

Study on Productive and Morphological traits of Goat Kids in different Ecozones of Rolpa district

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ABSTRACT

Goat is a domesticated small ruminant, reared by small farmers across the country primarily for meat production. Productivity of goat is often low, which could be related to several genetic and non-genetic factors. A field study was carried out to characterize, evaluate and estimate the effect of non-genetic factors on the hill goat kids during December, 2015 to August 2016 in different eco-zones of Rolpa district, mid-west Nepal. Altogether 150 goat kids were selected for this study. Morphological attributes productive performances based on field monitoring and measurements within different altitudes of Rolpa were collected. Least square analysis was performed using Harvey (1990) computer software package, and means were compared using DMRT. The mean body weight of goat kids at birth, pre-weaning, weaning at 5 months' age were 2.62, 6.34, 10.15 and 13.87 kg respectively. Birth weight of kids significantly differed with respect to altitude ($P < 0.01$). Coat colour ($P < 0.05$) of does and parity ($P < 0.001$) of dams. Similarly, kidding rates of does significantly differed ($P < 0.05$) with respect to colour and altitude. Body weight of the kid at weaning were significantly ($P < 0.05$) correlated to body length, heart girth and wither height. Thus, the results of this study suggest that the performance of low altitude goat flocks was better than mid and high altitude goat flocks in Rolpa district in terms of production and reproduction traits. The selection of the best performing kids for higher weight gain could be done on the basis of both birth and weaning weights. This result could be attributed to superior genotype along with better management practices adopted by the farmers in Rolpa district.

Keywords: Kids, wither, girth weight, genetic

INTRODUCTION

Rolpa covers an area of 1,879 km² with population (2016) of 221,177. Rolpa is drained southward by the Madi River from a complex of 3,000 to 4,000 meter ridges about 50 kilometers south of the Dhaulagiri Himalaya (Statoids, 2014). The Rolpa district lies at

the height of 701m to 3639 meters above the sea level. The total area is 189385 hectares out of which 59854.5 hectare land is used for crop farming, forest consists 84474 hectare, pasture consists 32698.8 hectare, wild plants and forages 9620.8 hectare and rivers and rocks 1251.9 hectares. The average temperature in Rolpa district is maximum (31.2 Celsius), minimum (3.6 Celsius) and annual rainfall is 441mm (CBS, 2016). The elevations of high, mid and low altitude from the sea level in Rolpa district are at the range of 3639, 1375 and 701 m respectively. Nepal is an agricultural country where about 66 percent of the population is involved in agricultural occupation. Agriculture contributes to around 27.1 percent of the gross domestic product (GDP) of Nepal. The livestock sector contributes about 11.5 percent of the total GDP and 25.7 percent of the agricultural GDP (AGDP) as reported by MOAD (2018). Goat farming is the most popular means of self-employment among the youths in the country. Among the agricultural commodities, livestock plays an important role in agricultural development and economic upliftment of the country. Goat farming has been practiced by a large section of population in rural areas of Nepal. The recent population of goat is about 13.4 million and total meat contribution was 7.1 thousand metric tonnes (contributing to 20.1% of total meat production in country) per year (MOAD, 2022). The rate of increment in goat population during last 15 years (2008 to 2018) was reported 3.74 percent per year (MOAD, 2018). Various breeds of goat breeds are reared in different ecological regions of Nepal. There are gradients of topography, environment and climatic conditions and each breed evolved is acclimatized to each corresponding topographical zone (Pradhan and Gurung1985). Four indigenous breeds of goat namely Chyangra, Sinhal, Khari and Terai are documented in Nepal goats. Chyangra (1%) are found at an altitude above 2400 masl in high Himalayans, Sinhal (16%)found in high hill ranging 1500-3000 masl, Khari (56%) are available across the hills 500-1500masl and Terai goats (27%) in Terai region below 500 masl (Pokharel and Neopane, 2008).

MATERIALS AND METHODS

Time and Location of the study

The study was carried out from September, 2015 to August 2016 in Rolpa district of mid-western Nepal.

Sampling procedure and sample size

The data were collected on the basis of Pocket areas of goats distributed within different altitude at Rolpa district. The selected high altitude (1500-1800 masl) gaupalikas were (Jaimakshala and Pakhapani) followed by mid altitude (1200-1400 masl) gaupalika (Gairigaun and Libang) and low altitude (800-1000 masl) gaupalika (Masina and Jhenam). Two wards from each VDCs were selected. Within the population, in each selected site, sampling goats' kids were identified randomly. A data recording format was developed to collect data and information related to growth performance, reproductive performance,

litter traits, morphological traits and production system of hill goats reared in the study area.

