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Influence of goat livestock systems on the performance of Cilentana kids

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SUMMARY – Thirty goats were equally divided before parturition into two groups (A and B) homogeneous in parity and milk production at the previous lactation. Group A (control) was housed in stall conditions, while group B was led to pasture and raised following EU Regulation 1804/99 on organic farming. Both groups received diets with the same energy and protein contents (1.03 UFL/kg DM; 18% DM of CP). The kids were weighed at birth, at 25 days of age and at slaughter (mean age 60 days). On six kids from each group, body measurements before slaughter and carcass measurements, after 24 hours of refrigeration, were taken and dressing percentages were calculated. The right hind leg of each animal was dissected to calculate meat, fat and bone percentages. Finally, the meat water-holding capacity was evaluated. No significant differences were found between the groups, suggesting the effectiveness of organic livestock production systems.

Keywords: Organic system, Cilentana goat, kid performance.

RESUME – *"Influence des systèmes d'élevage caprin sur les performances des chevreaux Cilentana". Trente chèvres ont été divisées avant la mise bas, en deux groupes égaux (A et B) homogènes en numéro de parturition et production de lait lors de la lactation précédente. Le groupe A (témoin) était logé en stabulation, tandis que le groupe B était mené en pâturage et élevé selon la réglementation 1804/99 de l'UE sur l'agriculture biologique. Les deux groupes recevaient des régimes ayant les mêmes teneurs en énergie et protéine (1,03 UFL/kg MS ; 18% PB MS). Les chevreaux étaient pesés à la naissance, à 25 jours d'âge et à l'abattage (âge moyen 60 jours). On a effectué sur six chevreaux de chaque groupe, des mesures corporelles avant l'abattage, ainsi que des mesures sur la carcasse, après 24 heures de réfrigération, et on a calculé les pourcentages de rendement de la carcasse. La jambe arrière droite de chaque animal a été disséquée pour calculer les pourcentages de viande, gras et os. Finalement, la capacité de rétention d'eau de la viande a été évaluée. Il n'a pas été trouvé de différences significatives entre les groupes, ce qui suggère l'efficience des systèmes d'élevage biologique.*

Mots-clés : *Système biologique, chèvre Cilentana, performances des chevreaux.*

Introduction

From an analysis of Italy's national economy it emerges that organic farming has broadened its consumer market in the last years, with organic produce now marketed by the large distributors as well. Regulated by two EU Regulations (2092/91 and 1804/99, for vegetable and animal production, respectively), organic production in recent years has become a major asset in Italian agricultural production and in its heritage in wine and gastronomy. This production system represents an important opportunity in inland areas of southern Italy and its islands. The use of the organic system enhances product value without having to make definitive changes to farm management.

Goat livestock farming is a very important sector in developing the world's marginal areas (Morand-Fehr and Boyazoglu, 1999) where the goat population is particularly concentrated (95.4%). The caprine breeds used in the Mediterranean area are particularly specialised in milk production (Dubeuf *et al.*, 2004). In this area, the milk (18% of world goat milk production) is predominantly used for cheese-making. The aim of this work is to compare the effects of two different livestock systems (conventional *vs* organic) on the production of meat of an autochthonous goat population called "Cilentana", extensively bred in Cilento (Salerno province) whose milk production potential is still studied also by our research group.

Material and methods

The trial was carried out on a farm with about 200 heads of Cilentana goats, most of which (about 80%) had lambed twins. According to local practice, the kids are taken to market at Easter and the farmer, regulating the goats' exposure to bucks, plans lambing for this occasion. Hand milking is effected twice a day at different times of the day, depending on the season.

Thirty multiparous goats were used, equally divided before lambing into two groups (A and B) homogeneous in parity and milk production at the previous lactation. Group A (control) was housed in a stall, while group B was led to pasture and raised following EU Regulation 1804/99 on organic farming. Both groups received diets with the same energy and protein contents. Two concentrates were used with the following energy and protein levels: 1.03 Feed Units of Lactation (UFL)/kg of dry matter (DM) and 18% DM of crude protein (CP). The concentrate supplied to the B group was made up only of raw materials from organic farming. Both concentrates were fed in different proportions (200 - 300 and 400 g/head/d, respectively 45 - 30 and 15 days before lambing). In both groups after lambing (occurring in each case up to the 1st week of February 2004), administration of concentrates was gradually increased up to 700 g/head/d. This limit was necessary to avoid exceeding maximum concentrate administration (40% of DM) allowed according to Regulation1804/99. The mean live weight was close to 50 kg, and for goats led to pasture a dry matter intake amounting to 3.5% of live weight (LW) was estimated (Rubino, 1996), being the maximum concentrate administration (700 g) the 40% of dry matter intake as allowed by regulations. As for forage, while group B grazed on pasture, group A received alfalfa hay *ad libitum* for the whole trial period. It must be pointed out that alfalfa hay was selected to guarantee the same protein intake for both groups. In previous trials (Infascelli *et al.*, 1998; Cutrignelli *et al.*, 2000) effected in the same area, we found that in spring the pasture had a mean protein content close to 15% DM.

