

Comparative Analysis of Goat Management System and Productive-Reproductive Performance in Backyard and Commercial Farming Settings



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List of abbreviations

Abbreviations	Elaboration
BBG	Black Bengal goat
DLS	Department of Livestock Services
AI	Artificial Insemination
BER	Bangladesh Economic Review
SE	Standard Error
BCS	Body condition score

Abstract

This study was undertaken to determine the productive and reproductive performance of goats in both backyard and commercial farming in Sitakunda Upazilla, Chattogram, Bangladesh. Various parameters, including age, gender, housing, breeding methods, disease prevalence, and reproductive and productive outcomes, were analyzed to compare the two farming systems by collecting data from farmers through a pre-tested questionnaire. The study revealed that reproductive performance indicators such as age of puberty was 6.05 ± 0.18 months in backyard and 6 ± 0.31 months in commercial farming, gestation length 156 ± 23 days in backyard farming and 157.28 ± 3.37 days in commercial farming, and first kidding age 11.53 ± 0.21 months in backyard and 11.71 ± 0.24 months in commercial farming. This finding showed no significant differences between backyard and commercial farming. One significant disparity ($P < 0.05$) emerged in milk production, where commercial farming demonstrated markedly higher yields (0.77 ± 0.11) compared to backyard farming (0.42 ± 0.18). Additionally, the study highlighted the prominent role of women (76.67%) in backyard goat farming, with commercial farming showing a higher proportion (75%) of educated farmers. Natural breeding was the preferred method in both farming systems. This research provides valuable insights into the dynamics of goat farming in Bangladesh, offering information that can inform management decisions and contribute to the sustainable development of the goat farming sector.

Keywords: Comparison, Reproductive performance, Backyard farming, Commercial farming, Goat.

Chapter 1

Introduction

Goat farming holds significant popularity in Bangladesh due to its minimal investment requirements, reduced feed consumption, and consequently lower risks associated with farming ventures. These goats are raised in both backyard and commercial farm settings, with backyard farming being the more prevalent one. Between sheep and goat, goat is more suitable to rear for country like Bangladesh as they are able to survive in extreme hot and humid weather, having high production with feeds of low nutritive values and their smaller in size. It is a multipurpose animal that produce meat, milk, skin, and manure. It gives 20 million square feet of skins per year (BER,2012) Black Bengal goat is well known in international market for its excellent meat and skin quality. One of the significant benefits of rearing goat is that they need low cost for maintenance. That's why it is called poor man's cow. In addition, there is no religious taboo regarding goat meat (chevon) and acceptable to all classes of people.

Goat rearing is a profitable business for marginal landless rural people of Bangladesh. About 52 percent of total goat population are reared by landless marginal farmer in Bangladesh (Chowdhury *et al.*, 2002). Mainly women are more involved in this business to earn their livelihood. Rural women play a significant role in the economic need of herself and her family. According to Department of Livestock Service (DLS) report, Bangladesh has 26.8 million goat population in total (BBS, 2022). Black Bengal is the renowned breed that covers almost 90% of total goat population of Bangladesh. Rest of the populations consisting of Jamunapari, Haryana, Totapuri and cross breeds.

Goat are usually reared through subsistence (Backyard), smallholder and small-scale-commercial operation in Bangladesh. About 80.5% of the farmers rear goat in semi-intensive system, 7.3% rear in confinement system whilst 12.2% rear in free range system. Approximately 2-5 goats are reared by women and children in subsistence condition along with other livestock species such as cattle, sheep, chicken and duck (Islam *et al.*, 2009). Large-scale well-established goat farms are not so common in Bangladesh.

Whatever the rearing system is, the success and profitability of a goat farms mainly depends on its management strategies, productive performances and reproductive

potentialities. Reproductive performance means the number of young ones born per litter. In comparison with large ruminants, small ruminants such as Sheep and goat, produce more offspring per gestation (Plakkot *et al.*, 2020), where twins or triplets are common in kidding. Numerous studies have been conducted about performances of goat (age of sexual maturity, litter size, gestation length, milk production) in backyard farming in different regions of Bangladesh. However, comparative study between the performance of goat in commercial and backyard farming is rare.

