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Original Research

Morphological Characterization and Reproductive Performance of Indigenous Goats of Rayalaseema Region of Andhra Pradesh

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Abstract

Data on phenotypic characteristics of 1081 female and 340 male goats at milk teeth, 2, 4, 6 and 8-teeth of age and reproductive performance of 316 does and 83 bucks reared under field conditions in Rayalaseema region (Chittoor, YSR Kadapa, Anantapur and Kurnool) of Andhra Pradesh were utilized for the present study. Predominant coat colour was black (37.72%) followed by an admixture of black and white (25.05%) and black, white and brown (9.57%). Pendulous ears, beard and wattles were noticed in 91.27, 3.94 and 28.50 per cent of goats. Head profile was straight in 54.89% of goats studied. Overall least squares mean for age at first mating in males and females, age at first kidding, service period and kidding percentages were 406.04±111.48 and 262.97±3.42, 412.96±3.42, 76.71±1.19 days and 130.95±35.67 per cent, respectively.

Keywords: Indigenous Goats, Morphological Traits and Reproductive Performance

Introduction

India is bestowed with rich genetic resources with 34 recognised goat breeds (NBAGR, 2020) and ranked first in world with goat population of 148.88 million (Livestock Census, 2019). Andhra Pradesh possess about 64.27 lakhs goats (ahd.aponline.gov.in). Indigenous goats are valuable genetic resource because of their adaptation to harsh climatic conditions and resistance to diseases and parasites. Breed characterization has traditionally been recognized as the first approach for sustainable use of animal genetic resources. Although, indigenous goats are extensively reared, little information is available on their habitat, distribution, phenotypic characters and performance. Hence, the present study was conducted to identify the phenotypic attributes and reproductive performance of indigenous goats under field conditions.

Materials and Methods

The goat population of Rayalaseema region is highest in Andhra Pradesh, hence Rayalaseema is selected as study area. Data was recorded on indigenous goats spread over 40 villages in 20 mandals of four districts of Rayalaseema. From each districts five mandals were selected at random and from each mandal two villages are randomly chosen. Flock size of study area varied from 30 to 40 goats with one or two or none adult males from the flocks. Data on phenotypic attributes of 1249 does and 83 bucks at milk teeth, 2, 4, 6 and 8-teeth of age and reproductive performance of 316 does were collected from farmers flocks in Chittoor, YSR Kadapa, Anantapur and Kurnool districts of Rayalaseema region of Andhra Pradesh from November, 2017 to July, 2018. Data on phenotypic attributes like coat color (single, bi or tri colored), head profile (straight, convex or slightly convex), ear profile (pendulous or horizontal), wattles (present or absent), beard (present or absent), horns (present or absent), horn shape (straight or curved) and orientation (backwards and upwards, backwards, upwards and outwards) were recorded as per the proforma given by National Bureau of Animal Genetic Resources, Karnal by visual observation of the animal. Data on reproductive performance *viz.*, age at first mating, age at first kidding, service period and kidding percentage were recorded on does present in the flock by interviewing the owner.

Data were grouped according to district and sex within age groups and subjected to least squares analysis (Harvey, 1987) by using the following statistical model-

$$Y_{ijk} = \mu + D_i + S_j + e_{ijk}$$

Where,

Y_{ijk} = the measurement on k^{th} animal belonging to j^{th} sex and i^{th} district.
μ = Overall mean
D_i = Effect of i^{th} district (i=1 to 4)
S_j = Effect of j^{th} sex e_{ijk}= random error.

Duncan's multiple range tests as modified by Kramer (1957) was employed to make pair wise comparisons of least-squares means.

Results and Discussion

The results with respect to phenotypic characteristics and reproductive performance of indigenous goats of Rayalaseema region of Andhra Pradesh maintained by farmers are presented in the following Tables 1 to 3.

