PRESENT STATUS OF USING AQUA MEDICINES AND CHEMICALS ON FISH HEALTH MANAGEMENT IN BOGURA DISTRICT, BANGLADESH

A THESIS

BY

GOBINDO CHANDRA SARKER
Examination Roll No. 1605547
Session: 2016-2017
Semester: July-December, 2017

MASTER OF SCIENCE (MS)

IN

AQUACULTURE

DEPARTMENT OF AQUACULTURE

HAJEE MOHAMMAD DANESH SCIENCE AND TECHNOLOGY UNIVERSITY, DINAJPUR

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Submitted to the Department of Aquaculture
Hajee Mohammad Danesh Science and Technology University, Dinajpur
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Approved as to style and content by

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Professor Dr. Mst. Nahid Akter	**Md. Abu Zafar**
Supervisor	**Co-Supervisor**

_____

Dr. A.S.M. Kibria
Chairman
Examination Committee
and
Chairman, Department of Aquaculture
Hajee Mohammad Danesh Science and Technology University, Dinajpur
December 2017

Dedicated

To My

Beloved Parents

DECLARATION

I declare that this MS thesis entitled Present Status of Using Aqua Medicines and Chemicals on Fish Health Management in Bogura District, Bangladesh, which I submit in Department of Aquaculture, was carried out by me for the degree of Masters in Aquaculture under the guidance and supervision of Professor Dr. Mst. Nahid Akter, Department of Aquaculture, Hajee Mohammad Danesh Science and Technology University, Dinajpur.

Furthermore, I took reasonable care to ensure that the work is original, and has not been taken from other sources except where such work has been cited and acknowledged within the text.

The author

ACKNOWLEDGEMENTS

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The author

CONTENTS

LIST OF TABLE

LIST OF FIGURE

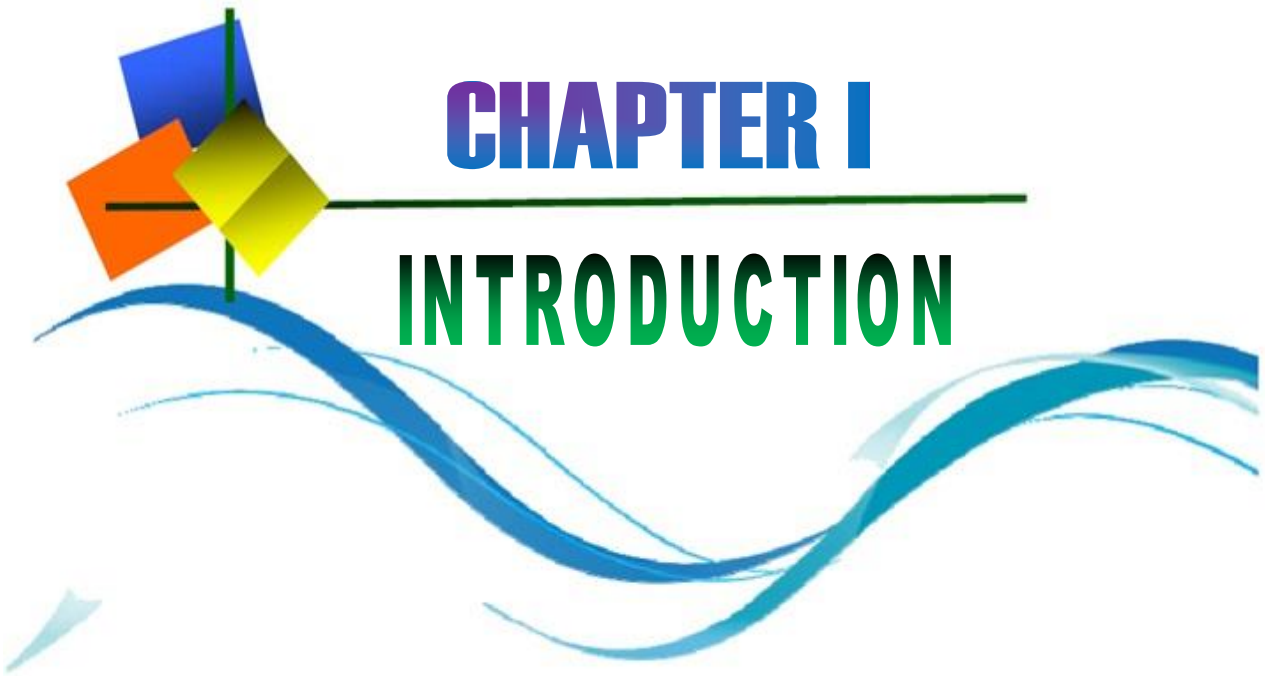
ABBREVIATIONS AND ACRONYMS

Abbreviation form	Elaborated form
DoF	: Department of Fisheries
FAO	: Food and Agricultural Organization
TSP	: Triple Super Phosphate
MP	: Murate of Potash
GO	: Government Organization
NGO	: Non-Government Organization
DFO	: District Fisheries Officer
UFO	: Upazilla Fisheries Officer
AFO	: Assistant Fisheries Officer
CP	: Charoen Pokphand
GDP	: Gross Domestic Products
FGO	: Focus Group Discussion
EUS	: Epizootic Ulcerative Syndrome
MIC	: Minimal Inhibitory Concentration
MBC	: Minimal Bactericidal Concentration
BKC	: Benzal Konium Chloride
DO	: Dissolved Oxygen
FDA	: Food and Drug Administration

ABSTRACT

Current investigation was conducted to comprehend existing status of the practice of aqua-medicines and chemicals for fish health management in freshwater aquaculture in Bogura district. Data was collected via questionnaire survey, individual communication, focus group discussion with target group and representative of aqua-medicine enterprises. All fish farmers had fish farming experience and most of them were facing by various diseases and water quality problems in the study area. A variety of chemicals including disease treatment, pond preparation, disinfectants, growth promoter, probiotics, toxic gas reducer and oxygen producer were produced by the selected aqua medicine companies and being used in the selected aquaculture zone. Salt, potassium permanganate, lime, formalin, bleaching powder, sumithion, melathion, methylene blue and malachite green were frequently used as traditional chemicals in heath management. Among the new aqua-chemicals geotox, jv zeolite, mega plus, aquastar pond, acme's zeolite, zeo-fresh, aqua green, biomin pond life, aquakleen, megagio gold, and aqua boost were utmost extensively used. Probiotics like profs, aqua photo, aqua gold, super biotic and pond care were used. The selected farmers also used growth promoter such as saltose, panvit aqua, spa gelly, aqua boost used as growth promoter and bio-pond, bio-grow, aqua pure, gasstrap, metrix, geo-rich bio-aqua 50 and aqua magic as toxic gas reducer. Approximately 11 trade names of antibiotics were marketed in the selected area among them some were used by the fish farmers. Their main active ingredients were chlortetracycline, oxytetracycline, amoxicillin, co-trimoxazole, azithromycin and sulphadiazine. The survey identified some problems connected with the practice of such chemicals such as shortage of fish farmer’s knowledge about the usage of chemicals, proper dosage and their maintenance.

Keywords: Aquaculture, aqua medicine, chemicals, fish health management, Bogra district.



CHAPTER I

INTRODUCTION

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INTRODUCTION

Aquaculture is the most important sectors in the economy of Bangladesh. It is expanding rapidly and playing a significant role in term of food, nutrition, income, employment and foreign exchange (Samuelsen, 1994). Now, aquaculture contributes 3.69% to the national Gross Domestic Products (GDP) and 23.81% to the agriculture sectors of Bangladesh while fisheries sector contributes 60% of the total animal protein (DoF, 2017). Approximately 11% of the population directly and indirectly depends on fisheries for their livelihood (DoF, 2017). To fulfill the demand of over growing population it is essential to intensify aquaculture to contribute more in national GDP. Presently, Bangladesh is the fifteen leading aquaculture producing countries in the world achieving 5th position in inland culture fisheries (FAO, 2017).

Through invention and adaptation of new techniques, this sector has got a dramatic diversification. Although, aquaculture production is increasing day by day, fish disease is being considered one of the main obstacles of this potential sector, hampering the total production of aquaculture.

During the most recent epoch aquaculture has prolonged, diversified, intensified and mechanically praise worthy in Bangladesh. Chemicals are in fact a vital fixing to profitable aquaculture, which has been applied within different structures for periods. Intensification of aquaculture attains the utilization of more chemicals and anti-toxins in this sector. Chemicals having more anti-microbial properties are acute parts in safety administration in soil and water administration, enhance common amphibian benefit, transportation of live fish, nourish plan, control of multiplication, development advancement and handling and worth expansion of the final item.

There is an extensive history of using aqua drugs and chemicals in aquaculture. A variety of aqua drugs and chemicals are used in both inland and coastal aquaculture that can be listed according to the purpose of use, types and stages of organism's cultured, culture systems practiced and types of farmers (Subasinghe *et al.*, 1996).

Aqua drugs and chemicals plays an indispensable role not only in fish health management but also for pond construction, soil and water quality management, enhancement of natural aquatic productivity, feed formulation, manipulation of reproduction, growth promotion, processing and value addition of the final product (GESAMP, 1997; Subasinghe *et al.*, 1996). In aquaculture, chemical is the vital inputs for successful fish production, which has been used in several forms for centuries (Subasinghe *et al.*, 1996).

There are several reasons of using drugs in aquaculture which include i) reducing the entrance of pathogenic organisms in culture area ii) reducing multiplication of pathogenic organisms iii) reducing the stressful condition on fish health iv) reducing the outbreak of disease and v) treatment of the disease (FDA, 2001). Some common aqua chemicals used for fish health management by the Bangladeshi fish farmers are salt, lime, sodium chloride, formalin, malachite green, methylene blue, potassium permanganate, hydrogen per oxide, copper compounds, glutaraldehyde and trifluralin etc. (Plumb, 1992).

Sodium chloride is an old treatment used for a variety of diseases of fish. It is especially effective chemical when treating some fungal and parasitic diseases in fish. Formalin is another important compound used in a variety of ways in treating fish. Formalin is primarily used for the killing of external fish parasite. Potassium permanganate ($KMnO_4$) is used for the treatment of protozoan infestations on skin, gills and fins (Floyd, 1993).

Due to high neurotoxicity of organophosphates, compounds shown potential health effect of fish farm workers are being considered as health hazardous chemical (Alderman *et al.*, 1994).

Different types of aqua medicine are produced by different companies which are used in various aquaculture activities including water quality management, improvement of dissolve oxygen, growth promoters, antibiotics and disinfectants. In Bangladesh near about 100 pharmaceuticals companies are now producing around 400 different types of aqua-medicines (Ashraful *et al.*, 2014).

Various types of aqua medicine such as geotox, jv zeolite, mega plus, aquastar pond, acme's zeolite, zeo-fresh, aqua green, biomin pond life, aquakleen, megagio gold and aqua boost etc. are used for maintaining water quality parameters (Rasul *et al.*, 2017). While oxyflow, oxymax, bio care, bio-ox, oxy-gold, oxy-a and oxylife etc. are used for increasing dissolved oxygen level in pond.

Generally farmers of our country also used different types of antibiotics such as renamox, povin vet, acimox (vet) power, bactiab, cotrim vet bolus, renamycin, cotrim vet and oxin ws. Disinfectants such as argulex, safeguard, timsen, virex, polgard plus and albeas are very important for increasing aquaculture production.

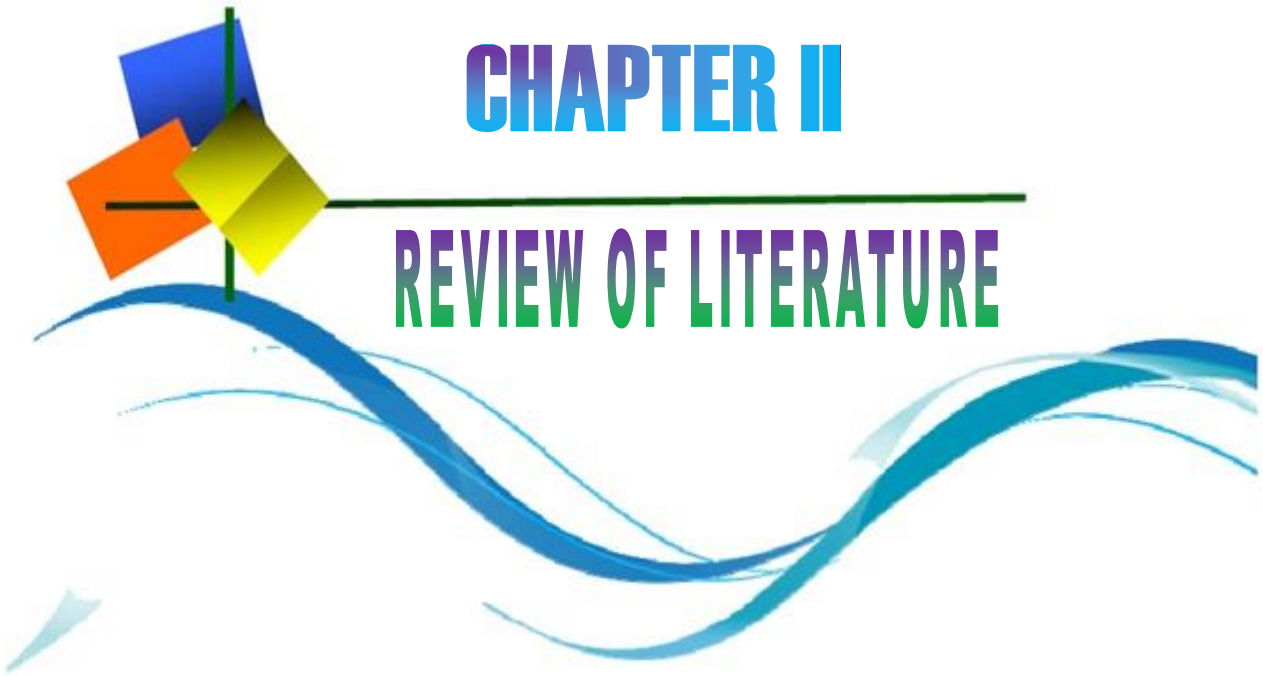
However, the use of aqua-medicine can creates environmental degradation in some areas making the water quality unsuitable for aquaculture. Because most of the farmers do not know the appropriate dosages and method of their application. It is realized that farmers are using aqua-medicines without knowing their efficacy. This is due to lack of knowledge, information regarding the present status and consequences of aqua-medicines using in aqua-health management. This creates major problem in aquatic environment and causes for low production in aquaculture. On the other hand, fish

disease is a great threat to achieve optimum production and become a limiting factor to economic success of aquaculture in Bangladesh. So, aqua culturist uses a variety of aqua drugs and chemicals to overcome such undesirable problems.

