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ORIGINAL RESEARCH ARTICLE



## Availability of aqua drugs and their uses in semi intensive culture farms at Patuakhali district in Bangladesh

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### ABSTRACT

A survey was undertaken to examine the accessibility of aqua-drugs and their applications in the semi-intensive aquaculture farms in Patuakhali district. A total of 83 stakeholders were selected and data gathered from aqua-medicine stores, representatives of different pharmaceuticals and semi-intensive aqua-farms owners via questionnaire interviews. PRA tools like focused group discussion, cross-checking, and key informant interviews were also used. Results show that 78% of farmers conduct polyculture and rest executes monoculture. Among the total fish farmer majority, 38% used lime for pond preparation and water quality management and potash used by 44% farmer as a disinfectant. For increasing dissolve-oxygen Oxy-rich (26%) was vastly used while 28% of farmers don't use any oxygen supplier in their pond. However, 14% of farmers use commercial Megavit-Aqua growth promoters and 14% farmer used probiotics. For disease control, 52% and 14% of farmers use Renamycin and Renamox respectively due to its easy availability and affordability compared to probiotics. Several issues have been reported due to improper use of aquatic medications, such as lack of information about chemical use, sufficient dosage, form of application and indiscriminate use of antibiotics. This research result will help the policymaker to understand the requirement of fishers for healthy and sustainable aquaculture practices.

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### INTRODUCTION

Geographic position of Bangladesh arises with various aquatic species and provides quite diversified fisheries resources (DoF, 2018). Aquaculture plays a vital role in the national economy as well as in the fulfillment of the animal protein demand, opportunity for employment, poverty alleviation and earning foreign currency in Bangladesh (Hossain, 2015). Aquaculture production is increasing day by day through culture system diversification (Mahmud *et al.*, 2012; Ahmed *et al.*, 2012). Aquaculture intensification is also playing a vital role on fish production (Shamsuzzaman *et al.*, 2017) and production heavily depends on formulated feeds input and the application of various aqua drugs in Bangladesh (GESAMP, 1997; Subasinghe

*et al.*, 1996). Aqua-medicines are used extensively in aquaculture device for different purposes, e.g. pond building, soil and water conservation management, natural aquatic enhancement productivity, live-organism transport, formulation and manipulation of feed, enhancing fertility and development promotion (Anwar, 2018).

Fish diseases are one of the main constraints for successful implementation of intensive and semi-intensive technology of fish culture (Hossain, 1995). Previous study found a wide range of diseases in farmed aquatic animals in Bangladesh (BFRI, 1999; Faruk *et al.*, 2004). However, farmers are using a wide range of chemicals and antibiotics blindly without knowing their necessity, effectiveness, proper dose and method of application to control fish disease and other cultured aquatic animals.

Chemicals are crucial fixing to fruitful aquaculture which has been utilized within different structures for centuries (Faruk et al., 2008). Moreover, chemist and representative of various pharmaceuticals business often persuaded the farmer to use their products. Some of the farmers indiscriminately use these chemicals without their need, efficacy, proper dosage and method of application (Kawsar, 2019). Only few studies conducted to find out the problems associated with the use of aqua chemicals in Bangladesh (Uddin and Kader, 2006; Khan et al., 2011). Due to the negative effects on the environment their application is no longer been recommended (Cabello, 2006). Now concern is growing over the usage and potential misuses of some of these chemicals. Naturally-occurring microorganisms play a key role in aquatic environments like recycling nutrients, degrading organic matter and protecting fish against infections (Bentzon-Tilia et al., 2016).

In Patuakhali district the use of chemicals, antibiotics and aqua drugs are increasing tremendously along with aquaculture expansion (Sharker et al., 2014). Therefore, the present study was carried out to assess the drugs and chemicals used in aquaculture practice in Patuakhali district.

## MATERIALS AND METHODS

### Study area

The study was carried out in 8 upazillas namely Patuakhali Sadar, Dumki, Bauphal, Dasmina, Galachipa, Rangabali, Kalapara and Mirzagang of Patuakhali district in Bangladesh. It lies between 21°48' and 22°36' north latitudes and between 90°08' and 90°41' east longitudes. The study area is shown in Figure 1.

### Duration and target groups

Data was collected from July 2019 to October 2019. To get the desired achievement from the study a total of 83 stakeholders were selected. There were 50 fish farmers, 7 technical people of different drug producing companies, 10 key informants and 16 aqua drug shops interviewed during the study period.

### Preparation of questionnaire

Three questionnaires were prepared on the basis of objectives, one for the collection of data from farmers, one for data collection from retailers and another for key informant survey.

### Data collection method

Before collecting the primary data, a well structure questioner was developed and pre testing in few farmers in the adjacent areas. In the pre testing much attention was given to any useful information for the completeness of the objective. After improving the final questionnaire, primary data were collected through questionnaire interview with culture farm owner, chemical seller, and medical representative of different Pharmaceuticals Company (Anwar, 2018). Relevant secondary data were collected from district and upazilla fisheries officer as Key informant interviews, published material such as journals, textbooks, newspaper, etc.

### Data analysis

Statistical Package for the Social Sciences (SPSS) software (ver. 25) has been used for data processing and analysis.

