EFFECT OF CHEMICAL TREATMENT OF SESAME SEED CAKE ON RUMINAL DRY MATTER AND CRUD PROTIEN DEGRADATION

A.G.Mahala[*1], M.B.E. Mohammed[1] and S.A.Omer[2]

1 University of Khartoum, Faculty of Animal Production, Dept. of Animal Nutrition.
2 University of Sudan, Faculty of Veterinary Medicine and Animal Production, Dept. of Biomedical Science

المستخلص

تم تقييم معدل تكسر النيتروجين والمادة الجافة لامباز السمسم المعامل بالايثانول ذو التركيز 50 % و 70%) فى درجة حرارة78 ºم والمعامل بالشحم بنسبة 10 % . أجريت تجربة التكسرية للبروتين الخام والمادة الجافة فى ثلاثة ثيران ذات ناسور كرشى غذيت على قصب الذرة الرفيعة كعليقة اساسية مع امدادها ب 2 كجم/يوم عليقة مركزة و حجر اللحوس . ثلاثة اكياس (كيس/ ثور / فترة زمنية) فى كل المعاملات تم تحضينها فى الكرش للفترات الزمنية التالية 3, 6, 12 , 24 ,36 و48 ساعة. البروتين الخام والمادة الجافة . جهد القابلية التكسرية والجزء الذائب من الغذاء وفاعلية الكرش التكسرية لعينات امباز السمسم المعاملة كانت اقل معنويا عندما قورنت مع العينات الغير معاملة. أقصى أ نخفاض فى تكسرية البروتين الخام , فى المعاملة بالايثانول 50 % يليه المعامل بالايثانول 70 % والمعامل ب 10 % شحوم. معاملة أمباز السمسم بالايثانول تحمى البروتين الخام من التكسرية بواسطة ألميكروفلورا فى الكرش ومن المتوقع أن تحسن أستهلاك النيتروجين.

Key words: degradation, chemical treatment, sesame, cake.

[*] Corresponding author: ahmedgofoon9@yahoo.com

Abstract

Nitrogen and dry matter disappearance of sesame seed cake treated with ethanol (50% and 70%) at 78°C and 10% tallow were estimated. Rumen degradability was carried in three fistulated bulls fed sorghum stover as basal diet with 2 kgs supplemental concentrate and salt lick stone, three bags (a bag in bull at a time) from each treatment were incubated for 0, 3, 6, 12, 24, 36, and 48 hours.

In situ crude protein and dry matter, potential degradability, soluble fraction and effective rumen degradability for treated sesame cake were significantly ($P < 0.05$) lower compared with untreated sesame seed cake.

The maximum reduction in CP degradability was reported in 50% ethanol, 70%ethanol and 10% tallow respectively. Ethanol treatment protected protein from being degraded by microflora, and would be expected to improve nitrogen utilization.

Introduction

Diets of high producing ruminants are based on inexpensive and abundant supplies of cereal grains and oilseed meals (Zinn *et al*, 1981). Sesame cake protein serves as source of metabolizable protein to the ruminant by providing both ruminal degradable protein for microbial growth and some ruminal undegradable protein for intestinal digestion. The high solubility mainly due to non protein nitrogen and rate of rumen degradation

of sesame cake result in excessive amount of ammonia production in the rumen, some of the ammonia produced in the rumen is utilized by the rumen bacteria for microbial protein synthesIs. The reminder of the ammonia is either recycles and or excreted as waste. High producing animals can meet their protein requirements with microbial protein synthesized in the rumen, remainder of the required protein must be supplied by dietary protein that escapes ruminal degradation. Several chemical and physical treatment of feedstuff have been describeD in the literature to reduce the rate of ruminal protein degradation and increasing the proportion of protein that escape degradation in the rumen. Various methods have been used to protect proteins from microbial degradation including the simple application of heat (Mahala and Gomaa, 2007) and chemical agents such as formaldehyde (Reis and Tunk, 1969), alcohol (Vander *et al*, 1982), tannins (Driedger and Hatfield, 1972), and sodium hydroxide (Mir *et al*, 1984), all have been used successfully to reduce ruminal degradability. The objective of this study was to estimate the effect of chemical treatment of sesame seed cake (SSC) on dry matter and nitrogen disappearance in the rumen.

Materials and Methods

Animals:

Three castrated bulls from a local breed (Kenana) aged 2 - 2.5 years were fitted with rumen cannulae, maintained with a well balanced ration of concentrates (2 Kg) and sorghum stover and fed twice daily.

