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A Study on Some Non-Genetic Factors and their Impact on Some Reproductive Traits of Sudanese Nubian Goats

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Abstract: The objective of the current study was to estimate reproductive parameters of Sudanese Nubian goat under extensive management system. The data of eighty-six parities of Sudanese Nubian goats were used; the parities occurred during the period from October 1998 to August 2000, to a parent stock raised on traditional pastoralism. These parities were used in completely randomized design to investigate the effects of grazing supplementation, season of kidding and parity order on the pattern of recurring estrous cycles during the year, gestation length, service period, kidding interval and kidding rate. The results indicated non seasonal pattern of ovarian cyclicity, the gestation length averaged 148.57±3.60 days. Nutritional supplementation, season of kidding and parity order had non-significant effect on gestation length. The service period averaged 148.29±62.38 days. Nutritional supplementation and season of kidding exerted a significant ($p<0.05$) effect on service period. However, the parity order had a non-significant effect on service period. The average kidding interval was 278.05±75.19 days. Nutritional supplementation, season of kidding and parity order had non-significant effect on kidding interval. Litter size was 1.12±0.36 kids. Nutritional supplementation, season of kidding and parity order had non-significant effect on litter size.

Key words: Nubian goat, non-genetic factors, reproductive-traits

INTRODUCTION

Reproductive efficiency plays a pivotal role in sustainable animal production industry. The reproductive performance of animals on the other hand is governed by genetic and non-genetic factors; the non-genetic factors play the greater role. Several-non genetic factors were cited in the literature including nutritional supplementation (Lehloenya *et al*., 2005; Tedonkeng-Pamo *et al*., 2006) season of kidding (Mellado *et al*., 1991; Galina *et al*., 1995; Odubote, 1996; Silva *et al*., 1998) and parity order (Awemu *et al*., 1999; Moaeen-Ud-Din *et al*., 2008). Moreover, the reproductive efficiency is tightly geared with a variety of physiological and managerial aspects like gestation length, service period, kidding interval and litter size (Greyling, 2000; Song *et al*., 2006).

Data on major reproductive traits of Nubian goats reared under range condition are scarce. Moreover, studies dealing with non-genetic factors impacts on goat reproductive performance are juvenile. The present study was designed to evaluate the effect of supplementation, season of kidding and order of parity on some reproductive traits in Nubian goats.

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MATERIALS AND METHODS

In this experiment eighty-six parities of Sudanese Nubian goats were analyzed; the parities occurred during the period from October 1998 to August 2000, to the parent stock raised on traditional pastoralism. The grazing zone of these animals was in the Southern Butana plains of Sudan near Abu Deleig, 100 km North East of Khartoum. The prevailing metrological conditions and pasture composition are given in Table 1 and 2, respectively. The year was divided into three seasons, summer (from March to June), autumn (from July to October) and winter (from November to February). The parent stock was divided into three groups (A, B and C) of equal number and weight. All groups were offered sorghum stalks at a rate of 500 g/head/day and allowed access to fresh pore-hole water twice a day in dry summer and once in winter. During winter and summer goats were allowed day grazing and in the evening they were kept indoors in enclosures made of mud and given supplement feed. Group A was given sorghum grains at a rate of 500 g/head/day for 30 days before parturition and throughout the lactation period. After that the group was given sorghum at a rate of 170 g/head/day. Group B was also supplemented with sorghum grains at a rate of 170 g/head/day throughout the experimental period to simulate the traditional management in the area. Group C was given a molasses based diet at a rate of 380 g/day/head throughout the experimental period (Table 3).

Table 1: Some meteorological data of the region during the experimental period of the study

	Year								
	1998			1999			2000		
Month	RH (%)	Temp. (°C)	RF (mm)	RH (%)	Temp. (°C)	RF (mm)	RH (%)	Temp. (°C)	RF (mm)
January	26	20.8	-	28	23.7	-	36	22.9	-
February	21	23.0	-	24	28.4	-	33	24.1	-
Marsh	17	26.1	-	15	27.1	-	21	26.2	-
April	15	31.7	-	14	31.2	Trace	18	31.7	Trace
May	18	34.1	-	22	35.2	Trace	26	34.3	0.1
June	22	34.5	-	25	34.8	4.70	26	35.7	-
July	39	33.9	1.4	44	31.5	42.2	36	32.8	2.5
August	50	30.7	34.7	51	30.3	51.3	39	32.5	2.0
September	52	31.3	87.6	44	31.1	20.4	39	31.7	16.3
October	37	32.0	7.2	36	31.5	4.2	30	30.2	24.1
November	25	32.9	-	26	28.0	-	27	26.7	-
December	28	25.5	-	33	25.0	-	29	22.5	-

