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Aqua-chemicals and Antibiotics Used in Freshwater Aquaculture of Sylhet, Bangladesh

Md. Golam Rasul[1, *], Bhaskar Chandra Majumdar[1], Taslima Akter[2]

[1]Department of Fisheries Technology, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur, Bangladesh
[2]Department of Aquaculture, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur, Bangladesh

Abstract

Present study was carried out to comprehend current status of the practice of chemicals and antibiotics for fish health management in freshwater aquaculture in Gowainghat and Balaganj Upazilla of Sylhet, Bangladesh. Data was collected through questionnaire interview, personal contact, market survey, focus group discussion with target group and representatives of pharmaceutical companies. A range of chemicals including antibiotics were found available in market and being used in the aquaculture sector. Lime, salt, potassium permanganate, sumithion, melathion, formalin, bleaching powder, methylene blue and malachite green were some commonly used traditional chemicals in heath management. Of the new products JV Zeolite, Mega Zeo Blue, Green zeolite, 5 Star Aqua, Aqua C, Aquavit, Bio-Ox, Oxy plus and Bio care were most widely used compounds. About 18 trade names of antibiotics were found and their major active ingredients were oxytetracycline, chlorotetracycline, amoxicillin, co-trimoxazole, sulphadiazine, azithromysin. Among the available antibiotics, Oxy-Dox-F and renamycin was used widely and popularly by the freshwater aqua farmers in study area. The study also indicated some problems associated with the use of such chemicals due to lack of knowledge of farmers about the use of chemicals, appropriate dose and their indiscriminate.

Keywords

Aquaculture, Antibiotics, Chemicals, Disinfectants, Fish Health Management

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1. Introduction

Throughout the most recent decade aquaculture has extended, diversified, intensified and mechanically praiseworthy in Bangladesh. Chemicals are in fact a crucial fixing to fruitful aquaculture, which has been utilized within different structures for centuries [1]. Intensification of aquaculture achieves the utilization of more chemicals and anti-toxins in this segment. Chemicals having more anti-microbial properties are critical parts in wellbeing administration of oceanic creature, lake development, soil and water administration, enhance common amphibian benefit, transportation of live fish, nourish plan, control of multiplication, development advancement and handling and worth expansion of the final item [2, 3, 4].

Anti-toxins have been connected in aquaculture for over 50 years for treating bacterial contamination in fish. Some regular chemicals incorporate sodium chloride, potassium permanganate and hydrogen for every oxide, copper mixes. Sodium chloride is an old treatment utilized for a mixture of ailments of fish. It is particularly successful synthetic when treating some parasitic sicknesses in fish. Formalin is adaptable compound utilized in a mixture of routes in treating fish. Formalin is utilized fundamentally as an outside parasiticide on fish and fish eggs as flush star yearned or indefinite treatment for parasite control. Potassium

* Corresponding author
E-mail address: rasul.gsau@gmail.com (Md. G. Rasul)

permanganate ($KMnO_4$) is one of the generally utilized substances in fish wellbeing administration. Potassium permanganate is useful for treating outer protozoa and outside bacterial diseases [5]. Malacite green is an organic color that has been prevalent as a parasiticide and fungicide on fish. It is essentially utilized within incubation facilities instead of develop out frameworks. Lengthy withdrawal period is essential following application because of persistent residues [6]. Pesticides are also used in aquaculture for disease treatment, such as organophosphates, organotin compounds, rotenone and saponin. Dichlovos, trichlorfon diptarex, melalhion are the widely used organophosphate applied to control ectoparasitic crustacean infections in finfish culture. All the organophosphates chemicals have negative effects on non-target organisms, particularly crustaceans as well as health of fish farm workers due to its high neurotoxicity [7].

