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PRODUCTIVITY OF DESERT LAMBS AS EFFECTED BY NUTRITION IN NORTH KORDOFAN STATE, SUDAN

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ABSTRACT

The present investigation was undertaken to evaluate the influence of supplementation during mating, late pregnancy and pre-lambing period performance of Desert lambs under an extensive tropical management in North Kordofan State, Sudan. Eighty eight (88) lambs were used in this experiment. The lambs born belong to ewes supplemented with concentrate ration and un-supplemented with concentrate ration. Lambs were divided into four groups A, B, C and D. Group A, B and C were assigned to supplementary feeding treatments 1, 2 and 3 respectively same as rations given to their mothers. Group D as a control (un supplemented with any diet depend on pasture only as practice by farmers). Supplementation (ration 1, 2 and 3) was offered at evening with 150 g / head/day increase to 250g / head /day. The results indicated that supplementation to desert ewes significantly ($p < 0.05$) effected birth weight where supplemented ewes recorded higher lambs weights as 2.32, 2.11 and 2.02 kg for group A, B and C respectively as compared with group D with 1.80 kg. Group A, B and C were scored significantly ($p < 0.05$) highest growth rate from birth till 90 days of birth, with best final weight mentioned in group A and B as 11.46±0.19 and 10.70±0.20 kg. Also daily weight gain was exerted significant ($p<0.01$) effected by supplementation, recorded as 102.62 ± 1.29, 95.35 ± 1.37, 74.44 ± 1.46 and 65.95 ± 1.73 g/day for A, B, C and D groups respectively.The supplementary feeding significantly ($p < 0.05$) affected lambs weaning weight, high weaning weight in supplemented groups as 11.46, 10.70 and 8.82 kg for A, B and C respectively as compared with low weight in group D as 7.86 kg. The effect of supplementary feeding was exerted significant ($p<0.05$) effect on pre weaning mortality rate, where supplementary lambs recorded zero mortality and higher survival rate, group D was recorded relatively 6.3% highest mortality rate compared with other group. In conclusion, the amount and type of feed (flushing and steaming-up) provided to pregnant ewe have influences on birth weight of lamb and improved lamb growth rate before weaning and increased daily gain and weaning weight.

KEYWORDS

Desert lamb, supplementation, birth, weaning weight, mortality rate, Sudan.

INTRODUCTION

Livestock production is a major component of the agricultural economy of developing countries and goes well beyond direct food production. Sheep s production in Sudan is an important activity for smallholders, particularly for resource poor farmers in many parts of the Sudan. Sheep are the living bank for many farmers and have a critical role in the agricultural intensification process through provision of draught power and manure for fertilizer and fuel. Also they provide their owners with a vast range of products and services such as immediate cash income to farmers, meat, milk, skin, manure, risk management and social functions. Sudan Desert sheep and their crosses make about 80% of sheep found in Sudan; they are raised mainly under harsh dry land farming conditions under open rangelands for mutton production (Idris et al., 2011). The productivity of desert sheep in North Kordofan is low; the sector has not received a great deal of attention from scientists, administrators and legislators.

Evaluation of the reproductive traits of local sheep breeds is an important part of categorization of their productive and reproductive performance. Many factors influence reproductive performance of sheep, of which genetic and the environment (Kafi *et al*., 2004; Tailor *et al*., 2006), management and particularly the nutritional status of the animal are important (Al-Ghalban *et al*., 2004). The production of Desert sheep is carried out in extensive grazing systems, where the contribution of grasslands generally does not cover the nutritional demands of the animals. The reproduction of sheep managed under extensive range grazing conditions can be affected by nutrients availability and especially by the mineral content of the forages resources on the rangeland (Blache et al., 2008; Parraguez *et al*., 2020). Grazing alone may not be sufficient for optimizing live weight gain, wool production (Kochapakdee *et al*., 1994). Inadequate feed intake during late pregnancy and post lambing has been found to cause a reduction in birth weight, growth rate mammary gland development and milk production (Idris *et al*, 2014).