Chemical treatment of sesame seed cake (SSC):

Untreated SSC was oven dried (T1): 800 g SSC was heated to 78ºc in heater prior to its addition to a vessel containing 2 litter of ethanol 50% (vol/vol) (T2) and/or ethanol 70% (vol/vol) (T3). The treated SSC was mixed periodically and kept at 78ºc for 1 h after which it was strained through cheesecloth and oven dried at 50ºC, and 100g of tallow a mixture with 10 ml of Isopropanol, as an organic solvent, and then added to1000g of SSC resulted in 10% tallow (T4), mixed for 1 h and then air dried.

Dry matter (DM) and crude protein (CP) Degradability:

According to the polyester bag technique of Mehrez and Orskov (1977), the bags were prepared from nylon material of length 15.5cm, with 8.5cm and weighing 5g. The empty bags were individually weighed, five grams of treated or untreated cakes were put in a bag tied with a nylon ribbon, attached to a plastic tube, of 45.5cm length, 0.8cm diameter, and introduced inside the

rumen. The bags (3bags/animals/period/treatment) were incubated for 3, 6, 12, 24, 36, or 48 hours each.

Calculation of ruminal degradability:

Degraded dry matter percentage was calculated according to the formula:

$$\text{Dry matter loss} = \frac{(\text{Wt.of incubated sample} - \text{Wt. of residue after incubation}) \times 100}{\text{Wt.of incubated sample}}$$

Residual samples after incubation for each period were separately mixed, pooled and made ready for CP content determination (AOAC, 1990) and then protein degradability was calculated.

Degraded protein was calculated according to the formula:

$$\text{CP loss} = \frac{(\text{Wt.of incubated CP sample} - \text{Wt. of CP residue after incubation}) \times 100}{\text{Wt.of incubated CP sample}}$$

The degradation kinetics of the incubated sesame seed cake (treated and untreated) was described by curve –linear regression of DM or CP loss from the bags with time by the equation of Oraskov and McDonald (1979).

$$P = a + b\,(1-\exp^{-ct})$$

Where:-

P= potential degradability.

a = the soluble fraction.

b= the potentially degradable fraction.

c = the rate of degradation of b.

t =time (hour).

Effective degradability (Ed) of DM and CP were determined, at 0.02, 0.05, and 0.08 ruminal outflow rates.

Statistical analysis: -

The data were subjected to one way analysis of variance to examine the effect of the treatment on DM and CP degradation kinetics. Significant differences among the treatment were determined using least significant differences (LSD) test according to Gomez and Gomez, (1984). The Stastistix8 computer program was used for the analysis.

Results

Insitu DM degradability of treated and untreated SSC is showed in Table (1). The soluble fraction (a) of dry matter (DM) for untreated SSC was significantly (P<0.05) higher (15.5) than for treated with ethanol 50% and ethanol 70% and Tallow 10% 8.5 , 9.9 and 5.2 respectively.

DM degradability in treated SSC was obviously reduced (Figure 1). Potential degradable fraction (b) was not significantly varied among the treatments. While Pd was significantly (P<0.05) varied. Untreated SSC was recorded 93.7 which considered as high level followed by ethanol 70%, tallow and ethanol 50% 90.2, 84.6 and 84.4 respectively.

Effective rumen degradability (Ed) of untreated SSC at the three levels of the rumen out flow rates (0.02/h, 0.05/h and 0.08/h) were significantly (P<0.05) higher than in chemically treated SSC.

Table (1): *Insitu* dry matter (DM) degradability of ethanol (50 and 70%) and 10% tallow treated and untreated sesame seed cake (SSC)

Treatment	a	b	c	Pd	Ed0.02	Ed0.05	Ed0.08
T1	15.5[a]	78.2	0.07[a]	93.7[a]	77.7[a]	63.4[a]	54.6 [a]
T2	8.5[b]	75.9	0.04[b]	84.4[b]	59.9[c]	42.5c	33.6[a]
T3	9.9[b]	80.3	0.04[b]	90.2[a]	65.2[b]	48.8[b]	40.5 [b]
T4	5.2[c]	79.3	0.07[a]	84.6[b]	66.4[b]	48.8 [b]	41.6 [b]
SEM	1.36	5.39	0.55	2.40	0.89	1.42	1.6
L.S	*	NS	*	*	*	*	*

a: Soluble fraction of feed
b: Potential degradable fraction
C: Rate of degradation of fraction b (h-1)
Pd: Potential degradability
Ed: Effective rumen degradability calculated at out flow rate K= 0.02, 0.05, 0.08
SEM: Standard error of means
T1: Untreated SSC
T2: SSC treated with 50 % Ethanol
T3: SSC treated with 70 % Ethanol
T4: SSC treated with Tallow 10 %
NS: Not significant
L. S: Level of significance
* = $P < 0.05$

