SOCIO-ECONOMIC PROFILE OF THE BUFFALO FARMERS IN MADARGONJ UPAZILLA OF JAMALPUR DISTRICT

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CERTIFICATE

*This is to certify that thesis entitled, "**SOCIO-ECONOMIC PROFILE OF THE BUFFALO FARMERS IN MADARGONJ UPAZILLA OF JAMALPUR DISTRICT**" submitted to the Faculty of Animal Science & Veterinary Medicine, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE (MS) in ANIMAL SCIENCE**, embodies theresult of a piece of bona fide research work carried out by **MD. SAMIUL HAQUE** Registration No. **12-05072** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.*

I further certify that such help or source of information, as has been availed of during the course of this investigation, has duly been acknowledged.

Dated:
Dhaka, Bangladesh

_____
Prof. Dr. Md. Jahangir Alam
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DEDICATED TO

My Beloved Parents

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SOCIO-ECONOMIC PROFILE OF THE BUFFALO FARMERS IN MADARGONJ UPAZILLA OF JAMALPUR DISTRICT

ABSTRACT

The study was conducted to investigate the socio-economic profile of the buffalo farmers and management practices at four unions namely Balijuri, Char Pakerdha, Jorekhali, Karaichura of Madargonj upazilla of Jamalpur district. The experiment was undertaken in five villages from four unions of Madarganj Upazilla in Jamalpur district of Bangladesh. A total of 60 respondents were randomly selected from the four unions; each union consists of different numbers of respondents. The period of data collection was from October to December, 2018. The data was collected through personal interviewing with pre-tested questioner. The investigation revealed that buffalo rearing was practiced by the middle (30-40 years) and old (>40 years) aged farmers than the young (<30 years). Majority (75%) of the buffalo farmers are illiterate to primary education level. Maximum families (40%) were medium type family due to well decision of family planning. The major occupation of the selected farmers are mixed agriculture (dairy, poultry) (50%) followed by only buffalo rearing (36.7%). The buffalo farmers basically have no training skills (86.7%) but practiced buffalo rearing as their family profession and maximum farmers (45%) use bank loan where 41.7% farmers use own capital for buffalo's production. 56.7% farmers rear crossbred buffalo and rest 10% were mixed indigenous and crossbred type. The buffalo farmers purchased usually one pair of buffalo and reared at least for 2 years. The buffalo houses were made of varieties of local materials such as straw, tin, mud, chatai etc. About 63.4% houses were made of straw, 28.3% made of tin. The farmers fed their buffalos with locally available river side grasses but they (75%) did not practice concentrate feeding. Semi-intensive feeding system was practiced for rearing buffaloes followed by extensive feeding system. Majority of the buffalo farmers allowed wallowing buffaloes for once or twice in a day and 58.3% followed only natural breeding method for breeding. The major diseases of buffaloes found in the studied areas were Foot and Mouth Disease (FMD) followed by Black Quarter (BQ) and Anthrax. Most of the buffalo farmers practiced vaccination and de-worming regularly. The highest portion of the farmers used average cost of one pair of buffalo at 90000-100000 BDT. The annual total cost of production was Tk 9570, while a gross return was Tk 26400 per buffalo. The annual food and cloth purchasing capacity of the buffalo farmers were found to be increased to 65.60 and 57.24%, respectively. Similarly, the ability to maintain health care, social status, education and housing of the buffalo farmers were also increased through buffalo rearing. Considering all this parameters related to livelihood, it was clearly found that the socio-economic status of the buffalo farmers was improved through buffalo rearing although the management practices need to be improved with scientific approaches.

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LIST OF ABBREVIATION

FAO	**=**	Food and Agricultural Organization
BBS	=	Bangladesh Bureau of Statistics
BCSRI	=	Bangladesh Council of Scientific Research Institute
cm	=	Centimeter
DLS	=	Department of Livestock Service
NGO	=	Non-government Organization
et al.	=	And others
e.g.	=	exempli gratia (L), for example
etc.	=	Etcetera
HSC	=	Higher Secondary School Certificate
BC	=	Before Christian
g	=	Gram (s)
i.e.	=	id est (L), that is
Kg	=	Kilogram (s)
SSC	=	Secondary School Certificate
m^2	=	Meter squares
ml	=	MiliLitre
M.S.	=	Master of Science
No.	=	Number
SAU	=	Sher-e-Bangla Agricultural University
var.	=	Variety
^oC	=	Degree Celsius
%	=	Percentage
NaOH	=	Sodium hydroxide
FMD	=	Food & Mouth Disease
mg	=	Milligram
HS	=	Hemorrhagic Septicemia
WHO	=	World Health Organization
BDT	=	Bangladeshi Taka
L	=	Litter
µg	=	Microgram
USA	=	United States of America
BQ	=	Black Quarter
A.M	=	After mid-night
P.M	=	Past mid-night
AOAC	=	Associate of official Analytical Chemists
DM	=	Dry Matter
CP	=	Crude Protein
CF	=	Crude Fiber
EE	=	Ether Extract

CHAPTER I

INTRODUCTION

The Buffalo is a large bovine domestic animal, frequently used as livestock in southern Asia and also widely in South America, southern, Europe, northern Africa, some of the part in Bangladesh and elsewhere. These ruminant mammals are, in fact, inhabitants of the Northern Hemisphere and bear some similarity in appearance to cattle. Although often the name 'buffalo' is erroneously applied to the American bison, the latter has no relations with true buffaloes. The water buffalo or Indian buffalo, *Bubalus bubalis* is found in Southeast Asia, where it was domesticated at a very early period. Buffalo exists both as a wild and a domestic animal. As a truly wild animal, it is found in Nepal, Assam, the old Central Provinces and perhaps-other parts of India, Myanmar and Borneo. As a feral animal, roaming wild but descended from domestic stock, buffalo is also found in several other countries including Sri Lanka, Indonesia and Malaya.

Buffalo is a long-headed, large ox-like animal. It is massive and rather clumsy built. The Indian buffalo, standing nearly 1.8m (over 6 ft) has a dull black body, a straight back, and is very sparsely covered with short hairs. The large horns are triangular in cross section, spread outward and upward and approach each other towards the tip.

Main livestock of Bangladesh include cattle, buffalo, sheep, goat etc. Buffalo and cattle are considered as major breed for production. The domestic buffalo is an important animal in the agricultural economy of many tropical and subtropical countries (Suhail*et al*., 2009). Buffalo, also known as 'Asian Animal' plays very important role in agricultural economy, being an integral part of farming system.

The Buffaloes are raised in a mixed crop livestock system. It plays a very important role over the centuries, and especially in Bangladesh, for the lives of millions of people, by ensuring work power and food at the end of their career as work animals. Ninety six percent (96%) of the world buffalo population is found in Asia (FAO, 2009), where only 0.6 percent buffaloes are found in the particular agro-ecological zones in Bangladesh (Faruque*et al.*,1990).

The economy of Bangladesh is primarily depending on production of crop, livestock and fisheries. The livestock sub-sector contributes 1.78% to the GDP, contributes 16.71% to the agricultural GDP, generates 20% of country's employment directly and 40% indirectly, contributes 4.31% to country's total export earning, provides 25% of households energy supply, produces 125 MMT of organic manure utilized for crop production. In financial year 2014-15, the livestock population is 539.72 lakh (ruminant) whereas the buffalo is 14.64 lakh BER (Bangladesh Economic Review), 2018.Ministry of Planning, Government of the Peoples Republic Bangladesh.Buffaloes hold strategic place in overall livestock economy of Bangladesh and serve three important purposes such as milk, meat and drought power supply (Kumar *et al*., 2017)..It provides high quality milk and meat, dung as fuel and organic fertilizer; mechanical or draft power and hides and skins as raw material for industry (Das and Khan 2010 and De-La-Cruz-Cruz, 2014).Buffalo have significant contribution to GDP through production of meat, milk and skin representing about 27.0, 23.0 and 28.0%, respectively to the total production from livestock sector in Bangladesh (FAO, 2008).

It is widely used to plough, level land, plant crops, puddle rice fields, cultivate field crops, and pump water, carts, sleds and shallow-draft boats. It is also used to carry people, thresh grain, press sugar cane, haul logs, and more. Buffalo have an advantage over other draught animals in wet or muddy areas, with their large hooves. Their legs can withstand wet conditions better than cattle. However they are not as fast as cattle, horses or mules. This puts them at a disadvantage in dryer areas. Therefore, the additional income every year through the sale of surplus milk is vital to their well-being and economic security. The most important and desirable quality of the water buffalo is its extraordinary capacity of utilization less digestible feeds (straw, sugar cane wastes etc.) than cattle. So it requires less concentrate feeds than cattle. This mean that it can produce excellent quality food meat and milk using only crop residues, pasture, and mineral salts, without the addition of supplement concentrates. Buffalo is highly adaptable and healthy animal that can resist infectious and contagious diseases. However, they must receive the same vaccines, hygienic care and dedicated attention as do cattle. The females, because they produce nutritive milk, transfer their calves more resistance to dangerous diseases. There is no report of mad cow disease in buffalo from any part of the world. Buffalo

enrich soil structure and fertility while tracking paddy field. Each year, an adult buffalo produce 4-6 tons of wet manure plus additional urine as bio-fertilizer (Hamid *et al*., 2016).

This reduces the requirement of chemical fertilizers as well as provides soil humus that chemicals cannot provide. Buffalo can survive against tidal wave better than any other livestock species. This is evidence from the cycles that occurs frequently in the coastal area of Bangladesh. Buffalo does not require expensive house as like cattle. It can even live in open air throughout the year. This is true in many parts of world. But commercial production of buffalo, feeding and housing play a pivotal role in exploiting the genetic potential of animal. Feeding alone contributes about 60-70 percent of total cost of milk production and offers the greatest scope to bring the input-output relationship to an economical level. Besides, providing proper housing to dairy animal is also equally important in order to achieve maximum return from the animals. Better housing arrangements not only provide shelter but also keep the animals in comfortable zone especially during severe environmental conditions i.e. either extreme cold or hot when animals are most vulnerable to get afflicted with stress conditions (Kumar *et al*., 2017). Inherent qualities as meat producer Buffaloes have a unique ability to utilize coarse feeds, straws and crop residues converting them into protein rich lean meat. Hence buffaloes fit well in poor countries having poor feed resources. Buffalo properly managed and fed as a meat producing animal and slaughtered at 16 to 20 months of age yields a highly satisfactory top quality meat at a much lower cost than the cattle (Karim*et al*., 2013).

Since buffaloes have been used as draught animals for centuries, they have evolved with exceptional muscular development. Until recently, little thought was given to use them exclusively for meat production. Buffaloes are lean animals. The sub-coetaneous fat layer of the carcass is usually thinner than that on comparably fed cattle. Fat is low even under feed lot conditions. More lean and less fat compared to cattle, has created a demand for it among health conscious consumers (Viswkarma*et al*., 2018).

Reasons for the selection of area are based on abundant natural green grasses in the river bank of old Brahammaputra and JumunaRiver, suitable temperature, ecology and good transport facilities. However, the production potential of livestock depends mostly on the

management practices under which they are reared and these practices vary significantly across various agro-ecological regions due to many factors. Understanding of livestock management practices followed by farmers in a region is necessary to identify the strengths and weaknesses of the rearing systems and to formulate suitable intervention policies (Gupta *et al*., 2010)

In our country buffalo is our wealth. If we use buffalo properly then we can solve our many problems. Besides solving economical problem, in future we can earn foreign money from domestic animals. Buffalo rearing increase livelihood status of the farmers especially for the farm women and development of this sector is the potential path to rural prosperity (Kumar *et al*., 2017). Very little work has been done so far on the socio-economic status of the buffalo farmers and the management practices of buffalos in Bangladesh. Therefore, considering the; above discussion, the present investigation was undertaken to know the socio-economic status farmers and the management practices of buffaloes in selected Brahmaputra-Jamuna flood plain riverside area of Jamalpur district.

Objectives

1. To investigate the socio-economic status of buffalo farmers in selected areas of Madargonj Upazilla in Jamalpur district.
2. To observe the different management practices of the buffalos in experimental areas.
3. To detect income, cost and livelihood changes of the buffalo farmers.

CHAPTER II

REVIEW OF LITERATURE

Bangladesh is a South Asian country where the economy is based primarily on agriculture and livestock is an essential component of the rural economy. The buffalo is an important part of livestock in Bangladesh. Small scale farming is the most prevailing farming system of Bangladesh. So, management systems of buffalo and poverty alleviation through it, is a considerable thing. Literatures reviewed here are based on the management practice for buffalo rearing and socio-economic status of buffalo farmers.

History

Buffaloes are becoming world's most interesting domestic animals and extensive efforts have been made throughout the world to improve and exploit the production and reproduction (Siddiki*et al.*, 2015).

Wild water buffaloes were domesticated in the Indian subcontinent about 5000 years ago, and about 4000 years ago in China. There are two types of water buffaloes which are raised by the farmers. These two types are recognized based on morphological and behavioral criteria. These recognized two types are the river buffalo and the swamp buffalo. The river buffaloes are found in the Indian subcontinent and further west to the Balkans and Italy. And the swamp buffaloes are found from Assam in the west through Southeast Asia to the Yangtze valley of China in the east (Source: Encyclopedia Britannica).