With the development of aquaculture in Bangladesh, there has been expanding pattern in utilizing more chemicals as a part of sea-going creature wellbeing administration. Generally utilized chemicals as a part of Bangladesh aquaculture are lime, rotenone, and different manifestations of inorganic and natural composts, phostoxin, salt, dipterex, antimicrobials, melathion, and so forth [8, 9, 10, 11, 12]. A range of disease could be found in farmed aquatic animals in Bangladesh [13, 14, 15]. Farmers are using a range of chemicals and antibiotic for the treatment of diseased animal and fish/prawn farmers are influenced by pharmaceutical companies and chemical sellers to buy their products. The farmers have been using these chemicals without knowing their necessity and effectiveness. Hence, the objectives of the present study were to identify types of chemical and antibiotic used in aquatic animal health management, their purpose, doses and to detect the problems associated with their use.

2. Materials and Methods

2.1. Study Area and Timing of Survey

The study was conducted for 6 months from January to June, 2013 in some private hatcheries, nurseries and culture farms of Gowainghat and Balaganj upazilla of Sylhet Districts (Figure 1). These locations were chosen because of large fish farming areas. Altogether fifty fish farmers were interviewed in these locations. The farms were selected as randomly as possible within each area. However study also conducted in some aqua drug shops and some medical representatives of respective companies. The study was in the form of the field survey and was conducted to locate and identify the existing and present application of chemicals or fish poison in hatchery, nursery and fish farm management.

Data were collected through questionnaire interview with hatchery owners, culture farms owners, chemical sellers, medical representatives of pharmaceuticals companies. During visiting the hatcheries, nurseries and culture ponds, the elements that were considered with importance about chemicals and fish toxicants were purpose of use of chemicals or toxicants, variation in methods of application, effectiveness of chemicals or toxicants, price and availability of the chemicals, specific remark and recommendation of the chemicals. Some of informations were also found regarding the numbers, areas of the hatcheries and nurseries and use of drug and chemicals from the survey section of Department of Fisheries (DoF) office, Sylhet. Data were collected through semi-structure questionnaire, personal contact, market survey and participatory rural appraisal (PRA) like focus group discussion (FGD).

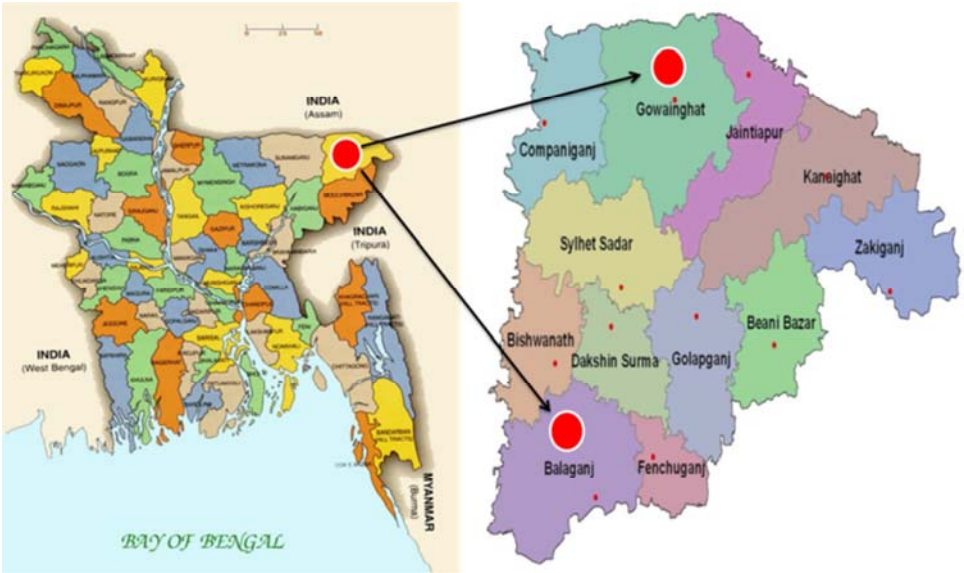

Figure 1. Location of the study area in Sylhet District.

2.2. Analysis of Data

The data were analyzed using tabular statistical techniques. The summary tables were prepared in accordance to the objectives of the study. The technique of analysis included the classification of tables into meaningful result by arithmetic mean, percentage and ratios. Collected data were compiled, tabulated and transformed into reports through logical analysis.

