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Effects of housing system on welfare and milk yield and quality of Girgentana goats

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RIASSUNTO – Effetti del sistema di stabulazione sul benessere e sulla produzione di latte di capre Girgentane – *La stabulazione in poste individuali, in uso per la razza Girgentana, per evitare che le capre possano procurarsi lesioni con le corna, viene confrontata con la stabulazione libera, valutando il grado di benessere e la produttività di 40 capre. Le Girgentane tenute alla posta hanno fatto rilevare buone condizioni di benessere e un più elevato livello produttivo, collegati alla mancanza degli effetti stressanti della gerarchia sociale ed alla possibilità dell'integrazione individuale. Tuttavia, assicurando adeguata igiene e sufficiente spazio, le Girgentane hanno mostrato di poter adattarsi anche alla stabulazione libera, che ha offerto maggiori possibilità di movimento e relazioni sociali, e ha indotto una migliore risposta immunitaria; la minore esigenza di manodopera compenserebbe il più basso livello produttivo registrato con tale sistema.*

KEY WORDS: Girgentana goats, housing system, welfare, milk.

INTRODUCTION – In the past years, in Sicily, goats of the Girgentana breed have decreased so drastically in number that they risked extinction. Among the causes, particular blame can be laid at the traditional housing system, in which the goats, after coming back from pasture, were tethered in individual wooden stalls. Such a system is still considered necessary by breeders in order to avoid aggressive and harmful behaviour on the part of the animals, due to the presence of their long horns (Giaccone *et al.*, 1994). This belief negatively interferes with the action recently initiated for the recovery and regeneration of the breed (Portolano *et al.*, 2002); in fact, the tie stalls housing, increasing manpower, limits the increase in size in herds of Girgentana goats. On the other hand, the biological production method does not admit the tie stall housing, but imposes a housing system that ensures that animals have freedom of movements and can express normal social behaviour. The present study aims to contribute to the development of the Girgentana breed, evaluating its adaptation to free-housing. Goats tethered in stalls and free-housed in a straw-bedded pen were compared by assessing their behavioural, immunological, endocrine and productive responses.

MATERIAL AND METHODS – The experimental site was the Pietranera farm (Agrigento, Italy, latitude 37°37'N, longitude 13°29'E, altitude 178 m a.s.l.). The research lasted 10 weeks during spring 2002 and involved 2 groups of 20 Girgentana goats each, homogeneous for age, stage of lactation (from 60 to 100 d), milk yield and BCS. Both groups were maintained on the same fenced pasture (1 ha) during the daytime (9.00am-4.00pm), and moved to a semi-open shelter in the afternoon. Within the same shelter, the goats of one group (TS) were tethered in wooden stalls equipped with a trough and bucket, whereas the other group (FH) was free-housed in a straw-bedded pen of 80 m^2 (4.0 m^2/head), with a manger of 8 m (0.4 m/head); a layer of straw was added daily to keep the pen dry. The goats of both groups

were fed 500 g/head/d of hay in the evening, and 300 g/head/d of whole barley into two meals; water was provided *ad libitum*. Ambient temperature and humidity in the shelter were monitored by thermo-hygrographs. Body weight and BCS were measured at the start and the end of the trial. Jugular blood samples for cortisol dosage (RIA, Immunotech, France) were collected at 1st and 10th week. The skin test, as indicator of the cell-mediated immune response, was performed at 3rd and 10th week, injecting intra-dermally phytohemoagglutinin (PHA-P, Sigma-Aldrich; 1 mg dissolved in 1 ml of sterile saline solution) in the upper side of each shoulder, and measuring the skin-fold thickness before and after 24 h PHA injection with a caliper. Goats were hand milked twice daily (7.00am and 4.30pm). Group milk yield and hay intake were recorded daily. Other measurements were effected 5 times bi-weekly. Behavioural activities (grazing, eating, ruminating, walking, standing, lying, social and aggressive interactions, self scratching, licking) of groups were recorded by video-camera at pasture and in shelter, from 9.00am to 6.30pm every 15 minutes. Forage samples selected by goats at pasture were hand collected. Analysis for DM, CP, EE, ash, NDF, ADF, ADL and in vitro dOM (Aufrere, 1982) was carried out on green forage (20.9% CP, 36.2% NDF, 77.1% dOM), hay (12.5% CP, 47.1% NDF, 58.9% dOM) and barley (11.5% CP). Individual milk yield was recorded and milk samples analysed for pH, titratable acidity, fat, protein, lactose, somatic cells, bacterial count, total N, non-casein N, non-protein N and lactodynamographic parameters (r, k_{20}, a_{30}) (ASPA, 1995). Means difference for daily milk yield and hay intake were tested by Student "t" test in pairs. Milk quality parameters and behavioural activities were analysed by GLM procedure of SAS, including the effects of housing system, time and their interaction. The somatic cells and bacterial count values were transformed logarithmically ($\log_{10}$). Other parameters were tested by simple Student "t" test.

