

# Evaluation of Effects of Genetic and Non-Genetic Factors on the Growth Performance of Boer Cross, Jamunapari Cross and Local Khari Breeds of Goat in Jagatpur Farm, Chitwan, Nepal

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## Abstract

The popularity of exotic goats and its crosses with indigenous breeds has been increasing amongst the Nepali farmers as it improves productive and growth performance of indigenous breeds through cross breeding. The purpose of this study is to evaluate the effects of genetic and non-genetic factors on the growth performance of Boer crosses with Local khari and Jamunapari cross breeds of goats in Jagatpur Farm, Chitwan, Nepal. Data of 60 registered kids were recorded in Jagatpur Agro Farm for five-month period and was analyzed using general linear model (univariate) in IBM SPSS Statistics 20. The mean birth weight of Boer × Khari, Jamunapari × Boer and Local khari was  $3.19 \pm 0.09$ ,  $3.45 \pm 0.08$  and  $3.21 \pm 0.08$  respectively. The effect of breed was significant on 3 month weight ( $p < 0.001$ ), 5 month weight ( $p < 0.05$ ) and pre-weaning average daily gain ( $p < 0.05$ ). Boer × Khari was heavier than Local Khari followed by Jamunapari cross in all the three aspects; 3 month weight, 5 month weight and pre-weaning average daily gain. Sex was significant on 3 month weight ( $p < 0.05$ ), 5 month weight ( $p < 0.05$ ), pre-weaning average daily gain ( $p < 0.05$ ) and overall average daily gain ( $p < 0.05$ ). Male had higher weight and weight gains than female. The mean 3 month weight, 5 month weight, pre weaning average daily gain and overall daily gain of male was  $14.85 \pm 0.48$  kg,  $23.88 \pm 0.41$  kg,  $127.64 \pm 4.84$  g/d and  $136.8 \pm 2.43$  g/d whereas female was  $13.56 \pm 0.49$  kg,  $22.2 \pm 0.42$  kg,  $115 \pm 4.98$  g/d and  $126.79 \pm 2.5$  g/d respectively. Parity and season had no significant ( $p > 0.05$ ) effects on any weights and daily gains. Similarly, post-weaning average daily gain was not significantly affected by any factors. It was concluded that cross breeding of Boer goat with Jamunapari and Khari breeds with ability to adapt to local conditions can add much more value to productive performance including body weights and weight gains. Similarly, the fixed effects such as sex, breed and parity should always be taken into consideration as it had significant effects in goat performance. Thus, cross breeding and effects of these factors need to be studied in more detail to determine impacts on productivity and profitability of the meat goat industry.

**Keywords:** Weaning; Parity; Genetic Factors; Growth

## Introduction

Goat is one of the most common domestic animals reared in Nepal. It is one of the important meat animals with second highest demand after the buffalo meat in Nepal [1]. Indigenous goat breeds of Nepal are Khari, Terai, Chyangra and Sinhal. Popular exotic goat breeds in Nepal are Boer, Barbari, Jamunapari and Beetle which are used for cross breeding to upgrade indigenous breeds [1].

Boer goats are meat type goats originated in South Africa and have been introduced in many countries including Nepal. They have good resistance capacity, rapid growth rate, heavier body weight, high prolificacy with average litter size close to two and high carcass quality [2]. Because of these important traits, cross breeding of Indigenous breeds with Boer has been very popular in Nepal since it is a better way to get productive goats in short period of time [3]. Boer goat can attain weight of 25 kg for male and 22 kg for female in four months of time whereas for Khari it takes a year to achieve 25 kg of weight [3] similarly a year for Jamunapari [4]. However, there are many genetic and non-genetic factors that affects the growth and productive performance of goats [2,5-9] have discussed about the factors affecting growth and reproductive performance of Boer and its crosses. Similarly, Das et al. and Hassan et al. [4,10] have discussed about Jamunapari and its crosses. Similarly, Bhattarai et al. [11,12] have discussed about Local Khari and its crosses but no extensive comparative studies has been done about the effects of factors that affects the growth performance of Boer × Khari, Jamunapari × Khari and Local Khari together. So, our study was felt necessary for evaluation of effects of genetic and non-genetic factors in the growth performance of these breeds as they will directly or indirectly affect the genetic and economic of our nation in

coming future due to extensive use of cross breeding and introduction of Boer in our country. So, the objective of the research is to evaluate the effects of genetic and non-genetic factors in the growth performance of Boer × Khari, Local Khari and Boer × Jamunapari breeds under the same environmental conditions.

