Iraqi Journal of Veterinary Medicine Vol. 33, No. 2, 2009

Effect of Body Condition and Supplementary Feeding on the Reproductive Performance of Awassi Ewes

***A. D. Salman , ** Hadeel K. Ibrahim , **A. F. Al-Khalisy**

*** R. A. Ibrahim**

* State Board of Agricultural Research, Ministry of Agriculture

** College of Veterinary Medicine, Baghdad University

Summary

This study was conducted to evaluate the effect of body condition score (BCS) and supplementary feeding on the reproductive performance of Awassi ewes.

One hundred sixty Awassi ewes aged 3-5 years (Average live weight 47.41±0.76) were used in a completely randomized design. Six weeks before mating ewes were screened for their body condition score (BCS) and divided into two groups, low BCS (<2.0) and high BCS (>2.0) and ewes in each group were subdivided according to BCS and to non-supplemented and supplemented groups (n=40 ewes).Therefore, the four groups were:

1. Group (LBCN) = Low Body Condition Non-supplemented.
2. Group (LBCS) = Low Body Condition Supplemented.
3. Group (HBCN) = High Body Condition Non-supplemented.
4. Group (HBCS) = High Body Condition Supplemented.

All ewes received ad libitum barley straw, and (350g DM/ewe/day) whole barley grains. The supplemented groups (groups 2 and 4) were fed Mating Feed Blocks (MFB) ad libitum. Mature fertile Awassi rams (Three rams / group) were run with each group.The results showed that the pre-mating, mating, and post-mating condition scores and body weights of the non-supplemented Ewes (Groups 1 and 3) are maintained throughout the trial. Ewes offered supplementary feed the supplemented ewes (Groups 2 and 4) gained in body condition score and weights, the differences were not significant. The BCS and weights at mating for supplemented groups are 2.12, 2.64 and 46.11, 53.38 kg for groups 2 and 4 respectively. The results showed that the reproductive performance of Awassi ewes improved considerably due initial BCS and MFB supplementation. The percent of ewes lambed after mating during the first and second estrus cycles were significantly (P<0.05) affected by ewes' initial BCS and MFB supplementation. The percent of ewes lambed in first cycle were 50%, 77%, 72.3% and 87% for groups LBCN, LBCS, HBCN and HBCS respectively. Supplementation of low BCS ewes resulted a significant (P<0.05) improvement in conception rate (17.5%) and lambing rate (12%). The results have not shown any significant of initial BCS and supplementation on twinning percentage. The percent of barren ewes at end of the trial was higher (20%, P<0.05) in LBCN compared to other groups. It can be concluded that using supplementary feed for Awassi ewes is more feasible to be used with low BCS ewes than ewes with high BCS.

Iraqi Journal of Veterinary Medicine Vol. 33, No. 2, 2009

تأثير درجة حالة الجسم والعلف التكميلي على الأداء التناسلي للنعاج العواسية

*علاء داود سلمان , **هديل خليل إبراهيم , **عباس فوزي الخالصي و
رائد عبد الحي إبراهيم*

* الهيئة العامة للبحوث الزراعية– وزارة الزراعة

** كلية الطب البيطري– جامعة بغداد

تأريخ التسليم 20/2/2009

تأريخ القبول 20/5/2009

الخلاصة

أجريت هذه الدراسة بهدف تقيم تأثير درجة حالة الجسم وتغذية العلف التكميلي في الأداء التناسلي للنعاج العواسية. استخدم في التجربة 160 نعجة عواسية و بعمر 3–5 سنوات و معدل وزن ابتدائي 47.41 ± 0.76 كغم في التصميم العشوائي الكامل. 6 أسابيع قبل التسفيد تم مسح النعاج الدرجة حالة جسمها وتقسيمها الى مجموعتين حسب درجة حالة جسمها واطئ (2.0 >) أو عالي (2.0 <) بعدها تم تقسيم كل مجموعة الى مجموعتين وهي بدون علف تكميلي أو مع العلف التكميلي وعلى ضؤ ذلك كانت المجاميع الأربعة مايلي:

المجموعة الأولى (LBCN): درجة حالة الجسم واطئ وبدون علف تكميلي

المجموعة الثانية (LBCS) : درجة حالة الجسم واطئ مع علف تكميلي

المجموعة الثالثة (HBCN) : درجة حالة الجسم عالي وبدون علف تكميلي

المجموعة الرابعة (HBCS) : درجة حالة الجسم عالي مع علف تكميلي

غذيت جميع المجاميع على تبن الشعير بصورة حرة و حبوب الشعير (350غم /نعجة/ يوم) و غذيت على البلوكات العلفية الخاصة بالتسفيد (MFB) بصورة حرة للمجاميع الثانية والرابعة خلال 28 يوم قبل أطلاق الكباش و54 يوم بعد التسفيد. أظهرت نتائج التجربة بأن النعاج التي لم يقدم لها علف تكميلي (المجموعة الأولى والثالثة) قد حافظت على درجة حالة الجسم وأوزانها خلال فترات قبل التسفيد، التسفيد وبعد التسفيد. في حين ان المجاميع التي تم تقديم علف تكميلي لها (المجموعة 2 و4) قد حققت زيادة في درجة حالة الجسم والوزن إلا أنه لم يكن هنالك أختلاف معنوي بين المجاميع. أن معدل درجة حالة الجسم والوزن للنعاج التي غذيت على العلف التكميلي كانت 2.12, 2.64 و46.11 , 53.38 كغم للمجاميع الثانية والرابعة على التوالي. أظهرت النتائج أن الأداء التناسلي للنعاج قد تحسن نتيجة أثر نحسن درجة حالة الجسم خلال التسفيد واستخدام العلف التكميلي. كان لدرجة حالة الجسم والعلف التكميلي تأثير معنوي ($P<0.05$) في1 نسبة النعاج المسفدة في الدورة التناسلية الأولى والثانية. كانت نسبة النعاج الوالدة نتيجة لتسفيدها في الدورة الأولى هي 50%, 77%, 72% و87% للمجاميع الأولى, الثانية, الثالثة و الرابعة على التوالي. أن تقديم العلف التكميلي للنعاج التي كانت درجة حالة جسمها واطئة قد ادى الى تحسن معنوي ($P<0.05$) في نسبة الحمل (17.5%) ونسبة الولادات (12%) مقارنة مع النعاج التي لم تغذى على العلف التكميلي. ولكن لم يكن هنالك أثر لدرجة حالة الجسم والعلف التكميلي في نسبة التوائم. أن نسبة النعاج الحائل كانت عالية (20%) في المجموعة الأولى (LBCN) مقارنة مع المجاميع الأخرى. يمكن أن نستنتج بأن أستخدام العلف التكميلي ذي جدوى اكثر للنعاج العواسية التي درجة حالة جسمها واطئة خلال موسم التناسل.

Introduction

Low productivity seems to be a dominant feature among the majority of the sheep breeds in Iraq and other countries in the region. This is mainly due to their low reproductive performance as compared to other sheep breed of European origin (1).

Awassi is a fat-tailed breed of sheep. It is the dominant type in Iraq, Syria, Jordan, Lebanon and Southern area of Turkey (2). The great seasonality of lambing in the Awassi breed, which is inherently a seasonal in oestrus activity, has always been a strong indication that nutrition has important affects on reproduction in commercial flocks (1,3)

Survey of flocks in Near East have shown that lambing percentage of Awassi ewes are rarely above 85% and often as low as 65%. This is a major cause of the low productivity of sheep systems in the region. The low fertility levels result from a combination of poor nutrition, poor management, and disease and possibly the effects of high temperatures at mating, which generally occur in mid-summer (3).

Body condition score is a valuable tool for assessing the health and nutritional status of a ewe since it is largely independent of body frame size (4). This is not the case with body mass which can be a misleading term since a small framed ewe with a low mass can be in good condition (fat) and conversely a large framed ewe with a large mass can be in poor condition (thin).The body condition scoring (BCS) technique was devised in Australia and has been adopted by research workers in other developed countries (5). It involves giving a score, on a scale ranging from 0 to 5, according to degree of fatness. Body condition scoring has been widely adopted for managing the nutrition of flocks, especially when grazing, and for selecting lambs for slaughter. In Britain and Europe, body scoring is based on a subjective assessment of the fat level and muscle thickness on the backbone behind the last rib, according to a five-point scale (6). The BCS technique is simple, applicable, does not need any tool and could be used by trained farmers. It helps farmers decide on the kind of feed supplementation they would provide to the flock some time prior to the mating season.

