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Aqua drugs and chemicals used in fish farms of Comilla regions

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Abstract

A study was carried out to investigate the drugs and medicine used in aquaculture activities in greater Comilla region in Bangladesh for fish health management and increasing aquaculture production. Questionnaire interview, personal contact, market survey and participatory rural appraisal like focus group discussion were conducted to collect the data. Approximately 138 stakeholders (24 drug companies, 14 drug traders/sellers and 100 fish farmers) were used to collect data from the selected upazilla of Comilla district. Major aquaculture species in experimental areas were monosex tilapia (6%), carps with tilapia (39%), carps with catfish (33%) and combination of carps, tilapia and catfish (22%) respectively. Among the total responded (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; (ACI-OX 28%, oxymax 22%, oxy more 11%, oxy flow 22%) used as oxygenation into water; (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; (aqua boost 28%, AQ grow-G 17%, Eon fish grower 22% and vitamin premix 22%) used as growth promoter; (aqua photo 28%, profs 39% pH fixer 22% and other 11%) used as probiotics and (ammonil 33%, bio-aqua-50 22%, gasonex plus 11% and others 17%) used as toxic gas reducer in the aquaculture pond in Comilla regions. This research finding will help to fish farming community to know the appropriate dose and administration methods for safe and sustainable aquaculture practices.

Keywords: Aquaculture; aqua chemicals and drugs; antibiotics; questionnaire interview; pharmaceuticals; drug traders/sellers; fish farmers etc.

1. Introduction

Aquaculture intensification is crucial needs and practiced in Bangladesh to increase in the total aquaculture production ^[1, 2]. Aquaculture production has impact on national economy and act as a source of animal protein, employment opportunities, food security, foreign incomes and socio-economic improvement ^[3]. Fisheries production contributes 4.39% to GDP and 22.76% to agricultural GDP in Bangladesh. Directly and indirectly involved about 10% of the population and intake 60% of our daily animal protein from fisheries products ^[4].

Fisheries sectors plays a crucial role in income and employment-generating in Bangladesh and supplies safe foods to the population of the peoples of country ^[5]. Total fish production in our country during the 2015-2016 was about 3.46 million metric tons of which 2.68 million metric tons were produced from freshwater including culture fisheries and 0.05 million metric tons from marine water including shrimp ^[6].

Aqua-drugs greatly impacts on production ^[7] and applied in different administration ways ^[8]. Different types of chemicals and drugs (include sodium chloride, formalin, malachite green, methylene blue, potassium permanganate, hydrogen per oxide and glutaraldehyde) used in health management of aquatic animals, pond construction, soil and water management, improve aquatic productivity, feed formulation, manipulation of reproduction, growth promotion and processing and in value added products ^[8-10].

Commonly used chemicals and aqua-drugs are lime, rotenone, various forms of inorganic and organic fertilizers, phostoxin, salt, dipterex, antimicrobials, potassium permanganate, copper sulphate, formalin, sumithion, melathion etc. ^[11-15]. Different kinds of anti-bacterial drugs likes antibiotics used for the treatment of diseased fish, presently lots chemicals industries influenced to the farmers to use the chemicals in their aquaculture productions, although most of the farmers has not adequate knowledge about the drug stability and effectivity ^[16-18].

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This research carried out and enlisted the chemicals and drugs as well as investigated different measures and drug doses applied to problems in aquacultures.

2. Materials and Methods

2.1 Study area

The study was carried out in Comilla Sadar, Daudkandi, Muradnagar, Brahmanpara, Burichang, Chaudagram, Laksam and Barura upazilla of Comilla district, Bangladesh. The study area and four fish farms of Muradnagar, Brahmanpara, Burichang and Barura upazilla are shown in Fig.1.

2.2 Duration

Data were collected from December 2015 to June 2016. During this period 100 fish farms of Comilla district were investigated.

2.3 Target groups

To get the desired achievement from the study 138 questionnaires were selected during the investigation. They were 100 fish farmers, 24 technical people of different drug

producing companies and 14 drug shops were also interviewed during the study period.

2.4 Preparation of Questionnaire

Two questionnaires were prepared, one for the collection of data from farmers and another for data collection from retailers. The key points incorporated in the farmer form were: i) name and addresses of the fish farm, ii) types of the species cultured in the farm, iii) types of drugs and chemicals used in the farm, iv) their knowledge about banned chemicals or medicine, v) source of purchased drugs/chemicals, vi) prevention of diseases, vii) effect of chemicals, viii) training received on use of chemicals/drugs, ix) awareness about aqua drugs/chemicals. The points included in the questionnaire of traders/suppliers were i) types of medicine, ii) source of drugs (information on import, local or self-manufacture), iii) function of drugs, iv) advising farmers on use of drugs, v) knowledge on banned drugs/chemicals, vi) Action taken regarding expired drugs/chemicals, vii) training on use of drugs, viii) price of drugs ix) support received from different organizations/manufacturing company.

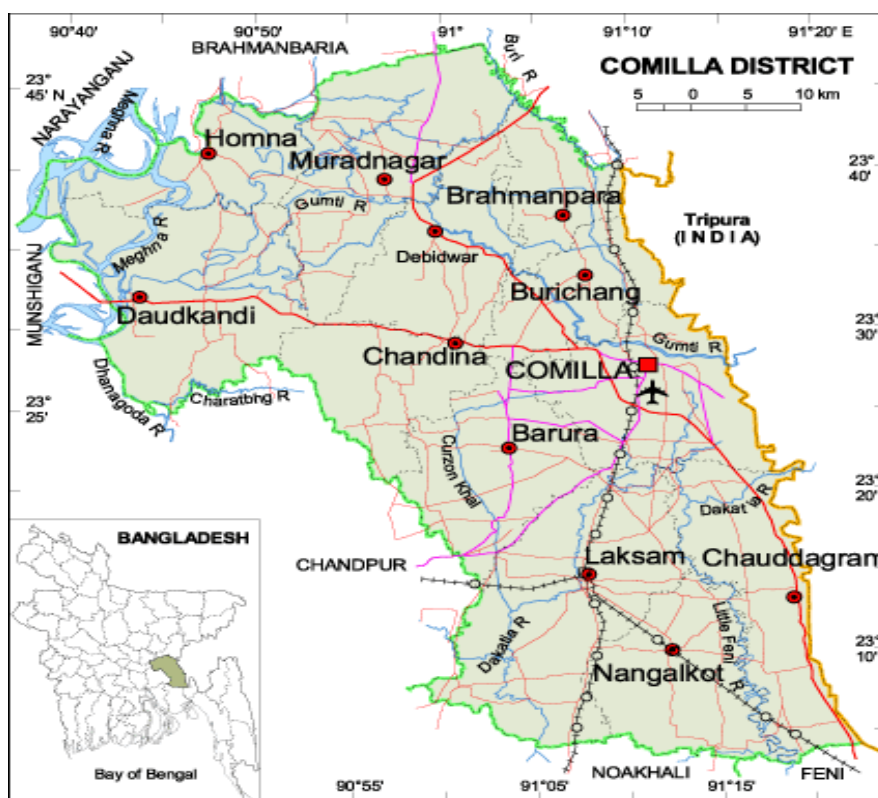


Fig 1: The map showing the study area

2.5 Data collection method

Data was collected through questionnaire interview, personal contact, market survey and focus group discussion (FGD).

1. Questionnaire interview: Questionnaires are usually paper and pencil instruments that the respondent completes. Interviews are completed by the interviewer based on the respondent says.