Morphological Characteristics

Colour Pattern

Seven variants in coat colour were seen in the indigenous goats of Rayalaseema region of Andhra Pradesh (Table 1). The predominant colour pattern observed was single colour (49.83%) followed by bi colour (40.6%) and multicolour of black, brown and white (9.57%). The single coat colour pattern consists of mainly Black (37.72%) followed by brown (8.52%) and white (3.59%).

Table 1: Color patterns and morphological characteristics in Indigenous goats of Rayalaseema Region of Andhra Pradesh

Coat Colour patterns		Females		Males		Pooled	
		N	%	n	%	n	%
Single colour	Black	405	37.47	131	38.53	536	37.72
	White	38	3.52	13	3.82	51	3.59
	Brown	98	9.07	23	6.76	121	8.52
Bicolour	Black and white	270	24.98	86	25.3	356	25.05
	Black and brown	86	7.96	31	9.12	117	8.23
	Brown and white	89	8.23	15	4.41	104	7.32
Multicolour	Black, white and brown	95	8.79	41	12.06	136	9.57
Total		1081	100	340	100	1421	100
HEAD PROFILE							
Straight		625	57.82	155	45.59	780	54.89
Convex		198	18.32	87	25.59	285	20.06
Slightly convex		258	23.86	98	28.82	356	25.05
EARS							
Erect		56	5.18	9	2.65	65	4.57
Pendulous		977	90.38	320	94.12	1297	91.27
Horizontal		48	4.44	11	3.23	59	4.15
BEARD							
Present		39	11.47	17	1.57	56	3.94
Absent		301	88.53	1064	98.43	1365	96.06
WATTLES							
Present		296	27.38	109	32.06	405	28.5
Absent		785	72.62	231	67.94	1016	71.5
HORNS							
Horned		969	89.18	285	83.82	1249	87.9
Polled		112	10.82	55	16.18	172	12.1
HORN ORIENTATION							
Backward		327	33.75	96	33.68	423	33.87
Backward and downward		489	50.46	155	54.39	644	51.56
Backward and downward and outward		41	4.23	14	4.91	55	4.4
Backward and forward		78	8.04	16	5.62	94	7.37
Upward		34	3.51	4	1.4	38	2.8

Table 2: Horn length in indigenous goats of Rayalaseema region of Andhra Pradesh

Age	Small (< 15 cm)		Medium (15 to 25 cm)		Large (> 25 cm)		Total	
	N	%	N	%	N	%	N	%
Overall	969	77.6	255	20.42	25	2	1249	100
MALES								
Milk teeth	180	63.16	10	3.51	0	0	190	66.67
Two teeth	28	9.82	12	4.21	3	1.05	43	15.09
Four teeth	8	2.8	14	4.91	0	0	22	7.72
Six teeth	1	0.35	8	2.8	13	4.56	22	7.72
Full mouth	2	0.7	4	1.4	2	0.7	8	2.8
Total	219	76.83	48	16.84	18	6.32	285	100
FEMALES								
Milk teeth	292	30.29	2	0.21	0	0	294	30.5
Two teeth	92	9.54	9	0.93	0	0	101	10.48
Four teeth	122	12.66	24	2.49	0	0	146	15.15
Six teeth	127	13.17	50	5.19	0	0	177	18.36
Full mouth	117	12.14	122	12.66	7	0.73	246	25.52
Total	750	77.8	207	21.47	7	0.73	964	100

Table 3: Reproductive Performance (in days) of Indigenous goats of Rayalaseema region of Andhra Pradesh

