

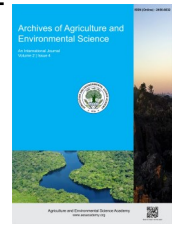


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ORIGINAL RESEARCH ARTICLE



## Aqua drugs and chemicals used in commercial aquaculture in Mymensingh, Bangladesh

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### ABSTRACT

Mymensingh is a division in north-central Bangladesh renowned for its lush landscapes and agricultural productivity, with a strong focus on aquaculture as a key part of its economy. The study was performed to investigate the aqua drugs companies and their products used in commercial aquaculture farms in Mymensingh division. Questionnaire based data were collected from representatives of various aqua drug companies, district and upazila fisheries offices, chemical vendors, farmers, and hatchery owners of the Mymensingh division. The present study found aquaculture practices in Mymensingh rely heavily on various antibiotics, probiotics, disinfectants, and feed additives to prevent the spread of diseases, maintain water quality, and increase growth of culture fishes. Drugs from various companies are widely utilized across the Mymensingh division. Fishtech BD contributing the highest percentage (12%), followed by Eon Pharmaceutical Ltd. (11%) and ACI Animal Health (10%), while AVON Animal Health made the lowest contribution (2%). Among the various drugs from different companies, Remamycin (antibiotic), Timsen and Emsen (disinfectants), Pond Care (probiotics), Zeolite Gold, Gasonex, and Mega Zeo Plus (zeolite) are commonly preferred by the farmers. The study also found that many farmers lack knowledge about chemical ingredients, proper dosages, and appropriate application methods. Therefore, adequate training and implementation of government rules and regulations are necessary to ensure responsible use.

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### INTRODUCTION

Aquaculture significantly contributes to food security, livelihoods, and economic growth in developing nations. Recently, there has been a notable increase in attention and rapid growth in this sector, mainly attributed to advancements in aquaculture (Macqueen *et al.*, 2020). Technological innovations and the growing demand for fish as a source of animal protein are key drivers behind the industry's expansion (Flourizel *et al.*, 2023). Consequently, this growth has led to the adoption of more intensive culture methods aimed at achieving higher production

yields (Manan *et al.*, 2023). Aquaculture faces significant production losses due to various factors, with disease being the most detrimental. Diseases have a negative impact on farmers' livelihoods, resulting in job losses, reduced income, and food insecurity. Research indicates that nearly half of the production loss can be attributed to diseases, particularly affecting developing countries (Assefa & Abunna, 2018). However, the use of chemicals in aquaculture farms has raised concerns about its potential effects on downstream aquatic ecosystems (Rico *et al.*, 2012). To effectively manage and control infectious diseases in fish, it is beneficial to adopt advanced husbandry and

management practices, restrict fish movement, select genetically resistant stock, and incorporate dietary supplements and non-specific immunostimulants (Meyer, 1991). Other strategies include the use of vaccines, probiotics, prebiotics, medicinal plant products, antimicrobial compounds, and water disinfection methods (Kelly & Renukdas, 2020).

Bangladesh is the third-largest producer of freshwater fish in the world (DoF, 2022). Fish is an essential part of the cuisine in Bangladeshi households, highlighting the significance of the aquaculture industry in the country. Furthermore, the fisheries sector in Bangladesh has experienced significant growth in recent years and has contributed to the country's economy (Samanta Chandan & Roy, 2024). The expansion of freshwater aquaculture in Bangladesh has led to a shift from paddy farming to aquaculture. This transition is mainly driven by increased knowledge and adoption of aquaculture practices (FAO, 2022). As aquaculture continues to expand in Bangladesh, there is a growing need for effective management of aquatic animal health (Little & MacKenzie, 2023). Aqua drugs and chemicals are widely used throughout the country for various purposes, including disease prevention, treatment, water quality management, and improving growth (Hossain et al., 2021). Additionally, the aquaculture industry in Bangladesh relies on aqua drugs for disease management and growth stimulation of cultivated aquatic organisms (Kawsar et al., 2022). However, it is crucial to use these substances responsibly and with proper knowledge to avoid negative impacts on the environment and human health. The indiscriminate use of aqua drugs and chemicals often leads to issues such as drug resistance, tissue residues, and adverse effects on species biodiversity (Sorower, 2020). Approximately 100 aqua drug companies and manufacturers are established in Bangladesh, offering over a thousand registered aqua drug products in the market.

Aquaculture is a significant industry in Mymensingh, contributing to the local economy and food security. Mymensingh division is located between approximately 24.5° and 25.5° north latitude and 89.5° and 91.5° east longitude. The division is known for its high-quality aquaculture practices, producing a variety of fish species, and making a significant contribution to the country's animal protein supply (Heal et al., 2022). Studies have indicated that aqua drugs and chemicals significantly contribute to promoting sustainable aquaculture in Mymensingh by addressing these challenges (Ahmed et al., 2015). However, there is limited available data regarding the use of commercial aqua drugs and chemicals in Mymensingh. This study gathered and examined data on different commercial aqua drugs and chemicals utilized in the Mymensingh division, providing insights into their manufacturers, recommended dosages, and specific applications within aquaculture.

## MATERIALS AND METHODS

### Study area

The study was conducted for six months (January 2023 to June

2023) in four districts within the Mymensingh division, which is located at coordinates 24.7136° N, 90.4502° E. This division is bordered to the north by Meghalaya, a state in India, and the Garo Hills. To the south, it is adjacent to the Dhaka division, to the east it shares boundaries with the Sylhet division, and to the west, it is bordered by the Rajshahi division. The geographic map of the study area is shown in Figure 1.

