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Study of Productive, Reproductive and Moropholgical Traits of Bucks in Different Regions of Salyan District

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Abstract
Goat is a domesticated small ruminant, primarily reared by small farmers for meat production, across the country. 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 productive and reproductive performance of hill goats during December, 2016 to August 2017 in different eco-zones at Salyan district of mid-western Nepal. Altogether 45 bucks of different age groups were identified for this study. Morphological attributes, productive, and reproductive performance were collected based on field monitoring and measurements within different altitudes of Salyan district. Least square analysis was performed using Harvey (1990) computer software package, and means were compared using DMRT. The measurements of morphological traits were higher in male as compared to females. Results revealed age at first service of bucks (332 days), average body weight of buck was (37.56 kg),overall body length of buck from one to four year (79.01cm),overall heart girth of one to four years age buck(76.37cm),average wither height from one to four year old buck(70.23cm),overall average Scrotal circumference of bucks (1-4 years) were 25.33 cmrespectively. Theresults of this study suggest that the performance of low altitude goat flocks was better than mid and high altitude goat flocks in Salyan district in terms of production and reproduction traits. The selection of the best performance of buck could be done on the basis of their traits for breeding. This result could be attributed to superior genotype along with better management practices followed by the farmers in Salyan district.
Key words: *Buck, Weight, parity, genetic*

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I. Introduction

Nepal is an agricultural country where about 66 percent of its population is involved in agricultural occupation. Agriculture contributes to around 27.1 percent of the gross domestic product (GDP)of Nepal, of which, 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 being the most popular means of self-employment among the youths in the country. Current statistics regarding to goat population indicated that there are more than 11.64 million of goats in the country (MOAD, 2018).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 11.64 million and total meat contribution was 6.9 thousand metric ton per year (MOAD, 2018). The rate of increment in goat population during last 15 years (2008 to 2018) was reported 3.74 percent per year contributing about 20.1% to the total meat production in the country (MOAD, 2018). Goats breed in Nepal are quite different with locational difference. There are gradients of topography, environment and climatic conditions vary from South to North, and each breed evolved is acclimatized corresponding to each topographical zone (Pradhan and Gurung1985).In Nepal there are four commonly documented breed of goats as Chyangra, Sinhal, Khari and Terai goats. Chyangra goats are found in 2400 meters in high Himalayans, while Sinhal found in high hill ranging 1500-3000 meters from sea level. Khari are available across the hills of Nepal while Terai goats are available in Terai region of Nepal. Chyangra (1%), Sinhal (16%), Khari/hill goat (56%) and remaining 27% are of Terai and other breeds (Pokharel and Neopane, 2008).

II. Materials And Methods

This section deals with the site of study, data collection and recording procedures, data analysis techniques, description of data sets and models used for analyzing the recorded traits.

Time and Location of the study

This study was carried out from December, 2016 to August 2017 in Salyan district of Nepal.Salyan District is a part of Karnali province, is one of the seventy-sevendistricts of Nepal. Salyan covers an area of 1,462 km^2 (564sq m) with a population of 213,500 in 2001 and 241,716 in 2011.The district's administrative center is namedSalyanor SalyanKhalanga; today it is part of Municipality. AlthoughSalyan is considered ahilly district, its southwest salient is actually outside thePahari-inhabited hill region, in the lowerSiwalik Hills that are more an extension of the Terai. The Babai River flows through the southwestern Siwaliks section after drainingDang Valley. A tributary Sharad Khola drains the eastern half of Salyan's hill region—including the district center, then exits these hills by cutting through the Mahabharat Range to its confluence with the Babai. The western half of Salyan's hill region is drained by the Bheri (Statoids, 2014).

Sampling procedure and sample size

The datas were collected on the basis of Pocket areas of goats distributed within different altitude at Salyan district. The selected high altitude regions were (Kalagaun and Dermakot) followed by mid altitude regions (Chande and jimali) and low altitude (Kabhrechaur and Kalimatikalche). The elevations of high, mid and low altitude from the sea level in salyan district are at the range of 2000-3000, 1000-2000 and 300-1000 m respectively. From allregion at least 8available bucks with reproductive and productive parameters were recorded.The productive parameters includes bucks were body weight, wither height, body length, heart girth, Scrotal circumference length etc. The reproductive parameters of buck age at first mating (puberty) etc. Within the population, in each selected site, sampling goats were identified randomly. A data recording format was developed to collect data and information related to reproductive performance, 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

Model I (fixed effect model) for buck weight, body measurements and reproductive traits

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

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 breed (j = 1 ,2and 3)

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

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

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

III. Results And Discussion

This chapter describes the study results focusing to the growth performance, morphological traits and reproductive traits of goats.

