



Status of Aqua Drugs Applied in Freshwater Aquaculture of Moulvibazar District, Bangladesh

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Authors' contributions

This work was carried out in collaboration among all authors. Author SS did the survey, performed the statistical analysis and wrote the first draft of the manuscript. Authors TS and AH designed and made the protocol of the study and supervised the study. Authors NNR and MRH managed the literature searches and finalize the draft of the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Aims: Our study aimed to assess the current situation of accessibility and the use of various chemicals and medicines in freshwater aquaculture.

Methodology: A questionnaire interview survey was conducted among 14 aquaculture farms and 23 aqua chemical retailers.

Results: Due to easy availability, farmers used large quantities of lime and cow dung to prepare ponds and manage water quality. Beside these rotenone, zeolite gold, acme's zeolite, aqua kleen, urea and TSP (triple super phosphate) are also found. Timsen, polgard-plus, deltax, virex, magic-fos and pond-safe were mostly used as a disinfectant. Epizootic Ulcerative Syndrome (EUS) disease was found predominantly in the farmer's pond. For disease treatment, renamycine soluble powder (oxy tetracycline) was used, 32% farmers. Two oxygen suppliers oxy gold and oxy life were used to increase oxygen concentration. Among 11 types of growth promoters were found in chemical shops

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in which charger gel and rapid grow were mostly used. Most farmers use gas trap and gasonex plus as gas reducer.

Conclusions: There are mostly six categories of 48 aqua drugs and chemicals are observed and treated for health monitoring of fish and shellfish. Due to lack of knowledge concerning the proper dosage and procedure of using chemicals, technique of application and indiscriminate practice of chemicals etc. are common problems of aqua drugs in Moulvibazar district.

Keywords: Aquatic drugs; chemicals; fish farm; chemicals alternatives.

1. INTRODUCTION

Aquaculture is the major practice of fish production at present in Bangladesh. The mainstream of aquaculture production move toward freshwater pond aquaculture production. In the Sylhet division, total fish production is 262454 MT and the contribution of pond aquaculture is 62858 MT, seasonal cultured water body 11493 MT, shrimp/ prawn farm 5.67 MT, pen culture 125.1 MT, cage culture 112 MT [1].

Aquaculture largely hinges upon the contribution of formulated feeds, chemicals, aqua-drugs, and antibiotics. These are the key catalyst for increasing fish growth, fecundity and decreasing disease, mortality and finally increasing the total production of fish and other commercial aquatic organisms (plants and animals). Other than the fish health management, aqua drugs and chemicals assume a significant part in managing soil and water, enhance natural productivity, diet formulation, reproductive manipulation, growth advancement and value addition of the finished product [2,3].

Generally, in developing countries most common issue is using aqua medicine and drugs in the aquaculture and fish industry unconsciously and without knowing the adverse effect of this medicine and chemicals. These unapproved, non-biodegradable medicine or chemicals have several effects on human health [4]. We should have concerned about the practice of using feed additives, hormones, disinfectants, the rapeutants and vaccines which will have adverse impact on environment as well as product quality such as chemical effects on water and sediment quality (nutrient enrichment etc.), effects on natural aquatic communities and microorganisms and also chemical residues in aquaculture product [3].

At present, the fisheries involvement as well as the no. of fish farms and hatcheries is increasing in the greater Sylhet region specifically in the Moulvibazar district. Along with the large number

of the fish farm and fisheries activities proportionally increase the amount of using aqua drug and chemicals. The adverse effect of these drugs and chemicals in the natural ecosystem decreases the availability of fish fry, spawn, and endanger fish species from the haor basin. The government and non-government organizations need to pay attention to this serious issue. But in this country precisely in this region, little to no records was observed for the drugs and antibiotics used for aquaculture. Subsequently, information is absent concerning the current scenario of aqua medicines, antibiotics and chemicals utilizing in the aquaculture industry specifically for fish and shellfish health management and requires inspection. The current study was designed to enlist the available drug and chemicals used in Moulvibazar district to perceive the aim, dose and techniques of their application, to identify and evaluate the difficulties related with their usage for fish and shellfish health management.

2. MATERIALS AND METHODS

2.1 Study Area

Our study was undertaken in Moulvibazar district under Sylhet division in Bangladesh. It is situated between 24.10 degrees to 24.35 degrees north latitude and between 90.35 degrees to 91.20-degrees east longitude.

2.2 Study Period

Survey data were collected for seven months from January to July, 2019 from dominant aquaculture region of Moulvibazar district. Information was also collected from the government fishery office. A total of 13 farms, 23 aqua drug, and fish feed center shops were surveyed.