Considering the above facts, the present study was conducted in Bogra district of Bangladesh with its purposes for identifying the diverse group of aqua drugs and antibiotics used for aquatic health management, their dosages, application methods and reducing different types of aqua-health problems upon using. This research finding will help to fish farming community to know the appropriate dose and administration methods for safe and sustainable aquaculture practices.

Objectives of the study

- To know the types, purpose and application methods of aqua medicines and chemicals in aquatic animal health management in Bogra district and
- To investigate the impact of using commercial aqua medicines and chemicals on fish health and pond ecosystem.



CHAPTER II

REVIEW OF LITERATURE

CHAPTER II

REVIEW OF LITERATURE

The purpose of this chapter is to review the past research works which are related to the present study. The most appropriate studies, which have been conducted in the recent past and related to this research, are discussed below:

2.1 Traditional chemical used for disease treatment

Ali (2008) found that commonly used chemicals in aquaculture were lime, salt, urea, triple super phosphate, potassium permanganate, vitamins, rotenone, phostoxin, sumithion, melathion and some hormones.

Faruk *et al.*, (2005) observed that commonly used chemicals in aquaculture are lime, salt, urea, triple super phosphate, potassium permanganate, vitamins, antibiotics (mainly oxytetracycline and chlortetracycline), rotenone, phostoxin, sumithion, melathion and some hormones. It is also found that most of the farmers used chemicals and antibiotics indiscriminately without knowing their mode of action, doses and appropriate procedures of application.

Sultana (2004) found that commonly used chemicals in aquaculture were lime, salt, urea, triple super phosphate (TSP) potassium permanganate, vitamins, antibiotics (mainly oxytetracycline and chlortetracycline), rotenone, phostoxin, sumithion, melathion and some hormones.

Brown and Brooks (2002) observed that in Bangladesh about 52% farmers used potassium permanganate, while 40% used lime, 11% used salt as a disease treatment, such as disinfectants, banana leaves, fertilizer, alum and water exchange.

Chowdhury *et al.,* (1999) suggested that lime and salt treatment of 250 kg/ha respectively were found to be the most effective to suppress the ulcer disease through pond treatment.

Lilley and Inglis (1997) carried out pond treatment trials and obtained that 5 ppm corprol (a chelated copper compound) prevented induction of EUS lesions in abraded African catfish while malachite green (0. 1 mg/liter) was partly effective and formalin (25 mg/liter) was ineffective. The authors also reported that malachite green, hydrogen peroxide and proxitane showed a fungicidal activity against *Aphanomyces invadans* in-vitro trial.

Lilley *et al.,* (1997) obtained the success in pond treatment by using agricultural lime at the amount of 150-600 kg/ha in 1.0 m deep ponds at 2-4 weeks intervals depending on the pH of the pond water.

Chowdhury *et al.,* (1996) investigated that lime and salt treatment of 250 kg/ha respectively were most effective to suppress the ulcer disease through pond treatment.

Tamuli and Shanbhogue (1996) investigated the efficacy of some commonly available chemicals in the treatment of anchor worm *(Lernaea maelraensis)* infection in India. The authors were used potassium permanganate, formalin and sodium chloride bathing treatment twice a day over five consecutive days at 30 ppm $KMnO_4$ for 20 min was found to be 100% effective in killing adult and embedded larval parasites.

Li *et al.,* (1996) studied on the efficacies of formalin, potassium permanganate, sodium chloride and copper sulphate as prophylactic treatments for saprolegniasis in 5 to 7d channel catfish (*Italurus panctatus).* Formalin and copper sulphate were also evaluated as post-infective treatments for the disease. Formalin (25mg/liter) was effective as both a

prophylactic and post-infective treatments. Sodium chloride at 5000 mg/liter was effective in preventing saprolegniasis.

Floyd (1993) realized bath treatment was effective in controlling external infection in fish. The author observed that copper sulfate, formalin and potassium permanganate had similar efficacy against protozoan infestations on skin, gills and fins. The author also found that out of the three chemicals, potassium permanganate had broader spectrum of in its activity, as it was a very effective against both bacterial and fungal infections of fish body.

Yadava *et al.,* (1993) indicated the toxicity of herbicides on fingerlings and weeds in pond. The author observed that the safe concentration of five herbicides (2, 4-d, dalpon, MSMA, diquat and simazine) were simazine at 0.5 ppm, dalapon at 0.75 pm, diquate at 1.0 ppm, MSMA at 1.5 ppm and 2, 4-D at 2.0 ppm for the control of *Ceratophyllum demersum.*

Armin-Walser and Phelps (1993) suggested that formalin was more effective than iodine in maintaining *Saprolegnia* infections on channel catfish eggs.

Plumb (1992) stated that potassium permanganate is good for treating external protozoa and external bacterial infections. He also stated that Sodium chloride is an old treatment used for a variety of diseases of fish especially some fungal and parasitic diseases.

Baticados and Paclaibare (1992) was used formalin and potassium permanganate in treating the velvet disease caused by *Piscinodinium*, a protozoan flagellate in aquarium fish body.

Alderman (1992) explained that malachite green is an organic dye that has been popular as a parasiticide and fungicide on fish. It is principally used in hatcheries rather than

grow-out systems. Lengthy withdrawal period is essential following application because of persistent residues.

Chinabut *et al.* (1992) suggested that quick lime and slaked lime both have a very high pH and in addition to increased alkalinity, can have a sterilizing effect against disease.

Bhaumick *et al.* (1991) carried out investigation in the West Bengal on the effect of epizootic ulcerative syndrome (EUS) and looked that application of lime in ponds gave 68 % positive result.

According to Rydlo (1989) for controlling the protozoan parasites *Costia necatrix, Chilodonella cyprini, Ichthyophthirius multifilis* and *Trichodina* sp., and the crustaceans *Argulus foliaceus* parasitizing *Salmo gairdneri,* the suitable preparations were sodium chloride, potassium permanganate, slaked lime at pH 10, calcium hypochloride, formaldehyde, malachite green and masoten.

Limsuwan (1987) realized the acute toxicity of malachite green to silver barb *(Puntius gonionotus),* nile tilapia *(Tilapia nilotica),* gunther's walking catfish *(Clarias macrocephalus),* carp *(Cyprinus carpio)* and snakehead fish (*Ophicephalus striatus*). Gunther's walking catfish was the most sensitive to malachite green (96-h LC 50, 0.066 mg/litre) and nile tilapia was the most resistant (96-h LC50, 0,425 mg/liter). It was concluded that malachite green was highly toxic to fish health and use of malachite green at 0. 10-0.15 mg/liter. He also found that a 5 to 10 min bath of potassium permanganate at 100 mg /liter was enough to kill sea lice for therapeutic treatment of fungal infections and external parasites of fish could be toxic to some species.

Anonymous (1986) investigated that early cases of columnaris disease might be successfully treated with surfactant bath or prolonged immersion in potassium

permanganate or copper sulfate. However, they expressed the use of antibiotic such as oxytetracycline or nifurpirinol for successful treatment of columnarles diseases.

Kabata (1985) expressed the use of formalin, malachite green, formalin-malachite green combination and potassium permanganate in controlling the white spot disease caused by the protozoan *lchthyopthirius multififlis*. He also found that a 5 to 10 min bath of potassium permanganate at 100 mg /liter was enough to kill sea lice.

Boyd (1979) explained that the lowest concentration of potassium permanganate in which the pink hue remains after 15 min was considered the endpoint for the treatment of ectoparasites and skin and gill bacterial infections in freshwater fish.

2.2 Antibiotic used

Hoque (2012) conducted that an experiment for *Aeromonas hydrophila* infected silver carp with antibiotics. Oxysentin 20% (oxytetracyline HCL BP), acimox (amoxicillin tri hydrate BP) and oxy-d vet (oxytetracycline 20% and + doxycycline 10%) were used at lower, recommended and higher doses, respectively. The antibiotic trial was conducted for 10 days. Among the three antibiotics, oxycentin 20% and acimox at higher dose showed good results where 100% fish were recovered.

Mahamud (2011) reported that oxysentin 20% (oxytetracycline hcl bp), acimox (amoxicillin tri hydrate bp) and oxy-d vet (oxytetracycline 20% and + doxycycline 10%) were used in separate nine aquaria at lower, recommended and higher dose, respectively. Dose of oxysentin 20% (oxytetracycline HCL BP) were given as 25 g, 35 g, 45 g/100 Kg body weight. Dose of acimox (amoxicillin tri hydrate BP), were given as 4 g, 5 g, 7.5 g/15 Kg body weight. Dose of oxy-d vet (oxytetracycline 20% and + doxycycline 10%) were given as 0.80 g, 1 g, 1.5 g/4 Kg body weight. Combined effect of oxy-d vet

(oxytetracycline20% and + doxycycline 10%) at recommended dose treatment showed the best result where 100% fish were recovered.

Faruk *et al.,* (2008) found that a range of chemicals including antibiotics used in aquaculture for fish health management and disease treatment. Along with commonly used traditional chemicals, The authors found a number of new products with various trade names like zeolite, geotox, green zeolite, orga-vit aqua, fish vita plus, oxy flow, oxy max and O_2-marine were the most widely used compounds. Fourteen branded antibiotics were found with different trade names for disease treatments of aquatic animal. Major active ingredients of these antibiotics were oxytetracycline, chlortetracycline, amoxicillin, co-trimoxazole, sulphaduzina and sulphamethoxazole.

Parimal *et al.,* (2006) tested on the sensitivity of *Aeromonas hydrophila* and concluded that bacterium was susceptible to gentamicin, ciprofloxacin, chloramphenicol and oxyteracline but resistant to erythromycin, nitrofurantion and penicillin.

Yucel *et al.,* (2005) stated that *A. hydrophila, A. caviae* showed resistance to ampicillin, cephalothin and trimethoprim but susceptible to ciptofloxacin and ceftriaxone.

Chowdhury *et al.,* (2003) found that antibiotic like renamycin (oxytetracycline) had positive effect against bacterial infection at a dose of 50 mg/kg body wt. /day applying for days and 80-90% fish were recovered under laboratory condition.

Sarker (2000) in an experiment to test drug sensitivity of five isolates of *A. sobria* found that most of the isolates were found sensitive to oxytetracycline, oxolinic acid and chloramphenicol but resistance to erythromycin and sulphamethoxazole.

Rahman and Chowdhury (1999) conducted trials of chemotherapy to the ulcer disease-affecting catfish as a case study; the best result was obtained by a successive bath in 12%

NaCl suspension and subsequent oral treatment with commercial oxytetracycline at a dose of 75 mg per kg body weight of fish for 5 days.

Singh and Singh (1997) obtained seven isolates of *Edwardsiella tarda* and showed that all the isolates were resistant to calistin and gentamicin, but sensitive to ciprofloxacin, chloramphenicol, alidixic acid, nitrifurantoin, ofloxacin and streptomycin.

Hague *et al.,* (1997) studied on the Minimal Inhibitory Concentration (MIC) and Minimal Bactericidal Concentration (MBC) of three antibiotics were commonly used and found that most of the antibiotics could not inhibit organisms under the range of concentration tested, amphicllin (2 to 64 mg/ml), amoxicillin (1 to 32 mg/ml) and tetracycline (1 to 32 mg/ml).

Smith *et al.,* (1994) found that oxytetracycline is one of the most widely used antibacterial in aquaculture worldwide. The vast majority of oxytetracycline supplied in mediated feed can be found in hatchery effluent at concentrations that account for nearly the entire drug supplied.

Prasad *et al.,* (1996) reported the effect of five different antibiotics on EUS affected fish and found that chloramphenicol and oxytetracycline would be effective drugs in curing the EUS lesion; tetracycline and streptomycin were found to be less effective in curing the ulcers.

Inglis (1996) found that anti-bacterial chemotherapy has been applied in aquaculture for over 50 years, with early attempts to use sulphonamides in the treatment of furunclosis.

Lipton (1991) discussed the effect of antibiotic compounds on the growth inhibition of fish pathogen *Aeromonas hydrophila* isolated from the hemorrhagic lesions of *Labeo rohita.* He established that among the ten antibiotics, gentamycin, tetracycline,

Streptomycin, penicillin and neomycin inhibited the growth of the bacteria. Antibiotics gentamycin, streptomycin and tetracycline were effective at 10 9g/ml. Tetracycline was effective at 20 9g/ml and gentamycin, neomycin and streptomycin at 50 9g/ml for *Aeromonas hydrophila.*

2.3 Water quality improvement, toxic gas reducer and disease treatment by aqua drug

Rasul *et al.,* (2017) investigated that different types of new aqua products jv zeolite, mega zeo blue, green zeolite, 5 star aqua, aqua c, aquavit, bio-ox, oxy plus and bio care were most widely used for water quality improvement, toxic gas reducer and disease treatment of fish.

