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Rearing Practices and Performance Attributes of Assam Hill Goat in Assam, India

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ABSTRACT

The study was conducted in the hill district of Assam to collect information on existing management practices of Assam hill (AH) goat and assess their productive and reproductive performances under field conditions. The data were collected through field survey, PRA, focus group discussion, pre-tested interview schedule and records obtained through individual farm visits. The study showed that 94 per cent of the goat farmers didn't have knowledge on availability of different goat breeds. Most of the tribal farmers didn't maintain breeding buck (75.5%) and used natural service method (100%). A large share of the farmers reared their goat in open grazing/tethering under semi intensive system (89%) followed by semi stall feeding (11%) with provision of temporary house (84%) made of locally available materials (81%). The study on feeding practices showed that 94.5 per cent farmers didn't cultivate green fodder and 65.5 per cent farmers didn't provide concentrate feed. The study revealed that 92.5 per cent of the farmers don't vaccinate their goats and while only 10.0, 7.0 and 11.0 per cent used antibiotics, deworming and ectoparasitic drugs, respectively. Tick/mange/mite infestation, diarrhoea, PPR, *or* goat pox and mastitis were reported by 71, 78, 61.5, 47, 30 and 13 per cent of the goat farmers, respectively. Most of the farmers had flock size of 5-10 (66%) with average litter size of 1.69. The mean body weight gain of Assam Hill goat at birth, 3, 6, 9 and 12 months were 1.61±0.03, 4.62±0.09, 8.48±0.08, 11.75±0.08 and 15.24±0.14 kg, respectively. The mean age at puberty, sexual maturity, length of estrus cycle, first kidding, post-partum estrus period, gestation length were 276.19±1.19,298.39±0.94, 20.97±0.03, 449.56±0.85, 64.78±0.71, 247.73±0.95 and 147.91±0.16 days, respectively. No significant differences were observed in productive and reproductive performances ($p>0.05$) among the districts.

Key Words: Artificial Insemination, Breed, Disease, Goat, Puberty, Survey

INTRODUCTION

Goat produces meat, milk, hide, fibre and manure. It plays an incredibly significant role for upliftment and rural economy of small, landless and weaker section of the society including women folk (Ravikumar *et al*, 2019). It has the widest range of ability to adopt in diverse agro-climatic regions and capacity to convert poor quality feed into a valuable human food (Doley *et al*, 2018). Among the recognized goat breeds in India, Assam hill goat is considered as one of the most prolific, small size, meat type goat breed with high fertility and fecundity (Deori *et al*, 2016). The goat breed is native to the hill agro-climatic region of Assam and adjoining areas of Meghalaya. The Assam hill goat is very popular among the rural farmers due to its ability to adopt wide range of environmental conditions, lower disease incidence and better meat quality.

The hill agro-climatic region of Assam comprises of Karbi Anglong (now divided into West Karbi Anglong) and Dima Hasao district accounts for 19.4 per cent of the total geographical area in

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Table 1. Brief profile of the districts.

Sr. No.	Particular	Karbi Anglong	Dima Hasao
1.	Geographic location	25º33′-26º35′N latitudes and 92º10′-93º50′E longitudes	24º58-25º32′N latitude and 92º27′-93º43′E longitudes
2.	Average rainfall	1572.2 mm	1145 mm
3.	Altitude (Highest)	1360 m	1868 m
4.	Temperature	6ºC-32ºC	6.02ºC-33.06ºC
5.	Total geographical area	10,438 sq. Km (undivided)	48,90 sq. Km
6.	Forest cover	7939 sq. Km	4528.87 sq. Km

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state of Assam. Demographically, majority of the population in the district Karbi Anglong and Dima Hasao are inhabited by different tribes, constituting about 56.3 per cent and 70.9 per cent, respectively. As per 20th livestock census (2019), Assam has total goat population of 43.15Lakh out of which the hill district contributes 10.17 per cent alone. The basic source of livelihood in the districts are agriculture and allied farming activities, which accounts for more than 85 per cent of the total population and 90 per cent of the tribal population residing in rural areas (Doley *et al*, 2022). Goat farming is considered as an age-old traditional practice along with other livestock enterprises which provides supplementary income and nutritional support (Haque *et al*, 2021). The goat farming practices in the district are still in infancy stage although it has huge potential for commercialization. Till today, no study has been conducted in respect to traditional goat farming pattern followed by the indigenous tribal farmers which is required to designing suitable scientific and policy intervention. Under the above circumstances the present study was conducted with the objectives to know about traditional goat farming practices followed by tribal goat farmers and to study productive and reproductive performances attributes of AH goat in field condition

