Sustainable Livestock Production in the Perspective of
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Using DVE/OEB System to Predict Protein Value of Soybean Meal, Yasmino Max® and Fishmeal for Ruminants

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ABSTRACT

This study was conducted in order to compare protein value of Soybean Meal (SBM, 451.70±2.8 g/kg DM), a commercial protected soybean meal product (Yasmino Max®, 459.30±1.7 CP g/kg DM) and fishmeal (FM, 510.90±0.9 CP g/kg DM) expressed according to Dutch protein evaluation system. Ruminal incubations for test feeds and laboratory analyses were performed according to Protocol for in situ Rumen Incubations published by Centraal Veevoeder Bureau standards. Truly absorbed protein in the small intestine (DVE) contributed by (1) feed protein escaping rumen degradation, (2) microbial protein synthesized in the rumen and (3) a correction for endogenous protein losses in the digestive tract, the difference between the potential microbial protein synthesis based on rumen degraded feed CP and that based on energy available for microbial fermentation in the rumen (OEB) and fermentable organic matter (FOM) were calculated according to DVE/OEB model. According to the results in spite of the fact that FM is considered to be a valuable source of protein due to its high protein content andruminal stability, Yasmino Max®provides animal with more DVE (260.95±6.9 g/kg DM) comparing to SBM(196.47±4.3) and FM (239.79±0.7). Although FM has a relatively low CP degradability in rumen, it has a higher OEB value (123.13±0.6 g/kg DM) comparing to SBM(117.85±3.7) and Yasmino Max® (90.32±6.0) which reflects the effect of FOM (334.09±10.5, 306.41±16.6 and 206.97±1.4 g/kg DM for SBM, Yasmino Max and FM respectively)on OEB value. In conclusion among the tested feedstuff Yasmino Max® is the most favorable since it delivers more DVE to animal and has a better balance between the rumen available N and fermentable energy.

Key Words: Soybean meal, DVE/OEB system, Protein value

INTRODUCTION

Soybean meal (SBM) is widely used as a protein supplement in dairy diets and among the common plant proteins used in animal feeds, SBM has one of the highest percentage of essential amino acids and its bypass essential amino acid index is near to ruminal microbial protein comparing to all other undegradable protein sources (Chandler 1989). However, SB and SBM have relative low protein efficiency because of extensive ruminal degradation. Therefore, improvement in ruminal escape characteristics of SB and SBM is of major importance to both beef and dairy producers and the soybean industry (Lin and Kung 1999).A modern protein evaluation system, the DVE/OEB1994 system (Tamminga et al. 1994) has been developed based on principles in the existing models such as INRA, ARC, NKJ-NJF and NRC. This model considers the strong elements of other developed protein evaluation systems and introduces new elements, such as the role of energy balance in intestinal protein supply (Tamminga et al. 1994). In the DVE/OEB1994 system, each feed has a protein DVE value, which stands for true absorbable protein in the small intestine. Each feed also has a protein OEB value, which stands for rumen degraded protein balance. This study was conducted in order to compare protein value of Soybean Meal (SBM), a commercial protected soybean meal product (Yasmino Max®) and fishmeal (FM) expressed according to Dutch protein evaluation system.