Miah *et al.,* (2016) observed that farmers used various aqua drugs and chemicals such as geotox, zeolite, mega zeo, oxyflow, ammonil for improved water quality and lime, salt, potassium permanganate, sumithion, formalin, methylene blue, malachite green, timsen, oxysentin 20%, captor, aquqmycine, megavit aqua, aqua boost, aqua grow-p and ac mix super fish against fish diseases and health problems of their cultured fishes.

Ashraful *et al.,* (2014) investigated area various types of diseases such as bacterial infection, EUS (epizootic ulcerative syndrome), ichthyophthiriasis, argulosis, swollen abdomen, and white spot diseases were found to affect tilapia (*Oreochromis nilotica*), sharputi (*Puntius sarana*), rui (*Labeo rohita*), catla (*Catla catla*), mrigal (*Cirrhinus cirrhosus*), bagda (*Penaeus monodon*), golda (*Macrobrabrachium rosenbergii*) and silver carp (*Hypophthalmicthys molitrix*). Geotox, jv zeolite, mega zeo plus and zeolite gold were found to be used for water quality management; oxyflow, oxymore, bio-ox and oxy-gold to improve dissolved oxygen level; megavit aqua, charger gel, acimix

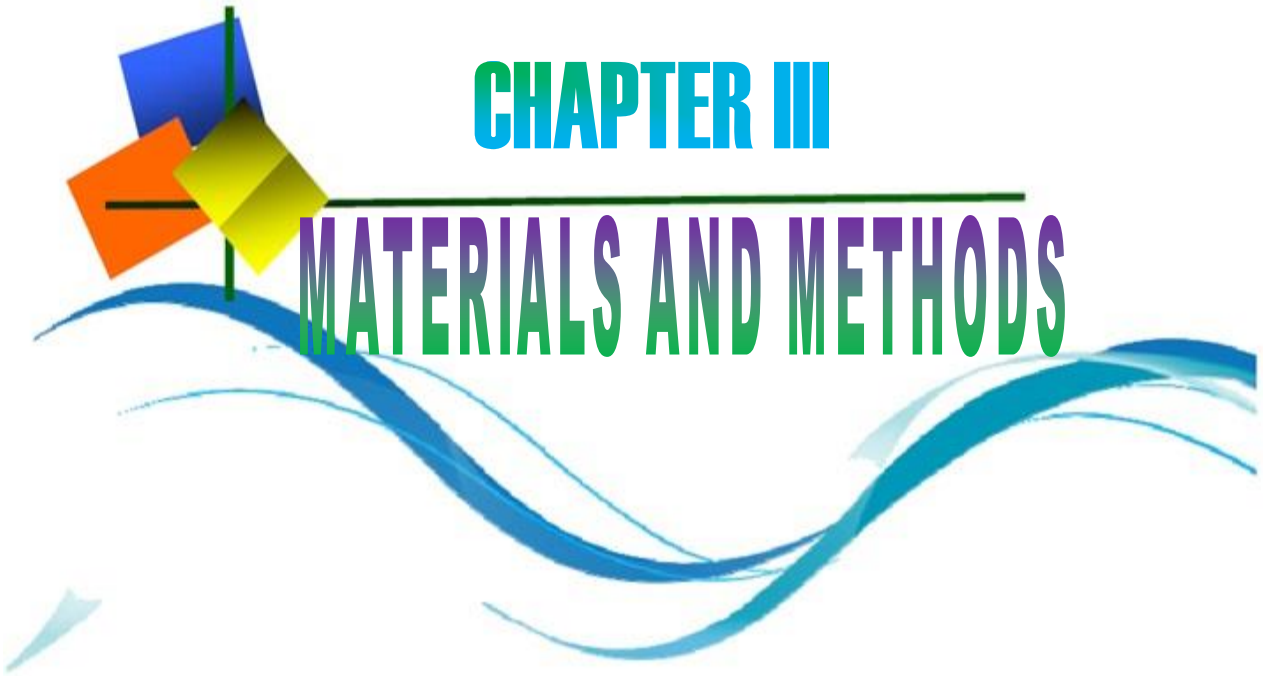
super-fish, vitax-c and rena fish as growth promoter; oxysentin 20%, captor, oxy-d vet and aquamycine as antibiotics; timsen, emsen and polgard plus as disinfectant; megazeo pro, biomin pond life and aqua photo as probiotics and lime, salt, formalin, methylene blue, potash and malachite green were found to be used against different fish diseases.

Islam (2013) showed that farmers used a wide range of aqua-medicines. For water quality management and gas reducer, aqua photo, mega zeo plus, pondkleen, jv geolite, matrix, bio aqua 50, geotox, ammonil, blumix and eco-marin; as disinfectant, virex and timsen; as growth promoter, acimix super fish, spa, mega-vit aqua, charger gel, rapid grow and nutrimix; as probiotic, navio plus, biozyme, pro marine and aqua boost; as plankton producer, aquamin, benthod and bio marine; as stress remover, energy plus and osmosaline; as oxygen supplier, bio-ox, oxyflow and O_2 marine; as antibiotic, oxy-dox-f, captor, renamox, renamycine, cipro vet, ct-dox and coli-tetrravet; as hormone, flash; as parasite killer, argulex and copper sulphate; as feed binder, aqua bond and as unwanted species controller, aqurote gold, rotenil and hunter were found to be widely used.

Mamun (2012) worked with growth promoters. Nutricell-aqua from "Eon", aqua boost from "Novartis" and hepaprotect-aqua from "Renata" were tested. Doses of nutricell-aqua were given as 10 mg, 15 mg and 5 mg/20 g feed/day. Doses of aqua-boost were given as 10 mg, 15 mg and 5 mg/20 g fleed/day. Doses of hepaprotect-aqua were given as 40 mg, 60 mg and 20 mg/20 g feed/day. Among the three growth promoter's aqua-boost from Novartis Company at higher dose and hepaprotect-aqua from Renata Company at recommended dose showed good result.

Monsur (2012) showed that farmers used various aqua drugs and chemicals such as geotox, mega zeo, lime, bio aqua, timsen, efinol, polagard plus, oxyflow, oxy-a, potash, salt, capter, megavit aqua, aqua boost and ac-mix super-fish against fish diseases and health problems of their cultured fishes.

Shamsuddin (2012) reported that in medicine shop of investigated areas, 49 different types of aqua-drugs and chemicals were recorded. Among those, 15 types were widely used by the farmers.



CHAPTER III

MATERIALS AND METHODS

CHAPTER III

MATERIALS AND METHODS

The methodology is the obligatory and integrated part of any research work. This chapter deals with the methodology which is an important part of scientific research and depending upon the aim, objectives and there are several methods and techniques of data collection. There are more than few methods that are used for collection of data and information. The selection of a particular method depends on several considerations such as the nature of research problems, time constrains and fund accessibility. The survey method was followed for data collection and it is depending on primary and secondary data in support of the present study. The methodology includes the selection of the research title and objectives, selection of research area, identify target groups, and data collection are describes in this section.

3.1 Selection of the study area

Bogura district was selected for the present study to know the status of using of commercial aqua drugs by fish farmer based on the aquaculture development, problems and potentialities. This district is well developed for fish production and well communicated with other districts.

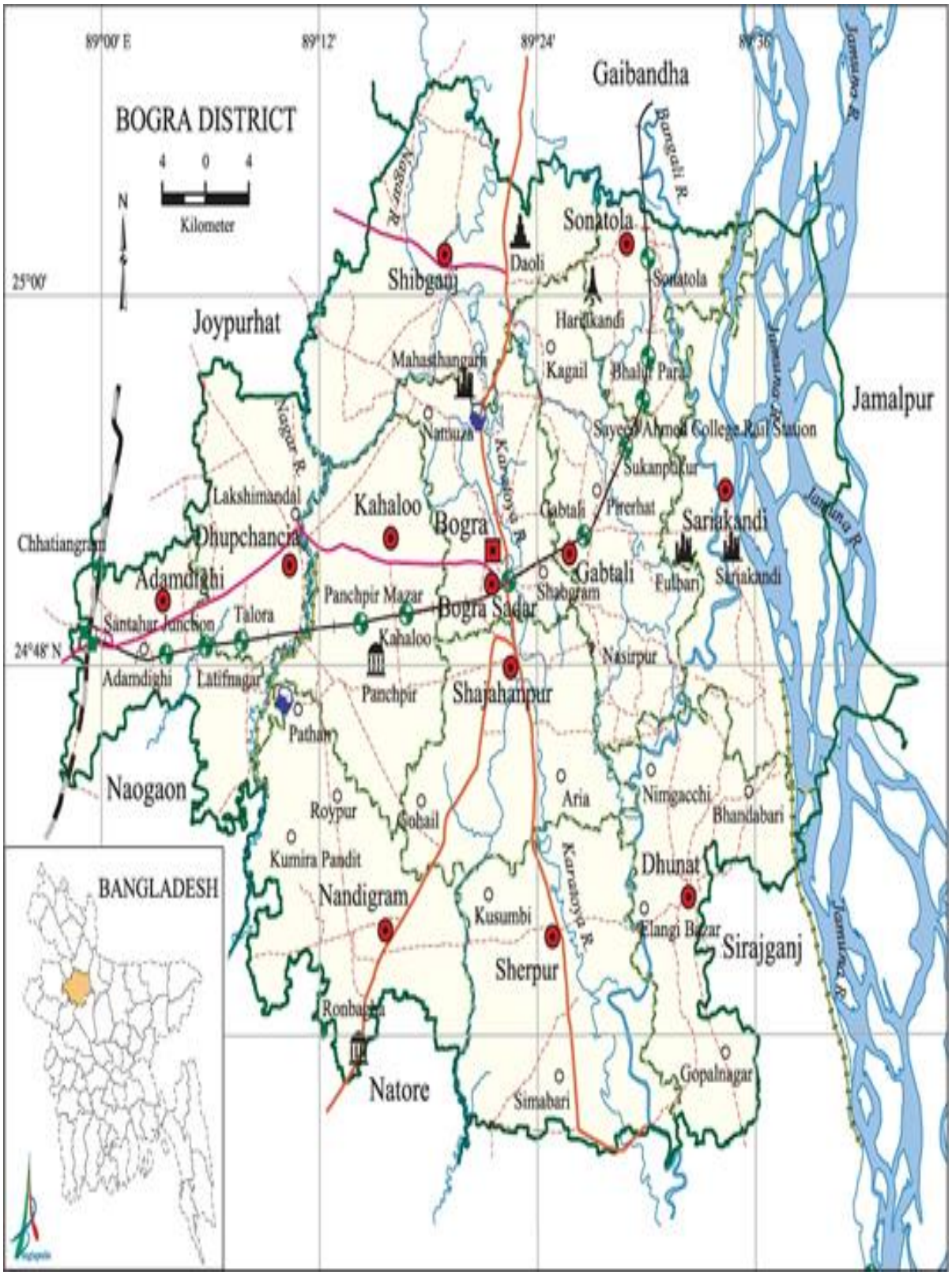


Figure 3.1 Map of the selected area

Bogura District is the most important districts in Bangladesh which is famous for short cycle aquaculture operation and fish production. Total land area of Bogra District 2898.25 sq. km and it is located in between 24°32' and 25°07' north latitudes and in between 88°58' and 89°45' east longitudes. It is bounded by Joypurhat and Gaibandha district on the north, Chalan beel, Natore and Sirajganj district on the south, Jamuna river and Jamalpur district on the east, part of Chalan Beel and Naogaon and Natore district on the west. Bogra District has 12 Upazilas: Adamdighi, Bogra Sadar, Sherpur, Dhunat, Dhupchanchia, Gabtali, Kahaloo, Nandigram, Shajahanpur, Sariakandi, Shibganj, and Sonatala. These upazilas can be considerd as suitable for fish production.

3.2 Flow chart of the research methodology

For success of any research works, the methodology should be done in routine work and by keeping this thing in mind that the present study was undertaken and completed according to the following order of methodology.