## Materials and Methods

### Location

Records from 60 kids of different breeds (Jamunapari cross, Boer cross and Local khari) and 7 sires were collected from Jagatpur Goat Farm, Bharatpur 22, Chitwan located at longitude  $84.325^\circ\text{E}$  and latitude  $27.577^\circ\text{N}$  (Figure 1).

### Animal management

Animals were raised under confinement as an intensive system. The

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Figure 1: Jagatpur Goat Farm, Bharatpur 22, Chitwan located at longitude 84.325°E and latitude 27.577°N (<https://www.google.com/maps/place/Jagatpur+Goat+Farm/>).

goats were housed according to sex, size and pregnancy in different pens in an iron galvanized sheet with a wooden slatted floor raised above the ground level. The house was provided with necessary arrangement for feeding, watering and fresh air. Animals were vaccinated against PPR and Pox and dewormed routinely. Animals were identified with ear tags. For each, record sheets with full details of different parameters were maintained. New born kids were allowed to suckle their mothers and were weaned at 3 months age. No castrated was performed on the male kids.

### Data collection

A total of 18 Jamunapari (50%) × Boer (50%), 24 Boer (75%) × Khari (25%) and 18 Local khari goats were taken. Data were collected between November 1, 2015 to March 27, 2019. Information about sex, season, breed and parity was recorded. Season was categorized as Dry (Nov-March) and Wet (Apr-Oct) based on rainfall (mm). Parity as I, II, III and IV was considered.

### Traits analyzed

The considered traits were birth weight, 3<sup>rd</sup> month weight, 5<sup>th</sup> month weight, pre-weaning average daily gain, post-weaning average daily gain and overall average daily gain.

### Statistical analysis

The significance of fixed effects was tested by General Linear Model using SPSS ver. 20.

$$Y_{ijkl} = \mu + B_i + S_j + P_k + S_l + \epsilon_{ijkl}$$

Where,

$Y_{ijkl}$ : Observation on birth weight, 3 month weight, 5 month weight, pre and post-weaning growth rate and overall growth rate

$\mu$ : General mean

B: Fixed effects of the *i*th breed (1=Boer × Khari, 2=Jamunapari × Boer, 3=Local Khari)

S: Fixed effects of the *j*th sex (1=Male, 2=Female)

P: Fixed effects of the *k*th parity (*k*=1, 2, 3, 4)

S: Fixed effects of the *l*th season (1=Dry season, 2=Wet season)

E: Random error

## Result and Discussion

### Body weight

**Birth weight:** The mean birth weight of Boer × Khari, Jamunapari × Boer and Local khari was 3.19 ± 0.09 kg, 3.45 ± 0.08 kg and 3.21 ± 0.08 kg respectively which was not significantly affected by any factors unlike the result obtained by Nepalese Journal of Agricultural Sciences where birth weight was significant to sex and genotype. Similarly, the mean birth weights of male and female kids were 3.36 ± 0.07 kg and 3.18 ± 0.07 kg. It was higher than the data obtained by Adhikari et al. but resembles with birth weight of boer goat which was 3.4 kg [2] and khari goat which was 3.97 kg [12].