Body weight of bucks

The overall average body weight of buck was 37.56±0.31 kg as mentioned detail in Table (1). The data's were collected and analyzed from one to four year old bucks. The bucks were also in crossed form like as does. Joshi *et al*. (2003) also reported Khari, Khapari and Khabari breed bucks were 28-40,52±4.80, and 43.5±4.9 kg respectively. The various factors such as altitude color and ages were considered in this study for the body weight of the bucks.

Table 1. Least square means for body weight (kg) of buck in Salyan district, Nepal, 2016/17

Factors	LS±SE	NO	Significant Level
Overall	37.56 ±0.35	43	
Altitude			NS
LA	39.74±0.48	17	
MA	37.39±0.39	14	
HA	39.15±0.41	12	

Breed			**
Khari	35.68 ±0.55[b]	29	
Khapari	37.29 ±1.04[b]	8	
Khabari	45.32 ±0.63[a]	6	
Colour			NS
Black	40.78±0.66	27	
Brown	34.57±0.73	8	
Mixed	37.94±0.81	8	
Age			***
1Year	34.86 ±0.48[c]	13	
2 Year	36.08 ±0.30[c]	12	
3 Year	41.64 ±0.53[b]	15	
4 Year	46.46 ±0.96[a]	3	

Note: **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.

Body Length of buck

The overall body length of buck from one to four year was 79.01±0.35 cm. The various non- genetic factors affected the body length of buck in Salyan district. The various factors affecting the body length of bucks are presented in the Table(2). The acute shortage of genetically superior buck throughout the country is one of the major constraints of goat production in Nepal. Existing haphazard breeding system may lead to the extinction of the genetic potential of goats which requires selection of superior buck. During selection of buck attention should be given on the age, growth rate, body weight and soundness of the sexual organs and morphometric traits. In such case, body length and heart girth may be used as good reliable predictors to assess live weight (Islam *et al*., 1991).

Table 2. Least squares means for body length (cm) measurements of the bucks in Salyan district, Nepal, 2016/17

Factors	LS±SE	NO	Significant Level
Overall	79.01 ±0.33	43	
Altitude			NS
LA	78.77±0.35	17	
MA	73.46±0.33	14	
HA	75.58±0.35	12	
Breed			NS
Khari	70.28±0.40	29	
Khapari	79.43±0.38	8	
Khabari	72.28±0.45	6	
Colour			NS
Black	74.8±0.48	27	
Brown	79.07±0.53	8	
Mixed	75.05±0.58	8	
Age			***
1Year	63.60 ±0.33[c]	13	
2 Year	70.89 ±0.38[b]	12	
3 Year	79.54 ±0.32[a]	15	
4 Year	81.39 ±1.80[a]	3	

Note: ***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 are the numbers of observations.

Heart girth of buck

The overall heart girth of one to four years age buck was 76.37±1.45 cm. The various factors affecting the heart girth of buck are presented in Table (3). The acute shortage of genetically superior buck throughout the country is one of the major constraint of goat production in Nepal. Existing haphazard breeding system may lead to the extinction of the genetic potential of goats which requires selection of superior buck. During selection of buck attention should be given on the age, growth rate, body weight and soundness of the sexual organs and morphometric traits. In such case, body length and heart girth may be used as good reliable predictors to assess live weight (Islam *et al*., 1991). The present investigation was designed to obtain some basic morphometric information and to relate body weight with different body measurements of goats.

Table 3. Least square means for heart girth (cm) of buck in Salyan district, Nepal, 2016/17

Factors	LS±SE	NO	Significant Level
Overall	77.57 ±1.65	43	
Altitude			NS
LA	78.30.±2.28	17	
MA	77.19±2.20	14	

HA	77.24±2.29	12	
Breed			*
Khari	77.86 ±0.25[b]	29	
Khapari	80.46 ±0.48[a]	8	
Khabari	81.35 ±0.27[a]	6	
Colour			NS
Black	77.97±0.30	27	
Brown	75.07±0.33	8	
Mixed	77.66±0.35	8	
Age			**
1Year	68.65 ±2.23[c]	13	
2 Year	76.12 ±2.48[b]	12	
3 Year	81.55 ±2.51[a]	15	
4 Year	82.95 ±1.67[a]	3	

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

Buck wither height

The average wither height from one to four year old buck was 70.23±2.14 cm in this study. The various factors affecting the wither height from one to four year old bucks are presented in the Table(4). During selection of buck attention should be given on the age, growth rate, body weight and soundness of the sexual organs and morphometric traits. In such case, body length, wither height and heart girth may be used as good reliable predictors to assess live weight (Islam *et al*., 1991). The present investigation was designed to obtain some basic morphometric information and to relate body weight with different body measurements of goats.

