



Kidding pattern and mortality rate of indigenous local goat kids reared under semi-intensive system in Andaman and Nicobar Islands

P PERUMAL¹, A KUNDU², J SUNDER³, M S KUNDU⁴, D BHATTACHARYA⁵, T SUJATHA⁶ and A K DE⁷

ICAR-Central Island Agricultural Research Institute, Port Blair, Andaman and Nicobar Islands 744 101 India

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ABSTRACT

Data of 544 kids born during 2000 to 2017 maintained at the institute were analysed to study the factors affecting the sex ratio and mortality rate in Andaman local goat under semi-intensive system. Frequency and percentage of kidding and mortality rate of kids under different years (2000 to 2017), months (January to December) and seasons (wet and dry season) were calculated. Relative female ratio (RFR) as well as secondary sex ratio (SSR) was also calculated to assess the sex ratio of the kids in the organised goat farm. Result revealed that birth rate, sex ratio, mortality rate, kidding pattern such as singles, twins and triplets varied with months, seasons and years. Birth rate, mortality rate, single and twine birth were higher in monsoon than dry season whereas triplets, quadruplet and sex ratio were higher in dry season than monsoon. In conclusion, sex ratio, birth rate and mortality rate differed significantly between months/seasons/years and wet season/months were most conducive for breeding of goat under semi-intensive system in Andaman and Nicobar Islands.

Key words: Andaman and Nicobar Islands, Birth rate, Goat, Kidding pattern, Season of birth, Semi-intensive system

The sex ratio of new born animals is an essential factor of any goat flock in replacing low performing or non-potential animals in order to maintain proper flock strength and in achieving sustainable production and/or reproduction performance leading to increased profitability of livestock farming system. Andaman and Nicobar Islands have indigenous goat breeds such as Teressa and Andaman local goat which are used mainly for meat purpose, and Teressa breed has been recognized by Government of India (Jayakumar *et al.* 2016). Per capita availability and production of goat meat is lesser in Andaman and Nicobar Islands as compared to national average. Goat population of Andaman and Nicobar Islands is 65,324 (19th Livestock Census 2012). Some preliminary studies were conducted on goat management in Andaman and Nicobar Islands (Saha *et al.* 2004, Sunder 2014, Sunder *et al.* 2016a, b). To increase the meat production and per capita availability in the Islands, there is a requirement to enhance the female kid ratio to select elite female and male kids as the future progenies for higher meat production.

Kidding pattern depends on management, nutritional and breeding factors. Knowledge of sex ratio in breeding population is useful in maximizing genetic gain by enhancing the intensity of selection of superior germplasm.

Present address: ^{1,7}Scientist (perumalponraj@gmail.com, biotech.cari@gmail.com), ²Director (drakundu1@yahoo.com), ^{3,4,5}Principal Scientist (jaisunder@rediffmail.com, mkundu47@rediffmail.com, debasis63@gmail.com), ⁶Senior Scientist (drsujathaars@rediffmail.com).

In general, the sex ratio does not deviate significantly from 50%. However, there are some unknown factors, which might favour or affect the deviation of the sex ratio. The kidding percentage and twinning ability are the most important parameters to investigate reproductive efficiency of goat breeds. It is the measure of production and profit point of view in organized and unorganized sector of goat farming. Season, month and year are the effective factors which determine the sex ratio in livestock species (Mopaté *et al.* 2014, Kharkar *et al.* 2017). Similar type of work has been reported in other domestic livestock species (Farahvash *et al.* 2008, Perumal *et al.* 2014), but lacking in Andaman local goat under organised semi-intensive system in Andaman and Nicobar Islands. Therefore the present study was undertaken to assess the effect of various factors on kidding pattern, mortality rate and sex ratio of kids reared under semi-intensive system in Andaman and Nicobar Islands.

MATERIALS AND METHODS

The present study was carried out at Goat Farm, Animal Science Research Farm of the institute. The average maximum temperature was 30.1°C and minimum temperature 23°C. Relative humidity ranged between 82–94%. The annual rainfall was more than 3,100 mm spread over more than 7 months in a year.