**Three and five month weight:** Three month weight and five month weight was significantly affected by genotype (*p*<0.05) and sex (*p*<0.05) in our study [13]. Boer cross was found heavier in 3 months and 5 month than local khari followed by Jamunapari cross shown in Table 1. According to Adhikari et al. [14] the three month and five month weight of local khari is 6.33 ± 2.1 kg and 11.12 ± 3.55 kg and Jamunapari cross is 8.45 ± 2.67 kg and 14.75 ± 3.12 kg which is extremely lower than the finding of our study. Similarly, Kadel et al. [15] found the weaning weight of Boer cross was 7.62 ± 1.37 kg which was also far

lower than our findings. Because of high fecundity of Boer goat (2.3) which is higher than most goat breeds [16] and genetic traits for meat production of boer goat, productive performance of indigenous goats through cross breeding is improved especially body weight and growing rate [2,3]. However, these body weight measurements can be varied by genetic influence, nutrition, health, disease, body age, methods and management.

The mean three month weight and five month weight of male and female was  $14.85 \pm 0.48$  kg and  $23.89 \pm 0.41$  kg and  $13.56 \pm 0.49$  kg and  $22.20 \pm 23.88$  kg respectively as shown in Table 1 which was greater than the weight obtained by Gurung et al. [9] of Boer  $\times$  Malawi breeds, Hassan et al. [10] of Jamunapari goats, Kadel [15] of Boer  $\times$  Khari breeds but lower than weights of Boer  $\times$  Spanish goats obtained by Jeffrey Andrew Rhone [17]. Male kids were significantly heavier than female kids [1,2,15]. It may be due to the difference in sexual chromosomes and difference in type and measure of sexual hormones in favor of male; Also, estrogen has limited effect on growth of long bones in female [18]. However this data was contrasted with Rasali et al. [19] where female ( $8.58 \pm 0.37$  kg) were heavier than male ( $8 \pm 0.36$  kg) at weaning month.

### Average daily gains

**Pre and post-weaning average daily gain:** Pre-weaning average daily gain was significantly affected by genotype ( $p < 0.01$ ) and sex (0.05). However, post weaning average daily gain was unaffected by any of the factors.

Table 2 shows the pre-weaning daily gain was highest in Boer  $\times$  Khari ( $138.3 \pm 6.15$  g/d) and lowest in Jamunapari  $\times$  Boer ( $95.52 \pm 5.65$  g/d). These were much higher than data obtained by Adhikari et al. [14] of Khari (51.44 g/d), Jamunapari  $\times$  Khari cross (69 g/d) and Boer 50% (100.11 g/d) goats; Boer  $\times$  Khari (45.75 g/d) [15]; Boer goats ( $81.33 \pm 0.41$  g/d) and Boer  $\times$  Baladi ( $66.44 \pm 0.54$  g/d) [8]. However, these data were lower than data obtained by Lu [2] of Boer  $\times$  Spanish (154 g/d) and Boer  $\times$  Angora (161 g/d). The variation in weight gains between breeds may be due to milk production potential of respective kid's dam and level of solid fed supplementation for milk fed crossbred kids [13].

The pre weaning average daily gain of male and female goats were ( $127.64 \pm 4.84$ ) g/d and ( $115.34 \pm 4.98$  g/d) respectively. These data were similar to that of Boer goats [1] and higher than that of Boer  $\pm$  Khari goats obtained by Kadel et al. [15]. Male had higher weight gain than female [15,17].

Factors	n	Birth weight	3months weight	5 months weight
			(Weaning weight)	
Genotype		NS	P=0.018	P=0.001
Boer (75%) $\times$ Khari (25%)	24	$3.19 \pm 0.09$	$15.64 \pm 0.61$	$24.5 \pm 0.52$
Jamunapari (50%) $\times$ Boer (50%)	18	$3.45 \pm 0.08$	$12.05 \pm 0.56$	$20.81 \pm 0.48$
Local Khari	18	$3.21 \pm 0.08$	$14.44 \pm 0.58$	$23.28 \pm 0.50$
Season		NS	NS	NS
Dry	36	$3.22 \pm 0.07$	$14.68 \pm 0.46$	$23.52 \pm 0.40$
Wet	24	$3.32 \pm 0.07$	$13.63 \pm 0.51$	$22.44 \pm 0.04$
Sex		NS	P=0.031	P=0.014
Female	24	$3.18 \pm 0.07$	$13.56 \pm 0.49$	$22.20 \pm 0.42$
Male	36	$3.36 \pm 0.07$	$14.85 \pm 0.48$	$23.88 \pm 0.41$
Parity		NS	NS	NS
First	23	$3.26 \pm 0.09$	$14.43 \pm 0.61$	$23.07 \pm 0.53$
Second	16	$3.42 \pm 0.10$	$14.98 \pm 0.68$	$23.96 \pm 0.58$
Third	14	$3.21 \pm 0.12$	$13.25 \pm 0.66$	$22.03 \pm 0.57$
Fourth	7	$3.13 \pm 0.13$	$14.16 \pm 0.86$	$23.222 \pm 0.746$

