

**EVALUATION OF GOAT PRODUCTION OPPORTUNITIES ON
THE EMBANKMENT OF SHRIMP FARMS IN SOUTHWEST
COASTAL REGION OF BANGLADESH**

A THESIS

BY

REZMA KABIR

EXAMINATION ROLL NO. MS- 210825

**A Thesis (Course No. AN-6104) Submitted to Agrotechnology Discipline in Partial
Fulfilment of the Requirement for the Degree of Master of Science in Animal Nutrition**



AGROTECHNOLOGY DISCIPLINE

KHULNA UNIVERSITY

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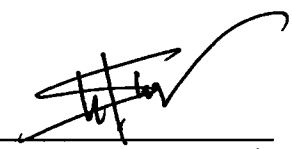
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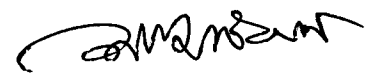
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**DEDICATED
TO MY
BELOVED PARENTS**

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Date: June, 2023

The Author

ABSTRACT

Goats are a significant source of protein, and often, the goat industry can help farmers overcome an unexpected situation that requires quick financing. This study was conducted to monitor the scope of goat rearing and evaluate the chemical content of naturally grown grasses in embankments of shrimp farms in the southwestern coastal region of Bangladesh. An interview schedule was prepared considering the objectives of the study. Three upazilas for data collection viz. Dumuria of Khulna, Tala of Satkhira and Fakirhat of Bagerhat district have been selected. Fifty farmers were randomly selected from each upazila for data collection. Samples of naturally grown grass were collected from the study area to determine its nutritional value. After collection, green grass samples were subjected to chemical analysis for determination of dry matter (DM), crude protein (CP), ether extract (EE), crude fiber (CF), and total ash (TA) at Animal Husbandry Laboratory, Khulna University, Khulna. Both survey and grass sample data were analyzed using the SPSS (version 22) computer program. The results of the survey showed that 75% of the farmers had their own shrimp farms. Among the goat breeds, Black Bengal was predominant (77.3%), Jamunapari was also seen in 19.3% cases. The mean age at first kidding (d), mean kidding interval (d) and mean litter size (No.) were 386.71, 189.70 and 1.91 respectively. The average mortality rate was only 1.23%. The results of the survey also stated that 72.0% of the respondents said that the grass grown naturally in the embankment of shrimp farm meets the nutritional needs of the goats. Among the grass samples, Kash (*Saccharum spontaneum*) had highest dry matter (DM) contents (45.39%±0.95), Durba (*Cynodon dactylon*) had highest ($p<0.001$) crude protein (16.07%±0.20), Gitla (*Paspalum conjugatum*) had highest ($p<0.01$) crude fiber (CF) (30.03%±0.20), Kash (*Saccharum spontaneum*) had highest ($p<0.05$) ether extract (3.42%±0.14) and Shama (*Echinochola crusgalli*) had highest total ash content (18.57%±0.18). The results of the study concluded that embankment of shrimp farms in southwest coastal region of Bangladesh have good potential for goat production considering first kidding, short kidding interval, good litter size and good nutritional value of naturally grown grasses.

Keywords: Chemical composition, Embankment, Goat production, Grasses, Shrimp farms

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CHAPTER I

INTRODUCTION

1.1 Background of the Study

Bangladesh is mainly an agricultural country. Agriculture is the single largest producing sector of the economy and it contributes about 22% to the total Gross Domestic Product (GDP) of the country (BBS, 2008). About 80% of total population directly or indirectly depends on it. Its economy mainly depends on crop and animal production. Livestock is an integral part of farming systems in Bangladesh. The major livestock in Bangladesh are cattle, buffalo, goat, sheep, chicken and duck. Livestock are well integrated into the mixed farming system of Bangladesh, where 25% of the population are directly involved in livestock production and another 60% are indirectly involved (Anonymous, 2001). Livestock plays a vital role in agriculture providing draft power and manure for crop production, food (milk, meat & eggs) for human consumption and foreign exchange thorough export of hides and skin.

Among livestock, goats constitute important animals in small farming systems in the developing countries. More than 95% of the goat population is found in developing countries (FAO, 2006). In the developing countries, goats make a very valuable contribution especially to the poor in the rural areas. Goat rearing is an integral part of many farming systems in Bangladesh. The goat is probably the only animal which in Bangladesh is managed for multiple end uses: meat, hides, milk and manure. It provides one of the main sources of income for the farmers of Bangladesh. It is a major contributor of protein and fat and often the goat enterprise can help farmers to overcome an unforeseen crisis, which demands immediate finance.

In Bangladesh, goat rearing has long been associated with the rural economy. Goat rearing is playing a role in improving the socio-economic status of small and marginal farmers and underprivileged women by providing them with alternative employment. Goat rearing is a profitable business that generates an important cash flow that is used for essential family and social activities. Goat meat has a great demand and value in the local Bangladeshi and international market. Goat milk is very suitable for human health and the popularity and consuming rate of goat milk is increasing rapidly. So, you don't have to think about marketing your products. Commercial goat farming in Bangladesh can be a great source of income and employment for the unemployed educated people of Bangladesh.

Goats require less living space, care and additional facilities compared to other livestock animal like cattle. They can manage themselves with less management, care, housing and feeding. In small scale production, you can keep your goats with other animals like cow or sheep. Infrastructure, feeding, treatment and other production costs are less. Highly productive goat breeds are available and suitable for farming in Bangladesh according to its weather, climate and other circumstances. Goats are smaller in size but reach slaughter age faster. There are no religious obligations or taboo for consuming goat products like meat and milk. Many highly productive local and foreign goat breeds are available and suitable for commercial production.

Khulna and Chittagong are the key locations for coastal shrimp aquaculture in Bangladesh. Currently, 80 percent of shrimp farms are found in the Khulna region in the southwest, with the other 20 percent spread out across Cox's Bazar and other coastal regions (Alam *et al.* 2004). Goats are small livestock animal. They require less space and care than cattle. Goat care and management process are very easy and simple. So that in coastal area farmers rear goats in the shrimp farms. They took their goats with them early in the morning and get back them at evening. All the day time goats are graze grasses in the embankment of farms. Some farmers give them other feed by purchasing at lower rate from the local market.

Locally available grasses like Durba, Gitla, Shama, khas ghas were found in the embankment and roadside of the shrimp farm. Goats can get proper nutrition from these grasses. So that farmers need not bear excess money. For this result farmers get profit without investing much money.

1.2 Justification of the study

Goat is known as 'Poor man's cow' and is a very important component in the farming system of Bangladesh. With very low investments goat rearing can be made in to a profitable venture for small and marginal farmers. Goat rearing is a profitable business that generates an important cash flow that is used for essential family and social activities. Farmers can rear goat beside their main occupation. They can rear goat beside farming, fishery, other multiple work. Women and children can also easily raise goats in addition to their regular household works. There are about 30.33 million goats in Bangladesh of which Black Bengal Goat comprises more than 90% of the total goat population; the remaining ones include the Jamuna pari and their crosses (Anonymous, 2021). Average

number of goats per farm was reported to be 4 and up to 41% of farm income comes from goat rearing in some parts of Bangladesh (PKSF, 2014). Faruque *et al.* (2016) stated that goat rearing in Mymensingh district has improved the livelihood of rural farmers by increasing their income.

Now a days lands were very limited. In this situation, it was very important to take alternative measures to increase goat rearing in the region. Goats were small animals that require less space, less feed and minimal care than larger animals such as cattle and buffaloes. In this case, it was possible to improve people's income and living standards by rearing goats in the embankment of shrimp farms.

1.3 Research Gap

- (i) The information on the problems and prospects of goat production on the embankment of shrimp farms in southwest coastal regions of Bangladesh is limited.
- (ii) Little information is available on the nutritional value of natural grasses grown on the embankment of shrimp farms.

1.4 Research Questions

- (i) What are the problems and prospects of goat production on the embankment of shrimp farms in southwest coastal regions of Bangladesh?
- (ii) What is the nutritional value of the natural grass grown in the embankment of the shrimp farms?
- (iii) What are the production and reproduction performance of goat reared on the embankment of shrimp farms?

1.5 Objectives of the study

- (i) To evaluate the problems and prospects of goat production on the embankment of shrimp farms in southwest coastal regions.
- (ii) To determine the nutritional value of natural grasses grown on the embankment of shrimp farms.
- (iii) To assess the productive and reproductive performances of goat reared on the embankment of shrimp farms.



CHAPTER II

REVIEW OF LITERATURE

In this chapter an attempt is made to critically review the past literature that is relevant to the present study. The reviewed literature would help to keep the research on proper lines and to bring refinement in the study. The research work carried out by various researchers related to the problem under study has been reviewed under the following heads.

2.1 Goats of Bangladesh

Goats, an integral component of farming in Bangladesh, support a large section of landless and marginal farmers (Singh *et al.*, 2000). There are about 300 breeds and varieties of goats domesticated in this subcontinent. More than 90% of the goats in Bangladesh are kept by rural people. Many of the landless and marginal farmers own 1-5 goats and contribute economically to the subsistence farmers in mixed farming systems (Husain, 1993).