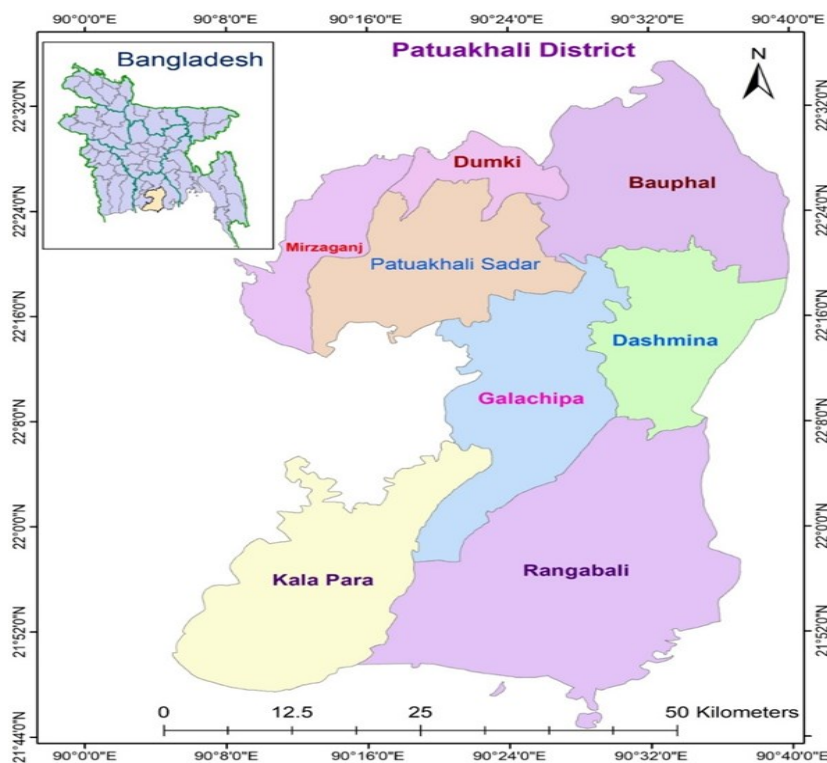


Figure 1. Map of the study area at Patuakhali district in Bangladesh.

## RESULTS AND DISCUSSION

At present 16 animal health companies were seen to market chemicals at field level. Moreover, these pharmaceuticals companies found to have very attractive information-based leaflet to sell their products to the farmer. According to respondent most of the farmer don't know the proper dosage and uses of these drugs. Farmer used only those products which were suggested by the chemical seller. According to the respondent a number of diseases i.e. dropsy, fin and tail rot, and Epizootic Ulcerative Syndrome (EUS) were reported in the study area which were treated using different chemicals and antibiotics. Farmers of Bangladesh commonly used chemicals in aquaculture are lime, rotenone, phostoxin, salt, dipterex, sumithion, melathion, antimicrobials, potassium permanganate, copper sulphate, formalin, etc. (Phillips, 1996; Brown and Brooks, 2002; DoF, 2002; Hasan and Ahmed, 2002; Faruk et al., 2004).

### Demographic characteristics of fish farmers

The present study was investigated on 50 fish farmers where 24% young (18-32 years), 46% middle age (36-45 years) and 30% old aged (above 54 years). Among them 34%, 42% and 24% farmers had low, medium and high farming experience, respectively. Small farm like less than 2 acres was 68%, moderate farm like 2-4 acre was 20% and large farm above 4 acres was 12%. Demographic characteristic of fish farmer of Patuakhali district is shown in Table 1.

### Culture system

Study shows that 78% farmer conduct polyculture and 22% farmer conduct monoculture system in Patuakhali district. In polyculture system Rui, Catla, Mrigal, Silver carp, Pangus, Tilapia, Kalibasu, Bighead carp, Grass carp, Sarpunti, Prawn are mostly cultured while Pangus, Tilapia, Koi, shing, Magur, Pabda, Gulsa are cultured in monoculture pond.

### Chemicals used for pond preparation and water quality management

A variety of chemicals of different companies had been found for pond and water quality management in the local aqua chemical and medicine shops of the study area shown in Table 2. Study shows that 38%, 4%, 30% and 28% farmer use lime, zeolite, lime and zeolite, and lime and other chemicals respectively for pond preparation and water quality management shown in Figure 2A. Lime is widely used due to its easily available and low cost. Other chemicals like Pondkleen, M H Aqua powder, Aqua photo (soil probiotic), Mega zeo plus, ACME's Zeolite, Super Fish Carp is widely used in Patuakhali district. Faruk et al. (2008) found drugs like Geotox, JV Zeolite, Mega Zeo, and Bio Aqua used for improving water quality. For health management commonly used traditional chemicals included Lime, Salt, Potassium permanganate, Sumithion, Melathion, Formalin, Bleaching powder and Malachite green. Most widely used compounds were JVzeolite, Geotox, Green zeolite, Orgavit aqua, Fish vitaplus, AQ grow-G, Oxy flow, Oxy max and O2-marine. 14 branded antibiotics were found in market of which, Renamox, Renamycin and Orgamycine were being widely used. Farmers of the Patuakhali district also use most the chemicals. Previous study shows that, 6 categories of aqua drugs and chemicals were used and lime, zeolite and rotenone were widely used for pond preparation and water quality management while 35% farmers used lime due to its low price, easy availability and effectiveness in water quality management in Patuakhali (Sharker et al., 2014). However, the present study found 11 category of aqua drugs and 38% farmer used lime due to low cost but farmer also used moderate price chemicals for better water quality management. Zeolite 4%, lime and zeolite 30% and lime and other chemicals 28% farmer used for pond preparation and water quality management in Patuakhali district.

