



## **Aqua Drugs and Chemicals Used in Aquaculture in Jamalpur Sadar Upazila of Bangladesh**

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### **Authors' contributions**

*This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.*

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### **ABSTRACT**

The present study was conducted to know the present status of use of commercial aqua drugs and chemicals and their impact on fish health management in Jamalpur sadar upazila (sub-district). A questionnaire survey was conducted for a period of seven months from December 2013 to June 2014 from nineteen small scale fish farms, seven commercial fish farms, eight fish hatcheries and seven chemical retailers. Five categories of aqua drugs and chemicals were identified and noted in the study area. Those drugs and chemicals were produced by the following seven pharmaceutical companies: Square Pharmaceuticals Ltd., Novarties Animal Health, ACI Animal Health, Fish Tech BD Ltd., Acme Laboratories, Reneta, and Eon Animal Health. Different types of diseases such as edwardsiellosis, EUS (epizotic ulcerative syndrome), red spot and different parasitic diseases were found to occur in pangus (*Pangasius hypophthalmus*), tilapia (*Oreochromis nilotica*), sharputi (*Puntius sarana*), rui (*Labeo rohita*), mrigal (*Cirrhinus mrigala*), Thai koi (*Anabas testudineus*), shing (*Heteropneustes fossilis*) and silver carp (*Hypophthalmichthys molitrix*). Geotox, JV Zeolite, Aquakleen and Biomin Aquaboost were used for water quality management; Oxyflow, Bio Care

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and Oxylyfe to improve dissolve oxygen level; Megavit Aqua, Aqua Boost, Aquamin, Acimix Superfish, Square Aquamix and Vitax-C as growth promoter; Oxysentin 20%, Captor, Aquamycine and Renamycin soluble powder as antibiotics; Hepaprotect-Aqua, Timsen, Virex, Polgard Plus as disinfectant; lime, salt, formalin, potash and malachite green were used against fish diseases. Susceptible months of disease outbreak in the study area were November to February. The recovery of fish diseases was found from 50% to 95% in Jamalpur region. Farmers' poor understandings about the application of aqua drugs and proper withdrawal period were found in the study area which might have adverse effect on fish and human health. Proper training of fish farming community about the appropriate dose and administration methods should be suggested for safe and sustainable aquaculture practices.

*Keywords: Aqua drugs; chemicals; fish diseases; aquaculture.*

## 1. INTRODUCTION

Aquaculture plays a vital role in the national economy of Bangladesh as well as fulfills the animal protein demand and creates new employment opportunity, helps in poverty alleviation and improves socio-economic conditions of people. It helps us to earn foreign currency and contributes 3.61% to national GDP and 24.41% to the agricultural GDP of Bangladesh [1]. It is essential to intensify aquaculture to contribute more in national GDP.

Aqua-medicines are widely used in aquaculture system for various purposes such as pond building, health management, soil and water management, enhancement of natural aquatic productivity, transportation of live organism, feed formulation, manipulation and improvement of reproduction and growth promotion. In aquaculture, chemicals can be classified by the purpose of uses, the type of organisms under culture, the life cycle stage for which they are used, the culture system, intensity of culture and by the type of people who use them [2].

Aquaculture practices are increasing day by day in Bangladesh. So, trend of use of aqua-medicines is also increasing. Commonly used chemicals in aquaculture are lime, rotenone, various forms of inorganic and organic fertilisers, salt, dipterex, antimicrobials, potassium permanganate, copper sulphate, formalin, sodium chloride, potash, malachite green, methylene blue, sumithion, melathion etc. [3,4]. Treatment by sodium chloride is an old treatment for diseases of fish. It is normally used for parasitic and fungal disease of fish. Formalin and malachite green are widely used for external

parasitic disease and EUS (epizotic ulcerative syndrome) of fishes. Potassium permanganate ( $\text{KMnO}_4$ ) is used for the treatment of ponds. It is good for protozoan infestations on the skin, gills and fins [5]. Most of the farmers have only limited or no knowledge about the appropriate dosages and method of application. This is due to lack of information regarding the present status and consequences of aqua-medicines use in aqua-health management.