Kumar and Singh (2005) stated that the socio-economic value of goat rearing as compared to other livestock species has been immense, for the poor farmers. It is mainly because the low input, high fecundity, easy marketing and unprejudiced social acceptance of their products are few of many advantages of this enterprise that provides assured higher income.

Bangladesh now has 26.604 million goats, and livestock contributes 1.44% of GDP, according to Development of Livestock Services (DLS) 2020-21. So it is need to focus on to increase income for farmers. Prank *et al.* (2023) stated that they require knowledge of prolific goat breeds, breeding, rearing systems, feeding, health care, hygiene and sanitation, entrepreneurship, empowerment of women, business strategy, financial incentives, and knowledge of marketing. To acquire all this knowledge, the study strongly recommends better training of farmers, hands-on education, modern goat farming, and raising awareness through regular vaccination campaigns.

2.2 Goat farming in Bangladesh

The contribution of livestock in Gross Domestic Product (GDP) during 2013-2014 was 1.78% while the share of livestock in Agricultural GDP during the same time was 14%. Goat occupies a significant position as an animal genetic resource in the pre-dominantly agro-based farming system in Bangladesh (Hossain, 2006). About 21.6 million goats are distributed throughout the country (FAO, 2010; BER, 2012). The present production systems of goats are in scavenging by small holder farmers with 2-5 goats per farmer. The Department of Livestock Services (DLS) has reported this figure to be slightly higher (25.43 million) during 2013-2014. The contribution of goat for livelihood improvement and food security is well established in Bangladesh. The activities of goat rearing are mainly performed by female members of the family. Department of Livestock Services (DLS) has taken goat farming as an action program to generate income and reduce poverty for the rural poor farmers. Chowdhury (2015). Goat production activities are also strengthened by some NGOs in the country. Goats are valued for their contribution in the national economy of Bangladesh due to:

- (i) Meat for human consumption from castrated male in particular
- (ii) skin for earning foreign currency irrespective of type of goat
- (iii) increase of income and poverty reduction for small holders
- (iv) employment generation in rural areas
- (v) cash income for empowerment of women.

2.3 Breeds of Goat

In Bangladesh currently you will find 20 to 22 Bangladesh goat strains (breeds) available for goat farming a few of these are; Black Bengal.

Black Bengal goat

Black Bengal goat is a native Bangladeshi goat breed. It is highly meat productive deshi goat breed. Black Bengal goats are dwarf breed and are known to be famous for its adaptability, higher disease resistance, fertility, fecundity, early sexual maturity, larger litter size, delicacy of meat and superior skin quality (Husain *et al.*, 1998). However, some authors reported that their growth rate is slow; milk yield is as low that sometimes it is not sufficient for their kids and higher kid mortality (Chowdhury *et al.*, 2002). Though majorities of the Black Bengal bear black coat color, black and white, brown, brown and white and white coat colors are also common in the Black Bengal Population.

Black Bengal goat constitutes nearly 90% of the total goat population of the country and the remaining are Jamunapari and their crosses (Husain *et al.*, 1998). It produces high-quality meat and skin, and is preferred for the skin and high proliferation rate.

This breed plays a very important role in reducing unemployment and poverty from Bangladesh. They can eat most vegetables, grasses and leaves, but a high amount of carrots is fatal to them (Murshed *et al.*, 2014)



Photo. 1. Black Bengal goats

Jamunapari goat

Jamunapari goat is a pure Indian breed. Name of the breed derived from the rivers the Yamuna, Jamuna (West Bengal and Bangladesh). The Jamunapari breed has found greater success in many countries for their fast growth and high yield on milk (Hassan *et.al.*, 2010).



Photo 2. Jamunapari goat

2.4 Housing of the goat

Goats by nature are very tolerant of all kinds of weather and can adapt to many different styles of housing, some of which can be simple and inexpensive.

The two principal categories for housing design are open housing and confinement housing. Open housing, or loose housing, allow goats to have protection from weather conditions while giving them open access to pasture. Confinement housing contains the goats totally within the structure and often includes a separate area for exercise which is outside and adjacent to the building. Any system should have the ability to separate groups of animals such as milking does, dry (non-lactating) does, newborn kids, growing kids, and bucks. Whichever type of housing used it is vital to know all the rules and regulations with respect to location, design, and type of operation. Also, appropriate building permits should be obtained. Speaking with an experienced builder or contractor can help to ensure the facility and equipment of the building is suitable for the cost; considering the size and intensity of the operation.



Photo 3. Bamboo made house of goat

2.5 Goat rearing in the rural area

Most developing countries are located in the tropics and subtropics. The per capita income in these countries is low compared to those in developed nations. Usually, the intake of energy, and especially protein, is also low. Based on data from the Food and Agriculture Organization in 1976, countries in Africa and Southeast Asia had the lowest animal protein intakes of lesser developed countries with 11.4 and 9.8 g per capita, respectively. The demand for goat meat surpasses supply in most less developed countries which, in turn, raises the unit price sold for goat compared to mutton. However, the majority of goat meat in villages and rural areas is raised and consumed at home instead of marketed or purchased commercially (Devendra, 1980). Rural households own greater than 90% of the goat population in lesser developed countries (Boyazoglu *et al.*, 2005).

2.6 Women's contribution in goat rearing

The role of women in livestock is well documented by (FAO, 2000). Studies revealed that in countries such as Yemen, Cyprus, Egypt, Marcoco and Syeria women have primary and basic responsibilities for livestock production. Approximately 85% of the work required for livestock production is carried out by women in Yemen and Morocco with the exception of health care and marketing women are conscientious for all other activities such as milking, clearing and feeding animals and in cheese-making and the production of other dairy products.



Photo 4. Feeding of goats

2.7 Goat production and management system

Goat production is well integrated with other livestock species and crop production. However, goat farming requires some management and husbandry skills to ensure that the goats are healthy and productive (Dev, 2012). Small farmers in India: Challenges and opportunities. It is important to provide goats with a balanced diet to meet their nutritional value. Goats also need proper management like fresh, clean at all time. They need to take care of them all time in day time.

2.8 Diseases and their control in goat farming in Bangladesh

Goats are susceptible to disease like parasites, pneumonia, enterotoxemia and foot rot and mouth disease (FMD). Parasites lead to weight loss, enemies and even death. Therefore, deworming goats regularly is the best way to prevent parasitic infections. Pneumonia is a respiratory disease that is caused by bacteria or viruses symptoms include coughing difficult breathing and nasal discharge. Vaccinations are available for some types of pneumonia and help prevent disease outbreaks on farm. Enterotoxemia is a bacterial disease that affects the intestines of goats. Symptoms are including diarrhea, vomiting, bloating and dehydration. Vaccinating can be preventing this disease from occurring (Hossain *et. al.*, 2019).

2.9 Cost of goat rearing

To analyze the cost-return it is necessary to describe the feed cost, breeding cost and cost of housing and equipment for goat rearing. The average cost of housing and equipment (per year) was higher than the average feed and breeding cost per year. Available local feed resources are usually used as road side grasses, embankment grasses, leaves of different types of trees, etc.

Table 2.1 Average cost for goat rearing per year

Category	Frequency (BDT)
Average feed cost	486
Average breeding cost	86
Average cost of housing and equipment	1144
Average cost of medicine	390
Average cost of vaccine	48
Total	2154



Source: Hossain *et.al.* (2017)

On the other hand, they purchased feed only during the scarcity period. The major cost of healthcare is medicinal cost. For medicine they were mostly dependent on the medicine shops located far from their house. For this reason, the average healthcare cost of goats was increased. During the rainy season, the occurrence of disease was spread-out due to lack of proper knowledge about the disease prevention and at that time the healthcare cost was increased. But, now-a-days various NGO's doing some handy jobs in aspect of preventing various livestock diseases by advising primary knowledge of disease prevention, providing veterinary services and giving trainings.

2.10 Return from goats

The main return from goat of experimental area was from kids. Goats are traditionally raised by the rural people mostly for cash income and this is especially true for Black Bengal goat (Rahman *et al.*, 1998). Generally, Black Bengal goats are poor milk producer having short lactation period. Farmers sold some milk in the markets; some were consumed by the family and in most cases the available quantity of goat milk were consumed by its kids. Saadullah (1995) reported that, goat milk contributes more than 28% of the total milk yield in the country. Total goat milk production in Asia as percentage of all milk is small and is about 3.6% (FAO, 2010) The net income was 2142 BDT which indicated that rearing of goat in the experimental area was profitable. Akter (2004) observed that per household annual total cost of production of Black Bengal goat was BDT 1651, while total income was BDT 2290 and net income was BDT 639 (Hossain *et al.*, 2017).

