The Journal of Animal and Plant Sciences, 22(2 Suppl.): 2012, Page: 38-44
ISSN: 1018-7081

REPRODUCTIVE BEHAVIOUR OF KARI SHEEP UNDER CONTROLLED CONDITIONS

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ABSTRACT

Reproductive behaviour of Kari sheep was studied during a three years period comprising two consecutives phases. 726 sheep spread in thirty shepherd's flocks at the three harbouring valleys i.e., Garam-Chashma (GC), Karimabad (KD) and Arkari (AR), were studied following a reproductive trial under controlled conditions near Chitral city. Kari ewes exhibited oestrous seasonality. November to January conceded 43% of total recorded conceptions. Lambings although, spread over the year, were concentrated in spring and autumn with two distinct peaks, around April and October. Twinning was uncommon. During controlled experiment, 255 copulation events were recorded in 13 days during the controlled trial. Majority (50%) of copulation happened in the morning followed by those in the evening (36%), noon (14%) and afternoon (<1%) and their frequency was conversely proportional to the lower ambient temperature recorded during that part of the day. Only three out of 25 mated ewes could successfully develop the foetus and deliver. Ewes lost 16% body weight in parturition. It is suggested that Kari sheep tend to exhibit seasonal breeding,whereas lambing is spreaded throughout the year. Copulative activity almost cease whenever temperature raises up to 25^0C. Mating frequency, during different parts of the day, negatively correlated with the minimum ambient temperature. Ewes lost 16% of their body weight as a result of parturition.

Keywords: Mating behaviour, lambing behaviour, aseasonality, Kari, Chitral.

INTRODUCTION

Kari is a small fine wool sheep breed raised under semi-nomadic pastoral system in valleys north of Chitral, a seasonally accessed mountainous district in Pakistan. Documenting its reproductive behaviour became the major challenge when farmers in a field survey claimed that kari breed possessed unique reproductive traits: aseasonality in breeding behaviour, shorter gestation of three months, shorter lambing interval allowing three lamb crops in a calendar year etc., (Ahmad et al., 2002; Ahmad, 2008).

Reproductive performance of any breed is crucial to its survivability and commercial viability. Fecundity, litter size, seasonality in breeding and gestation length constitutes reproductive performance of a breed. Maijala and Terril (1991) also emphasized the need for studying performance of native breeds in relation to their special produce, characteristics and specific adaptability within prevailing ecosystem. Present study was carried out in two phases. In the first phase data from thirty flocks registered for the project were collected for reproductive parameters such as age at service and lambing, litter size, gestation period and lambing interval while in the second phase mating behaviour and laming behaviour were recorded under controlled conditions for which a flock was established at possibly close proximity to the breeding-tract of the breed.

MATERIALS AND METHODS

Location: The study area comprised of three locations, Lotkho, Garam-Chashma, Karimabad and Shoghoor, in Lotkho Tehsil situated in the Chitral-city of Northern Pakistan. Majority of the area is characterized by rough terrain with high mountains, steep slopes, and long stretched valleys at the bottom and upland meadows in the mountains. Garam-Chashma is the largest of three UCs and comprised of several valleys including Begusht, Overk, Munnor, Murdan and Goboor with varying altitude ranging from 2000 meters at Izh to about 5000 meters at the southern peaks. Shared ranging summer pastures with Afghan flocks suspect the flock's purity in this area. Karimabad is blind at the distal end for having massive glaciers of Tirichmir peak and is therefore considered harbouring animal and plant species in most conservative form. It comprises of two valleys i.e., Karimabad and Parsan which are comparatively narrow and deep. Arkari lies 45 km in the Northeast of Chitral town, ranges in elevation from 2440 meter at Mizhigram to 7700 meters at Tirichmir peak, with several peaks over 6000 m. The valley at Arkari is neither as narrow as Karimabad nor as open as Garam-Chashma. People live in scattered settlements in these valleys and maximize utilization of the available cultivable land mass (Rahim and Shah, 2004).

