The Effect of Feeding Ruminally Undegradable Protein on Postpartum Reproduction of Awassi Ewes

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ABSTRACT : The objectives of this study were to evaluate the effects of feeding undegradable intake protein (UIP) on body weight changes and the return to estrus of Awassi ewes during the early postpartum period. Twenty multiparous Awassi ewes (BW=57.4±3.0 kg) were randomly assigned to two dietary treatment (10 ewes per treatment) for 4 weeks in a completely randomized design. Experimental diets were isonitrogenous, isocaloric, and were formulated to contain either 20% (CON) or 35% (SBM) of the dietary CP as UIP. On day 9±3 postpartum (day 0=parturition) ewes were housed in individual pens. Feed intake was recorded daily. Dry matter intake (DMI), organic matter intake (OMI), crude protein intake (CPI), undegradable protein intake (UPI) and metabolizable energy intake (MEI) were higher ($p<0.05$) for ewes on SBM diets compared with ewes on CON diet. Ewes receiving SBM diet gained more ($p<0.05$) weight than the controls (5.3 vs 0.5 kg). There was a tendency ($p>0.10$) for SBM ewes to have more luteal activity than the controls. Ewes in the SBM group came into estrus 4 days earlier than CON ewes ($p<0.10$). These results indicate that Awassi ewes receiving adequate nutrition are capable of returning to estrus one month postpartum thus posing the possibility of being able to lamb every 6 months. *(Asian-Aust. J. Anim. Sci. 2001. Vol 14, No. 8 : 1125-1128)*

Key Words : Awassi Ewe, Nutrition, Reproduction,UIP, Postpartum

INTRODUCTION

Available data from the Mediterranean region on the breeding season of Awassi sheep is highly variable. Epstein (1982) reported that the breeding season for traditionally-raised Awassi sheep lasts from June to September. Estrual activity in experimental Awassi-ewe flocks in Lebanon peaked in August and September, followed by a slight decrease until December then a marked decrease was observed from January to April before complete stop in May and June (Epstein, 1982). In Turkey, lambing season in Awassi ewes occurred in March and April, indicating that the breeding season took place in the early fall (Vanli and Ozsoy, 1988). Hamadeh et al. (1996) reported that early weaned lambs allowed the resumption of estrual activity in Awassi ewes during the first month of the postpartum period in early spring. The variability in breeding season could be attributed to nutritional status of the animals, primarily grazing conditions.

Protein quality and quantity have been shown to influence reproduction (Sasser et al., 1988: Wiley et al., 1991). Shorter days open intervals were observed in beef cows supplemented with undegradable intake protein (UIP) postpartum regardless of prepartum nutrition (Wiley et al., 1991). Ewes receiving supplements containing soybean and blood meal gained more weight than ewes receiving urea (Hoaglund et al., 1992). Sklan and Tinsky (1993) concluded that feeding UIP to dairy cows improved conception rate at first AI and increased the percentage of cows pregnant at 90 days postpartum.

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Little information is available on feeding ruminally undegradable protein to Awassi ewes during the early postpartum period. The objectives of this study were to evaluate the effects of feeding UIP on body weight changes and the return to estrus of Awassi ewes during the early postpartum period.

MATERIALS AND METHODS

The study was conducted at the Agriculture Center for Research and Production at Jordan University of Science and Technology located in the northern part of Jordan at 32° 34' N and an altitude of 520 m above sea level. The experiment was conducted during the months of December and January. Average length of the day in December and January is 10 h 29 min and 11 h 12 min, respectively.

Twenty multiparous, winter-lambing Awassi ewes (initial body weight=57.4±3.0 kg) and their lambs were randomly allotted to one of two dietary treatments (10 ewes/treatment) in a completely randomized design. Ewes were assigned to treatments on day 9±3 postpartum (day 0=parturition). Eighteen ewes were nursing single lambs and 2 ewes were nursing twins. Each of the ewes having twins was assigned to a different treatment.

Ewes and their lambs were placed in individual pens (1.5×1.5 m) in mid December and maintained in the pens throughout the trial (4 weeks). Pens were located in a barn having one open side. Animals were allowed one week in the individual pens for adjustment before receiving the experimental diets. Clean drinking water was available in plastic buckets. Animal pens were cleaned biweekly.