**Table 1.** Demography of fish farmer at Patuakhali district in Bangladesh.

| Characteristics | Scoring system | Range   | Category           | Respondent |    | Mean  | Standard deviation |
|-----------------|----------------|---------|--------------------|------------|----|-------|--------------------|
|                 |                |         |                    | N (50)     | %  |       |                    |
| Age             | Years          | 26-60   | Young (18-35)      | 12         | 24 | 42.78 | 9.25               |
|                 |                |         | Middle age (36-45) | 23         | 46 |       |                    |
|                 |                |         | Old aged (>45)     | 15         | 30 |       |                    |
| Experience      | Years          | 1-25    | Low (1-5)          | 17         | 34 | 9.12  | 5.97               |
|                 |                |         | Medium (6-10)      | 21         | 42 |       |                    |
|                 |                |         | High (>10)         | 12         | 24 |       |                    |
| Farm size       | Acre           | 0.33-10 | Small (<2)         | 34         | 68 | 1.96  | 2.24               |
|                 |                |         | Moderate (2-4)     | 10         | 20 |       |                    |
|                 |                |         | Large (>4)         | 06         | 12 |       |                    |

N= Number of respondents.

**Table 2.** Chemicals used for pond preparation and water quality management at Patuakhali district in Bangladesh.

| S.N. | Trade name        | Active ingredients  | Company                          | Dose                       | Price (Tk)          |
|------|-------------------|---|----------------------------------|----------------------------|---------------------|
| 1    | Mega Zeo Plus     | 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 and Mn | ACI Animal Health Ltd.           | 20kg/acre                  | 340Tk(\$4.3)/10 Kg  |
| 2    | 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 and Mn | Eon Animal Health Ltd.           | 22kg/acre                  | 350Tk(\$4.4)/10 Kg  |
| 3    | Lime              | CaO, Ca(OH) <sub>2</sub>  | Chemical Seller                  | 100 kg/acre                | 25Tk(\$0.3)/kg      |
| 4    | 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                          | National Agricare Imp. Exp. Ltd. | 20- 30kg/acre              | 550Tk(\$6.9)/10kg   |
| 5    | Zeolite Plus      | 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 and Mn | Dreemland                        | 20-22 kg/acre              | 250Tk(\$3.1)/kg     |
| 6    | Pondkleen         | Saponins, Glycocomponents   | ACI Animal Health Ltd.           | 70-100ml/dec               | 75Tk(\$0.9)/100ml   |
| 7    | Aqua Photo        | <i>Bacillus subtilis</i> and <i>Rhodoseudomonas</i>   | ACI Animal Health                | 50-70 ml/100 decimal       | 125Tk (\$1.6)/100ml |
| 8    | ACME's Zeolite    | Zeolite   | The ACME Laboratories Ltd.       | 7 kg/33 dec. every 15 days | 55Tk(\$0.7)/kg      |
| 9    | Green light       | Probiotics and Geolite's mixture  | Green Dale Bd Ltd.               | 2kg/33 decimal             | 325Tk(\$4.1)/3kg    |
| 10   | M. H. Aqua Powder | CaO, Al <sub>2</sub> O <sub>3</sub> , Trace elements  | Genetica                         | 2kg/33decimal              | 110Tk(\$1.4)/kg     |
| 11   | Supar Fish Carp   | Ca, Al, Na <sub>2</sub> SO <sub>4</sub> , Cu, K   | Hiron Agro. Ltd.                 | 500g-1kg/33decimal         | 200Tk(\$2.8)/kg     |
| 12   | Fish Carp Gold    | CaO, Al <sub>2</sub> O <sub>3</sub> , Trace elements  | Bismillah Co. Ltd.               | 500g/ 33 decimal           | 400Tk(\$5.0)/kg     |