### Survey questionnaire, data collection, and analysis

Data collection involved the preparation and pre-testing of a series of questionnaires to ascertain the appropriateness of the inquiries and their relevance to the sample producers. After necessary adjustments based on the pre-testing, a final set of questionnaires was prepared. The questionnaire focused primarily on farmers' experiences, cultural practices, and the use of chemicals from various aqua drug companies. The study data were collected from 100 stakeholders, including aqua-medicine stores, representatives of different pharmaceutical companies, government officers, and owners of semi-intensive aqua-farms, using well-structured questionnaire interviews. Additionally, participatory rural appraisal (PRA) techniques, such as focused group discussions, cross-checking, and key informant interviews, were employed to enhance the dataset. After collecting the data, it was organized in a tabular format to meet the objectives. MS Excel was used for data analysis.

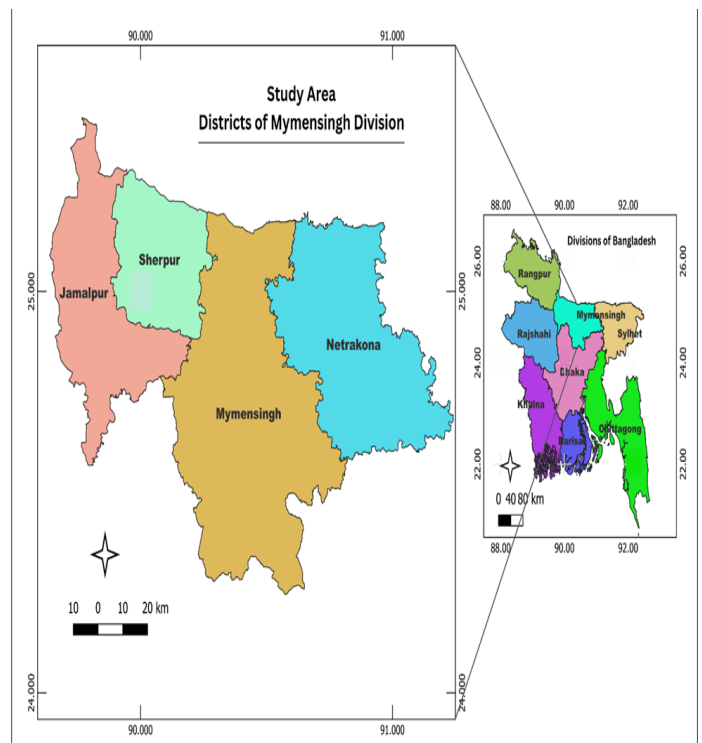


Figure 1. Geographical map of study area in Mymensingh division, Bangladesh.

## RESULTS AND DISCUSSION

In this study, aqua drugs and chemicals were classified into five main groups based on their function and use: pond preparing agents (gas removers, disinfectants, piscicides, oxidants, and pesticides), antibiotics, probiotics, oxygen suppliers, and feed additives. The distribution of company participation in the study varied (Figure 2), with Fishtech BD contributing the highest percentage (12%), followed by Eon Pharmaceutical Ltd. (11%) and ACI Animal Health (10%). Eskayef Pharmaceuticals Ltd. and Square Pharmaceuticals each contributed 6%, while C.P. Bangladesh and Century Agro Ltd. accounted for 5% each. Novartis, Exon Pharmaceuticals, and Organic Pharmaceuticals each contributed 4%, and Reneta, ACME Laboratories Ltd., and RALS Agro Ltd. each contributed 3%. AVON Animal Health made a contribution of 2%, while the remaining companies collectively accounted for 22% of the total participation.

### Pond preparing agents

In aquaculture, the preparation of ponds and the management of water quality are crucial for the health and productivity of aquatic organisms. Commercial aquaculture farms in Mymensingh commonly use various types of aqua drugs and chemicals for these purposes, including zeolite, benzalkonium chloride, lime, alum, probiotics, fertilizers, copper sulfate, potassium permanganate, rotenone, and prebiotics. The study found that lime is used to adjust pH levels and sterilize pond bottoms, alum is used to clarify water, and zeolite is used to remove toxins like ammonia. Benzalkonium chloride and potassium permanganate are used as disinfectants, while fertilizers promote natural food sources like plankton. The information on these drugs and chemicals, packaged by various manufacturers, is presented in Table 1. Traditional lime, salt, formalin, methylene blue, potash, and malachite green are also commonly used to combat various fish diseases (Alam & Rashid, 2014). Different studies have identified a variety of chemicals and aqua drugs used by farmers in different regions of Bangladesh. For example, in Moulvibazar, substances such as rotenone, zeolite gold, acme's zeolite, aquakleen, urea, and TSP (triple superphosphate) are used. In Jessore, gas reducers like Zeo-Fresh and Zeo Prime are commonly employed to remove hazardous gases ( $\text{NH}_3$ ,  $\text{H}_2\text{S}$ , and  $\text{CO}_2$ ) from pond water (Singha *et al.*, 2020; Adhikary *et al.*, 2018; Alam & Rashid, 2014). Farmers also use chemicals like Aquapure, Biopond, and Zeofresh for pond preparation and water quality management, as well as substances like Sumithion, Engreb, and I-mec to eliminate unwanted species (Das *et al.*, 2020). Products like Geotox, JV Zeolite, and Aquakleen are used to maintain water quality (Anwar *et al.*, 2018). In specific areas such as Jessore and Cumilla, farmers use combinations of chemicals like zeolite, lime, and bioaqua, along with toxic gas reducers like Ammonil and bio-aqua-50 (Sharker *et al.*, 2014; Rahman *et al.*, 2017). In north Chittagong, common chemicals include Geotox, Acmes Zeolite, and Vita plankton (Kawsar *et al.*, 2019). Disinfectants are essential for biosecurity in aquaculture as they ensure the safety and health of the culture unit by eliminating or