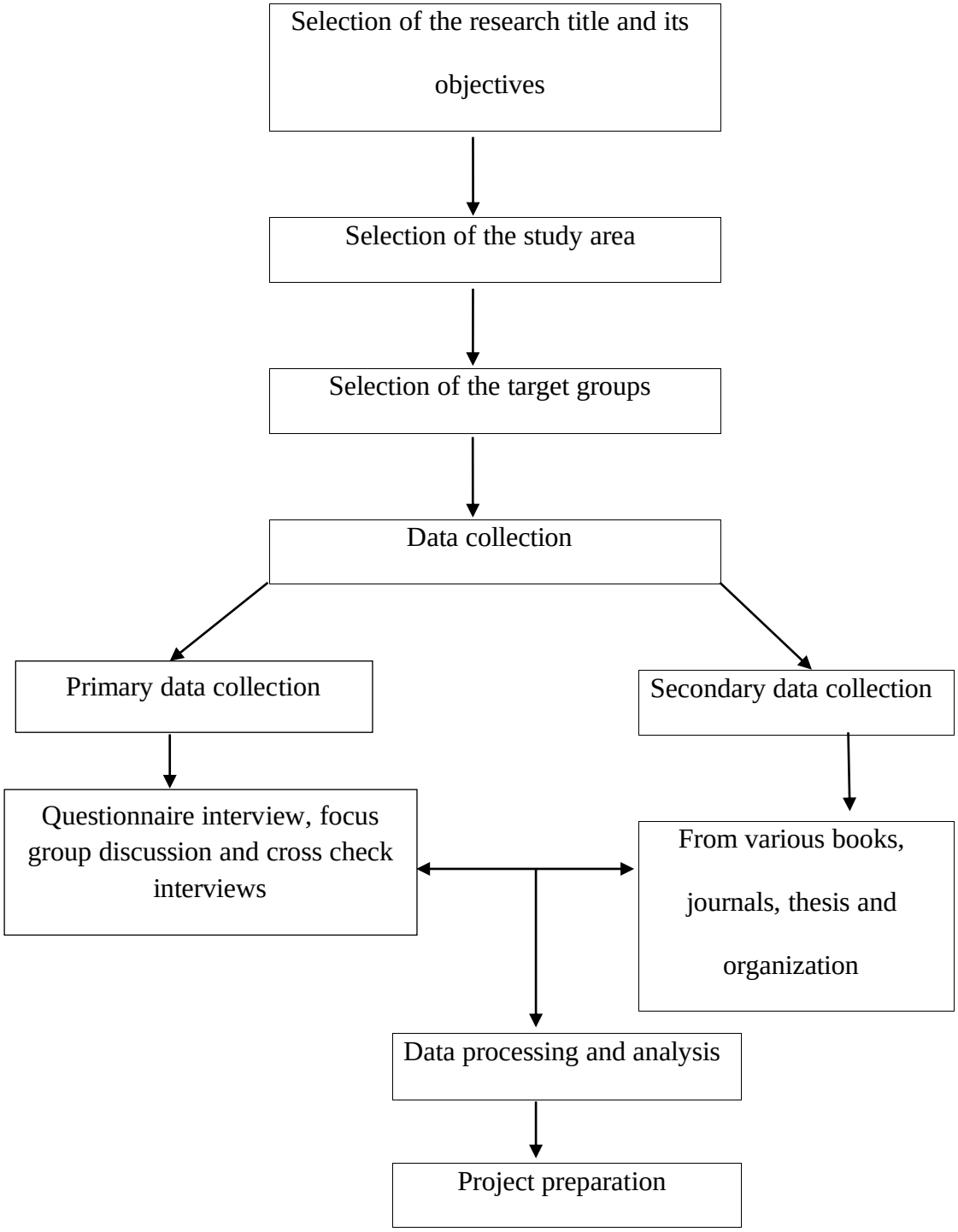


Figure 3.2 Flow chart of the research methodology

3.3 Study period

The survey was carried out for a period of 6 month from January 2017 to June 2017. During this period 80 fish farms and 12 aqua-medicine companies of Bogura district were investigated directly from the study area.

3.4 Target groups

To get the expected achievement from the study 92 questionnaires were selected during the investigation. They were 80 fish farmers and 12 technical people of different aqua-medicine producing companies were interviewed during the study period.

3.5 Questionnaire preparation

Mainly two types of questionnaires were prepared, one for the collection of data from the fish farmers and another for data collection from aqua-medicine producing companies. The main points incorporated in the fish farmers form were: i) name and addresses of the fish farmer, ii) purpose of fish culture, iii) experience of fish culture, iv) preparation of fish pond before releasing of fry, v) use of drugs/chemicals during pond preparation and culture period, vi) water quality problems, vii) various disease problems, viii) use of antibiotics, ix) awareness about aqua drugs/chemicals and x) main problems of fish pond.

The points included in the questionnaire of technical people of different aqua-medicine producing companies were i) company name and location, ii) types of aqua medicine and their purposes, iii) active ingredients, iv) methods of application, v) dose of aqua medicine, vi) price of drugs and vii) suggestions of farmers on use of drugs.

3.6 Data collection

Data was collected from different fish farmers and technical people of different aqua-medicine producing companies in the selected area. For this present study data were collected both from primary and secondary sources. Primary data were collected through

simple interview with the respondents while carrying the survey. Existing problems associated with the use of aquaculture drugs also collected from the secondary data sources. Secondary data also used for the confirmation of primary data. Secondary data were collected from different target groups to have an overall picture of the aqua-medicines used in aquaculture activities in the selected area. Data were collected by direct interviews with fish farmers and technical people of different aqua-medicine producing companies. Every responded was given a brief information about the different types of aqua chemicals, fish disease, water quality, use of antibiotics and purpose of the study during the interview in the selected area. They were asked the questions serially in a very simple way with explanation and necessary information was recorded. After completing the interview, the collected data was checked carefully before leaving the study area.

Figure 3.3 Showing the data collection from fish farmers

Figure 3.4 Showing the data collection from aqua medicine and chemical seller

Figure 3.5 Showing the data collection from company representatives

3.7 Focus Group Discussion (FGD)

Focus Group Discussion (FGD) was conducted with fish farmers, and representatives of aqua medicine Company. In this study, FGD was used to get an overview of particular issues such as the existing problems associated with the use of aqua drugs or chemicals. A total of three FGD sessions was conducted where every group size of FGD was 8 to 10 people in the selected area.

3.8 Crosscheck interview

It was quit indispensable to ensure the information for justification of the collected data, after completing the collection of the data through questionnaire interviews and focus group discussion. Crosscheck interviews were conducted with key persons in the selected area such as Districts Fisheries Officer (DFO), Upazila Fisheries Officer (UFO), Assistant Fisheries Officer (AFO), representatives of aqua medicine Company and NGO workers involved with aquaculture at their offices or home.

3.9 Summarizing, tabulating and checking reliability of data

The data were recorded in a excel sheet, after collection of data from the study area. After completion of the pre-tabulation task, actual tabulation work was started. On the basis of aim and objectives of the study a number of tables were prepared. Finally, tabulated data were analyzed and condensed by using averages, percentages etc. to obtain the results.

3.10 Analytical technique of the study

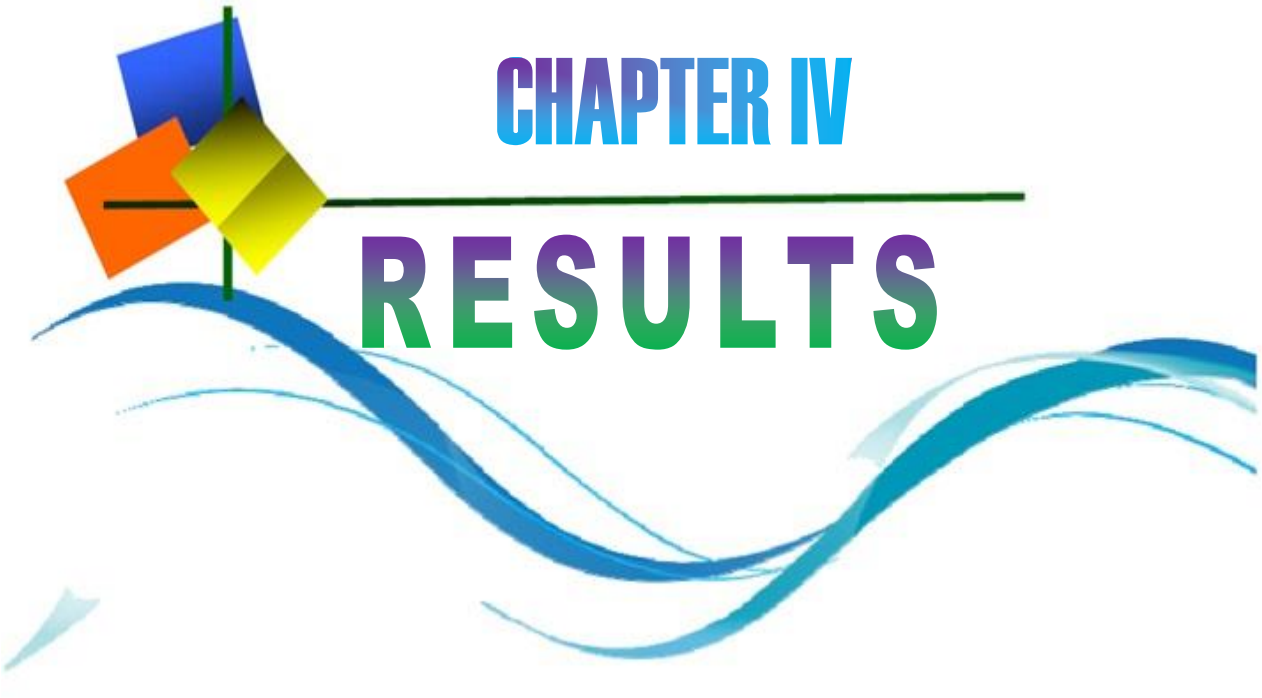
Mainly tabular analysis technique was used in this study. In this study data ware presented generally in the tabular form because of their easy collection technique, widely used and easy to recognized.

3.11 Problems encountered during data collection

During data collection in the study area different types of problems were encountered such fish farmers busy in the fishing, company representative busy for their official works and they were unwilling to talk. The fish farmers would think that the investigator could be the government officer from taxation department or other department and eventually some of them got afraid and not willing to supply the real information and hiding tendency was observed in the selected areas. Language and communication was also a small barrier for data collection in the study area because they use their local names and languages for fishes and fish culture. Though, the above problems were overcome sensitively and real information for the sake of a successful study was collected as much as possible.

3.12 Analysis of data

After data collection, all the data were analyzed using tabular statistical techniques. According to the objectives of the study the summary tables were prepared. This tabular statistical technique was applied for the process of analysis of data included the classification of tables into meaningful result by arithmetic mean, percentage and ratios. For processing and analysis purpose, MS excel and Small Stata versions 2012 were used.



CHAPTER IV

RESULTS

CHAPTER IV

RESULTS

The results of this study are presented in this chapter with the help of proper statistical analysis. This study has been methodically completed to fulfill the objectives. The first section deals with the different types of aqua chemicals or drugs that are produced by different aqua medicine companies. The remaining parts are designed according to fish farmer's bio data, types of chemicals used in fish culture and related problems.

4.1 Consumers of aqua medicines and chemicals in the study area

The main consumers of the investigated aqua medicine company were hatchery owner, fish farmer, aqua traders and aqua consultants. Above information's were collected from representatives of aqua medicine company through questionnaire survey.

4.2 Major aqua medicines and chemicals used for fish health management in study area

Aqua drugs were available in the local market which were produced by different aqua medicine companies and used at different stages in aquatic animal health management like pond preparation, increasing oxygen concentration, growth promotion, probiotic, disinfectant and fish disease treatment in the study area. Fish disease treatment was the major field where adequately of such compounds were used. The local animal feed and chemical shops were the major sources of these compounds in the study area.

4.3 Probable suggestions given to the customers

During fish culture fish farmers were faced different types of problems in different times. Representatives of aqua medicine company provide suggestions to the customers to minimize aquaculture problem. They suggest to the customers to use quality feed,

healthy and disease free fry, aqua chemicals and scientific method for diverse purposes in the study region.

4.4 Aqua medicines and chemicals used for oxygen supply

Chemicals used for oxygen supply were recorded from the aqua medicine enterprises. Around 10 aqua chemicals typically used for oxygen supply. Oxidizing agent and sodium per carbonate is the major active ingredients of such chemical shown in (Table 4.1).

Table 4.1 Aqua medicines and chemicals used for the supply of oxygen

Trade name	Active ingredients	Recommended dose	Pharmaceutical company
Oxyrich	Sustained release O_2 13.5%	10g/dec.	Opsonin
Oxyrich Tab	Sustained release O_2 12%	12-14 tab/dec.	Opsonin
Oxymore	Sustained release useful O_2 13.5%	200-250g/acre	SK+F
Oxylife	Sodium per carbonate	500-1kg/acre/5-6 ft. water	Square Pharmaceuticals LTD.
Oxy-max	Sodium per carbonate	250-300g/acre	Eon animal Health
Oxy-A	Sustained release useful O_2 13.5%	6-8 kg/33dec.	ACME
Oxy-ren	Sodium carbonate per oxy hydrate	2-3g/dec.	Renata
Bio-ox	$2Na_2CO_3 3H_2O_2$	300-400g/dec.	ACI animal Health
Oxy gold	Sodium per-carbonate	250 g/acre	Fish tech Ltd.
Quick oxygen	Sodium per-carbonate + free oxygen	500 g/acre	Organic Pharmaceuticals Ltd.

4.5 Antibiotics used for disease treatment

Antibiotics used by the fish farmers in the study zone are shown in (Table 4.2). The active ingredients of such antibiotics are mainly oxytetracycline, amoxicillin trihydrate, co-trimoxa zole, povin iodine U.S.P.10%, sulphamethoxole+trimethoprime and chlortetracycline. Varying opinions were made by the farmers about the usefulness of those particular products.

Table 4.2 Antibiotics used for disease treatment

Trade name	Active ingredients	Recommended dose	Pharmaceutical company
Renamox	Amoxicillin trihydrate	28-40g/100kg fish	Renata
Renamycin	Oxytetracycline	28-42g/100kg fish	Renata
Povin vet	Povin iodine U.S.P. 10%	2-3 ml/liter	Opsonin
Bactiab	Oxytetracycline 20%	50g/kg body weight,5-7 days	ACI animal health
Cotrim vet bolus	Co-trimoxa zole	Mixed with feed:1 bolus/10-12kg/body weight	Square Pharmaceuticals Ltd.
Otetra vet power 50	Oxytetracycline	Mixed with feed:11-16g/100 kg body weight	Square Pharmaceuticals Ltd.
Cotrim vet	Sulphamethoxole +Trimethoprie	o.50mg/ kg body weight	Square Pharmaceuticals Ltd.
Oxin WS	Oxytetracycline 20%	50mg/ kg body weight	Navana
Fish cure	Chlortetracycline HCL	500/1000 kg feed (3–5 days)	Rals agro Ltd.
Chlorsteclin	Chlortetracycline	200–300 gm./100 kg feed (5–7 days)	Elanco Pharmaceuticals Ltd.
Orgacycline 15%	Chlortetracycline	200–300 gm./100 kg feed 5–7 days	Organic Pharmaceuticals Ltd.