Note:  $p < 0.05$  means significant at 5% level,  $p < 0.01$  means significant at 1% level, NS=Not significant at 5% level ( $p > 0.05$ )

Table 1: Body weights of Boer cross, Jamunapari cross and Local Khari (Mean  $\pm$  SE).

Factors	n	Pre-weaning average daily gain	Post-weaning average daily gain	Overall average daily gain
Genotype		P=0.006	NS	NS
Boer (75%) $\times$ Khari (25%)	24	$138.3 \pm 6.15$	$147.62 \pm 8.4$	$142.05 \pm 3.09$
Jamunapari (50%) $\times$ Khari	18	$95.52 \pm 5.65$	$145.97 \pm 7.8$	$115.7 \pm 2.83$
Local Khari	18	$124.68 \pm 5.83$	$147.38 \pm 8.05$	$133.77 \pm 2.93$
Season		NS	NS	NS
Dry	36	$127.33 \pm 4.69$	$147.34 \pm 6.48$	$135.35 \pm 2.35$
Wet	24	$114.56 \pm 5.17$	$146.81 \pm 7.14$	$127.46 \pm 2.59$
Sex		P=0.033	NS	P=0.013
Female	24	$115.34 \pm 4.98$	$143.93 \pm 6.88$	$126.79 \pm 2.5$
Male	36	$127.64 \pm 4.84$	$150.53 \pm 6.68$	$136.8 \pm 2.43$
Parity		NS	NS	NS
First	23	$124.17 \pm 6.19$	$143.87 \pm 8.55$	$132.02 \pm 3.11$
Second	16	$128.41 \pm 6.82$	$149.7 \pm 9.42$	$136.93 \pm 3.42$
Third	14	$111.55 \pm 6.65$	$146.42 \pm 9.19$	$125.51 \pm 3.34$
Fourth	7	$122.57 \pm 8.7$	$150.93 \pm 12.01$	$133.94 \pm 4.37$

Note:  $p < 0.05$  means significant at 5% level,  $p < 0.01$  means significant at 1% level, NS=Not significant at 5% level ( $p > 0.05$ )

Table 2: Average weight gains of Boer cross, Jamunapari cross and Local Khari (Mean  $\pm$  SE).

**Overall average daily gain:** Overall average gain was significantly affected by sex ( $p < 0.05$ ). Daily weight gain of female and male was ( $126 \pm 79.35$ ) g/d and ( $136.8 \pm 2.43$ ) respectively. These data were higher than that of Boer  $\times$  Khari obtained by Kadel et al. [15] and Jamunapari cross [1]. Male had higher weight gain than female [5,13,17]. This result was contradicted with Rasali et al. [19] where female had better gain.

## Conclusion

The results indicated that cross breeding of Boer goat with Jamunapari and Khari breeds with ability to adapt to local conditions can add more value to productive performance including body weights and weight gains. The result also indicated that indigenous breeds can also give good growth performance close to cross breeds with proper application of management, nutrition and intensive care. So, indigenous breeds should be studied more to save the indigenous genetic resources. Similarly, the factors such as sex, breed and parity should always be taken into consideration in goat rearing system as they have significant effects in goat performance and productivity. Thus, above research concluded major relationship between different factors and breeds that has major impacts on productivity and profitability of the meat goat industry.

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