CHAPTER III

MATERIALS AND METHODS

Research methodology is the specific procedures or techniques used to identify, select, process, and analyze information about a topic. Methodology would enable the research to collect valid information and it properly to arrive at correct decisions. Keeping this point in view, the researchers took utmost care for using proper methods in all aspect of this investigation. Research methodology is a systematic way to solve a research problem. It may be understood as a science of studying how research is done (Kothari, 1990).

3.1 Design of the study

The present study was based on data collected by door-to-door interviewing. It was designed to evaluate goat production opportunities on the embankment of shrimp farms in southeast coastal region of Bangladesh.

3.2 Locale of the study

The study was conducted at three selected Upazila under Khulna district; a baseline survey was conducted in three coastal upazilas, Dumuria of Khulna, Mongla of Bagerhat and Tala of Satkhira districts.

3.3 Preparation of the interview schedule

An interview schedule was prepared keeping the objectives of the study in mind. The prepared interview schedule was pretested before collection of data. It was very important to pre-test the questionnaire before its final use and detect the problems with the interview schedule that might lead to biased answers. By pretesting the interview schedule, it could be easily found out which questions don't make sense, which is not the right question for the respondents and question create an odd situation for respondents.

3.4 Data collection

Data were collected from the goat farmers in shrimp producing areas of southwest coastal region. Data were collected by direct interview of the goat farmers. Fifty farmers were interviewed at random from each upazila to collect data.

3.5 Geographical Location of the study area



Fig 1: Map of Dumuria Upazila Khulna

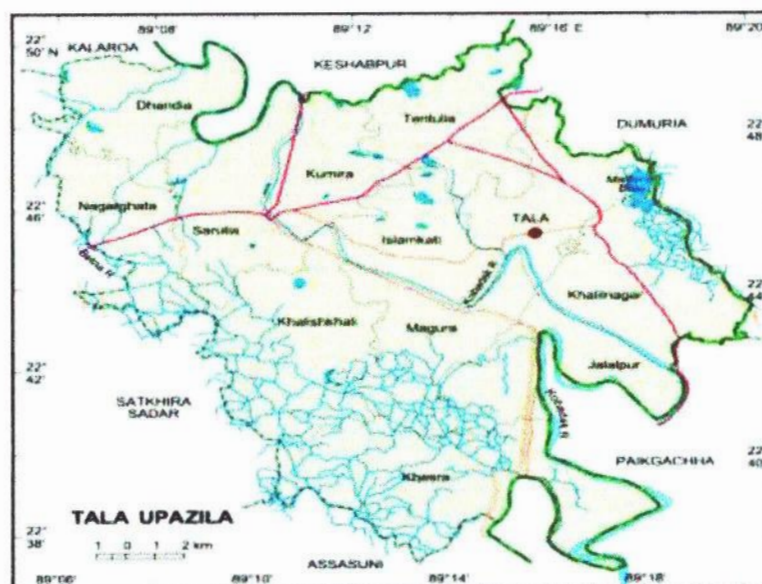


Fig 2: Map of Tala Upazila Satkhira Districts



Fig 3: Map of Mongla Upazila Bagerhat district

3.6 Data tabulation

After completion of field survey all the interview schedule were set for its data tabulation. All the individual variable of the interview schedule was transferred to a master sheet to facilitate tabulation.

3.7 Data analysis

Simple statistical method was used for analyzing the data so that the objectives can be fulfilled easily and accurately. To analysis, the data the IBM SPSS statistics 20.0 program was used. Tabular technique was used in data analysis of the research.

3.8 Collection of grass samples

Nine types of grasses were collected from three different upazila. Durba (*Cynodon dactylon*), Gitla ghas (*Paspalum conjugatum*), kash ghas (*Saccharum spontaenum*) these three grasses were collecting from local embankment shrimp farm of Dumuria upazila Khulna. Durba (*Cynodon dactylon*), Gitla ghas (*Paspalum conjugatum*), Shama ghas (*Echinochola crusgalli*) grasses were collecting from shrimp farm of Mongla Upazila Bagerhat. Durba (*Cynodon dactylon*), Gitla ghas (*Paspalum conjugatum*), kash ghas (*Saccharum spontaenum*) grasses were also collect from some local embankment of shrimp farm of Tala Upazila Satkhira. After collecting the samples, it was grounded by using an electrical grinder into small particle size. Then, the samples were kept in the oven for drying the samples at a temperature of 105°C for 24 hours to determine the dry matter. The rest of the samples were stored in dry and well-covered containers until analysis.

3.9 Proximate analysis

The analysis of proximate composition was conducted at Animal Husbandry Laboratory of Agrotechnology Discipline, Khulna University, Khulna. Samples of green grasses were subjected to chemical analyses for the determination of dry matter (DM), crude protein (CP), ether extract (EE), crude fiber (CF), and total ash (TA) following the method of AOAC (1990). On each chemical analysis, a double determination was carried out. Chemical composition data of grass samples was analyzed using SAS program (SAS, 2009).

3.10 Determination of dry matter

Procedures

At first, the tray was weighed with the help of weight machine (W1). Then grounded samples were taken to each tray. The weight of the sample with tray was recorded (W2). Samples were placed in preheated oven at 104+ 1°C and dried for 24 hours and after 24 hours dried samples were removed from the oven. After oven-dry tray containing the dried sample was weighed (W3). Dry matter (DM) determination was done according to AOAC (1990).

Calculation

Where,

W1 = weight of tray in grams

W2 = Initial weight of sample with tray in grams

W3 = Dry weight of sample with tray in grams

$$\% \text{ DM} = \frac{(W3 - W1)}{(W2 - W1)} \times 100$$

3.11 Crude Protein Detection

Procedures

Crude protein was determined followed by the Kjeldahl method. The power of the KDN Kjeldahl block digester was turned on and digestion tubes were checked and replaced those that were cracked or chipped 1g of sample was weighted out and taken. Crude protein (CP) determination was done according to AOAC (1990). The protein analysis was done by following three different steps which are discussed below:

Digestion

For concentrate samples,

1g of sample was taken into the test tube. For each sample 2 catalyst tablets DEE and 20 ml concentrated sulfuric acid (96-98%) were added into the test tube and the test tube was shaken gently. The sample with the H₂SO₄ mixture was given in the digestion block. The exhaust fan near the digestion block was turned on. The sample was heated 2 times in the digestion block. Firstly, 40 min at 300°C and then 90 min at 420°C. Then the test tube was kept into the digestion block for 15 minutes for cooling.

Distillation

After cooling the sample, it was mixed with 50 ml distilled water. Then the test tube with the sample was then put into the distillation cycle. 30ml 2% Boric acid solution was taken in a conical flask and 4 drops of methyl blue were added to it. The conical flasks were then placed near the distillation tube. The water flow and the flow of 50 ml 40% NaOH were previously adjusted. After that, the button was pressed to begin the distillation process. The distillation process was done for 5 min until the color of the indicator mixture solution did not turn into bottle green color.

Titration

The sample of the conical flask was then taken for titration. For concentrates, 0.1N HCl was taken into the burette pipe for titration and added dropwise and on the other hand, for grasses, 0.2 N HCl was taken. The procedure was continued until the color of the solution of the conical flask turns blue from bottle green. When the solution color had changed, the titration procedure was ended. The strength of the titrate was then recorded.

Calculation

$$\text{Nitrogen (\%)} = \frac{(\text{ml sample} - \text{ml blank}) \times 0.1 \times 14.01 \times 100}{1000 \times \text{sample weight (g)}}$$

$$\text{Crude protein (\%)} = \text{Nitrogen (\%)} \times \text{Conversion factor} *$$

*= Conversion factors for animal and plant origins ingredients are 6.25.

3.12 Ether Extract Detection

Determination of Ether Extract (EE)

Procedures

At first, the sample was weighed (W1), from 3 to 10 g. The samples were then introduced directly inside the cellulose thimble. Then the sample containing thimble was introduced into the extraction set. Extract collecting vessel was weighed (W2) and 70ml acetone was added into the vessel. Then the extraction vessel with solvent was introduced in the

extraction equipment. The extraction unit was closed and the unit was turned on by a general switch located on the control panel. For acetone, the temperature was fixed at 110°C. The cooling water flow and heating were started. When the solvent was started boiling, the thimble was immersed by placing the slider into an “immersion” position. After 60 minutes, the thimble was extracted from solvent placing the slider into the “washing” position. After 60 minutes of reflux washing, the slider was placed into the “recovery” position. After 30 minutes of recovery, the stopcock located under the water-cooled condenser was closed and the solvent was completely evaporated from the extraction vessel. Then the extract collecting vessel with boiling stones was dried in an oven for 30 minutes at a temperature high enough to evaporate completely solvent residues. Then the extract collecting vessel was cooled and weight (W3) was taken. Ether extract (EE) determination was done according to AOAC (1990).

