Effect of breeding month, pre-partum and post-partum protein supplementation on pregnancy, kidding rates, mortality rates, milk yield and birth weight in Angora goats under mountain conditions of Lesotho

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Abstract

Twenty seven Angora goat does blocked on initial body weight and divided into three dam weight groups were randomly assigned to three protein supplementary regimes: 0g, 150g and 300g and three breeding months (May, June and July). The experimental design consisted of three levels of 0g, 150g and 300g protein supplementation and three breeding months (May, June and July) combined factorially in a complete randomized block design (CRBD) with three replicates per treatment. Data were subjected to Analysis of variance using General Linear Model procedures (SPSS). Mean pregnancy rate of does bred in May and June (44%) was significantly ($p \leq 0.05$) lower than those bred in May and June that were the same (100%). Pregnancy rates for does that were not supplemented (68%) were significantly lower ($p<0.05$) than those on 150g and 300g protein. Kidding rates of does bred in May (122%) and June (100%) were significantly higher ($p<0.05$) than for July (56%). Mean birth weights of 2.25, 2.87, 3.08kg were obtained from supplementation of 0, 150 and 300g protein respectively. Heavier dams had higher birth weights of kids: 2.64, 2.68 and 2.89kg for dam groups 1 (24-30kg), 2 (31-37kg) and 3(38-43kg) respectively. Mortality rates

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were 18%, 0% and 20% for kids whose dams were bred in May, June and July respectively (p<0.05)). The study showed that there was a significantly negative correlation (r= -0.44; p<0.05) between birth weight and mortality. Daily milk yields from dams bred in May (0.45kg), June (0.39kg) and July (0.33kg) were significantly different (p<0.01). There was a significant positive correlation (r =0.34; p<0.01) between daily milk production and dam weight. Protein supplementation was positively correlated (r =0.16; p<0.05) with daily milk yield. It was concluded that pregnancy and kidding rates were highest in May mating. The condition of the dam was considered as a prerequisite as it influenced the subsequent birth weight of the kid.

Keywords:

1. Introduction

Angora goats play an important role in the economy of Lesotho. They provide a source of income through the sale of mohair, meat or animals themselves. In cropping system, goats make use of crop residues while returning valuable manure to the soil (Phororo, 1979; Hunter, 1987). However, studies indicate poor nutrition, diseases and bad weather conditions as the most important causes of the high annual kid mortality which is over 50%. It is this high kid mortality that causes the decline in annual goat numbers in Lesotho (Lawry, 1986; Hunter, 1987, N`gambi and Matebesi, 2002). Around 60% of the total kid mortality in Lesotho is caused by poor nutrition of the dam (Lawry, 1986).

Angora goats in Lesotho depend, mainly on natural pastures in communal rangelands to meet their nutritional requirements. These natural pastures are most limiting in protein especially during winter months when there are low temperatures that do not sustain plant growth (Phororo, 1979; Hunter 1987). Unfortunately, this is the time when Angora goat does are pregnant. As a result, nutrients provided to the growing foetus are limiting.

Poor pre-partum nutrition results in does giving birth to lighter kids (Bajhau and Kennedy, 1990). Birth weight of an Angora goat kid is positively related to its growth, survival, adult weight and subsequent performance (Shelton and Bassett, 1970; Bajhau and Kennedy, 1990). Poor post -partum nutrition of Angora goat does will result in less milk during the first few months after birth (Hunter, 1987; Mc Donald et al., 1987).

Angora goats in Lesotho are seasonal breeders. The farmers breed their animals in May, the recommended month (Lawry, 1986; Hunter, 1987). However, some farmers also breed the animals in June and July.

2. Objective of the study

To investigate the effects of breeding month and pre and post partum protein supplementation on pregnancy rate, kidding rate, mortality rate, milk yield and birth weight of Angora goat kids.

3. Materials and methods

The study was done in the communal rangelands of Lekubane in the Molimo-Nthuse area of Lesotho. Lekubane is about 100 kilometers east of Maseru.

Twenty seven Angora goat does on their second stage of lactation (2 years old) were used in the study. Blocking was done based on initial liveweights of the does, which were divided into three dam weight groups, as 24-30kg (Dam group 1), 31-37kg (Dam group 2) and 38-43kg (Dam group 3) and randomly assigned to three protein supplementation levels (0g, 150g and 300g) and three breeding months (May, June and July). The goats were also subjected to adlibitum grazing on natural pastures. There were three replicates per treatment. Supplementation of the does with a 25% protein supplement was done one month before kidding due to high nutrient requirements by fast growing foetus and two months after kidding to increase milk production for the kids for the first two months after birth.

