# Body Weight Change, Milk Production and Reproductive Parameters in Suckled vs. Non-suckled Awassi Ewes

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**ABSTRACT :** The objective of this study was to identify the effect of early weaning on body weight change, milk production and the return to estrus in Awassi ewes. Twenty multiparous winter-lambing Awassi ewes were randomly assigned to either suckled (S, n=10) or non-suckled (NS, n=10) groups in a completely randomized design. Lambs in the NS group were removed from their dams on day 2 postpartum (PP). Animal body weights (BW) and body condition scores (BCS) were recorded at the beginning of the study and every 3 weeks thereafter until the end of the experiment. Milk production was estimated by machine milking at weekly intervals for 4 weeks beginning on d 11 PP. Blood samples were collected from each ewe every third day for 4 weeks beginning on day 15 PP. Initial body weight was similar for both treatments. By the end of the experiment, NS ewes gained an average of 1.8±1.0 kg while S ewes lost an average of 7.0±1.0 kg ($p<0.001$). Body condition scores followed a trend similar to that observed for BW and was greater ($p<0.001$) in the NS ewes. Significant correlation existed ($p<0.01$) between BW and BCS ($r=0.77$). The first milk production recording for both suckled and non-suckled was similar. Later recordings, however, showed that the S group had greater milk production ($p<0.01$) compared with the NS group. Lambs in the NS group were heavier ($p<0.05$) than those in the S group on d 10 PP. By the end of the study, lamb weights in the NS group were significantly lower ($p<0.001$) when compared with S group. The first rise in plasma progesterone ($P_4$) occurred earlier ($p<0.05$) in the NS than S ewes (day 27.0±2.2 vs. 34.0±2.2 postpartum, respectively). All of the NS ewes (10/10) and 60% (6/10) of the S ewes expressed estrus following ram introduction ($p<0.05$). Results of the current study indicate that non-suckled ewes gained more weight and displayed ovarian activity earlier than suckled ewes. Early lamb removal can be used to obtain biannual lambing in Awassi sheep. ***(Asian-Aust. J. Anim. Sci. 2004. Vol 17, No. 9 : 1236-1240)***

**Key Words** : Awassi Sheep, Suckling, Postpartum, Reproduction

## INTRODUCTION

The demand for red meat is increasing around the world due to population growth and food preference. One of the ways to increase mutton production is to increase the number of lambs born per ewe. This can be achieved by inducing multiple births or acquiring two lamb crops per year. Knowledge of physiology and endocrinology are essential in order to improve reproductive efficiency (Tasende et al., 1996). Edgerton (1980) suggested that ovarian activity must be established within two weeks of parturition to obtain biannual lambing. The major limiting factor for the resumption of normal estrous cycle is the LH pulsatility, with no difference in FSH values among suckled and non-suckled ewes (Schirar et al., 1990). Coinciding of seasonal anestrus and lactation delayed the resumption of ovarian and estrual activity, but no difference was observed among dams suckling one or two lambs (Mandiki et al., 1990). Lactation and intensity of suckling stimuli can delay the time of first postpartum ovulation (Schirar et al., 1989; Scaramuzzi et al., 1996). Factors affecting the duration of postpartum acyclicity include suckling intensity, body condition, season, breed and health status (Fray et al., 1995).

Awassi is the predominant sheep breed in Jordan. Prolificacy of Awassi sheep is quite low and the actual breeding season is not well defined. The majority of researchers reported the breeding season of Awassi ewes lasts from June to November (Epstein, 1982; Harb, 1994) with a marked decrease in reproductive activity between January and April (Epstein, 1982). Upon lambing in the winter, Awassi ewes enter a period of anestrus that extends until the next summer. The lack of cyclicity in Awassi ewes during the early postpartum period may be nutritional, lactational, hormonal, suckling or a combination of these factors. Kridli et al. (2001) suggested that winter-lambing Awassi sheep can produce two lamb crops per year if they received adequate nutrition. Hamadeh et al. (1996) reported that early weaning allowed the resumption of estrual activity in Awassi ewes during the first month of the postpartum period in early spring.

Even though Awassi sheep are considered to be dual purpose (meat and milk production), their milk production in Jordan is quite low averaging around 40 to 50 kg per lactation (not including milk consumed by the lamb pre weaning) (REF). The goal of study was to identify the effect of early weaning on body weight change, milk production and the return to estrus in winter-lambing Awassi ewes.