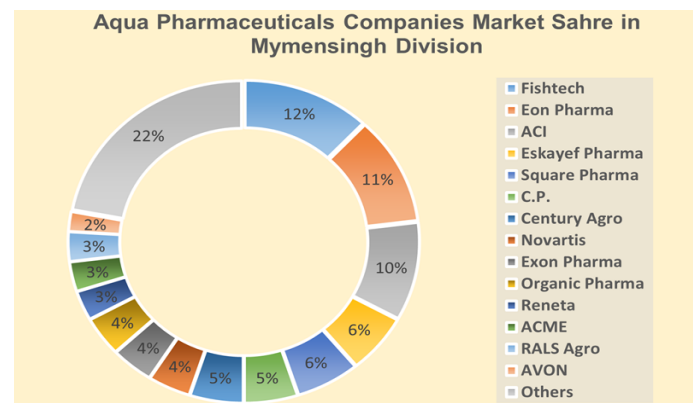


Figure 2. Aqua pharmaceuticals companies market share in Mymensingh division.

suppressing the growth of harmful microorganisms (Russell Danner & Merrill, 2005). Various disinfection methods, both physical and chemical, are employed in aquaculture according to the specific needs and requirements of each facility (Kasai *et al.*, 2002). The effectiveness of these disinfectants extends across a broad spectrum of pathogens, encompassing bacteria, viruses, and fungus. In aquaculture, disinfectants like chlorine-based substances, hydrogen peroxide, iodine compounds, and quaternary ammonium compounds are frequently used through water treatment, surface disinfection, and equipment sterilization (Bögner *et al.*, 2021). Furthermore, the choice of disinfectant and application method may depend on factors such as water temperature, pH level, and the specific pathogens present. The study found active ingredients of the used commercial products ranged from chlorine-based compounds, such as benzyl ammonium chloride 40% and stabilized urea 60%, and Virex by ACI Animal Health, which contains Potassium Peroxymonosulphate 50% (Table 1).

Different studies have noted the use of specific disinfectants across different regions and types of aquaculture systems. For example, Timsen, Emsen, and Polgard Plus are widely used disinfectants in several settings, as highlighted in (Alam & Rashid, 2014). Hepaprotect-Aqua, Timsen, Virex, and Polgard Plus are also commonly utilized for disinfection purposes in aquaculture farms (Anwar *et al.*, 2018). In addition to these, other brands such as Pathonil, Aquakleen, and Virex are prevalent choices for ensuring biosecurity in aquaculture environments (Adhikary *et al.*, 2018). Timsen, Virex, Polgard Plus, and Micronil are used for disinfection in different aquaculture systems, showing the broad application of these products (Das *et al.*, 2020). Disinfectants such as bleaching powder, Timsen, EDTA, Polgard, Aquakleen, Germnil, and Pond Safe are commonly used, demonstrating a mix of traditional and newer chemical treatments for disease management (Chowdhury *et al.*, 2015). Lime and salt combinations, potassium permanganate, and other chemicals have been employed to treat specific diseases in species such as tilapia and pangus, achieving recovery rates of 65-85% (Sharker *et al.*, 2014). Furthermore, the utilization of bleaching, EDTA,