Studies conducted in Iraq and at ICSAD and ICARDA in Syria gave encouraging results on the potential of BCS technique for improving the reproductive performance of sheep in the dry areas (7, 8, 9). Ewes of good body condition score at mating would have higher lambing and twinning rates. This technique is simple, applicable, does not need any tool and could be used by trained farmers. It might help farmers decide on the kind of feed supplementation they would provide to the flock some time prior to the mating season. The preliminary results indicated that body condition and body weight scores could be used in the fat-tail sheep under Iraqi conditions. The studies conducted in ICARDA clearly indicate that the fertility and prolificacy of the Awassi breed, like many other breeds, is affected by body condition and feeding level before mating (9).

Although previous studies have indicated that the reproductive performance of Awassi ewes is affected by body condition at mating, neither of these studies were specifically designed to investigate the effects of weight or body condition and level of nutrition before mating on the reproductive performances in Awassi ewes. Therefore, this study was implemented to investigate the effects of BCS at mating, and supplementary feeding on the reproductive performances of Awassi ewes.

Material and Methods

One hundred sixty Awassi ewes aged 3-5 years (Average live weight 47.41±0.76) were used in a completely randomized design. Six weeks before mating at Fudaliah Research Station (IPA) Agriculture Research Center ewes were screened for their body condition score (BCS) and divided into two groups, low BCS (<2.0) and high BCS (>2.0) and ewes in each group were subdivided according to BCS and to non-supplemented and supplemented groups (n=40 ewes/each). Therefore, the four groups were:

1. Group (LBCN) = Low Body Condition Non-supplemented.

2. Group (LBCS) = Low Body Condition Supplemented.
3. Group (HBCN) = High Body Condition Non-supplemented.
4. Group (HBCS) = High Body Condition Supplemented.

All the ewes received ad libitum barley straw, and whole barley grains (350 g DM/ewe/day). The supplemented groups (groups 2 and 4) were fed Mating Feed Blocks (MFB) ad libitum (28 days prior to mating and 54 days after introduction of rams). Both straw and barley grains were given in two equal daily meals (9.00 and 16.00 h).

Mature fertile Awassi rams (Three rams / group) were run with each group and throughout the mating period, rams were rotated between the groups. This was done to ensure that a ram failure did not affect reproductive outcome. The brisket of fertile rams was coated with a mixture of grease and colored chalk to mark ewes that were mounted. Mating dates were recorded daily.

Animals were weighed weekly and their body condition score (BCS) were recorded at start, mating and the end of mating. Body condition score recorded at the start and at the end of the experiment using a scale from 0 to 5 points (4, 6) with 0.25 subdivision fractions. Each individual BCS corresponds to the mean of three values registered by three different persons. The amounts offered and refusals of straw were registered daily and samples were taken once a week to determine chemical analysis. Conception rate, lambing and twinning rates were calculated as well as the percentage of barren ewes for all groups. Mating feed block (MFB) was used as supplementary feed during the experimental period. The formula of MFB was 30% wheat bran, 5% rice bran, 14% date pulp, 15% poultry litter, 7% cotton seed meal, 5% urea, 10% Cao, 1% CaSO4 and 5% NaCl. This feed blocks formula enriched with vitamins AD_3E (40000 IU/ Kg feed blocks). The chemical analysis of feeds supplement, barley grains and barley straw are presented in Table 1. The chemical analysis was conducted for these feed according to (10). Statistical analysis was done using GLM procedure of SAS (11). Chi-Square test was used to compare reproductive traits.

Table 1: The chemical analysis of mating feed blocks (MFB), barley grains and barley straw

	MFB	Barley grain	Barley straw
Dry matter	95.32	91.80	93.54
Crude protein	18.15	10.80	3.94
Ether extract	1.39	1.70	0.73
Crude fiber	13.79	6.70	39.14
Ash	23.41	2.70	12.65
Estimated ME (MJ/kg DM)	8.5	12.5	5.5

Results

The result of the effect of initial BCS and supplementary feed on the ewes' BCS and live weights and feed intake are presented in Table 2.

The results showed that the pre-mating, mating, and post-mating condition scores and body weights of the non-supplemented ewes (Groups LBCN and HBCN) are maintained throughout the trial. At pre-mating and post-mating, when ewes offered supplementary feed the supplemented ewes (Groups LBCS and HBCS) gained in body condition score and weights. The differences were not significant between the groups. The BCS and weights at mating for supplemented groups are 2.12, 2.64 and 46.11kg, 53.38 kg for groups LBCN and HBCN respectively. Changes in BCS paralleled to the body weights changes during the trial period. The gained in BCS and weights are more pronounced for supplemented ewes with low initial BCS (LBCS) than supplemented ewes with high initial BCS (HBCS).