The kids of both groups spent the day in the stall in a separate box and met goats only during the night when they could suckle. The kids were weighed at birth, at 25 days of age and at slaughter (average age of 60.77 and 59.32 days for groups A and B, respectively). Samples of each feed were collected to determine the chemical composition (AOAC, 1990). The energy value [Feed Units of Lactation (UFL)/kg of dry matter (DM)] was calculated as suggested by the researchers of INRA (1988).

Six subjects per group (3 males and 3 females) were slaughtered. Before slaughter the following measurements (ASPA, 1991) were made: height at withers, height at pelvis, length of rump, width of pelvis, depth of chest, width of chest, chest girth and body length. On the hot carcasses the following measurements were conducted (ASPA, 1991): width of pelvis, width of chest, carcass length, depth of chest and leg length. Moreover, skin and organs were weighed to calculate hot and cold dressing out.

After 24 hours of ageing at 4 ± 1°C the right hind leg of each animal was dissected and used as a sample cut to calculate the proportions of meat, bone and separable fat.

The water holding capacity (WHC) was estimated on fresh meat using four different methods. A portion of sample cut meat was used for this determination, with the weight losses being evaluated after: (i) refrigeration at 4° C for 48 h in a box with a grate, as described by Lundström, & Malmfors (1985); (ii) cooking on electric grill at 300°C of a piece (30 x 30 x 15 mm) until the internal temperature of 70°C was reached (Wheeler *et al.* 1990); (iii) cooking in bain-marie at 70°C for 30 minutes of a similar piece (Gault, 1985); and (iv) compression for 10 minutes according to Grau & Hamm (1957), but evaluating the weight losses.

All data were analysed statistically (ANOVA), using the SAS (2000) GLM procedure, according to the following model:

$$y_{ik} = \mu + M_i + \varepsilon_{ik}$$

where: y_{ik} = single observation; μ = general mean; M_i = livestock method (i = A, B); ε_{ik} = error.

Results and discussion

All goats have a regular pregnancy. On the whole in group A 30 kids were born (2 single, 2 trigeminal and 11 twin lambing, corresponding to 13, 13 and 74 %, respectively), while in group B only 25 kids were born, due to the absence of trigeminal lambing and to the different incidences of single and twin lambing (5 and 10, corresponding to 33 and 67%, respectively) occurring in this group.

Chemical composition and energy values (Table 1) of concentrates were similar, as the A concentrate had a lower fat content and a higher content of fermentable carbohydrates than B.

Table 1. Chemical composition and energy value of utilised hay and concentrates

	Group A		Group B
	Hay	Concentrate	Concentrate
		% as fed	
Crude protein	16.0	18.0	18.0
Ether extract	1.7	3.0	5.0
Crude fibre	24.8	9.0	7.8
Ash	7.5	8.0	8.1
UFL/ kg as fed	0.65	0.87	0.87

The kids of group B had a higher live birth weight than group A, probably due to the lower incidence of twins lambing. In contrast, the group A slaughter LW was higher than that of B. Nevertheless no significant differences were found between the groups (Table 2). The results of this trial agree with those of Coppola *et al.* (2003) on the same goat population and with Sormunen-Cristian & Kangasmaki (2000) on different genotypes. Also the daily weight gain did not statistically differ between groups.

Table 2. Live weight and daily weight gains (means ± SD)

	Group A (n = 30)	Group B (n = 25)
Liveweight (kg) at age (d)		
1 d	3.84 ± 0.51	4.02 ± 0.35
25 d	8.39 ± 1.27	8.40 ± 0.75
60 d	12.41 ± 1.20	11.78 ± 1.20
Daily weight gains (g/d) in periods		
1-25 d	182.0 ± 32.8	175.2 ± 25.27
1-60 d	136.2 ± 19.2	129.3 ± 29.40

Also the measurements effected on living animals and on carcasses (Tables 3 and 4, respectively) were unaffected by the livestock method.

