

# Effect of Concentrate Supplementation on Reproductive Performance of Desert Ewes Under Range Conditions, Sudan

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## Abstract

This study was conducted to investigate the effect of concentrate supplementation on reproductive performance and milk yield of Sudan desert sheep (Hamari subtype) on rangelands. The study was conducted at Elnuhood locality, western Kordofan state, Sudan shortly before ewe breeding season. Ninety ewes of similar age (1-3 years) and an average live weight range (40 to 58) kg were divided randomly into three feeding groups of 30 animals each. Group A was given concentrate supplement for one month before, one month after mating, and one month before lambing; group B was given the supplement for one month before mating and one month before lambing, whereas group C was kept on natural grazing as a control group. All animals were allowed to graze on natural range. Animals were watered every 2-3 days according to ambient temperature. The concentrate diet was offered on group base at a rate of 500 gm./ewe/day, and consisted of sorghum grains 15%, groundnut cake 20%, molasses 15%, wheat bran 25%, groundnut hulls 23%, 1% salt and 1% limestone. Mature rams were introduced to ewes at the beginning of the breeding season. Reproductive traits, mortality and daily milk yield were recorded for each group. Statistical analysis indicated that concentrate supplementation improved ewe reproductive traits as conception to first service, lambing rate, fecundity, and prolificacy, and reduced abortion and mortality rate. Concentrate supplementation of ewes had no significant effect on ewe average daily milk yield. It was concluded that concentrate supplementation before and during the breeding season of ewes grazing natural pasture enhanced ewe's reproductive attributes and reduced their mortality.

## Keywords

Supplementation, Hamari Sheep, Reproductive Performance, Range Condition

## 1. Introduction

Sudan is one of the few Arab and African countries with large animal population. They account for about 70% of cattle, 31% of sheep, 49% of goat and 25% of camel of the total population of the Arab world. The number of livestock population was estimated in the year 2015, as 106.62 million heads of which cattle, sheep, goats and camels amounted to

30.4, 40.2, 31.2 and 4.8 million heads, respectively. Livestock contribute to the national foreign exchange earnings, and its share in the national income is about 20.8% and 19.4% in 2013 and 2014 respectively [1].

Sudan desert sheep and their crosses make up about 86% of the sheep found in the country and are famous for their good meat quality. In Kordofan States (North, South, and West) of Sudan the major types of desert sheep are namely Hamari and Kabashi [2]. Sheep flocks in these states are well adapted to

the local environment and to the traditional pastoralism system of production, and are maintained under rangeland conditions for meat production [3]. The annual off take number of these sheep in 2014 was about 19.80 thousand head [1].

Ninety percent of sheep flocks in Sudan are in the hands of traditional producers who depend mainly on natural pasture [4]. The nutritive value of pasture and range land in Sudan is greatly affected by seasonality of rainfall, and during the dry season, grazing alone may not be sufficient to meet maintenance, production and reproductive requirements of these flocks. Feed supplementation is a strategy to solve this problem [5]. The main objective of this work is to study the effect of concentrate supplementation to improve reproductive performance of Sudan desert sheep (Hamari subtype) on rangelands of western Kordofan state.

## 2. Material and Methods

### 2.1. Study Site

This study was conducted at Um Jacko village, 20 kilometers East of Elnuhood town, Elnuhood Locality, West Kordofan State, Sudan. It is located in the semi-desert ecological zone. Elnuhood Location lies between latitudes (12-14)<sup>o</sup> north and longitudes (27-30)<sup>o</sup> East.

### 2.2. Climate, Topography and Vegetation

The area is located within the poor Savannah belt. The climate is warm in the wet season and hot dry in summer, with a temperature range of 33<sup>o</sup> to 46<sup>o</sup> C. In the cold season (winter) the minimum temperature is about 11<sup>o</sup>. The rainy season lasts for four months (July to October) and the annual average rainfall is between (450-550) mm [6].

The soil nature is mostly stabilized sand dunes and smooth undulating sandy plains (Goz) of low fertility and capable of absorbing water [7]. The dominant vegetation is a variable mixture of thorny trees, shrubs, herbs, and grasses. Acacia trees are dominant in the area where Acacia senegal (Hashab) is the most important type from an economic point of view, as it produces Gum Arabic which is considered as the best cash crop. Other trees include Acaia albida (Haraz), Bascia senegalensis (Mokhait), Adansonia gigitata (Tabldi), and Sclerocarya birrea (Hummat). Grasses and herbs which predominate include Dactyloctenium aegyptium (Abu- Asabi), Echnochloa colonum (Difra) and Andropogon gayanus (Abu Rakhies). Overgrazed areas are dominated by less palatable species such as Eragrostis tremula (Banu), Cenchrus biflorus (Haskaneet), Calotropis procera (ushar), grasses and herbaceous species such as Cenchrus setigrus, Chloris gayana, Cassia acutifolia Alexandrian (Senna), and Abutilon spp. (El Neiada).