MATERIALS AND METHODS

The study was conducted in Karbi Anglong, and Dima Hasao districts of Assam during April 2015 to June 2021 among the schedule tribe families. From each of the selected district, two community development blocks were selected *viz.,* Lumbajong and Bokajan block from Karbi Anglong district and New Sangbar and Diyung Valley development block from Dima Hasao randomly making a total of four blocks. From each selected block five villages were selected at random. From each village 10tribal goat farmers were selected purposefully making total of 200 tribal farmers from two districts. The various field data pertaining to goat farming pattern, productive and reproductive performances of Assam Hill goat were collected through field survey, Participatory Rural Appraisal (PRA), focus group discussion, farm visit along with pre-tested questionnaire. The data on productive and reproductive attributes were collected from performance records obtained from farmers after proper marking of the animals under the study area. The prior informed consent was also obtained from the participating farmers before collection of different information.

Farmers rearing a minimum of three does of 3-5 months age were selected thereby forming 50-unit size in each block. During the period all together 552 progenies from two hundred dams from two kidding's were included to assess the productive and reproductive performances. All the animals were maintained under routine traditional management system with no history of crossbreeding. The statistical analysis of the data was done as per standard procedures (Snedecor and Cochran, 1994).

Table 2. Breeding practices in goat followed by tribal farmers under field condition.

Breeding practices	Category	Hill zone area (n=200)				Pooled (n=200)	
		Karbi Anglong (n=100)		Dima Hasao (n=100)			
		F	%	F	%	F	%
Knowledge on diverse types of goat breed	Yes	8	8	4	4	12	6.00
	No	92	92	96	96	188	94.00
Knowledge on selection of goat	Yes	68	68	56	56	124	62.00
	No	32	32	44	44	76	38.00
Rearing of Buck for breeding purpose	Reared	22	22	27	27	49	24.50
	Not reared	78	78	73	73	151	75.50
Service time of Doe	Once immediately after onset of heat	24	24	28	28	52	26.00
	Twice after 12 hr interval	18	18	15	15	33	16.50
	Not fixed	58	58	57	57	115	57.50
Method of service to Doe	Natural	100	100	100	100	200	100.00
	Artificial insemination	0	0	0	0	0	0.00
Knowledge on signs of heat in Doe	Yes	98	98	97	97	195	97.50
	No	2	2	3	3	5	2.50

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RESULTS AND DISCUSSION

Breeds and breeding practices

Most of the goat farmers in the districts have limited knowledge on availability of different types of goat breeds (6%) (Table 2). This may be due to the reason that majority of the farmers in the study area have low level of education, socio-economic status and minimal exposure to modern farming practices. However, majority of the respondents showed basic knowledge on selection suitable progeny of goat for breeding (62%) and only 25.5 per cent respondent kept buck for breeding purposes (Table 2).57.5 per cent of the farmers were unaware of appropriate time for service (Table 2) implying for need of extension activities for scientific goat rearing. Khadda *et al* (2017) reported similar observations and need of farmers' awareness programme among goat farmers. All the farmers follow natural method of breeding (100%) and 97.5 per cent of the farmer has the knowledge on sign of heat in doe. The use of natural method of breeding may be because artificial insemination (AI) required high skill manpower and not readily available in the farmers doorstep. Furthermore, the AI centres were located far away from the farmhouse and involve labour and transportation cost of doe.

Housing practices

The study on housing practices (Table 3) revealed that majority of the goat farmers reared goat under semi-intensive with day time open grazing/tethering (89%) without provision of stall feeding followed by semi stall feeding (11%) and

Table 3. Housing practices of tribal farmers under field condition.