Table 4. Least squares means for wither height (cm) of bucks at Salyana district, Nepal, 2015/16

Factors	LS±SE	NO	Significant Level
Overall	70.23 ±2.14	43	
Altitude			NS
LA	71.67±0.53	17	
MA	71.47±0.68	14	
HA	72.99±0.96	12	
Breed			**
Khari	71.51 ±0.83[b]	29	
Khapari	78.44 ±1.52[a]	8	
Khabari	74.19 ±0.88[ab]	6	
Colour			NS
Black	74.32±2.43	27	
Brown	72.72±1.09	8	
Mixed	69.11±1.21	8	
Age			NS
1Year	63.65±0.68	13	
2 Year	71.79±0.76	12	
3 Year	72.20±0.73	15	
4 Year	78.58±1.37	3	

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

Scrotal circumferences of buck

The overall average scrotal circumference of bucks (1-4 years) were 25.33±0.61 cm as mentioned in Table (5). Testicular sizes of animals are important for identification of those with adequate sperm production. Abba *et al*. (2015) observed scrotal circumference (17.00 –21.80) cm in Nigerian goats.Bezerra*et al*. (2009) also reported scrotal circumference of Boers goats on average 7.9 ± 0.8 to 25.7 ± 2 cm in Brazil. This is the maximum dimension around the pendulous scrotum after pushing the testes firmly into the scrotum (Akpa*et al*., 2010). Raji*et al*. (2008) reported 23.17cm for Red Sokoto bucks at 2 years of age. These are higher than that of the present study at similar age group. Higher results had also been reported by Keith *et al.* (2009) and Mekasha*et al*. (2008). However, similar to what is obtained in the present study was the results of Ugwu (2009) who reported 17.25 ± 0.76 cm in west African dwarf. The variability may be due to breed difference, contemporary group level, age, weight and height of bucks (Bourdon and Brinks, 1986).Kabiraj*et al*.(2011) also reported that Scrotal Circumference for 0.5 to 1.0,1.5 to 2.0 and 2.5 to 3.0 years were 17.50±0.65, 21.38±0.43 and 22.88±0.66 respectively. These values were higher than those obtained in this current study. This is probably as a result of breed difference, differences in the age and number of bucks, dam's age at first breeding and rate of rebreeding as well as the general body size of the bucks. The SC was measured according to the method of Coulter and Foote (1979). The testes were first retracted into the lower part of the scrotum for measurement of the SC. In order to prevent the two testes from separation, the thumb and finger were placed on

the sides rather than the front or back of the scrotum. Then a flexible measuring tape was looped and placed around the greatest diameter of the scrotum and pulled so that the tape was firmly in contact with the entire circumference. The scrotal circumference is important traits considering in context of breeding of bucks.

Table 5. Least square means of Scrotal circumference (cm) of buck in Salyan district, Nepal, 2016/17

Factors	LS±SE	NO	Significant Level
Overall	25.33 ±0.61	43	
Altitude			NS
LA	24.91±2.43	17	
MA	23.41±2.36	14	
HA	24.81±2.43	12	
Breed			NS
Khari	24.13±1.11	29	
Khapari	23.19±2.05	8	
Khabari	25.73±1.24	6	
Colour			NS
Black	24.66±1.32	27	
Brown	26.09±1.44	8	
Mixed	23.39±1.60	8	
Age			NS
1Year	22.63±0.93	13	
2 Year	24.33±1.90	12	
3 Year	25.14±1.04	15	
4 Year	25.45±1.06	3	

Note: NS-non significant, LS mean- Least square mean, LSD-Least significant difference, SE- Standard error of mean. N0 are the number of observations.