Heat (Oestrus) of all the animals was synchronized prior to mating by use of flurogestone acetate (FGA)-based sponges (40mg), marketed as Ovakron. The insertion period of the sponges was 16 days for all the three groups and immediately after sponge withdrawal; the animals were injected intramuscularly at the rate of 250 I.U (1/2 ml) pregnant mare serum gonadotropin (PMSG), marketed as Fostim ™. Two days after sponge withdrawal and PMSG treatment, the does were mated using the same buck.

Pregnancy rates of the does were detected using rectal-abdominal palpation method of pregnancy testing at 60 days post mating.

Kids were weighed immediately after birth to obtain birth weights. Mortality of the kids was recorded from birth to weaning at 84 days (12 weeks) of age.

The initial milk yield for each animal was determined about one week post-partum. Thereafter, milk yields were determined every week until 8^{th} week of lactation. The milk yield determination was done on two-day intervals in a week and an average daily yield calculated. The oxytocin technique (oxytocin + hand milking) was done by milking the animals after injection of oxytocin at the beginning of each milking (Banda et al, 1990).

Ten international units or 1ml of oxytocin was injected intramuscularly into the rear flank. After 3 to 5 minutes the animals were milked out rapidly for 10 minutes each time until no more milk could be withdrawn and the amount of milk measured by weight.

Data were subjected to Analysis of variance using General Linear Model procedures (SPSS, 1989). Five animals, which were bred in July 2002, were not pregnant therefore their subsequent data for statistical analysis was estimated.

The statistical model included the effect of supplementation, block (dam group), breeding month and their interactions. The following linear model was used for data analysis:

$$Y_{ijk} = \mu + a_i + bj + c_k + (a*b)_{ij} + (a*c)_{ik} + X_{ijkl} + \Sigma_{ijk}$$

Where:

Y_{ijk} = Observation for kid birth weights, kid weaning weights at 84 days and milk yields.

μ = Overall mean

a_i = Effect of the ^{ith} supplementation where (i=1…..3)

b_j = Effect of the ^{jth} block (dam group) where (j = 1…3)

c_k = Effect of the ^{kth} month of breeding where (k=1…3)

$(a*b)_{ij}$ = interaction effect between ^{ith} supplementation and ^{jth} dam group.

$(a*c)_{ik}$ = interaction effect between ^{ith} supplementation and ^{kth} month of breeding

$(b*c)_{jk}$ = interaction effect between ^{jth} dam group and ^{kth} month of breeding

X_{ijkl} = The covariate value.

Σ_{ijk} = The error term associated with the ^{ith} supplementation, ^{jth} block, and ^{kth} month.

Pregnancy, kidding and mortality rates were analyzed using Chi-square (χ^2) (Mead and Curnow, 1983).

4. Results and discusion

Pregnancy rates

The results showed that there were no significant ($p>0.05$) differences in mean pregnancy rates for goats bred in May (100%) and June (100%) but there significant differences between July (44%) and the other two months (Table1; $p<0.05$). It was observed that pregnancy rates declined as breeding month advanced. The effect of melatonin a hormone that has the ability to advance and shorten the onset of breeding season has been reported to have significant effects on reproduction (Laliotis et al., 1997). The secretion of this hormone is directly influenced by night length (Bowen; 2003), hence its duration each day in July is shorter than in May and June. The low pregnancy rate in July mating could also be attributed to low temperatures, July being the coldest month.

Mean pregnancy rates for does supplemented with 150g and 300g protein were the same (89%) while does that were not supplemented with protein attained significantly ($p<0.05$) lower pregnancy rates (68%). This observation indicates that protein supplementation of the does might have played an important role in obtaining high pregnancy rates of the goats, thus preventing spontaneous abortions to occur. This is confirmed by Van der Westhuysen (1981) in which he reported that inadequate nutrition may cause losses during pregnancy (abortions) and stillbirths.

TABLE1: PREGNANCY RATES OF DOES.

Source of Variation	Pregnancy (%)	$\chi^2 = 9.49$ $P<0.05$
Breeding month		
May	100	
June	100	
July	44	
Supplementation		
0g	66.7	
150g	88.9	
300g	88.9	

Kidding rates

Kidding occurred in October, November and December 2002 for does, which were bred in May, June and July respectively. The kidding rates for does bred in May were (122%) and June (100%) were not significantly different ($p>0.05$). However, there were significant differences between May (122%) and July (56%; Table 2). The kidding rates observed in May were within the range (120-140%) reported by Jordan (1990). The higher kidding rates obtained in May might have been caused by one of the does within the group of nine animals giving birth to triplets. For June mating (100%), all the animals gave birth to one kid each. Lastly, in July the 56% observed might have been attributed to low pregnancy rates experienced in July where only four does kidded with one giving birth to twins.