Calculation

$$\text{Ether Extract (\%)} = \frac{(W3 - W2)}{W1} \times 100$$

Where,

W1 = initial weight of sample in grams

W2 = initial weight of vessel in grams

W3 = weight of vessel and Lipid residue in grams

3.13 Determination of Total Ash (TA)

Procedures

At first, the crucible was weighed (W1). About 2 g sample was weighed (W2) into a crucible that had been tarred. Crucibles were placed in a muffle furnace at 350°C for 4 hours. After 4 hours, crucibles were allowed to cool in a furnace and after that, the crucibles were placed in the desiccator. Crucibles were cooled in desiccators to room temperature and were weighed immediately (W3). Ash determination was done according to AOAC (2003).

Calculation

$$\text{Ash (\%)} = \frac{(W3 - W1)}{W2} \times 100$$

Where,

W1 = weight of crucible in grams

W2 = weight of sample in grams

W3 = weight of crucible and ash in grams



3.14 Determination of Crude Fiber (CF)

Procedures

The crude fiber was determined by following the method of AOAC (1990). At first, the sample moisture was determined separately by heating in an oven at 105°C to constant weight and was cooled in a desiccator. 1 g sample was weighed accurately (W). The switch of the fiber analyzer was turned on. 1.25% sulfuric acid was added to the 150ml notch, after preheating by the hot plate in order to reduce the time required for boiling. Then 3-5 drops of n-octanol as an antifoam agent was added. Exact 30 minutes was boiled from the onset of boiling. Then for draining sulfuric acid, it was connected to the vacuum. 30 ml of hot deionized water was added and washed three times, connecting each time to compressed air for stirring the content of the crucible. After draining the last wash, 150ml of preheated 1.25% potassium hydroxide (KOH) and 3-5 drops of antifoam were added and was boiled for 30 minutes. Then again 30 ml of hot deionized water was added and washed three times, connecting each time to compressed air for stirring the content of the crucible. Then in order to cool the crucibles, the last washing was performed with cold deionized water and then the crucible content was washed three times with 25 ml of acetone, stirring each time by compressed air. The crucible was removed and the dry weight was determined after drying in an oven at 105°C for an hour and then was cooled in a desiccator. The weight represents the crude fiber plus ash content (W1). The crucible was then placed in a muffle furnace and heated up to 550°C for three hours and reweighed after cooling in a desiccator (W2). Crude fiber (CF) determination was done according to AOAC (1990).

Calculation:

$$\text{Crude fiber (\%)} = \frac{(W1 - W2)}{W} \times 100$$

Where,

W = initial weight of sample in grams

W1 = weight of crude fiber plus ash content in grams

W2 = weight of ash in grams

3.15 Nitrogen Free Extractable Substance (NFE) % NFE = 100 - (% Crude protein + % Mineral matter + % Ether extract + % Crude fiber).

CHAPTER IV

RESULTS AND DISCUSSION

In this chapter, findings of the study have been presented in details as found to satisfy the objectives.

4.1 Personal Information of the Farmers

There are some important data, which helps to know about the socio-economic behavior of the respondents. To find out the socio-economic status of the respondents and to assess the opportunity of damming of shrimp farms in the southwest coastal region of Bangladesh, 150 respondents were interviewed.

4.1. 1 Age of the Farmers

According to the data, the farmers were ranged from young to old and in numerical value, they were ranged in 30 to 75 years. All the interviewed farmers are classified into three categories, which are mentioned in the Table 4.1. It is showed in the Table that about 50 percent of the farmers were occupied in the age range of 31 to 50 years and near about 45 percent of the farmers were old and about 10 percent were young aged.

Table 4.1 Distribution of the respondents according to their age

Categories	Scores (Years)	Respondents(N=150)		Mean $\pm$ SD	Min.	Max.
		Number	Percentage			
Young aged	≤ 30	10	6.7	2.37 $\pm$ 0.61	1	3
Middle aged	31-50	75	50.0			
Old aged	>50	65	43.3			
Overall		150	100.0			

Table 4.2 Average age of the respondents in three locations

Locations	N	Mean $\pm$ SD	Minimum	Maximum
Dumuria	50	42.80 $\pm$ 12.25	23	69
Mongla	50	54.44 $\pm$ 9.79	39	76
Tala	50	45.38 $\pm$ 11.70	25	70
Total	150	47.54 $\pm$ 12.29	23	76
F-value		14.646		
Level of significance		>0.001***		

*** p<0.001

4.1.2 Sex of the farmers

In my survey I found that the majority of respondents were male with about 68.0 percent and about 32 percent female. Most of the respondents were male as I visited the shrimp farm area where male farmers answered all my questions. And when I go to some houses for my survey I find some women farmers who are involved in goat rearing besides their housework.

Table 4.3 Distribution of the respondents according to their sex

Categories	Respondents(N=150)	
	Number	Percentage
Male	102	68.0
Female	48	32.0
Overall	150	100.0

4.1.3 Family members of respondents

According to the data, the members of the farming family are divided into several categories from small to large and the family size is determined from small to large according to numerical values. According to Table No. 4.4 about 72 percent of the families are small, about 24 percent of the families are medium and about 8 percent of the families are large in number.

Table 4.4 Family size category of the respondents

Categories	Score (Years of schooling)	Respondents (N=150)		Mean $\pm$ SD	Min.	Max.
		Number	Percentage			
Small	1-4	107	71.3	3.67 $\pm$ 1.52	2	8
Medium	5-7	35	23.3			
Large	>7	8	5.3			
Total		150	100.0			

Table 4.5 Average family members of the respondents in three different locations

Locations	N	Mean $\pm$ SD	Min.	Max.
Dumuria	50	3.40 $\pm$ 1.3	2	6
Mongla	50	3.80 $\pm$ 1.5	2	8
Tala	50	3.82 $\pm$ 1.7	2	8
Overall	150	3.67 $\pm$ 1.5	2	8
F-value		1.216		
p-value		0.299NS		

NS= Non significant ($p>0.05$)

4.1. 4. Level of education of the farmers

According to the level of education, the respondents were classified into five categories, as shown in Table 4.6 and the categories were illiterate, primary education, below SSC, SSC pass, HSC pass, graduate and above. It is found that about 48 percent of the farmers are illiterate. About 21 percent of farmers have passed primary education, about 10.7 percent of farmers are below SSC pass. Whereas initially 15 percent of farmers were SSC pass and about 6 percent HSC pass.

Table 4.6 Distribution of the respondents according to their education

Categories	Score (Years of schooling)	Respondents (N=50)		Mean $\pm$ SD	Min.	Max.
		Number	Percentage			
Illiterate	00	72	48.0	4.36 $\pm$ 4.93	0	14
Primary	1 to 5 years	31	20.7			
Below SSC	6 to 10 years	16	10.7			
SSC Pass	10 years	22	14.7			
HSC Pass	12 years	9	6.0			
Overall		150	100.0			

Table 4.7 Average education levels of the respondents in three different locations

Locations	N	Mean $\pm$ SD	Min.	Max.
Dumuria	50	4.28 $\pm$ 4.704	0	12
Mongla	50	3.88 $\pm$ 4.775	0	14
Tala	50	4.92 $\pm$ 5.333	0	14
Overall	150	4.36 $\pm$ 4.931	0	14
F-value		0.563		
p-value		0.571NS		

NS= Non significant ($p > 0.05$)

4.1.5 Occupation of the Farmers

Alam *et al.* (2004) noted that practically all respondents in each group reported that their major occupation was raising shrimp, whereas the same respondents reported that their secondary occupation was farming. In my study it was noted that the total respondents were classified into eight categories according to their occupation. The major category was crop, livestock & fish category, which was occupied by 29.3 percent farmers, next category was crop & fish, which was also occupied, by 29.3 percent farmers, crop & livestock was occupied with 25.3% farmers. 6.7% farmers was depended on fishing. Number and percentage distribution of respondents according to the occupation were furnished in the Table 4.8.

Table 4.8 Distribution of the respondents according to their occupation

Categories	Respondents(N=150)	
	Number	Percentage
Crop	4	2.7
Livestock	4	2.7
Fish	10	6.7
Crop + Livestock+ Fish	44	29.3
Business	1	.7
Day labor	5	3.3
Crop + Livestock	38	25.3
Crop + Fish	44	29.3
overall	150	100.0

4.1.6 Ownership of shrimp farms

According to my survey some farmers have their own shrimp farm and some farmers don't have their own shrimp farm. They gave me yes and no answers. About 75 percent of the farmers have their own shrimp farms and about 26 percent of the farmers do not have their own shrimp farms.

Table 4.9 Ownership of shrimp farms

Category	Frequency	Percent
Yes	111	74.0
No	39	26.0
Total	150	100.0

4.1.7 Area of Shrimp Farm

The majority (70.7%) of the shrimp farmers had medium sized shrimp farms followed by large (26.0%) and small sized farms (3.3%). The average shrimp farm size for Dumuria, Mongla and Tala Upazila were 124.13, 121.80 and 114.89 decimal, respectively where the mean differences were non-significant ($p>0.05$). Mohiuddin *et al.* (2018) stated a study in Paikgacha Upazila, Khulna, 72% of the land had only been utilized for agricultural purposes, 15% for settlement, and today, 65% of the land is being used for shrimp farming, which generates more money. Moreover, the establishment of haats and the seasonal vegetation for shrimp farms have steadily reduced waste land.

