

Fleece and skin traits of goats of different genetic types reared in southern Italy

A. Di Trana^{1#}, P. Celi¹, L. Sepe², S. Desantis³ and R. Rubino²

¹Dipartimento di Scienze delle Produzioni Animali, Università della Basilicata, 85100 Potenza, Italy

²Istituto Sperimentale per la Zootecnia, 85010 Bella-Muro, Italy

³Dipartimento Sanità e Benessere, Università di Bari, 70010 Valenzano, Italy

Abstract

The aim of this study was to evaluate the qualitative and quantitative characteristics of down fibre production and of the percentage of active hair follicles in several genetic types of Italian goats. The trial was carried out in two regions of southern Italy, Basilicata and Calabria. Two hundred and eighty adult female goats of five different genetic types were used in this study: the Azzara population, the Nicastrese population, the Red Syrian breed, the Garganica breed and the Calabrese population. A significant effect of genetic type was noted on cashmere diameter, standard deviation of cashmere diameter, yield, down length, guard hair length, crimps, secondary and active primary hair follicles. Calabrese goats presented the lowest fibre diameter values (13.03 µm) while the highest diameter was recorded in the Red Syrian breed (13.88 µm). Cashmere yield was higher in the Calabrese (9.6%), Nicastrese (9.1%) and Red Syrian (7.7%) than in the other genetic types. Cashmere length values were significantly higher in the Nicastrese (31 mm) and Calabrese (30 mm) groups than in Azzara and Garganica groups. Guard hair length was lowest in the Azzara population (88 mm) and highest in the Garganica breed (233 mm). Active secondary follicles were higher in the Calabrese, Azzara and Nicastrese (57.9%, 51.5%, 43.9%) goats compared to the Red Syrian and Garganica groups. The proportion of active primary follicles was similar in Azzara, Nicastrese and Calabrese goats, and it was lower than in the Red Syrian and Garganica breeds.

Keywords: Goats, genetic type, cashmere fibre, yield, cashmere length, diameter, secondary follicles

[#]Corresponding author. E-mail: ditrana@unibas.it

Introduction

The size of the Italian goat population has been estimated to be about 1 375 000 head, with 81% of them being reared in the southern regions (FAO, 2002). The majority of Italian goats are represented by breed-populations characterised by different productive traits which depend on the variability of environmental and genetic factors. Goat farming is mainly concentrated on dairy and meat production but, recently, attention has been focused on the production of animal fibre (Celi *et al.*, 1999). The body surface of goats is covered with a double-coat consisting of two types of hair, one long and coarse (guard) hair, the other short and fine (down) hair. They originate from the primary and secondary hair follicles, respectively (Ryder, 1966). The growth of the fibre that originates from the secondary follicles, also known as cashmere, normally takes place between the summer and winter solstices. The sustainability of fine fibre production from the local population of goats would be of great economic relevance since it would diminish the importation of fine fibres. Furthermore, it would be an additional income for the farmer in addition to that from milk and meat production. Previously, we have observed that down fibres are produced by a local population of goats (Rubino *et al.*, 2000). The aim of this study was to evaluate the qualitative and quantitative characteristics of down fibre production and of the percentage of active hair follicles in several genetic types of Italian goats.

Materials and Methods

The trial was carried out in two regions of southern Italy, Basilicata (41°N) and Calabria (39 °N). Adult female goats of five different genetic types were used in this study, viz. an Azzara population (n = 34), a Nicastrese population (n = 51), the Red Syrian breed (n = 65), the Garganica breed (n = 68) and a Calabrese population (n = 62). Hair from a 10 cm² patch was taken from the mid-side of each animal, using surgical clippers. Fibre samples were collected between the end of December and January of 2000/01. Fibre

samples were placed in a temperature (20 ± 2 °C) and relative humidity ($65 \pm 2\%$) controlled room overnight, as recommended by IWTO (1989). The hair samples were weighed, and then the guard (GH) and down (D) hair were manually separated and their length (GHL and DL) measured. The samples were then placed in a temperature-controlled room overnight. The GH and D were weighed separately and the weight of the down fibres was compared to that of the entire patch to represent down yield (Y). Mean down fibre diameter (MFD) and standard deviation of mean down fibre diameter (MFD-sd) were measured in each animal using the OFDA (Optical Fibre Diameter Analyser), according to fibre diameter of measurement programme of Macaulay Animal Fibre Evaluations Laboratory. The number of crimps (CR) in down was counted on some fibres and scored. Undercoat fibre colour was recorded as white or coloured. Skin biopsies were taken under local anaesthesia from all animals from the same spot where the hair was collected, using curved scissors. The number of active primary (P) and secondary (S) hair follicles was determined *via* histological examination of skin biopsies chosen randomly from 10 subjects in each genetic type (SACPIC method as modified by Nixon, 1993).

The statistical analysis of MFD of the down, MFD-sd, Y, DL, GHL, CR, active secondary hair follicles and active primary hair follicles was carried out with the analyses of variance procedure, using SYSTAT (1992) statistical package with a monofactorial model (effect of genetic type). Data expressed as proportions were subject to an angular transformation before analysis. The differences between means were tested using the least significant difference.