Mean kidding rates of does on 0, 150, and 300g protein supplementation were 89, 100 and 89% respectively, and were not significantly ($p>0.05$) different. This observation indicates that protein supplementation of does was not affecting kidding rates of does, however, other factors which were not taken into account in this research, e.g. effect of low temperature of the month of July (which is the coldest month) on the libido of the buck and the effect of photoperiodism could have contributed to low kidding rate in July.

TABLE.2: KIDDING RATES OF ANGORA DOES.

Source of Variation	Kidding rates (%)	$\chi^2 = 9.49$ $P<0.05$
Breeding month		
May	122	
June	100	
July	56	
Supplementation		
0g	89	
150g	100	

300g	89

Kid mortality rates

The results of mortality rates of Angora goat kids are shown in Table 3. Mean mortality for kids whose does were bred in May (18%) and July (20%), were not significantly ($p<0.05$) different. Eighteen percent of kid deaths occurred at birth from does in May mating and 20% deaths observed from kids whose dams were bred in July, while no deaths were recorded for kids whose does were bred in June. The results confirm the observations by (Khitšane, 2001) in which breeding the animals in June could have reduced kid mortality.

Twenty-five and ten percent of deaths were recorded for kids whose does were not supplemented and supplemented with 150g protein and were significantly higher ($p<0.05$) than no deaths that were observed from kids whose dams were supplemented with 300g protein diet. This observation is in agreement with reports by Harriet and Jansen. (1993) in which he reported that a gesting and lactating doe needs almost 227g of crude protein daily. Kid mortality occurred at birth and in the first week of lactation. This could partly be due to low milk production from the does since the lactation yield in the first week was low (Table 5).
High mortality could have been attributed to kids born having low birth weights from 1.0 to 1.5kg due to one of the does bred in May giving birth to triplets. The study also showed that there was a negative correlation ($r= -0.44$; $p<0.05$) between kid birth weight and mortality. This observation is supported by Neopane (1996) who reported mortality rates of 100% for kids weighing 1.0 to 1.5kg at birth. Yazman (1992) also is in agreement with the results; in which he reports that kid mortality in the

first 10 days is highest among kids born underweight either due to a premature parturition or poor doe nutrition.

TABLE.3: MORTALITY RATES OF ANGORA GOAT KIDS.

Source of Variation	Mortality (%)	$\chi^2 = 9.49$ P<0.05
Breeding month		
May	18.18	
June	0	
July	20	
Supplementation		
0g	25	
150g	10	
300g	0	

Kid birth weight

There were no significant differences of mean birth weights (p>0.05) by dam group, supplementation, breeding month and sex (Table 4). However, the result indicates that an increase in dam weight of the doe led to higher kid birth weights.

The studies done by Yalçin (1986) indicated that for good reproductive performance and better growth and survival of kids, an adult size doe is a prerequisite.

It was observed that there was an increase in birth weight with an increase in protein to the dam. However, the differences observed were not significantly (p>0.05) different.

Kids whose does were mated in June had higher (3.08kg) birth weights than those mated in May (2.77kg) and July (2.36kg) respectively. This is likely due to the fact that one month before kidding in October falls in spring when there is enough good pastures to provide nutrients for the fast growing foetus.

Male kids had higher weights than female kids. This observation agrees with studies by Jordan (1990) in which he reported that at birth, Angora single kid males average 2.95kg, and single females; 2.72kg with a range in birth weight from 2.0 to 3.4kg.

TABLE 4: MEANS OF FACTORS AFFECTING KID BIRTH WEIGHTS.