Andaman local goats were maintained in the semi-intensive system. The animals were allowed to graze from 08:00 to 13:00 h. Feeding and watering was done as per the

farm schedule. *Ad lib.* clean drinking water was available freely. The data related to kidding rate, sex of kids, mortality rate, kidding year, season and month from 2000 to 2017 were collected, grouped and analysed for the study. Kidding season was classified as wet (April to November) and dry (December to March) based on the monsoon and meteorological data. Secondary sex ratio (SSR) was calculated as per the procedure followed by Mora *et al.* (2010) [SSR = (A/C)×100: (B/C)×100; where A, number of male kids; B, number of female kids; C, number of total kids (A + B)]. Relative female ratio (RFR) was calculated from numbers of female and male kids for goats. Numbers of male and female kids become equal to each other when RFR=1. Number of female kids are more than that of male when RFR > 1. Number of male kids are more than that of females when RFR < 1 (Yilmaz *et al.* 2010). Kid mortality was recorded from kidding to weaning. Most of the kids were dead by the age of one month. In monsoon season, kid mortality frequently increased than other season. Frequently occurring pneumonia caused kid mortality.

Overall mortality rates for particular age and sex structure of flocks was calculated using given formulae.

$$\text{Mortality rate (\%)} = \frac{\text{Number of deaths per structure}}{\text{Number of stock within each structure}} \times 100$$

$$\text{Overall mortality rate (\%)} = \frac{\text{Number of deaths}}{\text{Total number of animals in the flock}} \times 100$$

The data were analysed statistically with the standard protocols. Analysis of variance was done with a generalized liner model (SPSS, version 16; Chicago, IL, USA) and using Student-Newman-Kuels (SNK) multiple range test. The data used in the study were tested for normality before analysis using Shapiro Wilk statistics. One way ANOVA was used to measure the variation among the months, years for different sex. Student t test was done to study the variation between the male and female in different months, seasons and years. Differences with values of $P < 0.05$ were considered to be statistically significant.

RESULTS AND DISCUSSION

Highest kidding rate in monsoon/wet season (April to November) and lowest in dry season (December to March) was observed. Sex of kid varied significantly between the months, seasons and years. The proportion of female and male kids born in farm was 51.10: 48.90 (1:0.95). Overall RFR and SSR values were 0.95 and 1:0.95, respectively. The RFR was >1 from June to August and in other months, it was < 1. Similarly RFR in monsoon and dry season was <1. RFR for 2000, 2002, 2004, 2007, 2010, 2011, 2013, 2016 and 2017 was >1 and for other years it was <1. Results revealed highest birth rate in January and July; intermediate in February, March, August and September, and lowest in other months. Whereas mortality rate was highest in July–September; intermediate in January, March, October to December and lowest in other months. Highest number of

twin birth in March, June, August and October to November; intermediate in January, February, July and September, and lowest in the other months were observed. Highest number of triplet was in January and lowest in other remaining months, and only one quadruplet was observed in January. In overall, singles, twins, triplets and quadruplets were 49.42, 46.21, 4.26 and 0.28%, respectively. Sex ratio was highest in June–August and lowest was in the remaining months (Fig. 1). Birth rate (year wise) showed highest rate in 2003–05 and 2007–08; intermediate in 2001–02, 2006, 2012, 2014 and 2017 and lowest in other years. Mortality rate was highest in 2001–02 and 2007; intermediate in 2000, 2004, 2007 and 2014 and lowest was in other months. Highest number of singles were observed in 2000, 2007, 2010, 2012–15 and 2017, and lowest in 2001 and 2004. Twins was highest in 2001–04, 2006 and 2008–09; intermediate in 2005, 2007, 2010–12 and 2015–16, and lowest in 2000, 2013–14 and 2017. Triplets were highest in 2004–05; intermediate in 2002, 2007, 2011 and 2013, and lowest in 2006 and 2008. Only 1 quadruplet was observed in 2004. Sex ratio was highest in 2000, 2002, 2004, 2007, 2010–11, 2013 and 2016–17, and lowest was in other years (Fig. 3). Birth rate, mortality rate, single and twin birth was highest in monsoon than dry season whereas triplets and quadruplet were higher in dry than monsoon season. Sex ratio was highest in dry than monsoon season (Fig. 2).