Age of First service of buck

The overall age of buck during first service at Salyan district is 332.25±1.09 days. Male goats up to 12 months of age are sometimes referred to as "buckling." Adult male goats can weigh anywhere between 100 to 350 pounds, depending on their breed, health and nutritional status. Although they can come into puberty and breed does as early at 4 months of age, waiting until a buck is a year of age to start using him for breeding is best. The number of does a buck can breed during the breeding season is often referred to as "Buck Power" (Noble, 2004).The sexual behavior of goats is an important factor for flock breeding efficiency and productivity in goat farming. Male fertility is a vital issue because numerous does are generally mated to a single buck. On the other hand, if sexual behaviors are expressed and semen is collected at earlier ages, these could be used in breeding programs to shorten the generation interval. Therefore, evaluation of male fertility using a serving capacity test prior to mating is good practice to reach breeding success. In goat bucks, courting (latency and amount of courting anogenital sniffing, vocalization, nudging, and flehmen) and copulatory (mounting and ejaculation) behaviors are evaluated using a sexual performance test that is part of a serving capacity test (Darwish and Mahboub 2011).The various factors affecting age of first service of buck are presented in Table(6).

Table 6. Least square means for Age (days) of first service of Buck at Salyan district, Nepal, 2016/17

Factors	LS±SE	NO	Significant Level
Overall	332.25 ±1.09	43	
Altitude			NS
LA	321.90±1.44	17	
MA	334.80±1.39	14	
HA	344.54±1.49	12	
Breed			NS
Khari	306.49±1.67	29	
Khapari	361.89±0.30	8	
Khabari	340.85±1.85	6	
Colour			NS
Black	346.98±1.98	27	
Brown	307.71±2.13	8	
Mixed	349.19±2.38	8	
Age			NS
1Year	316.84±1.39	13	
2 Year	324.15±1.57	12	
3 Year	356.71±1.67	15	
4 Year	350.02±0.27	3	

Note: NS-non significant, LS mean- Least square mean, LSD-Least significant difference, SE- Standard error of mean. NO are the numbers of observations.

IV. Discussion

This study was designed to characterize and evaluate the productive and reproductive performance of hill goat buck reared under farmers' condition in Salyan district of Nepal during December, 2016 to August 2017. The other objectives were to study the effect of non-genetic factors like altitude, colour, age, sex, parity etc in relation to the existing goat production system. There were three recognized breeds Khari, Khapari (Khari*Jamunapari) and Khabari (Khari*Barbari). However, Chyangra, Boers and Terai crosses were also observed in a few numbers. The data of 43 bucks were collected from different altitudes of Salyan districts. Farmers and technicians claimed the selected goats of being pure Khari, (Khari and Jamunapari) 50% cross breed and (Khari and Barbari) 50% cross breed. The bucks were also found in cross type genetically. However, characterization of such breeds at molecular level was not carried at Salyan district. So, it could not be understood so far their DNA level.

Morphological attributes, productive, and reproductive performance were collected based on field monitoring and measurements. Least square analysis was performed using Harvey (1990) computer software package. Information on goat production systems were collected by employing a semi-structured questionnaire and analyzed using SPSS.

The data's of bucks were collected from (1-4) years age.The overall mean body weights of bucks were 37.56±0.31 kg. Body weight of buck differ significantly ($P<0.001$) within ages and also differ significantly ($P<0.01$) within breed. Khabari buck body weight (45.32±0.63 kg) was significantly higher ($P<0.01$) than that of Khari buck (35.68±0.55 kg) and Khapari (37.29±1.04 kg) bucks.

The mean age of first service of buck was 332.25±1.09 daysThe overall mean for wither height of bucks were 70.23±2.14 cm. Wither height of buck differed significantly ($P<0.01$) within breed. The overall mean for body length of bucks were 79.01±0.33 cm. Body length of bucks differed significantly ($P<0.001$) with respect to ages. The overall mean for heart girth of buck were 76.37±1.45 cm. Heart girth of buck differed significantly ($P<0.01$) with respect to ages, and also significant ($P<0.05$) within breed. The overall mean for scrotal circumference of bucks were 25.33±0.61 cm. Goat farming was practiced as a subsistence occupation with three distinct systems of feeding i.e. extensive grazing, stall feeding, and grazing plus stall feeding supplementing little maize grains and flour as per availability. Majority of the farmers depended on the community forest as well as on their own farmland for collecting fodder and forages. Major problems of goat farming in Salyan district were occurrence of epidemic disease, lack of veterinary and technical advice, and attack of wild animal.The selection of the best performance of bucks could be done to obtain higher weight and production of offspring at later stages. This result could be attributed to superior genotype along with better management practices followed by the farmers in Salyan district.

V. Conclusion

The selection of the best performance of bucks could be done to obtain higher weight and production of offspring at later stages This result could be attributed to superior genotype along with better management practices followed by the farmers in Salyan district.

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