The controlled trial was carried out in an orchard research station situated at Seen-Lusht, a small settlement at the outskirts of Chitral town, some 40 km from the project area (Lotkho). As soon the land access to the

harbouring areas/valleys i.e Garam-Chashma, Karimabad, Shoghoor and Khoth (a location further up in the north, considered as the origin of Kari), become possible sheep were procured. A covered space in the fruit nursery was converted into four equal sheep pens using wooden partitions panels and slatted floor. The site of experiment was elevated at about 2000 meter asl, whereas the project area from where the ewes were brought had an elevation of 2500 to 3500 meters asl. However, Kari sheep normally spend their summer further up i.e., on the top of hills usually above 3500 meters elevation.

Climatic conditions: The climate of the area is distinctly continental. Daily ambient temperature and rainfall data were recorded in one of the registered farm at Garam-Chashma, (the native tract of Kari). The installed hygro-thermograph could remain functional only from March-October. However, rainfall data could record for the whole year which indicated that annual rainfall was 195 mm from March, 2005 to February, 2006. The autumn (October and November) and summer (June – September) were the drought periods, received only 3 mm of rainfall each, while spring (April and May) and winter (December – March) were the wet seasons, received 107 and 82 mm rainfall, respectively. Most of the rain in winter was received in the form of snow. Summer at the higher altitudes, including the project area, is cold and windy and extremely cold at nights (Mian, 1986). The peaks remain snow-clad, supporting glaciers, which feeds streams during summer. Another thermograph installed at the shed was used to record ambient temperature for the experimental period. Mean difference in daily temperatures recorded at one of the farm at Garam-Chashma and the Farm at Seen-Lasht was 7-10^{0}C difference at the highest day-temperature and 4-6 ^{0}C at the lower than those recorded for the second trial. The rainfall data was obtained from the nearby meteorological station in the outskirts of the Chitral town.

Animals selection and data collection: Thirty shepherds, each possessed a flock of at least 10 Kari-ewes, were registered for equally in three UCs recording on-field sheep performance. A total of 726 sheep in thirty registered flocks were belonging to non-selected foundation population of Kari breed. All farmers remained engaged at varying levels in the study for the period between November, 2004 and June, 2006 except one farmer in Garam-Chashma. After interviewing farmers for their cultural practices of grazing and feeding, all their animals in the flock were tagged and castrated all the rams present except the solitary sire selected for breeding. Successful copulation characterised by the mounts when the females stood and the male made one or more thrusting movements, were recorded. Sheep constituted major portion of their flocks/herds and were raised under semi-nomadic collective pastoral system governed by a social institution called "Suth Sairi". All flocks from the village communally range the summer pastures situated uphill. However, flocks of each farmer stay at stall near their homesteads in winter and is fed the Lucerne and range hay. Spring and autumn were the intervening periods between winter stalling and summer pasturing where fields and surrounding mountain flanks are grazed which can be characterized as range of low feed availability.

In the subsequent controlled experiment thirty-five Kari-ewes, free from physical deformities, sound in body conditions and did lamb within last one month were procured from local shepherds. The ewes were classified in to four categories on the basis of their live weight (kg) i.e., Small (≤16 kg), Medium (16.1 19 kg), Large (19.1-24 kg) and Madakhlasht (24.1 – 34 kg). Four breeding males, of normal reproductive organ and breeding history from the each class were used for breeding their respective ewes during trial. Ewes were grazed in nearby range for a short period of two-three hours daily. Animals at stall were offered Lucerne-hay mixed with chopped maize, wheat or barley straw supplemented with barley grains and ground pulses (in 3:1 ratio) @ 200 g per sheep, in addition to free access to Urea molasses blocks and water. Two ewes died within acclimatisation period (first week) of their arrival.

Thirty three ewes were treated with Estrumate® for shedding conception if any, and resultantly two aborted and were excluded from the experiment. Thirty one ewes after synchronization with Medroxyprogesterone acetate (MAP) for oestrous were allowed to breed. Above 90% ewes were expected to express heat 48 to 120 hours after hormone withdrawal (Romano *et al.*, 2000) but only 60% exhibited heat symptoms. Natural mating commenced which continued for two weeks. Six ewes failed to show any sexual receptivity and were excluded. Mating was allowed continuously in the day starting from 05:30 to 22:30. The period of proximity was categorised into morning (05:30 to 10:00 h), noon (10:00 to 14:00 h), afternoon (14:00 to 17:00 h) and the evening (17:00 to 22:30 h) for analysis. Mating activity ceased when light were been put off in the night. The flock activity was observed using electronic camera for getting closer observation of their mating/sexual behaviour. Copulation was considered to have taken place when during mounts, the females stood and the male made one or more thrusting forward movements, followed by no interest in the ewe. The same trial was repeated in 2008, but this time in the area lying within the breeding tract using 40 ewes and four rams representing the sub types. Exogenous hormones were avoided and ewes were kept separate from rams for five months (December till May) to get certain that they carry no fetus, which was also confirmed through Ultrasonic examination.