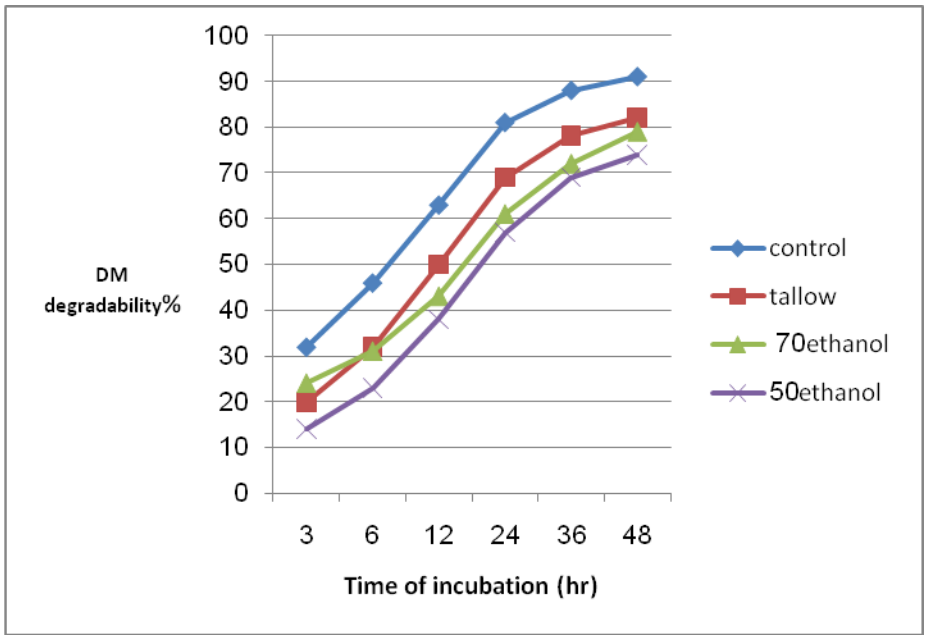

Figure (1): Dry Matter degradability of ethanol (50 and 70%) and 10% tallow treated and untreated sesame seed cake (SSC)

Crude protein (CP) degradability:

The result showed that both soluble fraction (a) and degradable fraction (b) were significantly ($P<0.05$) differ among treatments (Table 2). *In situ* crude protein degradability of treated SSC was decreased when compared with untreated SSC (Figure 2).

potential degradability (Pd) of untreated SSC 96.5 was significantly ($P<0.05$) higher than all treated SSC with ethanol 50%, ethanol 70% and tallow10% 81.4, 87.4 and 89.4 respectively (Table 2).

Similar to DM the CP effective degradability (Ed) of untreated SSC at the three levels of the rumen out flow rates (0.02/h, 0.05/h and 0.08/h) were significantly (P<0.05) higher than in chemically treated SSC (Table 2).

Table(2): *Insitu* crude protein degradability of ethanol (50 and 70%) and 10% tallow treated and untreated sesame seed cake (SSC)

Treatments	a	b	C	Pd	Ed0.02	Ed0.05	Ed0.08
T1	54^{a}	42.4^{c}	0.075^{a}	96.5^{a}	83.5^{a}	75.4^{a}	70.5^{a}
T2	31.3^{c}	50.1^{a}	0.043^{b}	81.4^{c}	68.1^{d}	56.2^{c}	50.1^{c}
T3	40.2^{b}	47.0^{b}	0.075^{a}	87.4^{b}	77.1^{c}	68.2^{b}	62.7^{b}
T4	37.5^{b}	51.9^{a}	0.082^{a}	$89.4a^{b}$	79.2^{b}	69.6^{b}	63.7^{b}
SEM	1.57	2.1	0.855	2.12	0.85	0.67	0.74
L. S	*	*	*	*	*	*	*

a: Soluble fraction of feed
b: Potential degradable fraction
c: Rate of degradation of fraction b (h^{-1})
Pd: Potential degradability
Ed: Effective rumen degradability calculated at out flow rate K= 0.02, 0.05 and 0.08
NS: Not significant
L. S: Level of significance
T1: Untreated SSC
T2: SSC treated with 50%Ethanol
T3: SSC treated with 70%Ethanol
T4: SSC treated with tallow 10%
SEM: Standard error of means
* = ($P < 0.05$)

