The Indian Journal of Animal Reproduction; 26(2): 113-116; December 2005

Fertility of female goats across the seasons in Kerala

C. IBRAHEEM KUTTY[1†]

Department of Animal Reproduction,
College of Veterinary & Animal Sciences, Mannuthy, Thrissur - 680 651 (Kerala)

Received : November 1, 2003
Accepted : November 18, 2004

ABSTRACT

Goats in temperate climate are seasonal breeders and in tropics seasonality of reproduction is believed to be less. The study was carried out at Kerala Agricultural University goat farm to find out fertility of remale goats across various seasons and its relationship with climate variables so as to make suitable management alterations. Fertility obtained in terms of 45th day non return rate, conception rate and kids/kidding showed significant monthly and seasonal variations. However, number of oestrus detected showed no obvious relationship with success rate of AI in terms of non-return and conception rates. Also conception rate across months showed no relationship with any of the climatic variables studied. It is concluded that even though fertility of female goats showed significant variations across months and seasons, there was no influence of higher oestrus activity or any of the climatic variables across seasons.

Key words : Season, fertility, conception, goats, artificial insemination

Even though goats in the temperate regions are seasonal breeders, in the tropical zone indigenous goats tend to breed throughout the year (Jainuddin and Hafez, 1993). However, restricted reproductive activity during some months is obvious especially in females and is understood to be regulated through various environmental factors such as photoperiodicity, relative humidity, high temperature and lack of feed availability (Engle, 1946; Malikov, 1963; Johnson *et al.*, 1970; Elwishy *et al.*, 1971; Gangwar, 1988). Since major reproductive responsibilities rest with females, seasonal pattern is more exhibited by females even though bucks may also exhibit some variation in semen characteristics (Leidl *et al.*, 1970; Hoffman *et al.*, 1972; Mittal, 1986; Miyamoto *et al.*, 1987). However, very little of fertility variations in females are attributable to variations in quality of semen across seasons (Bishop, 1955).

Attainment of high reproductive rate being fundamental for economic production, knowledge regarding seasonal pattern of reproduction in female goats will be very useful for efficient management. Earlier study has showed two seasonal peaks in reproductive activity of male goats under the same agroclimatic conditions, evidenced by variations in semen quality as well as morphometric parameters (Kutty and Mathew, 2000a; 2000b). Major determinants of those variations were found to be relative humidity and feed availability in the region. Hence, the present study was carried out to find out whether there are seasonal variations in fertility of female goats comparable to that of males and if so what are the environmental variables regulating the same.

MATERIALS AND METHODS

The study was carried out at Kerala Agricultural University Goat Farm, Mannuthy over a period of twelve months. About 250 adult female goats of breedable age belonging to Malabari and their exotic cross-breds were used for the study. Goats were managed semi-intensively. Breeding was done entirely through Artificial Insemination (AI) using freshly collected semen every day, following heat detection by a vasectomised buck. Those returned to heat were re inseminated in the combing two more cycles without adopting any treatments. Success of AI was assessed based on 45th day non return rate (NR), pregnancy diagnosis at 50-60 days using Kutty's bimanual technique (Kutty, 1998) and average number of kids born at kidding corresponding to AI done during each months.

Atmosphere temperature and relative humidity inside the animal shed was recorded every day and day

[1]Assistant Professor, Department of Animal Reproduction, College of Veterinary & Animal Sciences, Mannuthy, Thrissur - 680 651

[†]Corresponding author

length was recorded from sunrise and sunset details available for the region. For the purpose of analysis, the period of study was divided into 12 months, quarters corresponding to four seasons of the region, and half years of long and short days. The four seasons included Monsoon, post monsoon, spring and summer corresponding to the quarters June to August (JJA), September to November (SON), December to February (DJF) and March to May (MAM), respectively. Fertility assessed in terms of success rate of AI and kids/kidding was then statistically analysed for monthly and seasonal variations using SPSS PC + software. Relationship of fertility parameters with oestrus activity and climatic variables corresponding to the months of AI was also found out across seasons.

RESULTS AND DISCUSSION

During the 1 year period of study, a total of 482 AI were done with a monthly average of 40.17±19 and the variations between months were highly significant ($P < 0.01$). Monthwise total number of AI done, 45th days NR, percentage of conception verified at 60 days (CR) and details of kids born are given in Table 1. Number of AI corresponds to the oestrus activity of goats during each of the months and was low during May to July and maximum during August and October, while it was almost uniform during rest of the months. Success rate of AI in terms of 45 day NR and CR also showed significant variation (Chi squre test $P < 0.01$) between months with the highest during February and lowest during October-November. Total number of births and kids born were lowest corresponding to AI done during the month of November and highest for AI during August. Kids/kidding was lowest of 1.17 corresponding to AI during October and was highest of 1.63 each for the months May and July.

