

# Categorization and Distribution of Aqua-Chemicals used in Coastal Farming of South-Eastern Part of Bangladesh

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## ABSTRACT

The present study was conducted for a period of eight months from January 2019, to August 2019. The primary purpose of this study is to find out the number of aqua drugs shop and categorize the aqua drugs for fish health management in Noakhali sadar, Kabirhat and Begumganj upazila of Noakhali district. The main target groups were aqua drug sellers (aqua drug shops) and aqua drug representatives of pharmaceutical companies. Data were collected directly from aqua drug sellers and representatives in the study area. Totally 13 outlets were identified in the study areas, and all shops types were mixed, variety product such that animal feed and poultry product were also found in the study area. Aqua drugs and chemicals were classified into seven categories viz. aqua drugs available as Oxygen supplier, Growth Promoter, Antibiotics, Disinfectant, Insecticides, Probiotics, and Water Quality Management. In the study area, Timsen, Virex were mostly available as disinfectants. Aci-Ox and Oxymore were mostly used by the farmers as the oxygen supplier to increase dissolved oxygen level in the water body. Most of the farmers used Acimec 1% Oral solution, Rota Plus, Angreb as insecticides. Novamix-104, Renamycin were mostly available in the study area as antibiotics. Pond Life, Biopond, Pond care were the most available probiotics in the study area. Fish farmers and farm owners mostly used Pathonil, Plankton Grow, Megazeo Plus were for pond preparation and water quality management. Square Aquamix, Acimix Super Fish, Liquavit mainly were used as a growth promoter. Those drugs and chemicals were produced by the 13 pharmaceuticals companies. They provide details information about the purposes, dosages, duration and method of application of chemicals in the leaflet.

**Keywords:** Aqua-chemicals; Water quality management; Disease; Probiotics

## INTRODUCTION

Bangladesh is endowed with a vast expanse of inland open waters characterized by rivers, canals, natural and human-made lakes, freshwater marshes, estuaries, brackish water impoundments and floodplains [1]. According to FAO statistics 2016, Bangladesh is ranked 5<sup>th</sup> in world aquaculture production [2]. Fisheries is contributing significantly in food security through providing safe and quality animal protein; almost 60 per cent animal protein comes from fish. It adds 3.61 per cent to our national GDP and around one-fourth (24.41%) to the agricultural GDP. The overall growth performance from inland aquaculture shows a moderate increasing trend due to dissemination of improved technology packages and supportive/need-based extension services at farmer's level. During the last eight years, the aquaculture production became more than double (10.63 lakh MT in 2008-09 to 23.33 lakh MT in 2016-17).

A slight growth in the production from both inland capture and marine fisheries was also noticed during the recent past years with some exceptions. Inland aquaculture of indigenous and exotic carp species as well as tilapia, pangus and koi expanded massively which is involved to change the socio-economic status of fish farmer in different part of rural Bangladesh [3-16]. Besides, new interest grew in farming of indigenous species like koi, shingh, magur, pabda, gulsha, mola etc. [2,17].

Maintaining proper health condition of fish, drugs and chemicals play a vital role. There are several causes of using drugs in aquaculture which include reducing the entrance of pathogenic organisms in culture area, reducing the multiplication of pathogenic organisms, reducing the stressful condition on fish health, reducing or protect the outbreak of disease and treatment of the disease. With the expansion of aquaculture in Bangladesh,

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there has been an increasing trend in using more chemicals in fish health management. Commonly used chemicals in Bangladesh aquaculture are lime, rotenone, various forms of inorganic and organic fertilizers, phostoxin, salt, dipterex, antimicrobials, potassium permanganate, copper sulphate, formalin, sumithion, melathion etc. [2,18-22] mentioned that they discovered six types of aqua drugs and synthetic substances were utilized by farmers for water quality supervision, disinfectants, disease treatment, antibacterial agents and development promoter. Faruk et al. [23] watched that fish farmers and hatchery owners utilized antibiotics and synthetic compounds for water body arrangement and supervision, development advancement and change of water quality to improve water body productivity.