Factor	N	Mean (kg)	Standard deviation	Minimum	Maximum	CV	SE
Dam group							
1	13	2.64[a]	0.81	1.3	4.0	31	0.24
2	7	2.68[a]	0.46	2.0	3.4	17	0.28
3	5	2.89[a]	0.34	2.6	3.4	12	0.32
Supplementation							
0g	8	2.25[a]	0.93	1.3	4.0	41	0.27
150g	9	2.87[a]	0.49	2.0	3.4	17	0.24
300g	8	3.08[a]	0.36	2.4	3.4	12	0.25
Breeding month							
May	11	2.77[a]	0.78	1.3	4.0	28	0.29
June	9	3.08[a]	0.38	2.4	3.4	12	0.23
July	5	2.36[a]	0.39	2.0	3.0	17	0.38
Sex							
Female	13	2.50[a]	0.64	1.3	3.4	26	0.17
Male	12	2.97[a]	0.62	2.0	4.0	21	0.18

[a] Means with the different superscripts in the same column differ significantly ($p<0.05$)

Daily milk yield

The results of factors affecting daily milk yield are shown in Table 5. Dams with high liveweights produced high amount of milk. This may be attributed to the fact that larger and heavier goats eat more roughage and may be more efficient in converting the feed to milk (Steele, 1996; Devendra and McLeroy., 1982). The study showed that there was a positive and significant correlation ($r = 0.34$; $p<0.01$) between daily milk yield and dam group.

The lactation curve reached the peak at 4 weeks then leveled at 6 weeks and gradually declined afterwards (Figure1.0). Milk yields observed were in agreement with those found by Steele (1996) in which average daily yields were 0.4kg by Angora goats.

Does which were mated in May produced higher ($p<0.05$) daily milk yields than those mated in June and July. The results further showed no significant differences ($p>0.05$) on milk yields due to 0g, 150g, and 300g protein supplementary levels. However, there was a significant positive correlation ($r= 0.16$; $p<0.05$) between level of protein supplementation and daily milk yield.

Milk yield per day for 8 weeks of lactation is shown in (Figure 1). The regression equation $\mathbf{Y = 0.2562+0.0863X-0.0103X^2}$ fitted the data $\mathbf{(R^2= 0.270)}$. However, given the low R^2 value, the reliability of the equation for prediction purposes is not feasible.

TABLE 5 MEANS OF FACTORS AFFECTING MILK YIELD PER DAY (kg/day).

Factor	N	Mean (kg)	Standard deviation	Minimum	Maximum	CV	SE
Dam group							
1	**112**	**0.36[a]**	**0.08**	**0.13**	**0.53**	**24.0**	**0.01**
2	**64**	**0.38[b]**	**0.11**	**0.20**	**0.64**	**26.0**	**0.01**
3	**40**	**0.40[c]**	**0.10**	**0.30**	**0.73**	**25.0**	**0.02**
Breeding month							
May	**72**	**0.40[a]**	**0.12**	**0.22**	**0.73**	**30.0**	**0.01**
June	**72**	**0.38[b]**	**0.07**	**0.24**	**0.50**	**18.0**	**0.01**
July	**72**	**0.36[c]**	**0.11**	**0.20**	**0.63**	**26.0**	**0.01**
Supplementation							
0g	**72**	**0.36[a]**	**0.08**	**0.22**	**0.53**	**22.0**	**0.01**
150g	**71**	**0.38[a]**	**0.11**	**0.23**	**0.73**	**26.0**	**0.01**
300g	**73**	**0.40[a]**	**0.09**	**0.20**	**0.64**	**23.0**	**0.01**
Lactation week							
1	**27**	**0.33[a]**	**0.09**	**0.22**	**0.51**	**27.0**	**0.02**
2	**27**	**0.39[b]**	**0.08**	**0.30**	**0.56**	**21.0**	**0.02**
3	**27**	**0.44[c]**	**0.09**	**0.28**	**0.73**	**21.0**	**0.02**
4	**27**	**0.44[c]**	**0.09**	**0.30**	**0.64**	**21.0**	**0.02**
5	**27**	**0.44[c]**	**0.09**	**0.23**	**0.67**	**21.0**	**0.02**
6	**27**	**0.39[b]**	**0.07**	**0.25**	**0.64**	**18.0**	**0.02**
7	**27**	**0.34[a]**	**0.08**	**0.25**	**0.50**	**23.0**	**0.01**
8	**27**	**0.31[a]**	**0.07**	**0.13**	**0.50**	**23.0**	**0.01**