**Table 1.** Aqua drugs and chemicals used in pond preparation, managing water quality and disinfectants at Mymensingh.

S. No.	Trade Name	Active Ingredients	Company	Recommended Dose
1	Bluemix	Di calcium phosphate, Cobalt, Copper, Biotin, Folic acid	Fishtech BD	4 kg/Acr (3ft depth) during cultivation
2	Geolite gold	SiO <sub>2</sub> , Al <sub>2</sub> O <sub>3</sub> , Fe <sub>2</sub> O <sub>3</sub> , MgO, TiO <sub>2</sub>	Fishtech BD	200-250 g/dec.
3	Gasonex plus	Nalauryl ethersulphae	Fishtech BD	200-400 g/ kg zeolite
4	Polgard plus	3-methyl 4-alkyl two chain brominated compound	Fishtech BD	500 ml/Acr
5	Steridol	Octyldecl dimethyl ammonium chloride, Dioctyl dimethyl ammonium chloride, Didecyl dimethyl ammonium chloride, Alkyl (C <sub>14</sub> , 50%; C <sub>12</sub> , 40%; C <sub>16</sub> , 10%) dimethyl benzyl ammonium chloride	Fishtech BD	500 ml/Acr
6	Deletrix	Deltamethrin	Fishtech BD	25-30 ml/Acr (4 ft depth)
7	JV Zeolite	Na <sub>2</sub> O, K <sub>2</sub> O, Mn, P, SiO <sub>2</sub> , Al <sub>2</sub> O <sub>3</sub> , Fe <sub>2</sub> O <sub>3</sub> , CaO, MgO	Eon Pharma Ltd.	5-7 kg/33 dec
8	Matrix	SiO <sub>2</sub> , Al <sub>2</sub> O <sub>3</sub> , Fe <sub>2</sub> O <sub>3</sub> , CaO	Eon Pharma Ltd.	6-10 kg/Acr
9	Bio Aqua	Extract of Uka cidizera tree	Eon Pharma Ltd.	2ml/ 100 dec (1m depth)
10	Bio Aqua 50	Yucca plant extract, Saponin components, Glyco components	Eon Pharma Ltd.	60-70 ml/33 dec
11	Hunter	Rotenon 9%	Eon Pharma Ltd.	5-6 kg/Acr
12	Timsen	n-alkyl dimethyl benzyl ammonium chloride 40%, stabilised urea 60%	Eon Pharma Ltd.	20 g/33 dec (3-6 feet depth)
13	Eon CTC Powder	Effinol	Eon Pharma Ltd.	5-8 g/L water
14	Mega Zeo	SiO <sub>2</sub> , Al <sub>2</sub> O <sub>3</sub> , Fe <sub>2</sub> O <sub>3</sub> , CaO, MgO, Na <sub>2</sub> O	ACI Animal Health	20-25 kg/100 dec
15	Aqua lime	CaCO <sub>3</sub> , Ca (OH) <sub>2</sub>	ACI Animal Health	1-2 kg/dec
16	Acurote Gold	Rotenone 9%	ACI Animal Health	8 kg/Acr
17	Virex	Potassium Peroxymono sulphate 50%	ACI Animal Health	100-200 g/33 dec
18	Cal Zeolite	SiO <sub>2</sub> , Al <sub>2</sub> O <sub>3</sub> , MgO, CaO, Fe <sub>2</sub> O <sub>3</sub>	Century Agro Ltd.	6-8 kg /33 dec (After stocking 4-6 kg/33 dec)
19	TH4+	Alkyldimethylbenzylammonium chloride, Glutaraldehyde Terpin & Pine oil QS	Century Agro Ltd.	5 ml/ water
20	Zeo Prime	SiO <sub>2</sub> , Al <sub>2</sub> O <sub>3</sub> , Fe <sub>2</sub> O <sub>3</sub> , CaO, MgO, K <sub>2</sub> O	Eskayef Pharma Ltd.	20-24 kg/Acr
21	Well 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	Eskayef Pharma Ltd.	6-8 kg/ 33 dec
22	Pond Care	<i>S. faecalis</i> , other bacteria	Eskayef Pharma Ltd.	500 g/Acr
23	Emsen	n-Alkyl dimethyl benzyl ammonium chloride + stabilized urea	Eskayef Pharma Ltd.	80 g/33 dec (3-6 feet depth)
24	Aquanone	Rotenone and Rotenone isomers	Square Pharma Ltd.	7.2 kg/Acr
25	Aqua kleen	Tetradesail Trimethyl Ammonium bromide, BKC	Square Pharma Ltd.	0.5-1 L/Acr
26	Geotox	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	Novartis	20-25 kg/Acr
27	Virusnip	Potassium peroxymonosulphate 50%, Sodium dichloroisocyanurate 5%, Excipients 45%	Novartis	300-400 g/Acr
28	Acme's Zeolite	SiO <sub>2</sub> , Al <sub>2</sub> O <sub>3</sub> , Fe <sub>2</sub> O <sub>3</sub> , CaO, MgO, Na <sub>2</sub> O	Acme Laboratories Ltd.	7 kg/ 33 dec
29	Super Zeolite	SiO <sub>2</sub> , Al <sub>2</sub> O <sub>3</sub> , Fe <sub>2</sub> O <sub>3</sub> , CaO, MgO, K <sub>2</sub> O	Avon Animal Health	20-30 kg/Acr
30	Bis 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	Avon Animal Health	20-30 kg/Acr
31	Axon BKC	Alkyl dimethyl benzyl ammonium chloride 80%, Glutaraldehyde 5%	Axon Pharma	350 ml/Acr/ 3ft water
32	Bio-tuff	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, TiO	Organic Pharma	15-20 kg/Acr
33	Green 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, TiO <sub>2</sub>	Organic Pharma	20-25 kg/Acr
34	Alpha 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	Biswas Agrovet Ltd.	20-30 kg/Acr
35	Aquazet	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	Lion Overseas Trading Company	20-30 kg/ Acr
36	Zeonex	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	Anex vet (pvt.) Ltd.	20-30 kg/Acr
37	Fish Grow	S. Co, Mg, K, N, P, and Ca	Bismillah Enterprise	400 ml/Acr
38	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	Penta Agrovet	20-30 kg/Acr
39	Pathocide	Benzyl chromium + natural polymer	Penta Agrovet	200 ml/33 dec
40	Major Zeolite	SiO <sub>2</sub> , Al <sub>2</sub> O <sub>3</sub>	Univet Ltd.	30-40 kg/Acr
41	Pontox 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	Rals Agro Ltd.	15 kg/Acr After Stocking 10-20 kg/Acr
42	Penta Agrovet	Nony alkyl ohenoxypoly ethaneixide iodine complex	Rals Agro Ltd.	2-2.5 L/Acr
43	Germnil	BKC 50% with Glutaraldehyde	NAAFCO Pharma Ltd.	1-1.5 L/Acr
44	Lenocide	Alkyl benzyl dimethyl ammonium chloride + poly-2 deoxy-2 amino glucose	Nature Care	500-1000 ml/Acr
45	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	20-30 kg/Acr
46	Omicide	Benzyl ammonium chloride + urea	Lion Overseas Trading Company	200 ml/ 33 dec. After 24 h, 150 ml

\*L- litre, g- gram, Kg- kilogram, dec- decimal, Acr- acre, ft- feet, m- metre, Ltd.- Limited, Pharmaceuticals Limited- Pharma Ltd.