The production of aquaculture largely depends on the appropriate use of chemicals and proper water quality maintaining. The degree of intensification in aquaculture mainly depends on the use of aqua-drugs in all level of culture. Now-a-days, aqua-drugs have become a vital input for profitable farming and high production. Aqua-drugs used in agriculture can be categorized as the purpose of use such that probiotic, growth promoter, insecticides, water quality management, oxygen supplier, antibiotics, disinfectant and others. Thus, the present study was conducted to know the availability of aqua-drugs with their identification, purpose, methods and dosages of application and also showing their marketing channel in the study area.

## MATERIALS AND METHODS

### Study area and periods

The study was undertaken in Noakhali Sadar, Kabirhat and Begumganj upazilla under Noakhali district in Bangladesh. The study was carried out over eight months from January to August 2019 (Figure 1).

### Target group

Since aquaculture activities in Noakhali are quite diversified, data was collected from different target group to have an overall picture of the aqua-drugs used in aquaculture activities in this area.

### Factors considered concerning the use of aqua-drugs

During visiting the aqua-drug shops, some elements were considered very carefully about the aqua-drugs including the purpose of the aqua-drugs using, availability and effectiveness of the aqua-drugs, price of the aqua-drugs, and variation in the applied dose of aqua drugs, and specific remark and recommendation of the aqua-drugs.

### Data collection

Data were collected through structured and semi-structured questionnaire interview, personal contact, market survey and Participatory Rural Appraisal (PRA) like Focus Group Discussion (FGD) with key informants, wholesale and retailers of animal medicine and representatives of pharmaceuticals companies.

### Data processing and analysis

All the collected data were summarized and scrutinized carefully and recorded. Finally, relevant tables and charts were prepared with the objectives of the study. Data presented mostly in the tabular form using Microsoft excel 2019 software.

## RESULTS

### Categories of chemicals in aquaculture

Mostly seven different types of commercial aqua-drugs and chemicals were found that were used by aqua farmers. In the main seven significant groups, the mostly found were growth promoter.

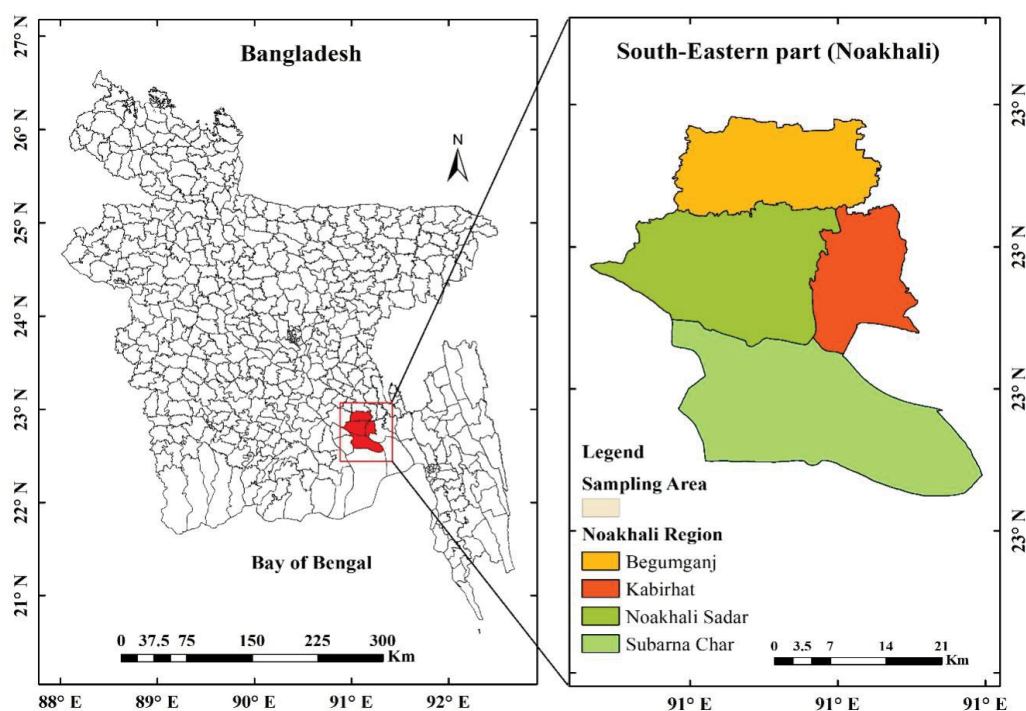


Figure 1: Sampling site of the studied area.