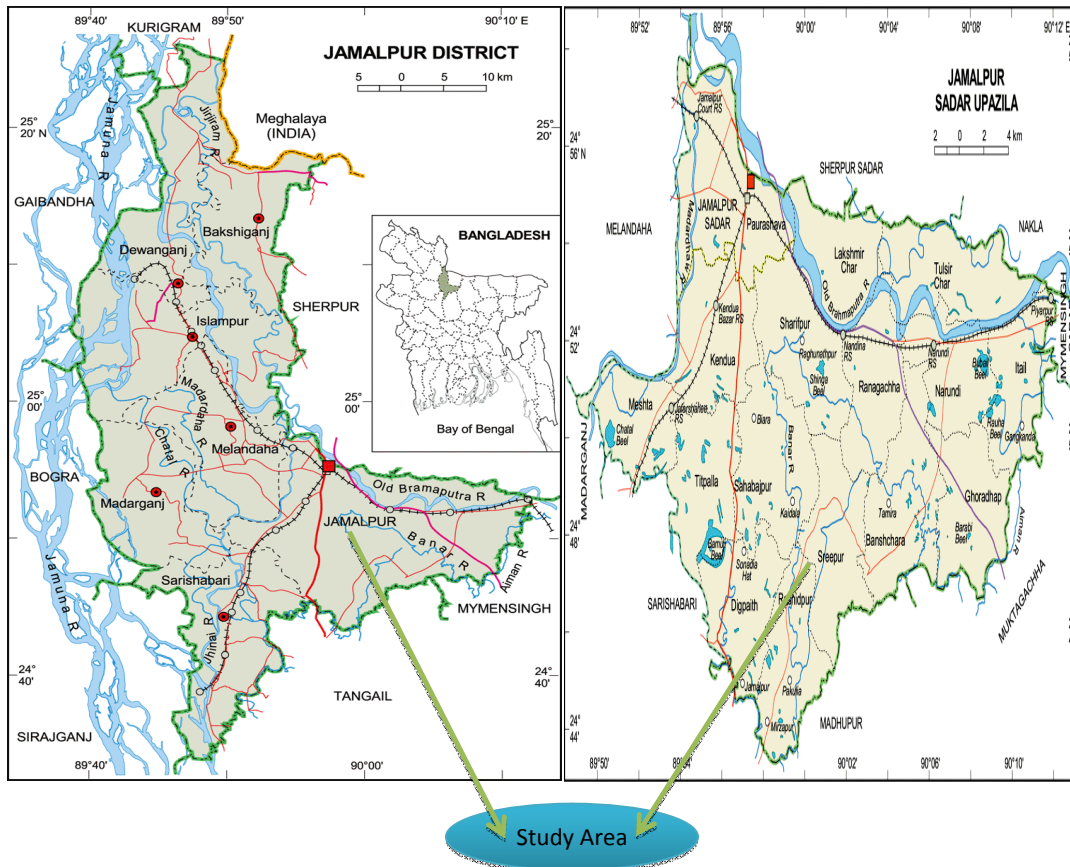
However, use of aqua-medicine creates environmental degradation in some areas making the water quality unsuitable for aquaculture. On the other hand, fish disease is a great threat to achieve optimum production and become a limiting factor to the economic success of aquaculture in Bangladesh. So, fish farmers use a variety of aqua drugs and chemicals to overcome such undesirable problems.

With the development of aquaculture in the Jamalpur region, the use of chemicals, antibiotics and aqua drugs are increasing fast. But no research works have been carried out on the use of drugs in aquaculture for fish culture and health management in that region. For this reason, the present research work was carried out to know various types of aqua drugs and chemicals used in aquaculture practices in Jamalpur Sadar Upazila and the effectiveness of aqua drugs on fish health and production.

## 2. MATERIALS AND METHODS

### 2.1 Study Area

The present study was carried out in Sadar upazila of Jamalpur district (Fig. 1).



**Fig. 1. Study area**  
(Source: *Banglapedia*)

## 2.2 Study Period

The survey was carried out for 7 months from December 2013 to June 2014.

## 2.3 Survey Questionnaire Preparation

Survey questionnaire was prepared to collect the expected data according to the objectives of the study. A draft questionnaire was first prepared and then pre-tested to verify the relevance of the questions and the nature of the response of the sample procedure. A final survey questionnaire with the schedule was developed after necessary adjustment.

## 2.4 Target Group

Data were collected from different target groups which cover 19 small scale (subsistence) fish farms, 8 fish hatchery, 7 commercial fish farms and 7 chemical retailers were investigated in Sadar upazila of Jamalpur district.

## 2.5 Data Collection Method

By direct questionnaire interview, data were collected from commercial fish farmers, small scale fish farmers, hatchery owners, chemical sellers and medicine representatives. Major topic of questionnaire were names of small scale fish farmers, commercial fish farmers, hatchery owners, chemical sellers, chemicals, active ingredients of chemicals, sources of chemical, purpose of use, method of application, dose, effectiveness, duration, price, effect on environment, impact on health and productivity. Questionnaire set was prepared separate for each group. Each person responded was given a brief introduction about the nature and purpose of the study during the interview. They were asked the questions systematically in a very simple manner. Answers of those questions were properly recorded.

## 2.6 Data Analysis

After data collection, all data were arranged in tabular form to fulfill the purposes of the study.

Simple descriptive analysis and tabular presentation of data were carried out by using Microsoft Word and Microsoft Excel (Version 2010).

### **3. RESULTS AND DISCUSSION**

#### **3.1 Major Aqua-medicine Companies and Their Products Available in Jamalpur**

Seven medicine companies were found in Jamalpur sadar upazila such as Square Pharmaceuticals, Novartis Animal Health, ACI Animal Health, Fish Tech BD Ltd., Acme Laboratories, Reneta, and Eon Animal Health. Various types of Aqua-medicine were produced by these seven companies which were widely used in aquaculture activities for water quality management, disinfection, improving dissolved oxygen level, using as antibiotics and growth promoter.

