



SAARC Journal of Agriculture

Journal Homepage: <https://www.banglajol.info/index.php/SJA>



Evaluation of the Socio-economic Status of Farmers and their Goat Breeding Practices in Different Districts of Bangladesh

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Abstract

The study explored the socio-economic characteristics of goat farmers and their breeding practices across different districts of Bangladesh. A total of 417 farmers rearing Black Bengal goat were surveyed in eight goat-dense districts, including Chuadanga, Meherpur, Jashore, Kushtia, Rajshahi, Bhaluka, Muktagacha, and Naikhongchhari. Survey results indicated that majority of the farmers were middle-aged (47.96%), illiterate (53.48%) and depended mainly on agriculture (44.12%) for their livelihood. Most farmers in the surveyed regions maintained small (0–5 goats; 49.16%) or medium-sized (6–25 goats; 47%) flocks and predominantly practiced a semi-intensive management system. The combined data indicated an overall buck-to-doe ratio of 1:29. Natural breeding was predominantly practiced (99.04%), whereas artificial insemination was adopted by only 0.96% of farmers. Approximately 95.92% of farmers depended on breeding bucks from neighboring farms, and 61.39% responded to estrus within 24 hours. A larger proportion of farmers paid more than 100 BDT per

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breeding service. The average repeat heat rate was 38.37%. The most frequently reported categories for age of doe at first service, weight of doe at first service, kidding interval, litter size and birth weight of kid were found as 9-12 months, less than 10 kg, 6 months, 2 and 1.0-1.5 kg, respectively. These results demonstrate that goat husbandry is a crucial socio-economic asset across the surveyed areas. The productivity of goat remains constrained by traditional breeding practices and high repeat heat rates, highlighting a critical window for policy interventions aimed at improving scientific and structured breeding strategies for the future sustainability and development.

Keywords: Community-based breeding, Goat breeding, Management, Rural Bangladesh, Socio-economic determinants

Introduction

Goat is the fourth largest livestock species in the world by population, where almost 94% are distributed in the tropical and sub-tropical areas of Asia and Africa (FAOSTAT 2021). Their small size facilitates easy trade and liquid form of asset compared to other large animal as well as lower cost involvement in production and management with higher prolificacy, disease resistance and adaptation ability (Rakib et al., 2022; Marius et al. 2021; Luo et al., 2019; Monteiro et al., 2017). Goat meat is accepted without any social or religious conflicts worldwide, and its milk is a demandable product for the nutritional value and therapeutic uses (Liang et al., 2019). In Bangladesh, livestock plays significant role to socio-economic development (Khandoker et al., 2023; Hossain et al., 2018; Jalil and Choudhury, 2018; Barman et al., 2017), while goat rearing is very popular for short generation cycle, easy handling, minimal initial investment and additional income particularly for the marginal or small holder farmers (Rahman et al., 2022; Kumar et al., 2018; Islam and Islam, 2018; Rahman and Alam, 2017). Goat rearing mostly driven in rural areas remain predominantly traditional. On average, 65% households of the country are engaged with goat farming as a primary or secondary income source (Chowdhury et al., 2002) with four goat per farm and up to 41% of the income is generated from the goat (PKSF, 2014). Continuous improvement by genetic selection, feeding and other management system may contribute to improve goat genetic resources in Bangladesh.

However, goat breeding practices of our country are generally conventional and significantly influenced by number of socio-economic factors like education, income, land ownership, and gender roles (Ahmed et al., 2015; Sultana et al., 2021). Farmers who are educated and have better understanding about animal management and care as well as market access generally practice different assisted breeding system viz. selective breeding or Artificial Insemination, but farmers with less knowledge always go for the natural breeding (Haque et al., 2018). The use of appropriate assisted reproductive technologies is necessary for the sustainable improvement and appropriate conservation of goat (Khandoker et al., 2011). Selective breeding with genetically superior goat can enhance their overall performance without much alteration in the prevailing production system.

Moreover, the decline of the pure breed from their native place is now becoming an issue worldwide, which leads to genetic erosion or disappearance of the pure germplasm line (Dhara et al., 2023). Although, genetic improvement is technically achievable, but the widespread implementation of advanced breeding practices remains limited by socio-economic constraints (Begum and Hossain, 2019). Despite the importance of these factors, there is limited research examining how socio-economic factors shape goat breeding practices at community level. A better understanding of these determinants is very crucial for developing targeted interventions aimed at improving the productivity, genetic quality and sustainable goat farming in Bangladesh. Therefore, the study designed to clarify the influence of socio-economic status of farmers on goat breeding practices across different regions in Bangladesh.