The most difficult parts of discussing the Water Buffalo with citizens of North America or any non-Asian fan of the American cowboy or jungle adventure movie is to identify the correct animal. There are many closely related groups within the Order Artiodactyls or even toed animals. The American Bison or American Western Buffalo is not a true buffalo but its own Genus. They are closer to cattle (Bos) than to the water buffalo and will interbreed with cattle. The African Cape Buffalo **(*Synceruscaffer*)** is actually only a distant relative. Their reputation for a mean-tempered disposition has tarnished the Water Buffalo, with which they will not interbreed and which is classified in a different genus.

Most water buffalo are generally docile and are frequently seen being tended and ridden by small children. An apparent exception is the Egyptian male buffalo which can be highly temperamental. There are two general types of water buffalo the Swamp (*Bubalus carabanesis*) which are found from the Philippines to as far west as India and River (*Bubalus bubalis*) which are found farther west from India to Egypt and Europe (Source: Encyclopedia Britannica).

Buffalo population in Bangladesh

Livestock resources of Bangladesh are mainly based on cattle, goat, sheep, buffalo, and poultry. Although the growth of livestock production is the second highest among all other sub-sector of agriculture in Bangladesh. BER (Bangladesh Economic Review), 2018. Ministry of Planning, Government of the Peoples Republic Bangladesh. Ministry of Bangladesh is one of the highest densities of livestock populated country in the world, of them 145 large ruminants per km2 compared with 94 for India, 30 for Ethiopia and 20 for Brazil (FAO, 2008). Buffalo population in this country is 1.62 million and is contributing through the production of 3500 and 22400 ton meat and milk respectively per year (DLS, 2018). Buffalo population from the year of 2006-07 to 2017-18.

Table 2.1: Year wise buffalo (in lakh) population in Bangladesh

Year	Number of buffalo (In a lakh)
2006-07	12.10
2007-08	12.60
2008-09	13.04
2009-10	13.49
2010-11	13.94
2011-12	14.43
2012-13	14.50
2013-14	14.57
2014-15	14.64
2015-16	14.71
2016-17	14.78
2017-18	14.85

Source: DLS, 2018

Buffalo populations in South Asian countries in comparison with Asia and all over the world

Buffalo holds the greatest promise for food security in the 21st century as these animals form an integral part of the typical farming system in many regions of the world. Buffaloes are the backbone of rural economy in many developing countries of the Asian region including developing countries. Buffaloes occupy a prominent place in the social, economic and cultural life of rural communities and are useful as a triple purpose animal for milk, meat and draft power (Chandrasekar *et al*., 2017). Buffalo population is highest in India followed by Pakistan, Nepal, and Bangladesh.

Table 2.2: Buffalo population's status in all over the world

Region/Country	Total population (million)	Share in world population (%)
World	194.29	100%
Asia	179.75	92.52%
Rest of world	14.54	7.48%
India	112.91	58.11%
Pakistan	32.70	16.83%
Nepal	4.99	2.57%
Bangladesh	1.464	0.753%
Sri Lanka	0.405	0.208%
Bhutan	0.000851	-

Source: FAO, 2009

Population of buffalo in the world

In Asia

The world buffalo population is estimated to be approximately 194.29 million over 42 countries (Hamid *et al*., 2016); Asian buffalo dominate the world population, representing 92.52% (179.75 million) of the total buffalo population (FAO, 2008). Within the Asian region, about 74.80% of buffaloes in the South Asia, 12.80% in East Asia and only 8.40% found in South-East Asia. In Bangladesh there are about 1.0 millions of buffaloes. India has 105.1 million and they comprise approximately 56.7 percent of the total world buffalo population. During the last 10 years, the world buffalo population increased by approximately 1.49% annually, by 1.53% in India, 1.45% in Asia

and 2.67% in the rest of the world.Bangladesh has only The 1.471 million buffaloes (Figure 1) mostly populated in the coastal regions about 40% (Faruque*et al*., 1990).

In the Philippines there are 3.2 million Carabao buffaloes, 99 percent belong to small farmers. Swamp buffalo locally known as the Carabao to develop their meat, milk and draught potential. An elite herd of Riverine buffalo has now been established at the Philippine Carabao Center, Science City of Muñoz, by importing about 3 000 Murrah buffaloes with pedigree performance records from Bulgaria. Each female crossbred when raised for milk can produce about 1 350 kg of milk per lactation (Cruz, 2003).

In Pakistan, the buffalo is the main dairy animal in the country. Out of the 22 million head of buffalo in Pakistan, 76 percent are found in the Punjab (24 percent in other provinces of the country: Sind, North West Frontier Provinces (NWFP), and Baluchistan). The Punjab supplies 73 percent of the total national milk production and 71 percent comes from buffaloes which are part of the traditional small mixed farming system which is integrated with crop production. Herd size is very small; 85 percent of buffaloes are raised in herds of one to five animals. There are 0.5 million landless farmers keeping dairy animals and contributing a significant (70 percent) share of the total milk production (Raza*et al*., 2000).

According to statistical data (FAO, 2008), the total number of buffaloes in China in 2003 was 22.759 million, the second largest population of buffalo in the world, representing 17.37 percent of the total bovine population in China. Chinese buffaloes are used for draught, often as their only task. Exceptions are the Wenzhou breed, which is regularly milked and produces 1020 kg milk in 278 days and the Jianghan (800 kg milk in 8-12 months). The Fuan breed is also sometimes milked, producing on average 2.6 kg milk/day, in a lactation of extremely variable length: 150 to 300 days (Zhang Chunxi and Li Zhongquan, 2001). The breeds of the lowlands are raised on fertile soils and paddy fields where intensive agricultural activities are carried out. This is the case of the Binhu breed (461 000 head) in the Hunan province, the Xinyang breed (290 000 head) in the Henan province, the Enshi breed (77 000 head) in Hubei, the Fuan breed (70 000 head) in the Fujian province, the Yanjin breed (45 000 head) in Yunnan, the Xinglong breed (24

000 head) in Hainan and the Wenzhou breed (10 000 head) in Zhejiang (Zhang Chunxi and Li Zhongquan, 2001).

In Sri Lanka are around 100000. However, hardly any of them are full time buffalo farmers. About 87 percent are crop producers, who rear buffaloes as an additional source of income. About 64 percent use buffaloes for draught purpose, 34 percent for milk and draught, while only 2 percent keep buffaloes purely for milk (FAO, 2009).

In the past Thailand had the second largest number of Swamp buffalo in the world. However this buffalo population drastically declined from 4.7 million in 1990 to 1.9 million in 1998. The number of buffaloes has decreased yearly and the present number is about 1.7 million.

Water buffalo are also present in the southern region of Iraq in the Mesopotamian Marshes. The draining of the Mesopotamian Marshes by Saddam Hussein was an attempt to punish the south for the 1991 uprisings in Iraq. After 2003 and the Fiords Square statue destruction, these lands were refolded and a 2007 report on Maysan and DhiQar shows a steady increase in the number of water buffalo. The report puts the number at 40,008 head in those two provinces (FAO, 2009).

Their reproduction efficiency is also low and calves in 3 years is common (Faruque, *et al*., 1990; Faruque and Amin 1995). It was revealed that 82% of the farmers have 1 to 3 buffalo per household and 73% of the farmers have 51 to 200 buffalo per bathan. Buffaloes were raised in homestead and approximately 5-7 hours were grazes per day in household farming.

In 2003 Bangladesh had 772 764 buffalo head owned by 270 228 holdings representing 1.52 percent of the total holdings in the country. The average buffalo head per holding was 2.67 (Faruque, 2003). Bangladesh now has about 400 000 adult female buffaloes that are being used for draught or dairy purposes. These buffalo are found in the Bramhaputra-Jamuna flood plain of central Bangladesh, the Ganges-Meghna flood plain of southern Bangladesh and in institutional herds. Bangladesh has milk/dairy buffaloes of the Swamp crossbred and River types such as the Murrah and Nili-Ravi. The occurrence

of crossbred dairy buffaloes indicates that the genetic improvement programme has been operative and is still running (Faruque *et. al*., 2003).

In Europe and the Mediterranean

Water buffalo were probably introduced to Europe from India or other eastern sources. In Italy, the Long bard King Agilulf is said to have received water buffalo in about the year 600. These were probably a present from the Khan of the Avers, a Turkic nomadic tribe that dwelt near the Danube River at the time. Sir H. Johnston knew of a herd of water buffalo presented by a King of Naples to the Bay of Tunis in the mid-19thcentury that had resumed the feral state in northern Tunis. European buffalo are all of the river type and considered to be of the same breed named Mediterranean buffalo. In Italy, the Mediterranean type was particularly selected and is called Mediterranean Italian breed to distinguish it from other European breeds, which differ genetically. Mediterranean buffalo are also kept in Romania, Bulgaria, Greece, Albania, Kosovo, and the Republic of Macedonia, with a few hundred in the United Kingdom, Germany, the Netherlands, Switzerland, and Hungary. Little exchange of breeding buffalo has occurred among countries, so each population has its own phenotypic features and performances. In Bulgaria, they were crossbred with the Indian Murrah breed, and in Romania, some were crossbred with Bulgarian Murrah. Populations in Turkey are of the Anatolian buffalo breed(FAO, 2008).

In Australia

Between 1824 and 1849, water buffalo were introduced into the Northern Territory from Timor, Kisar, and probably other islands in the archipelago. In 1886, a few milking types were brought from India to Darwin. They have been the main grazing animals on the sub coastal plains and river basins between Darwin and Arnhem Land since the 1880s. In the early 1960s, an estimated population of 150,000 to 200,000 buffalo was living in the plains and nearby areas (FAO, 2008).

They became feral and are causing significant environmental damage. Buffalo also occur in the Top End. As a result, they were hunted in the Top End from 1885 until 1980. The commencement of the brucellosis and tuberculosis campaign (BTEC,) resulted in a huge culling program to reduce buffalo herds to a fraction of the numbers that were reached in the 1980s. The BTEC was finished when the Northern Territory was declared free of the disease in 1997. Numbers dropped dramatically as a result of the campaign, but have since recovered to an estimated 150,000 animals across northern Australia in 2008.

During the 1950s, buffalo were hunted for their skins and meat, which was exported and used in the local trade. In the late 1970s, live exports were made to Cuba and continued later into other countries. Buffalo are now crossed with riverine buffalo in artificial insemination programs, and are kept in many areas of Australia. Some of these crossbreds are used for milk production. Melville Island is a popular hunting location, where a steady population up to 4,000 individuals exists. Safari outfits are run from Darwin to Melville Island and other locations in the Top End, often with the use of bush pilots. The horns, which can measure up to a record of 3.1 m (10 ft) tip-to-tip, are prized hunting trophies. The buffalo have developed a different appearance from the Indonesian buffalo from which they descend. They live mainly in freshwater marshes and billabongs, and their territory range can be quite expansive during the wet season. Their only natural predators in Australia are adult saltwater crocodiles, with which they share the billabongs, and dingoes, which have been known to prey on buffalo calves and occasionally adult buffalo when the dingoes are in large packs. Buffalo were exported live to Indonesia until 2011, at a rate of about 3000 per year. After the live export ban that year, the exports dropped to zero, and had not resumed as of June 2013 (FAO, 2015).

In North America

In 1974, four water buffalo were imported to the United States from Guam to be studied at the University of Florida. In February 1978, the first herd arrived for commercial farming. Until 2002, only one commercial breeder was in the United States. Water buffalo meat is imported from Australia until 2011; water buffalo were raised in Gainesville, Florida, from young obtained from zoo overflow. They

were used primarily for meat production, frequently sold as hamburger. Other US ranchers use them for production of high-quality mozzarella cheese (FAO, 2008).

Management practices of buffaloes

Husbandry and production systems for buffaloes vary depending on the topography and vegetation patterns of the country. Buffaloes are raised under an extensive system in the coastal and hilly areas where large-scale pasture land and enough green forage are available. Buffaloes are raised under a semi-intensive system on plain land and marshy land where there is limited pasture land. An intensive system for buffalo production is not practiced anywhere in Bangladesh even for institutional herds. The husbandry and care of the animals differs somewhat in the two systems. Nevertheless, there are some common practices. These common practices are: no housing system, no artificial insemination system, no routine vaccination programmers and no animal identification and record-keeping system. One of the most important characteristics of buffalo production in Bangladesh is that they are raised by medium or large farmers who are generally considered rich in the locality. The staple food for buffaloes in Bangladesh is rice straw, which is an inadequate source of energy and protein. Sugarcane leaves, micro silage of sugarcane leaves, cassava leaves, roadside grass, elephant grass, and maize with corn cob and pineapple bran are also used as feeding stuffs (Faruque, 2003).

Feeding of buffaloes

The crops residues are mainly constitute the feed materials for the Buffalo. Farmers are generally follow the traditional feeding practices and are fully dependent on their own farm produces dry roughages rice straw, grazing in common land and some concentrates ingredients like wheat bran, rice bran, and pulse bran. Small green grasses are available from rice field, road side grass and Char land grazing. Grazing on coastal salt rich herbage in submerged Char land areas are also practiced in coastal region. Migratory grazing on river basin areas is practiced. Variation of buffalo feedings are depending on production systems. Only domestic salt are used as mineral supply in upland areas. The major feed for buffalo is rice straw, crop residues supplemented with marginal quantities of cereal and oil seed by-products and weeds from crop fields (Faruque, 2003). Lack of

quality feeds, fodder and pasture land for buffalo rearing; hence, nutritional deficiency cause poor production profile of buffaloes in Bangladesh. Maize and berseem are two most common fodders preferred by local farmers for feeding buffaloes. Other sources to a lesser extent include sorghum, sugarcane tops, mott grass, oats and barley. Generally, 30 to 50 kg green fodder is daily fed to individual buffalo. Wheat straw invariably constitutes significant part of dairy ration and varies from 4 to 6 kg /head/day. During lean period, daily allowance of green fodder is reduced to about 10-15 kg and that of wheat straw is increased to above 8 kg as gut filler (Faruque, 2003)..