2. Personal contact: Personal contact refers to the telephone, mail, personal in home surveys and online surveys.

3. Market survey: "A market survey is an objective and systematic collection, recording, analysis and interpretation of data about existing markets for a product."

4. Focus Group Discussion (FGD): "A focus group discussion (FGD) is a good way to gather together people from similar backgrounds or experiences to discuss a specific topic of interest." The questionnaire was composed of both closed and open forms of the question. A set of preliminary questionnaire was prepared.

About 138 questionnaires were used to collect information from 24 pharmaceuticals companies, 14 drug traders/sellers and 100 fish farmers. In this survey much attention was given to any new information, which was not designed to ask but was important and informative towards the objectives. Thus necessary modifications were made based on the feedback and the final questionnaire was prepared on the basis of the survey. Separate set of questionnaire was prepared for each

group. For the interview, simple random sampling method was followed.

2.6 Impact and recovery assessment

The impact and recovery percentages of aqua drugs and chemicals were measured through the fish farm operators' observations.

2.7 Data analysis

After data collection, all the data were arranged in tabular form to fulfill the objectives of the study. By combining the both information from the study area, final result was prepared. For processing and analysis purpose, MS Excel and MS Word have been used.

3. Results

3.1 Types of fish species cultured

Farms investigated in the present experiment could be categorized into four types such as type A, cultured only monosex tilapia, type B, cultured carps and tilapia, type C, cultured carps and catfish and type D, cultured carps, tilapia and catfish. Percentages of the categories were 6, 39, 33 and

22 respectively in the above mentioned types (Fig. 2).

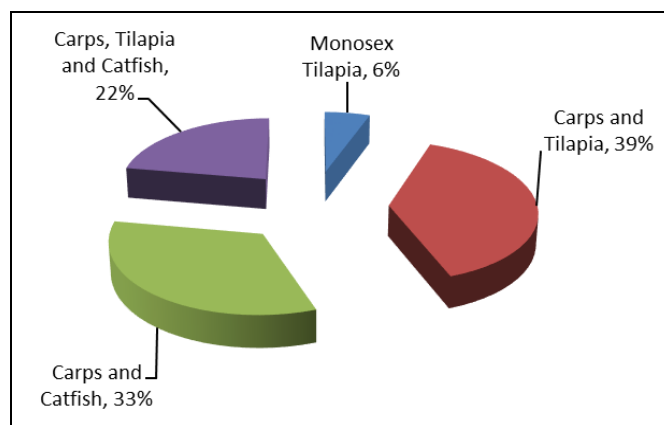


Fig 2: Percentages of different fish species cultured in fish farms

3.2 Aqua drugs and chemicals producing companies

Twenty four different aqua drugs producing and selling companies were recorded during the present investigation.

Table 1: List of aqua drugs producing companies recorded during the present study

| Sl. No. | Name of companies | Sl. No. | Name of companies |
|---------|---------------------------------|---------|----------------------------------|
| 1 | Eon Animal Health Products Ltd. | 13 | Lion Overseas Trading Company |
| 2 | Square Pharmaceuticals Ltd. | 14 | Catapol Bioscience Ltd. |
| 3 | Novartis Pharmaceuticals Ltd. | 15 | Avon Animal Health |
| 4 | ACI Animal Health | 16 | Century Agro Ltd. |
| 5 | SK + F Bangladesh Ltd. | 17 | M.R. Food and Protein Industries |
| 6 | The ACME Laboratories Ltd. | 18 | Rals Agro Ltd., Bangladesh |
| 7 | Nature Care Ltd. | 19 | Univet Ltd. |
| 8 | Fishtech (BD) Limited | 20 | S.S.S Agro Care Ltd. |
| 9 | Penta Agrovet Ltd. | 21 | Biswas Agrovet Limited |
| 10 | Chemical Seller | 22 | Navana Limited |
| 11 | Organic Pharmaceuticals Ltd. | 23 | Renata Pharmaceuticals Ltd. |
| 12 | First Care | 24 | CP Aquaculture Ltd. |

3.3 Major chemicals for pond preparation and fish health management

The chemicals found available in the market and are used at different stages of aquatic animal health management like during pond preparation, growth promotion, supply of oxygen, disinfectant, probiotic and fish disease treatment have

been collected and compiled. The local animal feed and chemical shops are the main sources of such compounds from where farmers usually purchased these. The list of such chemicals with their active ingredients prescribed dose, source and approximate price are shown in Table 2 and Fig. 3.

Table 2: List of chemicals use for pond preparation and water quality management

| Trade Name | Active Ingredients | Doses/ 3-6 feet water | Manufacturer | Price (BDT) |
|----------------|---|----------------------------|---------------------------------|-------------|
| JV Zeolite | SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ , CaO, MgO, Na ₂ O, K ₂ O, Mn, P | 5-7 kg/33 dec. | Eon Animal Health Products Ltd. | 56.5/kg |
| Matrix | SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ , CaO, | 6-10 kg/acre | Eon Animal Health Ltd. | 147/kg |
| Super Zeolite | SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ , CaO, MgO, LoI, K ₂ O | 20-30kg/acre | Avon Animal Health | 55/kg |
| Lime | CaO, Ca(OH) ₂ | 1-2 kg/dec | Chemical Seller | 25/kg |
| Mega Zeo | SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ , CaO, MgO, Na ₂ O | 20-25kg/100dec | ACI Animal Health | 50/kg |
| Zeo Prime | SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ , CaO, MgO, LoI, K ₂ O | 20-24kg/acre | SK+F Bangladesh Ltd. | 55/kg |
| Geotox | SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ , CaO, MgO, Na ₂ O | 20-25kg/acre | Novartis Pharmaceuticals Ltd. | 55/kg |
| Aquanone | Rotenone | 5-7kg/acre | Square Pharmaceuticals Ltd. | 400/kg |
| Alpha Zeolite | SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ , CaO, MgO, Na ₂ O | 20-30kg/acre | Biswas Agrovet Limited | 50/kg |
| Acme's Zeolite | SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ , CaO, MgO, Na ₂ O | 7 kg/33 dec. every 15 days | The ACME Laboratories Ltd. | 55/kg |
| Aqua Lime | CaCO ₃ , Ca(OH) ₂ | 1-2 kg/dec | ACI Animal Health | 27.5/kg |
| Bio-tuff | SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ , CaO, MgO, Na ₂ O, K ₂ O, TiO | 15-20 kg/acr | Organic Pharmaceuticals Ltd. | 55/kg |
| Aquazet | SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ , CaO, MgO, Na ₂ O | 20-30kg/acre | Lion Overseas Trading Company | 50/kg |
| Bio Aqua | Extract of Uka cidizera tree | 2 ml/100 dec. (1 m depth) | Eon Animal Health products ltd. | 250/ 100 ml |
| Zeonex | SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ , CaO, MgO, Na ₂ O | 20-30 kg/acre | Anex vet (pvt.) Ltd. | 55/kg |
| Fish Grow | S + Co + Mg + K + N + P + Ca | 400 ml/acr | Bismillah Enterprise Ltd. | 90/100 ml |

