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Evaluation of animal welfare and milk production of goat fed on diet containing hydroponically germinating seeds

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ABSTRACT - Hydroponic fodder is a particularly nutritious feed, rich in protein and vitamins such as β -carotene, trace elements and enzymes. It may also offer the advantage of a continuous availability. A pilot plant for hydroponically production of germinating seeds was built in an area of the same farm where the trial took place. Three homogeneous groups of 30 Jonica breed goats in lactation (4th-5th parity) were used to evaluate the effects of two different levels of partial dietary substitution with hydroponically germinating (h.g.) oat on plasma levels of cortisol and milk production. Germinated oat was used after 7 days of hydroponic growth. Control group (T) received only feed (fodder and oat integrated with complement feed). The other 2 groups were fed on diet containing different levels (1,5Kg - group A; 3Kg - group B) of hydroponically germinating oat. Goats showed a small interest in fresh feed during the trial period. The integration with hydroponically germinating oat in partial substitution of the traditional feed in the diet of goat did not significantly affect biochemical and haematological parameters.

Key words: Goat, Cortisol, Milk production, Hydroponics.

Introduction - Dairy goat and dairy sheep farming is a fundamental part of the national economy, especially the rural economy of many countries in the Mediterranean region (Boyazoglu, 2001). The two species are frequently reared together, although they are different under some points of view as disposition, temperament and productivity. In fact, goats are adapted to the difficult environment of marginal land and scarce feed (Kadim *et al.*, 2006). Researchers can formulate diet in order to optimize milk-production and, at the same time, offer a suitable and balanced feeding to animals, also improving their welfare. Some reports (Peris *et al.*, 1999; Bonanno *et al.*, 2007) establish the importance of the rearing conditions for goat during lactation. It is known that hormones, as well as modulators and central neuropeptides, interact with the energetic pathway and consequently affect productive and reproductive performances. For these reasons a study on welfare should analyse haematic-chemical characteristics, serum protein and hormone levels as stress indicators (Walsberg, 2003; Romero *et al.*, 2004; Scheneider *et al.*, 2004). Researchers have been used several physiological indicators to assess welfare/stress in livestock. Stress in animal husbandry is related to changes in hormone levels and blood chemistry as well as behavioural reactions. The plasma content of cortisol is an effective indication of goat welfare (Kannan *et al.*, 2000). It may be helpful to find new feeding systems, such as fodder produced hydroponically, which can offer a constant supply of food, characterized by a high protein level and mineral salts. This work aims to evaluate goat welfare and milk production when animals are fed on diet containing h.g. seeds. Data were recorded in order to assess the effects of this kind of diet and evaluate animal welfare (by biochemical, haematological and hormonal tests) and milk production.

Material and methods - The research was carried out in the agro-zootechnical farm “L’Aia Vecchia”, (Lecce, Apulia Region), between September 2006 and January 2007. Three homogeneous groups (10 subjects each one, 30 in total) of Jonica breed goats in lactation (4th-5th parity) were used for the trial. All the subjects were fed a daily ration *per capita* with 400g of feed and 700g of wheat straw as unifeed, (average moisture about 60%), by mixer wagon. In addition, the three groups received an integration of: 600g of feed for the first group, as control (T); 400g of feed and 1.5kg of h.g. oat in the second group (A); 200g of feed and 3kg of h.g. oat in the third group (B). The feed used was complete, balanced and pelleted, the same for all three groups. Chemical and nutritional characteristics of dry matter of diet for all groups were as follows: 16.5% crude protein, 25% crude fiber, 0.80UF for milk/ kg d.m. A pilot plant for h.g. seeds production was built in an area of the farm; h.g. oat was used after 7 days of hydroponic growth. The biochemical and haematological profiles, as well

Figure 1. Plasma cortisol level (ng/ml) in the three groups at time 0, after 1 and 2 months from the introduction of hydroponics in diet.