Feeding system of buffaloes

Buffaloes are raised mainly under a semi-intensive system on plain land and marshy land where there is limited pasture land. Recently, an intensive system for buffalo production is practiced by Lalteer Livestock Limited. Buffaloes are strict grazers and only browse when feed is utterly scarce. Normally, buffaloes graze during the day. In case of extremely high ambient temperatures, grazing takes place in the morning and afternoon and sometimes during night time Buffaloes graze more and better than cattle (LalTeer Livestock Development *(*BD*)* Ltd, 2018*).*

The basal diet for buffaloes is rice straw, poor quality roughage having inadequate source of energy and protein. Buffaloes are allowed to graze on natural pasture, fallow land or road side during the day time. No concentrate or mineral supplements are usually Fed. For milch buffaloes, the calves are usually separated from the dam in the evening or night and the milking only once in the morning. Sugarcane leaves, micro silage of sugarcane leaves, cassava leaves, roadside grass, elephant grass, and maize with corn cob and pineapple bran are also really used as feeding stuffs (Faruque, 2003). However, buffalo in the tropical area for feeding systems are based on unrestricted grazing, tethering or stall-feeding and free grazing, sometimes under the control of herders, is common in countries with native grasslands and fallows. Tethering and stall-feeding are practiced in areas where there is limited land and with cropping. In many situations, there appeared to be roughage limitations for animals in the stall-feeding and tethering system (Alam *et al,* 2005).

Housing of buffaloes

The need for Housing is **minimized** by the continuous presence of a herdsman who prevents the animals wandering outside their designated grazing areas and corrals them at night (Rathore *et al*., 2010). With more extensive systems of management, adequate housing becomes more important. Rivers or other bodies of water, form poor natural barriers for buffaloes which are strong swimmers and are known to have travelled several kilometers by this method (Mandal *et al*., 2004).

Traditional animal shelters have grown out of needs, resources and ingenuity of farmers. Building design and construction materials largely affect the thermal comfort inside dairy shelters. Efficiently designed sheds can help lesser the thermal stress thereby increasing feed intake, milk production and reproductive efficiency. Under varied climatic, geographical and economical conditions prevailing in Bangladesh, designing an ideal set of building for dairy animals throughout the country is impossible. Loose housing in which animals are kept loose in an open paddock throughout the day and night except at the time of milking and treatment. In this system, shelter is provided along one side of open paddock under which animals can retire when it is very hot or cold or during rains. Common feed manger and water tank is provided and concentrates are fed at the milking time which is done in a separate milking barn or parlous in which cows are secured at milking time and are milked. In Conventional of housing, the animals are confined together on a platform and secured at neck by stanchions or neck chain. Loose housing system is more advantage than conventional housing. The buffalo farmer use straw or tin to build their house.Farmers made certain extra arrangements against extreme weather conditions particularly during severe cold in winter season to protect their buffaloes. They preferably used gunny/jute bags curtain to cover the houses. Almost all the farmers provided bedding materials to the buffaloes by using paddy straw or other waste dry grasses (Mandal *et* al., 2004; Rathore *et al*., 2010; Kumar *et al*., 2006) Different materials are used for animal house flooring like brick, stones, soil etc. The maximum buffalo farmer house floor becomes kacca than pacca (Hossain *et al*. (2018). The provision of barren housing system irrespective of animal natural behaviors and needs may reduce the

welfare of livestock whereas it has been suggested that the well-being of an animal may be improved through valuable experiences that makes its life richer (Kumar *et. al.,* 2017)

Table 2.3: Floor space requirements of different type of Buffalo

Type of animal	Floor Space Requirements		
	Floor space requirement (sq.ft)		Manger length/ Animal(ft)
	Covered area	Open area	
1. Buffalo	30-40	80-100	2.5
2. Calves	20-25	50-60	1.5
3. Pregnant Buffalo	100-120	180-200	2.5
4. Bull	120-140	200-250	2.5

Lack of space resulted in evidence of stress, dehydration in animal (Cruz *et. al., 2003).* Accordingly a reduced calving interval and higher conception rate was observed in animals provided with a pool (Hamid *et. al*., 2016).

Production system

Buffaloes are raised in Bangladesh throughout the country with some specific distribution of concentration in coastal saline region, plain land, marshy land and hilly area which is fully depends on feed resources availability. On the basis of land areas and type, major buffaloes are raised under three production system: household subsistence, semi-intensive and extensive system in coastal saline region which covers about 23.00% of total land areas (Hamid *et. al*., 2016).

The household subsistence farming (HF) buffaloes are reared under stall feeding with 6 to 7 h grazing in and around backyard or public land with very little feed supply. The average herd size in HF is about 1 to 3 with highest number 10. The semi-intensive farming (SIF) buffaloes are raised in combination of seasonal based household during rice cultivation and free range system during common land free which is mostly upper part of coastal areas. Seasonal rice cultivation is the main occupation in the areas. The average herd size is 4 to 15 animals in highest. Buffaloes in the lower part of the coastal

area are raised under an extensive farming system (EF) locally called Bathan farming. The extensive farming system in Bathan coastal region includes offshore islands, mudflats, chars (accreted land) and new accretions. The important occupations include fisheries and salt production and buffalo rearing. Many of the coastal areas have extensive areas of grasslands. These are used as grazing lands for the buffalo. In the coastal area, buffalo are used for milk purpose along with live animal for meat. The herd size is about 51 to 200 with highest number 600 animals and is reared completely under natural grazing system with almost no extra feed supply (Gupta *et al.*, 2010).

Milk production of buffalo

Buffalo milk production in Bangladesh remained more or less stagnant due to absence of any milk improvement program. According to WHO per capita requirement of milk per day is 250 ml. By taking this into account the country's requirement of milk is about 13 MT (million tons) (Hamid *et al*.,2016).

Table 2.4: Average buffalo milk production in different countries

Country	Average milk yield(kg/animal/lactation)
Pakistan	1909
India	1407
Vietnam	1000
Turkey	969
Nepal	842
China	505
Bangladesh	407
Asia	1389

Source: FAO, (2009)

Average milk yield for all lactations has been reported 1820 kg in 305 days lactation (Taneja *et al*., 1998). Devendra (1980) reported average milk production of Murrah buffaloes are 8.45±0.32 kg per day. India is home to diverse biodiversity of buffalo germplasm, including the world famous Murrah buffaloes-renowned for higher milk production potential as well as wider use of improver breed for local buffaloes. The average milk production of Murrah buffaloes has

been reported 1618 kg in 305 days lactation and peak yield of herds recorded 7.93±0.16 kg (Devendra, 1980).

Table 2.5: Top Buffalo Milk Producing Countries in the World

Rank	Country	Buffalo Milk Production (Metric Tonnes)
1	India	70,000,000
2	Pakistan	24,370,000
3	China	3,050,000
4	Egypt	2,614,500
5	Nepal	1,188,433
6	Myanmar	309,000
7	Italy	194,893
8	Sri Lanka	65,000
9	Iran	65,000
10	Turkey	51,947

Economist, November 21, 2017. By Zainab Reza, On World Atlas.com

Table 2.6: Buffalo milk production (MT) in the world and in SAARC countries.

Region/Country	Total population (MT)	Share in world population (%)
World	95.815	100%
Asia	92.962	97.020%
Rest of world	6.525	2.980 %
India	65.140	67.990 %
Pakistan	22.955	23.960 %
Nepal	1.109	1.157 %
Bangladesh	0.037	0.039 %
Sri Lanka	0.046	0.048 %
Bhutan	0.000084	-

FAO, (2009)

However, Bangladesh produces only about 2.95 MT, showing a shortage of 10.05 MT. As the poverty is decreasing and income is increasing, the demand for not only milk but also milk products; like butter cheese, ghee, yogurt, ice cream is also increasing. Therefore, it is becoming very important to increase the supply of milk and milk products to meet the increasing demand of milk. Though total milk production of Bangladesh is

about 2.95 MT in 2011 out of which about 3 to 4% is produced by the buffalo in spite of the number buffalo growth rate are increasing (Taneja 1998). The average milk yield of water buffalo in Bangladesh is approximately 620 kg to 1161kg in 270 days to 330 days expansion (Islam *et* al., 2004).Faruque*et al*.,1990) reported that average lactation yield was 730 kg for 328 days lactation period where fat in milk was found to range 6.80 to 13.20 percent. Daily milk yield per buffalo was lower (2.00 to 3.50 liter) than the crossbred cattle (3.50 to 7.00 liter) but it is higher than indigenous cattle (Piark et al., 1989). The lactation yield was 712 kg for buffaloes in Mymensingh district. Faruque and Amin (1995) reported that the lactation yield of indigenous buffalo in Khulna region are 280 liters and found a lactation yield of 830 liters for buffaloes in Tangail district. It could be concluded from the discussion that the possible important factors are inferior genetic merit of breed/genotype for lower milk production along with other factors. As the buffaloes have high milk production than local cattle in the same climate which shows higher potentiality of buffalo for diminishing gaps of milk production in Bangladesh. The milk value chain development of buffalo milk is required to improve the situation to keep the higher trend of income of the farmers from buffalo milk (Hussain and Cheeke *et. al*., 1996)

Milk quality of buffalo

Buffalo has inherent ability to produce milk with high milk fat contents ranging from 6.0-8.5%. Because of the higher milk fat contents, buffalo milk is preferred over cow milk and fetch better price in milk market (Husain *and Cheeke*, 1996). Comparative milk composition in the buffalo and the cow is presented in Table6. Buffalo milk is healthy as it is richer in saturated fatty acids, higher fat, protein, and calcium and cholesterol contents. It also contains less cholesterol and more to copherol which is a natural antioxidant. Buffalo milk appears whiter than cow milk because it does not contain the yellow pigment carotene.

Table 2.7: Typical composition of buffalo and cow milk

Parameters	Buffalo milk	Cow milk
Total solids (%)	16.30	13.10
Fat (%)	7.90	4.3
Protein (%)	4.20	3.60
Lactose (%)	5.00	5.00
Tocopherol (mg/g)	0.33	0.31
Cholesterol (mg/g)	0.65	3.14
Calcium (mg/100g)	264.00	165.00
Phosphorus (mg/100g)	268.00	213.00
Potassium (mg/100g)	107.00	185.00
Sodium (mg/100g)	65.00	73.00
Vitamin A (IU)	33.00	30.30
Vitamin C (mg/100g)	6.70	1.90

Source: (Anonymous, resrarch book, 1995)

Buffalo milk contains various fatty acids, especially conjugated fatty acids (CLA), which possess beneficial biological activities in mammals. The cis-9, trans-11 CLA (Rumenic acid, RA) has been shown to reduce the incidence of cancer. The CLA content of milk is strongly linked to the ruminalbiohydrogenation (BH) of cis-9, cis-12 C18:2 (linoleic acid, LA) and cis-9, cis-12, cis-15 C18:3 (linolenic acid, LNA). In Argentina, the buffalo was recently introduced as an alternative breed with milk of good nutritional value and with high protein and fat content (Hasnath *et al*., 1985). The lower heat capacity and the higher thermal conductivity and thermal expansion of buffalo milk clearly indicate that a lower amount of heat energy is required to achieve certain desired heat effects in buffalo milk as compared to cow‟s milk (Das and Khan, 2010). Like cow milk, buffalo milk is used for different milk products such as butter, butter oil (ghee), soft plus hard cheeses, condensed milk, evaporated milk, ice cream, yoghurt and many more. The most popular of these products is the soft Italian cheese called mozzarella. A characteristic of buffalo milk is the very high fat content and the fat to protein ratio is about 2:1 (Devendra,C. *et al*., 1980).

Buffalo Meat production

Buffalo meat is not popular in Bangladesh, but its low cholesterol level and higher quality than cattle may attract by the consumers, if quality tender meat is available like cattle. Hasnath (1985) reported that the average live weight of buffalo slaughter age was about 320 kg where the dressing percentage was 44% only. It was reported that the average live Wight of adult buffalo was about 427 kg (EI-Krabi *et al*.,1995). From long passed, all most all buffalo in Bangladesh are slaughtered at older age after completing their whole life in works and animals are usually very emaciated. The meat fiber is very sticky and hard to chewing. However, a big number of buffaloes are slaughtered every day in the city market and it has been sold in disguise of beef with lower price than beef. In general, the quality of meat is one of the main reasons not to well accept by the consumers. The buffalo meat price is about taka 250/kg against cattle meat price taka 285/kg which is always lower in between taka 25 to 35 per kilogram (One US$= Taka 81) as tender aged quality buffalo meat is not at all available in common market (Hamid *et al*.,2016).

Table 2.8: Nutritive value per buffalo meat (100gm)

Particulars	Buffalo meat
Water (%)	74-78
Protein (%)	20.2-24.2
Fat (%)	0.9-1.8
Ash (%)	1.0
Cholesterol (mg %)	61
Energy (Kcal/100g)	131

Source: USDA Agriculture Handbook , 2014

Buffen is lean and rich in protein and less fatty than cattle. This has created a high demand for buffen among health-conscious consumers (Desmond, 1990).