| | | | | |
|---------------|--|--|----------------------------------|---------|
| Bis Zeolite | SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ , CaO, MgO, Na ₂ O | 20–30 kg/acre | Avon Animal Health | 55/kg |
| Zeolite Plus | SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ , CaO, MgO, Na ₂ O | 20–30 kg/acre | Penta Agrovet Ltd. | 55/kg |
| Green Zeolite | SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ , CaO, MgO, Na ₂ O, K ₂ O, TiO ₂ | 20–25 kg/acre | Organic Pharmaceuticals Ltd. | 60/kg |
| Zeocare | SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ , CaO, MgO, Na ₂ O | 200g/dec | Nature Care | 55/kg |
| Major Zeolite | SiO ₂ , Al ₂ O ₃ | 30–40 kg/acre | Univet Ltd. | 50/kg |
| Pontox Plus | SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ , CaO, MgO, Na ₂ O | 15 kg/acr. after stocking 10–20 kg/acr. | Rals Agro Ltd. | 60/kg |
| Well Zeolite | SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ , CaO, MgO, Na ₂ O | 6–8 kg/33 dec. after stocking 3–6 kg/33 dec. | SK + F Bangladesh Ltd. | 55/kg |
| Zeolite | SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ , CaO, MgO, Na ₂ O | 20–30kg/acre | National Agricare Imp. Exp. Ltd. | 55/kg |
| Hunter | Rotenon 9% | 5–6 kg/acre | Eon Animal Health Products Ltd. | 400/ kg |

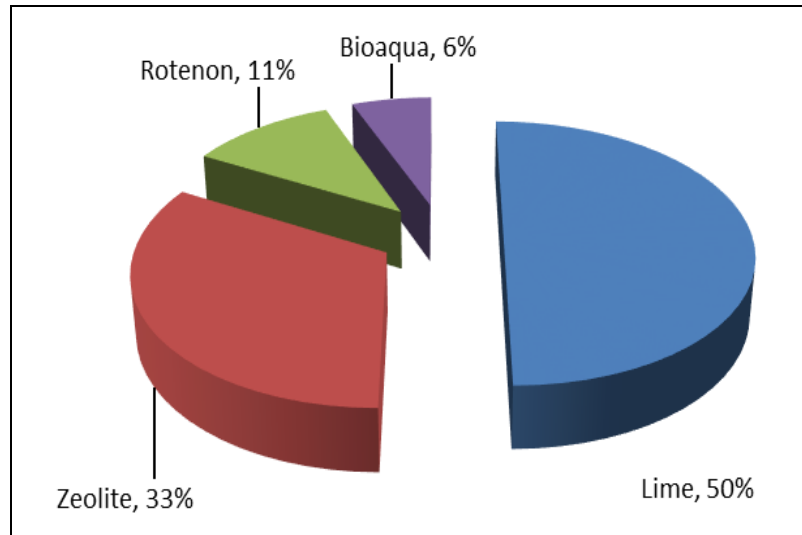


Fig 3: Most commonly used chemicals for pond preparation and water quality management in Comilla district

3.4 Chemicals use as disinfectant

Disinfectants are widely used in aquacultures. They are used both hatchery and grow-out facilities mainly for equipment

preparation, to maintain hygiene and in some case to treat disease. The following disinfectants listed in Table 3 were found available in the market (Fig. 4).

Table 3: List of chemicals used as disinfectant

| Trade name | Active ingredients | Doses /3-6 ft water | Source | Price (TK) |
|----------------------|--|---|---------------------------------|------------|
| Timsen | n-Alkyl dimethyl benzyl ammonium chloride 40%, stabilized urea 60% | 20 g/33 dec. (for prevention), 80 g/33 dec. (for treatment) | Eon Animal Health Products Ltd. | 261/50 g |
| Bleaching powder | Chlorine | 0.1–1 ppm | Chemical Seller | 55/kg |
| Eon CTC | Efinol | 5–8 gm/liter water | Eon Animal Health products Ltd. | 1600/ kg |
| Microdine iodine 20% | Nonyl alkyl phenoxypoly ethane iodine complex | 2–2.5 L/acre | Rals Agro Ltd. | 88/400 g |
| Emsen | n-Alkyl dimethyl benzyl ammonium chloride + stabilized urea | 80 g/33 dec | SK + F Bangladesh Ltd. | 238/50g |
| Formalin | 38% Formaldehyde | 1–3 ppm | Chemical Seller | 75/kg |
| Lenocide | Ankyl benzyl dimethyl ammonium chloride + poly-2 deoxy-2 amino glucose | 500–1000 ml/acre | Nature care | 110/100 ml |
| Pathocide | Benzyl chromium + natural polymer | 200 ml/33 dec. | Penta Agrovet Ltd. | 110/100 ml |
| Omicide | Benzyl ammonium chloride + urea | 200 ml/33 dec. after 24 h. 150 ml | Lion overseas trading company | 110/100 ml |
| Virex | Potassium Peroxymono sulphate 50% | 100–200 /33 dec | ACI Animal Health | 110/100 g |
| EDTA | Sodium thiosulphate | 0.1–1 ppm | Chemical seller | 45/kg |
| Water clear 300/L | Sodium thiosulphate | 2–3 L/100 dec. | Organic pharmaceuticals Ltd. | 330/L |
| Aquakleen | Tetradecyl Tri-methyl Ammonium bromide, BKC | 0.5–1 L/acre | Square pharmaceuticals Ltd. | 330/L |
| BKC | Benzalkonium chloride | Spread with water, 0.5 ppm | Chemical seller | 1550/kg |

| | | | | |
|--------------|--|---------------|-----------------------------|------------|
| Polgard plus | 3-Methyl and 4-Methyl two chain brominated compound | 500 ml/acre | Fish tech (BD) Limited | 490/200 ml |
| Virusnip | Potassium peroxymonosulphate 50%, Sodium dichloroisocyanurate 5%, Excipients 45% | 300-400g/acre | Novartis Animal Health Ltd. | 864/kg |
| Potash | KMnO ₄ | 5-15 mg/dec | Chemical seller | 190/kg |
| Salt | NaCl | 500-1000g/dec | Chemical seller | 18/kg |

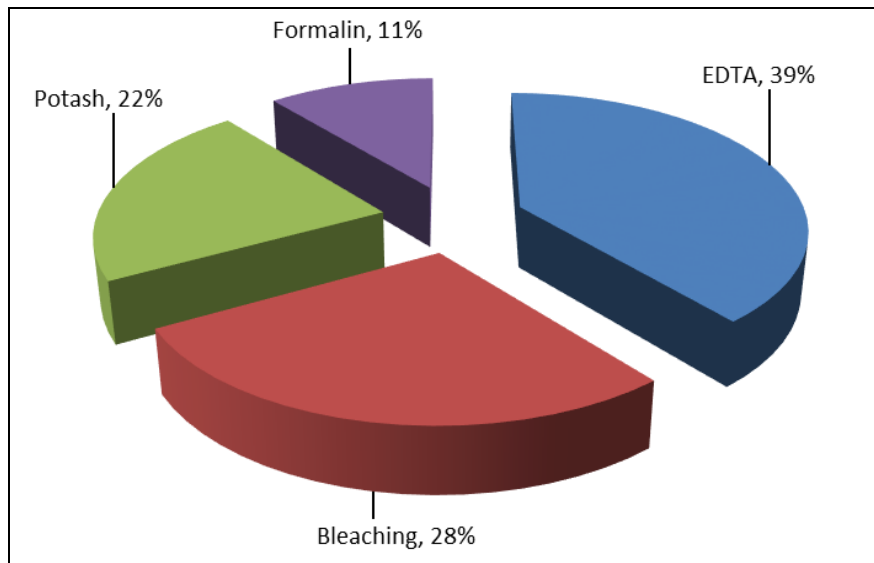


Fig 4: Widely used disinfectants in major farm in Comilla district

3.5 Chemical used for oxygen supply

Different types chemicals 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 chemical.