The slaughter measurements (Table 5) showed no significant differences between the groups. The skin incidence on net weight is higher than that registered by Dhanda *et al*. (1999a) on subjects of different genetic types (10.30 *vs* 7.38% of net weight), probably due to the lower age of our subjects (60.04 *vs* 89.6 d). Nevertheless the Cilentana kids showed in each case higher values of dressing out than that reported by the above authors (hot dressing out: 55.88 *vs* 43.06; net hot dressing out: 61.46 *vs* 50.36%, respectively for kids of this trial and that of Dhanda *et al.*1999a).

Table 3. Animals measurements (cm) (mean ± SD)

Group	A (n = 6)	B (n = 6)
Height at withers	44.08 ± 2.38	45.25 ± 3.28
Height at pelvis	46.00 ± 4.51	46.17 ± 5.12
Length of rump	7.25 ± 0.99	8.00 ± 0.89
Width of pelvis	16.42 ± 8.69	12.75 ± 1.54
Dept of chest	20.83 ± 0.98	20.67 ± 1.75
Width of chest	11.08 ± 1.43	12.17 ± 1.47
Chest girth	50.50 ± 3.15	52.00 ± 3.58
Body length	33.33 ± 8.43	33.67 ± 2.42

Table 4. Carcass measurements (cm) (mean ± SD)

Group	A (n = 6)	B (n = 6)
Width of pelvis	13.42 ± 1.69	13.17 ± 1.33
Width of chest	12.42 ± 1.39	12.67 ± 0.82
Length of carcass	43.00 ± 4.15	40.67 ± 3.08
Depth of chest	13.08 ± 1.86	13.67 ± 2.58
Leg length	33.67 ±5.75	34.00 ± 4.24

Table 5. Slaughter measurements (mean ± SD)

Group	A (n = 6)	B (n = 6)
Slaughter weight (kg)	12.01 ± 1.67	11.16 ± 1.25
Net weight (kg)	10.97 ± 1.48	10.10 ± 1.07
Hot carcass (kg)	6.808 ± 0.925	6.148 ± 0.641
Empty digestive tract (% net weight)	9.49 ± 1.12	10.38 ± 1.31
Skin (% net weight)	10.67 ± 0.81	9.93 ± 0.84
Pluck(% net weight)	3.62 ± 0.31	3.54 ± 0.42
Liver + spleen (% net weight)	3.39 ± 0.31	3.72 ± 1.11
Kidney + bladder (% net weight)	1.29 ± 0.29	1.23 ± 0.36
Cold carcass (kg)	6.439 ± 0.952	5.855 ± 0.636
Hot dressing out (%)	56.67 ± 2.74	55.09 ± 1.77
Net hot dressing out (%)	62.06 ± 2.43	60.87 ± 1.35
Net cold dressing out (%)	58.70 ± 1.88	57.97 ± 1.30

The body composition was not influenced by the livestock method (Table 6). Indeed, the right hind leg measurements of groups A and B were very close. Comparing our data with those registered by Dhanda *et al.* (1999c), dissecting the whole carcasses, while meat incidence was slightly higher in our kids than in those of Dhanda *et al*. 1999c (59 *vs* 53%, respectively), the bone incidence was very different (35 *vs* 20%). These differences are probably due to the different dissection methods and slaughter ages.

The meat WHC was also unaffected by the livestock method (Table 7). The bain-marie loss was slightly higher than that reported by Dhanda *et al.* (1999b) (42.32 *vs* 35.78%, respectively), which may well be due to the different age at slaughter. Due to the high variability in results, found by our group also in other species, the method of cooking on electric grill, proposed by Wheeler *et al.* (1990), could be considered less reliable.

Table 6. Right hind leg measurements (mean ± SD)

Group	A (n = 6)	B (n = 6)
Leg (% cold carcass)	10.48 ± 0.34	10.36 ± 0.90
Meat (%)	59.06 ± 6.77	59.62 ± 2.60
Bone (%)	33.54 ± 3.02	35.86 ± 3.07
Fat (%)	4.34 ± 1.20	4.51 ± 1.96
Meat/bone	1.76 ± 2.24	1.66 ± 1.82

Table 7. Water holding capacity (%) (mean ± SD)

Group	A (n = 6)	B (n = 6)
Bain-marie loss	41.80 ± 2.09	42.84 ± 2.48
Grill loss	27.62 ± 4.53	21.28 ± 7.39
Compression loss	2.18 ± 0.71	2.09 ± 0.80
Drip loss	6.53 ± 0.96	7.96 ± 1.61

Conclusions

No significant differences were found between the groups, suggesting the effectiveness of organic livestock production systems. Indeed, although the groups were fed the same nutrients, group B certainly had higher requirements due to the steep slope of the pasture. Nevertheless, the partial findings regarding intramuscular fatty acid composition (higher concentration of polyunsaturated fatty acids in group B than A) confirm the validity of the organic system and its positive effect on meat quality.