4.6 Aqua medicines and chemicals used as disinfectants

The selected fish farmers used various types of aqua medicine as a disinfectant in order to keep pond free from any pollutant or pathogen. The following disinfectants listed in Table 4.3. According to the leaflet information provided by the company, timsen and ascalina very effective in preventing of some bacterial, viral and fungal infection. Formalin is also used to control protozoan fish disease. Benzal konium chloride (BKC) is used for controlling bacterial disease.

Table 4.3 Aqua medicines and chemicals used as disinfectant

Trade name	Active ingredients	Recommended dose	Pharmaceutical company
Safegard	Vitamin, enzyme and Probiotics	1-2g/Kg feed	SK+F
Timsen	N-Alcohol, Di-ethyl benzyl ammonium chloride	20g/33dec.	Eon Pharmaceuticals Ltd.
Albeas	vitamins, minerals and antimicrobial agent	150-200 g/dec.	Eon Pharmaceuticals Ltd.
Argulex	Tri-chlorofone 40%	12-13 ml/dec.	Eon Pharmaceuticals Ltd.
Virex	Potassium peroxymono sulphate 50%	200g/33dec	ACI Animal Health
Polgard plus	3-methyl and 4 methyl two chain brominated compound	500ml/acre	Fish tech Ltd.
Ascalina	Organic sperulina 100%	5-10g/Kg feed	SK+F
Formalin	38% formaldehyde	1-3 ppm	Chemical seller
BKC	Benzal Konium Chloride	Spread with water, 0.5 ppm	Chemical seller
Polgard plus	3-methyl and 4-methyl two chain brominated compound	500 ml/acre	Fish tech Ltd.
Microdine iodine 20%	Nony alkl ohenoxypoly ethaneixide iodine complex	2 –2.5 L/acre	Rals Agro Ltd.

4.7 Aqua-medicine used for removal of harmful gasses

To eradicate organic and inorganic wastes producing gas in ponds, fish farmers were seen to use gas removal agent to their culture pond. About 14 toxic gas removals with different trade name were found to different companies. Their trade name, dose and manufacture are given in (Table 4.4).

Table 4.4 Aqua-medicine used for removal of harmful gasses

Trade name	Active ingredients	Recommended dose	Pharmaceutical company
Geo-rich	Natural geolite 100%	100-200g/dec.	Opsonin
Yucca	Yucca cidigera extract	2-3ml/dec.	Opsonin
Geo-prime	Natural green geolite 100%	200-250g/dec.	SK+F
Gasonil	Probiotic and yucca (30%)	150-200g/acre	SK+F
Geopel	Natural pellet geolite 100%	200-250g/dec.	SK+F
Bio-pond	Geo-lite and	200-250g/dec.	SK+F
Bio-grow	Vitamin, minarel and probiotics	150-200g/dec.	SK+F
Aqua pure	Natural sodium alluminium silicate	10-16kg/acre/3-6 ft. water	Square Pharmaceuticals Ltd.
Gasstrap	Enzyme and probiotics	200 g / acre/3-6 ft. water	Square Pharmaceuticals Ltd.
Metrix	Al_2o_3, CaO, SiO_2, Feroso ferric oxide	6-10 kg/acre	Eon Pharmaceuticals Ltd.
Bio-aqua 50	Extract of euka cidijera	3-4ml/3-4ft water	Eon Pharmaceuticals LTD.
Geo-ren	Aluminum sodium silicate	20-25kg/acre	Renata Animal Health
Megagio plus	SiO_2, Al_2o_3, Fe_2O_3, CaO	200g/dec.	ACI Animal Health
Ammonil	Yucca plant extract, *Bacillus subtillis, Candida utilis*	100-200 g/acre	Elanco Pharmaceuticals Ltd.
Gas stop	*Bacillus subtillis* Al_2O_3 SiO_2	500 mg/acre, 3 weeks	Organic Pharmaceuticals Ltd.
Aqua Magic	*Azotabactor chorococcum, Bacillus subtillis, Candida utilis*	400g/acre	Fish tech Ltd.

4.8 Aqua medicines and chemicals used for pond preparation and water quality management

Different types of aqua chemicals used by the fish farmers for the purpose of pond preparation and improving water quality management of fish pond in the study area. The list of such chemicals with their active ingredients, dose, and manufacture are shown in (Table 4.5). On the impact of these drugs/chemicals are also called health stone. Some mixture of same inorganic compound like calcium, magnesium, aluminum, silicon, etc. which together form very little pore and sponge like structure. Harmful pathogens and toxic gases (like ammonia) become trapped in the pores of such compound. They also absorb poisonous substance, odor of water thus ensuring clear and healthy pond environment.

Table 4.5 Aqua medicines and chemicals used for pond preparation and water quality management

Trade name	Active ingredients	Recommended dose	Pharmaceutical company
Megagio plus	SiO_2,Al_2o_3,Fe_2O_3,CaO	200g/dec.	ACI Animal Health
Megagio gold	SiO_2,Al_2o_3,Fe_2O_3,CaO	100-150g/dec.	ACI Animal Health
Aquastar pond	Probiotcs	6g/dec./3-4 ft. water	Renata
JV zeolite	Natural zeolite	6-8 kg/33dec.	Eon Pharmaceuticals
Zeo-fresh	Standard zeolite	25-30 kg /acre/3-6 ft. water	Square Pharmaceuticals Ltd
Aqua green	Seaweed extract and organic micro-nutrient	4-5kg/3ft water	Square Pharmaceuticals
Aqua pure	Natural sodium alluminium silicate	10-16kg/acre/3-6 ft. water	Square Pharmaceuticals Ltd.
Biomax	Aluminum sodium silicate	3-4 kg/3 ft. water	Square Pharmaceuticals Ltd.
Pond care	Probiotic	50-75g/acre	SK+F
Acme zeolite	Aluminum sodium silicate	20-30 kg/acre	ACME
Zeopel	Zeolite 100%	20-30 kg/acre	SK+F
Green Zeolite	SiO_2, Al_2O_3, Fe_2O_3, CaO, MgO, Na_2O, K_2O, TiO_2	20–25 kg/acre	Organic Pharmaceuticals Ltd.
Pontox plus	SiO_2, Al_2O_3, Fe_2O_3, CaO, MgO, Na_2O	15 kg/acr. After stocking 10–20 kg/acr.	Rals Agro Ltd.

4.9 Aqua medicines used for growth promoter

Diverse group of aqua-medicines were found to be used as growth promoter as well as to increase fish production such as saltose, panvit aqua, square aquamix, spa gelly, vitamix-F aqua premium, charger gel, aqua boost, megavit aqua etc. The list of such aqua medicines with their active ingredients, dose and sources are shown in (Table 4.6). All of the growth promoters play an essential role for rapid growth of fish. Some of these chemicals also improve disease preventing ability of fishes.

Table 4.6 Aqua medicines used for growth promoter

Trade name	Active ingredients	Recommended dose	Pharmaceutical company
Saltose	Probiotic and enzyme mixed	1-2g/Kg feed	Opsonin
Panvit aqua	Liquid multi-vitamne	0.5-1L/ton water	Square Pharmaceuticals Ltd.
Spa gelly	Omega-3 fatty acid	10-15g/kg feed	Eon Pharmaceuticals Ltd.
Vitamix- F aqua premium	Vitamine, minerals, ammino acid	2.5Kg/ton feed	ACME
Charger gel	1-3 D glucan, olysaccharides, btain, beta glucan	6-8/kg feed	Fish tech Ltd.
Aqua boost	Organic acid, ß-glucan	500 g/mt feed	Elanco Pharmaceuticals Ltd
Megavit aqua	Vitamin, mineral and amino acid supplement	100 g/100 kg feed	Elanco Pharmaceuticals Ltd.
Orgavit aqua	Vitamin, mineral and amino acid supplement	100 g/100 kg feed	Organic Pharmaceuticals Ltd.

4.10 Probiotics used in fish culture

In the present study, diverse types of probiotics are produced by aqua companies to control virbiosis and other luminescent bacteria, improving water and soil quality and control pH shown in (Table 4.7). The probiotic contains mainly different concentration of beneficial bacteria which include *Bacillius* sp., *Rodobacter* sp., *Rodococcus* sp., *Streptococcus faecalis*, etc.

Table 4.7 Probiotics used in fish culture

Trade name	Active ingredients	Purpose of use	Recommend dose	Pharmaceutical company
Profs	*Bacillus sp.* and *Padiococcus* sp.	Control vibriosis, luminescent bacteria	50-70 gm./33 Dec.	Eon Pharmaceuticals Ltd.
Aqua photo	*Bacillus subtilis* and *Rhodoseudomonas*	Control unwanted gas, sediment and increase growth of plankton	50 –70 ml/100 dec.	ACI Animal Health
pH fixer	*Bacillus* sp.	Improve water quality and control pH	1–2 kg/acre	CP Aquaculture
Eco marine	*Bacillius subtilis, B. pumilis, B. Amylolichenifacions, B. megaterium.*	Control vibriosis and luminescent bacteria.	3–4 tablet/acre	Organic Pharmaceuticals Ltd.
Aqua gold	*Rhodopseudomonas* sp.	Increase growth rate and disease preventive power	2 ml/100 dec.	Organic Pharmaceuticals Ltd.
Procon-PS	*Bacillus* sp. *Rhodococcus*, and *Rhodobacter*	Control unwanted gas, sediment and arrests the pathogens	5 L/hac (l m depth)	Rals Agro Ltd.
Super biotic	*Bacillus* sp.	Reduce pathogenic bacteria in water	1–2 kg/ acre	CP Aquaculture
Super PS	*Rodobacter* sp. *Rodococcus* sp.	Improve soil quality and reduce toxic gas from bottom	4–6 L/acre	CP Aquaculture
Pond care	*S. faecalis* and other bacteria	Inhibit pathogenic bacteria	50g/ acre	SK + F

4.11 Aqua medicines producing pharmaceutical companies

In the present study, about 40 companies were found either produce or market aqua products. ACI Animal Health Ltd., Organic Pharmaceuticals Ltd., Renata Ltd., Square Pharmaceuticals Ltd., Acme laboratories and Elanco animal health Ltd etc. were seen to produce different products for aquaculture while Eon animal health Ltd., CP Company, Rals Agro Ltd., SK+F Bangladesh Ltd. have been marketing various products from different countries including India, USA, Thailand, Taiwan, Indonesia, Malaysia and Spain. Similar chemicals and antibiotics were found in different trade names marketed by different companies. It was also observed that different feed and pharmaceutical companies were giving technical support to farmers to promote their products. The present survey revealed that among the 40 companies more than 70 % of the products seen to produce by 12 companies like Opsonine (6%), SK+F Bangladesh Ltd. (6.67%), Square Pharmaceuticals Ltd. (8.67%), Eon Animal Health Ltd. (7.33%), Reneta Pharmaceuticals Ltd. (4%), ACI Animal Health Ltd. (10%), Acme Pharmaceuticals Ltd. (7.33%), CP Aquaculture (3.33%), Rals Agro Ltd. (4%), Elanco Animal Health Ltd. (2.67%), Fish Tech (4.67%), Organic Pharmaceuticals Ltd(4.67%) and 30.67% were supplied by other pharmaceutical companies.

Table 4.8 Number of different products by pharmaceutical companies

Company Name	Number of products (N=150)	Products (%)
ACI	15	10.00
Square	13	8.67
Eon	11	7.33
Acme	11	7.33
SK+F	10	6.67
Opsonine	9	6.00
Fish tech	7	4.67
Organic	7	4.67
Reneta	6	4.00
Rals	6	4.00
CP	5	3.33
Elanco	4	2.67
Other companies	46	30.67

4.12 Problems of using aqua medicines and chemicals in fish culture

In the existing study information on the problems of using chemicals or antibiotics were collected from the selected fish farmers which are given below.

- Lack of knowledge about use of aqua chemicals
- Lack of knowledge of application procedure of aqua chemicals and antibiotics
- Indiscriminate use of aqua chemicals or drugs
- Use of low quality chemicals
- Lack of support from GO and NGOs
- Lack of awareness about the safety issues in using hazardous chemicals
- Lack of information on possible hazardous chemicals
- Lack of diagnostic facilities for proper disease diagnosis
- Lack of knowledge about residual effect and expiry date
- Lack of trained manpower to recommend fish medicine

4.13 Reasons of fish culture

According to the present investigation, almost all the fish farmers (100%) were performing fish farming due to continue their family occupation, 90% to increase their family income, 32.50% because of less employment opportunities, 17.50% in order to maintain their economic status, while the lowest percentage of fish farmers (10%) due to sense of self achievement (Table 4.9).

Table 4.9 Reasons of fish culture of the selected fish farmers

Reasons	Number of farmers (n = 80)	% of farmer
To continue in the family occupation	80	100
To increase family income	72	90
Lack of other employment opportunities	26	32.50
To maintain economic status	14	17.50
Sense of self achievement	8	10

4.14 Experiences of farmers in fish culture

The experiences of the selected fish farmers in fish culture activities were investigated in the study area which is shown in Figure 4.1. The survey revealed that each of the selected fish farmers (100%) has fish farming experience. More than fifty percent of the fish farmers (52.5 %) had 6-10 years fish farming experience, while 47.5 % fish farmers had 1-5 years.