Statistical analysis: Reproductive activity of Kari ewes were evaluated in the perspective of environmental and photoperiodic effects. Mating frequency expressed by different rams at different parts of the day (morning, noon, afternoon and evening) using two way analysis of variance and means ranking through Duncan's Multiple Range Test. Relationship between mating frequency with minimum and maximum temperature was also determined. Birth weight recorded during the first reproductive cycle of ewes were analysed for its variation. Factors including adult weight, gestation period, month of conception, month of lambing and litter size were analysed for its effect on the birth weight.

RESULTS

General reproductive traits are presented in Table 1. Although, observations on age at first service, conception and lambing were few yet has significance for the reason of non-availability of such information in literature. Mean age at first service, at first conception and at first lambing were 281.7, 293.9 and 409 days respectively. Majority of lambing resulted in singlet and seldom (4.98%) in twins. Kari ewes proved aseasonal in its reproductive cyclicity. Oestrous activity and conception spread over the entire months of the year (Figure 1). Peak oestrous activity was observed in November, accounted for 15.1% of the total matings in a year and 43% of total conception were recorded in coldest months (November- January). Each conception consumed 1.9 mating. Lambing concentrated in Spring and Autumn with two distinct peaks around April and October, respectively.

Mating behaviour: Majority of the ewes under controlled farm conditions (83%) expressed sexual receptivity manifested by mating. Oestrous behaviour was different as a result of the two trials. Majority of ewes after exogenous hormonal administration remained at oestrous for variable period mostly entered into second and third day. Contrary to this, oestrous in most (89%) of the ewes lasted the same day, and seldom (11%) entered in to the second day. None of the ewe expressed any sporadic oestrous as experienced in ewes administered with MPA.

A total of 395 matings were observed during the two trials. Mating frequency varied across the different parts of the day (Figure 2). Mating during morning was pronounced followed by evening and noon. Morning was the prime period for mating activity accounting for half of the sexual activity. Evening, noon and afternoon accounted for 36, 14 and >1%, of the sexual activity, respectively. No sexual activity was observed during Afternoon and Night despite the physical proximity. Ewes along with rams spent nights in full and the afternoons in partial recumbence. Afternoon was the hottest part of the day, having mean minimum temperature of 25.6^0C, followed by noon, whereas evening and morning were the colder parts. Sexual activity, irrespective of part of the day, ceased whenever temperature reached 25^0C: the probable the threshold temperature. Mating frequency, during different parts of the day followed the pattern negatively correlated with the minimum rather than mean ambient temperature. Sexual activity between ram and ewes varied (Table 2). Mating per ewe could not reach statistical significance ($P<0.05$) however, and copulation was maximum in the Kari-large. Ram behaviour included sniffing of the anogenital region, lateral approaches and flehmen posture with continuous roaring at the time of ewes' pursuit. Rams, before getting more proximal and pursuing for mating, used to sniff the urine of ewes-in-heat. Ewe-in-heat was escaping the ram and was usually was seeking hide of other ewes, moving in a circle. Reduced appetite manifested by detracting eating behaviour, frequent urination, wagging tail at the time of mount and increased movement were among the common symptoms in ewes.

Table 1. Reproductive performance of Kari sheep in different flocks under field conditions

Trait	N	Mean	SD	Minimum	Maximum
Age at first service (days)	7	281.7	78.78	183	405
Age at first conception (days)	7	293.9	87.91	183	405
Age at first lambing (days)	7	409	84.51	273	519
Litter size	363	1.07	0.25	1	2

Table 2 Mating frequency and lambing parameters in Kari sheep

	Matings / ewe	Copulations / day*	Weight loss at parturition (kg)	Weight at mating (kg)	Lambing duration (min)	Placenta expulsion period (min)
Small	7.4±3.05	4.0b±2.2	2.8 – 3.2	<16	23 – 43	210 – 490
Medium	5.0±1.27	2.7b±1.0	2.6 – 3.3	16.1 – 19	31 – 41	280 – 650
Large	15.9±6.13	9.8a±4.8	2.7 – 3.2	19.1 – 24	34 – 44	350 – 450
Madaklasht	8.2±3.50	3.2b±2.2	2.9 – 3.6	24.1 – 34	31 – 45	290 – 650

*Different superscripts in the column indicate significant difference ($P<0.05$) among means.