The last two months of pregnancy is a critical period, the final six weeks is an important period for the ewes to be supplemented because approximately 70% of the fetal growth takes place during this period. It is expected that improved feeding (concentrate supplementation) during the last 6 weeks of pregnancy affects lamb birth, growth rate, weaning weight, mortality rate, and lambing problems positively, also could help reduce both the incidence of peripartum diseases and the annual rate of losses (deaths) in ewes and lambs (Parraguez *et al*., 2020 and Cabiddu *et al*., 2020).The growth performance of sheep including birth and weaning weight is an important character which determines the overall productivity of the flock and the economic return from sheep production enterprises with the objective of meat production, through the market weight of lambs to market age (Mengisitie *et al*., 2010; Zohara *et al*. 2014). This study hypothesis that adequate feeding during lactation aims to improve lamb growth (birth and weaning weight) through increase milk production, and reduce mortality rate in lambs. However, in order to improve the productive and reproductive capacity of desert lambs, the use of concentrates as resort of supplement to desert sheep of the local breeds prior to mating and after lambing to ewes and their lambs may lead to improvement in their reproductive traits. Therefore, this paper focused on the effect of additional feeding in late pregnancy and post-lambing period on lamb's growth performance (birth and weaning weight, for Desert lamb.

MATERIALS AND METHODS

The present study was conducted at Foja village, Bara locality, North Kordofan State, Sudan during December 2016 to November 2017 (Longitudes 31.47˚-30.05˚ N, Latitudes 14.37˚-13.34˚E). The mean monthly temperature ranged from 31.3 C° in April to 25.8 C° in July, annual rainfall ranging between 500-800 mm, with peak rain in August (Technoserve, 1987). Eighty (80) ewes reared in natural grazing were selected from the flock of Desert sheep during the normal breeding season (February-March) for this study. Ewes were ear tagged, weighed and randomly divided into four groups A, B, C and D, each group of 20 ewes in complete randomized design. They were randomly assigned to supplementary feeding treatments as

group A was supplemented with diet one, group B was supplemented with diet two, group C was supplemented with diet three and the last group D as a control (un supplemented with any diet depend on pasture only as practice by farmers).

The born lambs (Eighty eight 88) from those ewes in the four groups were also assigned to supplementary feeding treatments of their mothers and were divided into four groups A, B, C and D in complete randomized design. As group A (27 lambs) was supplemented with diet one, group B (24 lambs) was supplemented with diet two, group C (21 lambs) was supplemented with diet three and the last group D (16 lambs) as a control (un supplemented with any diet depend on pasture only as practice by farmers) (Table1). After parturition, all lambs were marked with ear tag and remained with their dams for 24-48 h, lambs monitored from birth to weaning. Lambs were treated with the necessary medication against endo-and ecto-parasites (AGVET, USA 1.0 ml/50 kg body weight subcutaneously Ivomec super drench). All lambs were kept in separate enclosures constructed from iron bars and wire, and equipped with feeders and water troughs. Inside each enclosure the animals were individually tethered at sufficient distance away from each other and offered supplement type in separate troughs.

Diets and method of feeding:

All lambs were daily allowed grazing on pasture from 8.00 am to 6.00 pm after 30 day post birth. On their returning from pasture lambs in group A, B and C were offered 150 g / head/day increase to 250g /day/ head of concentrate ration 1,2 and 3 respectively (Table 1). The supplement diets were fed at night when the animals were kept in individual pens. The increment of supplement diets was based on body weight gain. Lamb body weights were recorded at birth and then were weighed at weekly interval from birth to weaning. Lamb birth, weaning weight and litter birth were estimated by weighing the lambs at these times. Growth rates were derived by taking the difference within the period from birth to weaning and dividing it by the time interval in days. Lamb and litter weights at weaning were adjusted to 90 days. The lambs were fasted overnight before being weighed.

Statistical analysis:

The data from feeding trials and reproductive traits were statistically analyzed according to complete randomizes design. All techniques of the statistical analysis were conducted using Statistical Package for the Social Sciences, software package (SPSS, 2005). Duncan's Multiple Range Tests (DMRT) was also used to test significance differences among means; analysis of covariance was carried out.