Buffalo may also be more resistant to disease than cattle the nutrient requirements of buffalo steer constitute 1.8 kg TDN, 6.6 mcal ME, 0.24 kg DCP, 11 g P and 14 g Ca. On ad labium and high concentrate (75:25) based rations the growth rate is 610 g/day (with feed efficiency of 7:1). The protein content of buffalo meat is higher than chicken, and

due to this buffalo meat is also called poor people protein. These taboos of low quality buffalo meat can be changed by introducing tender aged buffalo meat marketing through buffalo improvement program in the country. (Devendra *et al*.,2010), comparing recent consumers of water buffalo meat vs subjects who had never consumed water buffalo meat and long-standing consumers of the same kind of meat, suggest that a larger consumption of water buffalo meat could confer significant cardiovascular benefits, while continuing to provide a substantial proportion of the recommended daily allowance of protein. From baseline to follow-up, recent consumers of water buffalo meat change their intake of water buffalo meat from none to 600±107 g per week, with ensuing reductions in cow meat consumption from 504±104 to 4±28. At the end of the study, recent consumers of water buffalo meat showed a significant decrease in total cholesterol and triglycerides levels; lower pulse wave velocity, as well as a more blunted response to oxidative stress from baseline to follow-up in comparison with subjects who had never consumed water buffalo meat. The Authors concluded that water buffalo meat could be recommended as a safer and healthier alternative to cow meat, whereas continuing to provide a substantial proportion of the recommended daily allowance of protein. In conclusion, buffaloes have a high capacity for adaptation and are efficient production animals across broad climatic zones. This is the principal motivation able to explain the increasing interest in the world regarding buffalo breeding especially in tropical countries. The good feed conversion efficiency of buffaloes and the relatively low maintenance requirements are attributes which make them ideal in low-input, low-cost production systems (Desmond, 1990).

Table 2.9: Nutritional composition of meat of different species (per 100 grams)

Constituents	Unit	Chicken	Beef	Buffen
Protein	gm	16.7	24.07	26.83
Fat	gm	7.41	9.2	2.42
Calories	K-cal	190	211	143
Cholesterol	gm	89	86	82
Iron	gm	1.21	2.99	3.42
Vit-B12	gm	0.33	2.64	2.86

Source: FAOSTAT, 2017.

Benefits of buffalo carcass than beef in dressing percentage and composition

Young male buffaloes are usually slaughtered at 12-24 months when they weigh 250-300 kg. The dressing percentage varies with age and type of animal slaughtered. Mediterranean-type (Brazil) of buffalo yields a dressing percentage of 55.51%. Average dressing percentage on moderate diet is about 55.4-59.0. Buffalo veal yields about 61-64% (Bhat and Laksman, 1998).

Buffalo carcass has rounder ribs, a higher proportion of muscle and a lower proportion of bone and fat than beef.

Benefits and values of buffalo milk and meat

Buffalo milk contains less water, more total solids, fat and protein, slightly more lactose than cow's milk. It seems thicker than cow's milk because it generally contains more than 16% total solids compared with 12-14% for cow's milk. In addition, its fat content (6-8%) is usually 50-60% higher (or more) than cow's milk. Buffalo milk has considerably higher energy value than cow's milk because of its higher butter fat content. However, buffalo milk has significantly lower cholesterol content (0.65 mg g^{-1}) as compared to the corresponding value of 3.14 mg g -1 for cow milk (FAOSTAT, 2017). Fat globules of buffalo milk are larger in size, white in color and have higher anti oxidanttocopherol peroxidase (2-3 times more than cow milk). Buffalo milk has about 11.42 percent higher protein than cow milk and is also superior to cow milk in terms of important minerals, namely calcium, iron and phosphorus that are higher by 92%, 37.7% and 118% respectively than those present in cow milk. Buffalo metabolizes all the carotene into vitamin A (M. A. Hamid *et* al., 2016).

Table 2.10: Major Exporting Countries of Buffalo Meat

Region/Country	Buffalo meat(Metric tons)
USA	11,96,896.00
Poland	3,61,679.00
Australia	11,73,561.00
India	3,73,078.00
Brazil	11,29,915.00
Canada	2,93,581.00
U.K	1,17,795.00
Germany	3,21,858.00
Turkey	623.00
Bangladesh	1.00
Pakistan	10,116.00
Uganda	1.00

Source: COMTRADE, United Nations (2018)

It is widely used to plough, level land, plant crops, puddle rice fields, cultivate field crops, pump water, and haul carts, sleds and shallow-draft boats. It is also used to carry people, thresh grain, press sugar cane, haul logs, and more. Buffalo have an advantage over other draught animals in wet or muddy areas, with their large hooves. Their legs can withstand wet conditions better than cattle. However they are not as fast as cattle, horses or mules. This puts them at a disadvantage in dryer areas (FAOSTAT, 2017)

Breeding and reproduction

Males and females live in separate groups. They will merge in the beginning of the wet season for mating. The bulls can detect females in heat by their scent and find their camp. There is a period of foreplay before the actual mating takes place. This period is 1 to 3 days and allows the animals to get to know each other. The bull will not leave a female in estrus and he will not allow another bull to come near her. Only the most dominant bulls will mate.

The broad framework of buffalo breeding policy was formulated for crossing or grading up of non-descriptive and low producing buffalo with high yielding genetic merit milk

buffalo like Nili-Ravi, Murrah or Mediterreanean Buffalo. However, buffalo breeding policy is not well defined. Framers use to keep buffaloes for milk, draught and meat as surplus after work. The indigenous buffaloes are considered to have higher disease resistance, better tolerance to high hot and humidity conditions prevalent in Bangladesh. These animals are also more efficient in feed conversion efficiency of crop residues and naturally available low quality roughages. Buffalo is still considered as difficult breeders due to silent heat for reproduction. Buffaloes reared under household subsistence farming are subjected to control natural mating whereas animals in SIF and extensive farming are mated randomly with natural mating. Stud bull is one of the main problems for buffalo reproduction in all production systems. Castration is done early in life for male, by open method for producing work buffalo. Artificial insemination and time fixed synchronization are introduced by LalTeer Livestock Limited first time in Bangladesh. Delayed puberty, seasonal breeding, long calving interval, and poor estrus detection hampered the reproductive efficiency in the female buffalo.

(Canbolat *et al*. 2012) also found similar findings of age of first heat in Mymensingh and Laximpur district. It was reported (Piark, 1989) that the age at first calving for Nili-Ravi buffaloes ranges from 30-54 months and for Khundi buffaloes ranges from 48-57 months. The natural mating system was practiced in both the system of farming and artificial Insemination (AI) was not yet practiced commercially in Bangladesh due to the weakness of oestrus symptoms and variability of estrus length in buffalo. The reproductive performances of Bangladeshi male and female buffaloes with different genotypes which agreed the few parts of present contents on reproduction(Huque and Shahjahan, 2016)

Wallowing of buffaloes

Wallowing has two purposes; the most obvious is that of cooling, the other is protection from insects. Wallowing during daytime is done during the hottest hours. Wallowing during nighttime is instead a way for the animal to protect itself from insects. The buffalo has few sweat glands and a dark skin which makes it difficult for them to maintain their body temperature in hot and humid environments. Wallowing is a very important way for the buffaloes to maintain their body temperature. When buffaloes enter the water, they defecate and/or urinate. This seems to be a way to mark their wallow. Wallowing

behavior is a learnt behavior. An animal that has not wallowed from birth with other animals will not do so on its own. Teaching such an animal to wallow is almost impossible for humans. The buffalo has to learn it from other buffaloes; even so, the adult buffalo will be very suspicious and may not wallow by its own choice. If any water or mud hole is available, the buffaloes behave more like cattle. They will seek shade and graze more during the cool hours and less during the hot hours. Although buffaloes certainly prefer to wallow, buffaloes will seek shade if water is not available. Under these circumstances, they spend less time grazing than animal able to wallow (Tulloch, 1974). As a means of thermal regulation, shade and wallows were found to have similar effects in terms of rectal temperature changes. However, there appear to have been no measurements of differences in productivity between grazing swamp buffaloes provided with shade only and those given wallows (Tulloch and Litchfield, 1981). Swim baths or deep dips are inappropriate for parasite control since buffaloes regard them as wallows. Also, they become fouled due to defecation or urination by the animals (Cockrill, 1974)

Health care practice

Most of the diseases that occur in cattle also inflict harmful effects on the buffaloes. Foot and mouth disease is the most problematic disease in Bangladesh as quality vaccine is not freely available. Diseases such as Haemorrhagic septicaemia (HS), fasciolosis, ascariosis, anthrax, brucellosis, tuberculosis and black quarter are also important diseases causing more economic losses. Health care practice is not available in most cases of buffaloes as it reared in most remote areas. Now a day's very few farmers use Hemorrhagic Septicemia and antrax vaccines that are low cost produced in country. Most of the farmers do not use any anthelmintic for deworming in buffalo. The prevalence of GIT parasites was alarming in buffaloes in all over the areas of Bangladesh. Research findings of (Hamid *et al.*, 2016) revealed that 64.2% of the studied buffaloes were infected with one or more species of gastro-intestinal parasites. Younger animals were found to be more susceptible to both parasitic and protozoan infections but sex was found not to affect the incidence. Most of the non-parasitic enteritis was caused by E. coli (62.5%) and Salmonella spp. (29.16%). Clinical and subclinical mastitis were recorded in 23.68% and 31.57% of samples analyzed, respectively. The most isolated pathogens (Figure 4)

responsible for mastitis in buffalo was the Coagulase Negative Staphylococci (CNSs), Streptococcus spp., Bacillus spp. and Staphylococcus aureus (Hamid *et al*., 2016).

Livelihoods of buffalo farmers

Per capita fresh milk and milk products consumption is one of the most important index to measure the living standard of a nation. The more the people enjoy living standard in the world, the more they consume healthy milk and milk products (Aneja, 1990). The buffaloes hold strategic place in overall livestock economy of Bangladesh and serve three important purposes such as milk, meat and drought power supply (Ghaffar *et al*., 1991).

Buffalo rearing increased the livelihood status of the farmers especially for the farm women and the development of this sector is the potential path to rural prosperity. Buffaloes hold strategic place in overall livestock economy of Bangladesh and serve three important purposes such as milk, meat and drought power supply (Impact on purchasing capacity (Ghaffar *et al*. 1991).

CHAPTER III

MATERIALS AND METHODS

3.1 Selection of the study site

The study was conducted in selected Madarganj Upazilla of Jamalpur District in the Division of Mymensingh of Bangladesh. Madarganj is located at 24.8917°N 89.7500°E. It has 41,058 household units and a total area 225.38 km². There are seven unions and Four unions namely Balijuri,Char Pakerdha, Jorekhali, Karaichurawere selected due to abundant natural green grasses in the river bank of old Brahammaputra and Jamuna ,suitable temperature, ecology , good transport facilities and flood plain area. There are also char areas where a lot of grazing land for buffaloes. Therefore this area is suitable for buffalo rearing and at the same time to improve livelihoods of poor farmers.

Table 3.1. Name of the district, upazila, unions and number of respondents in study areas

District	Upazilla	Unions	Villages	No. of respondents
Jamalpur	Madarganj	Balijuri	Ghoshpara	25
		Char pakerdha	Koalikandi Char Nagor	15
		Jorekhali	Barabataga	10
		Karaichura	Mohisbathan	10
Total				60

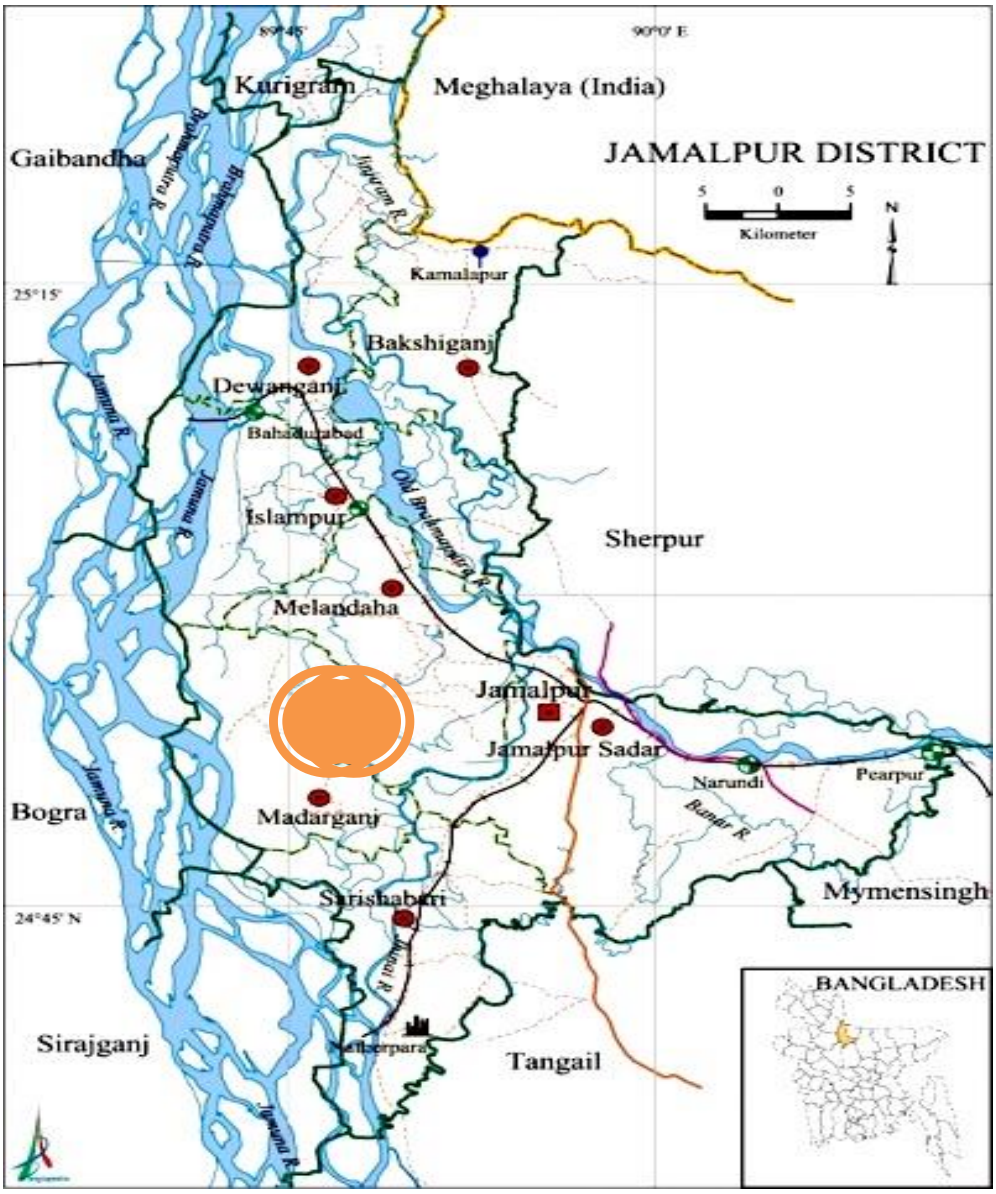

Fig:1. A Map of Madarganj Upazilla at Jamalpur district.