Reproductive rate can be influenced by conception rate, litter size, young mortality and interval between parturitions (Ndlovu and Simela 1996). The results of RFR and SSR indicated that there was a non-cyclical fluctuation of the male and female kid ratio, and total number of the kids born throughout the experimental years and months and overall it was 51:49. The SSR of 50% males reported in the present study disagree with earlier studies in goat which showed higher incidence of males than females (Kale and Tomar (1997) in Alpine × Beetal goats, Soundararajan and Sivakumar (2006a) in Kanni Goats, Sivakumar and Soundararajan (2007) in non-descript goats and Kharkar *et al.* (2017) in Osmanabadi goats). The results in overall on relationship between the kidding year and sex, and between kidding month and sex revealed significant association. Similar result of significant difference between kidding year and sex was reported by Deokar *et al.* (2000) in Osmanabadi goats, Barbind *et al.* (2004) in Beetal × Osmanabadi goats, Soundararajan and Sivkumar (2006b) in Tellicherry goats and Thiruvankadan *et al.* (2008) in Tellicherry goats. It was observed that kidding year influenced RFR and SSR in different goat breeds (Kale and Tomar 1997, Soundararajan and Sivakumar 2006a, Sivakumar and Soundararajan 2007, Kharkar *et al.* 2017 reported RFR>1.00 whereas Deokar *et al.* (2000), Barbind *et al.* (2004), Soundararajan and Sivkumar (2006b) and Thiruvankadan *et al.* (2008) reported RFR=1. RFR and SSR vary from year to year and also depend upon the year (Farahvash *et al.* 2008). Mortality rate was higher in monsoon ($9.35 \pm 0.93\%$) than dry ($8.50 \pm 0.88\%$) season with the average of $8.92 \pm 0.69\%$.

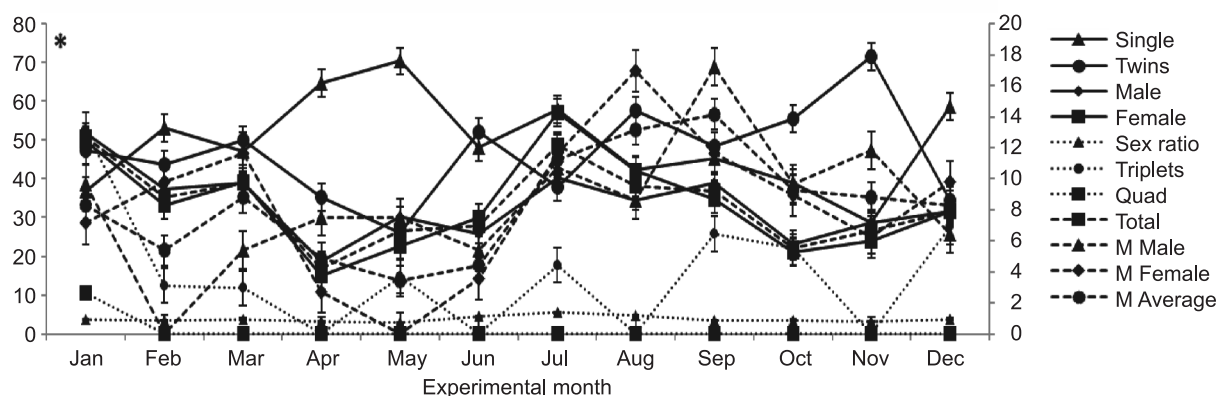


Fig. 1. Month-wise birth rate, sex ratio and mortality rate of goat reared under semi-intensive system in Andaman and Nicobar Islands (* $P < 0.05$). Quad, quadruplets; M Male, male mortality; M Female, female mortality; M Average, average mortality.

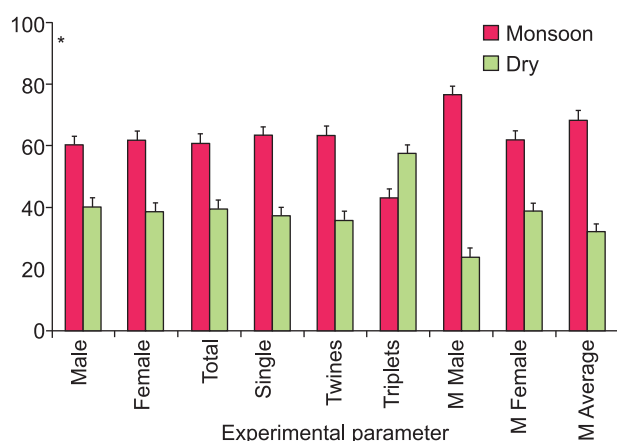


Fig. 2. Season birth rate, sex ratio and mortality of goat reared under semi-intensive system in Andaman and Nicobar Islands (* $P < 0.05$). M Male, male mortality; M Female, female mortality; M Average, average mortality.

