

Environmental effects on production traits of Jakhrana goat

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Proper evaluation of production performance of goats is of the utmost pre-requisite for genetic improvement programme in goat breeding enterprises. Various studies showed that a number of environmental factors affect the growth and lactation traits and thus directly obscure the recognition of the genetic potential of animals. The effect of various factors like year and season of birth, type of management and sex of animal on growth (Roy *et al.* 2003, Rai *et al.* 2004, Sharma and Pathodiya 2007) and lactation traits (Roy *et al.* 2001, Singh *et al.* 2005, Roy and Mandal 2010) of goats was studied. The present study was conducted to determine various environmental factors (viz. birth year, season of birth, lactation number of doe, sex and birth status of kid) influencing the growth and lactation traits of Jakhrana goats.

The Jakhrana breed of goats is one of the most important dairy goat breeds in India and generally well adapted to the semi-arid climatic conditions of Rajasthan province of the country. The natural habitat of Jakhrana breed is around Jakhrana village near Behror Tehsil in Alwar district of Rajasthan however, the breed is also found in neighbouring areas (Basai, Jatganwara, Khor, Nimrana etc.) of this district. Small population of this breed and its grade are also available in Narnaul, Gurgaon, Bhiwani and Rothak districts of Haryana and adjoining areas of Uttar Pradesh. The name of the breed derived from the name of a village called 'Jakhrana' where the goat with the highest concentration is found. The detailed descriptions of this breed along with their distribution and production performance were described by Rai *et al.* (2001) and Rai and Singh (2004, 2005). These animals were maintained under semi-intensive system of feeding management where they are allowed to graze for 7–8 h on

natural pasture with supplementation of some amount of concentrate depending upon the status and age category of the animals. Controlled mating was practised in the flock. At kidding, both kids and dams are weighed and the kidding date, sex and birth status of each kid are recorded. Kids are weighed at 15-day intervals from birth to weaning and thereafter at monthly intervals up to 12 months of age. Weaning of kids was generally done at 3 months of age. Animals were vaccinated against PPR, enterotoxaemia and FMD etc.

Growth data on 372 kids and lactation performance of 225 does of Jakhrana goats—maintained at the Central Institute for Research on Goats, Makhdoom, Farah, Mathura, Uttar Pradesh for 4 years (2005 to 2008)—were used for the present study. The body weights at different ages (i.e. at birth, 3, 6, 9 and 12 months) were recorded. The lactation traits analyzed for this study were 90-days milk yield (MY90D), 140-days milk yield (MY140D), total milk yield (TMY) and lactation length (LL) of animals. The data were classified according to year of birth/kidding, season of birth, parity of dam and sex of kid and birth status of kid.

Data were analyzed using a mixed model least-squares analysis for fitting constants (Harvey 1990) including all main effects as follows:

$$Y_{ijklmn} = \mu + Y_i + S_j + A_k + E_l + T_m + e_{ijklmn} \\ \text{(for growth traits)}$$

$$Y_{ijkmn} = \mu + Y_i + S_j + L_k + T_m + e_{ijkmn} \\ \text{(for lactation traits)}$$

where, Y_{ijklmn} is the record for the n th lamb, Y_i is the effect of the i th year of birth/kidding, S_j is the effect of the j th season of birth/kidding, A_k is the effect of the k th parity of dam, L_k is the effect of the k th lactation number of dam, E_l is the effect of the l th sex of kid, T_m is the effect of the m th birth status/type of kid born, e_{ijklmn} is the residual error element. The comparison of different sub-groups means was made by Duncan's multiple range test (DMRT) as described by Kramer (1957).

The average weights of Jakhrana kids at birth, 3, 6, 9 and 12 months of age were 2.66 ± 0.06 , 8.82 ± 0.20 , 11.70 ± 0.28 , 15.54 ± 0.59 and 21.89 ± 0.71 kg, respectively (Table 1).

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Table 1. Least- squares means along with standard errors of different body weights in Jakhrana goat