Table 4: List of chemical used for oxygen supply

| Trade name | Active ingredient | Doses | Source | Price (TK) |
|-----------------------|--|---|----------------------------------|------------|
| Oxymax | H ₂ O ₂ 10% | 250-500 gm/acre (1 m deep water body) | Eon animal health products ltd. | 720/kg |
| ACI-OX | Sodium carbonate, H ₂ O ₂ 10% | 5-8 gm/dec. | ACI animal health | 170/250 gm |
| Bio ox | Sodium carbonate, H ₂ O ₂ | 500–800 gm/acre | ACI animal health | 580/kg |
| Bio care | Sodium lorile ether sulphate | 80–120 ml/100 dec. | ACI animal health | 370/L |
| Oxy more | Sodium carbonate per-oxyhydrate | General dose 250–500 gm/acre. In case of high deficiency 750–1000 gm/acre | SK + F Bangladesh Ltd. | 720/kg |
| O ₂ marine | H ₂ O ₂ 10% | 66–90 tablet/33 dec. | Organic pharmaceuticals ltd. | 590/kg |
| O-plus | O ₂ promoter (H ₂ O ₂ /Ca ₂ O ₂) | 500 gm/acre | Nature care | 580/kg |
| Oxy gold | Sodium percarbonate | 250 g/acre | Fishtech Ltd. | 680/kg |
| Oxy-plus | O ₂ promoter (H ₂ O ₂ /Ca ₂ O ₂) | 500gm/acre | Penta Agrovvet ltd. | 530/kg |
| Oxylife | Oxygen precursors | 400g/acre | Square pharmaceuticals Ltd. | 680/kg |
| Quick oxygen | Sodium percarbonate + free oxygen | In case of high deficiency 500 gm/acre in same water body | Organic pharmaceuticals Ltd. | 610/kg |
| Oxy-A | Sodium percarbonate | General dose 300–400 gm/acre. In case of high deficiency 500-700 gm/acre | The Acme Laboratories Ltd. | 580/kg |
| Oxy flow | H ₂ O ₂ 10% | General dose 250–350 gm/acre. In case of high deficiency 500 gm/acre in same water body | Novartis Pharmaceuticals Ltd. | 800/kg |
| Oxygen plus | O ₂ promoter (H ₂ O ₂ /Ca ₂ O ₂) | General dose 250–500 gm/acre. In case of high deficiency 750–1000 gm/acre | Avon animal Health | 590/kg |
| Oxygrow | O ₂ promoter (H ₂ O ₂ /Ca ₂ O ₂) | 500 gm/acre | Century Agro Ltd. | 590/kg |
| Oxy gold | Sodium Percarbonate | 250-500 /acre | Fish Tech. | 635/Kg |
| Oxysun | Sodium peroxide, calcium peroxide, magnesium oxide, zinc oxide | 500 gm/acre | Rals Agro Ltd., Bangladesh | 590/ kg |
| Best oxygen | Sodium percarbonate | 250–500 g/acre | Univet ltd. | 580/kg |
| Fish care powder | Oxide of Ca, P, S, Mn, Mg, Cu, N | 1 kg/33 dec. | S.S.S Agro care ltd. | 75/400 g |
| Fish curepas | Oxide of Ca, P, S, Mn, Mg, Cu, N | 1 kg/33 dec. | M.R. Food and Protein Industries | 75/400 g |

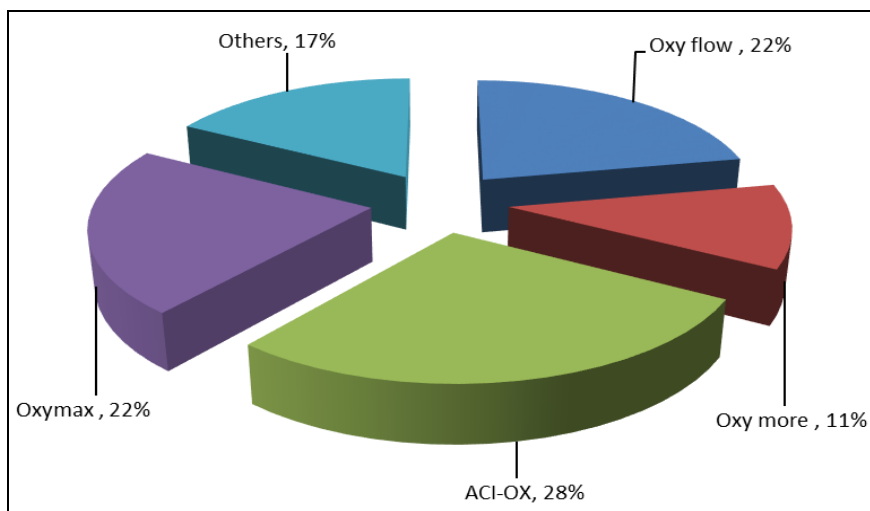


Fig 5: Commonly used chemicals for oxygen supply in Comilla region

3.6 Chemicals used for disease treatment

Different types of chemical are shown in following Table 5. Where eco-solution is effective for viral diseases. Melethion, dipterex, malachite green, 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. Spa is effective for both disease treatment and as growth promoter. Timsen is used for treatment of various diseases and as a disinfectant (Fig. 6).

Table 5: List of chemicals used for disease treatment

| Trade name | Active ingredients | Doses | Source | Price (TK) |
|-----------------|---|---|---------------------------------|------------|
| Timsen | n-Alkyl di-methyl benzyl ammonium chloride + stabilize urea | 80 g/33 dec. | Eon animal health products ltd. | 261/50 g |
| Spa | Protein, cholesterol, calcium, vitamin D, carotinoid | 10-15 gm/kg feed | Eon animal health products ltd. | 570/kg |
| Formalin | 40% HCHO | 1-3ppm | Chemical seller | 75/kg |
| Lime | CaO, Ca(OH) ₂ | 100kg/ha | Chemical seller | 18/kg |
| Albez | Doxycyclin, colistine sulphate + vitamin premix + mineral | | Syngenta pharmaceuticals Ltd. | 273/250 g |
| Melethion | Active melathion | 500g/acre | Chemical seller | 63/100 ml |
| Potash | KMnO ₄ | 5-15 mg/dec | Chemical seller | 190/kg |
| Salt | NaCl | Spread with water 6-10 ppm | Chemical seller | 18/kg |
| Malachite green | C ₂ H ₂ O ₄ | 1ppm; 1min; dip | Chemical seller | 550/25 g |
| Sumithion | Fanitrothion | | Chemical seller | 95/100 ml |
| Eco-solution | Eco-solution | 200-250ml/acre | Chemical seller | 90/100 ml |
| Methylene blue | C ₁₀ H ₁₈ ClN ₃ SxH ₂ O | 2-3ppm bath for 1h/10-20 mg/L for 15 min. | Chemical seller | 75/100 ml |
| Registrol | Betain, Calcium, P, Vit-C | 5-10ml/kg feed | Square pharmaceuticals Ltd. | 1150/1 |
| Emsen | n-Alkyl dimethyl benzyl ammonium chloride stabilized urea | 80 g/33 dec. | SK + F Bangladesh Ltd. | 270/50g |
| Virex | Potassium Peroxymono sulphate 50% | 100-200 /33 dec | ACI Animal Health | 110/100 g |