Therefore, this study was conducted with the aim to assess the comparative management system, productive and reproductive performance of goat between backyard and commercial farming conditions at Sitakunda Upazilla, Chattogram, Bangladesh with following objectives:

1. To compare the management system goat in backyard and commercial farming condition.
2. To Compare the productive and reproductive performance of goat in backyard and commercial farming condition.

For this study, data has been collected from farmers through questionnaire where both close and open question were asked. To assess the productivity, we looked for important productive and reproductive traits such as milk production, number of parities, kids per conception, age at puberty, age at first service, gestation length, age at first kidding, kidding interval etc. The study shows that, reproductive performance of goat in backyard and commercial farming does not have significant differences. However, productive performance, particularly milk production was higher in commercial settings compared to backyard farming. The outcomes of this study will provide valuable insights into the enhanced milk production attributes within commercial goat farming. These insights are expected to contribute to superior kid production through improved milk feeding practices. Furthermore, these findings will aid in making informed decisions regarding the preference of establishing commercial farming systems over backyard farming.

The findings of this study will help to know the differences of productive performance of goat when they are reared in commercial and subsistence way. For this study, data has been collected from farmers through questionnaire where both close and open question were asked. Then data has been analyzed and result has been demonstrated.

Chapter 2

Materials and Methods

2.1 Study area and period

The study was conducted in Sitakunda upazilla of Chattogram district. This area has been chosen because most of the village people are involved in livestock rearing particularly goat. The timeline of the study was 16 April 2023 to 17 August 2023.

2.2 Data collection

Data was collected by door-to-door survey at owner's house in Sitakunda upazilla. No prerequisite was set for selection of animal for collecting data rather data was collected randomly from goat owner. Information was collected by using a pre-designed questionnaire which was made through maintaining information related to this study such as breed, age, housing and feeding history, farm bio-security, disease history but emphasized was given in reproductive data like parity, litter size, age at puberty, age at first kidding, gestation length etc. Both open ended and close ended question were included in this study. The questionnaire was pre-tested initially by collecting data of few farms and necessary corrections were made.



Figure 1: Data collection from goat owner

2.3 Statistical analysis

The raw data was recorded in MS Excel-2010 file. Then the data was compiled and arranged according to variable for statistical analysis. The compiled data transferred to Stata/IC 15.1 version for analysis and following two types of analysis was done based on variable categories. For qualitative variable, Fisher's exact test was performed and for quantitative, to compare data of backyard and commercial farm, t-test was performed. The significant association was considered when P value was less than 0.05.

Chapter 3

Results and Discussion

3.1. Gender and educational qualification of farmers

The information on farmers gender and education levels are presented in Table 1. Among the farmers of study population, more women were involved in backyard farming (23.33% male vs. 76.67% female) whereas men were dominated in commercial farming (75% male vs. 25% female). This finding has the similarity with Rokonuzzaman and Islam (2009) who found that women were mainly involved in backyard farming of goat. Considering the education levels, commercial farmers were more educated (75%) than backyard farmers (30%).

Table 1: Gender and education levels of backyard and commercial goat farmers.

Variable	Categories	Backyard farms (N=30)	Commercial farms (N=4)	<i>P value</i>
Gender	Male	7 (23.33%)	3 (75%)	0.067
	Female	23 (76.67%)	1 (25%)	
Education	Below SSC	21 (70%)	1 (25%)	0.115
	Higher than SSC	9 (30%)	3 (75%)	

3.2. Demographic data for goats under study in backyard and commercial farms

The demographic data of goat was collected individually from each backyard and commercial farms. A comparative information between backyard and commercial farms are depicted in Table 2 and are now discussed under following heads:

3.2.1. Breed

Among the study population, there were Black Bengal (BB), Jamunapari and cross breed (BB x Jamunapari). In backyard farming, the most common animals were cross breed (76.67%) followed by BB (20%) and Jamunapari (3.33%). In commercial farming, BB was 5 in number (35.71%), cross breed was 9 (64.29%) and no Jamunapari found in commercial farm. In both case, cross breed holds the uppermost position. Although, the differences in

breed distribution between backyard and commercial farm is statistically insignificant ($P>0.05$) (Table 2).

