

# Effects of Diet Soybean Meal Substitution by Flaxseed and Lupins on Milk Production, Milk Composition in Holstein Cows - Abstract

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## Summary

The effect of partial substitution of soybean meal by equal quantities of flaxseed and lupins in diets of Holstein cows on metabolism and performance was investigated. A total of 60 animals (30 multiparous and 30 primiparous) were equally allocated into equal groups in a randomized block design. The experiment was conducted in a commercial dairy farm in Polydamio, Farsala, Thessaly. The study period for each animal was 60 days (25 days prepartum and 35 days postpartum). The experimental diet in control group (group M) contained corn, barley, soybean meal, rapeseed cake, corn silage and Lucerne hay, whereas, in the treated group (group T) 75% of soybean meal was substituted by 37.5% whole flaxseed and 37.5% lupins. The experimental diets were fed twice daily with a daily allowance of 24 kg dry matter intake per animal for both groups. The two groups were fed isonitrogenous and isoenergetic diets. Water was available *ad libitum*. Milking was carried out 3 times daily and milk yield was recorded automatically. Milk samples were analyzed for chemical composition, SCC content, CFU, and fatty acid profile. Blood samples were collected on days -30 ( $\pm 5$ ), -15 ( $\pm 5$ ), 0 (calving), 7, 14, 21, 28, 35, 42 and 56 from the tail vein. Serum was separated by centrifugation and stored at -20°C until analysed for NEFA, BHBA, and glucose concentrations. On the days of blood sampling clinical examination of the animals including -when appropriate- evaluation of the uterine involution and ovarian resumption, and determination of body condition score (BSC) were carried out by an experienced vet. Throughout the study period no differences were detected in BCS, glucose and BHBA concentration between the two groups. At calving NEFA concentration did not differ between groups; on days 14 and 42 NEFA levels were higher in group M compared to group T (day 14:  $0.74 \pm 0.2$  mmol/l vs  $0.48 \pm 0.1$  mmol/l,  $p < 0.01$ ; day 42:  $0.37 \pm 0.2$  mmol/l vs  $0.2 \pm 0.1$  mmol/l,  $p < 0.05$ , for groups M vs T, respectively). On day 7, the total milk yield tended to be higher in

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control group ( $29.3 \pm 9.1$  kg vs  $25.4 \pm 8.8$ ,  $p=0.08$ ), which was attributed to the lower milk production of treated primiparous cows ( $22.7 \pm 5.4$  vs  $26.8 \pm 5.6$ ,  $p<0.05$ ). On day 64 no difference was found in milk yield between multiparous or primiparous of the two groups ( $43.4 \pm 12.4$  vs  $42.7 \pm 8.7$  and  $32.0 \pm 11.4$  and  $34.8 \pm 9.0$ , for multiparous and primiparous animals from groups C and T, respectively). The mean increase rate, calculated as the difference of day 64 minus day 7 produced milk, was significantly ( $p<0.05$ ) higher in primiparous treated cows compared to the respective controls. No difference was recorded in milk fat, milk protein, SCC, and CFU at any time point between the two groups. Group T animals had reduced ( $p<0.05$ ) palmitic acid, increased ( $p<0.05$ ) oleic acid and increased ( $p<0.05$ ) linolenic acid (C18:3  $\omega$ 3) compared to group M. Furtherly, milk produced from group T cows expressed decreased milk saturated fatty acids, atherogenicity and thromogenicity indexes and increased the concentrations of unsaturated fatty acids compared to controls. In conclusion, partial soy meal replacement by flaxseed and lupins favors milk production in primiparous cows with a neutral effect on overall production, and improves the fatty acid profile. The reduced NEFA signify lower fat mobilization, which might be indicative for higher feed utilization. However, the underlying mechanisms leading to this warrant further investigation.

**Keywords:** dairy cows; soybean meal; flaxseed; lupins; performance; milk fatty acids.

**JEL Codes:** N50; Q10; Q13.

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