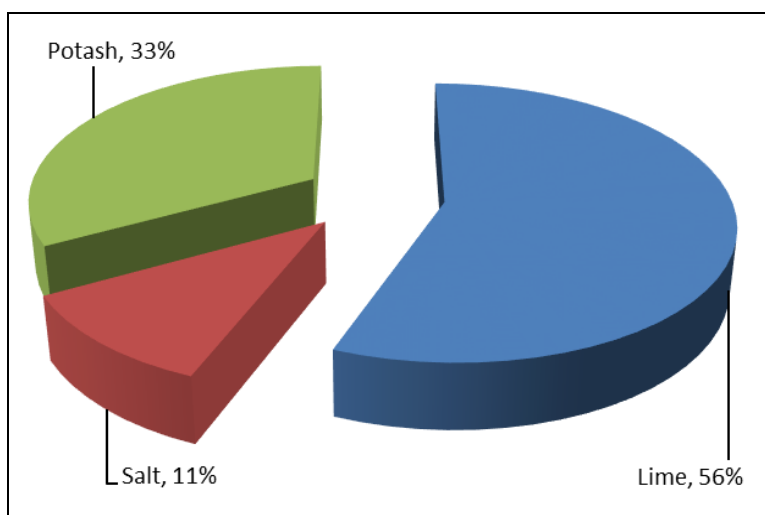


Fig 6: Commonly used chemicals in disease treatment of fish in Comilla region

3.7 Antibiotics for disease treatment

In the present investigation about 20 branded antibiotics with different trade name were seen in the market as well as used by the fish farmers which are shown in Table 6. The active

ingredients of such antibiotics are mainly oxytetracycline, chlortetracycline amoxicillin, co-trimoxazole, sulphadiazine and sulphamethoxazole (Fig. 7).

Table 6: List of antibiotics for disease treatment

| Trade name | Active ingredients | Doses | Source | Price (TK) |
|------------------------|--|---|-------------------------------|--------------|
| Oxy-D Vet | Oxytetracycline 20% Doxycycline 10% | 5-10 g/Kg body wt. for 5-7 days | Eon Animal Health Ltd. | 173/100 gm |
| EST-Vet | Erithromycine thiocyanate, Suiphadyazine, Trimethoprim | 100-150 gm/1000 kg body wt. for 3-5 days | Eon Animal Health Ltd. | 393/100gm |
| Ablaze | Vitamin, Mineral, Antimicrobial agents | 150-200 gm/ 1000 kg body wt. | Eon Animal Health Ltd. | 390/250gm |
| Bactitab | Oxytetracycline 20% | 5 gm/kg body weight 5–7 days | ACI animal health | 70–80/100 gm |
| Acimox (vet) powder | Amoxicillin trihydrate | 1 gm/1 kg feed | ACI animal health | 75/100 gm |
| Cotrim-vet | Sulphamethoxazole + trimethoprim | 0.5 mg/kg body weight | Square pharmaceuticals ltd. | 70–80/100 gm |
| Contrim (vet) bolus | Cotrimoxazole | 1 bolus/10–12 kg body weight | Square pharmaceuticals ltd. | 64/100 gm |
| Otetra (vet) powder 50 | Oxytetracycline | Mixed with feed; 11–16 gm/100 kg body weight | Square pharmaceuticals ltd. | 156/100 gm |
| Oxin WS | Oxytetracycline 20% | 50 mg/kg body weight | Navana pharmaceuticals ltd. | 70–80/100 gm |
| Oxysentin 20% | Oxytetracycline HCL BP | 50–100 gm/100 kg feed, 5–7 days (for treatment) | Novartis pharmaceuticals ltd. | 965/kg |
| Ranamox | Amoxicillin trihydrate | 28–40 gm/100 bd of fish, 10 days continuously | Renata pharmaceuticals ltd. | 140/100 gm |
| Renamycin | Oxytetracycline | 28–42 gm/100 kg feed, 10 days | Renata pharmaceuticals ltd. | 82/100 gm |
| Sulphatrim | Sulphadiazine | 50 gm/kg body weight, 5–7 days | Square pharmaceuticals ltd. | 70–80/100 gm |
| Aquamycine | Oxytetracycline HCL 25% | 1-2 g/Kg feed for 5-7 days | ACI Animal Health Ltd. | 70/100 g |
| Chlorsteclin | Chlortetracycline | 200–300 gm/100 kg feed (5–7 days) | Novartis pharmaceuticals ltd. | 300/kg |
| Amoxifish | Amoxicillin trihydrate | 3-5 gm/kg feed | Fish tech | 280/kg |
| Orgacycline 15% | Chlortetracycline | 200–300 gm/100 kg feed 5–7 days | Organic pharmaceuticals ltd. | 295/kg |
| Fish cure | Chlortetracycline HCL | 500/1000 kg feed (3–5 days) | Rals agro ltd. | 275/kg |
| Argulex | Trichlorofon 40% | 12-13 ml/dec | Eon Animal Health Ltd. | 475/500 ml |