Statistical analysis

Collected data were entered in the computer using MS- Excel and converted into text documents i.e. Text (MS-DOS). To study the main causes of variation and effects of non-genetic factors on productive and reproductive traits, as well as to overcome the difficulty of disproportionate subclass numbers, data were analyzed by least squares procedure using Harvey, (1990) which is based on least squares technique of variance analysis. The pair wise comparison of the least square mean comparison was made using DMRT (Duncan's Multiple Range Test) (Duncan, 1955) as modified by Kramer (1957).

Models used to analyze the collected data

A fixed effect model given by Handerson (1953) was used to analyze the body weight of kids at different stages of growth.

Morphological traits

The morphological traits were measured by using the measuring tape.

Body length (BL) - Distance from shoulder joint to the pin bone.

Wither height (WH) - Distance from ground to the point of wither.

Heart girth (HG) - Body circumference at the chest immediately behind the fore Legs.

Models used to analyze the collected data

A fixed effect model given by Handerson (1953) was used to analyze the body weights of kids at different stages of growth.

Fixed effect model for weight and body measurement traits of kids

Following statistical model was used to analyze the litter traits, body weight and morphological traits of goat kids-

$$Y_{ijklmn} = \mu + a_i + b_j + c_k + d_l + f_m + e_{ijklmn}$$

Where, μ is the overall mean

a_i is the effect of i^{th} altitude ($i=1,2$ and 3)

b_j is the effect of j^{th} type of colour ($j = 1, 2, 3$ and 4)

c_k is the effect of k^{th} type of age in month ($l= 1, 2, 3, 4$ and 5)

d_l is the effect of parity ($k= 1, 2, 3$ and 4)

f_m is the effect of m^{th} season of birth ($n=1$ and 2)

e_{ijklmn} is the random element (error mean) assumed to be normally and independently distributed among the sampled population.

RESULTS AND DISCUSSION

Birth weight of kids

The overall mean birth weight of hill goat kids in this study was 2.44 ± 0.91 kg (Table 1). Parajuli *et al.* (2014) reported the average birth weight of born kids were in the range of 2.83 kg to 2.62 kg at Nawalparasi. Kolachhapati (2006) also reported the birth weight of kids in hill goats of Surkhet, Udaypur and Kavre was in the range of 1.87-2.47 kg. The birth weight of kids in this study were similar to that of Indian Ganjam goats (2.25 kg) reported by Rao *et al.* (2007). The effects of various factors on the birth weight of kids are presented in (Table 1). Pandey *et al.* (2009) reported that the mean litter weight of 2.88 kg for 50% Kharai and Jamunapari.

Table 1. Least squares means for Birth weight (kg) of hill goat at Rolpa district, Nepal, 2015/16

Factors	LS±SE	NO	Significant Level
Overall	2.44 ±0.91	150	
Altitude			**
Low Altitude	2.62±0.20 ^a	46	
Mid Altitude	2.18±0.93 ^b	44	
High Altitude	2.53±0.10 ^a	60	
Breed			***
Khari	2.14±0.20 ^b	87	
Khapari	2.52±0.17 ^a	47	
Khabari	2.66±0.23 ^a	16	
Colour			*
Black	2.24±0.20 ^b	69	
Brown	2.25±0.18 ^b	57	
White	2.73±0.26 ^a	8	
Mixed	2.55±0.21 ^a	16	
Parity			**
1-2	2.17±0.17 ^b	56	
3-6	2.41±0.17 ^a	88	
Season			NS
Dry(Dec-May)	2.63±0.14	143	
Wet(Jan-Nov)	2.26±0.26	7	
Sex			NS
Male	2.47±0.20	41	
Female	2.41±0.17	109	

Note: * significant at 5% ($P < 0.05$), **significant at 1% ($P < 0.01$) ***significant at 0.1% ($P < 0.001$), NS-non significant, LS mean- Least square mean, SE- Standard error of mean. NO are the numbers of observations.