3. Results and Discussion

3.1. Status of Fish Pond Management

Average farm size of all the fish farms surveyed in Gowainghat and Balaganj Upazillas of Sylhet was over 50 decimals (Table 1). Almost all the farms used to dry their pond, repair dike and remove predatory fishes before culture. Most of the farms in all the two regions remove aquatic weed or scum from pond before starting of operation. Most of the fish farmers use lime and fertilizer in their pond. In the Sylhet belt of Bangladesh, fish culture can be classified as: Fish and shrimp culture; Tilapia and other carps culture; Tilapia-Sarpunti culture and Monoculture of Pangas. On the basis of the farm management, however, for example stocking rate, feed supply etc. fish culture practice in Bangladesh can be divided into three categories: Traditional, Improved traditional and Semi-intensive system.

Sources and stocking of fingerlings in fish farms of Gowainghat and Balaganj upazillas are presented in Table 1. The source of the fingerlings was mostly from hatchery. The stocking density was 150-300 fry/decimal. The fry were released 7-25 days after entering water from March to May. In all farms, the fry were released after conditioning in nursery. Both commercially produced feeds such as Saudi-Bangla Feeds, Niribily Feeds, Quality Feeds, ACI Feeds, Balaka Feeds, etc. and those prepared locally were used. In both Gowainghat and Golapganj, some of the farmers use Pharmaceuticals such as Aquamarine, Oxycentril, etc. whereas few of them use growth hormones in feeds. Most of the farmers denied use of poultry dropping as fertilizer in the ponds of these two upazillas, whereas a few farmers admitted to use poultry feed. Farmers apply feeds 12-15 hours prior to harvesting.

Table 1. Farm size, Farm operating season, Stocking period of Post Larvae (PL) and Stocking density in Gowainghat and Balaganj in the Sylhet district.

Major aspects	Sylhet District	
	Gowainghat Upazilla	**Balaganj Upazilla**
A. Farm size		
Average farm size	33% over 50 decimals	100% over 50 decimals
B. Farm preparation		
Water source	Rain and river	Rain and river
Culture type	Traditional, improved traditional and semi-intensive	Traditional, improved traditional and semi-intensive
Liming in farm	100% Yes	100% Yes
Fertilization in farm	50% Yes 50% No	100% Yes
C. Farm operating season		
Months	3-12 months	12 months
D. Stocking		
Source of fry/fingerlings	Private hatchery	Private hatchery
Length of fry/fingerlings	½-2 inch	½-1.5 inch
Stocking density	150-300 fry/ decimal	120-300 fry/ decimal
Stocking period of PL	March-may	January-February
E. Feeding		
Feed used	Locally made feed and Brand feed (Saudi Bangla, Niribily, Quality, ACI, Balaka)	Locally made feed.
Locally used feed ingredients	Rice Bran, Boiled rice, Maize, Wheat, Bran, Mustard Oil Cake (MOC), Molasses	Rice Bran, Boiled rice, Maize, Snail, Wheat Bran, Boiled Pulse, Mustard Oil Cake (MOC), Chira, Molasses, Bason
Feed formulation type	13% Semi Solid 87% Solid	Mainly solid
Feeding Rate (Kg)	5-10	2-8
Feeding frequency	1-2 times/ per day	2-3 times/ month
Use of Pharmaceuticals in Feed	13% use (Aquamarine) 87% do not use	16% use (Oxycentril) 84% do not use
Use of growth promoter/hormone in Feed	Only use 4% (Urea)	Only use 8% (Noverties Hormone, Urea)
Use of Poultry dropping/ waste in feed	No	No
Use of Poultry feed	Only use 4%	No

3.2. Fish Pond Management Issues Analysis

Table 2. Disease related information in Gowainghat and Balaganj.