The results presented in Table 2 also showed the effect of initial BCS and supplementary feed on dry matter intake, ME intake, CP intake and CP/ME ratio. The means of total dry matter intake were 1114, 1377, 1106 and 1343 g/ewe/day for groups 1, 2, 3 and 4 respectively. The supplemented groups (LBCS and HBCS) had

higher total dry matter intake, ME intake and protein intake than non-supplemented groups (LBCN and HBCN).

Using MFB as supplementary feed for ewes depend on barley straw and barley grains as their basal diet resulted a considerable improvement of the CP/ME ratio. The CP/ME ratios were 7.74, 10.84, 7.81 and 11.72 for groups LBCN, LBCS, HBCN and HBCS respectively.

Table 2: Effect of initial BCS and supplementary feed on the ewes' BCS and live weights and feed intake

Traits	Group1 (LBCN)	Group 2 (LBCS)	Group 3 (HBCN)	Group 4 (HBCS)
No. of ewes	40	40	40	40
Pre-mating ewes weight (kg)	43.38±0.59	43.16±0.60	51.41±1.06	51.71±0.79
Mating ewes weight (kg)	43.42±0.69	44.22±0.70	50.85±1.04	52.20±0.87
Post-mating ewes weight (kg)	43.55±0.75	46.11±0.71	51.42±1.02	53.38±0.97
Pre-mating ewes BCS	1.92±0.039	1.90±0.033	2.50±0.050	2.50±0.04
Mating ewes BCS	2.02±0.046	2.12±0.030	2.54±0.052	2.64±0.05
Post-mating ewes BCS	2.01±0.045	2.22±0.034	2.55±0.061	2.72±0.065
*Feed Intake (g DM/ewe/d)				
Whole barley grains	350	350	350	350
FB supplement	-	362	-	373
Barley straw	764	665	756	620
Total intake	1114	1377	1106	1343
ME intake (MJ/ewe/d)	8.96	11.43	8.91	11.26
CP intake (g/ewe/d)	69	124	70	132
CP/ME ratio	7.74	10.84	7.81	11.72

*= Due to group feeding no statistical analysis has been implemented

The result of the effect of BCS and supplementary feeding on the reproductive performance of Awassi ewes are presented in Table 3. These results showed that the reproductive performance of Awassi ewes improved considerably due initial BCS and MFB supplementation. The percent of ewes lambed after mating during the first and second estrus cycles were significantly ($P<0.05$) affected by ewes' initial BCS and MFB supplementation. The percent of ewes lambed in first cycle were 50%, 77%, 72.3% and 87% for groups LBCN, LBCS, HBCN and HBCS respectively. Supplementation of low BCS ewes resulted a significant ($P<0.05$) in conception rate (17.5%) and lambing rate (12%). The results (Table 3) have not shown any significant of initial BCS and supplementation on twinning percentage. The twinning percentages were 5%, 5%, 5% and 10% for groups LBCN, LBCS, HBCN and HBCS respectively. The percent of barren ewes at end of the trial was higher (20%, $P<0.05$) in LBCN compared to other groups.

Table 3: Effect of BCS and supplementary feed on the reproductive performance of Awassi ewes

Traits	Group1 (LBCN)	Group2 (LBCS)	Group 3 (HBCN)	Group 4 (HBCS)	Significance
No. of ewes exposed to rams	40	40	40	40	
No. of ewes lambed	32	39	36	38	
No. of lambs born	34	41	38	42	
No. of ewes given twin	2	2	2	4	
Ewes' lambed 1st cycle (%)	50	77	72.3	87	P<0.05
Ewes' lambed 2nd cycle (%)	37.5	23	27.7	13	P<0.05
Ewes' lambed 3rd cycle (%)	12.5	0	0	0	NS