Table 4.10 Area of shrimp farm

Category	Frequency	Percent
Small (>33 decimal)	5	3.3
Medium (66 to 100 decimal)	106	70.7
Large (>100 decimal)	39	26.0
Total	150	100.0

Table 4.11 Average area (decimal) of the shrimp farms of the respondents in three different locations

Locations	N	Mean $\pm$ SD	Min.	Max.
Dumuria	50	124.13 $\pm$ 81.86	66	330
Mongla	50	121.80 $\pm$ 79.93	66	330
Tala	50	114.89 $\pm$ 81.50	33	330
Overall	150	120.27 $\pm$ 80.65	33	330
F-value		0.176		
p-value		0.839NS		

NS= Non significant ($p>0.05$)

4.1.8 Annual income

According to annual income farmers were categorized into three categories those were Low (<1 lac), Medium (1 to 1.5 lac) and High income (>1.5 lac). The data are presented in the Table 4.12 which reveals that majority of the farmers (92%) belonged to the low-income category where 6 percent farmers belonged to the medium income category and only 3 percentage farmers belonged to the high-income category. It means most of the farmers income was below the range of 1 lakhs at my survey area.

4.1.9 Annual income from goat rearing

All the farmers belonged to low-income group from goat rearing. Where a study at Chawgasa and Kaligonj farmers got profit about 83 and 73 percentage near about my survey Paul *et al.*, (1991).

Table 4.12 Distribution of the respondents according to their annual income

Categories	Frequency	Percent	Mean $\pm$ SD	Min.	Max.
Low Income (<Tk. 100,000.00)	138	92.0	20800.00 $\pm$ 14475.877	5000	50000
Medium income (Tk. 100,000.00 to 150,000.00)	9	6.0	21400.00 $\pm$ 15552.413	5000	70000
High Income (>Tk. 150,000.00)	3	2.0	20800.00 $\pm$ 14475.877	5000	50000
Total	150	100.0		5000	70000
F-value	3.665				
p-value	0.028NS				

NS=non-significant ($p>0.05$)

Table 4.13 Distribution of the respondents according to their annual income from goat rearing category

Category	Frequency	Percent
Low Income(<Tk 100,000.00)	150	100.0

4.1.10 Experience of farming

According to the farming experience, farmers were categorized into four categories which is shown in the Table 4.14. The data of the table reveals that majority of the farmers (51.3 percent) had short-term (1to 5 years) experience in farming. Second highest percentage (22 percent) of the farmers had no farming experiences, 14 percent farmers had medium (6 to 10 years) experiences and 12.7 percent farmers had long term farming experiences.

Table 4.14 Experience of farming category

Category	Frequency	Percent
No experience	33	22.0
Short term (1-5yrs)	77	51.3
Medium (6-10 yrs)	21	14.0
Long term (>10 yrs)	19	12.7
Total	150	100.0

Table 4.15 Average experience of farming of the respondents in three different locations

Locations	N	Mean $\pm$ SD	Min.	Max.
Dumuria	50	6.92 $\pm$ 8.787	0	30
Mongla	50	10.66 $\pm$ 11.34	0	40
Tala	50	8.60 $\pm$ 8.63	0	30
Overall	150	8.73 $\pm$ 9.72	0	40
F-value		0.498		
p-value		0.609NS		

NS=non-significant ($p>0.05$)

4.1.11 Experience of Goat farming

In the present study, experience of goat farming was categorized into four categories. About 32.7% respondents had 1 to 5 years short-term experiences. Major percentage of the respondents (32.5%) had short-term experience followed by medium-term (26.7%), long-term (23.3%) and no experience (17.3%) in shrimp farming (Table 4.16). Kamal *et al.* (2012) stated in their study about 42% respondent were 8-14 years medium category experience, 30.7% were up to 7 years short term experience, rest 27.3% respondent were high experienced and nearly 80% respondents were having no experience in goat rearing.

Table 4.16 Experience of goat farming category

Category	Frequency	Percent
No experience	26	17.3
Short-term (1-5 yrs)	49	32.7
Medium (6-10 yrs)	40	26.7
Long-term (>10 yrs)	35	23.3
Total	150	100.0

Table 4.17 Average experience of goat farming of the respondents in three different locations

Locations	N	Mean $\pm$ SD	Min.	Max.
Dumuria	50	6.92 $\pm$ 8.79	0	30
Mongla	50	10.66 $\pm$ 11.34	0	40
Tala	50	8.60 $\pm$ 8.63	0	30
Total	150	8.73 $\pm$ 9.72	0	40
F-value		1.878		
Level of significance		0.157NS		

NS= Non significant ($p > 0.05$)

4.1.12 Farming system

All the respondents are classified into several groups according to their farming system. Some respondents are involved only in livestock rearing. Some respondents cultivated crop with fish. A few farmers were able to cultivate crop, fish, rear poultry and they involved in other service. Data of the Table 4.18 shows the percentage of respondents those are involved in that particular type of farming system.

Table 4.18 Distribution of the respondents according to their farming system and income source

Categories	Frequency	Percent
Livestock	24	16.0
Fishery	9	6.0
Fishery+livestock	27	18.0
livestock+fishery+crop	54	36.0
Livestock+Crop	30	20.0
crop+Livestock+service	6	4.0
Total	150	100.0

4.2 Information about Goat

4.2.13 Types of Goats

Black Bengal goat is the only recognized breed of goat in Bangladesh which is found in natural grazing systems across the country Omar *et al.* (2016). In my study area I found about 78 percent of goats to be Black Bengal. Some 19.3 percent of the respondents were found to be observing Jamunapari. A few more goats are found there, as shown in Table 4.19.

Table 4.19 Types of goats

Categories	Frequency	Percent
Black Bengal	116	77.3
Jamunapari	29	19.3
Crossbred	3	2.0
Others	2	1.3
Total	150	100.0

Table 4.20 Total number of goats in three different locations

Locations	Number	Mean $\pm$ SD	Min.	Max.
Dumuria	50	7.52 $\pm$ 4.65	1.00	20.00
Mongla	50	7.62 $\pm$ 5.18	1.00	25.00
Tala	50	7.84 $\pm$ 4.36	1.00	20.00
Total	150	7.66 $\pm$ 4.71	1.00	25.00
F-value		0.060		
p-value		0.942NS		

NS=non-significant ($p>0.05$)

Table 4.21 Total number of male goats in three different locations

Locations	Number	Mean $\pm$ SD	Min.	Max.
Dumuria	50	3.50 $\pm$ 2.92	0.00	15.00
Mongla	50	3.26 $\pm$ 2.33	0.00	10.00
Tala	50	2.88 $\pm$ 2.60	0.00	10.00
Overall	150	3.21 $\pm$ 2.62	0.00	15.00
F-value		0.709		
p-value		0.494NS		

NS=Non-significant ($p>0.05$)

Table 4.22 Total number of female goats in three different locations

Locations	Number	Mean $\pm$ SD	Min.	Max.
Dumuria	50	3.92 $\pm$ 3.03	0.00	15.00
Mongla	50	4.30 $\pm$ 3.89	0.00	20.00
Tala	50	4.96 $\pm$ 3.38	0.00	18.00
Overall	150	4.39 $\pm$ 3.45	0.00	20.00
F-value		1.163		
p-value		0.315NS		

NS=Non-significant ($p>0.05$)

4.2.14 Age at puberty of goats

Maximum and minimum puberty ages of 240 days and 160 days, respectively, were observed in three distinct of the study areas. According to Khartum *et al.* (2000), does go through puberty at the age of 6 to 8 months, whereas bucks go through it around the age of 4-6 months. Breed, nutritional state, and environmental factors including the season of birth can all affect an animal's age at onset, which can vary between breeds.

Table 4.23 Average age at puberty (days) of goats in three different locations

Locations	Number	Mean $\pm$ SD	Min.	Max.
Dumuria	50	193.40 $\pm$ 17.68	160	240
Mongla	50	193.20 $\pm$ 17.66	160	240
Tala	50	195.40 $\pm$ 16.44	160	240
Overall	150	194.00 $\pm$ 17.18	160	240
F-value		0.248		
p-value		0.781NS		

NS=Non-significant ($p>0.05$)

4.2.15 Age at first kidding of goats

The study's results revealed in Table 4.24 that the p value is statistically non-significant. In contrast a study by Hasan *et al.* (2007), the average age at first kidding for Black Bengal goats was 360-510 days, compared to 411-515 days for crossbred goats. Therefore, Black Bengal goats had superior reproductive performance than crossbred goats, which was statistically significant (P 0.05).