Housing practices	Category	Hill zone area (n=200)				Pooled (n=200)	
		Karbi Anglong (n=100)		Dima Hasao (n=100)			
		F	%	F	%	F	%
System of rearing	(a) Open grazing/Tethering	86	86	92	92	178	89.00
	(b) Semi-stall feeding	14	14	8	8	22	11.00
	(c) Stall feeding	0	0	0	0	0	0.00
Location/ construction of the house	Near dwelling (<10 m)	56	56	65	65	121	60.5
	Away from dwellings	36	36	31	31	67	33.5
	No housing/Kept under open yard /under trees	08	08	04	04	14	6.00
Type of housing	Temporary	82	82	78	78	160	80.00
	Permanent	18	18	22	22	40	20.00
Floor structure	*Chang type*/Raised slatted floor	96	96	98	98	194	97.00
	Deep litter	04	04	02	02	6	3.00
Housing materials	Locally available materials	80	80	73	73	153	76.50
	Others	20	20	27	27	47	23.50
Provision of drinking water	Present	08	08	05	05	13	6.50
	Not present	92	92	95	95	187	93.50
Electricity facility	Present	03	03	06	06	9	4.50
	Not present	97	97	94	94	191	95.50
Cleaning practices	Daily	08	08	11	11	18	9.00
	Weekly	26	26	23	23	49	24.50
	>week	66	66	65	65	131	65.50

none kept under stall feeding system. This finding agrees with Khadda *et al (* 2017) who reported that 11.60 per cent farmers adopted semi-stall feeding while 99.60 per cent farmers followed grazing and none of the goat keeper kept under stall feeding. The study on different housing practices revealed that most of the farmers do not follow any scientific housing practices whether in terms of space requirements, site selection, height, drainage, waste disposal facility *etc.* This might be due to the reason that farmers were less aware about scientific housing practices and involvement of high cost, non-availability of raw materials for housing.

The housing structures mostly consist of locally available bamboo with wooden post with *Chang type/raised slatted floor* (97 %%) followed by deep litter (3%) with provision of wooden plunk, saw dust *etc* on the floor. In *Chang type* housing the floor is made up of slatted floor with bamboo splints (78%) followed by unusable leftover wooden plunk (22%). This might be due to the fact that the North Eastern part of India including the hill district of Assam has high degree of rainfall which compelled the farmers to build raised floor or *Chang type* of goat house. The average heights of the goat house are ranging from 5'-8' in *Chang type* and 4'-7' in case of deep litter housing. The roof of the house made of Galvanized Iron (GI) sheet (52%), plastic tarpaulin (18%) and thatch, rice straw, or some locally available materials (30%). Only, 6.5% of

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Table 4. Feeding practices.

Feeding practices	Category	Hill zone area (n=200)				Pooled (n=200)	
		Karbi Anglong (n=100)		Dima Hasao (n=100)			
		F	%	F	%	F	%
Cultivation of green fodder crops/tree	Cultivate	07	07	04	04	11	5.50
	Not cultivate	93	93	96	96	189	94.50
Concentrate feed	(a) Offered daily	01	01	0	0	1	0.50
	(b) Offered sometime	32	32	36	36	68	34.00
	(b) Not offered	67	67	64	64	131	65.50
Knowledge on green fodder cultivation	Yes	12	12	08	08	20	10.00
	No	88	88	92	92	180	90.00
Feed additives/ supplementation of multivitamin/mineral	Yes	08	08	04	04	12	6.00
	No	92	92	96	96	188	94.00
Provide drinking water	Yes	12	12	18	18	30	15.00
	No	88	88	82	82	170	85.00

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the farmers have provision of water and 95.5% of the farmers don't have electricity facility in the house. The cleaning practices of the goatry shed revealed that only 7 per cent of the farmers cleaned daily followed by weekly (24.5%) majority farmers cleaned their shed in more than one week period (65.5%). In a similar study in Indonesia, it was reported that majority of the farmers (97.92%) cleaned their goat house with a frequency of every day (14.89%), every three days (17.02%), once a week (40.43) and without fixed frequency by 27.66 per cent respondent (Rahadi *et al*, 2020).

Feeding practices

The study on feeding practices revealed that goats were mostly reared by browse in natural vegetation, pasture, hilly track and forest area that other ruminants usually do not consume. The farmers informed that usually in the morning around 7 to 8 am (during summer) and 8.30 am to 9.30 am (during winter) let loose/tethered their goats for entire day with occasional provision of drinking water. The cultivation practices on green fodder showed (Table 4) that majority of the farmers didn't undertook fodder cultivation for goat (94.50%) and 90 per cent of the farmers don't have knowledge on green fodder cultivation. The present finding is coincide with observation of Bhikya *et al* (2021). Only, 0.5 per cent of the farmers provide concentrate feed in daily basis. None of the farmers in the study area provide routinely balanced concentrate ration (95.50%) except occasional whole maize grain supplementation and common salt. In contrast to present findings, Gurjar *et al* (2009) and Khadda *et al* (2018) reported that majority of the farmers provided concentrate feed to goat. Regarding use of feed additives/multivitamin/mineral mixture revealed that 94 per cent of the farmers don't use during the entire production period. Study on provision of drinking water revealed that 85 per cent farmers do not provide drinking water routinely during day time except during kidding and emergency.