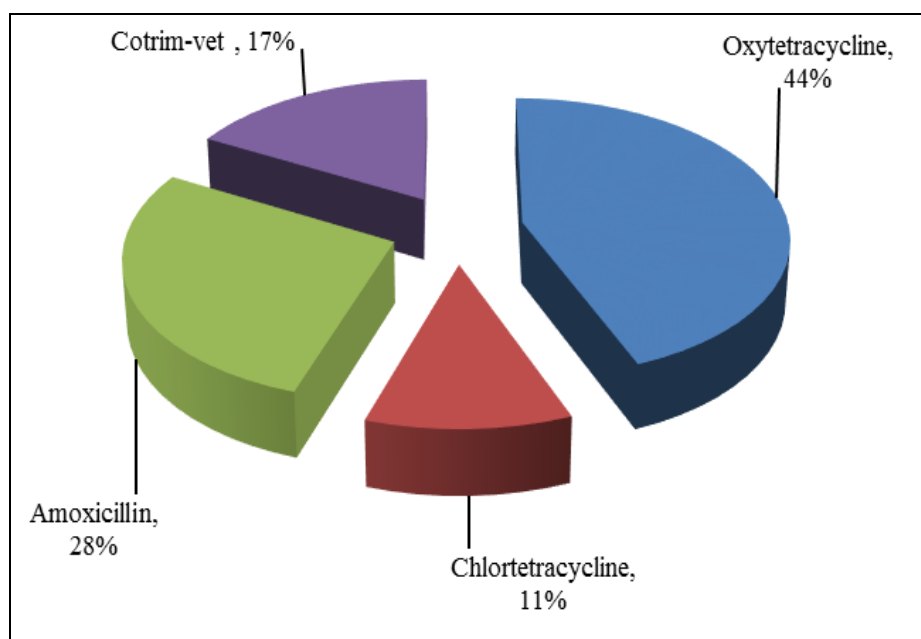


Fig 7: Commonly used antibiotics in disease treatment of fish in Comilla region

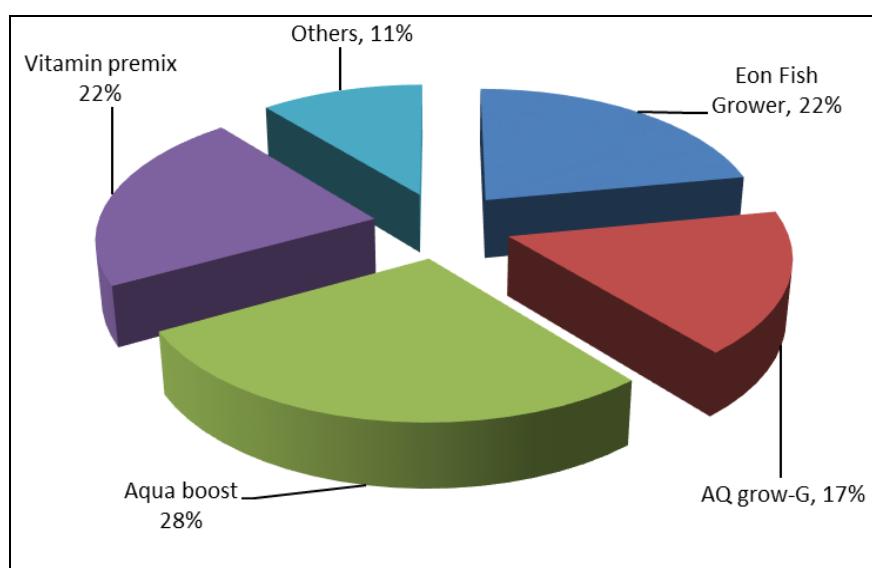
3.8 Chemicals used as growth promoter

Several chemicals which were found in the chemical shops used as growth promoter as well as increase the production. A

list of growth promoters is shown in Table 7. All of the growth promoters play a vital role for rapid growth of fish.

Table 7: List of chemicals used as growth promoter

| Trade name | Active ingredients | Doses | Source | Price (TK) |
|--------------------|---|------------------------|---------------------------------|---------------|
| Vitax-C | Vit C BP 100 mg/g powder | 1-2 g/2-3 Kg feed | Eon Animal Health Ltd. | 200/100 g |
| Eon Fish Grower | Vitamin + Mineral premix | 1.5-3 gm/kg feed | Eon Animal Health Ltd. | 255/kg |
| Aqua savor | Amino acid premix | 2-3 kg/MT feed | Eon Animal Health products Ltd. | 750/kg |
| AQ grow-G | Herbal growth factor | 1-3 ml/kg feed | ACI animal health | 300/kg |
| AQ grow-L | Herbal growth factor and binder | 1-2 ml/kg feed | ACI animal health | 230/kg |
| AQ grow-P | Herbal growth promoter premix | 1-2 g/kg feed | ACI animal health | 230/kg |
| Acimix super-fish | Vitamin mineral + antioxydent | 1 kg/ton feed | ACI animal health | 350/kg |
| Fibosoel. | β -Glucan and mannos polymer | 200-300 g/MT feed | Eon animal health products ltd. | 325/200 g |
| Aqumin | Cu, Co, Mg, Fe, Zn, I, Ca, P, D, L. Mithiolin, L-lysine HCl | 1gm/kg feed | ACI animal health | 150/kg |
| Ayumin powder | Mineral + herbs | 5-10 kg/ton feed | ACI animal health | 150/kg |
| Calfostonic powder | Vit + mineral + amino | 1-2 kg/ton feed | ACI animal health | 350/kg |
| AQ cell | Ca, P, vitamin and herbs | 1-2 gm/kg feed | ACI animal health | 300/kg |
| Aqua boost | Organic acid, β -glucan | 500 g/mt feed | Novartis pharmaceuticals ltd. | 300/kg |
| Fish vita plus | Vitamin, mineral and amino acid supplement | 200-300 ml/100 kg feed | Rals Agro ltd. | 250/kg |
| Grow fast | Vitamin, mineral and amino acid supplement | 200-300 ml/100 kg feed | Rals Agro ltd. | 650/L |
| Growmax | Vit + mineral + amino acid | 2.5 kg/ton feed | Penta Agrovat ltd. | 350/kg |
| Megavit Aqua | Vitamin, mineral and amino acid supplement | 100 g/100 kg feed | Novartis pharmaceuticals ltd. | 380/kg |
| Nature aqua GP | Vit + mineral + amino acid | 2.5 kg/ton feed | Nature care ltd. | 300-350/kg |
| Orgavit aqua | Vitamin, mineral and amino acid supplement | 100 g/100 kg feed | Organic pharmaceuticals ltd. | 325-350/kg |
| Vitamin premix | Multivitamin | 100-150 g/kg | Square pharmaceuticals ltd. | 390/kg |
| Cevit Vet | Vitamin C | 25 mg/kg feed | Square pharmaceuticals ltd. | 90-100/100 gm |
| Rena Fish | Vit A, B, C, D3, E, K, Cu, Mn, Fe, Co etc. | 1 Kg/ton feed | Reneta Ltd. | . 260/Kg |
| Charger Gel | 1-3 D-Glucan, Polysaccharides, Btain, Beta Glucan | 6-8 g/Kg feed | Fishtech | 1060/Kg |
| Square Aquamix | Vitamin, Amino acid, Minaral, Probiotic, Anti oxydent etc. | 1 g/Kg feed | Square Pharmaceuticals Ltd. | 295/Kg |
| Vitamix F aqua | Vit + mineral + amino acid | 2.5 kg/ton feed | The Acme laboratories ltd. | 300-350/kg |
| Catamin | Vitamin and mineral | 2-3 L/acre | Catapol Bioscience ltd. | 445/L |

**Fig 8:** Commonly used chemicals as growth promoter in Comilla region

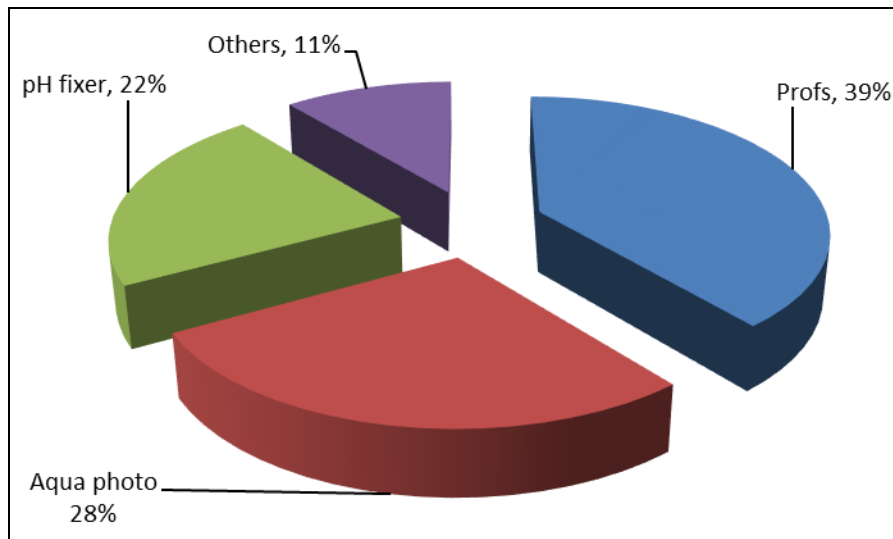
3.9 Use of probiotics in fish farming

In the present study some fish farmers were found to use a range of probiotic products to control vibriosis and other luminiscent bacteria, improving water and soil quality and

control pH Table 8. The probiotic contains mainly different concentration of beneficial bacteria which include *Bacillus* sp., *Rodobacter* sp., *Rodococcus* sp., *Streptococcus faecalis*, etc (Fig. 9).