3.2.2. Physiological status

In both backyard and commercial farming milch animal was most predominant (76.67% vs 78.57%), dry animal was least in both backyard (3.33%) and commercial (7.14%) whereas pregnant animal was 14.29% and 30% in commercial and backyard farming respectively. However, differences in physiological status were statistically insignificant (Table 2).

3.2.3. Age

There was little indifference between age of backyard and commercial farming (2.08 ± 0.21 year vs 2.21 ± 0.27 year) which was statistically insignificant ($p>0.05$). (Table 2)

3.2.4. Number of male and female

Number of male animal was 0.9 ± 0.22 vs 7.75 ± 1.93 in backyard and commercial farming respectively. In case of number of dam, it was 2.73 ± 0.32 in backyard farming and in commercial farming it was 10.25 ± 1.79 which was insignificant statistically ($p>0.05$) mentioned in Table 2.

3.2.5. Body condition score

The body condition score (BCS) of study population in backyard farming was 2.57 ± 0.92 and in commercial farm it was 2.71 ± 0.13 which shows no significant difference statistically ($p>0.05$) (Table 2). The health condition of study population was not so good in both farming.

Table 2: Comparative presentation of goat's demographic data between backyard and commercial farms

Variable	Categories	Backyard (N=30)	Commercial (N=14)	<i>P value</i>
Breed	Black Bengal	6 (20%)	5 (35.71%)	0.63
	Jamunapari	1 (3.33%)	0 (0.00%)	
	Cross	23 (76.67%)	9 (64.29%)	
Physiological status	Milch	20 (66.67%)	11 (78.57%)	0.51
	Pregnant	9 (30%)	2 (14.29%)	
	Dry	1 (3.33%)	1 (7.14%)	

Variable	Mean \pm SE		<i>P value</i>
	Backyard (N=30)	Commercial (N=14)	
Age (Year)	2.08 \pm 0.21	2.21 \pm 0.27	0.72
Male	0.9 \pm 0.22	7.75 \pm 1.93	0.00
Dam	2.73 \pm 0.32	10.25 \pm 1.79	0.00
BCS	2.57 \pm 0.92	2.71 \pm 0.13	0.36

3.3 Management system of backyard and commercial farms

To find out the strategic differences in management system, we compared the obtained data on Table 3, and the different attributes are discussed under following heads:

3.3.1. Rearing system

The rearing system was semi-intensive in most of the case. In backyard farming 26 farmer (86.67%) rear their animal in semi-intensive condition, others (13.33%) were intensive. In commercial farming, 75% farmer rear in semi-intensive condition and others (25%) in intensive condition. As, pre-weaning increase, weaning weight, doe's final live weight at postpartum heat and milk production were all higher in semi-intensive system compared to intensive system (Hossain et al., 2015).

3.3.2. Housing

In case of housing there was insignificant difference ($P > 0.05$) between commercial and backyard farming. Most of the farmer (53.33%) of backyard farming house their animal

in ground house and rest of the farmer (46.67%) maintains stilted housing. But in case of commercial farming this number is equal in both cases.

3.3.3. Floor

In terms of flooring system, there was insignificant difference ($p>0.05$) among backyard and commercial farming. 10 farmers (33.33%) keep their animal in earthen floor, 6 farmer (20%) use concrete flooring and rest of the farmer (46.67%) provide wooden floor to the animal. In commercial farming, 50% farm have concrete floor and 50% have wooden floor and no farm use earthen flooring.