**Table 3.** Chemicals used as disinfectant at Patuakhali district in Bangladesh.

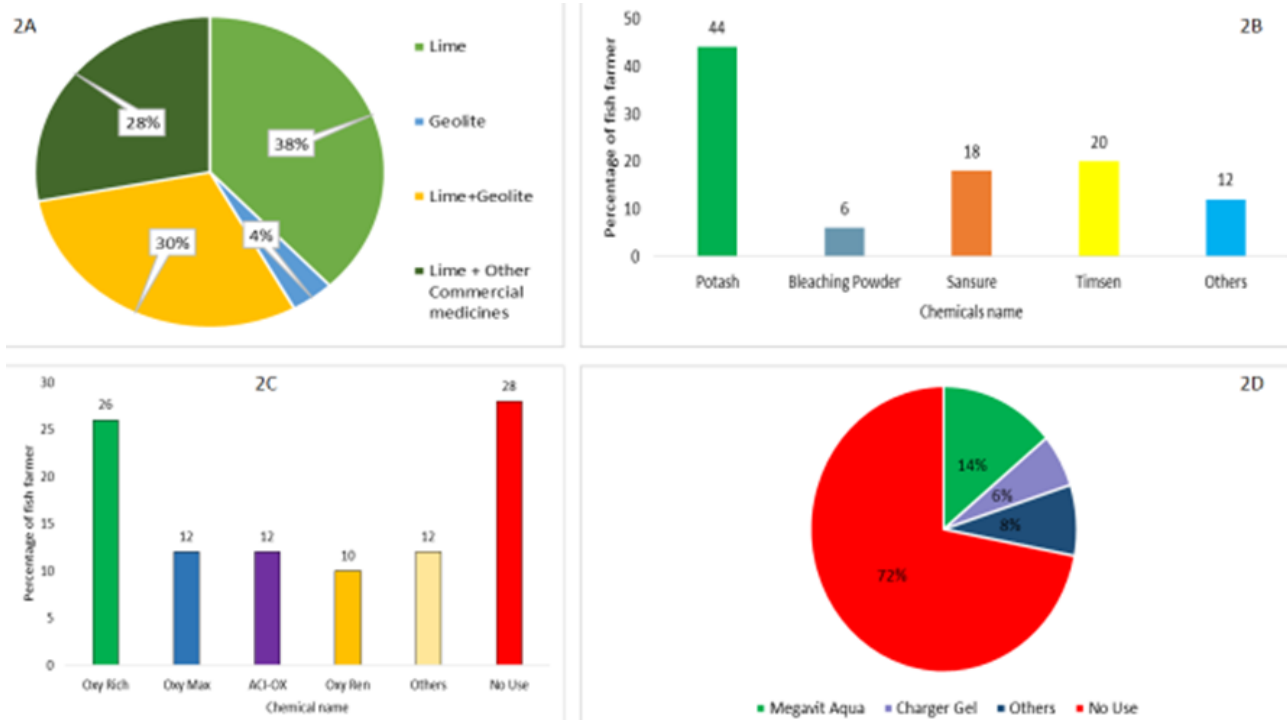
| S.N. | Trade name       | Active ingredients  | Company                         | Dose                 | Price (Tk)          |
|------|------------------|---|---------------------------------|----------------------|---------------------|
| 1    | Virex            | n-Alkyl dimethyl benzyl ammonium chloride 40%, stabilized urea 60%                | ACI Animal Health               | 20-80g/33 decimal    | 261Tk(\$3.3)/50 g   |
| 2    | Timsen           | Potassium Peroxy mono sulphate 50%  | Eon Animal Health Products Ltd. | 100-200g /33 decimal | 110Tk(\$1.4)/10g    |
| 3    | Pathonil         | Alkyl dimethylbenzyl ammonium chloride 80%, BKC 80%                               | ACI Animal Health               | 200ml/33 decimal     | 265Tk (\$3.3)/100ml |
| 4    | Sansure          | BKC-80%   | Opsonin Pharma Ltd.             | 100ml/33 decimal     | 285Tk (\$3.6)/100ml |
| 5    | Aquakleen        | Tetradecyl Trimethyl Ammonium Bromide: 6.6 g, BKC-83g, Amino Nitrogen-10000ppm    | Square Pharmaceuticals Ltd.     | 1L/acre              | 468Tk(\$5.9)/L      |
| 6    | Potash           | KMnO <sub>4</sub>   | Chemical seller                 | 10g/decimal          | 190Tk(\$2.4)/kg     |
| 7    | Salt             | NaCl  | Chemical seller                 | 500-1000g/ decimal   | 18Tk(\$0.2)/kg      |
| 8    | Bleaching powder | Clorine   | Chemical Seller                 | 0.1-1 ppm            | 55Tk(\$0.7)/kg      |
| 9    | Virmax Special   | Alkyl Dimethyl Benzyl, NH <sub>4</sub> Cl 80%, Gluterdehyde 10%, Formaldehyde 10% | Rims Bd                         | 600-800ml/ acre      | 230Tk (\$2.9)/100ml |

### Chemicals used as disinfectant

Farmers use disinfectant mainly for cleaning equipment; maintain hygiene, to keep their pond free from pathogen and to treat diseased fish. Locally available disinfectants are given in Table 3. Present study shows that 44% farmer used Potash as disinfectant. Besides 20% used Timsen, 18% Sansure, 6% Bleaching powder and 12% others shown in Figure 2B. Among the others chemicals like Virex, Aquakleen, Salt, Pathonil etc. are also used by the farmers as disinfectant. Rahman *et al.* (2017) reported that 22% farmer use potassium permanganate as disinfectant in their culture pond in Comilla region. Rotenone 11%, bioaqua 6%, zeolite 33% and lime 50% used for pond preparation and water quality management; Bleaching 28%, EDTA 39%, formalin 11% and potash 22% used as disinfectants. Sharker *et al.* (2014) observed that 44% farmer used Potash as disinfectant. Besides 20% farmer used Timsen, 18% Sansure, 6% Bleaching powder and 12% others aqua drugs in patuakhali district.

### Chemicals used to increase dissolved oxygen level in pond

Different types of chemicals of various companies are used for increase dissolved oxygen in aquaculture pond shown in Table 4. Oxidizing agent, hydrogen peroxide and Sodium carbonates are the major active ingredients of those chemicals. In the present investigation it was observed that 28% farmers don't use any oxygen supplier in their pond. On the other hand, Oxy rich (26%) was vastly used followed by Oxy max (12%), ACI OX (12%), Oxy-ren (10%) and others (12%) shown in Figure 2C. Others like Oxy life, Bio-ox, Oxy flow, Oxymax, Oxy-H, M. H Ten-Oxy are also used in the study area. Rahman *et al.* (2017) conveyed that ACI-OX 28%, oxymax 22%, oxy more 11%, oxy flow 22% used as oxygenation into water in their culture pond in Comilla region. Ali (2008) reported that Oxyflow and Oxymax were used to remove hardness and poisonous gases.



**Figure 2.** Chemical used for water quality management (2A), chemical used for disinfectant (2B), chemical used for supply dissolve oxygen (2C) and chemical used for growth promoter (2D).

