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# Improvement of sheep welfare and milk production fed on diet containing hydroponically germinating seeds

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**ABSTRACT** - Plasma cortisol and milk production responses of 45 lactating Comisana sheep (4<sup>th</sup>-5<sup>th</sup> parity), divided into three homogeneous groups of 15 subject each, were used to evaluate the effects of two different levels of partial substitution of a complete feed with hydroponically germinating seeds. Germinated oat was employed after 7 days of hydroponic growth. The three groups received the following diets: Control group (T) received only complete feed. The other 2 groups were fed on diet containing different levels of hydroponically germinating oat (1,5 kg – group A; 3 kg – group B). All the subjects have shown to accept the diets because the *per capita* ration was always completely consumed. In the second month, the A and B groups showed lower average values of cortisol ( $P<0.01$ ) and a statistically significant increase in milk production as compared to T ( $P<0.05$  and  $P<0.001$ ). The obtained data induced to conclude that integration with hydroponically germinating oat in partial substitution of the complete feed does not modify biochemical and hematological parameters and seems to produce an improvement in animal welfare and production of milk.

*Key words:* Sheep, Cortisol, Milk production, Hydroponics.

**Introduction** – The sheep rearing is a productive reality of Apulia region, widespread and with a strong tradition. Several available researches, even recent, are related to sheep milk composition, which, on the other hand, is characterized by great structure variability (Pinto *et al.*, 1979-80; Ledda, 1992; Ragni *et al.*, 2001). This variability depends on endogen factors such as breed, individual, lactation duration, hygienic and sanitary condition and external factors such as feeding, environment and breeding technique, that can be easily controlled and managed. An important factor is feeding. Researchers can use it to optimize milk-production and, at the same time, to offer a suitable and balanced feed to animals, also improving their welfare. Some reports (Casamassima *et al.*, 2001; Panagakis *et al.*, 2004) establish the importance of the rearing conditions for sheep during lactation. It is known that hormones, as well as modulators and central neuro-peptidis, interact with the energetic pathway and consequently affect productive and reproductive performances. For these reasons, an experiment on welfare has to analyse haematic-chemicals, serum protein and hormones levels as welfare/stress indicators (Walsberg, 2003; Romero *et al.*, 2004; Schneider *et al.*, 2004).

The sheep breeders have to face daily economic difficulties in fodder supply. It may be useful to find new feeding systems, such as feed produced by hydroponically germinating seeds, which can offer a constant supply of food, characterized by a high protein level and mineral salts and poor in raw cellulose and dry matter, already abundant in dry fodder used.

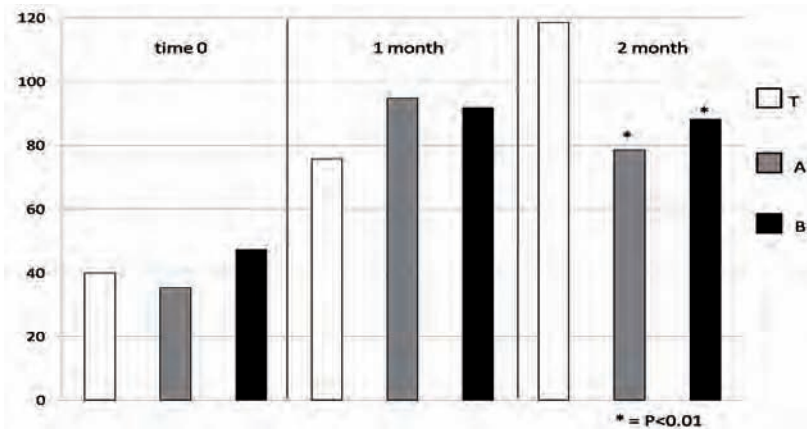
Hydroponic feed has excellent nutritive value as it is fed to animals in its entirety - roots, seed, and

green foliage. The hydroponic feed can be grown from grains such as oat, barley, rye, wheat, sorghum or corn. This work aims to evaluate animal welfare and milk production of sheep fed on diet containing hydroponically germinating seeds. Use of hydroponically germinating seeds in diet will improve animal welfare conditions. Data have been recorded in order to measure the effects of this use and to 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), where a flock of 700 Comisana breed was usually reared.