Table 8: List of probiotics used in fish culture in Comilla region

| Trade name | Compositions | Purpose of use | Doses | Source | Price (Tk) |
|--------------|---|--|---------------------|------------------------------|------------|
| Profs | <i>Bacillus sp.</i> and <i>Padiococcus sp.</i> | Control vibriosis, luminescent bacteria | 50-70 gm/33 dec. | Eon Pharmaceuticals Ltd. | 660/100gm |
| Aqua photo | <i>Bacillus subtilis</i> and <i>Rhodoseudomonas</i> | Control unwanted gas, sediment and increase growth of plankton | 50-70 ml/100 dec. | ACI Animal Health | 350/L |
| C-150 | Coated Vit-C | Increase resistant power for shrimp | 5 g/kg feed | CP Aquaculture | 1050/kg |
| Mutagen | Major vitamin and minerals | For better health | 5 g/kg feed | CP aquaculture | 230/kg |
| pH fixer | <i>Bacillus sp.</i> | Improve water quality and control pH | 1-2 kg/acr | CP Aquaculture | 325/kg |
| Eco marine | <i>Bacillus subtilis</i> , <i>B. pumilis</i> , <i>B. amylolichenifaciens</i> <i>B. megaterium</i> . | Control vibriosis and luminescent bacteria. | 3-4 tablet/acre | Organic Pharmaceuticals Ltd. | – |
| Aqua gold | <i>Rhodopseudomonas sp.</i> | Increase growth rate and disease preventive power | 2 ml/100 dec. | Organic Pharmaceuticals Ltd. | – |
| Procon-PS | <i>Bacillus sp. Rhodococcus</i> , and <i>Rhodobacter</i> | Control unwanted gas, sediment and arrests the pathogens | 5 L/hac (1 m depth) | Rals Agro Ltd. | 450/L |
| Super Biotic | <i>Bacillus sp.</i> | Reduce pathogenic bacteria in water | 1-2 kg/ acre | CP Aquaculture | 550/kg |
| Super PS | <i>Rodobacter sp. Rhodococcus sp.</i> | Improve soil quality and reduce toxic gas from bottom | 4-6 L/acre | CP Aquaculture | 200/L |
| Pond care | <i>S. faecalis</i> and other bacteria | Inhibit pathogenic bacteria | 50g/ acre | SK + F Bangladesh Ltd. | 375/100gm |

**Fig 9:** Commonly used probiotics in Comilla region

3.10 Chemicals used as toxic Gas removal

To remove organic and inorganic wastes producing gas in ponds, farmers were seen to use gas removal agent to their

culture pond. About 10 toxic gas removal with different trade name were found to different farm. Their name, dose and sources are given in Table 9 and Fig. 10.

Table 9: List of available toxic gas reducer in market and field level

| Trade Name | Active ingredients | Doses | Company | Price (Tk.) |
|--------------|---|-----------------------|--------------------------------------|-------------|
| Bio-Aqua-50 | Yucca plant extract, Saponin Components Glyco components | 60-70 ml /33 dec | Eon animal health Co. Ltd. | 2500/kg |
| Ammonil | Yucca plant extract, <i>Bacillus subtilis</i> , <i>candida utilis</i> | 100-200 g/acre | Noverties Pharmaceuticals Co. Ltd. | 2800/kg |
| Gas stop | <i>Bacillus subtilis</i> Al ₂ O ₃ SiO ₂ | 500 mg/acre, 3 weeks | Organic pharmaceuticals Co. Ltd.(BD) | 2500/Kg |
| Gastrap | Lactic acid <i>Bacillus sp. Bacillus subtilis</i> Cellulase, Hemicellulase, amylase | 200 mg/acre | Square pharmaceuticals Co Ltd. | 3000/ Kg |
| Aqua Magic | <i>Azotabactor chorococcum</i> , <i>Bacillus subtilis</i> , <i>candida utilis</i> | 400g/acre | Fish tech.(BD) Co. Ltd. | 2700/kg |
| Pond D tox | Pracoccus pantotrophus | 4 ppm | Fish tech.(BD) Co. Ltd. | 2800/Kg |
| Gasonex plus | . Na-lorile ether sulphate | 200-400 mg/Kg Zeolite | Fish tech. (BD) Co. Ltd. | 435/100gm |
| Gas kit | | 200-300 g/acr | Catapol Bioscience ltd. | 340/100g |
| Gas check | | 200 g/acre | First care | |

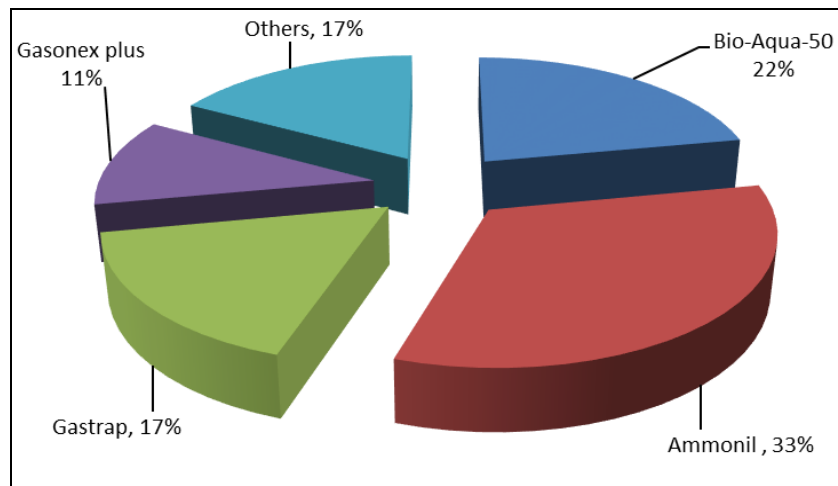


Fig 10: Commonly used toxic gas reducer in Comilla Region

3.11 Enzyme

Only one type of enzyme was used by the fish farmers in fish feed named Biozyme. They used it at a dose of 25-50gm/100 kg feed. The pharmaceutical company Fish Tech provides the enzyme to the farmers.

3.12 Insect killer

Sumithion and Deletix are the two insect killer used by the farmers in their pond to kill different types of harmful insects. The recommended dose of Sumithion was 5- 10ml/day/3ft depth and Deletix was 25-30 ml/acre for 4 feet water depth. Samco and Fish Tech were the two companies which provide the chemicals to the farmers.

3.13 Predator killer

Farmers use rotenone powder to remove predator fish. Rotenone with a brand name Acurte Gold is provided by a pharmaceutical company Samco was found in the study. The recommended dose of Acurte Gold was 15 gm/dec/1 ft depth.

3.14 Algae killer

Seaweed was the only type of algae killer used by the fish farmers. They used it at a dose of 2-4 liter/acre. The pharmaceutical company Fish Tech provides the Seaweed to the farmers. It is used to remove or control toxic algae and phytoplankton growth.

3.15 Knowledge and training of fish farmers

It was observed that 33% fish farmers had no training while 67% farmers received short term training from Department of fisheries. Different NGOs such as DANIDA, Youth Development, Worldfish Center and CARE 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 TSO (Technical Service Officer) of different pharmaceutical and feed companies. Training status of fish farmers is shown in Figure 11.