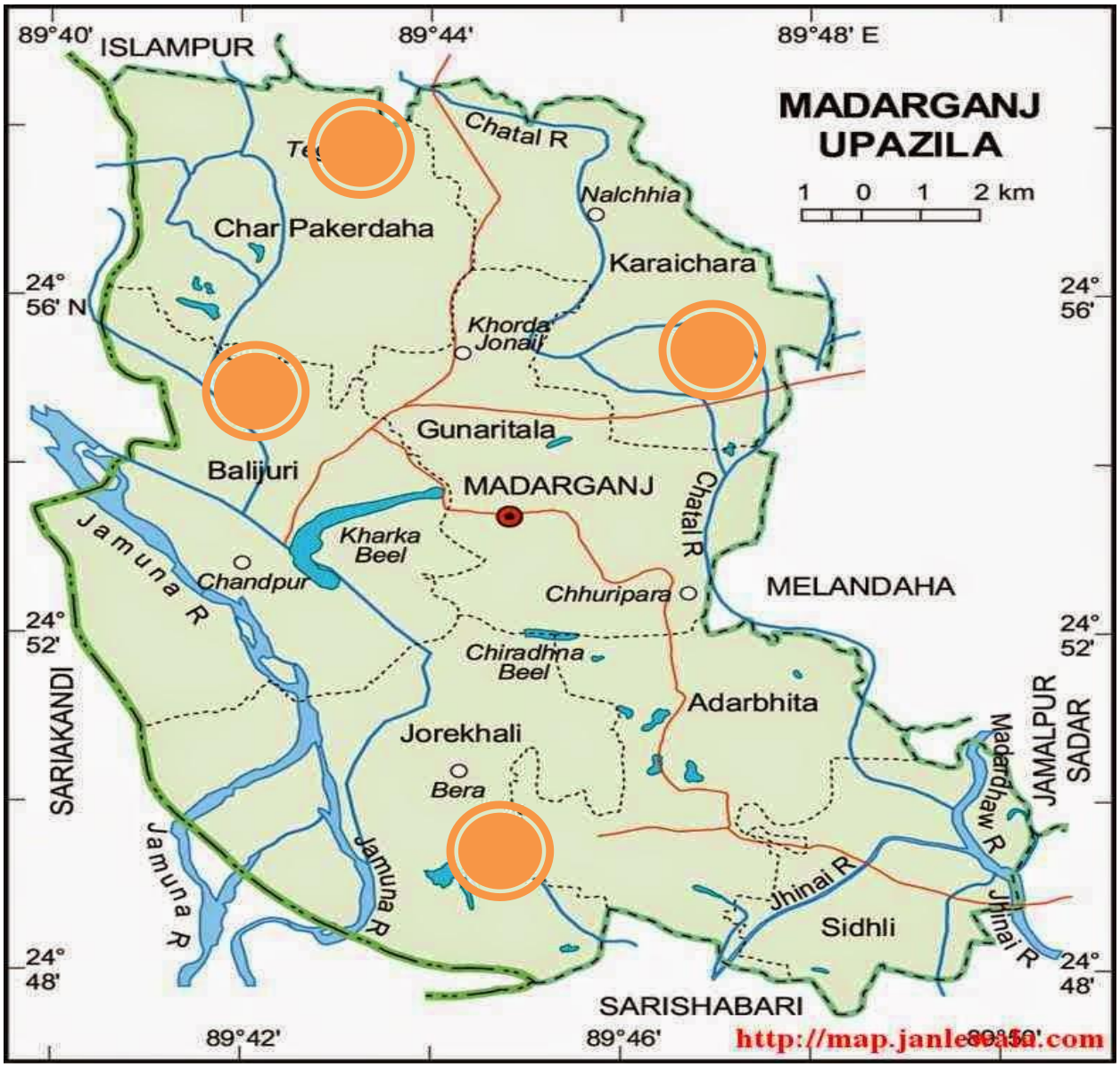

Fig:2. Map of Selected areas of Balijuri union, Karaichara union, Char pakerdaha, Jorekhali unions at Madarganj Upazilla.

3.2 Selection of Respondents

Total sample consist of 60 respondents from selected 5 villages of 4 unions. Respondents were classified into four groups according to the first letter of their union name. They were Group-P, Group-B, Group-k and Group-J. While selecting respondents due care was taken to ensure that they were evenly distributed in the village and truly represented buffalo housing ,feeding, breeding, health and care management practices prevailing in the area. Ordinations of respondent are shown in Table 3.1.

3.3 Development of interview schedule

The interview schedule was prepared based on the objectives of the study as mention in appendix. At first a draft interview was developed and it pretested with selected farmers in experimental areas. If get any problem then it modified as required. It prepared on easy way so that to get correct answer. This primary interview was selected as final interview schedule according to the knowledge gathered from field survey. The interview schedule was then printed in its final forms. Necessary photocopies were then made. A copy of the interview schedule in English version has been furnished in Appendix.

3.4 Conducting interview and Data collection

Data were collected personally through face to face interview from individual buffalo farmers in experimental areas. Interviewer took to support from upozilla livestock veterinary hospital and local leader. The data were checked before leaving the survey area due to reduce errors. The farmers were interviewed at their own house so that they could supply correct and authentic information without any hesitation. The behavior of farmers were friendly and cooperatively with interviewer at data collection period. The objectives were clearly explained to farmers by using local language as far as possible. Data were collected during the period of 5 October to 30 December 2018.

The response of each question in the interview schedule was coded and tabulated respondent-wise in a master table. The qualitative data were tabulated on group basis.

3.5 Measurement of variables

In a social research, the selection and measurement of variables constitute an important task. The selected variable are Farmer's personal information (Education level, Age, land holding, buffalo rearing experience, Family size, occupation, Source of capital and income), Housing condition, feeding method, source of feed, breeding status, Type of breed, Health care, Incidence of disease, Use of medicine, Daily routine for buffalo rearing, Average cost for production, Annual income from one buffalo, Status of buffalo farmer after rearing buffalo, Problem of buffalo rearing, Suggestion for farmer.

3.6 Proximate analysis of feeds and local grasses

- ✓ Proximate analysis some local grasses like Dubra, dull, Helencha and feeds (Broken rice, Rice polish), straw were done.
- ✓ 1-2 months old local grass and feeds were collected from experimental areas farmer.
- ✓ Preserve the sample in suitable temperature in lab.
- ✓ After properly mixed, it dried in hot air oven at a 105 of temperature and taken accurate weight
- ✓ All oven dried sample were grinded by grinding machine (CYCLOTEC 1093 Sample mill Tecator, Sweden) at the size of 0.5mm for chemical analysis.
- ✓ Chemical analysis were done according to the methods of AOAC (2004) and estimated CP (crude protein), CF (crude fiber), EE (ether extract), NFE (nitrogen free extract) of feeds and fodder.

3.7 Statistical analysis of the data

All the collected data were checked and cross checked before transferring to the master sheets. The data were coded, compiled, tabulated and analyzed to the objectives of study. Qualitative data were converted into quantitative by means of suitable scoring technique wherever applicable. Data presented in tabular form. Various statistical measures like number, frequency, average, percentage, chi-square test etc were done in describing the variables.

CHAPTER IV

RESULTS AND DISCUSSION

4.1 Socio-economic information of the buffalo farmer

The socio-economic characteristics of the farmers under the present study are presented under the following headings:

4.1.1 Age

The different age's farmers were included in Table 4.1. Buffalo farmers were classified into three categories considering Ministry of Youth, People Republic of Bangladesh, (2013): "Young" (18 to 35 years), "Middle aged" (36-50 years) and "Old" (above 50 years). In the survey area, It observed that 23.3% buffalo farmers were young aged (25 to 30), 51.7% buffalo farmers were middle aged (30 to 40) and 25% were old aged (above 40). So larger part of buffalo farmer in these respected areas were middle aged who engaged to buffalo rearing than other age's farmer and the old aged farmer less interest than middle aged.

Table 4.1: Distribution of buffalo farmers according to their age

Categories (Years)	**Frequency**	**Percentage**
a .Young aged (25-30)	14	23.3
b.Middle aged (30-40)	31	51.7
c.Old aged (Above 40)	15	25
Total	60	100.0

4.1.2 Education background

The different education levels of farmers were included in Table 4.2. Education backgrounds of the farmer were classified into four categories namely can sin only, primary level (1-5), secondary level (6-10), higher level (above10) considering their year of schooling. In experiment area, It was found that 50% farmer were cannot read and write, 23.3% farmer completed primary level, 21.7% farmer can sing only, 3% farmers

were under S.S.C level and 5% farmers were in higher level(above 10). There were no degree pass or Hon,s pass farmer in study area. Larger portion of buffalo farmer were illiterate due to lack of education media (School or college) or consciousness. The education level of buffalo farmers was reported to be 91.82% and 56.1% in Bihar (Singh *et al*., 2011) and Jharkhand (Siddiki*et al*., 2015). Chandra sarkar*et al.,* 2017) reported that the educated farmers of Bagerhat Districts in Bangladesh were 81.6%.

Table 4.2: Distribution of buffalo farmers according to their educational background

Categories	**Frequency**	**Percentage**
a. Cannot read and write	45	75
b. Can sign only	8	13.3
c. Primary (1-5)	5	8.3
d. Below SSC (6-10)	2	3.4
e. Higher level (above 10)	0	0
Total	60	100.0

4.1.3 Family size

According to family planning ministry, family size of the farmers were classified into three categories: 'Small family' (up to 4), 'Medium family' (5-7) and 'Large family' (above 7) considering their no. of members. In survey areas, 28.3% farmer family were small family, 40% farmer family were medium family and 31.7% were large family (Table 4.3). Maximum families were medium type family due to well decision of family planning. Faruque (2003) also found similar result.

Table 4.3: Distribution of farmers according to their family size

Categories	**Frequency**	**Percentage**
a. Small family (up to 4)	17	28.3
b. Medium family (5-7)	24	40
c. Large family (above 7)	19	31.7
Total	60	100.0

4.1.4 Farmer's type

According to FAO (2008) given classification/type, farmers were classified into five categories: 'Landless farmer' (below 0.02ha land) 'Marginal farmer' (0.02-0.2 ha land) 'Small farmer' (0.2-1 ha land), 'Medium farmer' (1-3 ha land), Large farmer (above 3 ha land). Data in Table 4.4 indicate that 50% had small farmer, 15% had marginal farmer, 40% percent had medium farmer and 1.7% had large farmer. Data revealed that the majority (33.3%) of the buffalo farmers had small to medium categories. It might be due to fragmentation of land and high price of land in this study area. (Sarker*et al.,* 2013) found similar results.

Table 4.4: Buffalo farmers according to farmer's type

Categories	**Frequency**	**Percentage**
a. Landless farmer (below 0.02 ha)	0	0
b. Marginal farmer (0.02-0.2 ha)	9	15
c. Small farmer (0.2-1 ha)	30	50
d. Medium farmer(1- 3 ha)	20	33.3
e. Large farmer(above 3 ha)	1	1.7
Total	60	100.0

4.1.5 Occupation

The occupation status of buffalo farmers is presented in Table 4.5. In the study area, 50% of the buffalo farmers were engaged with combined agriculture farming, 36.7% farmers engaged with buffalo rearing and rests of 8% were engaged with others like agriculture crop farming and poultry farming. So the main occupation in the study areas were combined agriculture farming due to high profit return. Sarker*et al.,* (2013) reported that Bagerhat Districts in Bangladesh were fully depended on buffalo rearing & Amin *et al.,* (2015) reported that 80% of the buffalo farmers were engaged with agriculture along with buffalo rearing and rests of them were engaged with other business.

Table 4.5: Occupational status of the buffalo farmers

Occupation	Frequency	Percentage
a. Only buffalo rearing	22	36.7
b. Agricultural crop farming	5	8.3
c. Mixed Agriculture(Dairy, poultry)	30	50
d. Chicken and duck rearing	3	5
Total	60	100.0

4.1.6 Purchasing ability of farmers

Purchasing ability of buffalo farmers is presented in Table 4.6. Data in Table 4.6 indicates that 16.7% farmers can purchase one buffalo at a time, 58% farmers were purchased two buffalo at a time, 25% farmer able to purchase more than two buffalo at a time. Data revealed that the majority (58%) of the buffalo farmers purchase one buffalo at a time for rearing and draught purpose.