**Table 4.** Chemicals used to increase dissolved oxygen level in pond at Patuakhali district in Bangladesh.

| S.N. | Trade name | Active ingredients                                  | Company                         | Dose           | Price (Tk)         |
|------|------------|---|---------------------------------|----------------|--------------------|
| 1    | Oxylife    | Oxygen precursors                                   | Square pharma. Ltd.             | 400g/acre      | 680Tk(\$8.5)/kg    |
| 2    | Bio-ox     | Sodium carbonate, H <sub>2</sub> O <sub>2</sub>     | ACI animal health               | 500g-1kg/acre  | 580Tk(\$7.3)/kg    |
| 3    | ACI-OX     | Sodium carbonate, H <sub>2</sub> O <sub>2</sub> 10% | ACI animal health               | 5-8 g/dec      | 170Tk(\$2.1)/250 g |
| 4    | Oxy flow   | Sodium carbonate, H <sub>2</sub> O <sub>2</sub>     | Elanco Ltd.                     | 500g-1kg/acre  | 800Tk(\$10.0)/kg   |
| 5    | Oxy-Ren    | Sodium carbonate                                    | Renata Ltd.                     | 500g-1kg/acre  | 600Tk(\$7.5)/kg    |
| 6    | Oxymax     | Sodium carbonate, H <sub>2</sub> O <sub>2</sub>     | Eon animal health products ltd. | 500g-1kg/acre  | 720Tk(\$9.0)/kg    |
| 7    | Oxy-H      |   | HironAgro Ltd.                  | 250-700g/acre  | 155Tk(\$1.9)/250g  |
| 8    | Oxy Rich   | Sustained release oxygen 13.5%                      | Opsonin Pharma Ltd              | 5-10g/ decimal | 560Tk(\$7.0)/4kg   |
| 9    | M.H TenOxy |   | Genetica                        |                | 455Tk(\$5.7)/kg    |

### Chemicals used as disease treatment

There are different chemicals used for the treatment of fish disease. These types of chemical are shown in Table 5. Melethion, formalin, salt, methylin blue, etc. is useful for eradication of external parasite as well as fungal diseases. Lime is also used for common fish disease. Timsen is used for treatment of various diseases and as a disinfectant. Ali (2008) observed that Timsen was effective to prevent some bacterial and fungal infections. Ali (2008) and Rahman (2011) found several aqua drugs like Lime, Salt, Potassium Permanganate, Sumithion, Melathion, Formalin and Bleaching Powder were used as disease treatment.

### Chemicals used as growth promoter

Several chemicals which were found in the aqua medicine shops used as growth promoter as well as increase the production. A list of growth promoters is shown in Table 6. Present study shows that 72% farmer don't use any growth promoter while 14% farmer use Megavit Aqua, 6% farmer use Charger gel and 8% farmer use others commercial growth promoter in their farm shown in Figure 2D. All of the growth promoters play a

vital role for rapid growth of fish. According to the respondents, growth promoter support to improve growth rate, improve FCR (Food Conversion Ratio) and thus increase the yield. Rahman *et al.* (2017) reported that aqua boost 28%, AQ grow-G 17%, Eon fish grower 22% and vitamin premix 22% used as growth promoter in Comilla region. From there search finding of Rahman (2011), it was observed that aqua drugs used as growth promoter were ChargerGel, Aqua Boost, Bio- Grow and Grow Fast. All the growth promoters played a vital role for rapid growth offishes.

### Chemicals used as toxic gas removal

Several aqua-drugs were reported which are used to remove organic and inorganic wastes producing gas in the ponds. About 5 toxic gas removals with different trade name were found to different chemical and fish feed shops. Their name, dose and sources, companies and approximate price are given in Table 7. Rahman *et al.* (2017) found that ammonil 33%, bio-aqua-50 22%, gasonex plus 11% and others 17% used as toxic gas reducer in the aquaculture pond in Comilla region which were more or less similar to the current study.

**Table 5.** Chemicals used as disease treatment at Patuakhali district in Bangladesh.

| S.N. | Brand name     | Active ingredients   | Company                         | Dose                                      | Price (Tk)         |
|------|----------------|--|---------------------------------|---|--------------------|
| 1    | Potash         | KMnO <sub>4</sub>  | Chemical seller                 | 10gm/decimal                              | 190Tk(\$2.4)/kg    |
| 2    | Salt           | NaCl   | Chemical seller                 | 500-1000g/ decimal                        | 18Tk(\$0.2)/kg     |
| 3    | Virex          | n-Alkyl dimethyl benzyl ammonium chloride 40%, stabilized urea60%              | ACI Animal Health               | 20-80g/33 decimal                         | 261Tk(\$3.3)/50g   |
| 4    | Timsen         | Potassium Peroxymono sulphate 50%  | Eon Animal Health Products Ltd. | 100-200g/33 decimal                       | 110Tk(\$1.4)/10g   |
| 5    | Aquakleen      | Tetradecyl Trimethyl Ammonium Bromide: 6.6 g, BKC-83g, Amino Nitrogen-10000ppm | Square Pharmaceuticals Ltd.     | 1L/acre                                   | 468Tk(\$5.9)/L     |
| 6    | Pathonil       | Alkyl dimethylbenzyl ammonium chloride 80%, BKC 80%                            | ACI Animal Health               | 200ml/33 decimal                          | 265Tk(\$3.3)/100ml |
| 7    | Lime           | CaO, Ca(OH) <sub>2</sub>   | Chemical Seller                 | 100 kg/acre                               | 25Tk(\$0.3)/kg     |
| 8    | Methylene Blue | C <sub>10</sub> H <sub>18</sub> ClN <sub>3</sub> SxH <sub>2</sub> O            | Chemical seller                 | 2-3ppm bath for 1h/10-20 mg/L for 15 min. | 75Tk(\$0.9)/100 ml |
| 9    | Bleaching      | Clorine  | Chemical Seller                 | 0.1-1 ppm                                 | 55Tk(\$0.7)/kg     |
| 10   | Melathion      | Active melathion   | Chemical seller                 | 500g/acre                                 | 63Tk(\$0.8)/100 ml |
| 11   | Bactrol        |  | GreenDale Bd. Ltd.              | 3-5ml/ decimal                            | 260Tk(\$3.3)/100ml |