Sixteen aqua-drugs were found which used as a growth promoter, in percentage, it was 33. Then water quality management related aqua-drugs the percentage was 20. Probiotics were 18%, and then oxygen supplier was 14% (Figure 2).

### Trends of aqua-drug business in Noakhali region

Total 13 shops were found in the study area most of the shops were mixed, variety product such that beside aqua-drugs there also found the animal feed and different poultry product (Figure 3).

### Aqua-drugs producing pharmaceutical companies

In the study total, 13 aqua-drugs company was recorded which provide different drugs and chemicals in the study area. There were ACI Animal Health (37.5%), Eskayef Bangladesh (16.66%), Fishtech (BD) Ltd (12.5%) were the dominant (Table 1).

### Drugs used as a growth promoter

In the study area, there were found 16 growth promoters, which helps to increase the production of fish. Generally, different types of vitamins and minerals are the main active ingredient of growth promoter (Table 2).

### Aqua-drugs used as Probiotic

Generally, two types of probiotics were found in the study area one is used in pond preparation period another used in the culture

period both are directly mixing with pond water with different depth (Table 3).

### Aqua-drugs used as water quality management

Ten types of water quality management drugs from different pharmaceutical companies were recorded from the study area. Mainly Yucca plant extract was found majorly as active ingredients (Table 4).

### Aqua-drugs used as an oxygen supplier

Seven types of oxygen supplier drugs were found from a different pharmaceutical company in study area mostly are used to pond water with different depth (Table 5) directly.

### Aqua-drugs used as an insecticide

In the study area, three types of insecticides from the different pharmaceutical company were found which are mostly used before the culture period (Table 6). Some are used directly to water, and some are used as a water-insecticides mixture with different pond water depth.

### Aqua-drugs used as a disinfectant

Two types of disinfectants were found in the study area, which is directly used in water with different depth (Table 7).

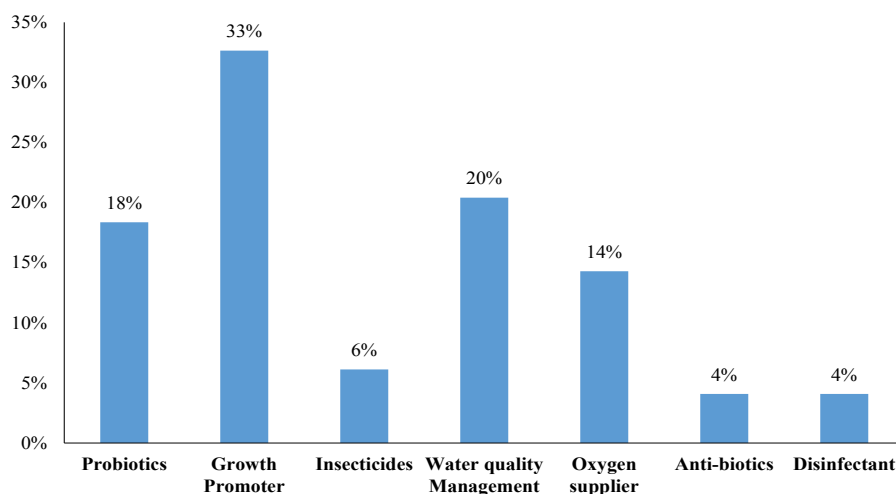


Figure 2: Categories of aqua-chemicals used in the studied area.