Table 4.6. Purchasing ability of farmers

Purchase at a time	Frequency	Percentage
a) One	10	16.7
b) Two	35	58.3
c) More than two	15	25
Total	60	100.0

4.1.7 Source of training skill and capital

Source of capital of buffalo farmers is presented in Table 4.7. There were 52% farmers who got no training on buffalo husbandry and 8% farmers taken different training on livestock at a short time course by NGO, Upozila livestock office etc on poultry farm management, small scale rural goat farming. The large portion of buffalo farmers (45%) took bank loan to buy their buffaloes. Some of them used their own capital to rear buffaloes. The study indicates that 27% farmers took loan from bank, 8% farmers took loan from different NGO like ASA, PKASP, Progoty etc.

Table 4.7: Source of training skill and capital

Source of training skill	**Frequency**	**Percentage**
a. Rearing training	8	13.3
b. Rearing without training	52	86.7
Total	60	100.0
Source of capital		
a. Own capital	25	41.7
b. Loan from bank	27	45
c. NGOs	8	13.3
Total	60	100.0

4.1.8 Duration of rearing buffaloes

Duration of buffaloes rearing is presented in Table 4.8. In experiment area, it was found that 30% farmer keep buffalo for 6 months, 16.7% farmers keep their buffalo for one year, 33.3% famer's rear for 2 years and rest 20% farmers keep buffalo for more than 2 years. The Larger portions of buffalo farmer were kept buffaloes due to more profit in market or future breeding bull.

Table 4.8: Duration of buffalo rearing

Duration of rearing	**Frequency**	**Percentage**
a. 6 months	18	30
b. 1 year	10	16.7
c. 2 year	20	33.3
d. More than 2 years	12	20
Total	60	100.0

4.1.9 Type of buffalos in selected areas

Type of buffaloes rearing in study is presented in Table 4.9. In experiment area, it was found that 33.3% buffalos were Indigenous type, 56.7% farmers rear crossbred buffalo and rest 10% were mixed indigenous and crossbred type. The major type of buffalos bred was crossed milking and bull buffalo.

Table 4.9: Distribution of buffaloes in selected areas

Category	Frequency	Percentage
a. Indigenous Milking and bull buffalo	20	33.3
b. Crossbred Milking and bull buffalo	34	56.7
c. Crossbred and Indigenous buffalo	6	10.0
Total	60	100.0

4.1.10 Herd size of buffalo farmer

Herd size of buffalo farmer in study is presented in Table 4.10. In study area, it was observed that 15% farmers were (1-3) number of buffalo, 66.7% farmers were (4 to10) number of buffalo and the rest 18.3% farmers were more than 10 buffalos. The highest number of buffalos of farmer was in 4-10 and more than 10 herd size respectively. (Sarker *et al.,* 2013) conducted a study in different districts and found that out of 100 farms 45 farms had 4-8 herd size and only two farms had above 30 herd size. It was revealed.

Table 4.10: Buffaloes in herd of each farmer

Herd size(No. of buffalos)	Frequency	Percentage
a. 1-3	9	15
b. 4-10	40	66.7
c.>10	11	18.3
Total	60	100.0

4.1.11 Housing of buffalo

Housing management of buffalo by farmer in study area is presented in Table 4.11. The buffalo houses were made of varieties of local materials such as straw, tin, mud, chatai, etc. About 63.4% houses were made of straw, 28.3% made of tin and 8.3% houses were made in half building. This may be related to the economic condition of the farmers which is much better for the farmers. Highest percentage of farmers (70%) provided open house, 30% provided closed house.

On the basis of floor type, 13.3% of farmhouse was found with pacca (with bricks) and the rest 86.7% had kacca floor. Hossain *et al*. (2004) observed that 63% farmers provided closed house and 63% farmers used kacca floor. 15% houses shed was inside the owner shelter house and 85% shed of farm were outside from main shelter.

The location of the cattle house in most cases (60%) was far from the farmer's house which is different from the findings of the (Hamid *et al.* 2016). He reported that in most cases cattle house were near the farmer's house.

In sight into data further reveal that only 86.7 per cent respondents provide well ventilation in buffalo houses which include in fair category and 13.3 percent provided no ventilation in the house due lack proper management house or accurate size and shape of shed. 83.3% houses shed have well drainage system and 16.7% shed have no drainage system.

As a result buffalo affect different disease due to proper sanitation. Regarding the summer management in buffaloes, majority of the farmers (66.7%) practice summer management practices to protect buffaloes from extreme heat and took management care to protect buffaloes from extreme cold. But 33.3% farmers were not taking any management in winter and summer season.

Table 4.11. Housing management

Items	Frequency	Percentage
1.Type of shed		
a. Tin shed	17	28.3
b. Straw shed	38	63.4
c. Half building	5	8.3
Total	60	100.0
2.Pattern of House		
a. Open	42	70
b. Close	18	30
Total	60	100
3. Pattern of Floor		
a. Pacca	8	13.3
b. Kacha	52	86.7
Total	60	100.0
4. Location of shed		
a. Inside owner shelter	9	15
b. Outside of owner shelter	51	85
Total	60	100
5. Ventilation facilities		
a. Adequate	52	86.7
b. Not adequate	8	13.3
Total	60	100.0
6. Drainage channel		
a. Yes	50	83.3
b. No	10	16.7
Total	60	100.0
7. Summer and Winter management practices		
a. Yes	40	66.7
b. No	20	33.3
Total	60	100.0

4.2 Feeds and feeding

4.2.1 Feed management

Feed management of buffalo by farmer in study area is presented in Table 4.12. Generally buffalo farmers maintain three feeding methods namely, Extensive, Semi-intensiveand Intensive. About 63.3% (highest) respondents followed Semi-intensive feeding method where 26.7% extensive and only 10% was in Intensive feeding methods (Table 4.12).This might be related to the economic condition of the farmers which make them low or high input ability for feeding of buffalo.

Four categories of sources of feed was considered for sources of buffalo feed in the study area namely, River side area (char) grass, Own land cultivated grass;others people land and Roadside green grass and unconventional feed. Here, it was observed that there was no farmers depends on others people land as source of buffalo feed where 58.3% (highest) farmers used River side area (char) grass, 30% farmers used Roadside green grass and unconventional feed and only 11.7% farmers used own land cultivated grass (Table 4.12).

In terms of concentrate feeding for buffalo, major portion of the respondents (75%) did not make concentrate feeding for buffalo where 8.3% respondents used purchased (Wheat bran, Mustered oil cake) feed and only 16.7% respondents used Homemade concentrate (Rice broken, Rice polish, Broken wheat etc.) feed (Table 4.13).

This might also be due to cause of economic circumstances of the farmers which make them food supply ability for their buffalos according to their economic condition as food sources.

Table 4.12: Feeding method and sources of feed in study areas

Particulars	Frequency	Percentage
1.Feeding method		
a. Extensive	16	26.7
b. Semi-intensive	38	63.3
c. Intensive	6	10
Total	60	100.0
2. Sources of feed		
a. River side area(char) grass	35	58.3
b. Own land cultivated grass	7	11.7
C. Others people land	0	0
d. Roadside green grass and unconventional feed	18	30
Total	60	100

Table 4.13: Concentrate feeding for buffalo in study areas

Parameters	Frequency	Percentage
a) Homemade concentrate(Rice broken, Rice polish, Broken wheat etc.)	10	16.7
b) Purchased (Wheat bran, Mustered oil cake)	5	8.3
c) Not feeding	45	75
Total	60	100.0

4.2.2 Chemical composition of different local grass and feed in study areas

Chemical composition of local grass and feed in the experimental are presented in Table 4.14. The local grass in study area like Dubra, Dhal, Helencha contains respectively 16.5%, 15.6%, 20.2% of crude protein. It observed that the Helencha contain more crude protein than others and low amount of crude fiber.So Helencha grass is suitable to growth muscle and reproduction of buffalo in this area.Dubra, Dhal,Helenchawerecontains 21.3%, 28.5%, 16.3% of crude fiber.Dhal grass contain high amount crude fiber which could not easily digested by buffalo but other grass easily utilized by buffaloes due to low amount of crude fiber. Dubra, Dhal, Helencha grass were 36.4%, 40.9%, 43.02% of NFE of these area, It clearly proved that helencha provide more energy than other grass. It was seem that from table 4.14, Dhal grass contains more amount Ash which supply

mineral and Dubra contain more dry matter which help to supply better nutrient in the body buffalo. The Broken rice, Rice polish,Straw was contains 88.5%, 92.3%, 86.8% of DM & 9.2%, 10.7%, 3.6% of CF .Among the feed (Rice polish,broken rice,Straw), the rice polish comparatively contain more nutrient than others. These finding were as same as to finding of Sarker*et* al., (2013).

Table 4.14. Chemical composition of different local grass and feed in Experimental areas

Feedstuffs	Chemical composition(%DM basis)					
	DM	CP	CF	EE	NFE	Ash
Broken rice	88.5	9.2	23.5	2.3	62.8	2.3
Rice polish	92.3	10.7	11.7	9.6	51.2	15.8
Straw	86.8	3.6	3.8	1.5	44.9	14.2
Dhubla grass (*Cynodondactylon*)	90.2	16.5	21.3	1.9	36.4	12.6
Dhal grass (*Hymenachneamplexicaulis*)	89.6	15.6	28.5	1.4	40.9	17.1
Helencha (*Enhydrafluctuans*)	86.4	20.2	16.8	13.0	43.02	6.4

4.2.3 Feeds and fodder availability

Feeds and fodder availability in the experimental are presented in Table 4.14.About 70% of the total respondents seemed that feeds and fodder are available in the study area where 30% respondents were not agreed with them. They seemed that feeds and fodder in the study area was not sufficient.

Table 4.15: Feeds and fodder availability in the experimental areas

Parameters	Frequency	Percentage
a) Available	42	70
b) Not available	18	30
Total	60	100

4.2.4 Habituation of feeding in respect of caring

Existing situation on frequency of feeding, watering and given special feed for buffaloes in a day in the experimental are presented in Table 4.15.It was found that about 70% of the respondents were habituated in once feeding/day where only 30% respondents applied twice feeing/day. It was also observed that there was no three times feeding/day to buffaloes among the respondents (Table 4.15).

In terms of watering/day, it was found that 2 times watering/day was followed by about 80% respondents where 20% respondents use free access of water for watering of buffaloes (Table 4.15).

In terms of special feed given to buffaloes in a day, regular practice regarding add salt or mineral mixture in water for feeding of buffaloes was done by 53.3% (highest) respondents whereirregular was done by only 16.7% respondents. It was also observed that there was no special feeding was done by 30% respondents (Table 4.15).

The overall scenario was might be due to cause of economic circumstances of the farmers which make them food supply ability for their buffalos according to their economic condition as food sources.

Table 4.16: Frequency of feeding, watering and given special feed for buffaloes in a day

Parameters	Frequency	Percentage
1. Feeding/day		
a. Once	42	70
b. Twice	18	30
c. Three times	0	0
Total	60	100
2. Watering/day		
a. 2 times	48	80
b. Free access of water	12	20
Total	60	100
3. Add salt or mineral mixture in water		
a. Regular	32	53.3
b. Irregular	10	16.7
c. Not feeding	18	30
Total	60	100

4.3 Breeding management practices

Breeding management practice is the most important factor for successful buffalo production. Among the respondents, 16.7% followed A.I. breeding method where 25% followed A.I. and naturalbreeding method and maximum 58.3% followed onlynaturalbreeding method (Table 4.16).

In case of heat detection, about 41.7% respondents were able to identify successfully 'heat' stage of buffaloes where 58.3% respondents were not successfullyidentified this stage (Table 4.16).

In terms of symptoms of heat detection, majority of the respondents were in favor of the terms of 'Mounting & urination'. About 23.3% respondents depended on the symptoms of 'Mucus discharge' for heat detection and about 25% respondents opined the symptoms of 'Bellowing & discharge' for heat detection (Table 4.16).

Table 4.17: Breeding management practices of the respondents in the study area.

Parameters	Frequency	Percentage
1. Method of breeding		
a. A.I.	10	16.7
b. A.I and Natural	15	25
c. Only natural	35	58.3
Total	60	100.0
2. Heat detection		
a. Yes	25	41.7
b. No	35	58.3
Total	60	100.0
3. Symptoms of heat detection		
a. Mucus discharge	14	23.3
b. Mounting & urination	25	41.7
c. Bellowing & discharge	15	25
Total	60	100.0

4.4 Wallowing of buffaloes

The frequency of wallowing of buffalo is shown in Table 4.17. Water buffalo like hanging out in water and wallowing the mud. They are typically put to work in the morning and taken to a pond, river or mud hole in the afternoon heat to wallow in the mud or water and often relax in a position in which they are nearly completely submerged with only their nostrils showing. In addition to cooling the animal, wallowing helps remove skin parasites and keep away biting flies and other pests.The study area are riches water bodies like Jhinai, Jamuna, Chatal river; ChiradhunaBeel, KharkaBeel etc. The majority of farmers complete wallowing one time in a day (66.7%) & 33.3% farmer complete wallowing to their buffalo twice in a day. Maximum farmers complete to wallowing of buffalo in beel and river water.