Table 4.24. Average age at first kidding (days) of goats in three different locations

Locations	Number	Mean $\pm$ SD	Min.	Max.
Dumuria	50	383.60 $\pm$ 51.08	330	480
Mongla	50	386.30 $\pm$ 52.97	320	510
Tala	50	390.22 $\pm$ 58.48	310	510
Overall	150	386.71 $\pm$ 53.97	310	510
F-value		0.188		
p-value		0.829NS		

NS=Non-significant (p>0.05)

4.2.16 Litter size of Goat

The average goat gestation lasts 150 days, so a female goat could have two deliveries per year. In these three-location maximum litter size is 3 and minimum 1.

Table 4.25 Average litter size of goats in three different locations

Locations	Number	Mean $\pm$ SD	Min.	Max.
Dumuria	50	1.98 $\pm$ 0.77	1	3
Mongla	50	1.80 $\pm$ 0.78	1	3
Tala	50	1.96 $\pm$ 0.78	1	3
Overall	150	1.91 $\pm$ 0.77	1	3
F-value		.805		
p-value		.449NS		

NS=Non-significant (p>0.05)

4.2.17 Kidding interval of goats

In Table 4.26. the minimum level of the kidding interval is 170 days, while the maximum level was 210 days. According to Hasans *et al.* (2007), the average interval between kidding in Black Bengal and Crossbred goats was 179 $\pm$ 20 and 270 $\pm$ 22days respectively, and the differences are highly significant. Similar as the data shown in Table 4.26.

Table 4.26. Average kidding interval (days) of goats in three different locations

Locations	Number	Mean $\pm$ SD	Min	Max
Dumuria	50	188.90 $\pm$ 10.01	170	210
Mongla	50	190.40 $\pm$ 9.89	180	210
Tala	50	189.80 $\pm$ 9.58	180	210
Overall	150	189.70 $\pm$ 9.78	170	210
F-value		0.295		
p-value		0.745NS		

NS=Non-significant ($p>0.05$)

4.2.18 Mortality rate of goats

Approximately 22% of growing goats (3 to 12 months) perished, with pneumonia and diarrhea being the leading causes of death. Mortality was higher (almost 40%) in the hot and rainy season (July to October). Infectious diseases, such as diarrhea, pneumonia, ecthyma, and enterotoxaemia, accounted for 63% of all infant deaths (0-3 months) throughout the research period. M. Ershaduzzaman *et al.*, 2007. The study of Ershaduzzaman, *et al.* (2007) is most closely related to the maximum 22.22% death rate in Table 4.27.

Table 4.27 Total number of goats mortality rate in three different locations

Locations	Number	Mean $\pm$ SD	Min.	Max.
Dumuria	50	1.6310 $\pm$ 4.49623	.00	22.22
Mongla	50	1.2098 $\pm$ 3.15823	.00	12.00
Tala	50	.8534 $\pm$ 3.11620	.00	16.60
Overall	150	1.2314 $\pm$ 3.63642	.00	22.22
F-value		0.570		
p-value		0.567NS		

NS=Non-significant ($p>0.05$)

4.2.19 Number of services per conception of goat

According to BBG, each conception requires between 1.2 and 1.4 services. According to the information in Table 4.28, the maximum number of services per goat conception is 3 and the minimum number is 1.

Table 4.28 Average no. of service per conception of goat in three different locations

Locations	Number	Mean $\pm$ SD	Minimum	Maximum
Dumuria	50	1.38 $\pm$ 0.56	1	3
Mongla	50	1.46 $\pm$ 0.64	1	3
Tala	50	1.44 $\pm$ 0.64	1	3
Overall	150	1.43 $\pm$ 0.61	1	3
F-value		0.225		
p-value		0.798NS		

NS=Non-significant ($p>0.05$)

4.2.20 Post-partum heat of goats

Post-partum heat period (PPHP) of goats is shown in Table 4.29. Post-partum heat of goats was ranged from 35 to 60 days. However, Moni *et al.* (2019) reported longer PPHP of 77 days. Many factors like feeding and nutrition, housing, reproductive management, improper heat detection, reproductive disorders and others may be associated with the variation of PPHP in animals. However, better nutrition might be the most important contributing factor responsible for lowering the PPHP in goats.

Table 4.29 Average post-partum heat of goat in three different locations

Locations	Number	Mean $\pm$ SD	Min.	Max.
Dumuria	50	39.74 $\pm$ 3.35	35	60
Mongla	50	40.46 $\pm$ 4.21	38	60
Tala	50	41.56 $\pm$ 5.94	38	60
Overall	150	40.59 $\pm$ 4.65	35	60
F-value		1.961		
p-value		0.144NS		

NS=Non-significant ($p>0.05$)

4.2.21 Gestation length of goats

The gestation period measured in this study in BBG ranged from 145 to 182, with a mean of 150.5 days; a shorter gestation period of 143 days has previously been reported in BBG by Moni *et al.* (2019). Close to the maximum and minimum lengths of time provided in table 4.30 of 156 and 140 days, respectively.

Table 4.30 Average gestation length of goats in three different locations

Locations	Number	Mean $\pm$ SD	Min.	Max.
Dumuria	50	147.80 $\pm$ 3.81	140	156
Mongla	50	146.96 $\pm$ 3.91	140	156
Tala	50	149.22 $\pm$ 4.06	142	156
Overall	150	147.99 $\pm$ 4.01	140	156
F-value		4.221		
p-value		0.017NS		

NS=Non-significant ($p>0.05$)

4.2.22. Types of feeds

Most of the people in the surveyed area keep goats in their own shrimp farms. So that the goats can graze all day in the embankment of the shrimp farm. The data given in Table 4.31 shows that most goats get about 71 percent of the embankment grass. Whereas 2 percent of the farmers gave cultivated fodder and only 0.7 were found to gave compound feed. Whereas goats were given only 26.7 percent mixed feed.

Table 4.31 Types of feeds

Categories	Frequency	Percent
Embankment grass	106	70.7
Cultivated fodders	3	2.0
Compound feeds	1	.7
Mixed feed	40	26.7
Total	150	100.0

4.2.23 Source of feeds

Data furnished in the Table 4.32 reveals that maximum farmers (51.3%) are purchased feed from market. 30% farmers liked to feed their goat from both readymade and homemade sources and very few farmers like 18.5% are liked to purchase feed for their goat. Most of them also slightly depended on embankment grass, roadside grass or cultivated fodder in the shrimp farm.

Table 4.32 Source of feeds

Categories	Frequency	Percent
Purchase/Readymade	28	18.7
Produce/Homemade	77	51.3
Both	45	30.0
Total	150	100.0

4.2.24 Housing of Goats

Table 4.33 shows the different categories of accommodation facilities for goat rearing. Siddiky (2017) stated that goats are kept in a portion of the household that is not used for living, cooking, or keeping items. Farmers utilize a house with amenities to provide shelter and feed (grass + concentrate) for medium scale, semi-intensive systems. This particular style of home is made of bamboo, kacha, permanent, semi-permanent, kacha and others.

Table 4.33 Housing of goats

Categories	Frequency	Percent
Permanent	11	7.3
Semi-permanent	31	20.7
Bamboo structure	49	32.7
Kacha	51	34.0
No sheds	2	1.4
Others	6	4.0
Total	150	100.0

4.2.26 Vaccination of goat

Animal disease control through vaccination is the most cost-effective way to reduce disease incidence and reduce economic losses. Table No. 4.34 shows the data that most of the respondents were aware of vaccinating their goats. About 73% of the farmers administered the vaccine regularly but 28% of the farmers were not aware of administering the vaccine.

Table 4.34 Percentage of goat's regular vaccination

Categories	Frequency	Percent
Yes	109	72.7
No	41	27.3
Total	150	100.0

4.2.27 Isolating sick goats

The data given in Table 4.35 shows that most of the respondents (88%) distinguished sick goats from good goats. Only 12% of farmers were not aware of isolating goats when they fell ill. In order to save goats from disease, it is necessary to separate infected goats from healthy goats.

Table 4.35 Distribution of the respondents according to isolation of sick animals

Categories	Frequency	Percent
Yes	132	88.0
No	18	12.0
Total	150	100.0

4.3 Information about goat rearing

4.3.28 Grazing requirements of goats

From table 4.36 we can see that about 72% of the respondents answered yes to me, it means they said that forage meets the complete nutritional needs of goats. About 28% of the respondents disagreed because they were not satisfied with the nutritional value of goats by grazing requirements.

Table 4.36 Percentage of satisfied nutritional value of goats grazing requirements

Category	Frequency	Percent
Yes	108	72.0
No	42	28.0
Total	150	100.0

4.3.29 Supplements feed for goat

Table 4.37 shows that about 52% respondents said yes to feeding their goats with supplementary feed and 48% respondents did not. Where Kumar *et al.* (2018) in his study showed that only 11% farmers use vitamin, mineral supplements.