RESULTS AND CONCLUSIONS – During the trial, the daily average temperature and humidity into the shelter ranged from 6.0 to 22.5°C and from 57.5 to 96.0 %. The FH goats had a higher hay intake (289 *vs* 253 g DM/head/d, P≤0.01), probably due to the higher amount of hay fell down. Initial and final body weight and BCS of goats did not differ between groups. The level of cortisol, equal in the groups at 1st week, increased in the FH goats at 10th week (37.6 *vs* 24.6 ng/ml, P≤0.05), possibly due to stress caused by the unavoidable social hierarchy. The increase in skin-fold thickness was comparable between groups at 3rd week, but was higher in FH goats at 10th week (11.7 *vs* 9.8 mm, P≤0.05), demonstrating a better immune response induced by FH, not impaired by the cortisol level (Rhind *et al.*, 1999). At pasture, the incidence of goats involved in different behavioural activities was similar in the groups; grazing was the main activity for both groups (77.0%). During housing (Figure 1), differences emerged in the incidence of goats involved in the various behavioural categories. The FH increased standing activity and both social and aggressive interaction, whereas the TS favoured lying and ruminating activities, but obviously excluded walking. During trial, milk yield of TS goats was constantly higher than the FH group (1096 *vs* 1004 g/head/d, P≤0.01) (Figure 2), a consequence of both lower energy consumption and individual feed supplementation. The milk quality of FH group differed from that of TS group for casein (2.9 *vs* 2.7 %, P≤0.05) and a_{30} (43.2 *vs* 40.2 mm, P≤0.05). Housing system did not affect somatic cells and bacterial count. Therefore, the TS goats seemed to have a better state of well-being, not being subjected to stress due to social hierarchy, and showed a higher milk yield, due to the possibility of individual feeding. Nevertheless, results indicate that the Girgentana goats can be well adapted to FH, as long as they have adequate hygiene and space for movements and feeding; the lower milk yield emerging here might be compensated by the better milk quality and a reduction in manpower.

Figure 1. Behavioural activities (%goats) observed during housing (*:P<0.05; **:P<0.01).

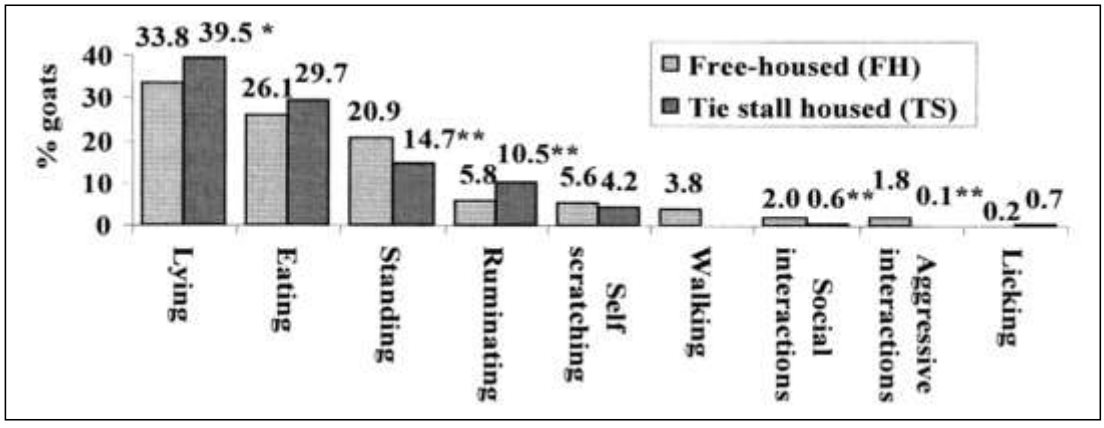
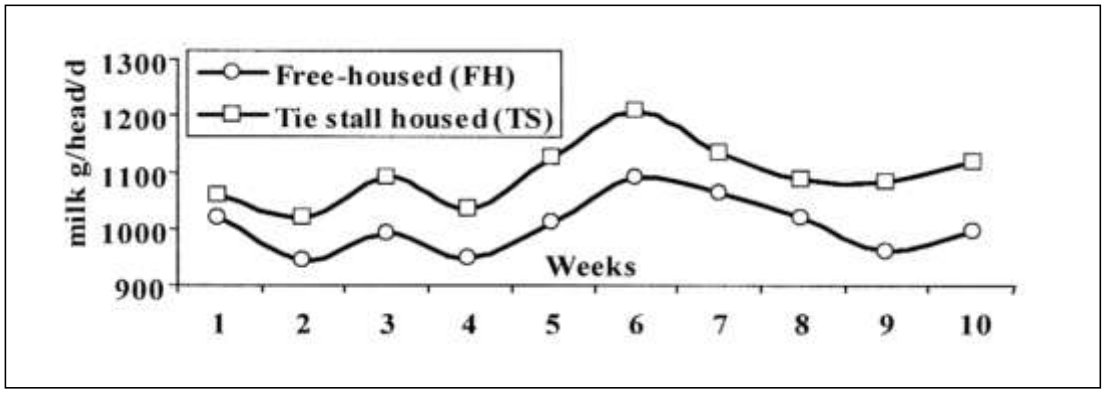


Figure 2. Milk yield (g/head/d) during the experimental period.



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