### 2.3. The Experiment

It was conducted in winter season shortly before the breeding season and extended up to weaning of born lambs in year 2014. Ninety local Sudanese desert ewes (Hamari subtype) were used in this work. Ewes were of similar age

(1-3) permanent incisors, and their average weight range was (40 to 58) Kg. Ewes introduced to a concentrate ration table 1 over 15 days before the start of the experiment, then drenched with Albendazole and injected with Ivomec at a rate of (7-10) cc according to body weight against internal and external parasites. Thereafter ewes were divided according to supplement feeding into three groups designed as (A), (B) and (C). Each group consisted of 30 animals of equal weight and age, and identified by paint. Five Mature rams with (1-3) permanent incisors and an average weight of 60-100 kg were introduced to the experimental ewes at the beginning of the mating season.

### 2.4. Feeds and Feeding

The strategy of feeding consisted of natural grazing, where all animals were allowed to graze together during the day in the surrounding grazing pastures. Supplementation with the concentrate diet was given during the breeding season which started in February and continued to March. Supplementation was at a rate of 500 gram/ewe/day. The supplement was offered on group base during resting period when ewes returned from grazing shortly before sun rise (sarba). Concentrate supplement was distributed at random among ewe groups. Group (A) was given the supplement for one month before, and one month following joining of rams with ewes (tubbing), and also for one month before lambing which was during the rainy season (June), Group (B) was given the supplement for one month before joining of rams with ewes, and one month before lambing, whereas group (C) remained as a control group which was kept on natural grazing only. Animals were watered every 2-3 days according to ambient temperature.

### 2.5. Reproductive Traits and Milk Yield

The reproductive data recorded included number of ewes mated, pregnant, failure, lambing and aborted ewes. Estrous was monitored by visual observation and ewes that returned to estrous were mated again. Number of matings per successful conception were recorded. Dates of services were determined. Ewe mortality rate from tubbing to lambing was also recorded. Bascule Balance (0-100 kg) was used for weighing.

The reproductive traits included lambing, and fecundity rates, prolificacy (litter size) as well as abortion rate were calculated [8]. Milk yield was determined in fifteen ewes, five ewes from each group. Determinations were made every two weeks from the second week post-partum for 105 days. The day before milk yield measurements ewes' teats were sealed using a traditional anti-sucking device "Surar". Ewes were hand milked and daily milk yield was recorded using a spring scale (10 kg).

### 2.6. Statistical Analysis

Data were subjected to analyses of variance applicable to a randomized complete block design using computer program Statistical Package for the Social Sciences, software package (SPSS version 11.50 2002) [9].

**Table 1.** Ingredient proportions and chemical composition of the concentrate diet DM.

Ingredients	percentage
Sorghum grains	15
Groundnut cake	20
Molasses	15
Wheat Bran	25
Groundnut Hulls	23
Salt	1
Limestone	1
Total	100
Calculated Crude Protein (CP)%	18.47
Calculated Metabolizable Energy (ME) (MJ/kg) *	10.7
Proximate analysis (%) on dry matter basis:	
Dry matter	95.15
Crude protein	18.51
Crude fiber	7.57
Ether extract	4.65
Ash	8.10
Nitrogen Free Extract	61.27

ME: was calculated according [10].

### 3. Results

#### 3.1. Effect of Concentrate Supplementation on Percentage of Serviced Ewes and Mortality Rate

The effect of concentrate supplementation on percentage of serviced ewes and mortality rate is shown in Table 2. Concentrate supplementation considerably improved the percent of ewes got pregnant at the first heat. The conception rate to the first service was highest in ewes of group (A) 60.0% followed by those in group (B) 33.3% while the control group recorded the lowest percentage of pregnant ewes 30.0%. Percentages of ewes pregnant on the second heat were similar in all treatments and amounted to 16.7%. Ewes pregnant at the third heat were 6.7% in all treatments. Ewes that got pregnant at the fourth heat and more were higher in group (B) 10.0% followed by group (C) 6.7% and lowest in group (A) 3.3%. Paren ewes were higher in the control group (C) followed by group (B) and lowest in group (A). Total percentage of ewes served was 86.7% for those of group (A), 66.67% for those of group (B) and 60.0% for the control group (C). Mortality rate in group (A) was the lowest 3.33% and increased to a rate of 13.3% in group (B) and (C).