Table 1. Ingredients of the experimental feed stuffs

Components (%)	Ration 1	Ration 2	Ration 3
Sorghum grains	40	35	30
Groundnut Cake	35	30	25
Groundnut Hulls	20	30	40
Shells	4	4	4
lick salt	0.25	0.25	0.25
Common salt	0.75	0.75	0.75
Chemical composition of the experimental feed stuffs			
DM%	96.38	97.16	82.84
CP %	27.5	18.6	16.86
CF%	23.33	34.10	36.07
EE %	7.49	9.89	7.76

NFE %	33.05	30.41	30.58
Ash%	8.63	7.84	8.73
ME(MJ/ Kg DM)	11.42	11.26	10.51

The metabolizable energy values were calculated from chemical composition according to Ellis (1981). ME(MJ/Kg/DM)=0.012CP+0.031EE+0.005CF+0.014NEF

RESULTS

Effect of supplementation strategies on lamb's birth weight

The data on birth weight of lambs as affected by supplementation are shown in (Table 2).The supplementary rations that given to the experimental ewes, had highly significant ($p<0.01$) effect on lamb birth weight, lambs of animals that on group A (ration 1), group B (ration 2) and group C (ration 3) had significantly ($p<0.01$) maintained highly body weight (2.32±0.09, 2.11 ±0.10 and 2.02±0.11 kg) respectively as compared with control (unsupplemented) animal which maintained lightly bodyweight (1.80±0.12 kg) (Table 2).

Table 2. Effect of supplementation on lambs birth weight

Variables	No.of lambs	Means ±SE
Animal Group		
A	27	2.32 ± 0.09 [a]
B	24	2.11 ± 0.10[b]
C	21	2.02 ± 0.11[b]
D	16	1.80 ± 0.12 [c]
Overall mean± SE	88	2.08 ± 0.11

[abc] Values in the same column followed with different letters are significant at P<0.05

Effect of supplementation on lamb growth rate

The supplementary feeding had highly significant ($p<0.01$) effect on lambs growth from birth week till 90 days of birth (Table 3). Where lambs of group A were scored highest growth rate from birth till 90 days of birth, it noticed that group A scored higher weight during all period as 5.68±0.15, , 8.79±0.17 and 11.46±0.19 kg during 0-30, 30-60 and 60-90 days respectively. Where control group (C) recorded lowered weight at same period as 4.37±0.19, 6.43±0.22 and 7.86±0.25 kg. Best final weight mentioned in group A and B as 11.46±0.19 and 10.70±0.20 kg (Table 3).

Table 3. Effect of supplementation on desert lambs growth rate(Kg)

Animal Group	No. of lambs	0-30 day	30-60 day	60-90 day
A	27	5.68 ± 0.15 [a]	8.79 ± 0.17 [a]	11.46 ± 0.19 [a]
B	24	5.20 ± 0.15 [a]	8.19 ± 0.18 [a]	10.70 ± 0.20 [b]
C	21	4.55 ± 0.16 [b]	6.92 ± 0.19 [b]	8.72 ± 0.21 [c]
D	15	4.37 ± 0.19 [b]	6.43 ± 0.22 [b]	7.86 ± 0.25 [c]
Overall mean	87	5.05± 0.13	7.76± 0.18	9.97± 0.25

[abc] Values in the same column followed with different letters are significant at P<0.05

Effect of supplementation strategies on lambs weaning weight

Effect of supplementation on desert lambs weaning weight and body weight gain were demonstrated in (Table 4).The supplementary ration and steaming up to ewes had highly significant ($p<0.05$) effect on birth weight of lambs and subsequent lamb growth. Weaning weight at 90 days of age in supplemented groups A,B and C (given ration 1, 2 and 3) was significantly ($p<0.05$) effected by dietary energy level. The respective weaning weights were 11.46±0.19, 10.70±0.20 and 8.72±0.21 kg for the three groups A, B and C respectively as compared with group D 7.86±0.25 kg (Table 4). Also daily weight gain was exerted significant ($p<0.01$) effected by supplementation, recorded as 102.62 ± 1.29, 95.35 ± 1.37, 74.44 ± 1.46 and 65.95 ± 1.73 g/day for A, B, C and D groups respectively (Table 4).

Table 4. Effect of supplementation on lamb weaning weight, daily gain

Animal Group	No.of lambs	Weaning weight/kg	Daily body weight gain/g
A	27	11.46 ± 0.19 [a]	102.62 ± 1.29 [a]
B	24	10.70 ± 0.20 [b]	95.35 ± 1.37 [b]
C	21	8.72 ± 0.21 [c]	74.44 ± 1.46 [c]
D	15	7.86 ± 0.25 [c]	65.95 ± 1.73 [d]
Overall mean	87	9.97 ± 0.21	87.49 ± 1.46

[abcd] Values in the same column followed with different letters are significant at P<0.05

Effect of supplementation on lamb's mortality rate

Effect of supplementation on lamb's survival and mortality survival rate were tabulates in (Table 5). The effect of supplementary feeding was exerted significant ($p<0.05$) effect on pre weaning mortality rate, where supplementary lambs recorded zero mortality and higher survival rate, group D was recorded relatively 6.3% highest mortality rate compared with other group.