**Table 2.** Antibiotics used in commercial aquaculture farms and hatcheries in Mymensingh.

S. No.	Trade Name	Active Ingredients	Company	Recommended Dose
1	Aquamysine	Chlortetracycline	Fishtech BD	1-1.5 kg/ton feed
2	Amoxifish	Amoxicillin trihydrate	Fishtech BD	3-5 g/ kg feed
3	Oxy-D Vet	Oxytetracycline 20%, Doxycycline 10%	Eon Pharma Ltd.	5-10 g/ kg body weight for 5-7 days
4	EST-Vet	Erythromycine thiocyanate, Sulphadiazine trimethoprim	Eon Pharma Ltd.	100-150 g/1000 kg body weight for 3-5 days
5	Ablaze	Vitamins, minerals, antimicrobials agents	Eon Pharma Ltd.	150-200 g/1000 kg body weight
6	Argulex	Trichlorofon 40%	Eon Pharma Ltd	12-13 ml/dec
7	Bactitab	Oxytetracycline 20%	ACI Animal Health	5 g/kg body weight for 5-7 days
8	Acimox (vet) Powder	Amoxicillin trihydrate	ACI Animal Health	1 g/1 kg feed
9	Aquamycine	Oxytetracycline, HCl 25%	ACI Animal Health	1-2 g/kg feed for 5-7 days
10	Renamycin	Oxytetracycline	Renata	50 g/kg body weight
11	Renaquine	Flumequine	Renata	50 g/kg body weight
12	Renamox	Amoxicillin trihydrate	Renata	28-40 g/100 kg feed for 10 days
13	Oxysentin 20%	Oxytetracycline HCl BP	Novartis	100-200 g/100 kg feed for 5-7 days
14	Chlorsteclin	Chlorotetracycline	Novartis	200-300 g/100 kg feed
15	Orgamycins 15%	Oxytetracycline HCl BP	Organic Pharma	60 g/100 kg for 10 days
16	Orgacycline 15%	Chlortetracycline	Organic Pharma	200-300 g/100 kg feed (5-7 days)
17	Albez	Doxycycline, Collistine sulphate, vit premix	Syngenta	1-2 g/kg feed
18	Oxin WS	Oxytetracycline 20%	Navana Pharma Ltd.	50 g/kg body weight
19	Fish cure	Chlortetracycline HCL	Rals Agro Ltd.	500 g/1000 kg feed (3-5 days)

Aquakleen, Efnol, BKC, and formalin has been noted in the treatment of edwardsiellosis in Pangus and Koi fish (Ahmed *et al.*, 2015). For addressing conditions like tail and fin rot, red spot, and gill rot, farmers have applied diverse treatments including lime, potash, and high doses of vitamin C (Rahman *et al.*, 2017; Aftabuddin *et al.*, 2016).

### Antibiotic

The data provides an overview of antimicrobial agents and their active ingredients used in aquaculture to treat fish health issues. Antibiotic groups such as oxytetracycline, chlortetracycline, amoxicillin, erythromycin, sulfadiazine, and trimethoprim are commonly used in various products. These products contain active ingredients like oxytetracycline (Renamycin, Aquamycine, Oxy-D Vet), chlortetracycline (Aquamycine), Amoxicillin trihydrate (Amoxifish), and erythromycin thiocyanate, along with sulphadiazine trimethoprim (EST-Vet) (Table 2). Numerous studies conducted in different regions consistently report the widespread use of antibiotics in aquaculture. Antibiotics such as oxytetracycline, cotrim-vet, amoxicillin, and chlortetracycline were identified in studies conducted in the Cumilla district (Rahman *et al.*, 2017). In Jessore, antibiotics like oxysentin, renamox, renamycin, and orgamycine were commonly used among freshwater aqua farmers (Mostafa Shamsuzzaman & Kumar Biswas, 2012). Other studies have shown the extensive use of antibiotics such as Renamycin, Oxysentin, Chlorsteclin, Oxy-D Vet, Aquamycin, Orgamycin, and Orgacycline (Chowdhury *et al.*, 2015). Antibiotics such as Renamycin, Oxysentin, Chlorsteclin, Orgamycin, and Orgacycline are among the commonly used products (Anwar *et al.*, 2018). The use of antibiotics is particularly prevalent in areas affected by diseases like dropsy, fin and tail rot, and Epizootic Ulcerative Syndrome

(EUS), highlighting their significant role in maintaining aquaculture health (Rahman *et al.*, 2015).