Table 4.37 Percentage of supplementary feed for goat

Category	Frequency	Percent
Yes	78	52.0
No	72	48.0
Total	150	100.0

4.3.30 Different types of grass on the embankment

Different types of grass like durba, orail, kakpaya etc. are grown in the embankment of shrimp farm. However, most of the goats in the surveyed area graze on shrimp farm dams. So that they mostly find durba grass and other grasses also. Table 4.38 shows that about 91% of the goats received mixed grass and some (9.3%) received only Durba grass.

Table 4.38 Types of grass grown on the embankment

Category	Frequency	Percent
Durba	14	9.3
Mixed	136	90.7
Total	150	100.0

4.3.31 Satisfaction of respondents with nutritional value of grass

From Table 4.39 we can see that about 72% of the respondents were satisfied with the nutritional quality of goats that they got from embankment grass. Whereas only 28% respondents were not satisfied and they feed their goats with some other purchased feed.

Table 4.39 Percentage of the respondents satisfactions with nutritional value of grass

Category	Frequency	Percent
Satisfied	108	72.0
Not satisfied	42	28.0
Total	150	100.0

4.3.32 Cultivating fodder

From Table 4.21 we can see that about 72% of the respondents were cultivate fodders for their goats. Only 28% of the respondents did not cultivate fodder. They are totally dependent on naturally growing grass.

Table 4.40 Cultivating fodders for goats in the embankment of shrimp farm by the respondents

Category	Frequency	Percent
Yes	108	72.0
No	42	28.0
Total	150	100.0

4.4 Chemical composition of naturally grown grasses in the embankment of shrimp farm**4.4.1 Dry matter (DM) contents (%) grass samples**

Chemical analysis except for dry matter (DM) of grasses was carried out on a dry basis. Results of the chemical composition of grasses were presented in Table 4.40. Grasses were

collecting from three different upazila. Durba, Gitla and Khas ghas collecting from Dumuria upazila Khulna and Tala of Shatkhirra. Durba, Gitla and Shama ghas were collect from mongla upazila Bagerhat.

Data from the Table 4.41 showed that among 4 grass species that were evaluated in the present study, the highest average DM content (g/100g) was found in Kash (45.39%) and lowest in shama (27.50%). Dry matter content of other grasses was Durba (29.53%) and Gitla (27.31%). Manzoor *et al.* (2013) reported nearest DM content (g/100g) of Durba (28.36) of the present findings. But lower DM content Durba (23.22) was observed by Oke *et al.* (2016).

Table 4.41 Dry matter (DM) contents (%) grass samples collected from three different upazila

Grasses	Number	Mean $\pm$ SE	Min.	Max.
<i>Durba (Cynodon dactylon)</i>	9	40.00 $\pm$ 0.96	36.54	44.20
<i>Gitla (Paspalum conjugatum)</i>	9	29.53 $\pm$ 0.32	28.12	30.72
<i>Kash (Saccharum spontaneum)</i>	6	45.39 $\pm$ 0.95	43.12	47.82
<i>Shama (Echinochola crusgalli)</i>	3	27.31 $\pm$ 0.10	27.18	27.50
Overall	27	36.30 $\pm$ 1.40	27.18	47.82
F-value		96.49		
p-value		<0.001***		

*** p<0.001

4.4.2 Crude protein (CP) contents (%) grass samples

Crude protein (CP) contents (g/100g) of grasses were highest in Durba (16.07%) and lowest in Khas ghas (7.15%). Gitla and Shama grass contain respectively 11.91% and 7.15%. The crude protein content (g/100g DM) of Durba (11.30) in the present study is higher than findings of Manzoor *et al.*, (2013) (11.30). Oke *et al.*, (2016) reported lower CP content (g/100 g DM) of Durba (8.60) than the present findings. Heuzé *et al.*, (2015) reported CP content (g/100g DM) of Durba to be 9.8 which is lower than the present findings. Due to different environmental effect and different soil composition, moisture content varies in different upazila of same district.

Table 4.42 Crude protein (CP) contents (%) grass samples collected from three different upazila

Grasses	Number	Mean $\pm$ SE	Min.	Max.
<i>Durba (Cynodon dactylon)</i>	9	16.07 $\pm$ 0.20	15.34	17.30
<i>Gitla (Paspalum conjugatum)</i>	9	11.91 $\pm$ 0.19	11.20	12.80
<i>Kash (Saccharum spontaneum)</i>	6	7.15 $\pm$ 0.23	6.40	7.90
<i>Shama Echinochola crusgalli</i>	3	14.10 $\pm$ 0.45	13.20	14.60
Overall	27	12.48 $\pm$ 0.66	6.40	17.30
F-value		279.673		
p-value		<0.001***		

*** p<0.001

4.4.3 Crude Fiber (CF) contents (%) grass samples

Crude Fiber (CF) contents (%) higher Gitla (30.03%) and lower in both Durba (28.08) and khas ghas (28.05). CP content in Shama ghas was only 29.28%. Heuzé *et al.* (2015) reported CF content (g/100g) of Durba to be 31.3 which is similar to the present findings. But lower CF content (g/100g) of Durba (21.01) was found by Oke *et al.* (2016).

Table 4.43 Crude fiber (CF) contents (%) grass samples collected from three different upazila

Grasses	Number	Mean $\pm$ SE	Min.	Max.
<i>Durba (Cynodon dactylon)</i>	9	28.71 $\pm$ 0.13	28.08	29.30
<i>Gitla (Paspalum conjugatum)</i>	9	30.03 $\pm$ 0.20	28.90	30.94
<i>Kash (Saccharum spontaneum)</i>	6	29.58 $\pm$ 0.55	28.05	30.84
<i>Shama (Echinochola crusgalli)</i>	3	29.98 $\pm$ 0.36	29.28	30.46
Overall	27	29.49 $\pm$ 0.18	28.05	30.94
F-value		4.918		
p-value		0.009**		

** p<0.01

4.4.4 Ether extract (EE) contents (%) grass samples

EE contents of grass sample was different in different upazila. Higher value of EE content was present in khas (3.42%) and lower in both Durba (2.84) and Gitla (2.84). Shama contain 3.13% EE content. Durba (1.9) were reported by Heuzé *et al.* (2015b) observed lower EE content (g/100g) than present findings.

Table 4.44 Ether extract (EE) contents (%) grass samples collected from three different upazila

Grasses	Number	Mean $\pm$ SE	Min.	Max.
<i>Durba (Cynodon dactylon)</i>	9	2.84 $\pm$ 0.22	2.20	3.74
<i>Gitla (Paspalum conjugatum)</i>	9	2.84 $\pm$ 0.15	2.30	3.70
<i>Kash (Saccharum spontaneum)</i>	6	3.42 $\pm$ 0.14	3.06	3.80
<i>Shama (Echinochola crusgalli)</i>	3	3.13 $\pm$ 0.18	2.80	3.40
Overall	27	3.00 $\pm$ 0.10	2.20	3.80
F-value		2.07		
p-value		0.132 NS		

NS= Non-significant (p>0.05)

4.4.5 Nitrogen free extract (NFE) contents (%) grass samples

Nitrogen free extract contents of the grass samples was highest in khas (53.92%) and lowest in Shama ghas (34.21%).the nearest value of NFE contents in Durba (40.83%) and Gitla (39.80).

Table 4.45 Nitrogen free extract (NFE) contents (%) grass samples collected from three different upazila

Grasses	Number	Mean $\pm$ SE	Min.	Max.
<i>Durba (Cynodon dactylon)</i>	9	40.83 $\pm$ 0.51	38.88	42.92
<i>Gitla (Paspalum conjugatum)</i>	9	39.80 $\pm$ 1.52	33.31	43.41
<i>Kash (Saccharum spontaneum)</i>	6	53.92 $\pm$ 0.60	51.71	55.81
<i>Shama (Echinochola crussgalli)</i>	3	34.21 $\pm$ 0.45	33.32	34.72
Overall	27	42.66 $\pm$ 1.35	33.31	55.81
F-value		42.099		
p-value		<0.001***		

*** p<0.001

4.4.6 Total ash (TA) contents (%) grass samples

Data furnished in table 4.45 that the total ash content of shama ghas was higher than other grasses. Overall ash content of Shama ghas was 18.57%, Gitla Ghas 11.70%, Durba 11.55% and Kash 5.93%. However, lower ash contents (g/100g) of Durba (9.5) observed by Heuzé *et al.* (2015). But lower ash content (g/100g) of Durba (1.18) was reported by Oke *et al.* (2016) than the present findings

Table 4.46 Total ash (TA) contents (%) grass samples collected from three different upazila

Grasses	Number	Mean $\pm$ SE	Minimum	Maximum
<i>Durba (Cynodon dactylon)</i>	9	11.55 $\pm$ 0.55	8.93	13.45
<i>Gitla (Paspalum conjugatum)</i>	9	15.42 $\pm$ 1.49	11.70	21.45
<i>Kash (Saccharum spontaneum)</i>	6	5.93 $\pm$ 0.07	5.75	6.23
<i>Shama (Echinochola crussgalli)</i>	3	18.57 $\pm$ 0.18	18.22	18.80
Overall	27	12.37 $\pm$ 0.95	5.75	21.45
F-value		19.066		
p-value		<0.001***		

*** p<0.001

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 SUMMARY

Goat rearing is an important element on rural life in South-West Bangladesh. The enterprise is profitable and generates an important cash flow which is used for essential family and social activities. Additionally, goats require less space and feed than other livestock animals, making them cost-effective. A field survey was carried out according to a pretested interview schedule involving 150 respondents who were involved in goat rearing.