Materials and methods

Study Area

The study was carried out in the eight different goat populated areas viz. Chuadanga, Meherpur, Jashore, Kushtia, Rajshahi, Bhaluka, Mutagacha and Naikhongchhari in Bangladesh (Figure 1). A baseline survey was performed among the areas selected by “Black Bengal Goat Conservation and Development Research Project”, Bangladesh Livestock Research Institute, Savar, Dhaka-1341.

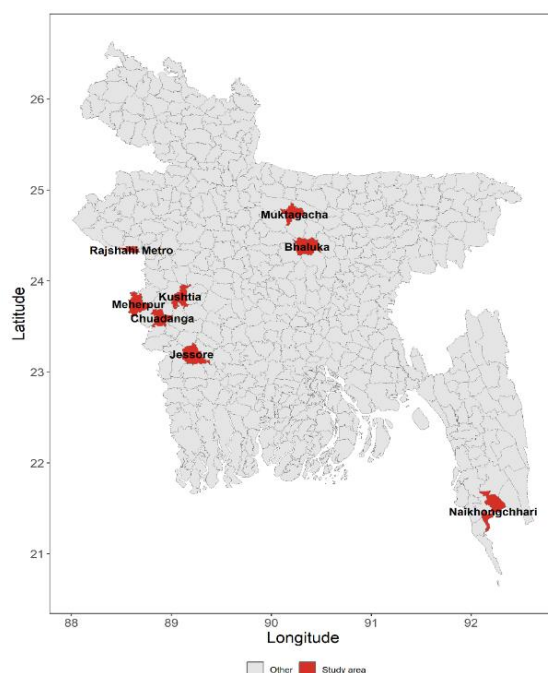


Fig. 1. Geographic distribution of the study area

Data collection

Five villages from each district were chosen on the basis of availability of goat population. Data were collected at 2021 by face-to-face interview through a well-structured pre-tested questionnaire following the objective. A total of 417 farmers having Black Bengal goat were participated in the survey with a goat population of 2,980. The information collected were-

- a) Socio-economic factors: age, sex, educational qualification, main occupation etc.
- b) Breeding parameters: buck-doe ratio, breeding management, cost included for breeding, reproductive parameters etc.

Data analysis

The gathered information was categorized, tallied, and examined in light of the study's goals in order to extract pertinent conclusions. Recorded data was assembled, arranged, and analyzed by Microsoft Excel-2019. Geographical map was prepared by using "ggplot", "sf", and "gridextra" packages, while alluvial graphs and chord diagram were prepared by using "readxl", "dplyr", "ggplot2", "ggalluvial", "cowplot" and "circlize" packages in R-software version 4.4.5.

Result and Discussion

Socio-economic profile of goat rearing farmers

Table 1 describes the demographic and socio-economic profile of the farmers in the survey area. The large number of farmers cluster (47.96%) engaged in goat rearing were found within the age group of 35 to 49 years, suggesting predominant participation of middle-aged individuals in this sector. The results are consistent with the findings of Sarker (2024), Islam et al. (2016a), Hossain et al. (2018), Shahjahan et al. (2016), and Islam et al. (2018). About 63.31% females were occupied in goat husbandry which is lower than the finding of Shoshe et al. (2019) and Rahman et al. (2022) but higher than the findings of Prank et al. (2023) and the values were 70%, 95% and 57%, respectively.

Educational status indicates that the majority of respondents were illiterate (53.48%) while only 1.20% graduate or post-graduate. The findings are aligned with Rahman et al. (2022) and Islam et al. (2016a) but differs with the findings of Sarker (2014) who mentioned 11% illiterate respondents in the survey area. Other studies mentioned that a greater proportion of goat farmers had either a primary education (Begum et al., 2007) or equal to class eight pass (Majumder et al., 2017) which is opposite to the current findings. The variation in education might be due to the diversity in area and financial capability of the goat farmer.

The main occupation of the goat farmer was found as agriculture (44.12%) indicating goat husbandry serves as a significant supplementary income source for rural area. Almost similar findings were mentioned by Sarker (2014), Ahamed et al. (2010), Islam et al. (2016b) and Shahjahan et al. (2016).