**Table 6.** Chemicals used as growth promoter at Patuakhali district in Bangladesh.

| S.N. | Brand Name         | Active Ingredients                                    | Company                     | Dose             | Price (Tk)        |
|------|--------------------|---|-----------------------------|------------------|-------------------|
| 1    | Megavit Aqua       | Vitamin, mineral and amino acid supplement            | Elanco Ltd.                 | 100g/100 kg feed | 380Tk(\$4.8)/kg   |
| 2    | Charger Gel        | 1-3 D-Glucan, Polysaccharides, Btain, Beta Glucan     | Fishtech                    | 6-8g/Kg feed     | 1060Tk(\$13.3)/Kg |
| 3    | Vitamix F aqua     | Vit + mineral + amino acid                            | The Acme laboratories Ltd.  | 2.5 kg/ton feed  | 350Tk(\$4.4)/kg   |
| 4    | Acimix super -fish | Vitamin mineral + antioxydent                         | ACI Animal Health           | 1 kg/ton feed    | 350Tk(\$4.4)/kg   |
| 5    | DCP Plus           | CaHPO <sub>4</sub> 90%, MgSO <sub>4</sub> 2%, NaCl 2% | Opsonin Pharma Ltd.         | 1-5kg/ton feed   | 300Tk (\$3.8)/kg  |
| 6    | Rena Fish          |   | Renata pharmaceuticals Ltd. |                  | 360Tk(\$4.5)/kg   |
| 7    | Fish Vita          |   | Dreamland Bd                | 1g/kg feed       | 100Tk(\$1.3)/kg   |
| 8    | Mega Boost aqua    | Mannan Oligosaccharide, Beta-Glucan, Essential Oils,  | GreenDale Bd. Ltd.          | 1g/kg feed       | 180Tk(\$2.3)/100g |
| 9    | Gel Bind           | Protein, Fat, CHO, P, Ca, Vit-A, D3, E, K3            | Rims Bd                     | 8-10ml/kg feed   | 650Tk(\$8.1)/L    |
| 10   | Liquavit aqua      |   | ACI Animal Health           | 5-10ml/kg feed   | 550Tk (\$6.9)/L   |

### Enzymes used for better digestion

Different types of enzymes are available in poultry medicine shop. There only two company's products are used in fish farming for semi intensive culture farms given in the Table 8.

### Chemicals used as stress controller

Only one branded stress controller namely Energy plus supplied by ACI Animal Health had been found in the chemical seller shops of the study area. Its active ingredients are Glucose 98%, Vitamin-C 2% and dose for application are 1-2g/L water for fry, 3-5g/L water for Table fish. Its price is 140Tk (\$1.8)/0.5kg.

### Chemicals used as unwanted species controller

Rotenil was found in the chemical seller shops which are supplied by SK+F where 9% rotenone is used to kill the unwanted species. Its application dose is 1kg/acre and price are

300Tk (\$3.8)/0.5kg in the study area.

### Probiotics for fish farming

There were two branded probiotics found in the studied area shown in Table 9. The probiotics contained different beneficial bacteria including *Bacillus subtilis*, *B. licheniformis*, *B. megaterium*, *B. plantarum*, *S. faecalis* etc. The present study shows that 78% farmer don't use probiotics in their farm. Even they don't know anything about probiotics. The price of probiotics is high. On the other hand, 14 % farmer used Pond Care and 8% farmer used Navio plus in the studied area shown in Figure 3A. According to fish farmer's probiotics were used to control disease, improving water and soil quality and overall increase the yield. Rahman et al. (2017) reported that aqua profs 39%, aqua photo 28%, pH fixer 22% and other 11% used as probiotics in Comilla region.

### Antibiotics used for disease treatments

In the present investigation about 11 branded antibiotics with different trade name were seen in the market shown in Table 10. The active ingredients of such antibiotics are mainly oxytetracycline, amoxicillin, sulphadiazine and sulphamethoxazole. Study shows that 52% farmer use Renamycin, 14% use Renamox, 10% use other antibiotics and 24% farmer don't use any antibiotics in their farms shown in Figure 3B. According to the information from respondents, these antibiotics were effective against bacterial diseases. Rahman et al. (2017) reported that lime 56%, salt 11% and potash 33% used for disease treatment to fish; oxytetracycline 44%, cotrim-vet 17%, amoxicillin 28% and chlortetracycline 11% as antibiotics for disease treatments to fish. Sharker et al. (2014) observed that 46% and 31% farmers used lime and potash to control the dactylogyrosis, gyrodactylosis and argulosis and 62% farmer use renamycin for disease treatment of fish in Patuakhali region. Sharker et al. (2014) observed that about 11 branded antibiotics with different trade name were seen in the market. Among them 52% farmer use Renamycin, 14% use Renamox, 10% use other antibiotics and 24% farmer don't used any antibiotics in their farms in Patuakhali.