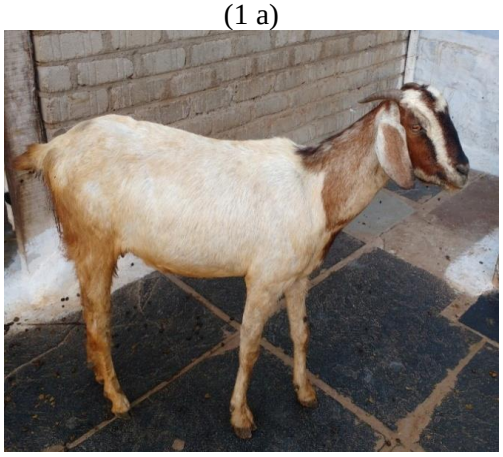
Factor	Reproductive Traits									
	Age at first mating				N	Age at first kidding	N	Service period	N	Kidding percentage
	n	Females	n	Males						
Overall	316	262.97±3.42	83	406.04±111.48	316	412.96±3.42	316	76.71±1.19	51	130.95±35.67
Districts										
Chittoor	85	271.09^{a}±6.50	11	426.82^{a}±287.38	85	421.09^{a}±6.50	85	88.13^{c}±2.25	15	113.16^{a}±64.51
YSRKadapa	58	248.28^{a}±7.87	20	425.25^{a}±213.12	58	398.22^{a}±7.87	58	78.83^{b}±2.73	14	140.28^{a}±66.77
Anantapur	85	268.76^{a}±6.50	23	386.74^{a}±198.74	85	418.76^{a}±6.50	85	72.25^{ab}±2.25	13	133.50^{a}±69.29
Kurnool	88	263.76^{a}±6.84	29	385.34^{a}±222.95	88	413.76^{a}±6.84	88	67.64^{a}±2.37	9	136.87^{a}±71.34

Whereas, the bi-colour pattern had predominant black and white (25.05%) followed by black and brown (8.23%) and brown and white (7.32%) followed by tri-colour pattern of black, brown and white (9.57%). Combination of two colours (black and white, brown and white, black and brown) was found in 40.6 per cent of the goats (Fig.1. a,b and c).

In the two districts *viz*., YSR Kadapa (65.10%) and Kurnool (40.82%), majority of the goats were black coloured. A large proportion of black coloured goats are also reported in Kathewadi breed (Mandakmale *et al*., 2016) and indigenous goats of Andhra Pradesh (Vinod and Punyakumari, 2019). Multicoloured pattern of black, white and brown (9.57 %) noticed in indigenous goats of Andhra Pradesh coincided with the findings of Manzi *et al*., 2011 in local goats of Rwanda. Among four districts studied, white colour pattern was less prevalent compared to black, brown and combinations of colours which were in close agreement with the findings of Koyal and Banerjee (2016).

(1 a)

(1 b)



(1 c)

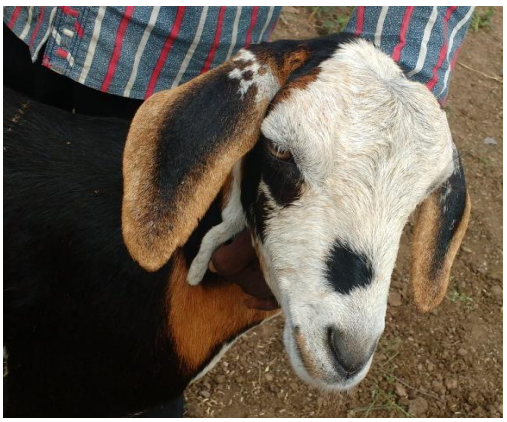
(1d)

Figure 1: Color pattern of indigenous goats under field condition(a,b- single, c- bi and d- multi color)

Head Profile and Ear Profile

Head profile observed was straight (54.89%) and almost equal proportion of animals had slightly convex head (25.05%) and convex head (20.06%) in local goats of Andhra Pradesh (Fig.2 a,b and c). Convex shaped head (22.8%) similar to present study also recorded in Mahabubnagar goats (Reddy, 2004), local goats of Rwanda (Manzi *et al*., 2011), Berari goats (Kuralkar *et al*., 2013) and Kathewadi goats of Maharashtra (Mandakmale *et al.*, 2016). Predominant ear pattern of pendulous ears (91.27%) in the present study coincided with the reports in KanniAdu goats of Tamilnadu (Thiruvenkadan *et al*., 2000) and Kathewadi goats of Maharashtra (Mandakmale *et al.*, 2016).