Table 1. Socio-economic profile of the farmers-

Characteristics	Categories	Frequency	Percentage (%)
Age	<35	108	25.89
	35-49	200	47.96
	>50	109	26.14
Sex	Male	153	36.69
	Female	264	63.31
	Illiterate	223	53.48
Educational qualification	Primary	123	29.50
	Secondary/Higher Secondary	66	15.83
	Graduate/Post Graduate	5	1.20
Main occupation	Agriculture	184	44.12
	Service	57	13.67
	Business	24	5.76
	Subsistence farming	143	34.29
	Others	09	2.16

Goat population in survey areas:

Notable differences were observed in the overall goat population across various regions (Table 2). The highest population density was found in Meherpur, while lowest was found in Muktagacha. However, the breeding buck-to-doe ratio was severely skewed in many areas. Naikhongchari had a relatively favorable ratio of 1:15. Conversely, serious breeding buck shortage was found in Muktagacha (1:98). The pooled buck and doe ratio was found as 1:29 which is almost similar with the survey of Islam and Islam, (2018) reported 1:25 at Munshiganj region. Meanwhile, the higher pooled ratio compare to the current result was found by Khandoker et al. (2011) who described the ratio as 1:128. The acute shortage of superior breeding buck ultimately shows negative impact on community breeding such as inbreeding depression, decrease in purity of indigenous breed as well as superiority of the breed.

Table 2. Goat population at different survey areas-

Area	Households (n = 417)	Total goat (n = 2980)	Breeding Buck (n = 38)	Breeding Doe (n = 1096)	Buck: Doe
Chuadanga	51	588	4	191	1:48
Meherpur	76	693	12	234	1:20
Jashore	52	405	2	134	1:67
Kushtia	53	334	2	128	1:64

Area	Households (n = 417)	Total goat (n = 2980)	Breeding Buck (n = 38)	Breeding Doe (n = 1096)	Buck: Doe
Rajshahi	34	253	1	72	1:72
Bhaluka	47	303	7	102	1:17
Muktagacha	50	190	1	98	1:98
Naikhongchhari	54	214	9	137	1:15
Pooled ratio of Buck: Doe					1:29

Breeding management

The breeding practices among the survey areas are shown in Table 3 and Figure 2. The vast majority of farmers (95.92%) relied on breeding bucks from neighboring farms rather than their own flock. However, the use of own breeding bucks was observed in a limited proportion of farmers, particularly in Naikhongchhari (14.81%), Meherpur (7.69%), Kushtia (3.77%), and Jashore (1.92%). Almost similar findings were found by Islam et al. (2018) and Hossain et al. (2015) narrated as 84.67% and 80.5% farmers do not retain bucks for breeding. In another survey, 54% farmers of Munshiganj area used breeding buck from other source (Islam and Islam, 2018). In contrast to the present findings, 33.3% of own breeding buck were used by the goat rearing community people of Tanzania (Chenyambuga and Lekule, 2014). However, reluctance to rear breeding bucks among farmers are primarily associated with socio-cultural constraints of our country. Additionally, inadequate knowledge of scientific breeding, limited farmer motivation, lack of space for buck rearing, and economic condition ultimately increase the dependence on breeding bucks from neighboring farms, often without consideration of genetic potential or purity.

The use of artificial insemination was found extremely rare (0.96%) with predominant natural breeding (99.04%) in the survey area. The results are consistent with the findings of Islam et al. (2009). Previous reports indicate that 100% of goat farmers practiced natural breeding (Kumar et al., 2018; Majumder et al., 2017; Islam, 2014), while Shoshe et al. (2019) observed a comparatively lower rate (84%). A high prevalence (96.67%) of natural breeding practiced by goat farmers was also documented by Islam et al. (2018). Conversely, the use of artificial insemination at the community level was reported to be 12% (Choudhury et al., 2016; Khandoker et al., 2011) and 16% (Shoshe et al., 2019).

Most of the cases (61.39%), farmers respond to heat sensing within 24 hours and only one service per conception required (64.03%) while repeat heat was found as 38.37%. However, the incidence of repeat heat could be minimized though ensuring timely mating at the optimal stage of estrus as well as availability of own breeding buck of the farmer. A single service was predominantly found sufficient for conception among the survey areas. Meanwhile, a higher proportion of farmers reported two service per conception in Rajshahi (76.67%). Among the areas, major

group of farmers pay more than 100 BDT per service followed by 60-100 BDT and 40-50 BDT, respectively. Compare to the current findings, Jalil and Choudhury, (2018) reported a lower service fee for breeding as 33.66 BDT in Bhaluka, whereas Islam et al. (2016b) documented a similar trend of service fee of 70.90 BDT in Mymensingh. However, the service charge varies across regions attributed by factors like availability and quality of buck, preference of farmers etc.