In each case dressing percentages were much higher than those reported in the literature for other genetic types. This is further justification for the increasing interest in recent years towards the Cilentana goat breed.

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References

AOAC (1990). *Official Methods of Analysis,* 15th edn. Association of Analytical Chemists, Arlington, VA, USA.

ASPA, Commissione metodologie di valutazione della produzione quanti-qualitativa della carne (1991). *Metodologie relative alla macellazione degli animali di interesse zootecnico e alla valutazione e dissezione della loro carcassa*. ISMEA, Roma.

Coppola, P., Infascelli, F., Zicarelli, F., Tudisco, R., Bovera, F., Cutrignelli, M.I. and Piccolo, V. (2003). Impiego di mangimi a diversa degradabilità proteica durante il preparto e l'allattamento in capre Cilentane allevate al pascolo. In: *Proceedings LVII SISVet National Congress*, Ischia (Italy), 25-27 September 2003.

Cutrignelli, M.I., Sarubbi, F., Durante, G., Bovera, F. and Infascelli, F. (2000). Influenza del livello energetico e proteico del mangime sulla produzione quanti-qualitativa di latte in capre allevate al pascolo. In: *Proceedings XIV SIPAOC National Congress*, Vietri sul Mare (Italy), 18-21 October 2008, pp. 363-369.

Dhanda, J.S., Taylor, D.G., McCosker, J.E. and Murray, P.J. (1999a). The influence of goat genotype on the production of Capretto and Chevon carcasses. 1. Growth and carcass characteristics. *Meat Sci.*, 52: 355-361.

Dhanda, J.S., Taylor, D.G., Murray, P.J. and McCosker, J.E. (1999b). The influence of goat genotype on the production of Capretto and Chevon carcasses. 2. Meat quality. *Meat Sci*., 52: 363-367.

Dhanda, J.S., Taylor, D.G., McCosker, J.E. and Murray, P.J. (1999c) The influence of goat genotype on the production of Capretto and Chevon carcasses. 3. Dissected carcass composition. *Meat Sci*., 52: 369-374.

Dubeuf, J.-P., Morand-Fehr, P. and Rubino, R. (2004) Situation, changes and future of goat industry around the world. *Small Rum. Res.,* 51: 165-173.

EC Regulation 1804/1999 of 19 July 1999. OJ L 222 of 24/8/1999

EC Regulation 2092/91 of 24 June 1991. OJ L 198 of 22/7/1991

Gault, N.F.S. (1985). The relationship between Water- holding capacity and cooked meat tenderness in some beef muscles as influenced by acidic conditions below the ultimate pH. *Meat Sci*., 15: 13-30.

Grau, R. and Hamm, R. (1957). Fleischwirts, 6, 36. Cit. by Grau, R. (1978). Carne e prodotti carnei. Edagricole, Bologna.

Infascelli, F., Sarubbi, F., Calabro, S., Bovera, F., Durante, G. and Piccolo, V. (1998). Influenza del livello di integrazione alimentare sulla produzione quanti-qualitativa di latte in capre allevate al pascolo. In: *Proceedings XIII SIPAOC National Congress*, Palermo (Italy), 16-19 April 1998, pp. 81-83.

INRA (1988). *Alimentation des Ruminants*. INRA, Paris.

Lundström, K. and Malmfors, G. (1985). Variation in light scattering and water-holding capacity along the porcine *longissimus dorsi* muscle. *Meat Sci*., 15: 203-214.

Morand-Fehr, P. and Boyazoglu, J. (1999) Present state and future outlook of the small ruminant sector. *Small Rum. Res*., 34: 175-188.

Rubino, R. (1996). *L'allevamento caprino.* ASSONAPA, Roma.

SAS (2000). *User's Guide: Statistics*. SAS Institute Inc., Cary, NC, USA.

Sormunen-Cristian, R. and Kangasmaki, T. (2000). Performance of Finnish Landrace goat kids and lambs raised under stall-feeding condition in Finland. *Small Rum. Res*., 38: 109-114.

Wheeler, T.L., Savell, J.W., Cross, H.R., Lunt, D.K. and Smith, S.B. (1990). Effect of post mortem treatments on the tenderness of meat from Hereford, Brahman and Brahman-cross beef cattle. *J. Anim. Sci*., 68: 3677-3686.