### Probiotics

The data provides a detailed overview of different probiotic products, highlighting active ingredients such as *Bacillus* species (*B. subtilis*, *B. mensentericus*, *B. subtilis*, *B. licheniformis*, and *B. amylolichenifacions*), which compete with harmful bacteria, and nitrifying bacteria (*Nitrobacter* sp. and *Nitrosomonas* sp.), which improve water quality and nutrient cycling. Various products contain probiotic bacteria along with enzymes, yeast, yucca extract, and other bio-based compounds. It is observed that *Bacillus* species are prevalent in products like Aqua magic plus (Fishtech), Aqua Photo (ACI Animal Health), and Profs (EON Pharmaceuticals), Aquaclean-S and Gastrap (Square Pharmaceuticals) (Table 3). The use of probiotics is gaining importance in managing potential pathogens in aquaculture (Sahu *et al.*, 2008). For example, a study by Rahman *et al.* (2017) identified the use of probiotics such as Aqua Photo, Profs, and pH Fixers. Another study by Hasan *et al.* (2020) found that approximately 14% of farmers used probiotics in their aquaculture practices. A study in the Cumilla region found that farmers use Aqua Photo, Profs, and pH Fixers. Additionally, Megazeo Pro, Biomin Pond Life, and Aqua Photo were identified as commonly used probiotics in another study (Alam & Rashid, 2014; Rahman *et al.*, 2017).

### Growth promoter

The data outlines various products containing active ingredients such as vitamins, minerals, amino acids, and other bio-based compounds to enhance fish growth and health in aquaculture. Many products include essential vitamins like A, D, C, and B complex, as well as minerals like calcium and zinc.

**Table 3.** Probiotics used in commercial aquaculture in Mymensingh, Bangladesh.

S. No.	Trade Name	Active Ingredients	Company	Recommended Dose
1	Aqua magic plus	<i>Azotabactor chorococum</i> , <i>Bacillus subtilis</i> , <i>Candida utilis</i>	Fishtech BD	5-8 kg /Acr
2	Pond Dtox	<i>Pracococcus pantotrophus</i>	Fishtech BD	4 g/L
3	Profs	<i>Bacillus sp.</i> and <i>Padiococcus sp.</i>	Eon Pharma Ltd.	50-70 g/33 dec
4	Aqua Photo	<i>Bacillus subtilis</i> and <i>Rhodoseudomonas sp</i>	ACI Animal Health	50-70 ml/100 dec
5	Biomax	Probiotics and nutrients	Square Pharma Ltd.	3-4 kg/Acr (3ft depth). After Stocking 4-5 kg/ Acr (3ft depth)
6	Probio Aqua LQ	Photosynthetic and heterotrophic bacteria	Square Pharma Ltd.	1-2 L /Acr (3ft depth) for pond preparation 2-3 L/Acr (3ft dept) for treatment
7	Aquaclean-S	<i>B. menseutericus</i> , <i>B. subtilis</i> , <i>B. licheniformis</i> , <i>Nitrobacter sp</i> , <i>Nitrosomonas sp</i>	Square Pharma Ltd.	1 <sup>st</sup> dose: 1 kg/Acr (1m depth) 2 <sup>nd</sup> dose: 500 g/Acr (1m depth)
8	Gastrap	Lactic acid <i>bacillus</i> , <i>B. subtilis</i> , <i>Saccharomyces cerevisiae</i> , xylogen, amylase, protease, phytase	Square Pharma Ltd.	200 g/Acr
9	Unicosense	<i>Bacillus subtilis</i> , <i>B. licheniformis</i> , <i>B. polymyxa</i> , <i>Aspergillus oryzae</i> , <i>Aspergillus niger</i> , <i>Pseudomonas denetrificans</i>	First Care Agro Ltd.	250-300 g/Acr for fish. 75-100 g/Acr for shrimp
10	V-Yucca Liquid	Probiotics BP 10 CPU, <i>Yucca shidigera</i> extract 10%	Century Agro Ltd.	250 ml/Acr
11	Ammonil	<i>Yucca plant extract</i> , <i>B. subtilis</i> , <i>Candida utilis</i>	Novartis	100-200 g/Acr
12	Asonex	<i>Pseudomonas florecum</i> , <i>Bacillus subtilis</i> , <i>Nitrococcus</i> , <i>Thiothrix</i> , <i>Rhodospirillum</i>	Axon Pharma	200-400 g/Acr
13	Pro-V	<i>Bacillus sp</i> , <i>Pediococcus sp</i> , protease, amylase, lipase	Axon Pharma	100 g/33 dec (3ft depth)
14	Gas stop	<i>Bacillus subtilis</i> , Al <sub>2</sub> O <sub>3</sub> , SiO <sub>2</sub>	Organic Pharma	500 g/Acr, 3 weeks
15	Procon-PS	<i>Bacillus sp</i> , <i>Rhodococcus sp</i> , <i>Rhodobacter</i>	Rals Agro Ltd.	5L/ha (1m depth)
16	Acurote Gold	<i>Bacillus sp</i> , <i>Rhodococcus sp</i> , <i>Rhodobacter</i>	Rals Agro Ltd.	5L/ha (1m depth)
17	Eco marine	<i>Bacillus subtilis</i> , <i>B. pumilis</i> , <i>B. amylolichenifacions</i> ,	Organic Pharma	3-4 tablet /Acr
18	Super Biotic	<i>Bacillus sp</i>	C.P. Aquaculture	1-2 kg/Acr
19	Super PS	<i>Rhodobacter sp</i> , <i>Rhodococcus sp</i> .	C.P. Aquaculture	4-6 L/Acr

