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EFFECT OF PROTECTED SOYBEAN MEAL ON MILK YIELD AND COMPOSITION IN LOCAL MERIZ GOATS

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ABSTRACT

The objective of this study was to evaluate the effect of protected soybean meal (SBM) on total milk yield (TMY) and composition, milk energy and body weight (BW) in lactating Meriz does. Eighteen does (BW 33.13±0.41 Kg) were randomly divided into two equal groups, control (untreated soybean meal) (C) and the treated soybean meal chemically treated with formaldehyde (T). Results revealed that protected soybean meal significantly ($P<0.001$) increased TMY (44.20 vs 34.08 kg), milk fat % (4.14±0.13 vs 3.32±0.06), and yield (25.45±0.75 vs 16.08±0.41 gm/day) , milk protein % (4.86±0.05 vs 4.31±0.04), and yield (30.73±1.02 vs 20.99±0.52 gm/day), and milk energy (3.38±0.05 vs 3.03±0.02 MJ/kg) as compared to control. It can be concluded that protection process of soybean meal increased milk yield, fat and protein content.

INTRODUCTION

Protecting high-quality protein sources, such as legumes and seed meals from ruminal fermentation positively affects animal performance. Various methods for treating proteins have been used to reduce their degradation in the rumen. These can be broadly categorized as chemical and physical treatments (Mir *et al.*, 1984). Chemical treatments can further be divided into methods in which the chemicals actually combine with the proteins, e.g., formaldehyde treatment, and those in which the chemicals denature the proteins, e.g., treatment with alcohol, sodium hydroxide, and propionic acid (Oldham, 1984; Varvikko *et al.*, 1983). Furthermore, formaldehyde can affect microorganism activities and consequently alter digestion (Mustafa *et al.*, 2000). Soybean meal (SBM) is the most commonly used protein supplement in broiler, beef and dairy rations. It is quite palatable and has a good amino acid balance with high availability (Yoruk *et al.*, 2006).The impact of protected soybean meal on milk production was studied in goats, by Chowdhury *et al.*, (2002), El-Shabrawy (2006), who reported an increase in milk yield in goats fed formaldehyde treated soybean meal compared to those fed untreated soybean meal. Moreover, Dosky (2007), Kassem *et al.*, (2007) and Salih (2009) noted an increase in milk yield of ewes fed formaldehyde protected soybean meal. On the other hand, Brun-Bellut *et al.*, (1990) showed that milk yield and milk nitrogen content did not change.Meriz is a native goat to Kurdistan region and raised mainly for its fine hair as well as for meat and milk production (Alkass and Juma, 2005). Earlier studies reported that total milk yield of Meriz goat was 104.82 and 107.72 kg for a lactation periods of 128 and 131.11 days, respectively (Shams El-deen, 2005; 2006). However, no information is available on the effect of protected protein in lactating Meriz does. Therefore, the main objective of this study was to investigate the influence of feeding protected protein of soybean meal on milk yield and composition of this breed.

MATERIALS AND METHODS

The present study was carried out at the animal farm, Animal Production Department, College of Agriculture, University of Duhok during the kidding season 2010.

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Eighteen Meriz does with an average weight (33.13±0.41 Kg) were divided into two equal groups (n=9). Each group was housed in individual pens (2.5 x 2.5 m^2) and grazed daily from 7.0 am to 2.0 pm. In addition the animals were fed 900gm/ head/ day concentrate ration (Table 1). The vitamins were mixed with concentrate as an additive. Soybean meal (15% of ration) were treated with formaldehyde solution according to Kassem *et al.*,(1987). Feedstuffs were chemically analyzed according to Anonymous (1980)**.** Goats were weighed at the beginning through biweekly interval during the experimental period. Clean water was available constantly.

Table (1): Ingredient and chemical composition of diet %.