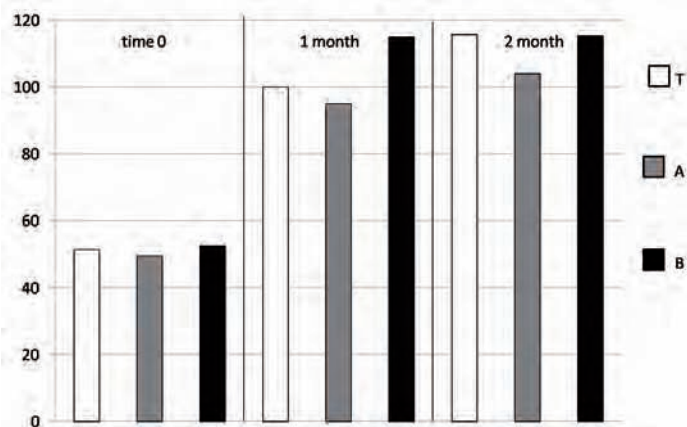
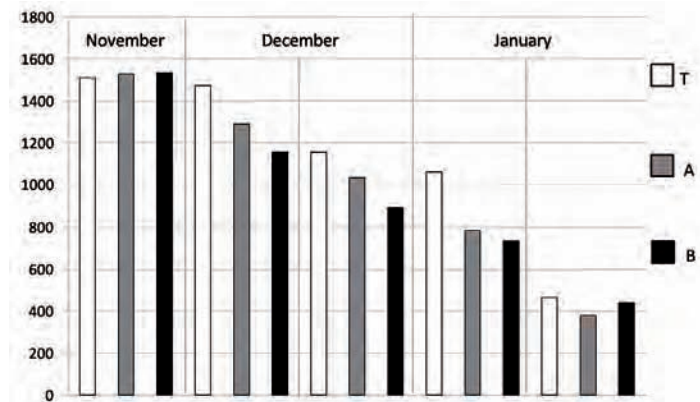


Figure 2. Daily average milk yield (g/d) in the three groups during the trial period.



as the level of plasma cortisol and the daily milk production (7 controls every ten days) were recorded. Blood parameters were established on samples taken from the jugular vein of the animals between 8:00 and 9:30a.m., at the end of each month. Plasma cortisol amount was assessed by ELISA Kit (Medical Biological Service). Statistical analysis was performed by one way ANOVA. Differences were considered statistical significant when $P < 0.05$, highly significant when $P < 0.001$.

Results and conclusions

- All the subjects displayed a little appeal to eat h.g. oat that had not been completely consumed, confirming the inclination of this species to select foodstuff. Data relating to biochemical and haematological profiles (not shown) were all in the physiological range, without any statistically significant change in the three groups of animals throughout the trial. The average values of plasma cortisol (ng/ml) in all groups at time 0 (before the introduction of hydroponics in the diet), after 1 and 2 months from the start of experiment are shown in Figure 1.

It was observed a progressive increase of cortisol during the time for all groups, proving that in goats the plasma levels of cortisol are higher during the winter than in other periods (Nelson *et al.*, 2000; Al Busaidi *et al.*, 2008), while for each sampling time of plasma cortisol no significant differences were detected among the three groups. The average daily milk yield (g/d) during the trial are shown in the Figure 2. It was noticed for all groups and for each decade of sampling a gradually decrease of daily milk yield, due to physiological trend of lactation. However, any relevant change in milk yield was never found among groups. In the end, we may conclude that the integration with h.g. oat in partial substitution of the traditional feed in the diet did not significantly influence physiological parameters of goat. The findings of this experiment are in disagreement with our other ones obtained by a simultaneous trial carried out on Comisana sheep (Micera *et al.*, 2009). In our opinion, the use of a feed based on h.g. seeds improved sheep welfare and milk production in ewes (Micera *et al.*, 2009), while did not determine any effect on goat physiological parameters. That is due probably to the behaviour of this last species about feeding fresh forage supplied in manger, considering that higher feed refusal estimations were recorded for forage grasses than leguminous fodder crops. It could be interesting to evaluate using of this kind of diet when it is supplying many times a day, since the metabolic effect of feed in goat accustomed to eat little and numerous intakes throughout the day (Abijaoudè *et al.*, 2000).

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