Table 5. Health care practices.

Health care practices	Category	Hill zone area (n=200)				Pooled (n=200)	
		Karbi Anglong (n=100)		Dima Hasao (n=100)			
		F	%	F	%	F	%
Vaccination to goat	Practiced	01	01	0	0	1	7.50
	Not practiced	99	99	100	100	199	92.50
Use of antibiotics	Used	8	8	12	12	20	10.00
	Not used	92	92	88	88	180	90.00
Deworming	Practiced	8	8	6	6	14	7.00
	Not practiced	92	92	94	94	186	93.00
Use of ectoparasitic drugs	Used	14	14	8	8	22	11.00
	Not used	86	86	92	92	178	89.00
Treatment of sick goat by Veterinarian/ para-vet	Yes	03	03	01	01	4	29.50
	No	97	97	99	99	196	70.50
Commonly encountered diseases/ailing							
Tick/Mange/mite and other skin infestation		78	78	64	64	142	71.00
Pestes des petits ruminants (PPR)		65	65	58	58	123	61.50
Orf		46	46	48	48	94	47.00
Goat pox		32	32	28	28	60	30.00
Mastitis		14	14	12	12	26	13.00

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Health care practices

The data (Table 5) indicated that 92.5 per cent of the farmers did not practices vaccination against any infectious viral and bacterial disease while only 10, 7 and 11 per cent used antibiotics, deworming and ectoparasitic drugs respectively. Tick/mange/mite infestation, diarrhoea, *Peste des petits ruminants* (PPR), sore mouth, goat pox and mastitis were reported by 71, 78, 61.50, 47, 30 and 13 per cent of the farmers, respectively. Incidence of different diseases such as diarrhoea, ectoparasitic infestation, pneumonia, pox *etc* were reported in Black Bengal goat in West Bengal (Nandi *et al*, 2011) in different age groups of goats. Regarding treatment of sick animals reveals that 70.50 per cent farmers treat their goat by their own with traditional practices and 29.50 per cent farmers through veterinarian and para-vets. This might be due to the reason that tribal farmers in the district are very rich and popular in traditional ethnoveterinary practices which are affordable and easily accessible. Majority of the farmers indicated more goat infestation with tick/mange/mite and other skin infestation in Karbi Anglong (78%) district than farmers of Dima Hasao district (64%) whereas less numbers with *orf* disease outbreak.

Purpose of rearing

The study on purpose of rearing of goats revealed that basic purpose of majority of farmers was to sell during emergency (58%) to meet sudden monetary needs followed by own used in rituals and socio-cultural activities (35%) and least farmers for direct consumption (7%). In a study, Kumar (2007) reported that 55.83, 42.50, 22.50, 16.67,12.50 and 10.83 per cent of the farmers sale their adult goat to fulfilled family needs including foods, social obligations, repayment of loan, unforeseen

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expenses like illness, purchase of seeds/fertilizers for crops and children education respectively.

Average flock size the farmers

A perusal of the data (Table 6) indicates that irrespective of the districts, 66 per cent of the farmers are small farmers with flock size of 5-10 followed by medium with flock size of 11-15 goats and rest 10 per cent farmers were large flock with flock size of >16 goat. In a similar study, an average flock size of 1-4 goat (56.3%) in West Bengal and up to 38 goats (90.80%) in Telangana was reported (Bhikya *et al*, 2021; Nandi *et al*, 2011)

Form of selling

The study revealed that 49 per cent of the farmers sale their stock at grower stage followed by sale of goat as fattener and castrated goat (30%) whereas 7 per cent as kid and 14 per cent as meat by the owner directly to consumer. In Rajasthan, 38.79, 23.08, 11.09, 5.62, 11.01 and 10.41 per cent farmers sale their produce at <3-m, 3-6 m, 6-12 m male, 6-12 m female, >12 m male and >12 m female, respectively (Kumar, 2007). In Karbi Anglong district, 12 per cent farmers directly involved in selling of goat meat in comparison to 14 per cent in Dima Hasao district as indicated in the Table 6.

