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Ruminal Degradation of Soybean, Canola and Cottonseed Meal Using *In sacco* Procedure in Sheep

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Abstract: This research was conducted in order to investigate rumen degradability of some factors includes; Dray Matter (DM), Organic Matter (OM), Crude Protein (CP), Acid Detergent Fiber (ADF) in three different plant protein supplements includes; soybean, canola and cottonseed meal. The experiment was carried out using in three castrated and fistulated male Zel sheep. Each feedstuff was weighed into duplicate nylon bags and incubated in each of the three rumen fistulated sheep for 0, 2, 4, 8, 16, 24 and 48 h. Results revealed that effective degradability of DM of soybean, canola and cottonseed meal were 55.8, 73.8 and 48.5%, respectively. Effective degradabilities of the CP in feedstuffs were 55.8, 62 and 48.3% for the respective feedstuffs. Effective degradabilities of the OM were 55.7, 56.4 and 47.4%, respectively. Results also showed that effective degradabilities of the ADF were 55, 56.4 and 37.6, respectively. According to the results the researchers concluded that canola and soybean were more degradable in the rumen of the sheep while cottonseed meal were less degradable and, hence resulted in higher rumen undegradable protein.

Key words: *In sacco*, soybean, canola, cottonseed meal

INTRODUCTION

A number of factors affect the quality and quantity of the productivity in animal husbandry, of which the nutrition of the animal is probably the most important (Khorshidi *et al.*, 2008). Ruminant diets in most developing countries are imbalanced and are deficient in protein, minerals and vitamins. Finding a way to supplement locally mixed concentrate with grains or protein foliages would improve rumen ecology, dry matter intake and subsequently meat and milk quantity and quality (Wanapat, 1999; Promkot and Wanapat, 2003; Suchitra and Wanapat, 2008). Ruminant depend on the microbial variety and population in their rumen to digest the food. In fact, these microbes can easily analyze the food with their special enzymes. After that, when microbes passing through rumen and reticulum to get to the lower parts of the alimentary system, micro organisms themselves will be dissected and turn into proteins which is called Microbial Protein (MP). Therefore, there are two sources of protein available for the ruminants: the true protein in the diet that escapes degradation in the rumen and the protein produced by the rumen microbes (Khorshidi and Faraji, 2011). For these reasons, study on ruminal degradability of local feeds is really important in

ruminant nutrition. Specially, when there is limited information is available on characteristics of Dray Matter (DM), Organic Matter (OM), Crude Protein (CP), Acid Detergent Fiber (ADF) in plant protein supplements includes; soybean, canola and cottonseed meal which are used for livestock nutrition in the Mazandaran Province, Iran. However, the researchers used the nylon bag technique which according to Orskov *et al.* (1980) is a powerful tool for indexing the relative degradabilities of feedstuffs and also to study rumen processes to study these feed staff using fistulated male Zel sheep.

MATERIALS AND METHODS

This experiment was conducted at 2007 on Animal Research Station, part of the Department of Animal Science, Faculty of Agriculture, Islamic Azad University, Ghaemshahr Branch, Iran. Three ruminally fistulated Zel Sheep with an average age of 14 months with initial live weight of 30 ± 2.30 kg were used as replicates to determine *in sacco*. The animals were allowed ten days period to adjust to the new feeding and housing conditions prior to suspension of the bags. The animals were housed in experimental pens and fed twice daily. Feed composition included alfalfa (20.0%), wheat straw (40.0%), wheat bran

(10.0%), barley grain (25.0%) and Cottonseed meal (6.0). Housing and management conditions were the same for all sheep. Dry Matter (DM), Organic Matter (OM), Crude Protein (CP), Acid Detergent Fiber (ADF) disappearances in the rumen were estimated for each feed sample using the nylon bag technique. The bags used were made from dacron cloth with size of (9×15 cm) and with pore size of 45 µm. The bags were tied to weight chains and placed in ventral rumen sac of sheep approximately 2 h after the morning feeding. During the experiment, all feed samples were incubated simultaneously in sheep. Bags for each feed sample were removed after 0, 2, 4, 8, 12, 24, 48 and 72 h of incubation. The bags were weighed and tested according to the procedure described by Orskov and McDonald (1979). Subsequently, DM, OM, CP and ADF were measured according to AOAC (1990) and Van Soest *et al.* (1991).

Data analysis: Data for ruminal disappearance characteristics were fitted to the equation mentioned by Orskov and McDonald (1979) and using the Nway program.

$$P = a + b(1 - e^{-ct})$$

Where:

P = Disappearance rate at time t (%)

a = The intercept of the degradation curve at time zero (%)

b = The fraction were degraded when given sufficient time for digestion in the rumen (%)

c = A rate constant of disappearance of fraction b (h⁻¹)

t = Time of incubation (h)

The data obtained were analyzed for ANOVA using SAS (1996) according to a completely randomized design.

RESULTS AND DISCUSSION

Results are provided in Table 1. Results show that effective degradability of dry matter (EDDM) is higher in cottonseed meal than soybean and for the soybean also higher than canola. For the effective degradability of organic matter (EDOM), results reveal a higher percentage in canola than soybean and cottonseed meal. Results also show that effective degradability of acid detergent fiber (EDADF) of canola is higher than soybean and cottonseed meal and effective degradability of crude protein (EDCP) is also higher in Canola. According to the results the feedstuffs with higher ED are those which are more degradable in the rumen of the sheep and provide less rumen undegradable protein. For

Table 1: Degradation parameters and effective degradability of soybean, canola, cottonseed meal produced in Mazandaran Province, Iran

Item	Soybean	Canola	Cotton seed meal
a	29.300	24.900	35.600
b	69.100	58.100	18.600
c	0.031	0.055	0.077
a+b	98.400	83.000	54.200
EDDM	55.800	55.200	64.900
a	28.800	29.800	36.500
b	71.200	57.300	21.300
c	0.030	0.043	0.052
a+b	100.000	87.100	57.800
EDOM	55.700	56.400	47.400
a	28.700	30.800	18.900
b	59.800	49.200	34.600
c	0.039	0.062	0.059
a+b	88.500	80.000	53.500
EDADF	55.000	58.200	37.600
a	29.300	32.700	34.800
b	69.200	66.000	22.000
c	0.031	0.040	0.078
a+b	98.500	98.700	56.800
EDCP	55.800	62.000	48.300

the soy bean, the results for the EDCP also are similar with the data mentioned in AFRC (1992) while for the (a) (b) and (a+b) the data are different. Effective Degradabilities of Canola and cotton seed meals also show differences with what is mentioned in AFRC (1992). These differences could be due to the differences between different varieties and also maybe differences in processing techniques of feedstuffs (USDA, 2004). Khorshidi *et al.* (2007) mentioned that these differences could happen because of the various oil extraction methods are used in the manufacture.

CONCLUSION

According to the result, it can be concluded that *in sacco* technique can be as a novel strategy for the determination of ruminal degradability of soybean, canola and cottonseed meal through the use of fistulated sheep. However, results show that cottonseed meal is less degradable and, thus resulted in higher rumen undegradable protein.

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