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**Table 1.** Body weights (kg) and body condition scores of suckled and non-suckled Awassi ewes[1]

| Item | Suckled (n=10) | Non-suckled (n=10) | p value |
|---|---|---|---|
| Body weight, d 10 postpartum | 52.1±2.0 | 53.3±2.0 | p>0.05 |
| Body weight, d 31 postpartum | 47.4±1.7 | 54.5±1.7 | p<0.01 |
| Body weight, d 52 postpartum | 45.1±1.7 | 55.0±1.7 | p<0.001 |
| Body condition score, d 10 postpartum | 2.0±0.27 | 2.7±0.27 | p<0.10 |
| Body condition score, d 31 postpartum | 1.8±0.23 | 2.7±0.23 | p<0.05 |
| Body condition score, d 52 postpartum | 1.3±0.17 | 3.1±0.17 | p<0.001 |

[1] Non-suckled ewes had their lambs removed on d 2 postpartum while suckled ewes were allowed to nurse their lambs throughout the trial.

## 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 860 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 3 to 6 years of age were used in the study. Animals were group housed in open-sided barns with free access to shade, water and mineral blocks. Animals were randomly assigned to one of two treatments in a completely randomized design (suckled vs. non-suckled). Each group was separately fed according to the productive status (NRC, 1985). Diets were composed of corn, barley, soybean meal, wheat bran, wheat straw, and mineral and vitamin supplement. Feed was offered twice a day at 0800 and 1600 h. Even though feed intake was not recorded in the experiment, both groups were offered the same amount of feed.

The experimental animals were selected based on lambing dates. Ewes lambing within 10 days of each other were selected. Ewes in both treatments gave birth to single lambs. Upon lambing, ewes and their offspring were placed in a large pen for 2 days. On day 2 postpartum, ten ewes had their lambs removed (NS) while the remaining ten ewes were allowed to nurse their lambs (S). Non-suckled ewes were milked twice daily throughout the study (machine milking). Body weight (BW) and body condition score (BCS) of all experimental ewes were recorded at the beginning of study (day 10 postpartum) and every 3 weeks thereafter until the end of the experiment. Milk production was estimated for each ewe in both groups by machine milking every week. No oxytocin was used, as ewes were accustomed to the milking process. Ewes nursing lambs were separated from their lambs 12 h prior to milking (Fadel et al., 1989). Milk production was estimated over a 24 h period. Lamb weights were recorded at the beginning, middle and end of experiment. Early-weaned lambs were housed in a closed barn and were bottle-fed with fresh sheep milk 5 timed daily throughout the first 14 days following weaning and 3 times daily, thereafter, until the end of the experiment. Lambs in both treatments were creep fed at 15 days of age.

Blood samples were collected from each ewe every third day for 4 weeks beginning on day 15 postpartum (average for all ewes). Blood samples were analyzed for progesterone as a marker of luteal activity. Blood was collected in heparinized tubes. Serum was harvested by centrifugation and stored at -20°C until analyzed for progesterone by RIA (Diagnostic Products, Los Angeles, CA, USA). Ovulation was not monitored in this study and was estimated to have occurred 4 days prior to the first rise in $P_4$ above 1 ng/ml.

Estrus was detected using vasectomized rams fitted with marking harnesses. Rams were introduced on day 23 postpartum (average for all ewes). Ewes were checked for breeding marks twice daily throughout the study. All breeding marks were confirmed by progesterone profiles for all ewes that showed signs of estrus. The day of expressed estrus was calculated for each ewe based on lambing dates.

Data were analyzed by analysis of variance for completely randomized design. Differences in body weight, body condition score, milk production and lamb weight were analyzed by split-plot analysis of variance for repeated measures. Progesterone rise and estrus expression were analyzed by Chi Square. Unless otherwise indicated, data are presented as means±SE. Analyses were conducted using the general linear model procedure of SAS (SAS, 1989).

## RESULTS

Data for BW and BCS are presented in Table 1. Initial body weight (BW1) was similar for both treatments. As the experiment advanced, ewes in the NS group were significantly heavier ($p<0.01$) than those in the S group (Table 1). By the end of the experiment (8 weeks of lactation), non-suckled ewes gained an average of approximately 1.8±1.0 kg while suckled ewes lost an average of 7.0±1.0 kg ($p<0.001$).

Body condition scores followed a trend similar to that observed for BW. At the beginning of the experiment, ewes in the NS group tended to have a better BCS ($p<0.10$) than those in the S group. Over the second and third BCS recordings, ewes in the S group had significantly lower ($p<0.05$) BCS when compared with the NS group (Table 1).