Major aspects	Sylhet District	
	Gowainghat Upazilla	Balaganj Upazilla
A. Major diseases occur		
Bacterial	12%	18%
EUS	44%	61%
Unknown	16%	Nil
None	28%	31%
B. Seasons of occurring diseases		
December	11%	23%
April	21%	46%
May	68%	8%
C. Repeated occurring of any disease		
Yes	33%	16%
No	67%	84%

Occurrence of major diseases, seasons of disease outbreak and use of pharmaceuticals/chemicals in the study area are established on Table 2. It was found that bacterial and EUS were the major diseases, there were also incidence of unknown diseases possibly related to low dissolved oxygen in the water where fish died immediately after coming to the edges of the pond mostly happened in early morning. In Gowainghat, these diseases occur in April to June when the environment temperature is high.

3.3. Chemicals Used in Different Stages of Fish Farming

In Gowainghat and Balaganj upazillas, informations about chemicals used in different stages of fish farming are presented in Table 3. Farmers of both upazillas use lime, rotenone, TSP, etc. during pond preparation, but the percentage of uses of lime, rotenone, TSP is higher in Gowainghat upazilla. Jelani *et al*. [16] reported that lime, zeolite, fish toxin, insecticides and different fertilizers are used for the preparation and water quality management in Noakhali district. In Bangladesh lime is the most commonly used chemicals due to its low price and effectiveness in water quality management [17]. For maintaining water quality, farmers normally use lime, MP and aqua jet. The farmers use various chemicals such as Ziolite, 5-Star Aqua, Aqua sol., Mega-Zeo blue, Methylene blue etc. to prevent diseases. Some previous studies also revealed the similar outcome reported by Faruk *et al*. [1], Sharker *et al*. [18] and Chowdhury *et al*. [19].

Table 3. Chemicals use in different stages of fish farming.

Major aspects	Sylhet District	
	Gowainghat Upazilla	Balaganj Upazilla
A. Chemicals used during pond preparation	27% Yes (Lime, Rotenon, Phosphate) 87% No	45% Yes (Lime, Triple super phosphate) 49% No
B. Chemicals used for water purification	50% Yes (Lime, Potas, Aqua jet, Metro sol) 50% No	100% No
C. Chemicals used for preventing disease	31% Yes (Ziolite, 5 Star Aqua, Aqua sol., Mega-Zeo blue, Methylene blue) 69% No	7% Yes (5 Star Aqua, Methylene blue) 93% No
D. Chemical used during transportation	100% No	100% No

3.4. Chemicals and Antibiotics Used in Sylhet District for Fish Production

Most of the farmers in Gowainghat and Balaganj upazillas used chemicals and antibiotics for pond and fish health management are shown in Table 4. The uses of chemicals and antibiotics were influenced by the culture system. A wide range of chemicals and antibiotics were used in semi-intensive and intensive culture system than extensive and simple culture system. In the present study, Thai pangus, Thai koi, Shingi, Tilapia farmers used more antibiotics than carp farmers.

Table 4. List of Chemicals and antibiotics for fish production.

No.	Name	Trade name	Chemical formula	Purpose	Dose
1	Lime	Chun / lime /agriculture lime	CaO, hydrated or slaked lime, $Ca(OH)_2$ and $CaCO_3$	Improve liberation of bases, biological activity, oxygen, decomposition. maintain pH of pond water, remove turbidity	0.5-1 kg /dec
2	Zeolite	JV Zeolite /Mega Zeo Plus /Mega Zeo/ Mega Zeo Blue/ Green zeolite	SiO_2, Al_2O_3, Fe_2O_3 CaO, MgO, Na_2O, K_2O	Remove gas. Maintains water color	200 g /dec
3	Rotenone	Rotenone /aquatin/aqurte-gold	$C_{23}H_{22}O_6$	Fish poison or toxicants	15-30 g /dec in nursery pond and 20-35 g /dec in culture pond
4	Phostoxin	Quickphos /phostoxin tablet	Aluminium phosphide	Fish poison	3-5 tablets /dec