Some products also incorporate enzymes like amylase, protease, and phytase to improve digestion and nutrient absorption. Additionally, certain products use beta-glucans and yeast for immune support, and organic acids and natural antioxidants for overall health (Table 4). Pharmaceutical companies like Fish Tech (BD) Limited and the Acme Laboratories Ltd. produce products such as Biozyme, Eurozyme, and Acme-zymes (Rahman et al., 2017). Adhikary et al. (2018) identified feed additives like Aqua Boost, AQ grow-G, and EON Pharmaceuticals Fish Grower. Other growth promoters like Megavit Aqua, Aqua Boost, Aquamin, and Acimix are extensively used to enhance yield performance. In southern districts, products like Megavit Aqua, Charger Gel, Acimix Super-Fish, Vitax-C, and Rena Fish are commonly used (Alam & Rashid, 2014). In contrast, northern districts like Jamalpur prefer Aqua Boost, Aquamin, Acimix Superfish, Square Aquamix, Megavit, and Vitax-C as growth promoters (Anwar et al., 2018). Similarly, Rangpur district farmers use various probiotics, including Aqua photo, Safegut, Biomax, Profs, and Pond care, Panvit Aqua, Nutrigel, Aquazyme, Spagelly, and Charger gel (Das et al., 2020). The input also mentions other growth promoters like JV zeolite, Oxymax, Bio Aqua-50, Oxy-dox F, and Acemix Super Fish as noted in studies (M. M. Rahman et al., 2015).

### Oxygen provider

The study observed that hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) and sodium percarbonate-based products are essential for improving oxygen levels and maintaining water quality in aquaculture systems. These include products like Oxymax, ACI-OX, Bio-ox, Oxy grow, Oxy more, Oxy- life, Oxy- A, O<sub>2</sub> marine, Oxy well, and O-plus. ACI-OX and Bio-ox contain sodium carbonate combined with H<sub>2</sub>O<sub>2</sub>. Sodium percarbonate can be found in Oxy-A, Oxy Well, and Best-Oxygen (Table 5). Earlier studies (Adhikary et al., 2018; Das et al., 2020; Sharkar et al., 2014; Rahman et al., 2017; Kawsar et al., 2019) identified commonly used products for this purpose, including Bio-ox, Oxylife, Oxymax, and Oxymore. These studies also noted that ACI-OX, Oxymax, Oxymore, and Oxy Flow are utilized as oxygen suppliers in aquaculture systems (Rahman et al., 2017). Furthermore, Oxyflow, Oxymore, Bio-Ox, and Oxy-Gold have been reported to effectively improve dissolved oxygen levels (Adhikary et al., 2018; A. Kawsar et al., 2019). Other chemicals such as Aci-ox, Oxy-rich, Oxy-aqua, and Oxyren are also applied to enhance oxygen concentration in ponds (Das et al., 2020). It is worth noting that a significant portion of farmers do not use any oxygen supplier in their ponds, while Oxy rich is extensively used for increasing dissolved oxygen (Hasan et al., 2020).

**Table 4.** Growth promoters used in commercial aquaculture at Mymensingh, Bangladesh.

S. No.	Trade Name	Active Ingredients	Company	Recommended Dose
1	Charger gel	1-3 D glucan, polysaccharide, betain, beta glucan	Fishtech BD	6-8 g/kg feed
2	Vita power	Vit A, D3, E, B1, B2, Nicotinic acid (VitB3), folic acid (VitB9), lysine	Fishtech BD	0.5-1ml/cubic meter of water
3	Biozyme	Protease, cellulase, amylase, phytase	Fishtech BD	2-3 g/kg feed
4	Sorphoral	Sorbitol, Vit C, Chlorine chloride, Vit E, Inositol	Fishtech BD	2-3 g/ kg feed
5	Ossi C	Oxolinic acid, Vit-C, Beta glucans	Fishtech BD	4-5 g/kg feed for 5-7 days
6	Spa	Protein, cholesterol, calcium, Vit D, carotenoids	Eon Pharma Ltd.	10-15 g/kg feed
7	Vitax C	Vit-C, BP 100mg/ gm power	Eon Pharma Ltd.	1-2 g/2-3 kg feed
8	Eon Fish Grower	Vitamins + minerals premix	Eon Pharma Ltd.	1.5-3 g/kg feed
9	Aqua Savor	Amino acid premix	Eon Pharma Ltd.	2-3 kg /MT feed
10	Fibosoel	B-Glucan and mannos polymer	Eon Pharma Ltd.	200-300 g/MT feed
11	AQ grow-G	Herbal growth factor	ACI Animal Health	1-3 ml/kg feed
12	AQ grow-L	Herbal growth factor and binder	ACI Animal Health	1-2 ml/kg feed
13	ACI mix superfish	Vitamins, minerals, and antioxidants	ACI Animal Health	1 kg/ton feed
14	Aqumin	(Cu, Co, Mg, Fe, Zn, I, Ca, P, D, L. Methionine, L-lysin, HCl)	ACI Animal Health	1 g/kg feed
15	Ayumin Powder	Minerals + Herbs	ACI Animal Health	5-10 kg/ton feed
16	Calfostonic Powder	Vit + minerals + amino acids	ACI Animal Health	1-2 kg/ton feed
17	AQ cell	Ca, P, vitamins, herbs	ACI Animal Health	1-2 g/kg feed
18	Rena Fish	Vit A, B, C, D3, E, K, Cu, Mn, Fe, Co etc.	Renata	1 kg/ton feed
19	Rena-C	Vit C	Renata	2-3 g/kg feed
20	Di-boost	Amylaze, protease, pectinase, xylanase, cellulose, phytase	Century Agro Ltd.	2-3 g/kg feed
21	Aqua Gel	Amino acid, fatty acid, macro and micro minerals, natural antioxidants	Square Pharma Ltd.	5-10 g/kg feed For treatment, 10-15 g/kg feed
22	Panvit Aqua	Vitamin A, D3, B1, B2	Square Pharma Ltd.	For hatchery 0.5-1 ml/ ton For nursery 5-10 ml/kg feed
23	Square Aqua mix	Vitamins, minerals, and probiotics	Square Pharma Ltd.	1 g/kg feed
24	Cevit- Aqua	Ascorbic acid	Square Pharma Ltd.	1 g/kg feed For treatment 2-3 g/kg feed
25	Megavit Aqua	Vitamin, minerals, and amino acids supplement	Novartis	1 g/kg feed
26	Aqua boost	Organic acid, beta glucan	Novartis	500 g/MT feed
27	Vitamix F aqua	Vitamins, mineral, and amino acids	Acme Laboratories Ltd.	2.5 kg/ton feed
28	Abavit-C	Ascorbic acid 90%, Dextose 10%	Axon Pharma	10 g/kg feed
29	Azyme	<i>Bacillus subtilis</i> , amylase, lipase, protein, fat	Axon Pharma	0.5-1 g/kg feed
30	Vita+C	Water soluble vit C premix	Star Agro products Ltd	1-2 g/2-3 kg feed for 5-7 days
31	Growmax	Vitamins, mineral, and amino acid	Penta Agrovet	2.5 kg/ton feed
32	Fish vita plus	Vitamins, minerals, and amino acids supplement	Rals Agro Ltd.	200-300 g/100 kg feed
33	Grow fast	Vit, minerals, and amino acids supplement	Rals Agro Ltd.	200-300 ml/100 kg feed
34	Nature Aqua GP	Vitamins, mineral, and amino acid	Nature Care	2.5 kg/ton feed
35	Catamin	Vitamins and minerals	Catapol Bioscience	2-3 L/Acr
36	Mutagen	Major vitamins and minerals	C.P. Aquaculture	5 g/kg feed