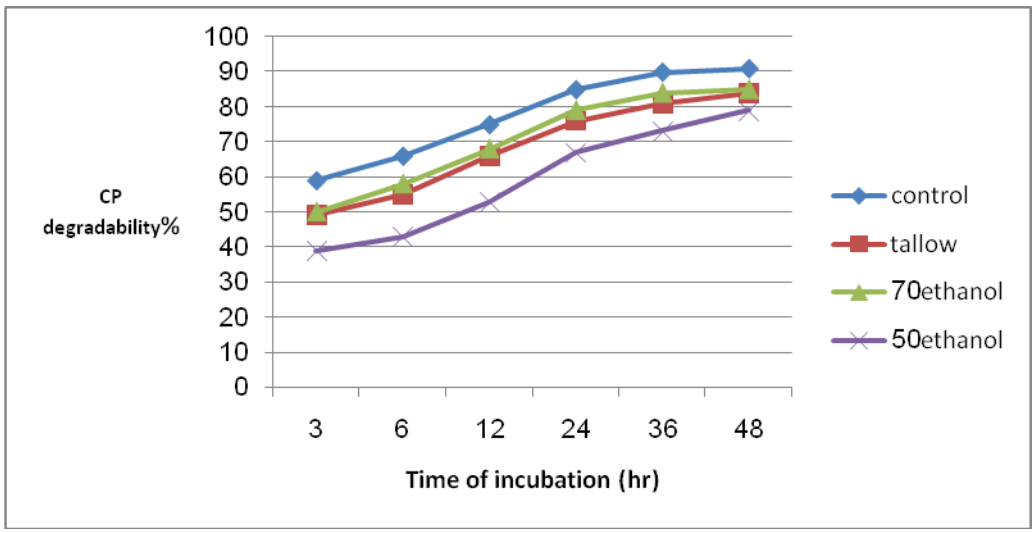

Figure (2): Crude protein degradability of ethanol (50 and 70%) and 10% tallow treated and untreated sesame seed cake (SSC)

Discussion

In the field of ruminant livestock nutrition, it is known that under same circumstances protecting dietary protein from extensive degradation in the rumen by microbial enzyme can lead to an increase in the out flow of amino acids from the rumen and /or a change in the balance of amino acids reaching the lower gut.

SSC protein is highly degradable (Mahala and Gomaa, 2007), therefore, chemical or physical treatment is required to protect it from microbial fermentation in the rumen. Chemical treatment of SSC by either ethanol or tallow reduced protein degradability by forming insoluble protein. This

finding agreed with Lynch *et al.,* (1987) who found the chemical bonding between denature vegetable protein and lipids, the resulting material improved stability in aqueous solutions which may render the protein more resistant to ruminal degradation, and Glenn, *et al*., (1977) who used various lipids to coat feed protein and amino acids to protect them from ruminal degradation.

In this study treatment of SSC with Tallow protect the protein from ruminal degradation whereas compared with untreated SSC. This finding were agreed by Lynch *et al.,* (1987) who found that an interaction between vegetable proteins and lipids were able to bind with lipids and form a lipoprotein-like complex the resulting products was more stable in aqueous solution and Lynch *et al*., (1986) found that tallow reduced N disappearance and rate of N loss. Lipid treatment used in this study consisted of applying 10% tallow to untreated SSC, similarly Peterson *et al.,* (1975) and Glenn, *et al*., (1977) found that 10% lipid would be more practical in terms of feed storage and handling. Treated SSC with 50% and 70% ethanol at 78^{o}c reduced both DM and CP disappearance, these results were similar to Vander *et al.,* (1983), who suggested that alcohol treatment of SBM reduce degradation of soluble proteins and found reduction in *insitu* N disappearance when comparing SBM treated with 40% ethanol at room temperature to untreated SBM and Mckinnon et al (1991) who reported the same reduction.

In this study the values recorded for dry matter and crude protein degradability, the degradation rate, soluble nitrogen, insoluble nitrogen and

effective protein degradation of SSC were similar to the results obtained for soybean meal (SBM), by Boruki, et al., (2007), who reported that treated soybean meal had high rumen undegradable protein.

Ethanol and tallow treatment of SSC protein revealed significantly ($P < 0.05$) lower degradability as compared to untreated sesame cake for all time of incubation. This is supported by Aplang (2008).

Conclusion

The results demonstrated that the treatment by ethanol or tallow of sesame seed cake increased the amount of dietary protein escaping degradation in the rumen and decreased the potential and effective degradability of crude protein and dry matter.

Recommendations:

Feeding trails should be performed to determine the effect of the treatment on feedlot performance.

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