**Table 2.** Daily milk production (g) of suckled and non-suckled Awassi ewes[1]

| Item | Suckled (n=10) | Non-suckled (n=10) | p value |
|---|---|---|---|
| Milk production, d 11 postpartum | 916±146 | 514±146 | p<0.10 |
| Milk production, d 32 postpartum | 1,028±113 | 391±113 | p<0.001 |
| Milk production, d 53 postpartum | 738±106 | 322±106 | p<0.05 |
| Milk production, d 64 postpartum | 710±102 | 239±102 | p<0.01 |

[1] Non-suckled ewes had their lambs removed on d 2 postpartum while suckled ewes were allowed to nurse their lambs throughout the trial.

**Table 3.** Body weights (BW) of nursed or non-nursed lambs[1]

| Item | Nursed (n=10) | Non-nursed (n=10) | p value |
|---|---|---|---|
| Body weight, d 10 postpartum | 3.61±0.18 | 4.23±0.18 | p=0.02 |
| Body weight, d 31 postpartum | 10.9±0.52 | 7.10±0.52 | p<0.001 |
| BW3 Body weight, d 52 postpartum | 16.6±0.75 | 10.5±0.75 | p<0.001 |

[1] Non-nursed lambs were removed from their dams at 2 days of age while nursed lambs were all kept with their dams until they reached 60 days of age.

**Table 4.** Reproductive parameters of suckled and non-suckled Awassi ewes[1]

| Item | Suckled (n=10) | Non-suckled (n=10) | p value |
|---|---|---|---|
| Ewes expressing estrus (#) | 6/10 | 10/10 | p<0.05 |
| Days PP to 1st $P_4$ rise [2] | 34.0±2.2 | 27.0±2.2 | p<0.05 |
| Days PP to ovulation[3] | 30.0±2.2 | 23.0±2.2 | p<0.05 |

[1] Non-suckled ewes had their lambs removed on d 2 postpartum while suckled ewes were allowed to nurse their lambs throughout the trial.
[2] PP: postpartum, $P_4$: progesterone. [3] Calculated based on progesterone profiles.

The last recording of BCS showed that ewes in the S group had lost a significant amount of body condition when compared with the NS ewes ($p<0.001$). Significant correlation existed ($p<0.01$) between BW and BCS ($r=0.77$).

Milk production was recorded four times throughout the experiment. Data for milk production are presented in Table 2. The first milk production recording (MP1) tended to be greater ($p<0.10$) in the S ewes. This recording occurred 9 days after lamb removal. The suckled group produced more milk ($p<0.01$) over the remaining course of the study.

Data for lamb weight are presented in Table 3. At the beginning of experiment, lambs in the NS group tended to have better body weights ($p=0.02$) than those in the S group. Over the second and third body weight recordings, lamb weights in the NS group were significantly lower ($p<0.001$) when compared with S group.

Rams were introduced on day 23 postpartum for heat detection. Data for estrus expression and progesterone rise are reported in Table 4. The number of ewes expressing estrus was greater ($p<0.05$) in NS than S ewes. Sixty percent (6/10) of S ewes compared with 100% (10/10) of NS ewes expressed estrus following ram introduction. Estrus expression was more synchronized in the NS ewes as it was observed over a period of 20 days in the 6 S ewes, while it was observed over a period of 7 days in the NS ewes.

Progesterone profiles indicated that all 20 ewes ovulated regardless of treatment. The first rise in plasma $P_4$ above 1 ng/ml occurred earlier ($p<0.05$) in the NS than S ewes (day 27.0±2.2 vs. 34.0±2.2 postpartum, respectively). Based on progesterone rise, ovulation occurred earlier in the NS than S ewes (Table 4).

## DISCUSSION

Awassi is the predominant sheep breed in Jordan. It is important to know more about physiology and endocrinology of this breed in order to increase number of lambs born and, consequently, mutton production. In Awassi ewes lambing in the autumn, the interval between parturition and the first estrus was variable (Epstein, 1982; Harb, 1994). The main factor causing postpartum acyclicty is the suppression of pulsatile LH secretion from the anterior pituitary gland (Mitchell et al., 1998). Factors that inhibit the release of LH during early postpartum are suckling, metabolic demands of lactation, inadequate nutrition and/or poor body condition, immaturity and the absence of inductive seasonal. Some researchers reported that an increase in suckling intensity delays the resumption of postpartum reproductive activity (Scaramuzzi et al., 1996) while other authors failed to observe any effect of suckling stimuli on the return to estrus (Mandiki et al., 1990).