Table 3. Breeding management in the study areas

Characteristics	Categories	Frequency	Percentage (%)
Source of breeding buck	Own	17	4.07
	Others	400	95.92
Breeding method	Natural	413	99.04
	AI	04	0.96
Service after showing heat (hour)	Within 6	13	3.12
	Within 12	148	35.49
	Within 24	256	61.39
Number of services required per conception	One	267	64.03
	Two	150	35.97
Repeat heat	Yes	160	38.37
	No	257	61.63

Management system

Small (0-5 goat) and medium (6-25 goat) farm size were predominantly found in the survey area followed by large (26-50 goat) and commercial (>50 goat), respectively (figure 2). At Muktagacha, 68% farmers maintain small farm while 78.67% farmers of Rajshahi had medium sized farm. However, large and commercial farms proportion was very negligible across the areas. The result is in accordance with Islam et al. (2016b) and Majumder et al. (2017) who found 3.56 and 5.64 goats per family at Mymensingh and Dinajpur district of Bangladesh. Khandoker et al. (2023) also found the similar output of 44.45% farmers had 1-3 goats. At Tanzania, 8.7 goats per family was found at community level (Chenyambuga and Lekule, 2014). The size of the farm mostly depends on the land, capital and financial capacity of the farmer.

The semi-intensive system was the most commonly practiced followed by extensive and intensive system, respectively. Similar finding was outlined by Prank et al. (2023) as 67.3%, 24.1% and 8.5% farmers reared goats in semi-intensive, extensive and intensive system, respectively.

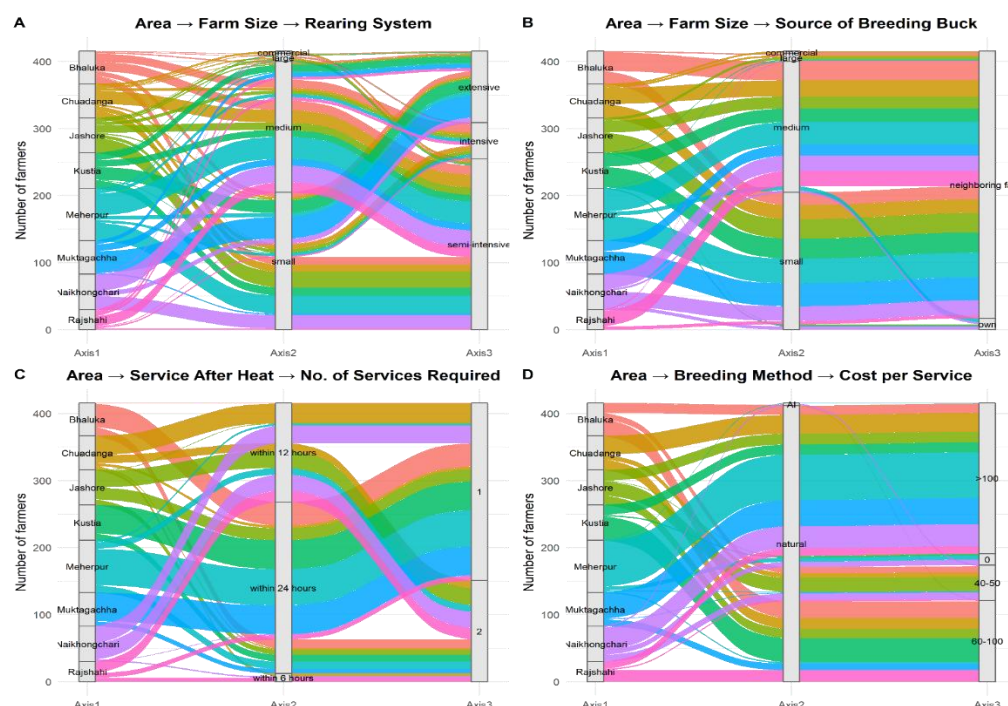


Fig. 2. Area wise breeding management (A: Area wise farm size to rearing system; B: Area wise farm size to breeding buck; C: Area wise service after heat to number of services required; D: Area wise breeding method to cost per service)

Reproductive performances

Variation in the productive and reproductive performances of goat was found among the survey areas (Figure 3). The predominant age of bucks at first service was found as more than 12 months with a body weight of 15-18 kg. Likewise, the age and weight of doe at first service were found as 9-12 months and less than 10 kg, respectively. However, early first breeding at the age of 6-8 months was practiced by 98% of farmers in Chuadanga. In other survey reports, the age at first service was documented as 8.87, 7.4 and 6.95 months by Jalil and Choudhury (2018), Islam and Islam (2018) and Hassan et al. (2007), respectively. The observed regional variations in breeding practices may reflect differences in farmers' educational status, economic conditions, access to breeding services, and local husbandry traditions. However, these associations were not formally evaluated in the present study.