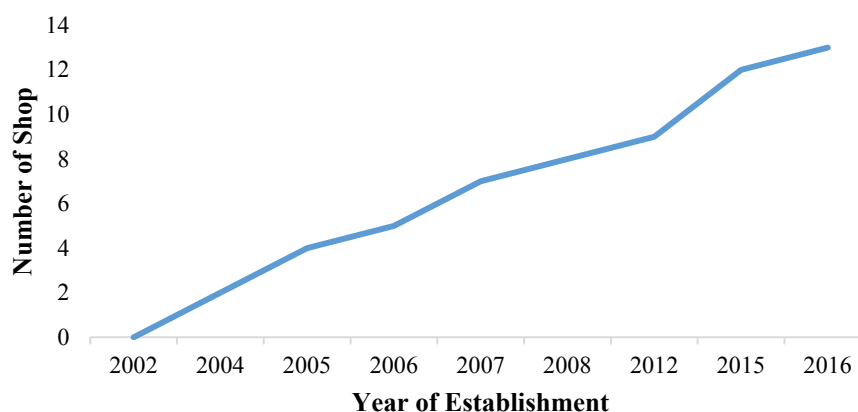


Figure 3: Trends of aqua-drug business in Noakhali region.

Table 1: Aqua-drugs produced by pharmaceutical companies.

Company name	Number of drugs	Aqua drugs (%)
ACI Animal Health	18	37.5%
Renata Ltd.	1	2.08%
Agrotek Bangladesh	1	2.08%
Eon Agro Industries Ltd.	4	8.33%
Genetica	1	2.08%
C Link Agrocare	2	4.16%
ACME Laboratories Ltd.	3	6.25%
Sun Green Impex Ltd.	1	2.08%
Square Pharmaceuticals Ltd.	1	2.08%
Navana Pharmaceuticals Ltd.	1	2.08%
Fishtech (BD) Ltd.	6	12.5%
Eskayef Bangladesh Ltd.	8	16.66%
Nahar Agro International	1	2.08%
Total	49	100%

Table 2: Growth Promoter found in the study area.

Name	Active Ingredient	Doses	Price (BDT)
Square Aquamix	Vitamins, Amino Acids, Minerals, Antioxidant	1 g/kg feed	310/kg
Acilina	100% Natural Spirulina	3-4 g/kg feed	315/100 g
Liquavit	Vitamins	5-10 ml/kg feed	130/100 ml
Eskavit C Aqua	Ascorbic Acid	1 g/kg feed	345/250 g
Acimix Super Fish	Vitamin, Trace element and other	1-2.5 g/kg feed	850/kg
DCP Gold	Organic CaHPO <sub>4</sub> , MgSO <sub>4</sub> , NaCl, Nano ZnO, I, Caseine, Trace elements	1-5 g/kg feed	120/kg
Pond Toss	Enzyme, Micronutrient, Amino Acids,	2 kg/acre	240/100 g
Antistress	L-Ascorbate polyphosphate, Citric acid, Exp. qs	2-3 g/kg feed	1450/kg
Biozyme	<i>Bacillus subtilis</i> , Yeast, Enzymes, Vitamins	0.5 g/kg feed	1120/kg
Ossi C	Vit-C, Beta glucan, Oxolinic acid	4-5 g/kg	3800/kg
Sorpherol	Sorbitol, Choline chloride, DL-Methionine, Vit-E, Vit-C, Vit-B12	2-3 g/kg feed	1850/kg
Protimin	Amino Acid and Mineral	1 g/kg feed	450/500 ml
Krill Meal	Crude Protein, Crude Fat, Crude Fiber	1-2 g/kg feed	150/100 g
Bigarol-Tuna	Tuna flavor, Aquatic Attractant, Potassium Sorbate, Silicon Dioxide	15-20 g/kg feed	390/100 g
Sun Vita	Vitamins, Minerals	1-2 g/kg feed	280/kg
Aquazyme Plus	Enzymes (unknown)	0.5-1 g/kg feed	636/kg

Table 3: Probiotic recorded in the study area.

Name	Active Ingredient	Doses	Price (BDT)
Pond Life	<i>Bacillus sp.</i> , <i>Nitrosomonas</i> , <i>Rhodococcus</i>	10 kg/acre	358/kg
Aqua Photo	<i>Rhodospseudomonas sp.</i> , <i>Bacillus sp.</i>	0.7 ml/acre	50/100 ml
Pond care	<i>Bacillus sp.</i>	225 g/acre	9200/kg
Biopond	Zeolite and <i>Bacillus sp.</i>	2-3 kg/acre	375/kg
Biogrow	<i>Bacillus sp.</i> , Vitamins, Minerals	2-3 kg/acre	510/kg
Pond care	<i>Bacillus sp.</i>	225 g/acre	9200/kg
Gasonil	<i>Yucca</i> plant extract, <i>Bacillus sp.</i>	150 g/acre,	460/100 g
Dynablend	<i>Yucca</i> plant extract, <i>Bacillus sp.</i>	500 g/acre	470/100 g
Gas Care Pro	<i>Yucca schidigera</i> , <i>Aloevera</i> , Microbes	250 g/acre	420/100 g