Postpartum body weight loss may be the main factor limiting the return to estrus and ovarian activity (Mbayahaga et al., 1998). Body weight of NS ewes increased throughout the experiment, while BW of S ewes drastically decreased indicating the negative energy balance of the S ewes. Low energy intake (negative energy balance) impairs fertility (Boland et al., 2001). This effect of BW may have affected estrus expression and ovarian activity through suppression of the increase in LH pulse frequency that is necessary for growth of ovarian follicles to the preovulatory stage (Schillo, 1992). Lower ovulation rate, associated with low LH pulsatility, has been observed in

sheep on low plane of nutrition (Rhind et al., 1989).

In the present study, ewes that maintained their body condition and weight (NS ewes) showed luteal activity (rise in $P_4$) earlier than suckled ewes, which lost body weight and condition during the experiment. 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 body condition. Rutter and Randel (1984) reported that cows maintaining body condition during the postpartum period had better responsiveness of pituitary gland (more LH stored and released). We didn't measure LH release in the current study, but we were able to see similar trend in PP reproductive activity to what was reported by previous research (Rutter and Randel, 1984). Suppression of cyclic ovarian activity during the early postpartum period is characteristic of the suckled beef cow (Williams, 1990). In the current study, losing body weight in suckled ewes may have decreased nutrient availability required for the pituitary gland to secrete gonadotropins, which was reflected in the reduced ovarian activity.

Body condition score is a reflection of nutritional status of the animal. In the current study, BCS of S ewes decreased throughout the experiment while BCS of NS ewes improved. As a result, NS ewes showed ovarian activity earlier than S ewes. This is in agreement with Kridli et al. (2001) who reported that postpartum Awassi ewes maintaining body condition were able to resume cyclicity earlier. If body condition score is poor, postpartum acyclicity will be prolonged.

Nursed lambs had an increase in body weight throughout the experiment, while the body weight of non-nursed lambs decreased. This is because nursed lambs had free access to suckle their dams and acquire their requirements, while the non-nursed lambs were fed (milk) at limited times and amounts which led to a slower increase in body weight when compared with the other group.

Milk production of NS ewes sharply decreased throughout the experiment while milk production of S ewes remained the same or gradually decreased. In this study, decreased milk production in the non-suckled group may be due to many reasons. These include nursing frequency, intensity or duration when lamb suckled its mother, and mothering ability (ewe-lamb interaction). If these factors are disturbed, milk production sharply decreases (Williams 1990; Yavas and Walton, 2000).

Prolactin secretion is correlated with milk production (Carruthers and Hafs, 1980). Higher milk-producing ewes tend to have greater circulating plasma prolactin. High circulating concentration of prolactin can reduce the responsiveness of ovarian follicles to LH stimulation (Mitchell et al., 1998). Wallace et al. (1989) reported that suckling induced hyperprolactinemia with its associated suppression of gonadotrophin secretion. Suckling reduced the amplitude of the estradiol-induced LH surge in both early and late postpartum ewes (Smart et al., 1994). This may be the case in the present study whereby suckled ewes probably had elevated plasma prolactin concentration resulting in reduced responsiveness to LH stimulation thus leading to reduced reproductive performance when compared with non-suckled ewes.

It has been well established that estrus expression in the ewe requires the sequential action of progesterone and estradiol (Schirar et al., 1989). Based on progesterone profiles, all ewes ovulated within 50 days post lambing. All of the non-suckled ewes (10/10) displayed estrus at the completion of a normal period of progesterone secretion compared with 6/10 of the suckled ewes that expressed estrus. This may be due to silent ovulation during the first cycle after lambing. Mandiki et al. (1990) reported elevated circulating prolactin and reduced estradiol concentrations in suckled compared with non-suckled ewes during the first 4 weeks postpartum when the suckling stimulus is most intense. Reduced responsiveness of higher brain centers to estrogen, together with reduced estrogen secretion may, therefore, account for the lower incidence of estrus behavior in ewes with an early onset of ovarian cyclicity.

## IMPLICATIONS

Several previous studies reported that suckling is a major factor delaying the resumption of normal ovarian activity. The present study showed that non-suckled ewes had lower milk production, maintained their body condition and gained more weight than suckled ewes allowing ovulation and progesterone rise to occur earlier. Results of this study indicate that early weaning of lambs decreases the duration of lactation and allows the resumption of ovarian activity shortly following parturition. This method can be used as a management tool to obtain semi annual lambing especially in flocks with reduced milk production.

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