Effect of soybean roasting and monensin on microbial protein synthesis, ruminal parameters and plasma metabolites of lactating dairy cows

E. Abdi^A, F. Fatahnia^A,D, M. Dehghan Banadaki^B, A. Azarfar^C and S. G. Mosavi^A

^ADepartment of Animal Science, Ilam University, Ilam, Iran.
^BDepartment of Animal Science, Tehran University, Karaj, Iran.
^CDepartment of Animal Science, Lorestan University, Khorramabad, Iran.
^DCorresponding author. Email: ffatahnia@yahoo.com; f.fatahnia@ilam.ac.ir

Abstract. This study was conducted to evaluate the effects of inclusion of roasted whole soybean seed and monensin (MO) in the diets of lactating dairy cows on plasma metabolites, ruminal parameters, and microbial protein synthesised in the rumen. Four multiparous Holstein lactating dairy cows (third parity; 656 ± 55 kg of liveweight; 83 ± 10 days in milk; 35 ± 4 kg/day milk yield) were assigned to a balanced 4 · 4 Latin square design. Each experimental period lasted 21 days with 14 days of treatment adaptation and 7 days of data collection. The control diet (C) was a total mixed ration consisting of 40% forage and 60% concentrate mixture on a dry matter (DM) basis. These cows were randomly assigned to one of the four dietary treatments. The first treatment was the C diet of unprocessed whole soybean seed, second was the C diet supplemented with 24 mg of MO/kg of DM (M), the third was roasted whole soybean seed (R) and the fourth treatment was R diet supplemented with 24 mg of MO/kg of DM (RM). Urinary excretion of creatinine and purine derivatives, microbial protein synthesised in the rumen, rumen pH and rumen concentrations of volatile fatty acids and ammonia were similar among the dietary treatments (P > 0.05). Orthogonal contrasts showed that the rumen concentration of acetate was lower in MO-supplemented cows than non-supplemented cows (P < 0.05). Dietary treatments had no effects on plasma concentrations of glucose, total cholesterol, triglycerides and total protein (P > 0.05). Plasma concentration of urea was significantly lower in cows fed with the RM diet compared with cows fed the C and M diets (P < 0.05). In conclusion, dietary treatments had no effect on microbial protein synthesised in the rumen, plasma metabolites (except for plasma concentration of urea) and ruminal parameters of dairy cows.

Additional keywords: ammonia, purine derivatives, urea, volatile fatty acids.

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Introduction

Oilseeds and their co-products are the most important protein and energy sources in dairy cow diets. Whole soybean seed is one of these commonly used oilseeds. However, most of its protein content can be degraded by rumen microorganisms leading to surplus ammonia production in the rumen (Faldet et al. 1991). Therefore, it would be advantageous to minimise the extent to which proteins are degraded in the rumen. It has been known that ruminal degradation of proteins should be restricted to an extent that is necessary for maintaining efficient microbial activity and growth, provided that the rumen undegraded fraction is digested in the small intestine (Goelema 1999). In the feed industry, many forms of technological processing have been applied to reduce ruminal degradation of dietary proteins. Thermal processing such as roasting and extruding are among the most prevalent processing techniques applied to the whole soybean seed. Such thermal processing renders the proteins into a less available form for microbial degradation, preventing unnecessary nitrogen (N) losses from the rumen (Goelema 1999). Ionophore antibiotics have also been used to reduce ruminal degradation of dietary proteins (Ipharraguerre and Clark 2003). Monensin (MO) is a carboxylic polyether ionophore antibiotic produced by fermentation of Streptomyces cinnamoneus (Russell 2002). It is extensively used in the diets of dairy cows so its effects on milk production and composition are well documented (da Silva et al. 2007; Odongo et al. 2007). The benefits of feeding MO to dairy cows include increased milk production and improved energy balance associated with reduced incidence of subclinical ketosis, clinical acidosis, and displaced abomasums (Duffield and Bagg 2000). MO is also known to reduce rumen degradation of dietary proteins and amino acids (Ipharraguerre and Clark 2003). In a previous study, the effects of soybean roasting and MO on milk production, composition, and milk fatty acids profile of lactating dairy cows were studied (Abdi et al. 2013). To our knowledge, the effects of roasting soybean seed in combination...