**Table 4:** Water quality management aqua-drugs.

Name	Active Ingredient	Doses	Price (BDT)
Pondkleen	Yucca plant extract	300 ml/acre	350/100 ml
Pathonil	Alkyl dimethyl benzyl ammonium chloride 80%	600 ml/acre.	265/100 ml
Fishcare Gold	Ca, KMnO <sub>4</sub> , P, Cu, Al <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub>	150 g /acre	122/500 g
Vita-Plankton	N, P, K, Mg	1-2 kg/acre	330/500 g
Plankton Grow	Minerals	6 kg/acre	150/kg
Megazeo Plus	Granular Zeolite	10-15 kg/acre	56/kg
Acme's Geolite	Aluminium sodium silicate	10-15 kg/acre	56/kg
Ukasol	Yucca plant extract	200-300 ml/acre	320/100 ml
Nordcap Fish Gold	Ca, KMnO <sub>4</sub> , P, SO <sub>4</sub> , Cu, Al	1.5 kg/ac	110/500 g
Ammocure vet	Yucca plant extract	200-300 ml/acre	315/100 ml

**Table 5:** Oxygen supplier aqua-drugs.

Name	Active Ingredient	Doses	Price (BDT)
Oxymax	90% Na <sub>2</sub> CO <sub>3</sub>	250-300 g/acre	700/kg
Aci-Ox	Na <sub>2</sub> CO <sub>3</sub> , H <sub>2</sub> O <sub>2</sub>	250-500 g/acre	742/kg
Oxy-A	Na <sub>2</sub> CO <sub>3</sub>	300-400 g/acre	580/kg
Oxycon	Na <sub>2</sub> CO <sub>3</sub> , Released O <sub>2</sub>	300-400 g/acre	800/kg
M:H-10	90% Na <sub>2</sub> CO <sub>3</sub>	500-600 g/acre	610/kg
Oxymore	Na <sub>2</sub> CO <sub>3</sub>	250-500 g/acre	760/kg
Oxy gold	Na <sub>2</sub> CO <sub>3</sub> (90%)	250-500 g/acre	635/kg

**Table 6:** Insecticide Aqua-drugs used in the study area.

Name	Active Ingredient	Doses	Price (BDT)
Acimec 1% Oral solution	Ivermectin, Excipients	300 ml/acre	107/100 ml
Rota Plus	Rotenon	2 kg/acre	480/kg
Angreb	Cipermethreyn	60-70 ml/ac	130/100 ml

**Table 7:** Disinfectant in the study area.

Name	Active Ingredient	Doses	Price (BDT)
Virex	Potassium peroxymonosulphate, Sodium dichloroisocyanurate	400-600 g/acre	1420/kg
Timsen	n-alkyl dimethyl benzyl ammonium	80 g/acre	261/50 g

**Table 8:** Antibiotics found in the study area.

Name	Active Ingredient	Doses	Price (BDT)
Novamix-104	Erythromycin thiocyanate, Sulfadiazine, Trimethoprim	0.1 g/kg body weight	4150/kg
Renamycin	Oxytetra cycline hydrochloride	2-3 g/kg feed	870/kg

### Aqua-drugs used as antibiotics

Two types of antibiotics were found which are used by mixing with feed (Table 8).