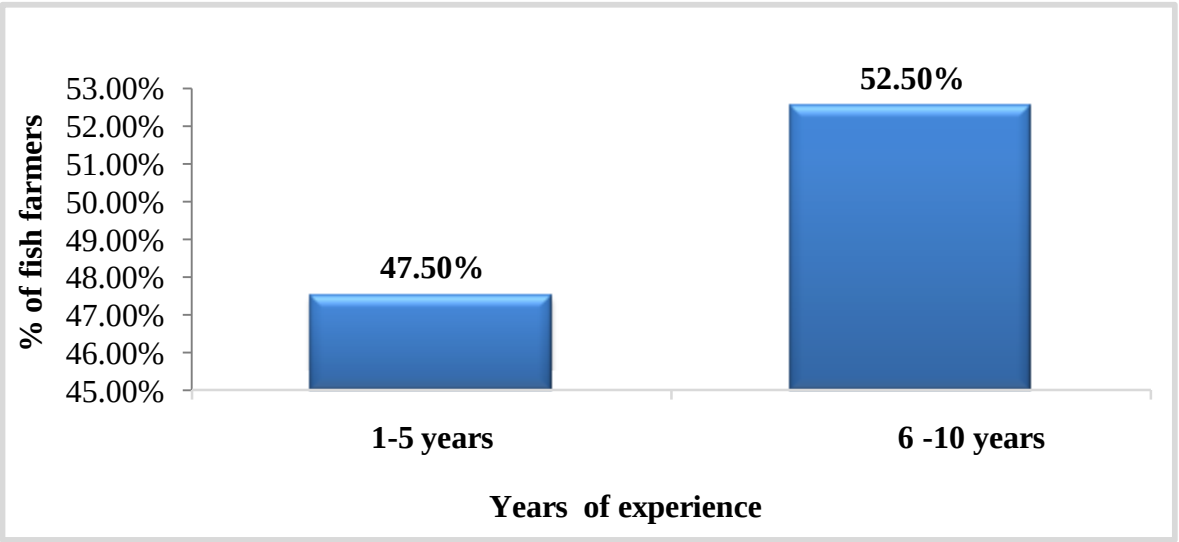


Figure 4.1 A graphical presentation of experiences of farmers in fish culture (n = 80).

4.15 Preparation of pond before releasing fry

In the study area, it was found that all the fish farmers were prepared their pond before releasing of fry shown in Table 4.10.

Table 4.10 Pond prepare before releasing fry

Response	Number of farmers (n = 80)	% of farmer
Yes	80	100
No	0	0

4.16 Aqua chemicals used during pond preparation and cultured period

From the present study, it was realized that different types of aqua chemicals are commonly used in the study area during preparation of pond and cultured period such as aqua gel, aqua pure, aqua green, aquakleen, askalina, argulex, bio-aqua, bio-ox, bio-max power, cevit-aqua, deletix, gastrap power, gasonil, oxyflow, oxylife, oxy-ren, panvit-aqua, probio aqua LG, square aqua mix, spa, timsen, zeo-fresh, zeo-ren etc. are displayed in Figure 4.3. The highest percentage of chemical (65%) used by the fish farmars in Bogra was zeo-fresh. On the other hand, 50% of aqua pure and oxylife were also used in the selected area. The results also revealed that around and less than 10% used chemicals

were aqua gel (10%), deletix (10%), spa (10%), zeo-ren (7.50%), aqua green (5%) and argulex (2.50%) (Figure 4.2).

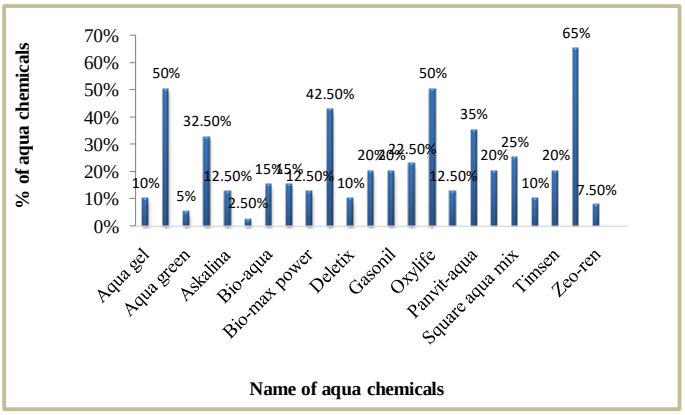


Figure 4.2 A graphical presentation of aqua chemicals used during pond preparation and cultured period (n = 80).

4.17 Treatment of fish before releasing in pond

In the present study area, majority of the farmers (70%) did not use chemicals for treating fry before releasing in the pond and only 30% farmers treated their fry before releasing in the pond as presented in Figure 4.3.

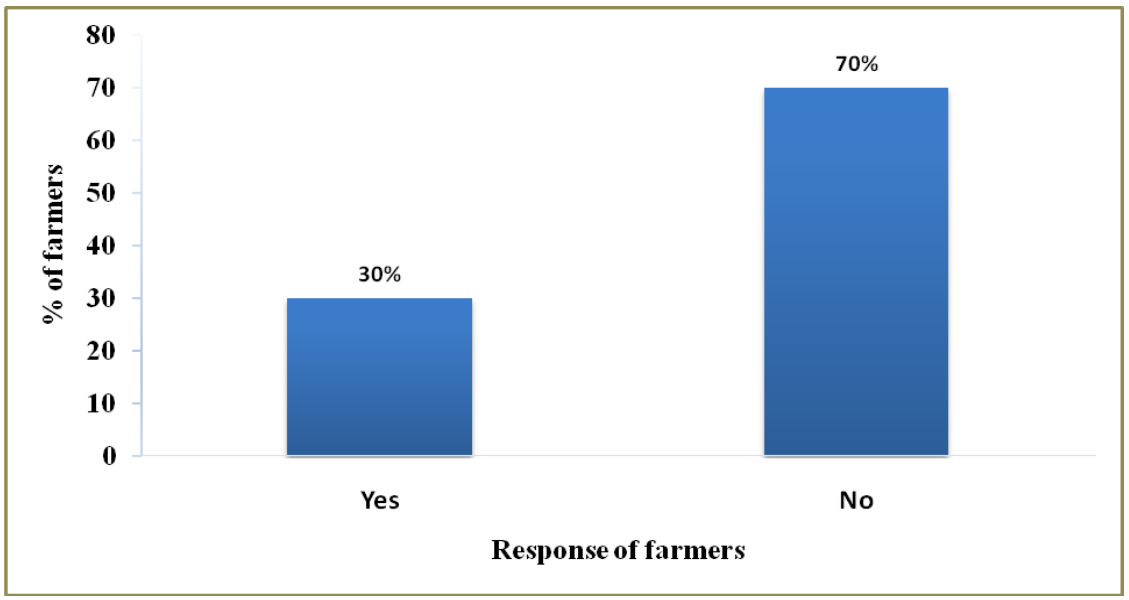


Figure 4.3 A graphical presentation of treatment of fish before releasing in pond (n =80).

4.18 Water quality problem in fish pond

From the present study, it was found that the areas for data collection were selected mostly on the basis of having water quality problem. When farmers were asked whether they had water quality problems in their ponds, all the fish farmers (100%) said they had water quality problems as shown in (Table 4.11).

Table 4.11. Water quality problem in fish pond

Response	Number of farmers (n = 80)	% of farmer
Yes	80	100
No	0	0

4.19 Water quality problems faced by the fish farmers in the study area

Water quality testing is an important part of environmental monitoring. When water quality is poor, it affects not only aquatic life but the surrounding ecosystem as well. These sections detail all of the parameters that affect the quality of water in the environment. In the study area, the fish farmers reported that various types of water quality problems were encounter in the fish pond during culture period including DO deficiency, high turbidity, high ammonia and poor phytoplankton production. The most

common water quality problem was DO deficiency (100%), pH (80%), 50% of the fish farmers reported high ammonia content, while 30% faced high turbidity. Few (10%) fish farmers mentioned that poor phytoplankton was another water quality problem (Table 4.12).

Table 4.12 Water quality problems faced by the fish farmers in the study area

Water quality problem	Prevalence (%)	Death (%)	Number of farmers (n = 80)	% of farmer
DO deficiency	30-40	10-30	80	100
pH	20-30	10-20	64	80
Ammonia	20-40	10-20	40	50
Turbidity	30-40	5-20	24	30
Poor phytoplankton	20-30	5-10	8	10

4.20 Fish disease problems in the study areas

In the present survey, the area was selected based on having disease history for data collection. When farmers were asked whether they had disease problems in their ponds, majority (100%) of the fish farmers said they had disease problems as displayed in Table 4.13.

Table 4.13 Fish disease problems in the study areas

Response	Number of farmers (n = 80)	% of farmer
Yes	80	100
No	0	0

4.21 Disease of fish

From the survey, it was found that various types of fish diseases were reported in the study area. Disease outbreak mainly occurred during winter season. Fishes were affected by different types of fish diseases such as EUS (100%), tail rot and fin rot (70%), dropsy (40%), argulus (35%), exophthalmia (22.50%), gill rot (22.50%), fin rot (7.50%), etc.

But proper preventive measures were reported to be adopted by the fish farmers to protect their fishes from various diseases shown in (Table 4.14).

Table 4.14 Disease problems faced by the fish farmers in the study area

Disease	Prevalence (%)	Death (%)	Number of farmers (n = 80)	% of farmer
EUS	20-50	3-20	80	100
Tail rot and fin rot	20-40	2-20	56	70
Dropsy	15-40	2-15	32	40
Argulus	20-40	5-10	28	35
Exophthalmia	20-30	5-10	18	22.50
Gill rot	20-30	5-30	18	22.50
Fin rot	15-30	3-10	6	7.50

4.22 Traditional chemicals used for disease treatment

A diverse numbers of chemicals were used for disease treatments in the study area as displayed in Figure 4.4. Application of salt (100%) was the most common treatment followed by lime (97.50%), urea (40%), TSP (32.5%), potash (32.50%), fitkiry (15%) and copper sulphate (7.5%).

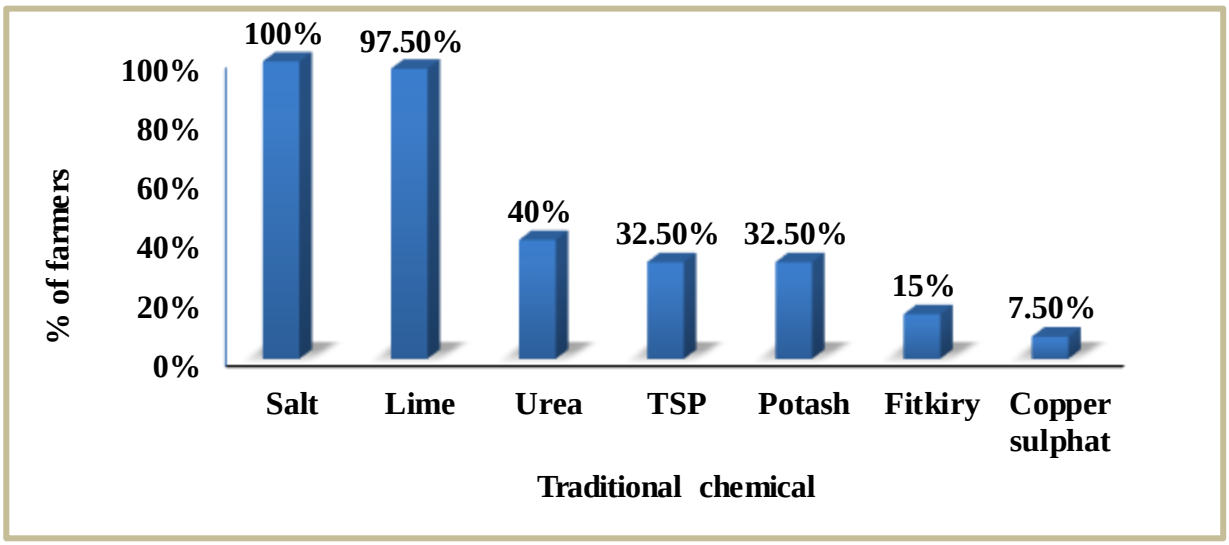


Figure 4.4 A graphical presentation of traditional chemicals used for disease treatment (n=80).

4.23 Widely used antibiotics in freshwater aquaculture

In the study area, it was also observed that the fish farmers were used different kinds of antibiotics for treating their fish such as renamycin (40%), bactiab (32.50%), oxin WS (22.50%), renamox (15%), cotrim vet (15%), cotrim vet bolus (12.50%) and otetra vet power 50 (5%), as shown in (Figure 4.5).