Similar report was reported in Black Bengal goat in semi-intensive ($15.0 \pm 0.50\%$) and lowest in extensive ($10.07 \pm 0.32\%$) system of management (Hasan *et al.* 2015). Mortality of kid is highly correlated with the weight of dam at kidding. Kid mortality of more than 87% was observed when the dam weight less than 10 kg which decreased exponentially with the increase in weight of dam (Hasan *et al.* 2015). Mortality of kids was high in semi-intensive condition, may be due to higher incidence of diseases of plant poisoning and due to predators like jungle animals or domestic dogs. One important possible reason is that semi-intensive production system increases stress on animal, which leads to higher incidence of diseases, nutrient deficiencies and mortality. Ahmed (2006) found that Black Bengal goat had higher mortality rate in first generation (10.5%). This might be due to the environmental factors, inexperience of mothering and lower milk production. In general, kid mortality was high under one month in semi-intensive production system due to immune level and kid birth weight. However the mortality rate reduced gradually

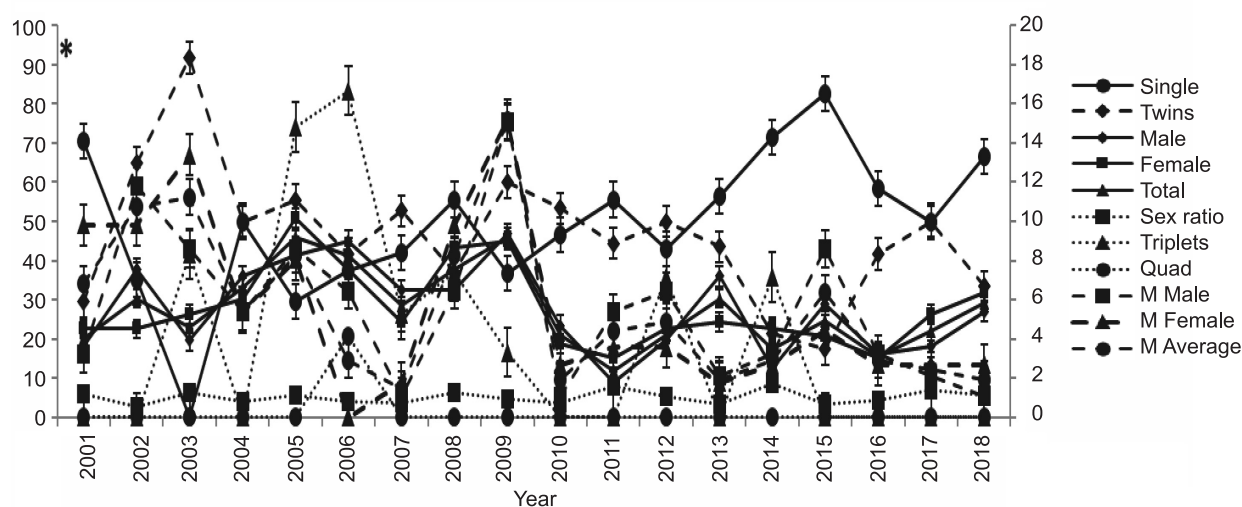


Fig. 3. Year-wise birth rate, sex ratio and mortality of goats reared under semi-intensive system in Andaman and Nicobar Islands (* $P < 0.05$). Quad, quadruplets; M Male, male mortality; M Female, female mortality; M Average, average mortality.