Body weight of kids

The overall body weight of kids from (5 month) age was 13.33 ± 0.91 kg. The numbers of kids above five months age were found in less number during data collection. So, they were not analyzed in this research. The effects of various factors on the overall weight of kids (1-5month) age are presented in Table (2). Regarding the birth season, the market requires ranges on the age of the kids between 4 to 8 months, which usually coincides with the summer period. Consequently, the improvement of the production of meat of kids during this early age has an important economic impact on the income of the ambulant herds (Gaddouret *et al.*, 2007). Under pastoral harsh conditions with restricted and irregular resources, goat productivity is highly influenced by non-genetic factors because of the extensive grazing management (Mahjoub *et al.*, 2005).

Pre-weaning (2 month) weight

The average pre-weaning weight of hill kids at 2 months was 6.34 ± 0.90 kg (Table 2). Rao *et al.* (2007) also reported similar value of pre-weaning weight (6.8 kg) of Ganjam goats in India. Parajuli *et al.* (2014) reported that the pre-weaning weight of kids was 6.84 kg in Nawalparasi.

Weaning (4 month) weight

The overall mean weaning weight of kids was about 10.15 ± 0.89 kg (Table 2). The weaning weight determines the economic value of the goats too. So, it is necessary to identify the weaning weights in the goat kids. Nearly similar value of average weaning weight of native Hill-goats (10.06 kg) was reported by Kolachhapati (2006).

Post-weaning (5 month) weight

The overall Post weaning weight of kids was about 13.67 ± 0.74 kg (Table 2). Bhattra *et al.* (2011) also reported similar results of mean body weight of kids at post-weaning 13.87 ± 0.94 . However, lower values of weaning weight of Khari was reported by Uprety and Khanal (1997), Neopane (1997) but Rao *et al.* (2007), Rai and Singh (2005) reported higher values.

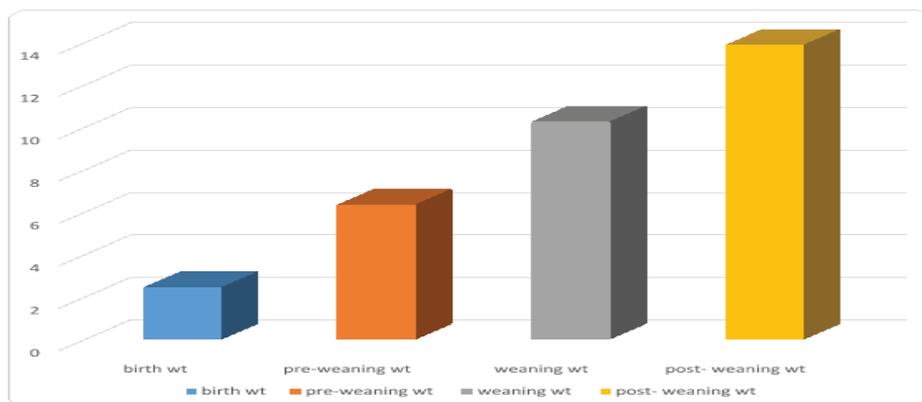


Figure 2: Weight of kid from birth to Post-weaning at Rolpa district, Nepal, 2015/16
 Table 2. Least Square means overall body weight(kg) of kids in Rolpa district, Nepal, 2015/16

Factors	LS±SE	N0	Significant-Level
Overall	13.33±0.91	150	
Altitude			***
Low Altitude	13.02±0.10 ^b	46	
Mid Altitude	15.02 ±0.93 ^a	44	
High Altitude	11.96 ±0.13 ^b	60	
Breed			*
Khari	12.74±0.14 ^b	87	
Khapari	14.51±0.89 ^a	47	
Khabari	12.94±0.11 ^{ab}	16	
Colour			**
Black	10.88±0.12 ^b	69	
Brown	12.66 ±0.91 ^{ab}	57	
White	15.87 ±0.13 ^a	8	
Mixed	11.92 ±0.12 ^{ab}	16	
Age			***
1 Month	5.43±0.87 ^c	50	
2 Month	6.34±0.91 ^c	28	
3 Month	7.15±0.11 ^c	12	
4 Month	10.15±0.89 ^b	37	
5 Month	13.67±0.74 ^a	17	
Parity			NS
1-2	13.00±0.86	56	
3-6	13.81±0.83	88	
More than 6 Year	13.18±0.14	6	
Season			NS
Dry(Dec-May)	13.16±0.71	143	
Wet(Jan-Nov)	13.50±0.13	7	
Sex			NS
Male	13.46±0.10	41	
Female	13.20±0.89	109	

Note: * significant at 5% (P<0.05), **significant at 1% (P<0.01), ***significant at 0.1% (P<0.001), NS-non significant, LS Mean- Least Square Mean, SE- Standard Error, NO are the number of observations.