### Knowledge and training of fish farmers

It was observed that 58% fish farmers had no training while 42% farmers received short term training from Department of

Fisheries shown in Figure 3C. Different NGOs such as Youth Development, World fish Center were found in the study area that arranged training and sometimes provided funds to them. The fish farmers received maximum information about particular chemicals and antibiotics from technical service officer of different pharmaceutical and feed companies and local chemical seller. Sharker et al. (2014) observed that 58% fish farmers had no training while 42% farmers received short term training.

### Conclusion

The study revealed the present status of aqua drugs in Patuakhali district. Though most of the farmers are experienced they don't aware about the indiscriminate use of aqua drugs. If the training program continues all over the area then the positive view towards probiotics used among the farmer will be increased and production will be high through maintaining eco-friendly environment. It will also create the opportunity to export these fish in future if we can encourage the farmers to use probiotics against antibiotics. To addressing the issues of drugs used in aquaculture with the view to decrease the negative impacts the government policy makers, fisheries professionals, researchers and scientists should work together.

**Table 7.** Chemicals used as toxic gas removal at Patuakhali district in Bangladesh.

| S.N. | Brand name   | Active ingredients  | Company                   | Dose                   | Price (Tk)          |
|------|--------------|---|---------------------------|------------------------|---------------------|
| 1    | Gasonex plus | Na-lorileethersulphate  | Fish tech. (BD) Co. Ltd.  | 200-400 mg /Kg Zeolite | 435Tk (\$5.4)/100g  |
| 2    | Gasonil      | <i>Bacillus subtilis</i> , <i>Bacillus polymyxa</i> , <i>Bacillus licheniformis</i> , Yucca 30% | Sk+F pharmaceuticals Ltd. | 200-400g/ acre         | 450Tk(\$5.6)/kg     |
| 3    | Eco Rich     | Zeolite, Minerals, Probiotics, Yuka   | Opsonin Pharma Ltd.       | 1-3kg/33 dec           | 800Tk (\$10.0)/5kg  |
| 4    | Yuka         | <i>Yucca schidigera</i> extract   | Opsonin Pharma Ltd.       | 2-3ml/ decimal         | 315Tk (\$3.9)/500ml |
| 5    | NO GAS       | Yucca Plants Extracts, <i>Bacillus subtilis</i> , Microencapsulated Enzymes, Saponins           | GreenDale BD Ltd.         | 2-4g/ decimal          | 300Tk (\$3.8)/100g  |

**Table 8.** Enzymes used for better digestion at Patuakhali district in Bangladesh.

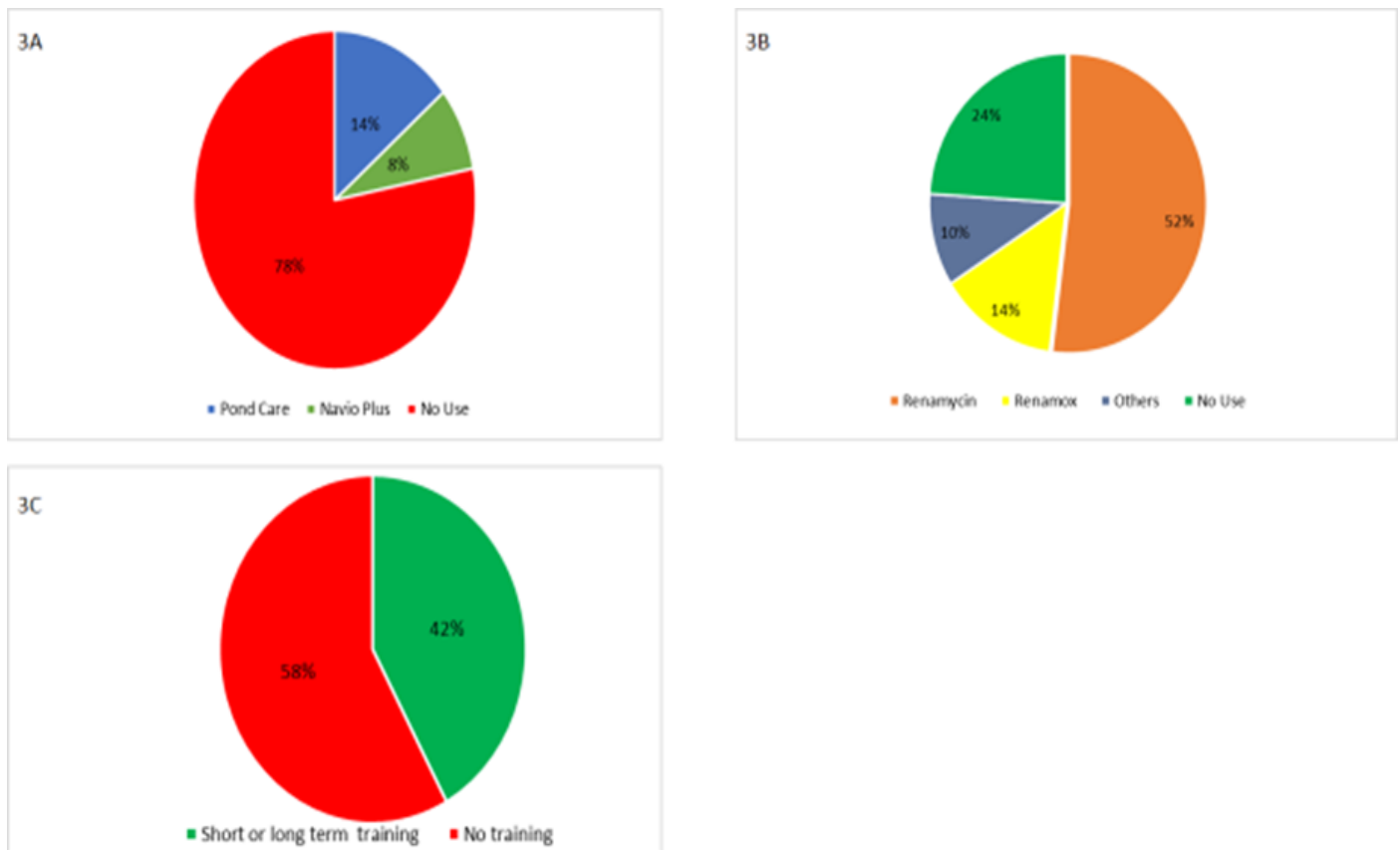
| S.N. | Brand name | Active Ingredients   | Company                     | Dose          | Price (Tk)           |
|------|------------|--|-----------------------------|---------------|----------------------|
| 1    | Polzyme    | Protease, Cellulase Xylanase, Lipase, Amylase  | Square Pharmaceuticals Ltd. | 1-3ml/kg feed | 172Tk (\$2.2)/250 ml |
| 2    | Acmezyme   | Cellulase, Zylanase, Protease, Amylase, Phytase, Pectinase, Hemicellulase, Lypase, $\alpha$ -galactosidase | ACME Laboratories Ltd.      | 1-3gm/kg feed | 600Tk (\$7.5)/500gm  |