Lambing behaviour: Out of total 27 ewes mated, only three delivered in the first trial (hormonally induced) whereas 22 out of 40 mated ewes lambed in the second trial (natural). All parturitions were swift and required no assistance. Pelvic ligaments started softening 20 days before lambing followed by appearance of thick mucous discharge on 12-15 days before lambing. Valvular swelling, pinkish colouration and wet appearance were on the steady rise without loss of appetite. Starting from the appearance of first water bag till the drop of lamb, it took 23-43, 31-41, 34-44 and 31-45 minutes whereas up to shedding of placenta 210-490, 280-650, 350-450 and 290-650 minutes in ewes belonging to Kari-small, Kari-medium, Kari-Large and Madakhlasht, respectively. All lambing resulted in singletons weighing 0.91 to 2.01 kg at birth. The strain and gestation period significantly affected the birth weight (Table-3). Increasing gestation lengths were associated with increasing birth weights. Ewes lost 16% weight as a result of their parturition. Ewes were continuously pawing their bellies, continued sitting and standing intermittently, searching for some hide out in the pen-corners upon lambing. Two ewes delivered while sitting whereas the third ewe gave birth to a lamb in standing position. Lambs were licked by the dams and started suckling within first 38 minutes of their births; however, the male lamb was quicker than the two female lambs in suckling response.

Table 3 Mean Birth weight (Kg) in Kari sheep as affected by different factors

Factors	Significance	Variable	Mean	SE
Strains	+++	Kari-Small	1.66	**0.08**
		Kari-Medium	1.38	**0.07**
		Kari-Large	1.22	**0.09**
		Madakhlasht	1.90	**0.07**
Gestation Period	++	<110 days	1.10	**0.08**
		111-130 days	1.53	**0.08**
		>130 days	**1.66**	**0.06**

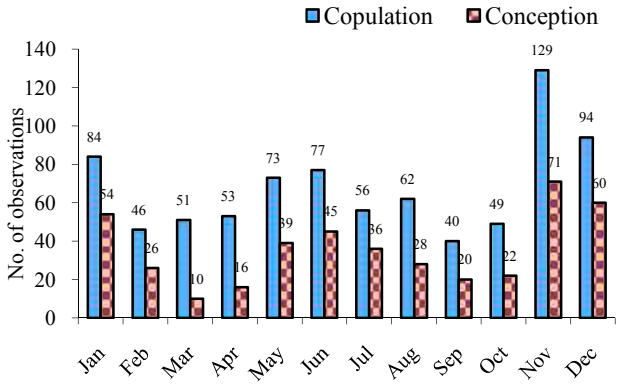

Figure 1 Distribution of mating and conception as happened during different months of the year in the registered flocks at field conditions

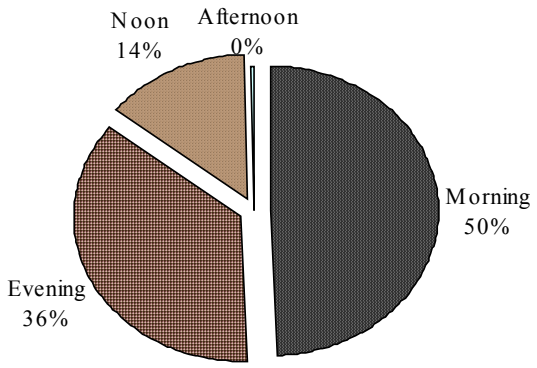

Figure 2 Distribution of mating activity at different time parts of the day

DISCUSSION

Majority of the sheep breeds have been reported as seasonal breeders where majority of lambing happen in February-March (Qureshi et al., 1998; Babar, 1994; Nawaz et al., 1999; Hussain, 2006). Contrary to this, seasonal changes could not influence breeding activity in Kari sheep. A few other breeds include Han sheep from China and D'man from Morocco (Bouix and Kadiri, 1975; Chu et al., 2007) exhibit aseasonal oestrous manifestation. Boroola Merino is somehow aseasonal too, exhibit 40% more oestrus cycles per year than other Merinos (Bindon and Piper, 1976), where 60% ovulate throughout the year. Among other prolific breeds Romanov and Finnsheep have been reported for inheriting the trait of prolonged sexual season (Thimonier and Mauleon, 1969; Wheeler and Land, 1977).