## DISCUSSION

Aquaculture practices in Bangladesh are increasing day by day. With the intensification of aquaculture practices in recent years in Bangladesh, uses of aqua-drugs were increased. In Bangladesh, aqua-drugs are used to improve water quality, dissolved oxygen level, as disinfectants, antibiotics, growth promoter, probiotics,

and insecticides in the culture system. Seven categories of aqua-medicines and chemicals were used by small fish farmers, commercial fish farmers and hatchery owners in Shatkhira District [24]. Eight different categories of aqua-drugs and chemicals were found to use in shrimp farming activities in the coastal belt of Bangladesh as oxygen suppliers, disinfectants, growth promoters, antibiotics, pond preparatory, gas removal, insect killers, and microbe killers [25]. Six categories of aqua-drugs and chemicals were found to be used by fish farmers and hatchery owners for water quality management, disinfectants, disease treatment, antibiotics and growth promoter [22]. The present study identified that eight

categories of aqua-drugs and chemicals were used by the fish farmers and farm owners. Drugs and chemicals were used as oxygen supplier, growth promoter, antibiotics, vitamins, disinfectants, gas reducer, disease treatment and water quality management which was similar to the findings of Alam et al. [24], Ahmed et al. [25], Sharker et al. [22], Rahman et al. [26], Adhikary et al. [27] and Chowdhury et al. [28].

From the study, it was observed that many aqua-drugs were available in the study area. Square Aquamix, Acilina, Liquavit, Eskavit C Aqua, Acimix Super Fish, DCP Gold, Pond Toss, Antistress, Biozyme, Ossi C, Sorpherol, Protimin, Krill Meal, Bigarol-Tuna, Sun Vita, Aquazyme Plus were available as a growth promoter. Pondkleen, Pathonil, Fishcare Gold, Vita-Plankton, Plankton Grow, Megazeo Plus, Acme's Geolite, Ukasol, Nordcap Fish Gold, Ammocure vet, were available for water quality management. Pond Life, Aqua Photo, Pond care, Biopond, Biogrow, Pond care, Gasonil, Dynablend, Gas Care Pro was available as probiotics. Oxy-max, Aci-Ox, Oxy-A, Oxycon, M: H-10, Oxymore, Oxy gold were available as an oxygen supplier. Acimec 1% Oral solution, Rota Plus, Angreb, were available as insecticides. Virex and Timsen were available as disinfectants. Novamix-104, Renamycin were available as antibiotics. A number of authors reported that different types of drugs and chemicals used in Bangladesh. Geotox, Zeolite, Zeocare, Lime, Mega Zeo, Bio Aqua, Aquanone and Zeo prime used for the pond preparation and water quality management. Bleaching, Aquakleen, BKC, EDTA, Etinol, formalin were used for the treatment of disease. Renamycin, Bactitab, Chlorsteclin, Comm-Vet, Orgacycline 15%, Oxy-sentin 20% and Sulfatrim were widely used antibiotics in the coastal region of Bangladesh [22]. Geotox, JV Zeolite, Aquakleen, Biomin Aquaboost were used for water quality management; Oxytlow, Bio Care, Oxylife to improve dissolve oxygen level; Megavit Aqua, Aqua Boost, Aquamin, Acimix Super-fish, Square Aquamix, Vitax-C as growth promoter; Oxy-sentin 20%, Captor, Aquamycine, Renamycin soluble powders antibiotics; Hepaprotect-Aqua, timsen, Virex, Poigard Plus as disinfectant, lime, salt, formalin, potash and malachite green were used against fish diseases in different region of Bangladesh [8,4,19-21,26-29]. Customers get different types of technical support and instruction from pharmaceutical representatives about the use of an oxygen supplier [2,7].

Growth promoter is used to increase body growth of fish and also to enhance the productivity of fish. Faruk et al. [23] found that megavit aqua, aqua boost, aqua savor, vitamin premix, fibosol, grow fast, orgavit aqua, aq-cell, aqgrow-g, fish vita plus, aq growl, growmax, nature aqua gp, vitamix, F aqua, acimix and many more chemicals have been used as growth promoters to increase production. From the present study, it was found that Square Aquamix, Acilina, Liquavit, Eskavit C Aqua, Acimix Super Fish, DCP Gold, Pond Toss, Antistress, Biozyme, Ossi C, Sorpherol, Protimin, Krill Meal, Bigarol-Tuna, Sun Vita, Aquazyme Plus were available as growth promoter from five pharmaceutical companies. In their Square Aquamix, Acimix Super Fish, Liquavit were mostly available growth promoter in the study area.