##### **3.1.1 Aqua-medicines used for water quality management**

During pond preparation and water quality improvement of fish ponds, different types of aqua-medicine were used. Geotox, JV Zeolite, Mega Zeo Bio Aqua and Acme's Zeolite, Benthod, Ammonil Gastrap, Biomin Pond Life, Aquakleen and Biomin Aquaboost were used for water quality management. List of such chemicals with their active ingredients, prescribed dosage, sources and approximate prices in BDT (Bangladeshi Taka) are shown in Table 1. Faruk et al. [6] also found drugs like Geotox, JV Zeolite, Mega Zeo, Lime, Bio Aqua and Acme's Zeolite used for improving water quality. Ali [7] and Rahman [8] observed slightly different types of chemicals used for improving water quality of fish ponds like Geotox, Green Zeolite, Lime, Pontox Plus, Mega Zeo, Benzo, Zeocare, Bio aqua, Bis Zeolite, Super-Zeolite, Bio-Tuff, Acme's Zeolite, Aquazet, Fish Grow and biolite Plus. Moreover, chemicals like Urea, Triple Super Phosphate (TSP), cow-dung and Murate of Potash (MP) used mainly for increasing primary productivity in various fish ponds in Jamalpur.

##### **3.1.2 Aqua-medicines used to improve dissolve oxygen level**

For improvement of dissolve oxygen level, Oxyflow, Oxymax, Bio Care, Bio-Ox, Oxy-Gold, Oxy-A and Oxylife were used in the study area

(Table 2). Rahman [8] observed that aqua drugs like Oxy-Gold, Oxyflow, Bio Care, Oxy Plus, Pure Oxy, Oxymax and Oxy flow were used to increase dissolve oxygen. According to local agents of Novartis Pharmaceuticals Ltd., Eon Animal health Products Ltd., ACI Animal Health and Square Ltd., Oxyflow, Oxymax, Bio- Ox and Oxylife are used to remove hardness and poisonous gases from pond.

##### **3.1.3 Aqua-medicines used as growth promoter**

Several aqua medicines were found in the Aqua-medicine company used as growth promoter as well as to increase production. Medicine like Megavit Aqua, Aqua Boost, Aquamin, Acimix Super-fish, Aqua-C, Cevit-Aqua, Square Aquamix, Panvit-Aqua, Cp-Vet WSP, E-Vet Plus, Vitamix F-Aqua, Rena-WS, Rena C, Rena Fish, Vitax-C, Vitax-ES, Charger Gel and Bio-Permix (Gold) were used (Table 3). Ali [7] observed Aqua drugs like Megavit Aqua, Aqua Boost, Orgavit Aqua, Vitamin Premix, Aqua Savor, Grow Fast, Diginex, Aqua, Fibosol, Aqua Grow-P, Vitamix F Aqua, Cevit Vet, diamond Fish, AQ Grow-G, Nature Aqua GP, ACmix Super-Fish and Aquamin Powder with the active ingredients include Vitamin, Mineral, Amino Acid, Organic acid,  $\beta$ -Glucan, Binder, Aloe Vera and Multivitamin were used as growth promoter. Rahman [8] was observed that aqua drugs used as growth promoter were charger Gel, Aqua Boost, Bio-Grow and Grow Fast. The entire growth promoter played a vital role for rapid growth of fishes. According to chemical sellers of study area, aqua Boost and AC Mix Super-Fish also used to prevent diseases in fish. Faruk et al. [6] observed that Aqua Boost and AC Mix Super-Fish also had disease preventing ability in fishes.

##### **3.1.4 Antibiotics used for fish disease treatment**

Most farmers used Oxysentin 20%, Captor, Acimox (vet) Power, Aquamycine, Oxy-Dox-F 100, Oxy-D Vet, Renamycin Soluble Powder, Moxilin Vet WSP, Tetravet WSP, Doxy-A Vet WSP for disease treatment. The list of such chemicals with their active ingredients, prescribed dosage, sources and approximate price are shown in Table 4. A number of authors also reported similar conditions about the use of antibiotics in aquaculture of Bangladesh [3,9, 10]. According to the information of leaflet provided by Eon Animal Health products Ltd.

above antibiotics were effective against bacterial diseases. Monsur [11] observed 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 ACmix Super-Fish against fish diseases and health problems of their cultured fishes. MacMillan [12] mentioned that antibiotics should be used only for the treatment of bacterial diseases. In a questionnaire interview, local agent of Novartis Animal Health mentioned that some of above antibiotics like Oxysentin 20%, Capter were also effective against EUS. Ali [7] and Rahman [8] also found that antibiotic like Oxysentin 20%, Orgacycline 15% were effective against EUS. Antibiotics were most effective when administrated at the early stage of disease. Aoki et al. [13] also found that antibiotics were most likely to be effective when administrated at the early stage of a disease. Uses of antibiotics are responsible for environmental pollution and affected human health due to drug residues. Burrige et al. [14] observed that use of antibiotics for aquatic animals might not only initiate environmental pollution problem but also affected human health due to drug residues.