Items	Control	Treatment	Chemical analysis %		
				Control	Treatment
Treated Soybean meal	-----	15	Dry matter*	92.98	92.96
Untreated Soybean meal	15	----	Crude protein*	14.9	14.8
Barley	60	60	Ether extract*	3.98	4.1
Wheat bran	15	15	Organic matter*	95.17	95.24
Wheat straw	9	9	Ash*	4.83	4.76
Salts	0.5	0.5	Crude fiber **	10.17	10.17
Limestone	0.5	0.5	NFE **	63.71	63.71

* Determined at nutrition Lab., Animal Production Dept. ** Calculated according to AlKhawaje *et al*., (1978).

Kids remained with their mothers till weaning except for the time when milk yield was recorded. During the pre-weaning period milk yield was recorded at biweekly starting two weeks post kidding. Kids were separated from their mothers at 4.00 pm and weighed at 10.00 am next morning, then allowed to suckle their mothers till they stop suckling and were weighed again to find out the amount of milk suckled. Then the kids were separated again from their dams at 10.15 a.m till 6.15 p.m when the same procedure was applied to find out the total daily milk yield.

Milk samples (40 ml) were collected from does by hand milking from both sides of the udder. The milk components were determined by using automatic analyzer (EKO-MILK Ultrasonic milk analyzers). Milk energy values were calculated according to Economides, (1986) using the following equation: Calorific value (MJ/kg) = 1.64+ 0.42 × fat%.

The data obtained was analyzed by using ANOVA within SAS program (Anonymous 2001) as in the following model:

$$Y_{ijk} = \mu + T_i + S_j + TS_{(ij)} + e_{ijk}$$

Where:

Y_{ijk} = Observational value of K^{th} animal.

μ = Overall mean

T_i = Effect of treatment ($_i$ = treated, non treated)

S_j = Stage of lactation ($_j$ = 1, 2, 3, 4, 5)

$TS_{(ij)}$ = Effect of interaction between $_i$ treatment and $_j$ stage of lactation

e_{ij} = Experimental error assumed to be NID with (0, σ^2 e).

RESULTS AND DISCUSSION

It appears from Table (2) that both DM and ME intake were almost similar in both treated and control groups. Protected soybean meal with formaldehyde resulted in a decrease of estimated RDP as compared to control group 6.67 vs 8.37 gm/MJ ME (Table 3). It is clear from Table (3) that RDP content was higher in control group by 7.17%, while a decrease -14.59% was noticed in treated group when compared with the Anonymous (1980) recommendation (7.81 gm RDP/ MJ ME).

Table (2): DM, ME and protein fractions intake and %, RDP required and rumen UDP Status.

Item	Control	Treatment
Daily DM intake (Kg/Animal)	0.846	0.850
Daily ME intake (MJ/Animal)	8.76	8.81
RDP% *	70.54	56.25
UDP% *	29.46	43.75
RDP intake (gm/day)	73.36	58.77
UDP intake (gm/day)	30.64	45.72
RDP required (gm/day) **	68.42	68.81
Rumen status of RDP (gm/day) ***	+4.74	-10.04

*Expressed according to (Anonymous, 1980):(Kassem,1986).** = 7.81× ME intake ((Anonymous, 1980). *** Intake RDP – required RDP.

Feeding Meriz does treated soybean meal increased significantly (P<0.001) daily milk production 631.44±20.39 gm/day as compared to control 486.89±10.9 gm/day (Table 4). Also, an increase of 29.69% in total milk yield (TMY) 44.20±2.75 Kg was achieved when does fed treated soybean meal as compared to control group 34.08±0.94Kg. It is known that treating SBM with formaldehyde reduced its ruminal degradation without adversely affecting its intestinal protein digestion and absorption.(Yoruk *et al*., 2006), therefore, this results may due to an increase in estimated MP availability in formaldehyde treated group (Table 3.) which may resulted in a higher yield. Similar results were obtained earlier by Chowdhury *et al*., (2002), and El-Shabrawy (2006) who reported an increase in milk yield in goats fed formaldehyde treated soybean meal compared to those fed untreated soybean meal. On the other hand Hadjipanayiotou and Morand-Fehr, (1991) showed a non significant increase in FCM yield of Damascus goat with protected soybean meal.