RH: Relative humidity, RF: Rain fall

Table 2: Chemical composition of natural pastures in the study area (on DM bases)

Botanical name	Local name	Type	CP	CF	EE	Ash
Acacia ehrenbergiana	Salam	Bark and Branch	12.66	27.51	1.95	6.36
Acacia ehrenbergiana fruit	Salam fruit	Fruit	1.67	16.00	3.00	8.25
Acacia ehrenbergiana flower	Salam flower	Flower	0.71	16.50	1.00	9.75
Acacia mellifera	Kitir	Bark and Branch	16.30	30.30	1.80	8.70
Acacia tortilis sub sp. *Radiana*	Seyal	Bark and Branch	12.14	28.55	2.12	4.14
Schoenefeldia gracilis	Dembelab	Grass	4.90	36.70	1.00	15.50
Aristid sp.	Gau	Grass	5.70	38.40	0.50	10.00
Urochloa trichopus	Taffa	Grass	8.30	34.30	0.90	13.90
Cymbopogon nervatus	Nal	Grass	6.40	31.90	1.40	8.40
Tribulus terrestris	Dirasa	Grass	26.17	33.00	4.00	24.00
Targus berteronianus	Shara	Grass	9.88	8.84	1.36	21.00
Ipomoea cordofana	Hantoot	Grass	18.38	17.50	1.50	22.00
Aristida adscension	Humra	Grass	2.98	43.00	2.22	8.75
Sorghum straw	Gasab feterita	Stem	1.58	24.50	0.50	7.00

Date of collection: Between end of September and beginning of November (1998). Stage of collection: Late bloom stage, dried aerial part for grasses and fresh twigs for trees. CF: Crude fiber, CP: Crude protein, EE: Ether extract

Table 3: Ingredients and proximate analysis of experimental diet (as fed basis)

	Ration		
Components (%)	A	B	C
Molasses	-	-	50
Sorghum grains	100	100	-
Wheat bran	-	-	41
Groundnut cake	-	-	8
Salt	-	-	1
Total	100	100	100
Proximate analysis (%)			
Dry matter	94.5	94.5	91.8
Crude protein	12.75	12.75	12.15
Crude fibre	2.87	2.87	6.1
Ether extract	2.46	2.46	2.71
NFE	74.34	74.34	51.08
Ash	2.08	2.08	9.09
ME (MJ kg^{-1})	12.84	12.84	9.51
Animal intake (g day^{-1})	500	170	380
ME intake (MJ day^{-1})	6.42	2.18	3.61
CP intake (g day^{-1})	63.75	21.68	46.17

During the autumn, all groups were taken outside Abu Deleig area, where night grazing was practiced in addition to day grazing. No dietary supplementation was offered during this period. Watering was once a day during this season.

Statistical Analysis

Means and standard deviations between the different traits were computed. Analysis of variance was performed in accordance with the general linear model (Steel and Torrie, 1980). Duncan's multiple range test was used with factors that had significant effect on the traits studied. All techniques of the statistical analysis were conducted using computer program statistical package for social science (SPSS, 1998).

RESULTS

The data in Table 4 dedicated that the peak of cycles were attained during summer (42%) followed by winter (31%) and the least number of cycles occurred in autumn (27%). The overall results indicated the occurrence of estrous cycles all round the year, indicating non-seasonality. On the other hand, the data showed that maximum cycles occurred in group A (39%), followed by group B (37%), while the minimum cycles occurred in group C (24%) The data in Table 5 shows the gestation length of the three experimental groups. The data indicated non-significant ($p>0.05$) effect of supplementation on gestation length. The longest gestation length was recorded in the group maintained on ration (C) (151.33±3.00 days). The mean gestation length of the three groups was 148.57±3.6 days. The data illustrated that season of kidding had a non-significant effect on gestation length, the values of gestation lengths for goat born in winter, summer and autumn were 149.28±0.48, 147.39±0.74 and 148.27±1.07 days, respectively. Parity order also seemed to have a non-significant effect on gestation length. The average gestation lengths of 1st, 2nd and 3rd parities were 148.32±3.80, 149.14±3.59 and 148.2±3.27 days, respectively (Table 5).