Water quality is one of the significant concerning a matter in aquaculture. Water quality includes natural productivity, pH level, water clarity etc. For maintaining water quality there were found Pondkleen, Pathonil, Fishcare Gold, Vita-Plankton, Plankton Grow, Megazeo Plus, Acme's Geolite, Ukasol, Nordcap Fish Gold,

Ammocure vet, from five pharmaceutical companies in there Pathonil, Plankton Grow, Megazeo Plus were mostly available aqua-drugs. Yucca plant extract, Granular Zeolite, Alkyl dimethylbenzyl ammonium chloride were the main active ingredients of these aqua-drugs. These similar findings are also revealed by the study of Biswas et al; Chowdhury et al., Rahman et al. [26-29].

Now-a-days, probiotic is an essential ingredient for inhibits the produce or growth of harmful bacteria by producing different types of beneficent bacteria. Different types of harmful bacteria cause different types of harmful bacterial disease. Pond Life, Aqua Photo, Pond care, Biopond, Biogrow, Pond care, Gasonil, Dynablend, Gas Care Pro as probiotics from three pharmaceutical companies. Pond Life, Biopond, Pond care were the most available probiotics. The main active ingredients of probiotics were *Bacillus subtilis*, *Bacillus megaterium*, *Bacillus mensentericus*. These similar findings are also revealed in Sylhet district by the study of Chowdhury et al. and Rahman et al. [26,28].

Disinfectants are widely used in many spheres of aquaculture. In our country, these are not frequently used in culture practice. They are used mainly used cleaning microbes, insects, algae, to maintain hygiene and in some cases to treat diseases. Virex and Timsen were available in the study area act as antifungal agents and the control of ectoparasites, most often in aquaculture systems and general disinfectant for aqua-culture equipment. Formalin, bleaching and EDTA were used as disinfectants of which formalin was the most widely (43% farmers) used disinfectant found by Chowdhury et al. and Rahman et al. [26,28].

An antibiotic is a substance produced by one microorganism that selectively inhibits the growth of another microorganism. Novamix-104, Renamycin were found as antibiotics two pharmaceutical companies in the study area. Chowdhury et al. [28] and Rahman et al. [26] found that in Oxytetracycline was the most widely used (47% farmers) antibiotic besides farmers used chlortetracycline and amoxicillin for disease treatment. Erythromycin thiocyanate, Sulfadiazine, Trimethoprim and Oxytetra cycline hydrochloride USP were the active ingredients of those aqua-drugs. Oxytetracycline is one of the most widely used antibacterials in aquaculture worldwide.

Insecticides are mainly used for eradication of different unwanted fish and insects which are harmful to good aquaculture practices. There were found Acimec 1% Oral solution, Rota Plus, Angreb in the study area from two different pharmaceutical companies. The main active ingredient were cipermethreyn, rotenone and ivermectin, excipients. Chowdhury et al. [28] and Biswas et al. [29] found that a large number of farmers used rotenone in nursery preparation and 80% of farmers in culture preparation. In addition, sumithion, malathion, diesel and dipterex were used as insecticides, 53% of the nursery farmers and 43% of grow-out owners used sumithion.

In the present study, about 13 pharmaceutical companies were found either producing or marketing products targeting aquaculture. Some products imported from different countries including India, USA, Vietnam, Indonesia, Holland, Peru, Germany, Canada, Belgium, England and Spain. They provide details information about the purposes, dosages, duration and method of application of chemicals in the leaflet. However, farmers had a different opinion about the use and efficacy of many of the products. Some

companies were seen to provide technical assistance to the farmers. In the present study, there were found 13 aqua-drug shops in the research area in there all shops were mixed type such that besides aqua-drug, there were also found animal feeds and poultry products.

## CONCLUSION

Aqua-drugs play important role in present aquaculture system, such that they are intensive, semi-intensive, semi-closed or closed systems. Aquaculture in Noakhali region is increasing rapidly and use of chemicals in aquaculture is also increasing simultaneously. The present study identified that different types of aqua-drugs were used for different purposes. A total 49 of aqua-drugs with seven types were found in survey area. A training session before use of any drugs by the respective company, NGO or government can be done for the basic fish health management strategies. Results of the present study will help further researches in aqua-drugs.

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