with the growth of kids. Similarly, Chowdhury *et al.* (2002) reported that the kid mortality is affected by many interacting factors such as effect of dam weight at kidding, birth weight of kid, milk yield of dam, season, effect of birth, effect of litter size, effect of parity, effect of dam's nutrition and diseases. Chowdhury *et al.* (2002) reported that the mortality rate was highest in kids (28.97%) followed by young goats (22%) and lowest in adult goats (11.78%). Most of the kid mortality is due to infectious causes such as diarrhoea and pneumonia. The relationship between the kidding season and sex was significant and more male and female kid were born in monsoon than dry season. Kidding percentage is an important parameter which reflects the reproductive efficiency and low heritability (0 to 0.15). However managerial practices play an important role in increasing the reproductive efficiency and fertility. The main factor that affected the sex ratio of the kid is type of breeding, either artificial or natural service, which in the present study indicates the sex ratio decreased. One contributing factor to the annual effect on sex ratio may be climate and its associated effects on sex ratio (Roche *et al.* 2006). The kidding percentage differed in different years and this might be due to some essential managerial as well as climatic factors and our result clearly indicated that the goat breeds in Andaman and Nicobar Islands have capability to show better reproductive efficiency which could be optimized by providing excellent nutrient and managerial practices. There are various factors such as buck, age of buck, parity, kidding year and season, climate, servicing/breeding time and maternal factors (age, stress etc.) which might affect the secondary sex ratio and RFR at birth in goat. Roche *et al.* (2006) found a significant effect of climate at conception as well as indicators of animals metabolic load (*i.e.* body condition score) at conception on secondary sex ratio. Climate in Andaman and Nicobar Islands follows a clear demarked seasonal pattern as dry and monsoon period thus providing one possible explanation for the effect of season/time of year on sex ratio in the Island. The climatic conditions are warm, rainy and humid in Andaman and Nicobar Islands. Some soils are deficient in micro nutrients. Though, annual rainfall is 3,100 mm, it is intense during rainy season, there is virtual drought in the dry period from January to April. Xu *et al.* (2000) reported a heritability of sex ratio of 2% suggesting the permanent environmental effect on the dam is the main contributor to the repeatability of sex ratio. Though it is said that goat breed throughout the year and no definite breeding season was observed as it is perennial breeder and polyestrous animal but the trend of kidding at goat farm, Andaman and Nicobar Islands compels us to speculate that some sort of seasonality does exist in goat breeds. Even in semi-intensive condition, most of the breeding took place in forest/grazing land itself and goat breeding records indicated maximum kidding took place in the January and July which means, most of the breeding might have taken place in the month of August and February and similarly lowest kidding was recorded during the month of April to June and October to December,

indicating very less number of animal had been in estrus in the month of November-January and July to September considering the gestation length of 150 days. The nutritional problem become more acute during dry season, where there is very less grass to feed upon. However in semi-intensive system of management, the goats were fed balanced commercially available concentrate feed fortified with mineral mixture in the present experiment. Further, it could be contemplated that temperature and humidity might be affecting the sexual desire of the animal, as comparatively less number of animal bred during the month of heavy rainfall (heavy rainfall might scarce the animal to exhibit estrus behaviour) as observed in goat in other part of India, though they get abundant of green grass, fodder, herbs and shrubs in jungle during this flush season. Maximum number of animal bred in August and February. Birth rate (year and month wise) showed a non-cyclical fluctuation and significant difference between seasons, months and years in the present study. Significantly higher mortality was observed in female than male kid and wet in than dry season.

Though the goat is polyestrous animal and adult female shows repeated estrous cycle after every 20–21 days interval with standing heat period ranging from 12 to 24 h in Andaman and Nicobar Islands. As the goat entirely depends on the locally available jungle fodders, the leaching of mineral elements is a common phenomenon especially during rainy season. Therefore, in a particular grazing gradient, the soil will be deficient in some important mineral elements. In that case, the vegetation of that particular area will also be deficient in some of the mineral elements, which may induce mineral deficiency (Das *et al.* 2011), which probably affects estrous exhibition in rainy season too.

It was concluded that breeding occurred throughout the year, however, wet season/months were found to be most conducive for breeding of goat under semi-intensive system in Andaman and Nicobar Islands. To establish the breeding season and months in the same agro-ecological climate of Andaman and Nicobar Islands, it warrants further study involving detailed study of endocrinological profiles of different hormones throughout the year in a larger population under semi-intensive condition.

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