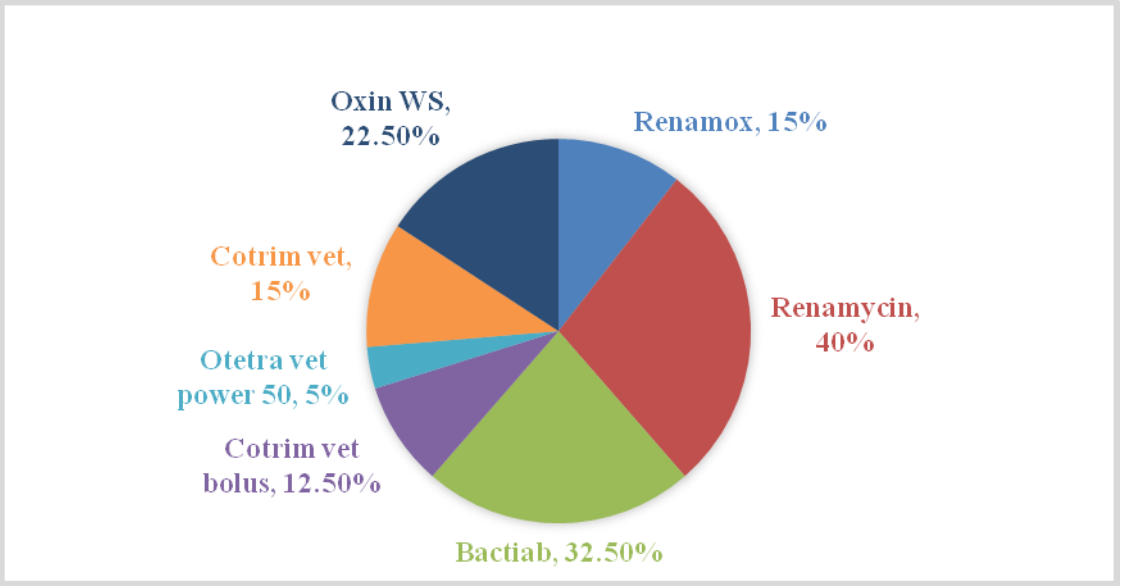


Figure 4.5 Widely used antibiotics in freshwater aquaculture (n=80).

4.24 Knowledge about aqua medicines and chemicals

From the present study, it was realized that the highest (77.50%) percentage of the respondents acquired knowledge regarding application of various aqua chemicals and antibiotics in fish culture only from different company representatives, while 17.50% of the farmers obtaining information from both company representative and different hatchery owners. The lowest percentage of farmers (5%) reported that their information sources were company representative including different hatchery owners and government organizations (GOs) (Table 4.15).

Table 4.15 Knowledge about aqua medicines and chemicals

Medium	Number of farmers (n = 80)	% of farmer
Company representative	62	77.50
Company representative and different hatchery owners	14	17.50
Company representative, different hatchery owners and GOs	4	5

4.25 Training experience on fish culture

From the present study, it was observed that only 12.5% of the fish farmers were received simple training from some GOs and NGOs for short duration on fish culture, while majority of the farmers (87.5%) did not get any institutional training (Figure 4.6).

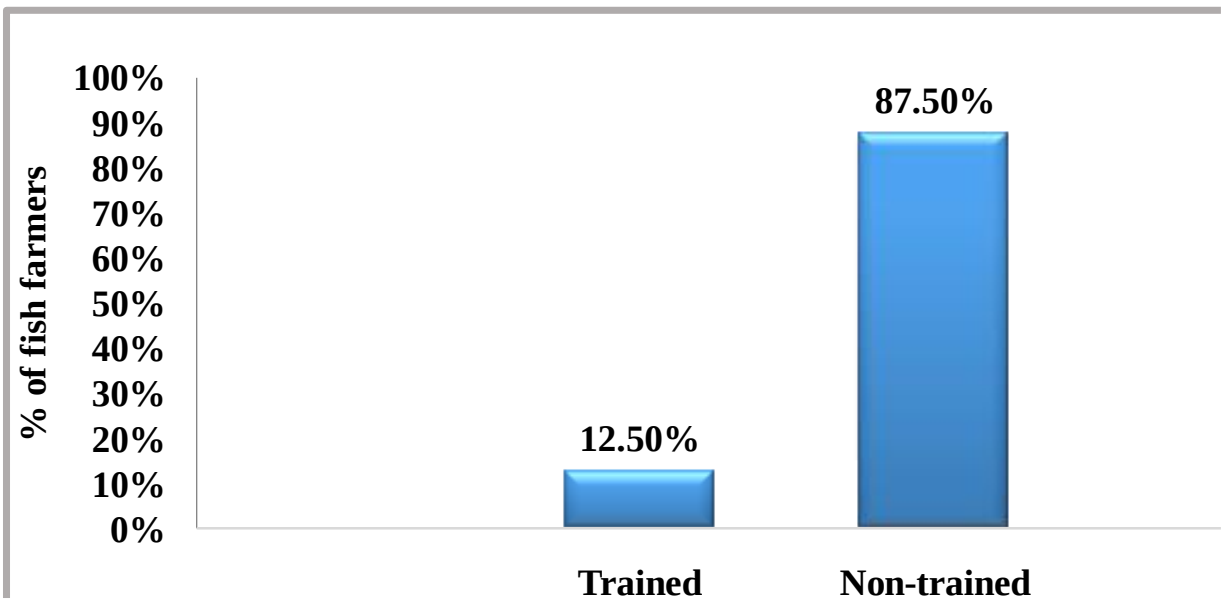


Figure 4.6 A graphical presentation of training experience on fish culture.

4.26 Training opportunity of fish farmer

Among the 12.50% of those trained farmers only 2.5% had 15 days training experiences and 7.5% fish farmers had 30 days. Surprisingly only 2.5% of the selected fish farmers had 180 days training experiences which are displayed in (Figure 4.7).

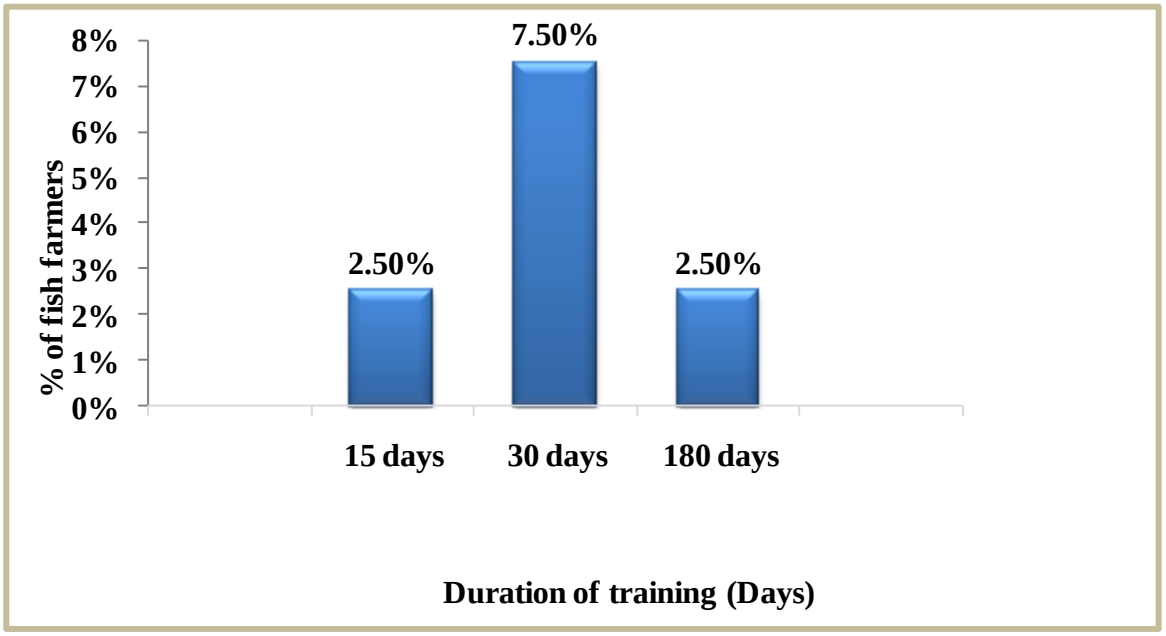


Figure 4.7 A graphical presentation of training opportunity of fish farmer (n=80).

4.27 Improvement of fish health condition after using of aqua medicines and chemicals

In the present investigation area, it was noted that almost all the fish farmers (100%) were reported positive improvement of their fish health condition after being applied various aqua chemicals and antibiotics for disease treatment.

4.28 Sources of suggestion to use aqua medicines and chemicals

From the present study, it was found that majority of the fish farmer (95%) received suggestions from various company representatives, while only 5% of the selected fish farmers obtained suggestions from both company representative and GOs on use of chemicals and antibiotics in fish culture (Table 4.16).

Table 4.16 Sources of suggestion to use aqua medicines and chemicals

Sources of suggestion	Number of farmers (n = 80)	% of farmer
Company representative	76	95
Company representative and GOs	4	5

4.29 Problems of fish culture in the study area

Different types of problems of fish culture were recorded in the investigation area including lack of technical knowledge, diseases, problem of taking lease pond, lack of chemicals and fertilizers, insufficient water in dry season, lack of marketing facility, lack of finance, theft of fish, poisoning in pond enmity, flood etc. The highest 100% of the respondent mentioned lack of technical knowledge is the prime problem for fish culture. While the second most significant concern were diseases (92.5%) followed by leasing pond (80%), flood (75%), insufficient water in dry season (65%), theft of fish (47.5%), poisoning in pond enmity (32.5%), lack of finance (15%), marketing facility (2.5%), lack of chemicals and fertilizers (2.5%) (Table 4.17).

Table 4.17: Problems of fish culture in the study area

Problems	Number of farmers (n = 80)	% of farmer
Lack of technical knowledge	80	100
Diseases	74	92.50
Problem of taking lease pond	64	80
Flood	60	75
Insufficient water in dry season	52	65
Theft of fish	38	47.50
Poisoning in pond enmity	26	32.50
Lack of finance	12	15
Lack of chemicals and fertilizers	2	2.5
Lack of marketing facility	2	2.50

CHAPTER V

DISCUSSION

CHAPTER V

DISCUSSION

The purpose of this chapter is to discuss the results and verify the outcomes with other findings of previous studies. Different aqua drugs and chemicals have become an essential part for successful aquaculture production. The present investigation was conducted to evaluate the existing status of commercial aqua-drugs and their impact on fish health. Data was collected through questionnaire interview of fish farmer and representatives of pharmaceutical companies in Bogra district. The results obtained from the study are discussed as follows:

From the existing study, it was observed that different categories of commercial aqua-drugs and chemicals were used by fish farmers for different aquaculture activities such as disease treatment, pond preparation, disinfectants, growth promotion and improve disease resistance. All these activities were related for better health management of aquatic animal.

In the current study, it was conducted to know the present status of commercial aqua drugs and their effect on fish health in Bogra district. Different types of aqua drugs were recorded in the study area for the improvement of water quality of fish ponds such as megagio plus, megagio gold, aquastar pond, jv zeolite, zeo-fresh, aqua green, aqua pure, biomax, pond care, acme zeolite, zeopel, green zeolite, and pontox plus. Faruk *et al.*, (2008) found that drugs like geotox, jv zeolite, lime, mega zeo, bio aqua and acmes zeolite used for improving water quality. Ali (2008) and Rahman (2011) were also reported various types of chemicals like bio care, geotox, pontox plus, green zeolite, benzo, zeo-care, bio tuff, acmes zeolite, supper zeolite, aqua zel, fish grow and biolite plus were used for the improvement of water quality parameters in fish ponds. Some

chemicals like urea, TSP and potash were used mainly for increasing primary productivity of the fish ponds in the present study area. Ali also (2008) reported that fertilizers were used for increasing primary productivity in the fish ponds.

In the study zone, diverse types of fish diseases such as EUS, tail rot, fin rot, gill rot, argulous, exophthalmia and dropsy were observed. Similar conditions were also reported by the various authors in previous studies in aquaculture of Bangladesh (DoF, 2002 and Faruk *et al.*, 2004). Majority of the farmers in the selected areas were also used different types of aqua drugs and chemicals in order to control these types of fish diseases. It meant that disease problem was the major constraint in aquaculture production of the selected areas.

In the study area, the fish farmers were used various types of aqua medicine such as safegard, timsen, albeas, argulex, virex, polgard plus, ascalina, polgard plus, microdine iodine 20% etc. as disinfectant in order to keep ponds free from pollution and pathogens. According to the leaflet information provided by the company, timsen and ascalina are effective in prevention of bacterial and fungal infection while formalin is also used to control protozoan fish disease. Benzal Konium Chloride (BKC) is chemical which is very useful to control bacterial disease. Apud (1984) investigated that farmers used formalin as disinfectant and to control protozoan diseases. Sharif *et al.*, (2000) mentioned lime, tea seed cake, formalin, benzal konium chloride, malachite green and hypochlorite as traditional disinfectants. In 2011 Rahman found various chemicals such as polgard plus, bactisal, virex, biogaurd, lenocide, timsen, emsen, aqua cleaner plus, formalin and bleaching powder were used as disinfectants. In previous study by Monsur (2012) who reported that various aqua drugs and chemicals such as geotox, mega zeo, lime, bio aqua, timsen, efinol, polagard plus, oxyflow, oxy-a, potash, salt, capter,

megavit aqua, ac-mix super fish and aqua boost were used by the selected fish farmers against fish diseases and health problems of cultured fishes.

In the present study, various aqua chemicals such as oxyrich, oxyrich tab, oxymore, oxylife, oxy-max, oxy-a, oxy-ren, bio- ox, oxy gold, and quick oxygen were mainly used for supplying oxygen in the fish pond. Ali (2008) mentioned that oxy max and oxy flow were used to control excess removal of hardness and poisonous gases. Similarly Rahman (2011) reported aqua drugs like oxy-gold, oxylife, bio care, oxy plus, pure oxy, oxy max, and oxy flow were effective the supply of oxygen.