Ewes and their lambs were weighed following the adjustment period. Ewe's body weight was recorded weekly

while lamb's weight was recorded at the beginning and the end of experiment. Ten ewes received control diet containing urea (CON) as a nitrogen supplement while the remaining 10 ewes received diets containing roasted soybean meal (SBM; 40% ruminally undegradable, NRC 1989) as a protein supplement as shown in table 1. Experimental diets were isocaloric and isonitrogenous. Chemical composition of the experimental diets is shown in table 2. Diets were mixed weekly and sampled upon mixing

Ewes were offered the experimental diets at 08:00 and 16:00 h daily. Amounts of feed offered and refused were recorded daily. Animals were maintained at ambient temperature and natural day length. Blood samples were collected from each ewe via jugular venipuncture every other day during the 4-week trial to monitor progesterone profile as an indicator of luteal activity. Blood was allowed to clot at room temperature. Serum was harvested by centrifugation and stored at -20°C until analysis by RIA (Diagnostic Products, Los Angeles, USA).

Composite samples of the diets were oven-dried (60°C), ground through 1-mm screen and analyzed for CP and ether extract (AOAC, 1984), amylase-modified NDF (Van Soest et al., 1991), ADF and permanganate lignin (Goering and Van Soest, 1970). Metabolizable energy content of the diet was calculated by using NRC, 1985.

Means for the effect of diet were analyzed as a completely random design using the general linear model procedure of SAS (1985). Differences among treatment means for the experiment were detected by least significant difference (SAS, 1985).

Table 1. Composition of ingredients in experimental diets

Ingredient	Diet	
	CON	SBM
	% of DM	
Corn	16.5	13
Barley	40	27
Wheat bran	17	15
Soybean meal	0	15
Wheat straw	23	28
Urea	1.5	0
Minerals and Vitamins mix[1]	2	2

[1] Supplies per kilogram of feed: 8.25 mg of Mg, 4.90 mg of Zn, 4.05 mg of Mn, 0.45 mg of Cu, 0.075 mg of I, 0.1 mg of Se, 2.500 IU of Vitamin A, 400 mg of Vitamin D, 2.5 IU of Vitamin E.

Table 2. Chemical composition of the experimental diets

Item	Diet	
	CON	SBM
Dry matter (% of DM)	91.5	89.3
Organic matter (% of DM)	89.9	90.5
Crude protein (% of DM)	14.1	14.2
UIP[1] (% of CP)	20	35
Ether extract (% of DM)	2.5	3.1
NDF (% of DM)	44.8	45.2
ADF (% of DM)	21.9	23.8
Lignin (% of DM)	4.8	3.9
ME[2] Mcal/kg DM	2.3	2.3

[1] Calculated by using the NRC (1989).
[2] Calculated by using the NRC (1985).

Table 3. Body weight change and nutrient intake in ewes fed the experimental diets

Item	Diet		
	CON	SBM	SE
Initial weight, kg	58.9	55.9^{x}	0.9
Final weight, kg	59.5	61.3^{y}	1.1
Body weight change, kg	0.5^{b}	5.3^{a}	0.4
DMI g/d	2370^{b}	2500^{a}	31
OMI g/d	2100^{b}	2289^{a}	27
CPI g/d	330^{b}	350^{a}	5.3
UIP[1] g/d	67^{b}	123^{a}	3.5
MEI[2] Mcal/d	5.4^{b}	5.8^{a}	0.1

[x,y] Means within a colum with different superscripts differ ($p<0.05$).
[a,b] Means within a row with different superscripts differ ($p<0.05$).
[1] UIP=undegradable intake protein.
[2] MEI=metabolizable energy intake.

RESULTS

Average body weight of all ewes used in this experiment at parturation was 59.5±2.0 kg. At the beginning of the trial (d 9 postpartum), CON ewes weighed 58.9±0.9 kg and SBM ewes weighed 55.9±0.9 kg (table 3). DMI was significantly higher in SBM diet ($p<0.05$) than in CON diet (table 3). The difference of DMI resulted in higher ($p<0.05$) OMI, CPI, UPI and MEI in SBM ewes compared with the controls. These differences in feed consumption were reflected in body weight change between the two groups. Towards the end of the trial, CON ewes regained the weight they lost before the experiment. Ewes receiving the soybean supplement lost more weight than controls before trial but they regained the weight and even surpassed their weight at parturition by the end of the trial (table 3). Altogether, ewes fed SBM diet gained more ($p<0.05$) weight during the experimental period compared with the controls (5.3±0.4 and 0.5±0.4 kg for SBM and CON ewes, respectively).