Across the surveyed areas, a gestation length of 145 days was the most frequently reported category (47.0%), closely followed by 150–155 days (46.76%), whereas only a small proportion of respondents (6.24%) reported gestation lengths of 156–160 days. A similar average gestation length of 153 days was documented by Islam and Islam (2018).

Likewise, the major farmer's group reported the age of first kidding to be more than 12 months. This result aligns with the findings of Islam and Islam (2018) and Jalil and Choudhury (2018), who documented age at first kidding of 14.5 and 13.85 months, respectively.

In the study areas, the most frequently observed litter size was 2 (48.20%), followed by 3 (39.09%), 1 (7.67%), and 4 (5.04%), respectively. Islam and Islam (2018) reported a similar average litter size of 2. Most kids were born with a body weight ranging from 1.0-1.5 kg. In Muktagacha, 74% of kids had lower birth weights (700–900 g), while in Rajshahi, 90% exhibited birth weights exceeding 1.5 kg. Jalil and Choudhury (2018) reported a birth weight of 1.45 kg in Bhaluka, whereas Islam and Islam (2018) documented a lower birth weight of 0.91 kg in Munshiganj.

A kidding interval of 6 months was the most frequently reported category (51.80%), followed by 6–9 months (40.77%), whereas only 7.43% of respondents reported intervals of 9–12 months. Regional variation was evident, all the does in Chuadanga and Kushtia (100%) were reported to have a kidding interval of 6 months, while in Naikhongchhari, all does (100%) exhibit a kidding interval of 6–9 months. Islam and Islam (2018) reported a similar kidding interval of 8.5 months. Kidding interval is a significant reproductive trait that reflects the reproductive efficiency and annual kid production by a doe.

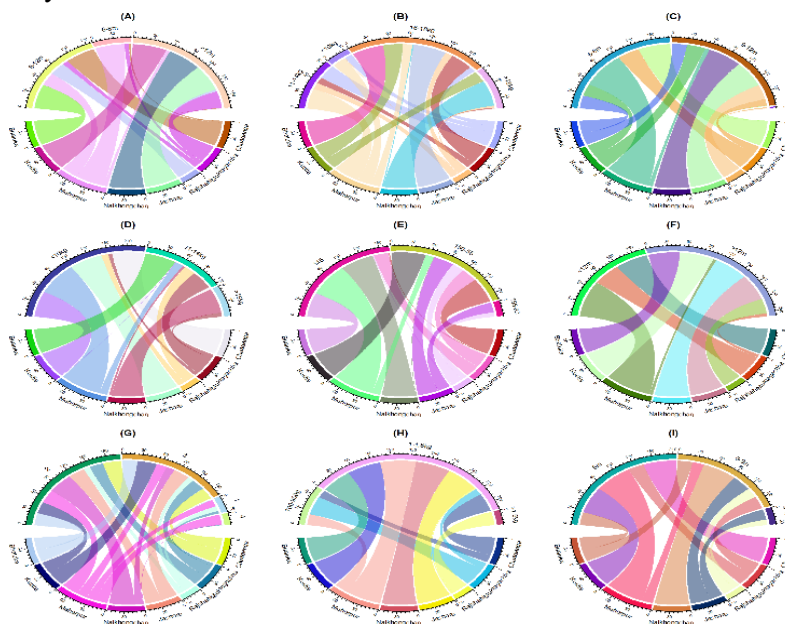


Fig. 3. Productive and reproductive trait of goat at different area. A) buck age at first service (month), B) buck weight at first service (kg), C) doe age at first service (month), D) doe weight at first service (kg), E) gestation length (day), F) age at first kidding (month), G) litter size (number), H) birth weight (kg), I) duration of kidding interval (month).

A limitation of this study is the time gap between data collection and publication. Although farming practices and socioeconomic conditions may have evolved over time, the findings provide valuable baseline information on the socioeconomic, management, and breeding characteristics of Black Bengal goat farmers, serving as an important reference for future comparative studies and conservation initiatives.

Conclusion

The study concludes that goat farming is predominantly practiced by farmers with limited formal education who rely mainly on agriculture for their livelihood. Women played a dominant role in goat husbandry across the surveyed regions. One of the main challenges in goat breeding was the dependence on breeding bucks from neighboring farms. Utilization of breeding bucks without reliable data on the genetic superiority or proper evaluation, potentially leading to genetic dilution and erosion in the population. Strategic emphasis on within-breed selection of indigenous breeds is recommended for long-term conservation and sustainable genetic improvement.

Acknowledgement

The authors are grateful to “Black Bengal Goat Conservation and Development Research Project”, Bangladesh Livestock Research Institute, Savar, Dhaka to facilitate this survey with funding.

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