### 3.1.5 Aqua-medicines used as disinfectant

Disinfectants are widely used in many spheres of aquaculture. They are mainly used to disinfect hatchery and other equipment. Hepaprotect-Aqua, Hepaprotect-Aqua, timsen, Virex, Polgard Plus and Eraprim vet were used as disinfectants. Farmers used chemicals as a disinfectant to keep their pond free from pollution or pathogen (Table 5). Rahman [8] observed that disinfectants were Polgard Plus, Bactisal, Virex, Biogaurd, Lenocide, timsen, Emsen, Aqua Cleaner Plus, formalin and bleaching Powder. According to the sales representative of Eon animal Health Products Ltd. timsen was also used as preventive measures for some bacterial, fungal and viral infections. Shamsuddin [15] observed 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. Ali [7] observed that timsen was effective to prevent some bacterial and fungal infections. Apud [16] observed that farmers used formalin as a disinfectant and to control protozoan diseases and lime as disinfectant. In Jamalpur region, farmers used formalin and salt as disinfectant to control protozoan and fungal diseases.

## 3.2 Small Scale Fish Farmers in Jamalpur Sadar

In Jamalpur district, farmers cultured mostly Thai pangus, Thai koi, tilapia, rui, mrigal, common carp, magur and shing. They were found to collect fry of fish from Mymensingh, Bogra, Jamuna river and local hatchery. Polyculture were found to be widely practised in this district. Some farmers followed the monoculture system. List of the investigated fish farms with the name of the farmers, size of farm, culture system, cultured species, stocking density and production are shown in Table 6.

### 3.2.1 Disease problem

Disease problems were found most common in the fish farms. Disease outbreak mostly occurred during winter. Most of the affected fishes were brood fish and fish fry. Fish were affected by different types of diseases such as EUS, edwardsiellosis, redspot, swollen abdomen and white spot. Affected fishes were tilapia, rui, catla, mrigal, sharputi, pangus, shing and Thai koi.

## 3.3 Commercial Fish Farmers in Jamalpur Sadar

In Jamalpur sadar, most of the commercial fish farmers have own fish farms. They cultured different fish species such as rui, catla, sharputi, tilapia, mirror carp, mrigal, bata, shing, magur, pabda etc. They were found to be well trained from various types of governmental organisations (GO) and non-governmental organisation (NGO). They were found to have own fry nursing facilities, good sanitation system and water treatment facilities. A list of fish culturists together with the name of their farms, size of farms, culture system, cultured species, stocking density and production are shown in Table 7.

### 3.3.1 Disease problem

Disease problems' possibilities were found very low in the farm of commercial fish culturists. However, sometimes few diseases were found to occur. Those are bacterial disease, fungal disease, parasitic disease etc. Affected fishes were tilapia, rui, catla, mrigal, sharputi, pangus, shing, Thai koi etc. A list of the investigated disease, clinical sign, species, prevalence (%), season and recovery (%) are shown in Table 8.

**Table 1. Aqua-medicines used for water quality management**

Trade Name	Active ingredients	Dose	Source	Price (BDT)
Geotox	SiO <sub>2</sub> , Al <sub>2</sub> O <sub>3</sub> , CaO, MgO, Na <sub>2</sub> O	For 3-6 feet deep water 20-25 Kg/dec. about 30-40 days.	Novarties Animal Health Ltd.	55/Kg
JV Zeolite	SiO <sub>2</sub> , Al <sub>2</sub> O <sub>3</sub> , Fe <sub>2</sub> O <sub>3</sub> , CaO, MgO, Na <sub>2</sub> O, K <sub>2</sub> O, Mn, P	6-7 Kg/33dec up to mud	Eon Animal Health Products Ltd.	350/10 Kg
Mega Zeo	SiO <sub>2</sub> , Al <sub>2</sub> O <sub>3</sub> , Fe <sub>2</sub> O <sub>3</sub> , CaO, MgO, Na <sub>2</sub> O, K <sub>2</sub> O, Mn	200 g/dec	ACI Animal Health	340/10 Kg
Bio Aqua-50	Extract of <i>Uka cidizera</i> tree	60-70 ml/dec for 3-4 ft depth	Eon Animal Health Products Ltd.	300/100 ml
Acme's Zeolite	SiO <sub>2</sub> , Al <sub>2</sub> O <sub>3</sub> , Fe <sub>2</sub> O <sub>3</sub> , CaO, MgO, NaO	10-15 Kg/acre for 3-4 ft depth	Acme Laboratories Ltd.	375/10 Kg
Benthod	Organic manure, Vitamin, Minaral	100-150 g/dec	ACI Animal Health	750/20 Kg
Ammonil	Yucca Plant Extract	100-200 g/acre for 3-6 ft depth, 1 time every month	Novartis Animal Health Ltd.	580/200 g
Aquakleen	Tetradesail trymethyl ammonium, BKC, Aminonitrogen etc.	0.5-1 L/acre	SQUARE Pharmaceuticals Ltd.	432/L
Gastrap	Lactic acid, Bacelas subtiles, amyles, proteas etc.	300 g/acre	SQUARE Pharmaceuticals Ltd.	300/100 g
Biomin Pond Life	Probiotics	200 g/Bigha	Renata Ltd.	2100/Kg
Biomin Aquaboost	Amino acid, natural immune-stimulating substance	100 g/100 Kg feed	Renata Ltd.	480/Kg
Zeolite Gold	SiO <sub>3</sub> , MgO, CaO <sub>2</sub> etc.	200-250 g/dec	Fish Tech BD Ltd.	410/10Kg
Polgard+	3-Methyl, 4-Alkyl Two chain Brominated compound etc.	500 ml/acre	Fish Tech BD Ltd.	1095/500 ml

