poly-unsaturated Fatty Acids	5.66	5.41	5.69 a	5.37 b	0.132
UFA / SFA	1.03	1.09	1.05	1.07	0.036
Softness index	0.95	1.03	0.98	1.00	0.038

Within a raw different letters stand for significant differences, P≤0.05 and P≤0.01 (capital letters).

Table 4. Physical characteristics and colorimetric parameters of M. *longissimus dorsi* muscle, according to sex and litter size (LSM).

	Sex		Litter size		SE
	Male	Female	Single	Twin	
Cooking loss (%)	14.89 a	16.48 b	15.75	15.62	0.07
Ultimate pH	5.59 A	5.54 B	5.57	5.56	0.01
Warner-Bratzler Shear force (KgF)	6.27	6.45	6.00	6.72	0.46
L*	51.09	50.03	49.31 A	51.80 B	0.73
a*	5.98	6.37	6.56	5.80	0.33
b*	10.13	10.07	10.59	9.61	0.46
Chroma	11.81	11.96	12.50	11.26	0.52
Hue angle	59.24	57.77	58.06	58.94	1.08

Within a raw different letters stand for significant differences, P≤0.05 and P≤0.01 (capital letters).