No.	Name	Trade name	Chemical formula	Purpose	Dose
5	Bleaching	Calcium hypochlorite	$Ca(ClO)_2$	Toxin, disinfectant and effective against saprolegniasis.	350-400 g /dec as toxicant and 60 g /dec as disinfectant.
6	Endrin	Endrin	$C_{12}H_8C_{l6}O$	Fish poison	50-60 ml /dec
7	Fenithrothion	Sumithion 50ec	Sulfur-by-phosphate O, O-methyl-2-O -(3-methyl- 4-nitrophenyl) ester	Insect kill	2-3 ml /dec
8	Malathion	Malathion 70ec	$C_{10}H_{19}O_6PS_2$	Pest control	2-3 ml /dec
9	Trichlorfon	Dipterex 80sp	Dimethyl-(2, 2, 2-trichloro-1-hydroxyethyl) phosphonate	Insecticide	6-12 ml /dec
10	Fertilizer	TSP, Urea and MP	43-45% P, 40-45% N, 48-62% P	Increased primary productivity	50-70g/dec 100-150g/dec 20-30g/dec.
11	Vitamin and mineral	Aqua Cal C /Aqua C /Aquavit	Vitamin C, Calcium plus /Ultra vita F	Anti-oxidant, developed body growth and weight	0.1-0.3 g /kg feed.
12	Formalin	Formalin	40 % HCHO	Employed as an antifungal agent and in the control of ectoparasites, most often in hatchery systems	1-3 ppm as disinfectants and 3-5 ppm for disease treatment
13	EDTA	Ethylene diamine tetra acetic acid	$C_{10}H_{16}N_2O_8$	Widely used to disinfectants of the hatchery equipment and also water treatment	0.1-1 ppm
14	Potassium permanganate	Potash	$KMNO_4$	Active against saprolegniasis, dactylogyrosis, gyrodectylosis, Argulosis	5-15 mg/dec
15	Malachite green	Malachite green	$C_2H_2O_4$	Active against the oomycete Saprolegnia, which infects fish eggs in commercial aquaculture	1-5 mg/dec, 1-2 ppm
16.	Methylene blue	Methylene blue	C_{10} H_{18} ClN_3Sx H_2O	Useful for eradication of external parasites as well as fungal diseases	2-5 mg/dec, 1-2 ppm
17	Copper sulphate	*Tut/* Copper sulphate	$CuSO_4$	Effective against external parasites	15-25 mg/dec
18	Salt	*Lobon/ Nun*/ Salt	NaCl	Active against coastiasis, chilodonelliasis, trichodiniasis, Dactylogyrosis	500-1000 g/dec
19	Hydrogen peroxide	Oxyflow/ Oxymax/ Bio care/ Bio-Ox/ Oxy plus	10% H_2O_2	Oxygen supplier	5-10 g/dec
20	Oxytetracycline	Oxy-Dof-F/ Aquamycine/ Renamycin/ Oxysentin 20%/ Orgamycin15%/ Oxin WS/ Tetravet 200 WSP/ Otetra vet power 50	Oxytetracycline 20%, doxycycline 10%. Oxytetracycline hydrochloride 25%, Oxytetracycline	Effective against a wide range of Gram-negative and Gram-positive bacteria, EUS, Edwardsiellosis, Columnaris	2-6 mg /kg feed
21	Amoxicillin	Acimox(vet) Powder/ Renamox 15%-vet/ Ranamox	Amoxicillin Trihydrate	Effective against columnaris, Edwardsiellosis and mycobacteriosis	3-7 mg/kg feed
22	Chlorotetracycline	Captor/ Orgacycline-15%/ Fish cure/ Aquamysine	Chloro-tetracyclin HCl BP 45, Chlorotetracycline	Effective against *Aeromonas*, *Vibrio* spp. in fish	3-7 mg/kg feed.
23	Co-Trimoxa zole	Cottrim vet Bolus	$C_{24}H_{29}N_7O_6S$	Active against a wide range of Gram-negative and Gram-positive bacteria	Mixed with feed; 1bolus/ 10-12 kg body wt
24	Sulphadiazine & Trimethoprim	Sulfatrim	$C_{10}H_{10}N_4O_2S$, $C_{14}H_{18}N_4O_3$	Effective against a wide range of bacteria	Mixed with feed:50 g/kg body weight, 5-7 days
25	Azithromysin	Eryvet	$C_{38}H_{72}N_2O_{12}$	Acts against Columnaris, Edwardsiellosis and Motile Aeromonas Septicemia, Vibriosis, Mycobacteriosis, EUS	1-2 g/kg feed