Price of goat meat, kid, grower, castrated goat and adult female goat

Table 6 also reflects that average price of kid, grower and fattener/castrated goat was 2426.5, 3936.75 and 5350.5, respectively in the hill district. The average price of per kg goat meat (Chevon) was recorded to be Rs. 564.80 in the hill district.

Mode of selling

It was evident that 80.5 per cent of the farmers were selling their produce directly to middlemen followed by directly to consumer (14.5%) in the local market during festive season and rest 5 per cent directly to wholesaler occasionally. A study in Uttar Pradesh revealed that, 53 per cent farmers used farmer to butcher/trader channel for marketing goat in the village and sold their 44 per cent of surplus live goats and 70 per cent of the total trade of live goats through farmers-butcher/trader in village and weekly market (Kumar, 2007). It was reported that the middlemen directly visit to the villages in search of farmers produce and directly sell to them. The farmers also informed that although in doing so farmers can save labour, time and transportation cost. Moreover, as the market areas were located far way which also a factor that compelled the farmers to sell their produce at lower cost than actual market price.

Productive performances

The mean body weight gain of Assam Hill goat at birth, 3, 6, 9 and 12 m were recorded and shown (mean ± SE) in the Table 7. The mean body weight at birth was recorded 1.67±0.03 and 1.59±0.04 kg in Karbi Anglong and Dima Hasao district, respectively. No significant difference was observed in different growth performances ($p<0.05$) of AH goat in terms of body weight gain between the two district. In a similar observation, the average body weight of AH goat was recorded to be 1.24, 5.29, 8.03, 10.73 and 13.94 kg at birth, 3, 6, 9 and 12 months of age, respectively (Das *et al*, 2021). In another study, Doley *et al* (2017) recorded average body weight of 1.46, 4.68, 8.75, 11.97 and 15.32 kg at birth, 3, 6, 9 and 12 months of age respectively under field condition. These findings were in line with our observed data. Ravimurgan *et al* (2009) and Malau-Adauli *et al* (2004) observed birth weight of 1.80 kg and 1.3-1.4 kg, respectively.

Reproductive performances

Reproductive performance of goat is a major determinant of productivity and economic viability of commercial goat farm (Mellado *et al*, 2006). The different reproductive performance attributes such as age at puberty, sexual maturity, length of estrus cycle, duration of estrus period (hr), age at first kidding, post-partum estrus period, kidding interval and gestation length of Assam Hill goat were presented in the Table 4. A perusal of the Table 8 indicates that mean age at puberty, sexual

Table 6. Distribution of respondents according to marketing pattern of goat stock, kid and chevon.

Sr. No.	Particulars	Hill zone area (n=200)		
		Karbi Anglong (n=100)	Dima Hasao (n=100)	Pooled (n=200)
A.	Purpose of rearing			
1.	Own consumption	08(8.00)	06(6.00)	14 (7.00)
2.	For sale during emergency	54(54.00)	62(62.00)	116(58.00)
3.	Rituals and other socio-cultural activities	38(38.00)	32(32.00)	70(35.00)
B.	Average flock size the farmers			
4.	Small (5-10)	68(68.00)	64(64.00)	132(66.00)
5.	Medium (11-15)	26(26.00)	22(22.00)	48(24.00)
6.	Large (> 16)	06(6.00)	14(14.00)	20(10.00)
C.	Form of selling			
7.	Kid (at 3 months)	8(8.00)	6(6.00)	14(7.00)
8.	Grower	46(46.00)	52(52.00)	98(49.00)
9.	Fattener/Castrated male	34(34.00)	26(26.00)	60(30.00)
10.	Meat	12(12.00)	16(16.00)	28(14.00)
D	Market Price, Kid (Rs)			
11.	Low (<2000-2500)	74(74.00)	78(74.00)	152(76.00)
12.	Medium (2501-3000)	14(14.00)	14(14.00)	28(14.00)
13.	High (>3000)	12(12.00)	08(8.00)	20(10.00)
	Mean ± SE	2442.5 ± 32.22	2410.5 ± 32.87	2426.5 ± 22.98
		t value=0.487825^{NS}		
E	Goat meat/Chevon			
14.	Low (<400-500)	4(4.00)	6(6.00)	10(5.00)
15	Medium (501-600)	82(82)	76(76)	158 (79.00)
16.	High (>601)	14(14)	18(18)	32(16.00)
	Mean ± SE	566.5 ± 5.99	563.1 ± 5.54	564.8 ± 4.07
		t value=0.677424^{NS}		
F	Castrated goat (Live)			
17.	Low (<4000-4500)	6(6.00)	10(10)	16(8.00)
18	Medium (4501-5500)	32(32)	38(38)	70(35.00)
19.	High (>5501)	62(62)	52(52)	114(57.00)
	Mean ± SE	5415 ± 57.60	5286 ± 59.51	5350.5 ± 41.55
G	Grower goat	t value=0.120932^{NS}		
20.	Low (<3000-3500)	16(16)	20(20)	36(18.00)
21.	Medium (3501-4000)	44(44)	48(48)	92(46.00)
23.	High (>4001)	40(40)	32(32)	72(36.00)
	Mean ± SE	4057 ± 49.36	3816.5 ± 41.57	3936.75 ± 33.29
		t value=0.000253^{NS}		