Body Length of kid

The mean body length of kids at one, two (pre-weaning), three, four (weaning) and five months (post weaning) kids were 32.86±2.18, 36.66±2.26, 42.90±0.25, 46.49±2.23 and

51.05±2.24 cm respectively. The numbers of kids above five months of age were found less in numbers during sample collection. So, they were not analyzed in this research. The detail of various factor effecting body lengths are presented in Table (3). Mabrouket *al.* (2011) reported similar values of goat kids body length at one, two, three, four and five months (32, 36, 42, 46 and 47 cm) respectively in Tunisia. Okafar *et al.* (2016) reported the body length (BL) of West African Dwarf kids ranged from 22.00 to 28.00 cm (mean, 24.52 ± 0.29 cm) at birth, 52.00 to 60.00cm (mean, 56.18 ± 0.33 cm) at 4month, and 60.00 to 67.00 cm (mean, 63.55 ± 0.26 cm) at 6 months in Nigeria.

Table 3. Least squares means for body length (cm) of the goat kids in Rolpa district, Nepal, 2015/16

Factors	LS±SE	NO	Significant Level
Overall	58.87 ±2.26	150	
Altitude			NS
Low Altitude	55.19±2.26	46	
Mid Altitude	51.86±0.40	44	
High Altitude	54.61±2.48	60	
Breed			*
Khari	49.87 ±2.23 ^b	87	
Khapari	58.29 ±2.51 ^a	47	
Khabari	50.47 ±0.27 ^{ab}	16	
Colour			*
Black	53.08 ±2.48 ^b	69	
Brown	50.87 ±2.26 ^a	57	
White	57.88 ±0.33 ^{ab}	8	
Mixed	53.69 ±0.25 ^{ab}	16	
Age			***
1Month	32.86 ±2.18 ^c	50	
2 Month	36.66 ±2.26 ^{bc}	34	
3 Month	42.90 ±0.25 ^{ab}	12	
4 Month	46.49 ±2.26 ^a	37	
5 Month	51.05 ±2.24 ^a	17	
Parity			***
1-2	54.35 ±2.13 ^b	56	
3-6	59.61 ±0.34 ^a	88	
More Than 6 Year	59.02 ±1.77 ^{ab}	6	
Season			NS
Dry(Dec-May)	54.60±1.77	143	
Wet(Jan-Nov)	53.18±0.32	7	
Sex			**
Male	55.52 ±2.48 ^a	41	
Female	52.24 ±2.20 ^b	109	

Note: * significant at 5% (P<0.05), **significant at 1% (P<0.01) ***significant at 0.1% (P<0.001), NS-non significant, LS mean- Least square mean, SE- Standard error of mean. NO is the number of observations.

Heart girth of kid

Average heart girth of kid at pre-weaning was observed as 46.07 ± 1.39 cm that reached up to the range of 51.75 ± 1.37 cm until weaning. The numbers of kids above five months age were found in less number during data collection so, they were not analyzed in this research. The heart girths of kid are presented in Table (4).

Table 4. Least square means for heart girth (cm) of goat kid in Rolpa district, Nepal, 2015/16

Factors	LS \pm SE	NO	Significant Level
Overall	50.62 \pm 1.37	150	
Altitude			*
Low Altitude	51.28 \pm 1.54 ^a	46	
Mid Altitude	51.35 \pm 1.39 ^a	44	
High Altitude	49.25 \pm 1.49 ^b	60	
Breed			NS
Khari	49.78 \pm 2.18	87	
Khapari	50.54 \pm 1.52	47	
Khabari	51.53 \pm 1.75	16	
Colour			NS
Black	49.63 \pm 1.49	69	
Brown	50.57 \pm 1.37	57	
White	51.30 \pm 2.03	8	
Mixed	50.97 \pm 1.65	16	
Age			***
1Month	42.18 \pm 1.3 ^c	50	
2 Month	46.07 \pm 1.39 ^b	34	
3 Month	49.53 \pm 1.65 ^b	12	
4 Month	51.75 \pm 1.37 ^a	37	
5 Month	54.15 \pm 1.34 ^a	17	
Parity			NS
1-2	50.59 \pm 1.29	56	
3-6	50.24 \pm 1.27	88	
More than 6 Year	51.02 \pm 2.18	6	
Season			NS
Dry(Dec-May)	50.11 \pm 1.04	143	
Wet(Jan-Nov)	51.13 \pm 2.03	7	
Sex			NS
Male	51.02 \pm 1.29	41	
Female	50.21 \pm 1.34	109	

Note: * significant at 5% ($P < 0.05$), ***significant at 0.1% ($P < 0.001$), NS-non significant, LSD-Least significant difference, LS mean- Least square mean, SE- Standard error of

mean. NO is the number of observations.