Particulars	Birth wt. (kg)	3 m wt. (kg)	6 m wt. (kg)	9 m wt. (kg)	12 m wt. (kg)
Overall mean	2.66±0.06 (372)	8.82±0.20 (317)	11.70±0.28 (237)	15.54±0.59 (187)	21.89±0.71 (153)
<i>Year of birth</i>					
2005	2.48±0.13 ^a (27)	8.76±0.44 ^b (27)	10.62±0.60 ^a (25)	13.80±0.94 ^a (23)	22.32±1.19 ^b (19)
2006	2.63±0.08 ^a (83)	9.98±0.30 ^c (74)	13.61±0.42 ^b (57)	18.79±0.68 ^b (55)	24.36±0.87 ^b (45)
2007	2.73±0.06 ^a (158)	8.88±0.21 ^b (137)	12.98±0.31 ^b (108)	15.27±0.49 ^a (102)	18.99±0.59 ^a (89)
2008	2.80±0.07 ^a (104)	7.76±0.26 ^a (79)	9.57±0.44 ^a (47)	14.32±1.31 ^a (07)	-
<i>Season of birth</i>					
March- April	2.77±0.06 ^a (174)	9.21±0.24 ^a (137)	11.89±0.36 ^a (92)	15.57±0.67 ^a (51)	23.97±0.85 ^a (40)
October-November	2.55±0.06 ^b (198)	8.43±0.23 ^b (180)	11.50±0.33 ^b (145)	15.52±0.63 ^b (136)	19.81±0.72 ^b (113)
<i>Parity of dam</i>					
1	2.52±0.06 ^a (134)	9.07±0.22 ^{ab} (118)	12.26±0.34 ^a (92)	15.99±0.61 ^a (80)	21.86±0.69 ^a (65)
2	2.60±0.07 ^a (120)	8.68±0.27 ^{ab} (105)	11.76±0.40 ^a (80)	15.67±0.73 ^a (72)	22.11±0.84 ^a (59)
3	2.64±0.09 ^{ab} (76)	9.24±0.32 ^b (60)	11.72±0.46 ^a (41)	15.44±0.89 ^a (28)	20.88±1.13 ^a (23)
4	2.88±0.10 ^b (42)	8.30±0.38 ^a (33)	11.04±0.53 ^a (24)	15.07±1.24 ^a (07)	22.71±1.61 ^a (06)
<i>Sex of kid</i>					
Male	2.78±0.06 ^a (191)	9.32±0.22 ^a (160)	12.48±0.31 ^a (119)	16.79±0.63 ^a (99)	23.38±0.73 ^a (81)
Female	2.54±0.06 ^b (181)	8.32±0.23 ^b (157)	10.91±0.33 ^b (118)	14.30±0.64 ^b (88)	20.40±0.80 ^b (72)
<i>Birth status of kid</i>					
Single	3.08±0.06 ^a (118)	9.06±0.22 ^a (105)	11.53±0.31 ^a (76)	15.39±0.61 ^a (59)	21.43±0.76 ^a (49)
Twins	2.76±0.05 ^b (235)	8.64±0.17 ^a (196)	11.28±0.24 ^a (150)	15.64±0.51 ^a (121)	22.10±0.67 ^a (97)
Triplet	2.14±0.13 ^c (19)	8.77±0.48 ^a (16)	12.78±0.71 ^a (11)	15.60±1.31 ^a (07)	22.15±1.54 ^a (07)

Means with different superscripts differ significantly ($P<0.05$) from each other.

Similar body weights of kids at different ages as reported in this study were also observed by Roy *et al.* (2003) in Jamunapari goats. However, higher body weights of kids at different stages of growth were reported by Rai *et al.* (2003) for this breed. The year of birth of kids had significant ($P<0.01$) effect on body weight of kids at all ages except at birth. Significant effects of year of birth on body weights of kids were also reported by Roy *et al.* (2003), Yadav *et al.* (2004) and Sharma and Pathodiya (2007) for various breeds of goat. Differences in body weights of kids born in different years may be attributed to differences in management and environmental conditions such as ambient temperature, humidity, rainfall etc. Season of birth of kids also showed significant ($P<0.01$) influence on all growth traits in this study. Kids born in March-April gained significantly higher body weights at all ages than kids born in October-November. Our finding was corroborated by the findings of Yadav *et al.* (2003) and Yadav *et al.* (2004) in different breeds of goats. The lower body weight at birth and subsequent ages of the kids, born in Oct.- Nov., in this study may be an effect of the ambient temperature, since gestation period of the does would occur during hot period of the year. The parity of dam contributed significantly ($P<0.05$) for birth and 3 month body weights of kids, but parity had no effect on 6, 9 and 12 months body weights. The similar significant effect of parity of dam on different body weights of kids was observed by Sharma

and Pathodiya (2007) in Sirohi goats. Sex of kids was highly significant ($P<0.01$) for all the growth traits under study. Male kids achieved significantly ($P<0.01$) higher body weights at all stages of growth than their counterparts (Table 1). Comparison of least-squares means for kids' weights at different ages showed that the differences in weight between male and female kids increased from 0.24 kg at birth to 2.98 kg at 12 months of age. The increase in the ratio of male to female body weight as the kids became older and their body weights increased, probably arises from the increasing differences in the endocrine system between males and females. These body weight differences between sexes were in consistent with the results from other studies (Rai *et al.* 2003, Yadav *et al.* 2004, Swami *et al.* 2006) for various goat breeds. The significant effect of birth status of kid on kid's birth weight was also observed in this study, which was also in agreement with the findings of Rai *et al.* (2003), Swami *et al.* (2006), and Sharma and Pathodiya (2007).