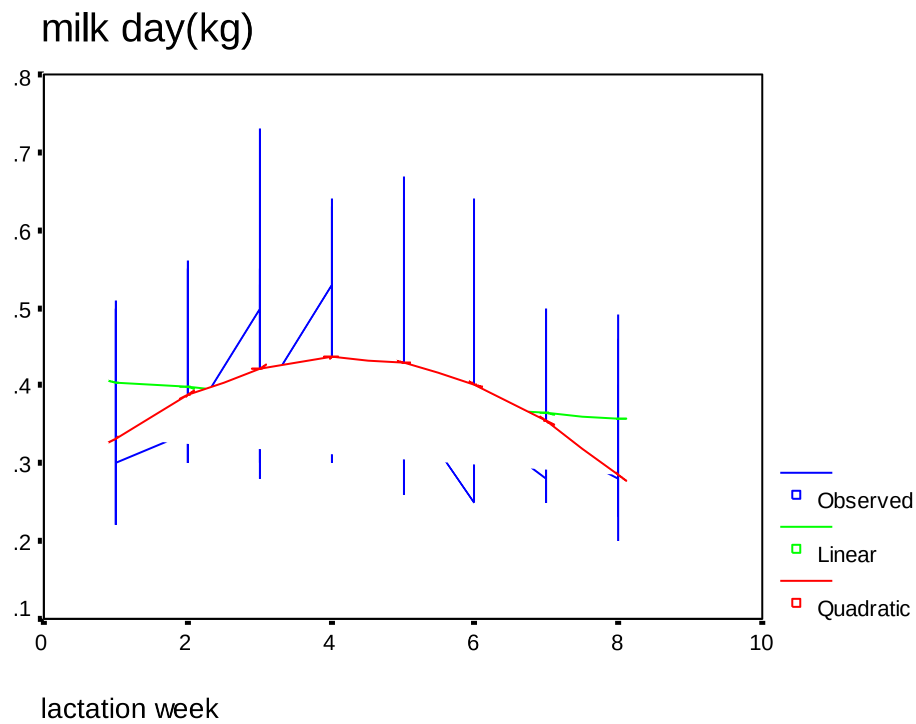
[a-c] Means with different superscripts in the same column differ significantly ($p<0.05$)

TABLE 6 CORRELATIONS

	Milk day (kg)	Dam group
Milk day(kg) Pearson correlation	1	0.335**
Sig (2-tailed)		0.000
N	216	216
Dam group Pearson correlation	0.335**	1
Sig (2 tailed)	0.000	
N	216	216
	Supplementation	Milk day (kg)
Supplementation Pearson	1	0.164*

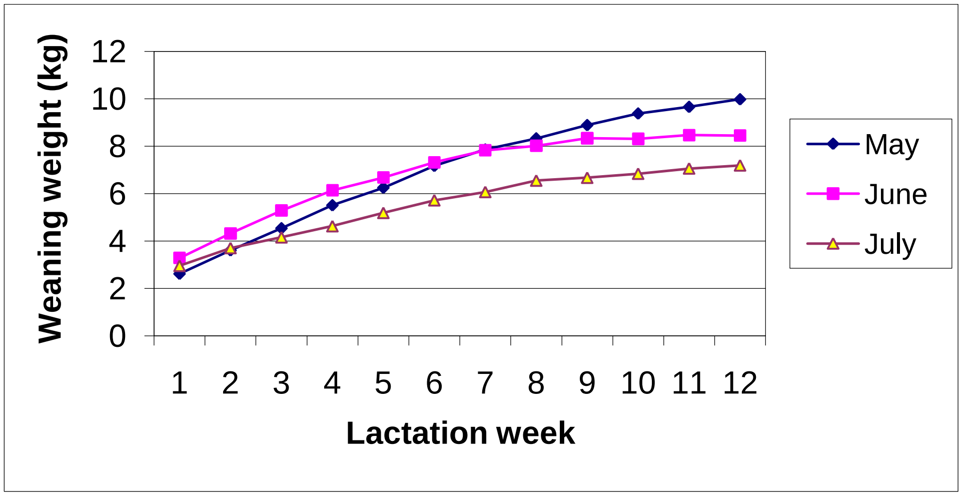
correlation		
Sig (2 tailed)		0.016
N	216	216
Milk day (kg) Pearson correlation	0.164*	1
Sig (2 tailed)	0.016	
N	216	216
	Birth weight	Mortality
Birth weight Pearson correlation	1	-0.440*
Sig (2 tailed)		0.028
N	25	25
Mortality Pearson correlation	-0.440*	1
Sig (2 tailed)	0.028	
N	25	25

Figure 1: Lactation curve of angora goat in 8 weeks of lactation.



$Y=0.2562 + 0.0863X- 0.0103X^2$

Figure 2: Effect of breeding month and lactation week interaction on weaning weight at 84 days.



5. Conclusions

Pregnancy, kidding and mortality rates

Does that were on 300g protein supplementation were highest in the following traits; pregnancy, and kidding rates. No mortality was observed on kids whose dams were on 300g protein supplementation regiment.

Kid birth weights

Birth weight increased with increase in dam weight. The implication could be that the condition of the dam prior to mating could influence the subsequent birth weight of the kid.

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