3.3.4. House location

In case of 53.33% of backyard farming goat shed is attached with farmer's residence and 46.67% have separate shed far from residence. In commercial farming, 75% shed is far from residence and 25% is near or attached with residence.

3.3.5. Vaccination and deworming

In backyard farming system, 80% farmer and 85.71% farmer of commercial farming maintain regular vaccination. In case of deworming, 86.87% farmer deworm their animal regularly in backyard farming and in commercial farming 64.29% farmer maintain regular deworming. According to Islam *et al.* (2016), 8% farmer vaccinate their goat and 50% farmer deworm their goat regularly which contradict the findings of this study. But another research findings show that most farmer vaccinate their goats (Hossain *et al.*, 2015) which is alike this study findings.

3.3.6. Breeding policy

Most of the case, farmers prefer natural breeding than artificial insemination (AI). 86.87% breeding in backyard farming occurs naturally either by buck from their own flock or from neighbor's flock. In commercial farming they prefer 100% natural breeding than AI. Compared to AI goats, naturally bred goats has a greater conception rate (Agossou and Koluman, 2018). That's why farmers prefer natural breeding over AI.

3.3.7. Disease prevalence

There are several diseases of goat commonly occur like PPR, goat pox etc. Disease prevalence in study population was not so high. Among backyard and commercial farming population of commercial farming was more diseased (35.71%) than backyard (20%).

Table 3: Comparative management system of goat in backyard and commercial farms

Variable	Categories	Backyard (%) (N=30)	Commercial (%) (N=14)	<i>P value</i>
Rearing system	Intensive	4 (13.33%)	1 (25%)	0.49
	Semi-intensive	26 (86.67%)	3 (75%)	
Housing	Ground	16 (53.33%)	2 (50%)	1.00
	Stilted	14 (46.67%)	2 (50%)	
Floor	Earthen	10 (33.33%)	0 (0.00%)	0.24
	Concrete	6 (20%)	2 (50%)	
	Wooden	14 (46.67%)	2 (50%)	
House Location	Attach with residence	16 (53.33%)	1 (25%)	0.60
	Far from residence	14 (46.67%)	3 (75%)	
Vaccination	Yes	24 (80%)	12 (85.71%)	1.00
	No	6 (20%)	2 (14.29%)	
Deworming	Yes	26 (86.87%)	9 (64.29%)	0.12
	No	4 (13.33%)	5 (35.71%)	
Breeding policy	Natural	26 (86.87%)	4 (100%)	1.00
	Artificial insemination	4 (13.33%)	0 (0.00%)	
Disease prevalence	Diseased	6 (20%)	5 (35.71%)	0.287
	Healthy	24 (80%)	9 (64.29%)	

3.4 Productive and reproductive performance

The productive performance was assessed by comparing the milk production obtained from record. Reproductive performance was measured through puberty age, gestation length, litter size, kidding interval, first kidding age and kid number at first parity. Productive performance was measured by amount of milk production. The relevant data are provided in Table 4.

3.4.1. Milk production

This study revealed that the average milk production was significantly ($p < 0.05$) higher in commercial farms (0.77 ± 0.11 liters/day/animal) compared to backyard settings (0.42 ± 0.18 liters/animal/day) (Table 4). This finding has partial coherence with the findings of Dhara *et al.* (2012) who mentioned that the average milk production of goat in Bangladesh is ranging from 0.24 to 1.73 kg/ day/ animal irrespective of breeds. According to research, total milk production of goat is 0.240 to 1.73 kg (Dhara *et al.*, 2012).

3.4.2. Age of puberty

In terms of age of puberty, it was more or less similar in backyard (6.05 ± 0.18 months) and commercial (6 ± 0.31 months) farming system which was insignificant statistically ($p > 0.05$) (Table 4). According to Hassan *et al.* (2007), average age of puberty is 199.6 days (6.65 months) which is similar to this study.

3.4.3. Age at first service

First service age was 6.53 ± 0.21 months and 6.43 ± 0.29 months in backyard and commercial settings respectively which was not significant statistically ($p > 0.05$) as noted in Table 4.