#### 3.2. Effect of Concentrate Supplementation on Some Reproductive Traits

Traits for the assessment of reproductive performance as lambing rate, prolificacy, fecundity, and abortion rate in ewes are shown in table 3. Generally concentrate supplement had positive influence on reproductive traits of ewes compared with non-supplemented control group. Supplemented ewes in group (A) had the highest lambing rate 86.67% followed by group (B) 66.67% while non-supplemented ewes (control group) recorded the lowest lambing rate 60.0%. Ewes in (group A) had the highest prolificacy rate 107.7%, while ewes

in group (B) and (C) had the same rate 100%. Fecundity rate was highest in ewes in group (A) 93.0% than those in group (B) 63.0%, and the control 56.67%. Abortion rate was none in group (A) and (C) and was 3.3% in group (B).

**Table 2.** Effect of concentrate supplementation on percentage of serviced ewes and mortality rate of Hamari ewes:

Traits	Ewe group		
	A	B	C
Number of ewes exposed to rams	30	30	30
Pregnant ewes (%)			
First heat	60.0	33.3	30
Second heat	16.7	16.7	16.7
Third heat	6.7	6.7	6.7
Fourth heat and more	3.3	10.0	6.7
Paren ewes	10.0	20.0	26.67
Mortality	3.33	13.33	13.33
Total ewes served	86.67	66.67	60.00

In this and subsequent tables: Group (A): Supplemented for one month before tubbing, one after tubbing, and one month before lambing. Group (B): Supplemented for one month after tubbing, and one month before lambing. Group (C): Un supplemented (control) group.

**Table 3.** Effect of concentrate supplementation on some reproductive traits (%).

Measurements	Ewe Group		
	A	B	C
Lambing Rate	86.67	66.67	60.00
Prolificacy	107.7	100	100
Fecundity	93.33	63.33	56.67
Abortion Rate	0.0	3.3	0.00

#### 3.3. Effect of Concentrate Supplementation in Ewe Milk Yield

The Effect of concentrate supplementation on ewe milk yield is presented in table 4. Concentrate supplementation had no significant ( $P < 0.05$ ) effect in average daily milk yield in all treatments. Concentrate supplementation in group (A) and (B) resulted in an increase in dam milk yield up to day 75 post-partum compared with that of group (C) ewes which were left on grazing only. Lactation curves for each group are illustrated in Figure 1. Milk yield at day 15 of lactation was the highest in ewes of group (A) and (B) that were given concentrate supplement and was lowest in ewes left on grazing only. Milk yield decreased gradually till the end of the third month of lactation in all ewe groups.

**Table 4.** Effect of concentrate supplementation on ewe average daily milk yield (Kg).

Milk Yield (kg) Day post-partum	Ewe Group			SE	P. level
	A	B	C		
15	0.99	0.95	0.90	0.03	NS
30	0.86	0.80	0.69	0.04	NS
45	0.57	0.61	0.53	0.05	NS
60	0.37	0.49	0.36	0.04	NS
75	0.35	0.36	0.33	0.03	NS
90	0.25	0.36	0.35	0.02	NS
105	0.21	0.19	0.20	0.02	NS
120	0.15	0.18	0.18	0.01	NS

## 4. Discussion

### 4.1. Effect of Concentrate Supplementation on Percentage of Serviced Ewes and Mortality Rate

The study indicated that concentrate supplementation of ewes during the breeding season improved conception rate and reduced paren rate over non-supplemented ewes. Ewes that were given concentrate supplementation for one month before, and one month after ram introduction had the highest conception rate to the first service than those supplemented for one month before ram introduction. The latter had greater percentage of total ewes served than non-supplemented ewes. Improvement of the nutrition status of ewes could be the possible reason for this improvement in conception rate. Concentrate supplemented ewes were served and conceived within a shorter time, and their mortality rate was reduced than non-supplemented ones [11]. Also supplementary feeding during mating and at late pregnancy of ewes improved the percentage of ewes that were pregnant in the first service [12].

The percentage of paren ewes was higher in the control group than in the supplemented groups, probably due to the low level of nutrition of the range. Low fertility in ewes was primarily attributed to factors including breed, heredity, environment, management and the reproductive soundness of the ewes [13].