**Table 2. Aqua-medicines used to improve dissolve oxygen level**

Trade Name	Active ingredients	Dose	Source	Price (BDT)
Oxyflow	H <sub>2</sub> O <sub>2</sub> 10%	General dose 250-350 g/acre. In case of high deficiency 500 g/acre in same water body.	Novartis Pharmaceuticals Ltd.	800/Kg
Oxymax	Calciumper oxid	250-300 g/acre for 3-4 ft depth 2.5-3 g/dec	Eon Animal health Products Ltd.	360/500 g
Bio Care	Sodium Lorile Ether Sulphate	80-120 ml/100 dec.	ACI Animal Health	300/L
Bio- Ox	Sodium percarbonat	10 g/dec	ACI Animal Health	475/Kg
Oxy-Gold	Sodium Percarbonate 90%	General dose 250-500 g/acre. In case of high deficiency 750-1000 m/acre in same water body.	Fish Tech BD Ltd.	670/Kg
Oxy-A	Sodium percarbonat	General dose 300-400 g/acre. In case of high deficiency 500-700 g/acre in same water body.	Acme Laboratories Ltd.	480/Kg
Oxylife	O <sub>2</sub> Precursors, Prebio-tics, Detoxificant	400 g/acre	Square Ltd.	610/Kg

**Table 3. Aqua-medicines used as growth promoter**

Trade Name	Active ingredients	Dose	Source	Price (BDT)
Aquamim	Methionin, Lysin	2-4 g/Kg feed	ACI Animal Health	140/Kg
Acimix Super-fish	Vitamin, Mineral, Amino acid	2.5 g/Kg feed	ACI Animal Health	325/2.5 Kg
Aqua-C	Vitamin C BP 50g	2-4 g/Kg feed	ACI Animal Health	100/100 g
Megavit-Aqua	Vitamin A, Ca, P, Na etc.	100 g/100 Kg feed	Novarties Animal Health	360/Kg
Aqua Boost	Organic acid, Beta Glucan, Manna, Oligosaccharide	500 g/ton feed	Novarties Animal Health	580/Kg
Cevit-Aqua	L-Ascorbic acid 990 mg	2-3 g/Kg feed	Square Pharmaceuticals Ltd.	210/100 g
Square Aquamix	Vitamin, Amino acid, Mineral, Probiotic, Antioxydent etc..	1 g/Kg feed	Square Pharmaceuticals Ltd.	295/Kg
Panvit-Aqua	Vitamin A, B, D, Ascorbic acid etc.	5-10 ml/Kg feed	Square Pharmaceuticals Ltd.	125/100 ml
CP-Vet WSP	Elemental Ca 42g, Elemental P 15g, Vit C 6g etc.	6-8 mg/Kg feed	Acme Laboratories	186/500 g
E-Vet Plus	Vit E100 mg, Selenium 0.5mg	5 ml/Kg feed	Acme Laboratories	385/500 ml
Vitamix F-Aqua	Vit A, D, E, B, Folic acid, Ca, Mg, P, Fe, Cu etc.	1 g/Kg feed	Acme Laboratories	280/ Kg
Rena-WS	Vit A, D, E, B, C, K, Folic acid etc.	100 g/100 Kg feed	Reneta Ltd.	235/Kg
Rena C	Ascorbic acid 99g	1-2 g/Kg feed	Reneta Ltd.	1725/Kg
Rena Fish	Vit A, B, C, D <sub>3</sub> , E, K, Cu, Mn, Fe, Co etc.	1 Kg/ton feed	Reneta Ltd.	260/Kg
Timsen	n-Alkyldimethyl benzylammonium chloride, Stabilized urea	20 g/33 dec. (Prevention) 80 g/33 dec. (Treatment)	Eon Animal Health	260/50 g
Vitax-C	Vit C BP 100mg/g powder	1-2 g/2-3Kg feed	Eon Animal Health	200/100 g
Vitax-ES	Vit E, Selenium	0.25 g/Kg feed	Eon Animal Health	256/100 g
Charger Gel	1-3 D-Glucan, Polysaccharides,	6-8 g/Kg feed	Fish Tech BD Ltd.	1060/Kg
Bio-Permix (gold)	Vit A, B, D, E, C, K, Niacin	100-150 g/100 Kg feed	Fish Tech BD Ltd.	360/Kg