Table 5. Effect of supplementation on lamb survival and mortality rate

Variables	No.of lambs	Survival rate	Mortality rate
Animal Group			
A	27	100	0
B	24	100	0
C	21	100	0
D	15	93.7	6.3
Overall mean	88	98.7	2.6

DISSCUSION

Effect of supplementation strategies on lamb's birth weight

Birth weight is an economically important trait in livestock production. It is measure of prenatal growth and which affect partially in post natal development. In this study the mean birth weight was found to be 2.08 ± 0.11kg, our finding also corresponds with Idris *et al*. (2018), El-Hag *et al*. (2007) and lower than finding of Rihawi *et al*, (2006), Belay, and Haile (2009), Abegaz *et al*. (2011**)** and higher than that reported by Hossain *et al*. (2020). In this study steaming-up and supplementation to ewes gave significantly heavier lambs at birth than controls. Evidence that there was a highly significant effect of feed supplementation during gestation on the birth weight of lambs has been observed in this study, a number of studies have examined the impact of ewe nutrition in pregnancy on foetal growth and lamb birth weight were showed by El-Hag *et al*. (2007), also Zohara *et al*.

(2014), Kenyon and Blair (2014), Hossain *et al.* (2020) and Parraguez *et al.* (2020) stated that nutritional supplementation had a positive effect on birth weight. However, when ewes are well supplemented during gestation and lactation live weigh at birth was higher than ewes managed without supplementation which agreed with results obtained by Macedo and Alvarado (2005), Macedo and Hummel (2006), Macías-Cruz *et al.* (2009) and Freitas-de-Melo *et al.* (2018).

Supplementation with concentrate was adequate to keep maternal body weight at a level still considered adequate for optimum lamb birth weight (Cranston *et al.*, 2017). To this, it is important to highlight that the increase in birth weight observed in newborn lambs from mothers with nutritional supplementation is equivalent to the decrease in newborn lamb birth weight reported when the mothers consume a diet that only covers 70% of the requirements (Borwick *et al.*, 2003). In general low ewe body condition scores are associated with reduced lamb birth weight and this effect is more likely to occur due to poor nutrition (Kenyon *et al.*, 2014).

This coincides with the level of nutritional restriction suffered by pregnant sheep maintained under extensive grazing conditions in North Kordofan state, observed in the present study with agreed with Lira (2012) and Parraguez *et al.* (2020). An increase in the premating weights of the ewes due good nutrition has resulted in a proportional increase in the birth weight of the lambs (Aliyari *et al.*, 2012; Akta¸s and Do˘gan, 2014). Supplementations of pregnant ewes during late gestation are to provide adequate energy and protein to support embryonic and fetal growth, maintenance of animal physiological needs, mammary gland growth, colostroum and milk yield. This explanation is in line with findings of Oeak *et al.* (2005). On other hand Kochapakdee *et al.* (1994) reported that supplementary feeding did not significantly affect either kid birth weight or weight gain in the first 6 weeks after birth. Also Kabbali and Pond (1990) found that lamb birth weight was not affected by level of protein or energy supplementation. Kenyon *et al.* (2011b) reported that early pregnancy nutrition had no impact on triplet birth weight. The differences in birth weight may be attributed to effect of the dams uterine environmental mostly in late gestation through it availability of nutrition. Low plane of nutrition will be unable to adequately nourish the foetus in the final stage of pregnancy and consequently birth weight will be reduced. It's showed that a large reduction in lamb weight was caused only when under nutrition in late pregnancy was accompanied by a marked lack of protein and energy. This observation agreed with Herrera (2000) who stated that pregnancy is associated with a significant increase in maternal body weight caused by increases in fat deposition during early pregnancy, employed afterwards to support fetal development, and by the increase of fetal weight during late pregnancy. On other hands Oeak *et al.* (2005) and Idris *et al.* (2014) stated that inadequate feed intake during late pregnancy has been found to cause a reduction in birth weight, mammary gland development and milk production, and subsequent high lamb mortality.