Also, result indicate that protection of soybean meal increased significantly (P<0.001) fat percentage 4.14±0.13 and yield 25.45±0.74 gm/day as compared to control group (Tables 4), this could be attributed to increase digestibility of the most nutrient and TDN as a result of protein protection (Kassab, et al., 2009). Similarly, other workers noted that protected soybean meal increased the fat percentage of German Fawn Goat (Chowdhury *et al*., 2002), Awassi ewes (Sulaiman, 2004), cows (Ashes *et al*., 1992). However, this result disagree with those of Dosky, (2007) who reported that formaldehyde treated concentrate ration have no effect on milk fat percentage in Karadi ewes. Also, data revealed a significant (P<0.001) increase in milk protein percentage 4.86±0.05 and yield 30.73±1.02 gm/day for Meriz does fed

treated soybean meal as compared to control (Tables 4). This increase may due to an increase in protected protein reach small intestine as well as microbial protein produced in the rumen (Anonymous, 1984).

Table (3): RDP (gm/MJ ME), Crude and true Microbial protein (gm/day),UDP (gm/day) in rumen and Estimated MP (gm/day).

Item	Control	Treatment
Estimated RDP(gm/MJ ME)	8.37	6.67
Crude Microbial protein (gm/day) *	84.1	84.57
True Microbial protein (gm/day) **	63.08	63.43
UDP (gm/day) in rumen	30.64	45.72
Estimated MP (gm/day) ***	59.74	69.59

* 9.6 ×daily intake ME MJ ((Anonymous,1998). ** Crude Microbial protein × 0.75 ((Anonymous, 1998) *** (True Microbial protein + UDP)×0.85×0.75 (by assuming true small intestine digestibility is 0.85((Anonymous,1998) and AA using efficiency 0.75 ((Anonymous, 1980).

Moreover, It is known that the fraction of dietary protein that escapes ruminal fermentation may, in virtue of its amino acid composition, supplement the protein of microbial origin in the duodenum. In this way, the protein content of the milk can be increased (Chandler, 1995; Santos and Huber, 1996; Sanza Sampelayo et al., 1999). Therefore, chemical treatment of soybean meal improves protein percentage through an increase of UDP (Table3.) and subsequently the potential supply of amino acids that generated from the enzymatic digestion of the escaped protein portion to the small intestine (Kassab, *et al*., 2009). Our results are in accordance with the finding of El-Shabrawy (2006) who found that protein percentage in goat milk was greater ($P<0.05$) with formaldehyde treated soybean meal than of untreated one.

Protected soybean meal significantly ($P<0.001$) increased daily milk energy

(3.38MJ/kg) of Meriz goat when compared to control 3.03 MJ/kg (Table 4). This could be attributed to an increase in fat percentage in formaldehyde protected soybean meal group (Table 4). Similar results were noted by Chowdhury *et a.l.,* (2002) who noted that protected protein increased net energy (NE) content of milk in German Fawn Goat. Also in Karadi ewes, Kassem *et al* (2009) noted a significant increase ($P<0.05$) in milk NE secretion when the animals fed formaldehyde protected concentrate. It seems that the peak of daily milk yield was occurred at second stage of the lactation and then decline towards the end of lactation. Fat% and milk energy increased steadily from the start to the termination of trail. Protein yield decreased with the advances of lactation (Table 2.).

Body weight of Meriz goat fed protected or unprotected soybean meal is presented in Table (4). Result indicates a non significant increase in body weight gain for both treatments with advancing of lactation. Our results are in agreement with Salih (2008) and Dosky (2007) who noted a non significant increase in final body weight for Awassi and Karadi ewes fed formaldehyde treated concentrate respectively. While disagree with those of Kassem (2002)

who found a significant increase in final body weight for cows fed silage with formaldehyde treated barley when compared to those fed untreated barley. Based on the finding of the present study it may be conclude that providing dietary undegradable protein had a beneficial effect on milk yield during lactation period in Meriz goat. Further studies with a greater number of animals fed different levels of dietary protein are needed.