Lambing on the other hand, although spread over the whole year, but distinctly followed a bimodal pattern where the two peaks were clustering around April and October. This pattern of lambing in Kari-ewes may due to extra-inherited factors. The semi-nomadic pastoral

production system, involve two-times alpine expedition of one to three weeks long at the advent of summer and autumn, which may account for poor sexual activity during this period and around. Photoperiodic effect like the administration of melatonin supplementation can stimulate early onset of breeding (Nett & Niswender, 1982; Bittman & Karsch, 1984; English et al., 1986). Rich availability of nutrients at the Hi-pasture during summer may be among the major contributing factors which may need further studies to delineate them. Oestrous synchronization in ewes during the current study did not yield expected results during the early trial. Use of progestagens is preferred for oestrous synchronization in ewes when the stage of ovarian cycle is unknown and treatment generally lasts for 12-13 days (Vein, 2005). Variables such as breed, ambient temperature, nutrient supply, lactation stage, post-partum interval, season, age and the kind of progesterone employed, are among the possible factors for limited success in synchronization in the present experiment (Robinson *et al.*, 1970; Colas, 1979; Romano, 1996). High ambient temperature (7-10^{0}C higher than valleys harbouring the breed) during June and July particularly at lower Chitral may be amongst the major reasons. Local flocks spent their summer in the alpine pastures which are further up on the top-hills and colder than dwellings down in the valleys.

The second trial which was carried out at the lower part of the harbouring valleys, did not yielded adverse results. Twenty two out of forty ewes lambed where entire process was kept natural and no application of exogenous hormones. This may imply that breed is well suited to the upper part of the Chitral where the ambient temperature seldom touches 25^{0}C, although with fluctuation in nutrient supply. The minimum temperature of 25^{0}C at any part of the day seemed to be the threshold level for cessation of sexual activity in Karis. The temperature for most part of the afternoon and some part of the noon touched the apparent threshold level, and thus had lowest sexual activity. Although mean maximum temperature in the noon and afternoon were similar, differences in the minimum temperatures accounted for varied sexual activity. Dawn and dusk, on the other hand, were comparatively colder parts of the day, accounted for most of the sexual activity. Temperature might have affected both sexual counterparts as increase in ambient temperatures have been reported detrimental to ram fertility (Waites and Setchell, 1990), and in ewes resulted in delayed onset of oestrus (Sawyer, 1979), and increase fertilization failure and embryo loss (Sawyer, 1979a).

Mating behaviour in rams was similar to generally described behaviour for sheep (Stellflug and Berardinelli. 2002; Rosa *et al.* 2000). The comparative number of mountings/ejaculations were far less than sniffing, lateral approaches and Flehmen expressions. Ram with large testicular size was pronouncedly active. The libido in rams is a function in addition to other reproductive characteristics such as male hormones secretion, testicular size and semen production (Lincoln and Davidson, 1977; Ortavant *et al.*, 1988). Ewes play an important factor as counterpart and their variability in sexual receptivity could contribute to variable sexual activity (Gelez *et al.*, 2003) yet allotment of ewes to the rams was random. Low fertility in the current study, probably had occurred due to high ambient temperature and/or the exogenous hormones administration.

Conclusion: It is suggested that Kari sheep tend to exhibit seasonal breeding,whereas lambing is spreaded throughout the year. Copulative activity almost cease whenever temperature raises up to 25^{0}C. Mating frequency, during different parts of the day, negatively correlated with the minimum ambient temperature. Ewes lost 16% of their body weight as a result of parturition.

Acknowledgment: The chore of success of this study rests the joint collaboration of pastoral community and the project staff sponsored by Pakistan Agricultural Research Council (ALP) and Higher Education Commission.

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