Wither height of kids

The average wither height of kids from one to five month ages was 43.28 ± 2.13 cm. The various factors affecting average wither height from one to five months' age of kids are presented in the Table (5). Animals have a balanced relationship between body weights and body measurements. From this standpoint, live weight is determined to the nearest kilogram (kg) and thereafter it could be evaluated for selling. On the other hand, productivity in livestock industry can be determined by using some phenotypic measurements. The present investigation was designed to obtain some basic morphometric information and to relate body weight with different body measurements of goats.

Table 5. Least squares means for kid wither height (cm) in Rolpa district, Nepal, 2015/16

Factors	LS \pm SE	NO	Significant Level
Overall	43.78 \pm 2.13	150	
Altitude			***
Low Altitude	42.79 \pm 2.43 ^a	46	
Mid Altitude	48.36 \pm 2.18 ^a	44	
High Altitude	40.23 \pm 2.33 ^b	60	
Breed			NS
Khari	43.86 \pm 2.1	87	
Khapari	42.74 \pm 2.36	47	
Khabari	44.75 \pm 0.25	16	
Colour			NS
Black	43.81 \pm 2.33	69	
Brown	42.08 \pm 2.13	57	
White	47.62 \pm 1.27	8	
Mixed	41.70 \pm 0.25	16	
Age			***
1Month	37.13 \pm 2.13 ^c	50	
2 Month	40.03 \pm 0.25 ^b	34	
3 Month	47.26 \pm 2.10 ^b	12	
4 Month	49.15 \pm 0.68 ^a	37	
5 Month	52.20 \pm 2.10 ^a	17	
Parity			NS
1-2	42.01 \pm 2.03	56	
3-6	44.52 \pm 2.0	88	
More than 6 Year	44.83 \pm 0.33	6	
Season			NS
Dry(Dec-May)	42.90 \pm 1.67	143	
Wet(Jun-Nov)	44.67 \pm 0.30	7	

Sex			*
Male	45.11 ±2.03 ^a	41	
Female	42.46 ±0.05 ^b	109	

Note: * significant at 5% (P<0.05), ***significant at 0.1% (P<0.001), NS-non significant, LS mean- Least square mean, SE- Standard error of mean. NO are the numbers of observations.

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Phenotypic Correlation

Phenotypic correlation between body weight and its measurements at pre-weaning

The phenotypic correlation coefficients between body weight of kids at weaning and their respective body measurements required in breeding. The coefficient of correlation of body length (r = 0.63), heart girth (r = 0.65) and wither height with (r = 0.59) with body weight at weaning was found to be significantly (P<0.05) and positively correlated.

Phenotypic correlation among body weight and its measurements at post weaning age of 5 months

Body length and Heart girth were significantly (P<0.05) and positively correlated with the post-weaning weight of hill goat, with the coefficient of 0.66 and 0.68, respectively. The coefficient of correlation of wither height (r = 0.64) with body weight at Post-weaning was observed to be significantly (P<0.01) and positively correlated with post-weaning weight of the kids with the higher value of 'r' compared to body length and wither height (Table 46).

Accordingly, the correlation coefficient of heart girth was greater compared to that of body length and wither height in weaning and post weaning weight of kids. Heart girth was more strongly correlated to the body weight of kids with the greater coefficient of correlation than that of body length and that of wither height.

Weaker degrees of association wither height with body weight at different age might be due to less contribution of legs for muscle mass deposition on the body as compared to the contribution made by increased heart girth and body length as reported by Kuwar (2000) and Popesco (1984).

High correlation existed between heart girth and wither height with respect to the live body weight of kids indicated the functional phenotypic relationship between these physical characteristics of body measurements as indicated by Badiet *al.* (2002) and Hassen and Ciroma (1992).

CONCLUSION

This study suggest that the performance of low altitude goat flocks was better than mid and high altitude goat flocks in Rolpa district in terms of production and reproduction traits. The selection of the best performance of kids could be done on the basis of both birth and weaning weights to obtain higher weight at later stages. This result could be attributed to superior genotype along with better management practices followed by the farmers in Rolpa district.

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