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Table. (4): Means and S.E. for effect of protected protein on Daily milk yield, Milk composition% and gm/day, milk energy and body weight of Meriz goat.

	Daily milk yield gm/day	Milk composition				Milk energy MJ/Kg	Body weight Kg
		Fat %	Fat gm/day	Protein%	Protein gm/day		
Overall mean	559.16±13.81	3.73±0.08	20.76±0.65	4.59±0.04	25.86±0.77	3.20±0.03	33.18±0.41
Control	486.88±10.91B	3.32±0.06B	16.08±0.41B	4.31±0.04B	20.99±0.52B	3.03±0.02B	33.97±0.57A
Treatment	631.44±20.39A	4.14±0.13A	25.45±0.74A	4.86±0.05A	30.73±1.02A	3.38±0.05A	32.39±0.58A
Stage of lactation							
1	609.44±33.98a	3.13±0.17c	20.95±1.58a	4.58±0.08a	28.23±1.97a	3.07±0.05c	30.77±0.75c
2	627.50±26.57a	3.45±0.15c	21.77±1.45a	4.60±0.08a	29.02±1.52a	3.09±0.06c	31.69±0.81c
3	564.44±29.37ab	3.65±0.15bc	20.76±1.49a	4.66±0.11a	26.52±1.70a	3.17±0.06bc	33.23±0.92bc
4	510.55±28.87bc	3.97±0.19ab	20.37±1.55a	4.47±0.14a	23.02±1.68b	3.31±0.08ab	34.40±0.86ab
5	483.88±23.30c	4.16±0.25 a	19.97±1.33a	4.62±0.08a	22.50±1.26b	3.39±0.11a	35.80±0.87a

Within a column and comparison, means bearing large letters differ significantly (P<0.001).

Within a column and comparison, means bearing small letters differ significantly (P<0.05).

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تأثير كسبة فول الصويا المحمية على انتاج الحليب وتركيبه الكيميائي في ماعز المرعز

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الخلاصة

تهدف هذه الدراسة لبيان تأثير حماية بروتين كسبة فول الصويا في انتاج الحليب الكلي ، مكونات الحليب ، كمية الطاقة في الحليب ووزن الجسم لماعز المرعز. وزعت ثمانية عشرمن اناث المرعز عشوائيا (معدل الوزن ٣٣.١٣±٠.٤١ كغم) الى مجموعتين متساويتين، وغذيت على عليقتين السيطرة (كسبة فول الصويا غير المعاملة) و كسبة فول الصويا المعاملة كيميائيا بالفورمالديهايد (المعاملة). بينت النتائج ان كسبة فول الصويا المحمية قد ادت الى زيادة عالية المعنوية (أ<٠.٠٠١) في انتاج الحليب الكلي (٤٤.٢٠ مقابل ٣٤.٠٨ كغم)، وفي نسبة دهن الحليب (٤.١٤±٠.١٣ مقابل ٣.٣٢±٠.٦)، وكميته (٢٥.٤٥±٠.٧٥ مقابل ١٦.٠٨±٠.٤١ غم/يوم) على التوالي ، نسبة بروتين الحليب (٤.٨٦±٠.٠٥ مقابل ٤.٣١±٠.٠٤)، وكميته (٣٠.٧٣±١.٠٢ مقابل ٢٠.٩٩±٠.٥٢ غم/ يوم) على التوالي ، والطاقة في الحليب(٣.٣٨±٠.٠٥ مقابل ٣.٠٣±٠.٠٢ ميكاجول/ كغم) مقارنة بمجموعة السيطرة. يمكن الاستنتاج بان عملية حماية كسبة فول الصويا ادت الى زيادة انتاج الحليب ومحتواه من الدهن والبروتين.

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