Effect of supplementation on lamb growth rate

The pre-weaning performance of lambs provides a stage upon which post-weaning performance is built. Lambs whose dams were supplemented significantly slightly higher growth rates and body weight gained than that of lambs from ewes not having supplementation and depend only on grazing (control), concerning the effects of supplementation and steaming up effect on growth and gain of lambs by providing nutrients during pre-and post lambing for milk sustainability, in general, ewes' pre-partum supplementation improved lambs daily growth rate and there were significant difference in lamb growth before weaning, similar results were reported by Salim *et al.* (2002), Rafique *et al.* (2007), Haddad and Ata (2009), Yiheyis *et al.* (2012), Idris *et al.* (2014), Freitas-de-Melo *et al.* (2018) they stated that increases dietary concentrate content improved the growth performance. This

finding can be mainly attributed to the fact that high-concentrate diet contains more digestive energy and nonstructural carbohydrates (Wang *et al*., 2015), which leads to increased nutrient intake, faster digestion through the digestive tract, and then improved growth performance and higher feed efficiency (Haddad and Ata, 2009; Haddad, 2005). Yiheyis *et al*. (2012) demonstrated that the growth rate of young lambs depends almost entirely on the quality and quantity of feed, the ewes milk yield, lambs milk intake. Furthermore, the milk yield of the dam in turn depends up on the nutrition and mature size of the ewes. Idris *et al*. (2011) reported that supplementation of ewes during mating and late pregnancy was improved their lamb growth rate before weaning.

The low growth rate and lighter for lambs born to ewes depends on grazing only may be this could be due to fact that in the suckling period lamb growth rate is mainly affected by the dams' milk yield, since the dams depends on grazing on poor quality feed then gain lower energy for milk production which reflect the poor milk produced from them. High milking ewes' lambs grow faster as compared to the poor milkers. The low daily weight gains of lambs in this experiment reflects the adverse feeding conditions during the summer between ewes depending on pastures and other supplemented with concentrate, our finding in this study also corresponds with Rosa *et al*. (2007), Rafique *et al*. (2007), Tufarelli *et al*. (2011), Yiheyis et al. (2012) who revealed that good nutrition during late pregnancy also increases the production of milk and colostrum by the ewe. The availability of enough milk from the supplemented dams results to faster pre-weaning weight gain. Contrary to the present results, Kochapakdee *et al*. (1994) found no differences were observed in ewe lamb growth performance and average daily weight gain.

The growth traits particularly pre-weaning in mammalian are not only influenced by the genetic factors but there were other factors such as direct maternal effect and permanent environmental effects (Baneh *et al*., 2020).These maternal effects reflect mainly the dam's milk production and mothering ability, though effects of the uterine environment. The discrepancies may be due to breed variation and differences in management particularly the age of weaning age and due to the weight gains during the early-pre-weaning growth stages, also the variation may be due to small size of experimental animals used in study. Generally results here suggestion that the growth rate of kids was influenced by the type of ration offered to their dams during post and pre lactation period.

Effect of supplementation strategies on lambs weaning weight and daily gain

Weaning weights are crucial and indicate the milking ability of the herds as well as the growth potential of the kids. In this study supplementation that offered to ewes affect daily body weight gain and weaning weight, same results obtained by Gaskins *et al*. (2005); Notter *et al*. (2005) Aliyari *et al*.(2012) who demonstrated that age of a ewe, the birth type, lamb's sex, as well as maintenance and feeding conditions are known to have an important impact on the weaning weight and daily gain of lambs.

The overall least square three months weight (weaning weight) obtained in this study (9.97kg) was almost lower than the report of Tibbo *et al*. (2004) and Abegaz *et al*. (2011) at 3 months. Pre and post-partum supplementary feeding of the dams had significant effects on weaning weight, lamb daily growth rate and total gain. In this study lambs born from ewes supplemented with concentrate rations had a significantly higher pre-weaning growth rate, daily gain and were heavier at weaning than lambs born from ewes unsupplemented with concentrates and depends only on grazing. These supplements had higher nutritive value. This result was in line with findings of El-Toum (2005) El-Hag *et al*. (2007) and Idris *et al*. (2014), Mekoya et al. (2019).