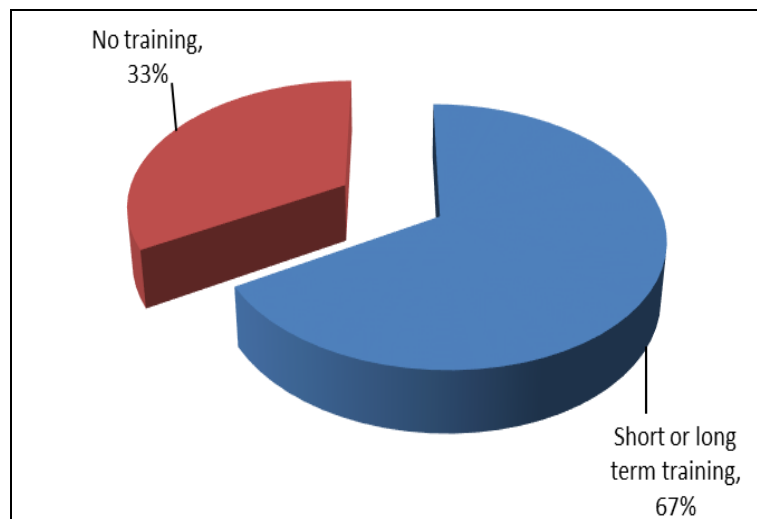


Fig 11: Percentages showing training status of fish farmers

4. Discussion

Aquaculture in Bangladesh is heading towards commercialization and intensification. Different types of drugs and chemicals have become an essential part of successful aquaculture production. The present investigation was conducted to know the current status of commercial aqua-drugs and their impact on fish health. Data was collected through questionnaire interview, market survey and personal

contact with retailers and representatives of pharmaceutical companies at Comilla Sadar, Daudkandi, Muradnagar, Brahmanpara, Burichang, Chauddagam, Laksam and Barura upazilla of Comilla district, Bangladesh.

In the present study, it was found that most twelve different categories of commercial aqua-drugs and chemicals were used by farmer for different aquaculture activities like disease treatment, pond preparation, disinfectants, growth promotion

and improve disease resistance. All these activities were related for better health management of aquatic animal. At present 24 animal health companies were seen to market at field level. Moreover, these pharmaceuticals companies found to have very attractive information leaflet to sell their products to the farmer. Farmers of the selected area used mainly Amoxifish, Renamycin, Timsen, Aquamysine, Deletix, Seaweed, Ossi-C, Oxy gold, Charger gel, Renaquine, Polgard plus, Vectisol, Aqua kleen, Rotenone, Aqua, boost, Timsen, Sumithione, Doxioxy, Aqua boost and Virex as trade name for disease treatment.

However, in the present study we got some new products with various trade names which include Ossi-C, Oxy gold, charger gel, Polgard plus and Vectisol. In the study area different types of fish diseases like EUS, tail rot, fin rot, red spot, white spot and dropsy in different fish species mainly in Shing, Koi, Tilapia and Pangus were observed. It meant that disease problem was one of the major concerns in the aquaculture of the studied areas.

The present study revealed that commercial aqua drugs have some positive impact on fish health management and disease treatment at the farmer's level. It was observed that farmers of the selected areas got good results in disease treatments by applying single or combinations of various aqua-drugs and chemicals. In some cases after use of drugs they got about 95% recoveries within a short period of time. These results influenced farmer to use more commercial aqua-drugs in controlling disease. Sometimes they applied drugs higher than recommended doses to get quick recovery. Normally in rural aquaculture, farmer used traditional chemicals in health management such as lime, salt, potassium permanganate, sumithion, melathion, formalin and bleaching powder. But, they did not get better results than commercial drugs and chemicals. So, the farmer showed less interest to traditional drugs for disease control. The uncontrolled uses of drugs sometimes have got negative impact on fish health. Some pathogen evolved drug resistance ability due to unconscious and repeated use of drugs. It was not possible to control the disease in such condition. It was also found that in case of diseased Shing, farmers did not get any recovery. In a certain region of the study area Shing had 90-100% mortalities within very short period from unknown reason with no obvious clinical sign. In the present study, it was observed that about 20 antibiotics with different trade names were used by the farmer. Antibiotics should be used only for the treatment of bacterial diseases. It was found in the present study that antibiotics were used indiscriminately without knowing the exact reasons of disease. Some farmers did not follow the described dosages for treatment.

Commonly found traditional chemicals in health management included salt, potassium permanganate, sumithion, melathion, formalin, bleaching powder, malachite green and methylene blue. Some previous studies also revealed the similar reports about the use of chemicals used in aquaculture in Bangladesh [13-15, 19]. The present study also noticed a number of new products with various trade names in the market which included zeolite, geotox, mega geo, aqua boost, oxyflow, bio-tuff, quick-oxygen, orgavit aqua, aqua-gold, timsen, efinol, etc. and various antibiotics and probiotics. The local animal feed and chemical shops are the main sources of such compounds from where farmers usually purchased these. In the present study the major diseases and conditions reported by farmers were EUS, tail and fin rot, dropsy, anal protrusion, fungal disease, nutritional disease, and red and white spot. A number of authors also reported similar conditions in

aquaculture of Bangladesh [14, 15, 20, 21] and excessive use of antibiotics contributes the development of resistant strains of bacteria [22].

5. Conclusion

The study was carried out to understand the current status of the use of chemicals and antibiotics in aquatic animal health management. Data was collected through questionnaire interview, personal contact, market survey and participatory rural appraisal like focus group discussion with fish farmers, retailers of animal medicine and representatives from and pharmaceutical companies in Comilla districts. The survey was carried out for six months from December, 2015 to May, 2016. A range of chemicals and antibiotics were found available in the market to use in aquaculture for various purposes. Fish health management and disease treatment were the major areas where farmers were seen to use a lot of such compounds. Other uses included pond preparation and management, growth promotion, improve water quality, dissolve oxygen supplier, as disinfectant, and probiotics. A number of new products with various trade names were also found available in the market. From huge amount of new products jv zeolite, geotox, green zeolite, etc. which contain more or less similar ingredients and use in mainly pond preparation as well management. Megavit aqua, fish vitaplus, aq grow-g, aqua boost, orgavit aqua, etc. use for growth promotion and increase production. Oxyflow, oxy max, O2-marine, quick-oxygen, etc. are effective to increase dissolved oxygen. EDTA, timsen, efinol, emsen, etc. also use as disinfectant. Various types of antibiotics (oxysentin, renamycin, orgamycin and ranamox) with different trade name were seen in the market as well as used by the fish farmers. Varying opinions were made by the farmers about the effectiveness of particular products. The price seems quite affordable by the commercial aqua farmers. Commonly found traditional chemicals in health management included lime, salt, potassium permanganate, sumithion, melathion, formalin, bleaching powder, etc. The use of these traditional chemicals was more or less similar in freshwater. In the present study fish farmers were found to use a range of probiotic products to control mainly bacterial disease. The probiotic contains different concentration of beneficial bacteria which include *Bacillus* sp., *Rodobacter* sp., *S. faecalis*, etc. About 24 pharmaceutical companies were seen either to produce or market such products. Some products have been marketed by different companies from overseas countries including India, USA, Thailand, Taiwan, Indonesia, Malaysia and Spain. Similar products were seen in different trade names. The price seemed quite affordable by the commercial aqua farmers. In conclusion, the present study demonstrated current status of chemicals and antibiotics using in aquatic animal health management and pointed out some problems of the use of chemicals by the farmers which include lack of knowledge of the chemicals, doses and methods of application of these chemicals. There are few alternatives to minimize the adverse effects of aquaculture chemical are simply use-less of them. Other alternatives could be used as bioremediation and the probiotics, immunostimulants vaccination and alternative therapeutic. However, policy makers, researchers and scientists should work together in addressing the issues of chemical use in aquaculture with the view to reduce the negative impacts.

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