(2 a) Stright



(2 b) Slightly convex

(2 c) Convex

Figure 2(a, b and c): Head profile of Indigenous goats

Beard

Most of the indigenous goats under study (96.06%) were devoid of beard. Among the animals with beard, males were predominant (11.47%) (Fig.3a and b). Reddy (2004) in Mahabubnagar goats, Deokar *et al*. (2005) in Sangamneri goats also observed low proportion of animals with beard.

(3 a)

(3 b)

Figure 3 (a and b): Beard in buck and does

Wattles

In the present study, 28.50% of the studied population have wattles (Fig. 4). Nearly equal per cent of males and females possessed wattles which coincided with the findings of Reddy (2004) in Mahabubnagar goats and Deokar *et al*. (2005) in Sangamneri goats.

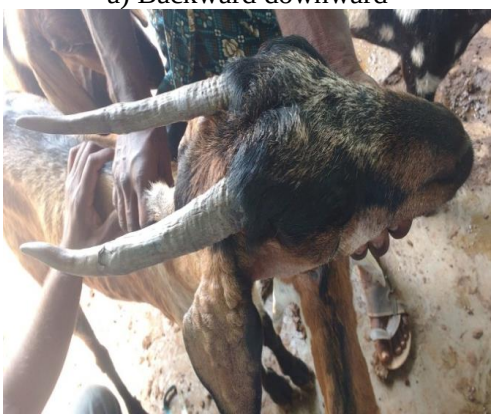
Figure 4: Presence of wattles in Indigenous goats under field condition

Horns

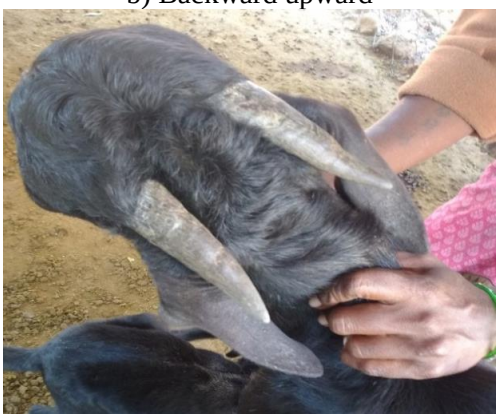
About 87.9% of indigenous goats of Andhra Pradesh had horns and lesser proportion of animals were polled (12.10%). In majority of horned animals, horns were oriented to backward and down ward (51.56%) and backward (33.87%). In majority of the horned animals horn length is less than 15 cm (63.46%), while 20.42% animals possessed medium sized horns (15-25) (Fig. 5a,b,c and d). Majority of males (83.82 %) and females (89.18 %) were horned in the present study confirmed the findings of Thiruvenkadan *et al*. (2000) in KanniAdu, Reddy (2004) in Mahabubnagar goats and Deokar *et al*. (2006) in Osmanabadi goats and Vinod and Punyakumari (2019) in indigenous goats of Andhra Pradesh.

a) Backward downward

b) Backward upward



c) Backward and forward



d) Backward and downward and outward

Figure 5 (a, b, c and d): Horn length and orientation of indigenous goats under field condition

Reproductive Performance

Age at First Mating (AFM) in Females

The first oestrus in females is the indicator that animal has reached sexual maturity. The overall least squares mean for age at first mating in females was 262.97±3.42 days (8.7 months) and varied from 248.28±7.87 to 271.09±6.50 days. The goat flocks in YSR Kadapa district matured at an early age (248.28±6.50 days) compared to flocks of other districts which might be due to the fact that the goats gained mature body weights by to 8 to 9 months of age.