**Table 5.** Chemicals used to increase dissolved oxygen level in aquaculture at Mymensingh, Bangladesh.

S. No.	Trade Name	Active Ingredients	Company	Recommended Dose
1	Oxymax	H <sub>2</sub> O <sub>2</sub> 10%	Eon Pharma Ltd	250-500 g/Acr (1m depth)
2	ACI- OX	Sodium carbonate, H <sub>2</sub> O <sub>2</sub> 10%	ACI Animal Health	5-8 g/dec
3	Bio-ox	Sodium carbonate, H <sub>2</sub> O <sub>2</sub>	ACI Animal Health	500-800 g/Acr
4	Bio care	Sodium lorile ether sulphate	ACI Animal Health	80-120 ml/100 dec
5	Oxy grow	O <sub>2</sub> promoter (H <sub>2</sub> O <sub>2</sub> / Ca <sub>2</sub> O <sub>2</sub> )	Century Agro Ltd.	500 g/Acr
6	Oxy more	Sodium carbonate per oxyhydrate	Eskayef Pharma Ltd.	250-500 g/Acr and for high density 750-1000 g/Acr
7	Oxy- life	Oxygen precursors, probiotics, detoxi-cants	Square Pharma Ltd.	400 g/Acr and for emergency 500 g/Acr
8	Oxy- A	Sodium percarbonate	Acme Laboratories Ltd.	3-4 g/dec
9	Oxygen plus	O <sub>2</sub> promoter, H <sub>2</sub> O <sub>2</sub> /Ca <sub>2</sub> O <sub>2</sub>	Avon Animal Health	250-500 g/Acr
10	O <sub>2</sub> marine	H <sub>2</sub> O <sub>2</sub> 10%	Organic Pharma	66-90 tablet/ 33 dec
11	Oxy well	Sodium percarbonate tetra acetyl ethylene diamine	First Care	150-200 g/Acr
12	Oxy plus	Na <sub>2</sub> O <sub>2</sub> + Al (OH) <sub>3</sub> Na <sub>2</sub> O <sub>2</sub> -90%	Navana Pharma Ltd.	500 g/Acr
13	Best- oxygen	Sodium percarbonate	Univet Ltd.	250-500 g/Acr
14	O-plus	O <sub>2</sub> promoter (H <sub>2</sub> O <sub>2</sub> / Ca <sub>2</sub> O <sub>2</sub> )	Nature Care	500 g/Acr

## Conclusion

Aquaculture is essential for meeting the increasing demand for aquatic food sources. However, effective management of health issues within the industry requires a multifaceted approach. This study catalogs the aqua drugs and chemicals used by commercial farmers in the Mymensingh division to prevent and control fish diseases, as well as to increase growth. These substances play a key role in sustaining aquaculture systems, enhancing productivity, and fostering healthy fish. The study found varied market shares of different companies. For example, Fishtech BD (12%) and Eon Pharmaceutical Ltd. (11%) led in company participation, while AVON Animal Health (2%) and Reneta (3%) had the lowest contributions. The study suggests that responsible use of these substances is vital for sustainable practices, to avoid drug resistance, tissue residues, and negative impacts on biodiversity and the environment. Creating a platform for information exchange between farmers and authorities, as well as utilizing advanced diagnostic tests, is crucial for ongoing fish health maintenance.

## DECLARATIONS

### Author contributions

Conceptualization and methodology- SMB and MNH; Data curation and formal analysis- MNH, MMI, and KTA; Visualization- MDR and MNM; Writing-original draft- SMB, MNH and KTA; Review and editing- MH and BA; Validation, resources, and supervision- SMB. All authors contributed to the article and approved the submitted version.

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