Results and Discussion

A significant effect ($P < 0.05$) of genetic type on MFD, MFD-sd, Y, DL, GHL and CR was noted (Table 1). Calabrese goats presented the lowest MFD and MFD standard deviations (s.d.) values while the highest MFD and MFD-s.d. were observed in the Red Syrian breed. No differences in MFD and MFD-s.d. were found between the other groups. The Calabrese population produced the highest hair yield and Garganica the lowest, with Azzara, Nicastrese and Red Syrian genotype groups having intermediary values for down yield. The DL values were lower ($P < 0.05$) in the Azzara and Garganica genetic types than the Nicastrese and Calabrese genetic types. Red Syrian goats produced intermediary values of DL. The GHL was lowest in the Azzara population and the highest in Garganica breed. The GHL was similar in Nicastrese, Red Syrian and Calabrese goats and longer than 100 mm. The CR score was higher in Red Syrian, Garganica and Azzara groups than in Nicastrese and Calabrese genetic types. Secondary fibre colour was white in the Azzara and Calabrese goats and coloured in the Red Syrian, Garganica. The fibres of the Nicastrese goats were 50% white and 50% coloured.

Table 1 Least squares means for mean fibre diameter (MFD), standard deviation of mean fibre diameter (MFD-s.d.), yield (Y), down length (DL), guard hair length (GHL) and crimps (CR)

Genetic type	MFD µm	MFD-s.d. µm	Y %	DL mm	GHL mm	CR score
Azzara	13.21 ^{ab}	3.64 ^{ac}	6.1 ^{ab}	23 ^a	88 ^a	4.3 ^a
Nicastrese	13.29 ^{ab}	4.03 ^{ac}	9.1 ^{ac}	31 ^b	125 ^b	3.0 ^b
Red Syrian	13.88 ^a	4.56 ^a	7.7 ^{ac}	26 ^{ab}	102 ^{ab}	4.6 ^a
Garganica	13.24 ^{ab}	2.95 ^{bc}	3.8 ^b	24 ^a	233 ^c	4.4 ^a
Calabrese	13.03 ^b	2.42 ^b	9.6 ^c	30 ^b	119 ^b	2.5 ^b
Pooled s.e.	0.30	0.51	1.32	2.11	9.23	0.3

^{a,b,c} column means with different superscripts differ at $P < 0.05$

The percentage of active secondary hair follicles and active primary hair follicles (Table 2) was significantly affected by genetic type ($P < 0.05$). The proportion of active secondary hair follicles was highly variable between genetic types, with the highest percentage ($P < 0.05$) recorded in the Calabrese goats. The percentage of active secondary follicles was higher ($P < 0.05$) in the Azzara, Calabrese and Nicastrese goats than in the Red Syrian and Garganica groups. The percentage of active primary follicles was similar in Azzara, Nicastrese and Calabrese goats, and was lower ($P < 0.05$) than in Red Syrian and Garganica breeds.

Similar parameters were reported by other authors for down fibre and skin traits of different genetic types. However, these studies cannot be clearly compared to the present one because Holst *et al.* (1982) reported fibre and skin characteristics of Australian feral does and bucks; Bishop & Russel (1994) described productivity of Scottish feral goats, but in this study the animals were 5-month-old kids. Vegara *et al.* (1999) reported down production levels of Norwegian dairy goats and these data seem to be close to the values in our study. Moreover, our research was supported by skin characteristics.

Table 2 Least squares means of percentage of active secondary follicles and primary follicles of skin

Genetic type	Secondary follicles (%)		Primary follicles (%)	
Azzara	51.54	a	81.64	a
Nicastrese	43.92	a	88.83	a
Red Syrian	2.31	b	44.38	b
Garganica	0.47	b	54.40	b
Calabrese	57.99	a	82.51	a
Pooled s.e.	7.70		5.61	

^{a,b,c} column means with different superscripts differ at $P < 0.05$

Conclusions

This study showed that the breed-populations used produce a very fine cashmere fibre. The observed values of down yield and the percentage of active secondary follicles suggest that the Azzara, Nicastrese and Calabrese populations have the potential to produce textile fibre of high quality. The observed values of down length represent a limiting factor for cashmere production, even if some genetic types (Nicastrese and Calabrese) exhibited interesting down length values.

Acknowledgements

The authors would like to thank the APA of Catanzaro for their support in the farms. This research was financially supported by MURST (Cofin. 1999-01).

References

- Bishop, C.S. & Russel, A.J.F., 1994. Cashmere production from feral and imported Cashmere goat kids. *Anim. Prod.* 58, 135-144.
- Celi, R., Di Trana, A., Totoda, F., Facciolongo, A.M., Colonna, M.A. & Rubino, R., 1999. Cashmere production in Italy: current status and future perspectives. *EFFN* 6, 15-16.
- FAO, 2002. Statistical database. <http://www.apps.fao.org>
- Holst, P.J., Clarke, W.H. & Maddocks, I.G., 1982. Skin and fleece characteristics of groups of feral goats. *Aust. J. Exp. Agric. Anim. Husb.* 22, 173-176.
- International Wool Textile Organisation (IWTO), 1989. Specification ITWO-8-89E International Wool Secretariat, Ilkley, UK, 1-17.
- Nixon, A.J., 1993. A method for determining the activity state of hair follicles. *Biot. Histoch.* 68 (6), 316-325.
- Rubino, R., Di Trana, A. & Sepe, L., 2000. First appearance of Cashmere in a local goat breed in Italy. *Proc. 7th Int. Conf. on Goats.* p. 656.
- Ryder, M.L., 1966. Coat structure and seasonal shedding in goats. *Anim. Prod.* 8, 289-302.
- SYSTAT, 1992. Statistics, Version 5.2 Edition. Evanston, IL, USA.
- Vegara, M., Ádnóy, T., Ádnóy, L.O., Eik, L.O. & Standal, N., 1999. Down production of Norwegian dairy goats. *Small Rumin. Res.* 33, 293-297.