Table 4.18: Wallowing of buffaloes

Parameters	Frequency	Percentage
c) One time in a day	40	66.7
d) Twice in a day	20	33.3
Total	60	100.0

4.5 Health care practices

Occurrence of disease is the most constraints for successful buffalo production. Sometime it is the main restriction for commercial buffalo production. In the study area, 56.7% respondents opined that the incidence of F.M.D.disease was highest compared to B.Q. disease (20%), Anthrax disease (13.3%) and Mastitis disease (10%) (Table 4.18). So, it can be stated that the most common disease in the study area was F.M.D. disease.

It is an established fact that 'prevention is better than cure'. So, vaccination is an important practice to keep buffaloes disease free. It was observed that the majority of the respondents (66.7%) were in favor of vaccination practice where about 33.3% were not in vaccination practice (Table 4.19). This might also be due to cause of economic circumstances educational status of the farmers which make them practicing or not practicing in vaccination program.

Source of vaccines, anthelmentics andmedicine are also an important factor to control diseases of buffaloes. Majority of the respondents (65%) depended on local market as source of vaccines, anthelmentics andmedicine where 26.7% respondents depended on Livestock office. Only about 8.3% respondents responded to calling a quack as source of vaccines, anthelmentics andmedicine(Table 4.20).

Treatment process of sick buffaloes is also another remarkable function for successful production system. Majority of the respondents (73.3%) depended on calling a quack for the treatment of sick buffaloes where only 26.7% respondents reminded veterinary doctor for the treatment of sick buffaloes. There was no respondents who used local empirical knowledge for the treatment of sick buffaloes (Table 4.21).

Table 4.19: Incidence of diseases of buffaloes in study areas

Incidence of diseases	Frequency	Percentage
a. Anthrax	8	13.3
b. F.M.D.	34	56.7
c. B.Q.	12	20
e. Mastitis	6	10
Total	60	100.0

Table 4.20. Vaccination schedule, deworming drugs and Practice to control Ecto -parasites

Parameters	Frequency	Percentage
Follow the Vaccination schedule		
a. Yes	40	66.7
b. No	20	33.3
Total		100.0
Use of deworming drugs		
a. Yes	36	60
b. No	24	40
Total	60	100
Practice to control Ecto -parasites		
a. Followed	31	51.7
b. Not followed	29	48.3
Total	60	100.0

Table 4.21. Source of vaccines, Anthelmentics, Medicine

Sources	Frequency	Percentage
a. Local market	39	65
b. Livestock office	16	26.7
c. Calling a quack	5	8.3
Total	60	100

Table 4.22. Treatment process of sick buffaloes

Treatment	Frequency	Percentage
a. Veterinary doctor	16	26.7
b. Calling quack	44	73.3
c. Use local empirical knowledge	0	0
Total	60	100.0

4.6 Sanitary condition

Sanitary condition regarding shed/shelter/standing place were classified in to 'good', 'satisfactory' and 'poor'. Majority of the respondents (43.3%) had satisfactory sanitary system where 35% respondents belong to good condition where 21.7% respondents had poor sanitary status for buffaloes. So, it was observed that most of the respondents (78.3%) belong to good to satisfactory sanitary system (Table 4.22).

Table 4.23: Sanitary condition of shed

Parameters	Frequency	Percentage
a) Good	21	35
b) Satisfactory	26	43.3
c) Poor	13	21.7
Total	60	100.0

4.7 Transport facilities

Transport facilities of buffaloes are an important factor for successful production and also for marketing system. Production system may be fruitful if marketing system is developed. Successful marketing system depends on transport facilities. It was observed that most of the respondents (56.7%) depended on 'by foot' facility where 25% respondents used boat for transport of buffaloes from one place to another. Only 18.3% respondents used van to transport buffaloes (Table 4.23).

Table 4.24: Transport facilities of buffaloes for marketing progress

Parameters	Frequency	Percentage
a) Boat	15	25
b) By foot	34	56.7
c) Van	11	18.3
Total	60	100.0

4.8 Marketing of buffaloes

Mainly marketing system is related to the relationship between sellers and buyers. It was observed that about 65% respondents sold their buffaloes at local market where 26.7% respondents sold their buffaloes to another farmer (Table 4.24).

Results also revealed that about 43.3% (highest) respondents sold their buffaloes to whole seller where 15% (lowest) respondents sold their buffaloes toconsumer. About 16.7% respondents sold their buffaloes to middleman and 25% sold their buffaloes toButcher (Table 4.24).

Table 4.25: Types of buffalo sellers and customers

Selling from	**Frequency**	**Percentage**
a. Local market	39	65
b. Another farmer	16	26.7
Total	60	100.0
Sold to		
a. Whole seller	26	43.3
b. Middleman	10	16.7
c. Butcher	15	25
d. Consumer	9	15
Total	60	100.0

4.9 Daily routine of farmers in buffalo rearing

The daily activity of the buffalo farmers is shown in Table 4.25. At 5.00-6.00 am. The farmer cleaning premises of buffalo shed, washing milking buffalo and dumping the dung. At 6.00-6.30 am. Farmer provided green grass, concentrate and fresh water. After some tines at 7.00-7.15 am. The buffaloes were milking and ready to calves for suckling to their mother and washing milking barns. Within 8.00-9.00 am the buffaloes were taken to field for ploughing of land & cultivation. Between 9.00-11.00 am the farmer completed some activities like vaccination, identification and isolation sick buffalo, Treating sick buffalo, Periodical spraying of animal houses with suitable pesticides, deworming, Clipping hair, Toe trimming, Dehorning of calves etc. At 11.00-5.00 pm. the farmer were harvesting, chaffing and feeding of green fodder to all the stock and

buffaloes were taken to Beel or River side char for grazing and wallowing.Farmer go off duty by 5.00 pm. At 5.30-6.00 pm. the buffaloes were sheltered in shed and maximum buffalo stay in char at whole night.

Table 4.26.Daily routine of farmers in buffalo rearing

Time	Activities
5.00-6.00 a.m.	Cleaning buffalo shed, Dumping the buffalo dung, Grooming and washing milking buffalo.
6.00-6.30 a.m.	Buffalo were provided by fresh water, dry fodder and concentrate just before milking.
7.00-7.15 a.m.	Milking of buffaloes and given to rest.
8.00-9.00 a.m.	Buffaloes were taken to field for ploughing of land & cultivation.
9.00-11.00 a.m.	Vaccination, Identification & Isolation sick buffalo, Treating sick buffalo,Periodical spraying of animal houses with suitable pesticides, Deworming , Clipping hair, Toe trimming, Dehorning of calves etc.
11.00-5.00 p.m.	Buffaloes were taken to Beel or River side char for grazing and wallowing.
5.00-5.30 p.m.	Return to grazing land and supplied to fresh water, tree leaves.
5.30-6.00 p.m.	Buffaloes were sheltered in shed.

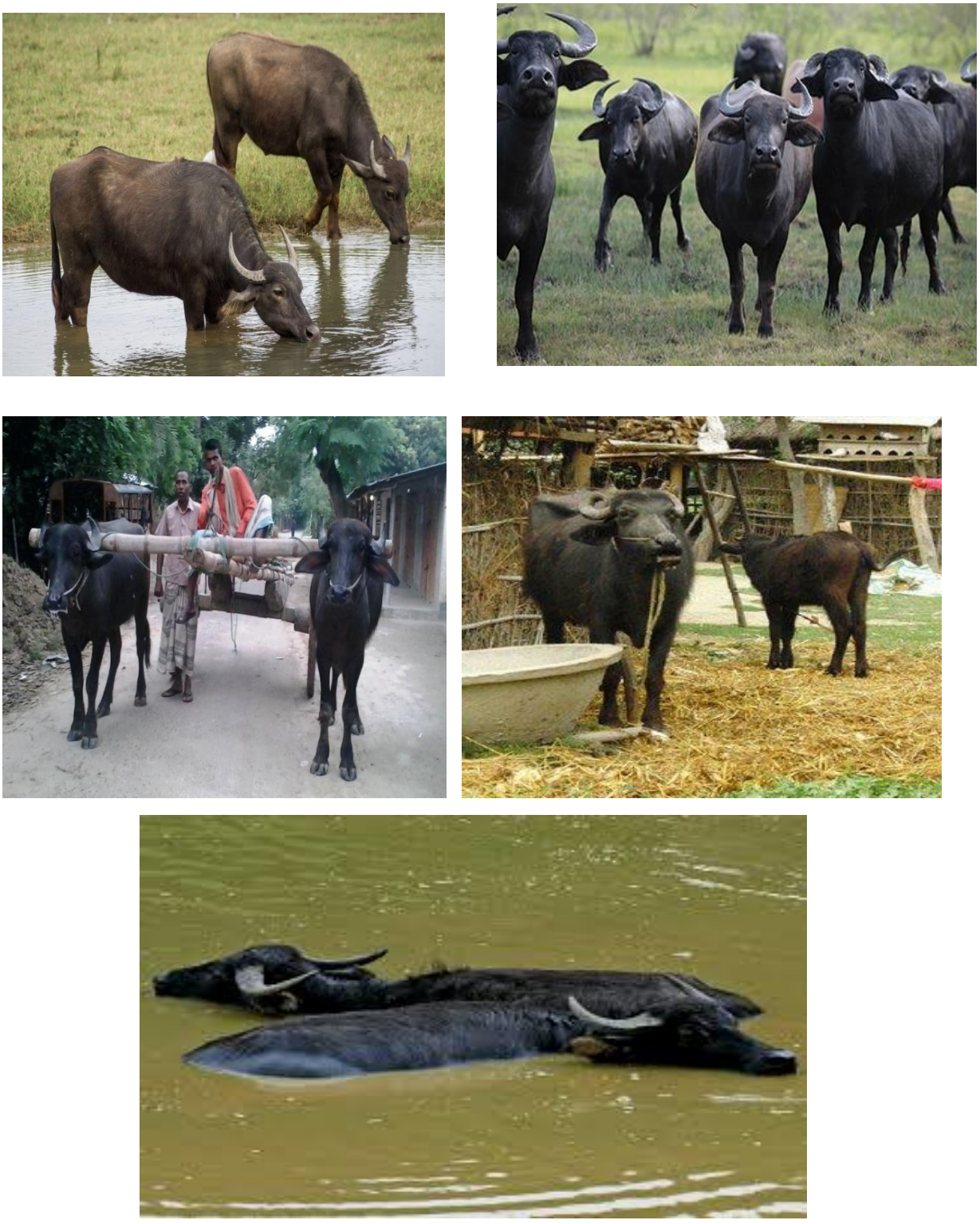

Fig:3. Buffalo observed in Madargonj Upazilla for data collection

4.10 Cost analysis

4.10.1 Cost of buffaloes

The cost of the buffaloes is included under the Table. Data shown on Table 4.26 indicate that the highest price of one pair of milking buffalo was ranged from 180000 to 250000 Tk. About 33.3% farmer brought one pair buffalo within price of range from 90000 to 100000 tk. The price of buffaloes in these experimental areas varies due to their health status and utility. The lowest price of one pair of buffalo was 90000 tk.

Table 4.27: Cost of one pair of buffalo

Cost/Pair	Frequency	Percentage
90000-100000/=	20	33.3
100000-130000/=	16	26.7
130000-160000/=	6	10.0
160000-180000/=	8	13.3
180000-250000/=	10	16.7
Total	60	100.0

4.10.2 Cost of feeding, breeding, housing, equipment and treatment

The cost of feeding, breeding, housing, equipment and treatment **is**presented in Table 4.27. Toanalyze the cost-return it is necessary to describe the feed cost, breeding cost, cost of housing and equipment and also treatment cost of buffalo rearing. The average cost of labor (per year) was higher than the average cost offeed, housing and equipment, breeding, veterinary doctor and medicine and vaccine (per year)e. Farmers generally bred their buffalo from the neighbor's bull buffalo and they sometimes artificially inseminate their buffaloes. For this reason, the breeding cost was low. On the other hand they never purchase feed for buffalo rearing. Average feed cost was 2360 BDT, housing and equipment cost was 2240 BDT, breeding cost was 520 BDT, labor costwas 3150 BDT, veterinary doctor and medicine costwas 1000 BDTand average cost of vaccine was 300BDT. So, Average rearing cost of one buffalo was 9570 BDT.

Table 4.28: Average feeding, breeding, housing, equipment and treatment cost for one buffalo in one year in the study area

Category	**Frequency (BDT)**
Average Feed cost (year)	2360
Average housing and equipment cost (year)	2240
Average breeding cost(year)	520
Average labor cost(year)	3150
Average Veterinary doctor and medicine cost(year)	1000
Average cost of vaccine(year)	300
Total rearing cost	9570

4.10.3 Cost of farmers and family members

The average expenditure per year per head is presented in Table 4.28. Food cost was the maximum among the total expenditure varies from BDT 1300 to BDT 2500. The second highest expenditure was social status from BDT 500 to BDT 2200 followed by the cost of clothing (250 BDT-1500 BDT), health care cost (100 BDT-1200 BDT), educational cost (100 BDT-1600 BDT) and housing (100 BDT-680 BDT).

Table 4.29: Average expenditure (BDT) per year per head in study area

Category	Av. Expenditure (BDT)	Minimum(BDT)	Maximum(BDT)
Food	1686.00	1300.00	2500.00
Cloth	773.00	250.00	1500.00
Housing	340	100.00	680.00
Education	342.00	100.00	1600.00
Health care	745.00	100.00	1200.00
Social status	1770.00	500.00	2200.00

4.10.4 Total income from one buffalo rearing per year

The total income (Draught + milk + dung) per year per buffalo is presented in Table 4.29. The average income per year per buffalo through draught was 15000 BDT followed by milk (BDT 10000).