**Table 4. Antibiotics for disease treatment**

Trade Name	Active ingredients	Dose	Source	Price (BDT)
Aquamycine	Oxytetracyclin HCL 25%	1-2 g/Kg feed	ACI Animal Health	70/100 g
Oxy-Dox-F 100	Oxytetracyclin HCL 20% + Doxycycling	1-2 g/Kg feed	ACI Animal Health	150/100 g
Captor	Clorotetracyclin HCL 45%	50-70 g/100 Kg feed	Novartis Animal Health	405/100 g
Oxysentin 20%	Oxytetracyclin HCL 200mg	100-200 g/100 Kg	Novartis Animal Health	840/1 Kg
Doxy-A Vet WSP	Doxycyclin Hyclat USP	4-6 g/Kg feed	Acme Laboratories Ltd.	151/100 g
Tetravet WSP	Oxytetracyclin HCL 500 mg/g	4-6 g/Kg feed	Acme Laboratories Ltd.	134/100 g
Moxilin Vet WSP	Amoxicilin-trihydrate 300 mg/g	50-60 mg/Kg body wt.	Acme Laboratories Ltd.	1103/Kg
Renamycin	Oxytetracyclin 200mg	50 mg/Kg body wt.	Reneta Ltd.	72/100 g
Oxy-D Vet	Oxytetracyclin 20% Doxycyclin 10%	5-10 g/Kg body wt.	Eon Animal Health	172/100 g

**Table 5. Aqua-medicines used as disinfectant**

Trade Name	Active ingredients	Dose	Source	Price (BDT)
Ossi C	Oxilinic acid, Betaglucan, Vitamin C	4-5 g/Kg feed	Fish Tech BD Ltd.	380/100 g
Timsen	n-Alkyldimethyl benzyl ammonium chloride, Stabilised urea	20 g/33 dec. (Prevention) 80 g/33 dec. (Treatment)	Eon Animal Health Products Ltd.	260/50 g
Virex	Potassium Peroxymono sulfate 50%	200 g/33 dec.	ACI Animal Health	100/100 g
Polgard Plus	3-Methyl, 4-Methyl	500 ml/acre	Fish Tech BD Ltd.	460/200 ml
Eraprim vet	Erythromycin Thiocyanate 180mg, Sulphadiagin 150mg, Trimethoprim BP 30mg	1 g/10 Kg body wt.	Fish Tech BD Ltd.	307/100 g
GPC-8	Glutaraldehyde, Phosphoric acid	100 ml/33 dec mix in 20ltr water for 3-4 ft depth	Reneta Ltd.	92/100 ml

**Table 6. Status of visited small scale fish farms in Sadar upazila of Jamalpur district**

Sl. No.	Name of farms	Name of farmers	Farm Size (acre)	Culture System	Cultured species	Stocking Density (fry/ha)	Production (tons/ha)
1	Merazul Fish Farm	Merazul Islam	14	Poly-culture	Pangus, Tilapia, Common carp, Rui	10120	4.85
2	Nazrul Fish Farm	Nazrul Islam	7	Poly-culture	Rui, Mrigal, pangus, Tilapia	8097	4.04
3	Farid Fish Farm	Farid Mollah	10	Poly-culture	Rui, Silver carp, Tilapia, Thai pangus	8097	3.23
4	Zahurul Fish Farm	Zahurul Islam	13	Poly-culture	Thai pangus, Koi, Tilapia, Tengra, Rui, Pabda	10120	4.04
5	Pinto Fish Farm	Pinto Master	8	Poly-culture	Rui, Silver carp, Tilapia	8097	3.23
6	Belal Fish Farm	Belal Akada	4	Mono-culture	Tilapia	12146	2.42
7	Jakir Fish Farm	Jakir Hossain	9	Mono-culture	Tilapia	10120	2.02
8	Nupur Fish Farm	Abdul Mazid	7	Poly-culture	Rui, Common carp, Pangus, pangus, Tilapia, Sorpunti,	8097	3.44
9	Bablu Fish Farm	Bablu Mia	6	Mono-culture	Shing	20242	1.61
10	Marium Fish Farm	Abdul Mannan	10	Mono-culture	Thai koi	11337	2.63
11	Sanuar Fish Farm	Sanuar Khan	4	Mono-culture	Thai koi	8906	2.42
12	Tuly Fish Farm	Rokibul Islam	6	Poly-culture	Tilapia, Thai pangus	8097	3.64
13	Riad Fish Farm	Rojob Ali	6.5	Poly-culture	Rui, Silver carp, Tilapia, Mrigal, Thai pangus	4048	2.83
14	Zinna Fish Farm	Md.Ali Zinna	5	Poly-culture	Rui, Mrigal, Common carp, Tilapia	4858	3.64
15	Rani Fish Farm	Mahbub Alam	5	Mono-culture Culture	Thai koi	10120	2.63
16	Rupali Fish Farm	Golam Robbani	7	Poly-culture	Thai pangus, mrigal, Rui	6072	2.63
17	Fatima Fish Farm	Haider Ali	5	Poly-culture	Thai Pangus, Tilapia,	8097	3.64
18	Tarek Fish Farm	Abu Tarek	4	Mono-culture	Tilapia	8906	2.42
19	Sadia Fish Farm	Korim Shekh	5	Mono-culture	Thai pangus	10121	4.04