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H	Mode of selling			
24.	Directly to consumer	16(16)	13(13)	29(14.50)
25.	Directly to middlemen	78(78)	83(83)	161(80.50)
26.	Directly to wholesaler	06(6.00)	04(04)	10(5.00)

Table 7. Mean growth performance of Assam Hill goat under field condition.

Sr. No.	Age group	Body weight (Mean ± SE)		Pooled (n=200) (Mean ± SE)	*t* value
		Karbi Anglong (n=100)	Dima Hasao (n=100)		
1.	At birth	1.67±0.03	1.59±0.04	1.61±0.03	0.077013^{NS}
2.	3 m	4.78±0.14	4.45± 0.10	4.62±0.09	0.074152^{NS}
3.	6 m	8.62±0.11	8.34±0.12	8.48±0.08	0.095945^{NS}
4.	9 m	11.95±0.13	11.55±0.09	11.75±0.08	0.017471^{NS}
5.	12 m	15.32±0.11	14.88±0.17	15.24±0.14	0.009814^{NS}

NS: Non-significant (p>0.05)

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maturity, length of estrus cycle, first kidding, post-partum estrus period, gestation length was 276.19, 298.39, 20.97, 449.56, 64.78, 247.73and 147.91d, respectively. The mean duration of estrus period was recorded to be 24.52±0.52 hr. No significant differences were recorded on different reproductive performances (p>0.05) of AH goat in terms of age at puberty, sexual maturity, length of estrus cycle, first kidding, post-partum estrus period, gestation length as well as duration of estrus period between the two districts. In similar observations, Doley *et al* (2017) and Das *et al* (2021) recorded age at first kidding and gestation period of 448.00 and 147.47 d, 405.07 and 147.31 d, respectively in Assam Hill goat. The average litter size of AH goat was recorded 1.69. Hasan *et al* (2014) recorded overall litter size of 1.6 under semi-intensive and 1.46 extensive condition in Bangladesh.

CONCLUSION

Assam Hill (AH) goat is an important goat germplasm found in Assam and its adjoining areas. It is one of the most prolific, high fecundity and small size goat breed popular among the tribal farmers. The study on productive and reproductive attributes revealed that AH goat was highly suitable and promising goat breed that can be promoted for commercialization for sustainable income generation. Scientific intervention is highly needed through capacity building and field demonstration on AH goat to promote and conserved the highly prolific meat breed in the hill region and adjoining part of Assam.

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Table 8. Mean reproductive performances of Assam Hill goat under field condition

Sr. No.	Reproductive traits	Reproductive performances (Mean ± SE)		Pooled (Mean ± SE)	*t* value
		Karbi Anglong	Dima Hasao		
1.	Age at puberty (Days)	272.91 ± 1.49	279.47±1.60	276.19±1.19	0.00698^{NS}
2.	Age at sexual maturity (Days)	295.08±0.89	301.69±1.36	298.39±0.94	0.00021^{NS}
3.	Length of estrus cycle (Days)	20.95±0.23	21.00±0.46	20.97±0.03	0.93377^{NS}
4.	Duration of estrus period (hrs)	24.78±0.80	24.26±0.71	24.52±0.52	0.43383^{NS}
5.	Age at first kidding (Days)	447.78±0.94	451.34±1.34	449.56±0.85	0.03591^{NS}
6.	Post partum estrus period (Days)	63.65±0.96	65.91±1.01	64.78±0.71	0.11406^{NS}
7.	Kidding interval (Days)	245.39±1.26	250.87±1.27	247.73±0.95	0.01226^{NS}
8.	Gestation length (Days)	147.73±0.19	148.08±0.25	147.91±0.16	0.28501^{NS}

NS: Non-significant (p>0.05)

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