3.4.4. Gestation length

Regarding gestation length, this study shows insignificant differences ($p > 0.05$) in between backyard (156.23 ± 1.53 days) and commercial settings (157.28 ± 3.37 days) (Table 4) and this is higher than the findings of Bhowmik *et al.* 2014. Even though the gestation time for goat is generally stable at 146 days (Devendra and Burns, 1983).

3.4.5. Litter size

In the matter of average litter size, the findings of this study was statistically insignificant ($p > 0.05$) where litter size at backyard was 1.96 ± 0.10 and at commercial settings it was 2.14 ± 0.18 (Table 4). Litter size number of goat is (1-3) according to Chowdhury *et al.* (2001), which is similar to this study.

3.4.6. Kidding interval

With regard to, kidding interval commercial settings have large kidding interval time (5.85 ± 0.39 months) than backyard (4.56 ± 0.57 months) that is insignificant statistically ($P > 0.05$) (Table 4). This finding is somewhat lesser than the findings of Bhowmik *et al.* 2014.

3.4.7. Age at first kidding

In terms of first kidding age, this study shows insignificant difference ($P > 0.05$) between backyard and commercial farming where backyard and commercial settings shows almost similar kidding age (11.53 ± 0.21 months vs 11.71 ± 0.24 months) which is slightly lower than the findings of Bhowmik *et al.* 2014.

3.4.8. Number of male and female kid at first kidding

Male and female kid number was almost alike in backyard and commercial farming system. Male kid number was 0.93 ± 0.13 vs 0.93 ± 0.17 in backyard and commercial settings. In case of female kid number it was 0.8 ± 0.11 vs 0.92 ± 0.13 in backyard and commercial settings respectively (Table 4). From above analysis male female kid ratio between backyard and commercial farming is not significant statistically ($p > 0.05$). Male female kid ratio was 1:1. According to Hassan *et al.* (1970) male kid was 53.2% and female were 46.7% which does not match with the findings of this study.

Table 4: Reproductive and productive performance of goat in backyard and commercial farming

Variable	Mean \pm SE		P value
	Backyard	Commercial	
Milk production (Liter/day/animal)	0.42 ± 0.18	0.77 ± 0.11	0.0001
Age of puberty (Month)	6.05 ± 0.18	6 ± 0.31	0.88
Age of first service (Month)	6.53 ± 0.21	6.43 ± 0.29	0.78
Gestation period (Day)	156.23 ± 1.53	157.28 ± 3.37	0.74
Average litter size	1.96 ± 0.10	2.14 ± 0.18	0.36
Kidding interval (Month)	4.56 ± 0.57	5.85 ± 0.39	0.15
First age of kidding (Month)	11.53 ± 0.21	11.71 ± 0.24	0.61
Male kid at first parity	0.93 ± 0.13	0.93 ± 0.17	0.98
Female kid at first parity	0.8 ± 0.11	0.92 ± 0.13	0.49

Chapter 4

Conclusion

Reproductive performance of goat in backyard and commercial farming does not vary as management system is more or less similar in both farming condition. Productive performance significantly varies in between backyard and commercial farming. More studies with large sample size on comparison of backyard and commercial goat farming would help to find the best farming way for better reproduction and production performance of goat in Bangladesh.

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Biography

This is **Sumaiya Meherin**, daughter of Jalal Ahmed and Masuma Parvin. She completed her Secondary School Certificate examination from Shaheed LT. G.M. Mushfique Bir Uttam High School, Chattogram in 2014 and Higher Secondary School Certificate from Chattogram Cantonment Public School and College, Chattogram in 2016. I am an intern veterinarian at Chattogram Veterinary and Animal Sciences University, Bangladesh under the Faculty of Veterinary Medicine. I have a strong interest in veterinary medical research and wish to use my skills and imagination to benefit the country. So that we can overcome the difficulties we currently face in this subject.