**Table 9.** Used probiotics for fish farming.

| S.N. | Brand name | Active Ingredients  | Company                | Dose         | Price (Tk)         |
|------|------------|---|------------------------|--------------|--------------------|
| 1    | Navio plus | <i>Bacillus subtilis</i> , <i>Bacillus licheniformis</i> , <i>Bacillus megaterium</i> , <i>Bacillus plantarum</i> | ACI Animal Health      | 1-3g/kg feed | 170Tk (\$2.1)/100g |
| 2    | Pond care  | <i>S. faecalis</i> and other bacteria   | SK + F Bangladesh Ltd. | 50g/ acre    | 375Tk (\$4.7)/100g |

**Table 10.** Antibiotics used for disease treatments at Patuakhali district in Bangladesh.

| S.N. | Brand name   | Active ingredients                                    | Company                     | Dose  | Price (Tk)            |
|------|--------------|---|-----------------------------|---|-----------------------|
| 1    | Renamycin    | Oxytetracycline                                       | Renata pharmaceuticals Ltd. | 5g/kg feed for 5 days                       | 82Tk(\$1.0)/100 g     |
| 2    | Renamox      | Amoxicillin trihydrate                                | Renata pharmaceuticals Ltd. | 28-40g/100 bd of fish, 10 days continuously | 140Tk (\$1.8)/100 g   |
| 3    | Cipro Vet    | Ciprofloxacin 10%                                     | Eon Animal Health Ltd.      | 1ml/kg feed for 5-7days                     | 230Tk(\$2.9)/100ml    |
| 4    | Aquamycine   | Oxytetracycline                                       | ACI Animal Health Ltd.      | 5 g/Kg feed for 5-7 days                    | 70Tk(\$0.9)/100 g     |
| 5    | EST-Vet      | Erythromycine thiocyanate, Sulfadiazine, Trimethoprim | Eon Animal Health Ltd.      | 3-5gm/kg feed for 3-5 days                  | 393Tk (\$4.9)/100gm   |
| 6    | Cotrim-vet   | Sulphamethoxazole + trimethoprim                      | Square pharmaceuticals Ltd. | 0.5 mg/kg body weight                       | 80Tk(\$1.0)/100 g     |
| 7    | Sulprim-vet  | Sulfadiazine, Trimethoprim                            | Square pharmaceuticals Ltd. | 3-5ml/kg feed for 3-5 days                  | 170Tk(\$2.1)/100ml    |
| 8    | Renatrim     | Sulfadiazine, Trimethoprim                            | Renata pharmaceuticals Ltd  | 3-5ml/kg feed for 3-5 days                  | 200Tk (\$2.5)/100ml   |
| 9    | AT-vet       | Sulfadiazine, Trimethoprim                            | ACME Laboratories Ltd       | 3-5ml/kg feed for 3-5 days                  | 250Tk (\$3.1)/100ml   |
| 10   | Micronid     | Erythromycin, Sulfadiazine, Trimethoprim              | Renata pharmaceuticals Ltd  | 5gm/kg feed for 3-5 days                    | 362Tk(\$4.5)/100g     |
| 11   | Ciprocin-Vet | Ciprofloxacin   | Square Pharmaceuticals Ltd  | 5ml/kg feed for 5 days                      | 1000Tk (\$12.5)/500ml |



**Figure 3.** Probiotics used fish farming (3A), Antibiotics used for disease treatment (3B), Knowledge and Training of fish farmer (3C).



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