**Table 7. Status of commercial fish farms in Jamalpur sadar**

Sl. No.	Name of Farms	Name of farmers	Size (acre)	Culture system	Cultured species	Stocking Density (fry/ha)	Production (tons/ha)
01	Zahurul Fish Farm	Zahurul Islam	13	Polyculture	Thai Pangus, Koi, Rui, Tilapia, Tengra, Pabda	10121	4.04
02	Nazrul Fish Farm	Nazrul Islam	7	Polyculture	Rui, Mrigal, pangus, Tilapia	8097	4.04
03	Marium Fish Farm	Abdul Mannan	10	Monoculture	Thai koi	11336	2.63
04	Jakir Fish Farm	Jakir Hossain	9	Monoculture	Tilapia	10121	2.42
05	Bablu Fish Farm	Bablu Mia	6	Monoculture	Shing	20242	1.61
06	Rubel Fish Farm	Rabiul Islam	12	Polyculture	Thai pangus, Mrigal, Rui, Tilapia	10121	4.04
07	Sultan Fish Farm	Sultan Mia	8	Polyculture	Tilapia, Pangus Silver Carp, Rui	10121	3.64

**Table 8. Effectiveness of aqua drugs on fish health and disease recovery**

Disease	Clinical sign	Species	Treatment	Prevalence (%)	Season	Recovery (%)
Fungal disease	Red spot on body, lesion on body surface	Rui, Catla, Mrigle, Bata, Tilapia	Renamycin: 50 mg/Kg body weight for 5-7 day Ossi-C: 4-5 g/Kg feed for 5-7 day	15	Aug.- Sep.	95
Bacterial disease	Exophthalmia, red spot on abdomen and dorsal side, spoilage on body	Pangus, Rui, Mrigal, Catla, shing	Timsen: 1 <sup>st</sup> dose: 80 g/33 dec, 2 <sup>nd</sup> dose: 50 g/33 dec Aquamycine: 1-2 g/Kg feed Geolite gold: 200-250 g/decimal	10	Sep.- Oct.	95
Parasitic disease	Erratic movemet, body rubbing with hard object	Rui, Catla, Mrigle, Grass carp, Silver carp, Mirror carp	Argulex: 12-13 ml/dec Sumithion (Fenitrothion) 200 ml/33 dec	40-60	All over the year	60

**Table 9. Status of visited hatcheries in Jamalpur sadar**

Hatchery name	Owner name	Source of brood	Species	Area (decimal)	Production (no. of fry/year)
Zahurul Islam Hatchery	Zahurul Islam	Jamuna river, Halda river	Pangus, Tilapia, Rui, Catla, Mrigal, Bata, Silver carp, Tengra, Pabda	52	10000000
Marium Fish Hatchery	Abdul Mannan	Jamuna river, Halda river	Rui, Catla, Mrigal, Bata, Tilapia	50	11000000
Kalam Fish Hatchery	Abul Kalam Azad	From river	Rui, Catla, Mrigal, sharpiti, Magur, Koi	40	10000000
Mitali Fish Hatchery	Aziz Mia	Jamuna river	Grass carp, Mirror carp, Pangus, Rui	50	13000000
Rubel Fish Hatchery	Rabiul Islam	Jamuna river	Tilapia, Koi, Shing, Gulsha, Mrigal	30	5000000
Shapon Fish Hatchery	Md. Shapo Mahmud	Jamuna river, Halda river	Rui, Catla, Mrigal, Bata, Puti, Silver carp, Grass carp	45	9000000
Jui Fish Hatchery	Kholil Mia	Dealer	Pangus , koi, Shing	25	4000000
Rabin Fish Hatchery	Mostofa Ali	Jamuna river	Rui, Catla, Mrigal, Bata, Silver carp, Tilapia	32	3000000

**Table 10. Diseases in Jamalpur hatcheries**

<b>Disease name</b>	<b>Affected Species</b>	<b>Treatment</b>	<b>Prevalence (%)</b>	<b>Season</b>	<b>Recovery (%)</b>
Bacterial infection	Pangus, Shing, Koi, Magur, Pabda	Aquamycine: 1-2 g/Kg feed Oxysentin 20%: 100-200 g/100 Kg Captor: 50-70 g/100 Kg feed	70	Winter season	50
Argulosis	Rui, Catla, Mrigal, Grass carp, Silver carp, Mirror carp	Argulex: 12-13 ml/dec. Sumithion (Fenitrothion): 200 ml/33 dec	60	All over the year	60
Fungal disease	Rui, Catla, Mrigal, Tilapia, Bata	Renamycin: 50 mg/Kg body weight for 5-7 day Ossi-C: 4-5 g/Kg feed for 5-7 day	10	Aug.-Sep.	95

### 3.4 Hatchery

In Jamalpur sadar, data of 7 hatcheries were collected. In most of the hatcheries, breeding of different types of fishes such as pangus, tilapia, rui, catla, mrigal, bata, silver carp, sharputi, grass carp, mirror carp, kalibaus, magur, pabda, shing and gulsha were found to be practiced. The seed of brood fish were found to be collected from Jamuna and Halda rivers. Some hatchery owners bought them from some dealer. These broods are generally reared in hatchery up to 3 years old. Because brood fishes were found to lay eggs up to the ages of 3 years. They were found to lay eggs three times a year. After 3 years the hatchery owners were reported to sell them to the local markets. For breeding purpose separate ponds were reported to be used for separate fishes. For water supply overhead tanks were present in the hatcheries. A list of the name of hatchery, owners' name, Source of brood fishes, species and area of hatchery are shown in Table 9.