Quarterly and half yearly figures of AI done, 45th day NR, number of pregnancies, CR and details of birth are given in Table 2. Between quarters corresponding to the four seasons also there were highly significant variation (Chi square $P < 0.01$) in the oestrus activity with highest in SON and lowest in MAM. However, the variation between half years of long and short days was non-significant . Both NR and CR varied significantly ($P < 0.05$) between seasons with the lowest rate during SON. However, highest NR was recorded during JJA, while the CR was highest during DJF. There was significant variation ($P < 0.05$) in the number of births and total number of kids born between quarters. Number of births and kids born were highest corresponding to AI during DJF and lowest for SON. Likewise kids per kidding for AI during SON was significantly ($P < 0.01$) lower than that of other quarters. Between the half years of long and short days number of births, kids born and kids per kidding was almost similar.

No. of AI done and success rate in terms of NR, CR and kids/kidding are compared with climatic variables recorded during the same period such as maximum temperature, relative humidity and day length in table 1. There were significant variations in these climatic parameters between months ($P < 0.01$). Among the four quarters, maximum temperature was highest during MAM and lowest in JJA, while humidity and day length were

Table 1. Comparison of oestrus activity and success rate of AI with monthly averages of climatic variables

Months	No. of A.I.	NR (%)	CR (%)	Average litter size	Max. temp. ℃	Day length (Hrs.)	Rel. Hum. (%)
Sept.	47	27.65	21.27	1.30	31.53	12.05	86.05
Oct.	62	14.51	9.67	1.16	31.43	11.47	90.37
Nov.	34	17.64	5.88	1.50	30.66	11.30	77.51
Dec.	39	23.07	28.20	1.30	31.87	11.22	73.46
Jan.	42	33.33	43.18	1.47	33.04	11.25	69.09
Feb.	48	70.83	68.75	1.54	35.24	11.37	70.10
Mar.	45	46.66	33.33	1.26	37.10	11.56	70.61
Apr.	37	43.24	16.21	1.50	36.18	12.14	78.10
May	17	64.70	47.50	1.62	33.93	12.31	74.72
June	13	69.23	53.84	1.28	29.64	12.38	89.53
Jul.	18	38.88	44.44	1.62	28.56	12.35	93.67
Aug.	80	53.75	47.50	1.51	29.59	12.22	92.41

Table 2. Quarterly and half yearly details of non return rate, pregnancy and kids born corresponding to the insemination done

Quarters	No. of AI	Corresponding to the number of AI done during the quarter						
		NR cases	NR %	Pregnant	CR %	Birth	Kids	Kids/kidding
SON	143	28	19.58	18	12.59	18	23	1.28
DJF	129	57	44.19	63	48.83	62	93	1.50
MAM	99	48	48.48	29	29.29	29	41	1.41
JJA	111	59	53.15	53	47.74	52	78	1.50
Half years		Corresponding to the number of AI done durin the half year						
HY-1	272	85	31.25	81	29.78	80	116	1.45
HY-2	210	107	50.95	82	39.05	81	119	1.47

highest in JJA and lowest in DJF. While correlation of maximum temperature was positive in nature with fertility parameters, humidity and day length showed negative correlation. However, correlation of any of the climatic variables with fertility parameters were not statistically significant.

There were significant variation between months and quarters in the reproductive activity of goats assessed in terms of number of oestrus and success rate of AI, even though reproductive activity is maintained throughout the year. There was not much difference in the reproductive activity during short and long day periods contrary to earlier reports (Johnson *et al.*, 1970; Gangwar, 1988), though there were seasonal peaks during some of the months and quarters. However, there was clear distinction between the periods of high oestrus activity and success rate of breeding.

Success rate of AI was highest during February- the period of moderate oestrus activity and was lowest during October-November, even though the oestrus activity was comparatively better during this period. Like wise both NR and CR were moderate during the month of highest oestrus activity. Between quarters also NR and CR were lowest during the period of highest oestrus activity and highest durin the periods of moderate oestrus activity. This difference between periods of better oestrus activity and success characteristics, management and environmental variations. The finding is not in agreement with positive relationship reported earlier between oestrus activity and conception rate (Krishnakumar, 1992).

Even though NR was comapratively higher (48%) during summer, conception obtained was comparatively poor (29% for the period, and can be attributed to the inadequacy of green fodder availability in the region leading to more cases of post service anoestrus in goats. During spring CR exceeded NR (44% versus 49%) which might have occurred due to cases of gestational oestrus which is common in goats subjected to heat detection by teaser bucks (Kutty and Mathew, 1995). During the monsoon and post monsoon seasons NR and CR were comparable. The number of births and total number of kids born were corresponding to the conception figures for each of the months. This indicates that the number of kids born per kidding is not much influenced by the oestrus activity of the conceived season, which also differs from earlier report by Krishnakumar (1992).