Survey data reveals 50% farmers were middle aged, where 43.3% were old aged. Male and female farmers were respectively 68% and 32%. Maximum family consists of small family members category (1-4) and about 23.3% was medium member category (5-7). Most of the farmers were illiterate and primary pass. Farmers live their livelihood by cropping, livestock and fishery. About 75% farmers had their own shrimp farm. Medium sized shrimp farm were found there. Majority of farmers 92% belonged to low income from goat rearing. Farmers were got short term (1-5) experience in farming and also 32.5 % were gotten experience in goat farming. About 36% respondents farming system was livestock, fishery and crop. Black Bengal goat is most famous in these locations. Age at puberty of goats were maximum and minimum 180-240 days. Mortality rate depends on the season. Only 2% farmer gave goats cultivating fodders. So the main source of feed was naturally grown grasses. The housing of goat is maximum (34%) kacha and (32%) was bamboo structured. Most of the respondents (72%) were gave vaccine to their goats. They were satisfied with the nutritional requirement of goats that they got from the embankment grass.

5.2 CONCLUSIONS

From the result of nutritional value of naturally grown grasses it has been observed that Durba (*Cynodon dactylon*), Gitla ghas (*Paspalum conjugatum*), kash ghas (*Saccharum spontaneum*), Shama ghas (*Echinochloa crusgalli*) four types of grasses were collected from three different areas. After collecting samples of green grasses were subjected to chemical analyses for the determination of dry matter (DM), crude protein (CP), ether extract (EE), crude fiber (CF), and total ash (TA) at Animal Husbandary Laboratory Khulna University, Khulna. The study discovered that among the grass species, Durba (45.39) had higher DM content where Shama ghas (27.31%) had DM content (g/100g). Durba also contains greatest CP content about 16.07 and kash has lowest CP content about 7.15%. Gitla ghas (30.03%) had higher CF content where Durba (28.7%) had lower CF content than other grasses. EE content was highest in kash (3.42%) and lowest in both Durba and Gitla Ghas (2.84%). NFE content is higher in kash ghas about 53.92% and lowest in Gitla ghas 39.80%. Finally, Gitla ghas (15.42%) had highest value in ash content and (5.93%) lowest value content in kash ghas than other experimental grasses.

The conclusion is that natural grasses grown locally, along the embankment of shrimp farms, can replace expensive feed and provide enough nutrition for a goat's whole diet. Without additional labor costs or financial outlays, farmers have found goat farming to be successful.

5.3 Recommendations

1. Farmers must pay attention to goat farming in their shrimp farms.
2. More training opportunities and marketing resources should be provided by the government.
3. The government should provide funding and loan opportunities for farmers.
4. Not only Government but also NGOs should also focus on trainings and other knowledges about vaccination, artificial insemination, breeding male goats.
5. The Government and NGOs should be made the farmer encouraged to utilize locally available feed for livestock.

CHAPTER VI

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APPENDIX-1
Evaluation of Goat Production Opportunities on the Embankment of Shrimp Farms
in Southwest Coastal Region of Bangladesh

Serial No:

Date:

A. Personal Information of the Farmer:

1. Name of the farmer:

Village: Upazila:

Contact no.:

2. Age of the farmer: Sex: ☐ Male ☐ Female

Number of the family members:

Education:

Main Occupation:

3. Do you have own shrimp farm?

Yes ☐

No ☐

Total land under shrimp farm:

4. Total Annual income (Tk./year):

5. Annual income from goat rearing (Tk./year):

6. Farm size

Please furnish information about your lands according to use

Sl. No.	Use of land	Area of land	
		Local unit	Hectare
1	Total land		
2	Homestead		
3	Land under cultivation		

7. Experience in farming: Years

8. Experience in goat farming/rearing: Years

9. Farming System (put √)

☐ Crop

☐ Livestock

☐ Fisheries

☐ Crop + Fish

☐ Crop+ Livestock

☐ Crop + Livestock + Fish

☐ Agriculture

☐ Livestock + Fish

☐ Others

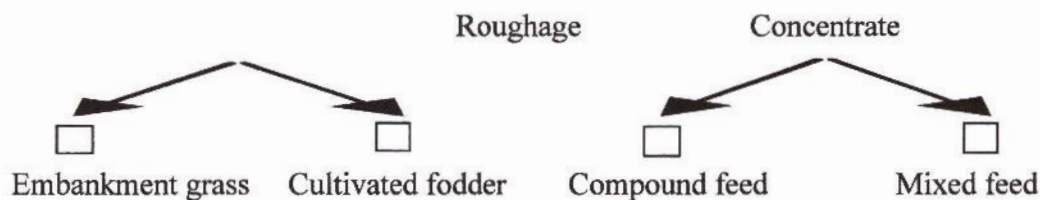
B. Information of the Goat:

1. Type of the goat: ☐ Boer ☐ Sirohi ☐ Black Bengal ☐ Jamunapari ☐ Others

Source of the goat: ☐ Purchase ☐ Own

Purchased from:

2. Which type of feed do you use?



Source of feed: ☐ Purchase ☐ Produce ☐ Both

3. Housing for Goat: Please furnish the information of your sheep shed (put $\checkmark$)

Permanent structure ☐ Semi-permanent structure ☐ Bamboo structure ☐
Kacha ☐ No sheds ☐ Others ☐

4. Number of goats: a) Total: b) Male: c) Female:

5. Do you provide regular vaccination? ☐ Yes ☐ No

6. Do you separate sick cattle from healthy goats? ☐ Yes ☐ No

6. Performance & information about goat

Sl. No.	Parameters	Value	Comment
1	Age at puberty (days)		
2	Age at first kidding (days)		
3	Litter size (No.)		
4	Kidding interval (days)		
5	Mortality (%)		
6	No. of services per conception		
7	Post-partum heat (days)		
8	Gestation length (days)		

C) Information about goat rearing:

1. How long goats grazed on gher embankment?

2. Is grazing covers their daily requirements?

3. Do you give them any other supplement feeds?

4. Which types of grasses are grown naturally on the gher embankment?

5. Do you satisfied about their nutritional value getting from the grass of shrimp embankment?

Yes ☐

No ☐

6. Do you specially cultivate grass to feed them?

D. Opportunities of goat production:

Sl. No.	Type of problem	Extent of problem			
		Highly agree (3)	Moderately agree (2)	Less agree (1)	Not at all (0)
A.	Economics				
1.	Goat rearing on the gher embankment is profitable				
2.	Investment is less to start a goat farm				
3.	Goats are highly prolific and produce more kinds within short period				
4.	Income from goat rearing on the embankment is high				
5.	Needs less care and attention				
6.	Small own lands are required				
7.	No extra labours are required				
8.	Goat farming is suitable for women				
9.	High market demand				
B.	Feeds & fodder related problems				
10.	Grasses are available on the gher embankment				
11.	Grasses grown on the gher embankment are sufficient to fulfil their requirement				
12.	Grasses grown on the gher embankment have good nutritional quality				
13.	Goats are very much fond of grass grown the gher embankment				
14.	No supplementary feeds are required				
C	Health related problem				
15.	Goats are disease resistant				
16.	Goat's mortality rates are less				
17.	Goat's vaccines are available				
18.	Less medicines are required for treatment of sick goats				
D	Other opportunities				
19.	Male goats for breeding are available				

20.	Goat's meat has no religious obligation				
21.	Goat's litter can use as manure				
22.	Goat's leather is of good quality				

E. Problems faced

Sl. No.	Type of problem	Extent of problem			
		Highly Severe (3)	Moderately Severe (2)	Less Severe (1)	Not at all (0)
A.	Feeds & fodder related problems				
1.	High price of feeds and fodder				
2.	Sufficient grasses are not grown on the embankment				
3.	Unavailability of quality feeds and fodder				
4.	Lack of knowledge of feed production				
5.	Lack of grazing land				
B.	Health related problem				
6.	Unavailability of vaccine and medicine				
7.	High price of vaccine and medicine				
8.	Lack of veterinary surgeon				
9.	Goats are more disease susceptible				
10.	Goat mortality rates are high				
C.	Other problems				
11.	Lack of breeding male goats				
12.	Lack of artificial insemination				
13.	Lack of capital and loan facilities				
14.	Lack of marketing facilities				
15.	Lack of Govt. support				
16.	Lack of training facilities				
17.	Lack of knowledge of goat rearing				

(Thank you for your nice cooperation)

Signature of the enumerator

.....

Date:

APPENDIX-2
Photographic presentation of the study