MATERIALS AND METHODS

Three Holstein milking cows, (weighing approximately 650 kg and 27 kg/d milk production) fitted with a large rumen cannula with an internal diameter of 10 cm were used for measuring rumen degradation characteristics. Cows were housed individually in the Dairy Research building at the Ferdowsi University of Mashhad, during in sacco rumen incubation time. Cows were fed according to their milk production level. Ration was based upon corn silage, alfalfa hay and mixed concentrate consisting of barley grain, corn grain, soybean meal, canola meal, cotton seed meal, Micro-mineral premix, Vitamin premix A and D, limestone, and salt. Animals were fed in the form of TMR daily at 06:00, 14:00 and 22:00 h right after milking. Water was always available. Ruminal degradation characteristics of samples were determined using the in sacco method. Incubation of all treatments in the rumen was done with 5 g DM sample in coded nylon bags (7 cm×12 cm with the pore size of approximately 50 µm). The rumen incubations were performed according to the `gradual addition/all out' schedule. Incubations were carried out for 96, 72, 48, 24,12, 8, 4 and 2 h. All treatments were randomly allocated over all cows and the whole incubation period. After incubation, bags were removed from rumen and rinsed under a cold stream of tap water to remove excess ruminal contents and microbes on the surface to stop microbial activity. After that, nylon bags were frozen for 24 h and washed in a washing machine (1202 Azmayesh washing machine, Iran) with cold water and without spin-drying and detergent and subsequently samples were dried using a forced-air oven at 70 °C to constant weight. The 0 h incubation were done only put the samples in the washing machine under the same conditions. Residues were pooled according to treatment, incubation period and incubation time and dry samples were stored in a refrigerated room (4°C) until analysis. Residues were analysed for dry matter and crude protein content. Standard procedures for Ruminal incubations and laboratory analyses for this system are fully described in a protocol published by Centraal Veevoeder Bureau (CVB 2003 a,b) and all steps in this experiment were performed according to that Protocol. Truly absorbed protein in the small intestine (DVE) contributed by (1) feed protein escaping rumen degradation, (2)microbial protein synthesized in the rumen and (3) a correction for endogenous protein losses in the digestive tract, the difference between the potential microbial protein synthesis based on rumen degraded feed CP and that based on energy available for microbial fermentation in the rumen (OEB), fermentable organic matter (FOM) and rumen degradable protein (RDP) were calculated according to DVE/OEB_{1994} model (Tamminga et al. 1994). The detailed concepts and formulas of the DVE/OEB_{1994}model were provided by Tamminga et al. (1994).

RESULTS AND DISCUSSION

Model predictions of the potential nutrient supply to dairy cattle from Soybean meal (SBM), a commercial protected soybean meal product (Yasmino Max®) and fishmeal (FM) using the DVE/OEB1994 system are presented in table 1. Results showed that in spite of the fact that FM is considered to be a valuable source of protein due to its high protein content and ruminal stability, Yasmino Max® provides animal with more Truly absorbed protein in the small intestine (DVE) (260.95±6.9 g/kg DM) comparing to SBM (196.47±4.3) and FM (239.79±0.7).

Table 1. Crude protein (CP), Truly absorbed protein in the small intestine (DVE) and balance between the rumen available N, fermentable energy (OEB) and fermentable organic matter (FOM) of test feeds using DVE/OEB model

Test feed	Parameter (g kg^{-1} DM)			
	CP	DVE ^{DVE1994}	OEB ^{DVE1994}	FOM ^{DVE1994}
SoybeanMeal	451.70±2.8	196.47±4.3	117.85±3.7	334.09±10.5
YasminoMax	459.30±1.7	260.95±6.9	90.32±6.0	306.41±16.6
Fishmeal	510.90±0.9	239.79±0.7	123.13±0.6	206.97±1.4

Although FM has a relatively low CP degradability in rumen, it has a higher OEB value (123.13±0.6 g/kg DM) comparing to SBM (117.85±3.7) and Yasmino Max® (90.32±6.0). The OEB value is the balance between microbial protein synthesis from rumen degradable protein and that from the energy extracted during anaerobic fermentation in the rumen. In other words differences in OEB value can reflect the effect of FOM (334.09±10.5, 306.41±16.6 and 206.97±1.4 g/kg DM for SBM, Yasmino Max and FM respectively) on microbial protein synthesis. When OEB is positive, it indicates the potential loss of N from the rumen. When negative, microbial protein synthesis may be impaired because of a shortage of N in the rumen. The optimum OEB value in a ration is therefore zero to slightly positive (Tamminga et al. 1994). In conclusion among the tested feedstuff Yasmino Max® is the most favourable since it delivers more DVE to animal and has a better balance between the rumen available N and fermentable energy.

CONCLUSION

In conclusion among the tested feedstuff Yasmino Max® is the most favorable since it delivers more DVE to animal and has a better balance between the rumen available N and fermentable energy.

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