Commonly found traditional chemicals in health management included lime, rotenone, salt, 5 Star Aqua, potassium permanganate, sumithion, melathion, formalin, bleaching powder, malachite green and methylene blue. Some previous studies also revealed similar reports about the use of chemicals in aquaculture of Bangladesh [8, 11, 15, 20].

Renamycin, Aquamysine, Oxy-Dox-F, Oxytensin, Amoxyfish, Amoxivet, Tetravet, Orgamysin, Eryvet were some antibiotics that used in the present study area. The active ingredients of such antibiotics were oxytetracycline, chlorotetracycline, amoxicillin, co-trimoxazole, sulphadiazine, Azithromysin. Most of the farmers used Oxy-Dox-F and renamysin at the rate of 1-2g/kg feed for 7 days for its high activity against bacterial diseases. Oxytetracycline and a potentiated sulfonamide are antibiotics

approved for use to treat disease but only in certain types of aquatic animal and only to treat certain diseases [21]. This result is agreed with Faruk *et al.* [1], Khan *et al.* [22] and Samsuzzaman *et al.* [23]. Faruk *et al.* [1] found a range of antibiotics used in aquaculture for fish health management and disease treatment.

The use of antibiotic substances is the cause of much controversy. Bacterial diseases of fish can he successfully treated with antibiotics. However, to ensure the correct antibiotic, the causative agent of the disease needs identification via a sensitivity test at a diagnostic laboratory. About 18 trades named antibiotics were found in the market to use for fish disease treatment. These antibiotics were used indiscriminately in the study areas without knowing the exact reasons of disease. It suggested that farmers didn't have training about the use of chemicals during chemotherapy. It is widely recognized that excessive use of antibiotics contributes to the development of resistant strains of bacteria [24]. There is no doubt that these compounds are widely abused in aquaculture at present. There are several rules that should be followed when considering the use of antibiotics which included (i) always improve the pond environment, (ii) only use antibiotics when it is essential, (iii) only use antibiotics for bacterial infection, (iv) use an antibiotic to which the bacteria are sensitive, (v) use fresh antibiotic from a reliable source, (vi) take care when handling antibiotics they can be dangerous to some people, (vii) make Tip the medicated feed fresh and do not store it for prolonged periods, (viii) use correct dose, (ix) use for sufficient duration and (x) apply an adequate withdrawal period [25].

In the present study, farmers were not aware about the mode of action of particular chemical. As a consequence, during disease treatment first they try with one chemical and if it does not work, they try for other one. They used doses of particular chemical based on their own experiences or either from the instruction of the packet or the suggestion of chemical sellers and companies' representatives.

The government as well as private sector should conduct more research and development towards reducing the harmful impacts of chemicals in aquaculture systems, and should work to improve public awareness of the pros and cons of chemical use.

3.5. Problems in Use of Aquaculture Drugs

The present study identified several problems associated with the use of aquaculture drugs which included lack of knowledge regarding use of chemicals, lack of knowledge of application of chemicals and antibiotics, indiscriminate use of chemicals, lack of knowledge about residual effect and expiry date and lack of diagnostic facilities for proper disease diagnosis.

4. Conclusion

The present study revealed the current status of chemicals and antibiotics using in fish health management and pointed out some problems of the use of chemicals by the farmers which include lack of knowledge of the chemicals, closes and methods of application of these chemicals. Diseases treatment in freshwater aquaculture can be of great value when chemicals are used properly but mismanagement of these chemicals can lead to an innumerable damage of production. 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 use of probiotics, immune stimulants 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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