From the existing study, it was also observed that different types of aqua-medicines like saltose, panvit aqua, square aqua mix, spa gelly, vitamix- f aqua premium, charger gel, aqua boost, megavit aqua etc were used as growth promoter and fish production in the study area. All of the types of growth promoting chemicals play a vital role for rapid growth of fish. Some of these chemicals were also used to improve the disease preventing ability of fishes. Faruk *et al.* (2008) found that ac-mix super fish and aqua boost has disease preventing ability in fishes. The authors mentioned that growth promoters such as vitamins, minerals and phospholipids enhanced growth and survival rate of fishes in the study area. Islam (2013) reported that farmers used a wide range of aqua-medicines for growth promoter such as acimix super fish, spa, megavit aqua, charger gel, rapid grow and nutrimix. Similar to the present study Ashraful *et al.*, (2014) were also reported that various types aqua chemicals such as megavit aqua, charger gel, acimix super-fish, vitax-c and rena fish were used for the rapid increase of fish growth.

At present, various types of antibiotics are used by the fish farmers in the study area for disease treatment such as renamox, renamycin, povin vet, bactiab, cotrim vet bolus, otetra vet power 50, cotrim vet, oxin ws, fish cure, chlorsteclin, and orgacycline 15%.

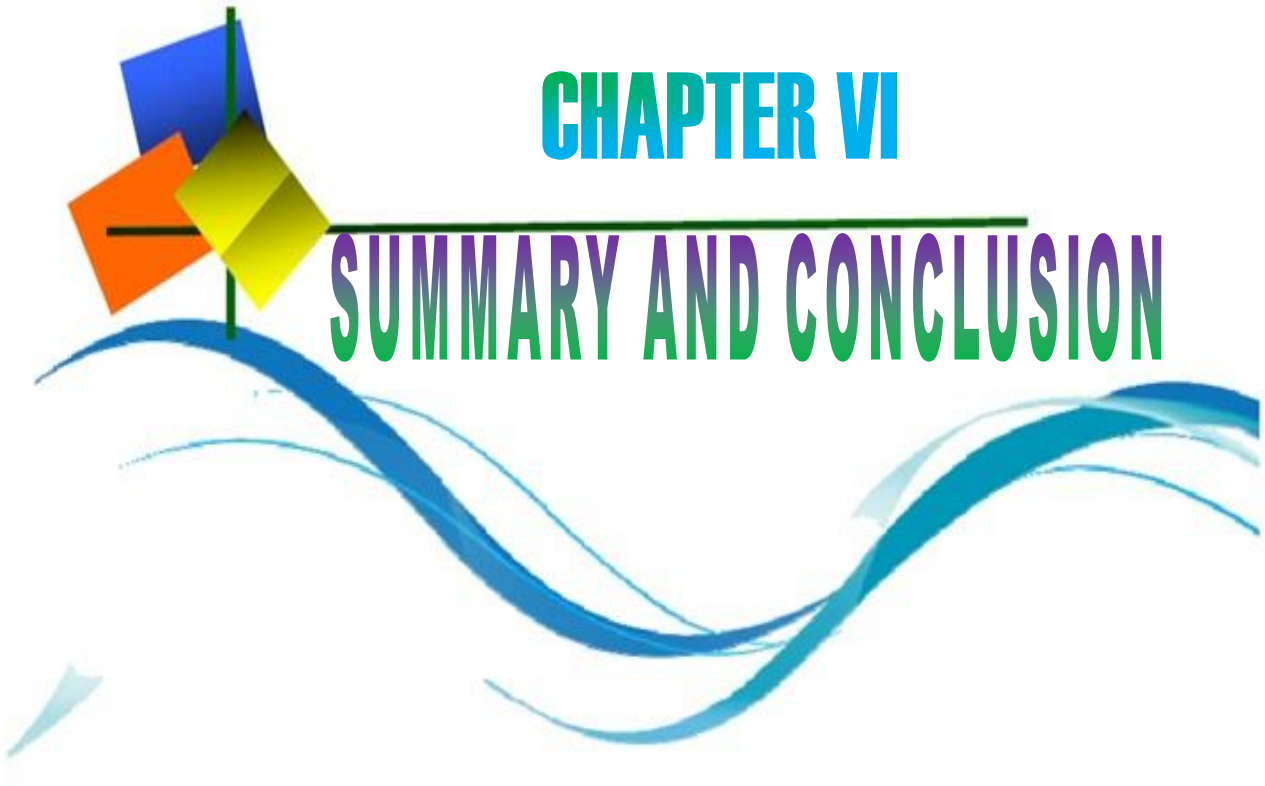
The farmers followed the recommended dosages and method of application of antibiotics in fish culture. Sarker (2000) observed in an experiment to test drug sensitivity of five isolates of *A. sobria* found that most of the isolates were found sensitive to oxytetracycline, oxolinic acid and chloramphenicol but resistance to erythromycin and sulphamethoxazole. Chowdhury *et al.* (2003) was found that antibiotic like renamycin (oxytetracycline) had positive effect against bacterial infection at a dose of 50 mg/kg body wt. /day applying for days and 80-90% fish were recovered under laboratory condition. Mahamud (2011) reported that oxysentin 20%, acimox and oxy-d vet were used in separate nine aquaria at lower, recommended and higher dose respectively. Hoque (2012) conducted an experiment for *Aeromonas hydrophila* infected silver carp which treated by antibiotics. Oxysentin 20%, acirnox and oxy-d vet were used at lower, recommended and higher doses respectively. The antibiotic trial was conducted for 10 days. Among the three antibiotics, oxycentin 20% and acimox at higher dose showed good results where 100% fish were recovered.

At present, data from 80 freshwater farmers were analyzed to know the status of using some commonly available traditional chemicals in the selected area. About 32.50% farmers used potash, follows by salt (100%), lime (97.50%), fitkiry (15%), copper sulphat (7.5%), urea (4%) and TSP (32.5%). Ali (2008) found that commonly used chemicals in aquaculture were lime, salt, urea, triple super phosphate, potassium permanganate, sumithion, and melathion. Sultana (2004) found that commonly used chemicals in aquaculture were lime, salt, urea, triple super phosphate, potassium permanganate, vitamins, rotenone, phostoxin, sumithion, melathion and some hormones. Faruk *et al.,* (2005) observed that commonly used chemicals in aquaculture were lime, salt, urea, triple super phosphate, potassium permanganate, rotenone, phostoxin, sumithion, melathion and some hormones. It was also found that most of the farmers

used chemicals indiscriminately without knowing their mode of action, doses and appropriate procedures of application.

In the present study, different types of probiotics were produced in different aqua companies to control vibriosis and other luminescent bacteria, improving water and soil quality and control pH. In study area found different types of probiotics such as profs, aqua photo, mutagen, pH fixer, aqua gold, procon-ps, super biotic, super-ps and pond care. The probiotic contains mainly different concentration of beneficial bacteria which include *Bacillius* sp., *Rodobacter* sp., *Rodococcus* sp., *Streptococcus faecalis* etc. Islam (2013) observed that farmers used a wide range of aqua-medicines as probiotic such as navio plus, biozyme, pro marine and aqua boost. Ashraful *et al.* (2014) observed that various types of probiotics such as megazeo pro, biomin pond life and aqua photo.

The commercial aqua drugs and chemicals were used in aquaculture for various purposes. There were new aqua drugs and chemicals being produced and a little information was available about their efficiency. There is no doubt that some chemicals are very useful. However, farmers must evaluate the cost and benefits of treatment before using any chemicals. Aqua drugs should not be used, if they are harmful to human. Pharmaceutical companies should conduct more research towards reducing the harmful impact of aqua medicine on aquaculture and also to know the exact dosage.



CHAPTER VI

SUMMARY AND CONCLUSION

CHAPTER VI

SUMMARY AND CONCLUSION

The study was conducted to know the present status of the use of chemicals and antibiotics in aquatic animal health management. Data was collected through questionnaire interview, personal contact and participatory rural appraisal like focus group discussion with fish farmers and representatives from pharmaceutical companies in Bogra districts. The investigation was carried out for six months from January, 2017 to June, 2017.

A wide range of aqua chemicals and antibiotics were found sufficient in the market to use in aquaculture for several purposes. Disease treatment and fish health management were the major parts where fish farmers were seen to practice a lot of such compounds. Other purposes of using chemicals included pond preparation and management, growth promotion, improvement of water quality, supply of dissolve oxygen, toxic gas reducers, antibiotics, probiotics and disinfectant.

During the observation we noticed diverse groups of commercial aqua drugs and chemicals were used for different purposes. From the opening of pond preparation to disease treatment different aqua drugs and chemicals were used by the fish farmers. There are many pharmaceuticals companies were found to provide all of those aqua drugs and chemicals with different trade name in order to meet the farmers demand. Different types of fish diseases like EUS, tail rot and fin rot, dropsy, argulus, exophthalmia, gill rot and fin rot were reported in the study area by the selected fish farmers. To overcome such kind of situation fish farmers used diverse types of aqua drugs and chemicals. After use of aqua drug they attained good to better outcome. Nonetheless some certain cases they did not grow any rescue.

A sum of new products with several trade names was also found available in the market. From massive amount of new products jv zeolite, geotox, green zeolite, etc. which cover more or less similar ingredients and use in mainly pond preparation as well management. Megavit aqua, fish vitaplus, aq grow-g, aqua boost, orgavit aqua, etc. were used for growth promotion which ultimate by help to increase production. Oxyflow, oxy max, O_2-marine, quick-oxygen etc. are effective to rise dissolved oxygen. While EDTA, timsen, efinol, emsen etc. were used as disinfectant.

Different types of antibiotics with different trade name were noticed in the market as well as used by the fish farmers. Varying views were made by the farmers about the efficacy of particular products. Normally found traditional chemicals in health management included lime, salt, potassium permanganate, sumithion, melathion, formalin and bleaching powder etc. The practice of these traditional chemicals was more or less identical in freshwater. In the existing study fish farmers were found to use a variety of probiotic products to control mainly bacterial disease. The probiotic contains different concentration of beneficial bacteria which include *Bacillius* sp., *Rodobacter* sp., *S. faecalis,* etc. Some products have been marketed by different companies from overseas countries including India, USA, Thailand, Taiwan, Indonesia, Malaysia and Spain. Similar products were seen in different trade names.

The present study demonstrated current status of chemicals and antibiotics using in aquatic animal health management and pointed out some problems of the use of chemicals by the farmers which include lack of knowledge of the chemicals, doses and methods of application of these chemicals. There are few alternatives to minimize the adverse effects of aquaculture chemical are simply use-less of them. Other alternatives

could be used as bioremediation and the probiotics, immune stimulants vaccination and alternative therapeutic.

Fish farmers should have proper information approximately the use of aqua drugs and chemicals. They also should maintain appropriate withdrawal period for using of aqua drugs and chemicals. However, policy makers, researchers and scientists should work together in addressing the issues of chemical use in aquaculture with the view to reduce the negative impacts.

The current investigation has been only shown in Bogra region and thus additional parts of the country essential to be investigated to have a clear picture of the use and effect of commercial aqua-drugs and chemicals in aquaculture of Bangladesh.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APPENDIX

APPENDIX

Fish Farmer

Basic information

a) Name of farmer: b) Village: c) Union: d) Upazila:	e) District: f) Cell: g) Year of operation:

Why do you culture fish?

Do you have any experience on fish culture?

Yes: ☐ No: ☐

If yes, then

Duration of the corresponding farmer's fish culture experience

☐

Do you prepare your pond before releasing fry?

Yes: ☐ No: ☐

If **yes**, give information about the used aqua medicines and chemicals during pond preparation and culture period

Trade name	**Generic name**	**Applied dose**	**Manufacturer**

Do you treat your fish before releasing in your ponds?

Yes: ☐ No: ☐

Do you have any water quality problems in your ponds?

Yes: ☐ No: ☐

If **yes**, give details about the water quality problems of your ponds

Water quality problems	**Clinical sign**	**Species**	**Treatment**	**Prevalence (%)**	**Death (%)**	**Season**

Do you have any disease problem in your ponds?

Yes: ☐ No: ☐

If **yes**, give details about the disease of your fish.

Disease	**Clinical sign**	**Species**	**Treatment**	**Prevalence (%)**	**Death (%)**	**Season**

Do you use chemicals against the mentioned disease?

Yes: ☐ No: ☐

If **yes**, Give information about the used chemicals in the table below:

Trade name	**Recommended Dose**	**Applied Dose**	**Manufacturer**

Give information about the used antibiotics in the table below

Trade name	**Generic name**	**Applied Dose (per decimal)**	**Manufacturer**

How did you know about the particular chemical?

Have you got any training opportunities from GO/NGOs on use of chemicals?

Yes: ☐ No: ☐

If **yes**, please mention the duration of the attained training program.

☐

Do you use common aqua medicines and chemicals against all disease?

Yes: ☐ No: ☐

If **yes**, why?

Is the fish health condition improved after using aqua medicines and chemicals?

Yes: ☐ No: ☐

You take suggestion to use aqua medicines and chemicals from which source?

What are the main problems of your fish pond?

.....

Date: **Signature of interviewer**

Medicine Company

Name of company:

Location:

Who are the main customers of your drugs?

a) b) c)	d) e) f)

What type of aqua medicines do you produce in your company?

Trade name	Active ingredients	Purpose of use	Method of application	Dose	MRP

What types of aqua medicines are commonly sold among the customers?

a.	e.
b.	f.
c.	g.
d.	h.

Have you any aqua culturist in your company to support the customer?

Yes: ☐ No: ☐

What are the suggestions do you give to the customers about aquaculture problems?

a.	e.
b.	f.
c.	g.
d.	h.

.....

Date: **Signature of interviewer**