Climatic determinants of seasonal variations such as relative humidity, day length and environmental temperature showed no significant correlation with fertility parameters. The finding is contrary to the many earlier reports of female fertility regulated by climatic variables such as temperature and day length (Johnson *et al.*, 1970; Elwishy *et al.*, 1971; Gangwar, 1988; Jainudeen and Hafez, 1993) and may be due to the uniform management of goats in the study and limited climatic variations in Kerala than any other parts of tropical areas.

Since the female is having the additional responsibility of carrying gestation, supporting the growth of foeti, the oestrus activity is regulated in accordance with the nutritional availability. This is also evident from the low success rate during post monsoon though the number of insemination were reasonably high, which is believed to be to reduce/avoid birth during February, March, April and May when there is dearth of food (Engle, 1946). It is evident that there is a difference in the mechanism of seasonal regulation between males

and females (Debeneth and Coll, 1992). While in males the regulation is mainly by environmental variables especially the relative humidity (Kutty and Mathew, 2000a&b), in females regulation appears to be mainly by nutritional availability.

It is concluded that even though there are seasonal variations in oestrus activity, success rate to AI and Kid crop, there is clear distinction between the periods of better oestrus activity and success rate to insemination. Success rate of AI in terms of non-return and conception rates showed no obvious relationship with number of oestrus detected during months or quarters. Also female fertility parameters studied had no significant correlation with any of the climatic variables such as temperature, day length and relative humidity indicating some other determinants for the obvious seasonal peaks.

REFERENCES

Bishop (1955). Inter-relationship between semen characteristics. In : *Studies on Fertility*. Blackwell Scientific Publications. Oxford, pp 48-62.

Debeneth, A. and Coll (1992). Male-female differences in seasonal reproductive rhythm in goats. Proc. 5th Int. Conf. Goats, New Delhi, Abstr. 1: 261.

Elwishy, A.B., Elsawaf, S.A., Elmikkawi, F. and Omar, A.A. (1971). Monthly and seasonal variations in sexual activity of male Damascus goats. Indian J. Anim. Sci., 41: 562-569.

Engle, E.T. (1946). The problem of fertility. Proc. of the Conference on Fertility. Pinceton University Press, New Jersey, pp 3-4.

Gangwar, P.C. (1988). Environmental control as a means of improving animal productivity in tropics. Indian J. Anim. Sci., 58: 487-497.

Hoffman, B., Leidl, W. and Karg, H. (1972). Seasonal rhythm of reproduction in the male goat. Proc. 7th Int. Cong. Anim. Reprod. Art. Insem. Munich : 423-424. Cited in Anim. Br. Abstr. 41: 2173.

Jainudeen, M.R. and Hafez, E.S.E. (1993). *Reproduction in Farm Animals*. Lea & Febiger, Philadelphia, 6th edn., pp 330-332.

Johnson, A.D., Gomes, W.R. and Van Demark, N.L. (1970). Seasonal variation and male reproductive efficiency. In: *The Testis*. Academic Press, New York and London, Vol. III, pp 139-160.

Krishnakumar, G. (1992). Reproductive pattern and performance of Nanny goats in Kerala. M.V.Sc. Thesis, Kerala Agricultural University.

Kutty, C.I. (1998). Pregnancy diagnosis in small ruminants using biannual palpation technique. Proc. 2nd Pan Commonwealth Vet. Conf., Bangalore, pp 139-141.

Kutty, C.I. and Mathew, S. (1995). Gestational oestrus in goats. J. Vet. Anim. Sci., 26: 121-122.

Kutty, C.I. and Mathew, S. (2000a). Seasonal variations in physical attributes of semen in Malabari and their exotic cross-bred bucks of Kerala. Indian J. Anim. Reprod., 21: 22-26.

Kutty, C.I. and Mathew, S. (2000b). Seasonal variations in morphometry of male goats in Kerala. Intas Polivet, 1: 299-304.

Leidl, W., Hoffman, B. and Karg, H. (1970). Endocrine regulation of seasonal rhythm of reproduction in the male goat. Zentbl. Vet. Med. Reihe, 17: 60-62, cited in Anim. Br. Abstr. 39: 2052.

Malikov, D.I. (1963). The effect of atmospheric pressure on reproduction in rams. Vestn. Sel. Hoz. Nauk. (Mosk.), 8: 82-86 (cited in Anim. Br. Abstr., 33: 457).

Mittal, J.P. (1986). Reproductive characteristics of indigenous and crossbred bucks maintained under desert conditions. Indian J. Anim. Sci., 56: 688-692.

Miyamoto, A., Umezu, M., Hamamo, K. and Masaki, J. (1987). Seasonal changes in inhibin activity in seminal plasma and serum concentration of FSH, LH and testosterone in the male goat. Theriogenology, 28: 67-76.