From this stock, 45 ewes (4<sup>th</sup>-5<sup>th</sup> parity), with similar milk yield in previous lactation, were chosen and assigned to three homogeneous groups (15 subjects each one) and used for the trial between September 2006 and January 2007. All the subjects were fed on a daily ration *per capita* prepared with 400 g of feed and 700 g of wheat straw as unifeed, (average moisture 60%), by a mixer wagon. In addition all groups received an integration *per capita* of: 600 g of feed for the first group, as control, (T); 400 g of feed and 1.5 kg of hydroponically germinating oat for the second group (A); 200 g of feed and 3 kg of hydroponically germinating oat for the third group (B).

Figure1. Mean values of cortisol in sheep expressed as ng/ml.

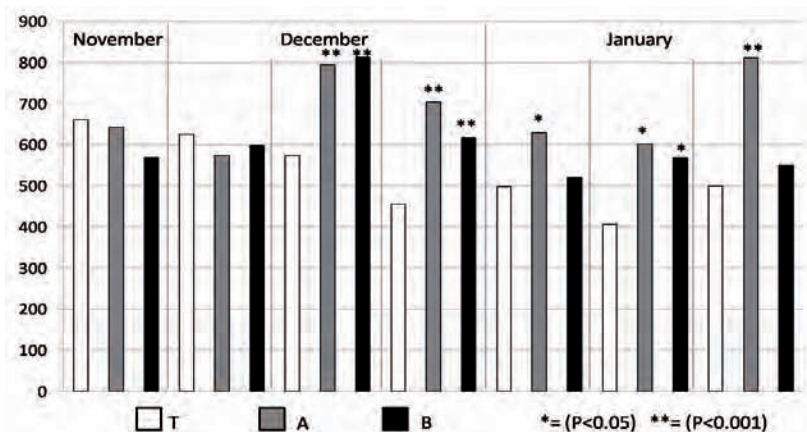


The feed was complete, balanced and pelleted, for all three groups. The chemical and nutritional characteristics of dry matter (DM) of the diet for all groups were as follows: 16.5% crude protein, 25% crude fiber, 0.80 forage unit (FU) for milk/kg DM

A pilot plant for hydroponically germinating seeds production was placed in an area of the farm. Germinating oat was used after 7 days of hydroponic growth. To evaluate sheep welfare and milk production, the biochemical and hematological profiles were recorded at the end of each month, as well as the milk production were assessed on 7 controls every ten days.

Blood parameters

Figure 2. Daily average values of milk production expressed in g



and the level of plasma cortisol were determined by analysis on samples taken from the jugular vein of the experimental animals between 8:00 and 9:30 a.m. The biochemical and hematological data were obtained by consolidated methods. Plasma cortisol concentration was assessed by ELISA Kit (Medical Biological Service).

Statistical analysis was performed by one-way ANOVA. Differences were considered statistically significant when  $P < 0.05$ , highly significant when  $P < 0.001$ .

**Results and conclusions** – All the subjects have shown to accept the hydroponically germinating oat because the *per capita* ration was always completely consumed. The data obtained by the evaluation of biochemical and haematological profiles (not shown), all in the physiological range, did not show statistically significant changes in the three groups of animals throughout the trial. The average values of cortisol (ng/ml) in 3 groups of sheep 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.

After 1 month plasma cortisol, increased in all animals, was statistically similar among groups. In the second month, the A and B groups showed lower average values of cortisol than T ( $P < 0.01$ ). As far as the average daily milk production (Figure 2), it may be observed that amounts, initially comparable among T, A and B (November and early December), were gradually **changed in successive decades**, with a regular decrease for T and a statistically significant increase in milk production for A and B as compared to T ( $P < 0.05$  and  $P < 0.001$ ).

The obtained data induced to conclude that integration with hydroponically germinating oat in partial substitution of the complete feed does not modify biochemical and hematological parameters and seems to produce an improvement in animal welfare and production of milk.

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