Serum samples collected every other day were analyzed for progesterone concentration. Concentrations above 1.0 ng/ml were considered as luteal activity. The authors feel there was a tendency ($p=0.15$) for more SBM ewes to have luteal activity compared with the controls. Eight SBM ewes and 5 CON ewes showed an elevation of serum progesterone above 1.0 ng/mL after receiving the

Table 4. Reproductive responses in ewes fed experimental diets[a]

Item	Diet		
	CON	SBM	SE
Number of ewes cycling	5	8	1.5
Return to estrus (d postpartum)	36.4[b]	31.8[d]	1.7

[a] Ten ewes per treatment.

[b,d] Means within a row with different superscripts tend to differ ($p<0.10$).

experimental diets (table 4). Additionally, the onset of progesterone elevation occurred 4 days earlier in ewes receiving SBM diet compared with ewes receving CON diet ($p<0.10$). First rise in serum progesterone (above 1.0 ng/ml) was observed on day 31.8±0.75 postpartum in SBM group and day 36.4±2.7 postpartum in CON group (table 4).

DISCUSSION

Jordan is a semi-arid country where an average rainfall is 200 mm/year (El-Shatnawi et al., 1999). The highest amount of rainfall occurs during December and January. This rainfall is followed by the appearance of spring grasses. The optimum pasture is available in late winter and early spring (February and March). The normal breeding season for local Awassi sheep begins in June and lasts until November peaking in July (Abi Saab and Hamadeh, 1984). Lambing season begins in late October and peaks in December. As previously discussed, the growth of grass and optimum availability of pasture occur in February. Thus, the peak of lambing does not coincide with the availability of good nutrition. As a result, lactating ewes are faced with inadequate nutrition, loss of body weight and undergo lactational and nutritional anestrus. When ewes graze the spring pasture, their body condition is restored and cyclic activity starts in May/June.

In the current study, supplying postpartum ewes with undegradable protein during the early postpartum period allowed them to consume more feed and gain more body weight than the controls. This is consistent with findings of other researchers who reported higher weight gains in sheep and beef cattle supplemented with ruminally undegradable protein of different sources (Hoaglund et al., 1989; Schloesser et al., 1991; Wiley et al., 1991; Rocha et al., 1995). Similarly, Dhuyvetter et al. (1993) concluded that beef cows fed 50% of the crude protein requirement as undegradable protein lost less weight than cows fed 25% undegradable protein.

The improvement in animal body weight could be of great importance to reproduction. Postpartum change of weight is more important to reproductive success than the absolute body condition of the animal (Rutter and Randel, 1984; Roberson et al., 1989). When we pooled the data with respect to body weight change, ewes that gained weight and ewes that did not lose more than 2 kg showed luteal activity while ewes that lost more than 2 kg during the experimental period showed no cyclicity. Rutter and Randel (1984) reported that cows maintaining their body condition during the postpartum period had better responsiveness of pituitary gland (more LH stored and released). Canfield and Butler (1989) reported that energy balance was important for the re-establishment of ovarian cyclicity in dairy cows by decreasing the frequency of LH pulse. Even though we did not measure LH release in the current study, we were able to see a similar trend to what was reported by previous researchers (Rutter and Randel, 1984; Canfield and Butler, 1989) as indicated by progesterone profiles. In the present study, ewes that maintained their body weight, regardless of the experimental diet, showed luteal activity (progesterone concentration > 1.0 ng/ml) while ewes that lost weight remained anestrus during the experiment. Moreover, ewes fed SBM (gained more weight) showed luteal activity earlier than the controls. This is consistent with the findings of Rutter and Randel (1984) who reported that cows maintaining body condition after calving had a shorter postpartum interval than cows that lost condition.

Gonadotropin releasing hormone-induced LH release is dependent upon the availability of energy (Sen et al., 1979). In the current study, losing body weight may have decreased nutrient availability required for the pituitary gland to secrete gonadotropins which was reflected in the minimal ovarian activity (progesterone concentration).

IMPLICATIONS

Suckled Awassi ewes undergo a period of anestrus following winter or spring lambing due to limited availability of nutrients under semi-extensive management regimes. Awassi ewes are capable of cycling during the early postpartum period provided that adequate nutrition is available to minimize loss of body weight. Feeding higher amounts of undegradable intake protein seems to help in maintaining postpartum body weight. Although feeding undegradable intake protein did not influence reproductive parameters in this study, ewes maintaining body condition, regardless of the type of protein in the diet, were able to return to estrus one month following parturition. This suggests that Awassi sheep are capable of lambing every six months when adequate nutrition is provided.

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