### 4.2. Effect on Others Reproductive Traits

The current study indicated that concentrate supplementation had a positive influence on reproductive traits. The supplemented group (A) recorded higher lambing rate, prolificacy, and fecundity percentages and lower abortion rate, followed by group (B) and (C). This might be due to the general body status of supplemented ewes particularly those supplemented pre-mating and during late pregnancy.

This result agreed with [11, 12, 14] who reported that pre-partum supplementation, flushing and steaming-up of the dams of the Sudan desert sheep had a significant ( $P < 0.05$ ) effect on ewe reproductive performance, increased fertility, prolificacy, fecundity, pregnancy, increased lambing and weaning rates, and reduced abortion rate. Concentrate supplementation in the dry season was reported to improve the productive performance of Sudan desert ewes [15]. In Bangladesh the reproductive performance particularly lambing rate increased to 100% in concentrate supplemented ewes and was 75% in the control group. Prolificacy, fertility, and ovulation rates were also increased by flushing Barbarire ewes [17].

Ewes supplemented with concentrates before and after tubbing and control ewe group had zero abortion rate, however ewes given concentrate supplementation for one month before tubbing had 3.3% abortion rate. This finding could be due to reason other than nutrition. Abortion rate in nomadic ewe flocks of Sudan desert sheep was reduced by concentrate supplementation [18-12].

### 4.3. Effect of Concentrates Supplementation on Ewe Milk Yield

Effect of concentrates supplementation on ewe milk yield as illustrated in figure 1 and table 4 showed no significant increase in average milk yield in concentrate supplemented ewes, and that milk yield progressively declined with progress of lactation. The milk yield during the early post-partum days in ewes supplemented during last month of pregnant could possibly be due to a slight improvement in body condition. The quantity and quality of natural pasture was reported to be inadequate to supply the nutrient requirements for milk production particularly during early lactation which necessitated feed supplementation of ewes to correct the nutrition deficiency [18].

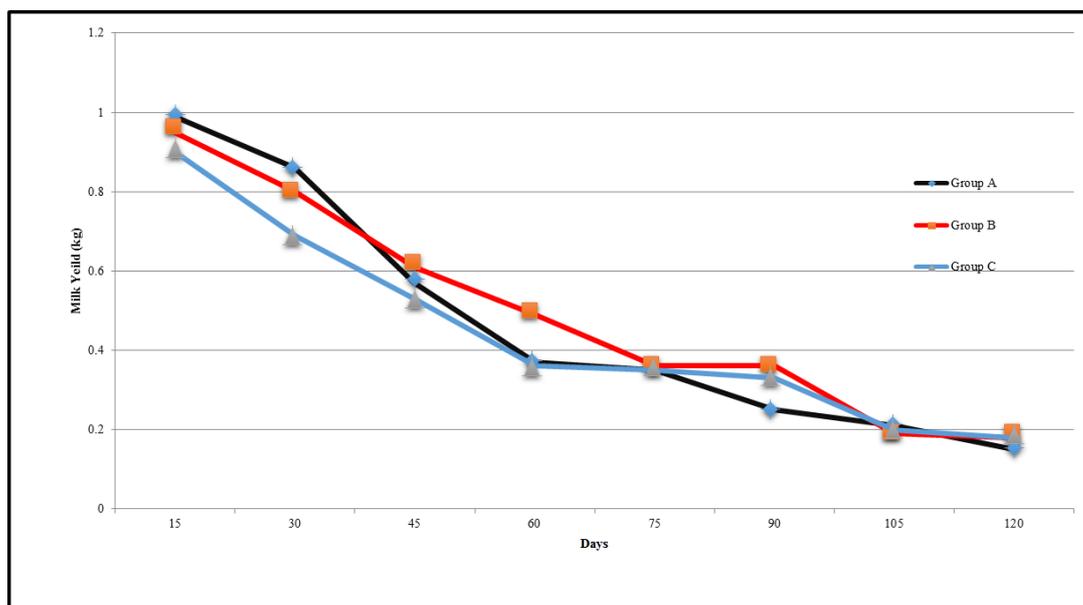


Figure 1. Effects of concentrate supplementation on Hamari ewe's average daily milk yield (Kg).

## 5. Conclusion

Can be concluded from this study Concentrate supplementation of ewes had improved their reproductive performance, and reflected positively on lambing rate, prolificacy, fecundity and reduced abortion rate and improved birth weight, and twins' rates. There was no significant difference between supplemented and grazing ewes on milk yield.

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