Conception rate [a] (%)	80	97.5	90	95	P<0.05
Lambing [b] (%)	85	102	95	105	P<0.05
Twinning [c] (%)	5	5	5	10	NS
Barren ewes [d] (%)	20	4.5	10	5	P<0.05

a no of ewes lambed/ no of ewes joined

b no of lambs born/ no of ewes joined

c no of ewes giving twin/ no of ewes joined

d no of ewes not lambed/ no of ewes joined

Discussion

The main objective of the present study is to evaluate the role of BCS technique and supplementary feed on reproductive performance of Awassi ewes depend on cereal straw as their basal diet. The results of the present study clearly demonstrate the important of BCS technique as tool for evaluating the nutritional status of Awassi ewes during mating season. Although Awassi sheep are inherently a seasonal in its estrus activity (1,12) but sheep-mating season occurs during summer (June-September), which is coincided with cereal stubble grazing. Flock owners surveyed in the dry areas in Iraq regard this period as a time of plentiful feed supply (3, 13). Cereal stubble grazing is considered as natural flushing for ewes due to availability of post-harvesting loss of wheat and barley grains and ewes' selective consumption of straw (14, 15).The present results confirmed these studies which indicate that non-supplemented ewes (Groups LBCN and HBCN) could maintained their weights and BCS when only fed barley straw and barley grains as their main diets. Ewes with low initial BCS had higher barley straw than ewes with high initial BCS. These results are in agreement with other studies which were conducted in other countries (16). However, using MFB as supplementary for ewes resulted a reduction in ewes' straw barley intakes and this confirm other study which showed that barley straw intake reduced when Awassi yearling ewes fed feed blocks as catalyst supplement (17). The important aspects in the present study, that using MFB as supplementary improved the nutritional status for Awassi ewes during mating period. The ME intake, crude protein intake and CP/ME ratios improve considerably (Table 2) due MFB supplementation. These energy and crude protein intakes are similar to the nutrients requirement of ewes during mating period suggested by feeding standard (4).

Body weight or body fatness, generally termed body condition, has been shown to affect lambing percentage in many sheep breeds by affecting the number of ova shed at ovulation (1). The roles of BCS at mating on the reproductive performance of thin-tail ewes are well documented (18, 19). It was found that high feeding for a short time before mating, termed flushing, only increases ovulation within a limited range of body condition (20).

The results of the present study indicate that ewes in high initial BCS (>2.0) at mating had higher (10 %) conception and lambing percentages and shorting of mating season than ewes with low initial BCS (< 2.0). These results are in agreement with earlier studies conducted in Iraq and ICARDA in Syria (14, 15). This study showed that using MFB as supplementary feed for low BCS Awassi ewes during mating period had a significant improvement (17%) in the conception and lambing percentages as compared with non-supplemented low BCS ewes.

However, the results (Table 3) showed the effect of supplementation on the conception and lambing percentages of Awassi ewes with high BCS at mating is less pronounced than the effect supplementation on low BCS Awassi ewes. This is in agreement with the results found in Spain (16) which showed that an increment in supplementation level from 250 to 500 g/d after weaning causes an increase in the ovulation rate in ewes with an initial body condition <2.25, but not in ewes with initial BCS >2.25. Also indicated that supplementation is recommended to enhance ovulation rate if animals are at low body condition at weaning (16). On other hand other studies showed a better ewe response to nutritional supplementation has been described in animals in high condition than in those in low body condition (21).

Earlier studies (22) have shown that when MFB enriched with undegradable protein (UDP) and vitamins AD_3E resulted in considerable improvement in twinning percentage (15-18%) of Awassi ewes as compared to the control (non - supplemented groups). But our results did not show similar trends to these previous studies. The only explanation for this contrast in the results that despite ewes used in the present study were screened for their BCS but their high mating BCS are lower than other previous studies. It was suggested that the lack of an increase in ovulation rate observed in this study may be due to the low body condition of the animals, since metabolic signals acting on a larger pool of follicles may have a better chance of rescuing follicles from atresia, thus increasing ovulation rate (23).

Ewes in high body condition had a higher number of gonadotrophin-dependent follicles than did ewes in low body condition (24, 25). Moreover, a better response to nutritional supplementation has been described in ewes that are in high rather than low body condition (21). It was suggested that the lack of an increase in ovulation rate observed in this study may be due to the low body condition of the animals, since metabolic signals acting on a larger pool of follicles may have a better chance of rescuing follicles from atresia, thus increasing ovulation rate.

It can be concluded that BCS technique which was devised in Australia and has been adopted by research workers in other developed countries for sheep breeds of European origin can be used as management tool for evaluating nutritional status of fat-tail Awassi sheep. Using supplementary feed for Awassi ewes is more feasible to be used with low BCS ewes than ewes with high BCS. More research works are needed to evaluate the role of BCS technique during different physiological stages (pregnancy, lactation) of Awassi ewes.

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