Lambs from supplemented ewe's growth faster than unsupplemented one this may be due to mammary gland development and milk production in those dams results in heavier weaning weight and total gain. Similar results were obtained by Njoya *et al*. (2005), and Oeak *et al*. (2005) Behrendt *et al*.(2019). Differences in weaning weight of lambs have been contributed by performance of ewes during lactation. This explanation is in line with findings of Rafiq *et al*. (2006). Inadequate feed intake during late pregnancy may cause a reduction in mammary gland development and milk production, so lambs suckling non supplemented ewes obtained low growth rates. A similar trend was recorded by Salim *et al*. (2002) and Tufarelli *et al*. (2011) showed that supplemented group of sheep gained significantly higher body weight at weaning time than that of control. Freitas-de-Melo et al. (2018) found that lambs from the high pasture allowances group tended to be heavier at 90 days than those from the low pasture allowances group. Contrary Kenyon *et al*. (2011b, 2013) they found that supplementary feeding did not significantly affect weaning weight.

Lambs born to supplemented ewes and feeding concentrate ration showed higher body weight gain compared with control one and unsupplemented. These results matched many researcher Salim *et al*., (2002) and Wang *et al*., (2015) reported that increases dietary concentrate content improved the growth performance. This may be mainly due to high-concentrate diet contains more digestive energy and nonstructural carbohydrates, which leads to increased nutrient intake, faster digestion through the digestive tract, and then improved daily gain and higher feed efficiency (Haddad and Ata, 2009). Lambs born to grazing ewes and unsupplemented secured low daily gain can be mainly attributed to the decrement in herbage supply (both in quantity and quality) which agreed with Idris *et al*. (2014). On other site Kochapakdee *et al*. (1994) and Salim *et al*. (2002) reported that supplementary feeding did not significantly affect weight gain. Generally supplementation of ewes during mating and late pregnancy was improved their lamb growth rate before weaning.

Effect of supplementation on lamb's mortality rate

The amount and type of feed provided to pregnant ewe have influences on birth weight of lamb, in which the low abortion rate and high survival rate for ewes steaming-up and flushing compared with ewes unsupplemented, this result is agreed with Wilkins (1997) for Merino ewes and El-Toum (2005) who found that supplementary feeding had resulted in a 21.0% decrease in abortion rate. Belkacemi et al. (2010); Igwebuike, (2010) and Dwyer et al., (2016) reported that maximizing lamb survival rates at birth is limited by under-nutrition and feed availability.

Preweaning mortality rates of lambs were reduced with supplementation compared with the control. The lower mortality in steamed-up ewes than in the other unsteamed-up groups may be this due to heavier of lambs at birth due to nutrient provide from their mother during pregnancy, similar results obtained by Reese *et al*. (1990); Casellas *et al*. (2007). Also Although, Hinch *et al*. (1996); Idris *et al*.(2018); Kenyon *et al*. (2019) reported that supplementation with ration meal under grazing conditions in mid- and late-pregnancy had a consistent positive effect across birth ranks on survival. Abate (2016) observed that poor nutrition during service period lead to increase embryonic mortality and hence abortion rate. Poor nutrition leads to reduced conception, embryonic losses, reduced lambing rates and high ewe mortality (Simbaya, 2002; El-Hag *et al*., 2007; Sirohi *et al*. 2014). The effects of pregnancy stress on ewes are manifested in increased abortions, weight loss and mortality (Sirohi *et al*., 2014). Contrary to this results Kerslake et al. (2009, 2010b); Kenyon et al. (2010b) found no difference between supplemented group and unsupplemented ewes. The variation in terms of the survival and abortion rate in lambs between this study and other studies may due to differences in management practice by farmer particularly feeding programs and different breeds, scarcity of feed sources and high summer temperatures.

Conclusion

In conclusion, the amount and type of feed (flushing and steaming-up) provided to pregnant ewe have influences on birth weight of lamb and improved lamb growth rate before weaning and increased daily gain and weaning weight of the lambs compared with these depend on natural grazing only. Therefore, this would be good strategically to provide the grazing desert sheep herds with adequate feeds for production and reproduction during the mating periods. This would require provision of feed supplements in attempt to balance the seasonal nutritional inadequacies of the natural pasture. It is recommended that, Supplementation during mating and late pregnancy should be undertaking using different local ingredients to form rations.

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