#### 3.4.1 Disease problem

Disease problems were found common in the hatcheries. Disease outbreak occurred during winter. Fry were more susceptible. Fishes were affected by different types of diseases such as argulosis, bacterial infection, EUS etc. But proper preventive measures were reported to be adopted by the hatchery owners to protect their fishes from various diseases. Diseases confronted by them with affected species, treatment, prevalence (%), season and recovery (%) were shown in Table 10.

The recorded fish diseases in Jamalpur region were EUS in rui, catla, mrigal, tilapia, bata, and sharpunti, red spot in pangus and Thai koi, edwardsiellosis in pangus, swollen abdomen in shing, White spot in Thai koi, Parasitic disease in rui, catla, mrigle, grass carp, silver carp and mirror carp. Faruk et al. [17], Rahman [8] and Monsur [11] also observed that disease condition in aquaculture of Bangladesh were EUS, red spot, white spot, dropsy, tail rot and fin rot in different fish species such as shing, Thai koi, tilapia and Thai pangus. Ali [7] mentioned that the major disease condition which were reported by farmers as EUS, tail and fin rot, dropsy, anal protrusion, fungal diseases, nutritional diseases and white spot. However, in Jamalpur region edwardsiellosis in pangus, EUS in rui, catla, mrigal, tilapia, bata, tilapia and sharputi was very common. Most of the farmers in the study area

used aqua drugs to control the mention diseases.

For EUS disease farmers of Jamalpur region used Renamycin, Polgardplus and Ossi-C. Achieved recovery was 90% in case of tilapia and 85% in case of sharputi, rui, catla and mrigal. Monsur (2012) observed recovery was 85% in case of EUS of tilapia, sharputi, rui, catla and mrigal in Jamalpur region. For edwardsiellosis farmers used timsen, Ossi-C and Polgard plus. Achieved recovery was 80% in case of pangus. Monsur [11] observed recovery was 75% in case of edwardsiellosis of pangus fish. Achieved recovery was 85% in case of pangus and 70% in case of Thai koi. For swollen abdomen disease farmers used Polgard plus and Bactisol. Achieved recovery was 10% in case of shing. Monsur [11] observed recovery was 10% in case of swollen abdomen disease of shing. For white spot disease farmers used Ossi-C and Polgard plus. Achieved recovery was 80% in case of Thai koi. For parasitic disease farmers of Jamalpur region used argulex and Sumithion (Fenitrothion). Achieved recovery was 60% in case of rui, catla, mrigle, grass carp, silver carp and mirror carp. In case of hatchery, for bacterial disease farmers of Jamalpur region used Aquamycine, Oxysentin and Captor. Achieved recovery was 50% in pangus, shing, koi, magur and pabda. For fungal disease farmers were used Renamycin and Ossi-C. Achieved recovery was 95% in case of rui, catla, mrigal, tilapia and bata.

Use of chemicals and drugs for disease treatment in Aquaculture has become fundamental for higher production and it can be used and applied properly. Lack of knowledge about the chemicals, appropriate doses and methods of application of these chemicals created ecological and human health problems in the study area. So, it is important to apply proper doses and best application methods for aqua-health management. Aqua drugs should not be used, if they are harmful to the farm workers and the inside and outside environment of farms.

### 4. CONCLUSION

Disease problem is a major alarming factor for aquaculture production in Bangladesh. Indeed, aqua medicines are essential components to solve these problems. But excessive use of aqua-medicines may be harmful to aquatic ecosystem. In the study area Geotox, JV Zeolite, Aquakleen, Biomin Aquaboost were used for

water quality management; Oxyflow, 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 powder as antibiotics; Hepaprotect-Aqua, timsen, Virex, Polgard Plus as disinfectant; lime, salt, formalin, potash and malachite green were used against fish diseases. The present study demonstrated current status of drugs and chemicals use in aquaculture in Jamalpur sadar upazilla. Lack of knowledge about the chemicals, inappropriate doses and improper methods of application of these drugs and chemicals may create ecological and human health problems in the study area. Finally, minimum use of chemicals is the best alternative to reduce the adverse effects of chemicals in aquaculture and human health.

## CONSENT

As per international standard or university standard written participant consent has been collected and preserved by the authors.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist. The company name (Square Pharmaceuticals Ltd., Novarties Animal Health, ACI Animal Health, Fish Tech BD Ltd., Acme Laboratories, Reneta, and Eon Animal Health) used for this research are commonly and predominantly selected in our area of research and country. There is absolutely no conflict of interest between the authors and company because we do not intend to use those company as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the company rather it was funded by personal efforts of the authors.

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