The data in Table 6 shows that the average service period was 148.29±62.38 days. The data also highlighted the significant ($p<0.05$) effect of nutritional supplementation on service period, the result verified that the goats on nutritional supplement (A) had the shortest service period (125.88±60.17 days) followed by goats on nutritional supplement (C) (139.33±19.10 days), while goats on nutritional supplement (B) with the longest service period (177.52±62.75 days). On the other hand, the results indicated that there was a highly

Table 4: Effect of some non-genetic factors on estrous recurrence

	Experimental supplement			Season of kidding		
Factors	A	B	C	Winter	Summer	Autumn
Estrous recurrence (%)	39	37	24	31	42	27

Table 5: Effect of some non-genetic factors on gestation length

	Experimental supplement				Season of kidding			Parity order		
Factors	A	B	C	Grand mean	Winter	Summer	Autumn	1	2	3
Gestation length (day)	148.342±3.45	148.14±3.69	151.33±3.00	148.57±3.6	149.28±0.48	147.39±0.74	148.27±1.07	148.32±3.80	149.14±3.59	148.2±3.27

Table 6: Effect of some non- genetic factors on service period

	Experimental supplement				Season of kidding			Parity order	
Factors	A	B	C	Grand mean	Winter	Summer	Autumn	2	3
Service period (days)	125.88±60.17^a	177.52±62.75^a	139.33±19.10^b	148.29±62.38	167.92±10.89^a	100.40±13.77^b	180.60±16.87^a	174.83±63.22	110.68±38.83

a, b = means in the same raw and under a same subtitle have the differentsuperscripts are significantly different ($p<0.05$)

Table 7: Effect of some non- genetic factors on kidding interval

	Experimental supplement				Season of kidding			Parity order	
Factors	A	B	C	Grand mean	winter	Summer	Autumn	1	2
Kidding interval (days)	250.94±79.24	314.21±62.04	290.00±19.05	278.05±75.19	309.84±45.00	208.30±94.56	236.67±26.69	310.05±63.80	231.12±66.54

Table 8: Effect of some non-genetic factors on litter size

	Experimental supplement				Season of kidding			Parity order		
Factors	A	B	C	Grand mean	Winter	Summer	Autumn	1	2	3
Litter size	1.08±0.27	1.19±0.47	1.00±0.00	1.12±0.36	1.15±0.41	1.07±0.18	1.00±0.00	1.15±0.43	1.04±0.19	1.17±0.38

significant ($p<0.001$) difference between service periods of goats kidded in summer and that kidded in winter and autumn, while there was a non-significant difference in service period between goat kidded in winter and autumn. The values of service periods of goat kidded in winter, summer and autumn were 167.92±10.89, 100.40±13.77 and 180.60±16.87 days, respectively. The data indicated that the length of service period of parity two was 174.83±63.22 days, while that of parity three was 110.68±38.83 days. The difference between the two values did not secure a statistical significance.

The data in Table 7 shows that the overall average kidding interval was 278.05±75.19 days. The data also highlighted the effect of nutritional supplementation on kidding interval and indicated that the goats of group A nutritional supplement had the shortest kidding interval (250.94±79.24 days), while goats of group B nutritional supplement had the longest kidding interval (314.21±62.04 days) with group C nutritional supplement ranking intermediate with a kidding interval of 290.00±19.05 days. The differences however did not secure a statistical significance. The data also shows that there were differences between kidding interval of goats kidded in different seasons of year. The goats kidded in the summer had the shortest kidding interval (208.30±94.56 days), while the goats kidded in the autumn had the longest kidding interval (236.67±26.69 days). The differences however did not attain a statistical significance. Results on the effect of parity order in kidding interval indicated that the kidding interval between parity one and two was longer than that between parity two and three. The recorded kidding intervals were 310.05±63.80 and 231.12±66.54 days, respectively. Statistical analysis indicated non-significance difference.

The results pertaining to the effects of nutritional supplementation on litter size are tabulated in Table 8. The data portrayed that the group maintained on supplement (A) secured a value of 1.08±0.27. Group B on the other hand, recorded a value of 1.19±0.47,

while group C value was 1.00. The overall litter size of the three experimental groups was 1.12±0.36. The result however, demonstrated non-significant effect of plane of nutrition on litter size. The data also shows, the effect season of kidding on the litter size and it indicated that there were differences between litters sizes of goats kidded in different seasons. Goats which kidded in the winter had the highest litter size (1.15±0.41), while the goats kidded in autumn had the lowest litter size (1.00±0.00). The differences however did not secure a statistical significance. Litter size of goats at 1st, 2nd and third parities were 1.15±0.43, 1.04±0.19 and 1.17±0.38, respectively. Analysis of variance shows that there were no significant differences among litter size of different parities.