The overall least-squares means for MY90D, MY140D and TMY of animals were 101.98±2.38, 144.60±3.53 and 166.05±5.21 litre, respectively (Table 2). The average lactation length for this breed was 183.04±4.04 days. The average milk yield at 90-days of obtained in this study was lower than the findings of Rai *et al.* (2003). The kidding year had highly significant ($P<0.01$) influence on all lactation traits in this study. Similarly the significant effects of period/

Table 2. Least- squares means along with standard errors of different lactation traits in Jakhrana goat

Particulars	MY90D (lit.)	MY140D (lit.)	TMY (lit.)	LL (days)
Overall mean	101.98±2.38 (225)	144.60±3.53 (174)	166.05±5.21 (219)	183.04±4.04 (219)
<i>Year of kidding</i>				
2005	88.11±6.53 ^a (17)	116.37±8.93 ^a (17)	152.46±14.28 ^{ab} (17)	208.32±11.06 ^b (17)
2006	98.84±3.58 ^{ab} (60)	137.73±5.14 ^b (54)	180.09±7.89 ^b (59)	206.91±6.11 ^b (59)
2007	119.60±2.53 ^c (91)	174.53±3.52 ^c (84)	201.75±5.52 ^c (91)	181.69±4.27 ^c (91)
2008	104.38±3.29 ^b (57)	149.78±7.18 ^b (19)	129.88±7.53 ^a (52)	135.25±5.83 ^a (52)
<i>Season of kidding</i>				
March-April	98.45±3.64 ^a (61)	138.02±5.18 ^a (53)	155.02±7.96 ^a (60)	175.53±6.17 ^a (60)
October-November	105.52±2.15 ^b (164)	151.18±3.52 ^b (121)	177.07±4.74 ^b (159)	190.55±3.67 ^b (159)
<i>Lactation number</i>				
First	96.99±2.60 ^a (100)	137.96±3.81 ^a (87)	164.74±5.75 ^a (98)	191.54±4.45 ^a (98)
Second	99.66±3.62 ^{ab} (68)	140.52±5.36 ^a (55)	161.77±8.03 ^a (65)	179.1±6.21 ^a (65)
Third or more	109.29±4.07 ^b (57)	155.33±6.46 ^b (32)	171.63±8.96 ^a (56)	178.48±6.94 ^a (56)
<i>Type of kid born</i>				
Single	99.82±2.96 ^a (110)	140.86±4.33 ^a (87)	162.17±6.52 ^a (106)	181.92±5.05 ^a (106)
Multiple	104.15±2.79 ^a (115)	148.35±4.22 ^a (87)	169.93±6.12 ^a (113)	184.16±4.74 ^a (113)

Means with different superscripts differ significantly ($P<0.05$) from each other.

years of kidding on lactation traits of does for other breeds were reported by Roy *et al.* (2001) and Singh *et al.* (2005). The significant differences in milk yields and lactation length among Jakhrana does kidded in different years may be attributed to differences in management, selection of bucks and environmental conditions such as ambient temperature, humidity, rainfall etc. Season of kidding had also significant ($P<0.01$) effect on all lactation traits. These findings were in agreement with the results of Roy *et al.* (2001) and Singh *et al.* (2005) for other goat breeds, which reported significant seasonal influence on lactation traits. In this study, does that kidded in October- November produced significantly more milk than the does kidded in March-April, which may be due to the fact that the does that kidded in October-November pass through a period with favorable climate, when good quality pasture was available. Significant ($P<0.05$) differences in 90 and 140 days milk yields existed among does of different lactation number. Lower milk yields were observed in does of first lactation as compared to does of second and onward lactation (Table 2). Significant effect of lactation number/order of does was observed for 90-days/lactation milk yield (Roy *et al.* 2001) in other breeds of goat. The type of kid born had non-significant ($P>0.05$) effect on lactation traits of animals in the present study.

SUMMARY

The average weights of Jakhrana kids at birth, 3, 6, 9 and 12 months of age were 2.66 ± 0.06 , 8.82 ± 0.20 , 11.70 ± 0.28 , 15.54 ± 0.59 and 21.89 ± 0.71 kg, respectively. Regarding the lactation performance of this breed, the average 90-days, 140-days and total milk yield of animals were 101.98 ± 2.38 , 144.60 ± 3.53 and 166.05 ± 5.21 litre, respectively. The

average lactation length for this breed was 183.04 ± 4.04 days. The study revealed that various environmental factors, viz. year of kidding and season of kidding had significant effect on growth as well as lactation traits of animals. Significant ($P<0.05$) differences in 90-days and 140-days milk yield was observed among the does of different lactation order.

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