Table 4.30: Total income from one buffalo rearing per year

Source of income	Taka	Minimum(BDT)	Maximum(BDT)
Draught	15000.00	6000.00	22000.00
Milk	10000.00	4000.00	20000.00
Dung	1400.00	600.00	2200.00
Total	**26400.00**	**10600.00**	**44200.00**

4.10.5 Net income

Net income from one buffalo for one year is presented in Table 4.30. The net income from one buffalo per year was 116830 BDT. It indicates that rearing of buffaloes in the experimental area was profitable.

Table 4.31: Net income from one buffalo per year

Category	Frequency(BDT)
Total Income	26400.00
Total Expenditure	9570.00
Net Income	16830.00

4.11 Livelihood improvement of buffalo farmers

Buffalo rearing increase livelihood status of the farmers especially for the farm women and development of this sector is the potential path to rural prosperity (Faruqe, 2003*et al*., 2009). To investigate the status of livelihood improvement of the buffalo farmers in the studied area, purchasing capacity of food and cloths, impact on social status, health care, education and housing were investigated. Buffaloes hold strategic place in overall livestock economy of Bangladesh and serve three important purposes such as milk, meat and drought power supply (Ghaffar*et al*., 1991).

The food purchasing capacity of the buffalo fanners is presented in Table 4.31. Before rearing of buffaloes the fanners spent only 860 BDT for purchasing food but they were able to spent 2500 BDT for food purchasing after they start rearing buffaloes, which was 65.60% more than previous state.

The Impact on cloths purchasing ability of the buffalo farmers is presented in Table 4.31. Before rearing of buffaloes the farmers spent only 620 BDT for purchasing cloths but they were able to spent 1450 BDT for cloth purchasing after they start rearing buffaloes, which was 57.24% more than previous state.

The Impact on social status is presented in Table 4.31.Before rearing of buffaloes the farmers spent only 1200 BDT to keep their social status but they were able to spent 2000 BDT for it after they start rearing buffaloes, which was 40% more than the previous state.

The Impact on education is presented in Table 4.31. Before rearing of buffaloes the farmers spent only 540BDT for education but they were able to spent 750 BDT for education after they start rearing buffaloes, which was 28% more than the previous state.

The Impact on housing is presented in Table 31. Before rearing of buffaloes the farmers spent only 360 BDT for their housing but they were able to spent 440BDT for their housing after they start rearing buffaloes, which was 18.18% more than the previous state.

It reveals that buffalo farmers were less interested of housing improvement. So it was clearly found that livelihood improvement increased in the experimental area by buffalo rearing.

Table 4.32: Impact of buffalo rearing on livelihood activity

Category	**Initial value(taka)**	**Final value(taka)**	**Percentage**	**Rank of Oder**
Food purchasing	860	2500	65.60	1
Cloth purchasing	620	1450	57.24	2
Health care	750	1430	43.61	3
Social status	1200	2000	40.00	4
Education	540	750	28.00	5
Housing	360	440	18.18	6

CHAPTER V

SUMMARY AND CONCLUSION

The study aimed to investigate the Socio-economic profile of the buffalo farmers in Madargonjupozila of Jamalpur district. The experiment was undertaken in nine five villages of four unions of MadarganjUpazila in Jamalpurdistrict of Bangladesh. In the selected areas, 60 respondents were randomly selected from the four unions; each union consists of variable respondents. The period of data collection was fromOctober to December 2018.

The age of the buffalo farmers in the experimental area was ranged from 26 years to more than 57 years; very few (23.3%) young farmers were engaged with buffalo rearing. Most of the farmers cannot read and write (75%) where 8.3%completed primary level followed by the farmers who were below can sign only (13.3%) and below SSC (2%).Degree pass buffalo farmers were not found in the study areas.

In the study area, majority of the farmers were under medium sized family (40%) and most of the farmers were under small category farmer (50%) and also under medium category (33.3%). Majority of the farmers were engaged (50.0%) with mixed Agriculture(Dairy, poultry)and only buffalo rearing was the next noticeable occupation (36.7%). In case of purchasing ability, majority of the farmers (58.3%) had ability to purchase two buffalo at a time where 25% had more than two.

Generally farmers have no training (86.7%) on buffalo rearing. They had only some experience over it as a family business tradition. Majority of the farmers took loan from the bank for buffalo rearing (45%) and 41.7% used their own capital. Duration of buffalo rearing was mostly practiced for two years for farmers (33.3%). Most of the farmers reared crossbred milking and bull buffalo 56.7% and 66.7% reared 4-10 herd size of buffaloes.

In terms of housing, most of the farmers (63.4%) used straw shed housing and 70% farmers used open pattern house for buffaloes. Majority of the farmers (86.7%) used kacha floor and 85% farmers constructed shelter outside of owner’s house.

As most of the farmers (58.3%) wanted their buffaloes to graze so the buffaloes mainly got the natural grasses. Most of the farmers (70%) appreciated the availability of buffalo feed and few (30%) of the buffalo farmers opposed it.

Most of the farmers (25%) applied AI and natural methods for breeding management, 16.7% farmers applied only AI and 58.3% farmers depended on natural process. Wallowing is an important physio-thermic activity for buffaloes and most of the farmers allowed their buffalo to wallow once a day (66.7%).

Major portion of the farmers (56.7%) faced FMD disease and 66.7% farmers followed vaccination process to keep disease free. Most of the farmers depended on local market to obtain vaccine. About 73.3% farmers depended on calling quack for the treatment of sick buffaloes. Most of the farmers (78.3%) had good to satisfactory sanitary system. Major portion (56.7%) of the buffalo fanners used 'by foot' for the transportation and marketing of buffaloes.

The price of the buffaloes varies according to the age,sex, size and purpose of the buffaloes. In the corresponding area, 33.3% farmers bought one pair buffaloes with the price ranges from 90000BDT to 100000BDT where 16.7% farmers bought one pair buffaloes with the price ranges from 180000BDT to 250000BDT. In respect of profitability, the findingsof the study revealed that the farmers net change in inventory before and after buffalo rearing were different. The net return from one buffalo was BDT 16830. So, it was found that in terms of net income rearing of buffaloes was the most suitable way to increase the socio-economic status of the farmers and the farmers.

Annual food purchasing capacity increase 65.60%. Similarly, clothing increases up to 57.24%. Health care status of the farmer increases up to 43.61%. The social status of the farmer family increases up to 40%. Educational and housing cost increased up to 28% and 18.18%respectively.

The result clearly indicated that livelihood increases dramatically through buffalo rearing in the study area. Considering all this parameters related to livelihood, it was clearly found that the socio-economic status of buffalo farmers was improved through buffalo rearing although the management practices need to be improved with scientific approach.

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APPENDIX

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Title: Socio-economic status of the Buffalo farmers and management practices in selected areas of Jamalpur district.

Socio-economic characteristics of buffalo farmers

1. Personal Information of farmer

i. Name: ……
ii. Village: ……
iii. Union ……
iv. Upazila: …..
v. Mobile: **.....**

2. Age of the farmers

i. 20 to 30 years…..
ii. 31 to 40 years…..
iii. 41 to 50 years …..
iv. 51 to 60 years…..
v. 61 to 70 years…..
vi. 70 and above …..

3. Educational qualification: Please mention your educational qualification.

i. Cannot read and write…..
ii. Can sing only…..
iii. Primary…..
iv. Below S.S.C……
v. Above S.S.C

4. Family size

i. Small family (up to 4)……
ii. Medium family (5-7)…..
iii. Large family (above 7)…..

5. Farmer's type

i. Landless farmer (below .02 ha)…..
ii. Marginal farmer (.02-.2 ha)…..
iii. Small farmer (.2-1 ha)…..
iv. Medium farmer (1- 3 ha)….
v. Large farmer (above 3 ha)….

6. Occupation

i. Only buffalo rearing …..
ii. Crop farming…..
iii. Chicken or duck farming……
iv. Goat and cattle farming……
v. Combined Agriculture (Dairy, poultry, crop, fish etc)……

7. Farming Experience: Years are engaged in Buffalo farming……years.

8. How much land does you

i. Own _____ hectares
ii. Lease in/rent in_____ hectares.

9. Source of capital

i. Own …..
ii. Loan from bank …..
iii. NGO……
iv. Others…..

10. Purchasing ability

i. One buffalo…..
ii. Two buffalo…..
iii. More than two buffalo…..

11. Duration of rearing of buffalo

i. 6 months…..
ii. 1 year…..
iii. 2 year…..
iv. >2 year…..

12. If there any undertaken a course or training on animal husbandry and Veterinary science.

Please mention your training information regarding the following table

Title of training	Duration for training (Day)	Name of Institution

13. Type of breed rearing in areas.

i. Indigenous Milking Buffalo and indigenous bull buffalo
ii. Crossbred Milking Buffalo and crossbred bull buffalo
iii. Crossbred bull buffalo and indigenous milking buffalo
iv. Others….

14. Housing system of buffalo rearing

i. Half building…..
ii. Tin shed….
iii. Straw shed …..
iv. Others…..

15.Pattern of housing of buffalo rearing

i. Open…..
ii. Closed…..

16. Pattern of floor

i. Pacca…..
ii. Kacca**…**

17. Drainage system

i. Yes……
ii. No……

18. Position of shed

i. Inside the owner shelter….
ii. Outside from owner shelter……

19. Provision of light and ventilation

i. Adequate……
ii. Not adequate…..

20. Summer management

i. Practiced…..
ii. Not practiced…..

21. Winter management

i. Practiced…..
ii. Not practiced…..

Feed management

22. Type of feeding

List of feed given:

Roughage	Amount gives per day
Green grass i. Naturally born- Dubra, carpet, others ii. Cultivated- Para, German, maize, Napier	
Straw i. Rice ii. Wheat iii. Others-	
Tree leaves i. Banana ii. Ipil-Ipil iii. Others	
Concentrates	
Protein source- i. Rice polish ii. wheat bran iii. Mustered oil cake iv. Others	
Energy source- i. Broken rice ii. Broken wheat	

23. Feeding methods

i. Extensive…..
ii. Semi-intensive……
iii. Intensive…..
iv. Others…..

24. Feeds and fodder availability

i. Available……
ii. Not so available…..

25. Frequency of feeding/ day

i. Once…..
ii. Twice…..
iii. Three times…..

26. Frequency of Watering

i. 2 times…..
ii. 3 times…..
iii. Free access of water…..

27. Feeding of mineral mixture or salt in water

i. Regularly…..
ii. Irregularly…..
iii. Not feeding.

28. Additional measures taken for fattening

i. Urea molasses straw…..
ii. Urea molasses block…..
iii. Fattening tablet or powder…..
iv. Any kinds of treated feed…..
v. No measures taken…..

Breeding management practices

29. Method of breeding

i. AI…..
ii. A.I and natural…..
iii. Natural….

30. Heat detection

i. Yes….
ii. No…..

31. Symptoms of heat detection

i. Mucus discharge….
ii. Mucus discharge + bellowing ….
iii. Frequent urination….
iv. Mounting….
v. Others…

Health care practices

32. Incidence of diseases

i. FMD….
ii. BQ….
iii. Mastitis….
iv. Anthrax….

33. Isolation of sick buffalo

i. Kept isolated….
ii. Not kept isolated….

34. Follow the Vaccination schedule

i. Yes….
ii. No….

35. Use of Deworming drugs

i. Yes….
ii. No….

36. Practice to control Ecto -parasites

i. Followed….
ii. Not followed….

37. Source of vaccines, anthelmentics, medicine

i. Local market…..
ii. Livestock office…
iii. Homemade…..

38. Treatment

i. Veterinary doctor…..
ii. Calling a quack …..
iii. Use of local empirical knowledge…..

39. Sanitary condition of shed / shelter / standing place

i. Good……
ii. Satisfactory……..
iii. Poor…….

40. Selling of buffalo

i. Market……
ii. Another farmer……

41. Transport facilities.

i. Van…..
ii. By foot….
iii. Boat……

42. Sold to buffalo

i. Whole seller…….
ii. Consumer…….
iii. Butcher…….

43. Daily routine activities of farmers in buffalo rearing

Time	Activities
5.00-6.00 a.m.	
6.00-6.30 a.m.	
7.00-7.15 a.m.	
9.00-11.00 a.m.	
11.00-5.00 p.m.	
5.00-5.30 p.m.	
5.30-6.00 p.m.	
6.00 p.m.	

44. Cost of one pair of buffalo…….

45. Average cost per buffalo per year

i. Average Feed cost (Paddy straw, Green grass, Concentrates)….
ii. Average Labor cost…..
iii. Average Housing and Equipments cost…..
iv. Average breeding cost…..
v. Veterinary doctor cost….
vi. A.I. cost……
vii. Vaccine and Medicine cost…..
viii. Transportation cost…..

46. Average expenditure of member of family per year

i. Food….
ii. Cloths….
iii. House….
iv. Education….
v. Health care…
vi. Social status (Gift, furniture etc)…..
vii. Other cost….

47. Income (BDT) from one buffalo per year

Source of income	Production of Buffalo per year	Price in market(Tk)	Total price(Tk)
Draught			

Milk			
Value of dung			
Return from calf			

48. Net income (Total income - Total expenditure) =

49. Impact of buffalo rearing on livelihood activity.

Category	Initial value(Tk)	Final value(Tk)
Food purchasing		
Cloth purchasing		
Health care		
Education		
Housing		
Social status		

50. Problem of buffalo rearing……..

51. Suggestion……

Date…….

Signature of interviewer

Thanks giving