These findings were in concurrence with Egwu *et al*. (1995) in Sahel (8 months), Ravimurugan *et al*. (2009) in PallaiAdu (8.45±19.33 months), Halim *et al*. (2011) in Black Bengal (234.16±6.54 days). However, the local goats in this study have better age at maturity than other breeds reported by Mia *et al*. (1996) in Barbari (11.52±0.37 months), Barbari X Black Bengal (10.19±0.65 months), Anglo Nubian (14.87±0.96 months), Ebozoje *et al*. (1998) in West African Dwarf goat (16.08 months), Chowdhury *et al*. (2002) in Black Bengal (10.98±0.57 months), Kataktalware *et al*. (2004) in cross bred goats of NDRI (487.13±6.87 days), Thiruvenkadan and Karunanithi (2006) in Salem Black (9.7±0.20 months), Maroof *et al*. (2007) in Beetal (386.29 days), Sharma *et al*. (2010) in Sirohi goats (519.26±9.89 days), Taye *et al.* (2013) in goats of Ethiopia (407.9 days), Bhagat *et al*. (2016a) in

Konkankanyal (406.76±4.09 days), Bhagat *et al*. (2016b) in KonkanKanyal goats (579.68±4.10 days), who, reported higher mean values for age at first mating (AFM) in females.

The means in the present study were higher than the values reported in Red Sokoto and West African Dwarf (Egwu *et al*., 1995), Black Bengal (Mia *et al*., 1996), Khari (Khanal *et al*., 2005) and Black Bengal (Giri *et al*., 2009 and Halim *et al*., 2011) females.

Age at First Kidding (AFK)

Age at first kidding ranged from 13 to 14 months (398 to 421 days) in the indigenous goats of Andhra Pradesh with mean age at first kidding as 412.96±3.42 days. AFK in YSR Kadapa district recorded lowest value as the AFM in that district is the lowest.

The age at first kidding obtained in the present study corroborated with the findings of Galina *et al*. (1995), Boichard *et al*. (1989), Silva *et al*. (1998), Chowdhury *et al*. (2002), Song *et al*. (2006), Zeshmarani *et al*. (2007), Ravimurugan *et al*. (2009) in Alpine and Saanen, Mexican dairy goats, Alpine dairy goats, Black Bengal, Korean native goats, PallaiAdu, respectively.

Age at First Mating (AFM) in Males

The district had no significant influence on age at first mating in males and the values varied from 386.34±222.95 to 426.82±287.38 days with an overall mean of 406.04±111.48 days.

Kidding Percentage

The overall least squares mean kidding percentage was 130.95±35.67 with a range of means from 113.16±64.51 to 140.28±66.77 among four districts. The means noticed in the present study was well coincided with the previous findings of Singh *et al*. (1996) in Barbari (149) and nondescript local goats (120).

Service Period

The overall least squares mean for service period was 76.71±1.19 days and varied from 67.64±2.37 (Kurnool) to 88.13±2.25 (Chittoor) days among four districts. The means recorded in the present study were within the range of means reported by Mia *et al*. (1996) in Black Bengal (86.00±8.73) and Halim *et al*. (2011) in Black Bengal (67.00±4.97). However, the local goats of Andhra Pradesh have better service period than other breeds like Barbari (Mia *et al*., 1996), Anglo Nubian (Mia *et al*., 1996), local goats of Gujarat (Singh *et al*., 2009) and Sirohi (Sharma *et al*., 2010).

Conclusion

The indigenous goats of Rayalaseema region *viz.*, Chittoor, YSR Kadapa, Anantapur and Kurnool in Andhra Pradesh state were similar in morphological characters. Predominant coat colour was black, head profile was straight, majority of population was horned and with pendulous ears. Bearded and wattles are present in lesser proportion of animals. Majority of the phenotypic characteristics observed in the indigenous goats are similar to some of the established indigenous goat breeds such as Kanniadu, Osmanabadi, Sangamneri and Kathewadi goats. Age at first mating, age at first kidding and service period is lower than the reproductive performance of other established breeds *viz.*, Barbariand and Sirohi. The present study has given fair view about the breeding and management strategies that are being followed in the region for the improvement of indigenous goats.

Conflict of Interests

There is no conflict of interest.

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