DISCUSSION

The present study showed that, the flock of goat studied used to maintain non-seasonal ovarian cyclicity, thus it can be deduced that, the Nubian goat breed all the year round. This result agreed well with Silva *et al.* (1998) for Alpine goats, Greyling (2000) for Boer goat and Webb and Mamabolo (2004) for South African Indigenous goats. The poly-estrous all year round in tropical goats might be attributed to that, in the tropics, the variation in day length is less marked (Amoah *et al.*, 1996). The data also indicating that grazing supplementation positively affect recurrence of estrous cycle. This result agreed well with Amoah *et al.* (1996), who reported that, availability of feed and variations in rainfall, temperature and humidity, may affect the breeding season of goats.

The gestation length calculated in this study was 148.47±3.60 days, this gestation length was comparable with what had been reported by Greyling (2000) for Boer goat and Webb and Mamabolo (2004) for South African Indigenous goats. However, slightly longer or shorter gestation lengths were reported e.g., Lehloenya *et al.* (2005) for Boer and Nguni goats and Moaeen-Ud-Din *et al.* (2008) for Matou goats.

Nutritional supplement, season of kidding and parity order had no effect on gestation length, these findings support previous results reported by Greyling (2000) for Boer Goat and Lehloenya *et al.* (2005) for Boer and Nguni goats.

The present study estimated the service period to be about 148.29±62.38 days, this result was comparable with what had been founded by Martinez *et al.* (2005) for Creole goat. However, longer or shorter service periods were reported by Martinez *et al.* (2005) for Nubian and Celtiberian goats and this may be attributed to different ways of management and environment. The present study indicated that there were significant differences between service periods of goats of different nutritional supplementation, this was in agreement with Tendonkeng-Pamo *et al.* (2006) for West African Dwarf goats in Cameron. There were also significant differences between service periods of goats kidded in different season of the year which were in agreement with Silva *et al.* (1998) for Alpine goats.

The results pertaining to the effect of parity order on service period claimed a non-significant effect. This finding contradicting with the findings of Awemu *et al.* (1999), who reported that in Red Sokoto does parity had significant effect on service period. This variation might be attributed to that this study was carried only for three parities and so variation was not clear.

The average kidding interval found in this study was 278.05±75.19 days. This result was comparable to the estimates reported by Odubote (1996) for West African Dwarf goat and Webb and Mamabolo (2004) for South African Indigenous goats. However, it was much shorter than most of the estimates reported in the literature. Galina *et al.* (1995) for Mexican dairy goats and Silva *et al.* (1998) for Alpine dairy goat. These differences were most probably due to differences in the lengths of the service periods, in the different reported experiment.

Nutritional supplementation, season of kidding and parity order had no significant effect on kidding interval. This agreed with the findings of Mellado *et al.* (1991) for Nubian goats in Mexico. While contradicting with the findings of Tendonkeng-Pamo *et al.* (2006) for West African dwarf goats. This contradiction may be attributed to different environmental conditions and supplementation levels.

The average litter size calculated in the present study was 1.12±0.36 kids. The results are in harmony with data reported by Martinez *et al.* (2005) for Creole, Nubian and Celtiberian goats. However, bigger litter size were claimed by several authors including Song *et al.* (2005) for Native Korean goats for Damascus goats and Moaeen-Ud-Din *et al.* (2008) for Matou goat. The difference in the average litter size in the different studies may be attributed to the different breeds, environmental and Managerial factors involved in the different experiments.

Nutritional supplementation, season of kidding and parity number had no significant effect on litter size. These results further confirm the findings of Melado *et al.* (1991) for Nubian goats in Northern Mexico and Galina *et al.* (1995) for Mexican dairy goats.

CONCLUSION

The results verified that:

- Grazing supplementation improved estrous recurrence and shorten service period and kidding interval
- Goats kidded in summer had the shortest service period and kidding interval
- To improve dairy goat production, grazing supplementation and breeding of goats to kid in summer season must be practiced

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