

Effects of feeding diets supplemented with fungus myceliated grains on some production, health and oxidation traits of dairy ewes

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Abstract – The beneficial properties of mushrooms bioactive compounds indicate their potential use as performance enhancing natural additive for livestock animals. This paper reports the preliminary results of a research on the effects of diets supplemented with fungus myceliated grains (FMG) to lactating ewes in terms of intestinal parasites control, milk production and cheese oxidative stability. During 8 weeks, 21 ewes were divided into 3 groups fed with hay *ad libitum* and 1.3 kg/day per head of one of 3 concentrates with 0, 10 or 20% of FMG. In front of analogous DM and nutrients intake, the ewes fed FMG at higher levels showed a reduction of intestinal parasite infection, a tendency to improve milk yield and a higher milk casein content. The increase of FMG in the diet was responsible of production of cheeses with a lower secondary lipid oxidation and a higher antioxidant capacity, suggesting a major oxidative stability of cheese fat and an enrichment of cheese in antioxidant compounds induced by the FMG. These preliminary results appear to be promising, and further investigations are recommended.

Keywords: ewes, fungus myceliated grains, intestinal parasites control, milk, cheese oxidative stability

INTRODUCTION

Mushrooms contain many bioactive compounds, mainly poly- and oligosaccharides, known to be beneficial for consumers' health. Among the polysaccharides, the β -glucans showed to exhibit immunomodulating, antibacterial and antifungal properties, in addition to antitumor activities [1].

Furthermore, some mushrooms showed to have antioxidant activities due to the presence of phenolic compounds, including flavonoids and phenolic acids, as well as vitamins like β -carotene, ascorbic acid and α -tocopherol [2]. The use of mushrooms in the feeding of poultry species indicated similar positive effects on immune system, microbial and parasite control, antioxidant protection and production [3,4]. Furthermore, mushrooms fed to broilers chickens in the form of fungus myceliated grains (FMG) were effective in the control of intestinal pathogens, such as *Salmonella enteritidis* [5] and *Eimeria* spp. [6]. However, until now, no experiment studied the effects of dietary mushrooms or FMG on physiological, health and productive responses of livestock ruminants. Thus, a study was aimed to test the effects of feeding diets supplemented with FMG to lactating ewes. This paper reports the preliminary results on the control of intestinal parasites, milk yield and quality, and cheese oxidative stability.

METHODS

A total of 21 ewes of Valle del Belice breed at 80 days in milk were divided into 3 groups. During 8 weeks, each group was fed with sulla hay *ad libitum* integrated with 1.3 kg/day per head of one of 3 isoproteic and isofibrous concentrates containing faba bean (50%), barley (30%) and experimental grains (20%), this latter supplied as FMG, prepared by incubating sterile grains with selected fungi [5], at 0% (FMG0), 10% (FMG10) or 20% (FMG20).

At the start and the end of the experiment, ewes live weight and body condition score (BCS) were assessed, and individual grab samples of faeces were collected to detect the presence of parasitic infections. At the 8th week, the skin test, as indicator of the cell-mediated immune response, was performed by injecting intradermally phytohemagglutinin and measuring the skin-fold thickness before injection and after 24 h with a calliper. Recording of feed intake and individual milk yield, sampling of feeds and individual milk, and manufacturing of 3 cheeses from each group were performed during the experiment. Samples of feeds were analyzed for chemical composition, and experimental grains were assessed for polyphenol content and antioxidant capacity (TEAC assay). Milk samples were analyzed for lactose, fat, protein, casein, somatic cells count, urea, pH, titratable acidity and clotting ability by Formagraph.

Cheeses aged 21 days were assessed for colour by Minolta Chroma Meter, and resistance to compression measured with an Instron 5564 tester. Freeze-dried cheeses were analysed for DM, fat, protein, ash and polyphenols; peroxide value (POV), as index of primary lipid oxidation; TBARs, as a measure of the secondary lipid oxidation products; the antioxidant capacity by TEAC assay. Data were analysed statistically by the GLM and MIXED procedures in SAS 9.2.

RESULTS AND DISCUSSION

Since concentrates were formulated to be isoproteic (CP 19.7% DM) and isofibrous (NDF 19.4% DM), the experimental groups showed equivalent total DM (3.2 kg/day) and nutrients intake, and the same incidence of concentrate in the diet (36% DM). The ingested FMG was equal to 3.7% and 7.4% of total DM intake with FMG10 and FMG20 diet, respectively.

At the end of experiment, the variations in live weight and BCS, and the immune responses of ewes at the skin test were comparable among groups; however, the ewes showing nematode eggs in faeces decreased more strongly with FMG20 diet (from 7 to 4 ewes infected with *Strongylus* spp., from 4 to 0 ewes with *Nematodirus* spp.), than with FMG10 (from 6 to 5 with *Strongylus* spp., from 5 to 4 with *Nematodirus* spp.) and FMG0 (from 4 to 3 with *Strongylus* spp., no change for the unique ewe infected with *Nematodirus* spp.). Milk yield tended to be higher in ewes fed FMG20 diet (1452, 1408 and 1381 g/day in FMG20, FMG10 and FMG0; $P < 0.10$). This trend was evident from the 4th week of experiment. Milk from ewes fed FMG20 also showed a higher casein content (4.78 vs. 4.32 and 4.27 % in FMG20, FMG10 and FMG0; $P < 0.05$), indicating a better efficiency of dietary protein utilization.

The increase of FMG in the diet was responsible of a reduction in the secondary lipid oxidation of cheeses, as indicated by the trend of TBARs values (4.50 vs. 5.68 and 7.71 µg/kg cheese in FMG20, FMG10 and FMG0; P<0.05), and an increase of the antioxidant capacity, measured by TEAC assay (10.99 vs. 6.06 and 5.65 mmol trolox eq/kg cheese in FMG20, FMG10 and FMG0; P<0.001).

These results suggest an improved oxidative stability of cheese fat and an enrichment of cheese in antioxidant compounds. These effects are presumably due to the transfer of FMG compounds with antioxidant activity, as supported by its TEAC value, which were higher than that of non-myceliated grains (11.05 and 7.30 mmol trolox eq/kg DM).

In summary, FMG is shown to have antiparasitic and antioxidant effects, which could have led to the observed increase in milk yield and the improved properties of dairy products and general health of the ewes. Further investigations are needed to confirm these promising results.

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Fungal supplements enhance beneficial bacteria in chicken stomach

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Keywords: Beneficial bacteria, Chicken feed, Gut microbiome, Mushrooms, Poultry

The chicken stomach microbiome has been found to facilitate various roles in feed conversion, protection of host against pathogens, and secretion of essential metabolites for host benefits. Identifying natural supplements that could boost these vital roles are critical, not only for efficiency in production, but also for protection against pathogens that may help reduce the agricultural over-dependence on antibiotics. The presence of various beneficial bacteria has proven to reduce the presence of pathogens in poultry, without any additional need for antibiotics.

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Edited by Maria Letizia Gargano & Giuseppe Venturella

University of Palermo
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24-28 SEPTEMBER – 2017
PALERMO, ITALY

***ADVANCES IN MEDICINAL MUSHROOM SCIENCE:
BUILDING BRIDGES BETWEEN WESTERN AND EASTERN MEDICINE***

The 9th International Medicinal Mushrooms Book of Abstracts

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ISBN: 978-88-97559-29-0

Design and Layout

Davide Miserendino

broquadro.com

Front cover photo provided by Riccardo Compagno

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