2.3 Data Collection Methods

We used primary and secondary data throughout the study. Questionnaire method was used to collect primary data in total 36 different markets

and aquaculture sectors to maintain the random selection method, to have on the spot assessment. After collecting data through questionnaire interviews and FDG, collected data should be justified. We cross-checked our collected data with the help of district fisheries officer (i.e., key informants).

2.4 Questionnaire Preparation and Interviews

The selected farm were visited and primary data were composed by direct questionnaire interviews from fish farmers (e.g., marginal and commercial), owners of hatchery, drugs supplier etc. and questionnaire forms will be filled throughout the survey time.

2.5 Data Processing

After collection of all primary data, these data were edited and coded. Data were summarized as well as examined cautiously and documented. Finally, every tables and charts were prepared according to the study objectives.

2.6 Data Entry and Analysis

All the collected information was gathered and analyzed using MS-Excel 2007. The analyzed data will be presented in textual, tabular and graphical form.

3. RESULTS AND DISCUSSION

3.1 Chemicals as Pond Preparation, Soil and Water Quality Management

A few customary, just as another compound, was utilized to pond preparation as well as monitor water quality. Nine types of drugs of different pharmaceutical companies were recorded from the study area. Drugs were often used in different periods of culture time with different pond water depth such that some were used in the culture period, and some were used in the pre-culture period (Table 1). In the study area, a combination of lime and cow dung (31%) and also a combination of lime, tsp, urea, and cow dung (24%) were highly used due to its ready availability and low cost followed by rotenone (14%), zeolite gold (14%), jv zeolite (7%). In a survey, it was found that during pond preparation commonly practiced dosage of lime of the farmers (62.67%) and culture period (53%) is 0.5-1 kg/40m² in the zakigonj upazila, Sylhet [5]. Urea and TSP utilized by the farmers mostly throughout the culture time with the common dose of 100-150 g/40m² (37.3%) and 50-100 g/40m² (68%) individually [5]. For enhancing water quality drugs like geotox, jv zeolite, lime, bio aqua, mega zeo and acme's zeolite were applied [6]. Furthermore, it was observed that 40% of Bangladeshi fish farmers choose lime for treating diseases [7].

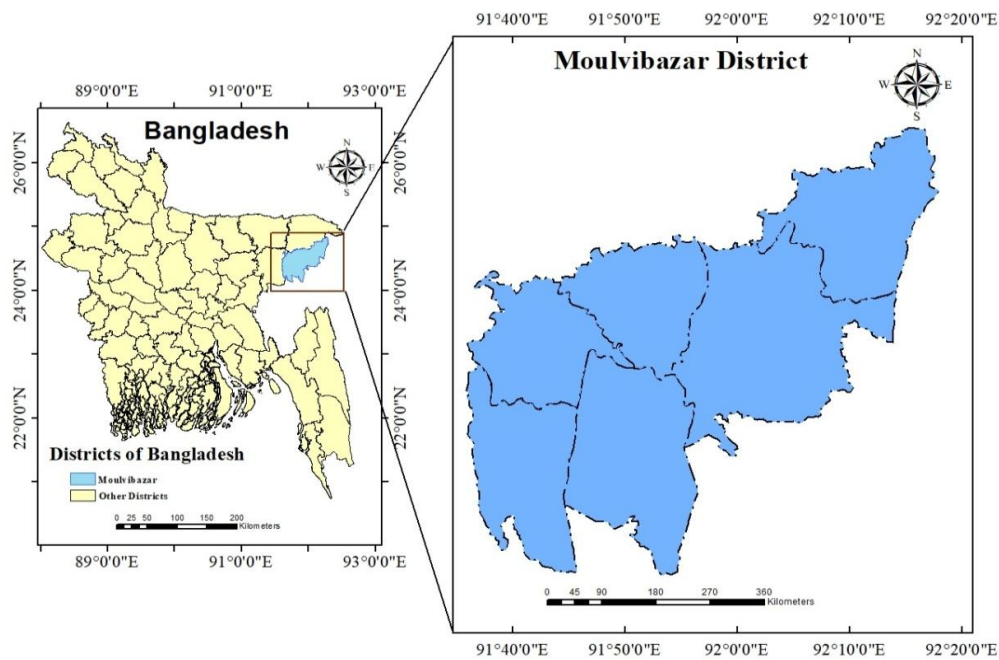


Fig. 1. Map location of study area

Table 1. List of chemicals as pond preparation, improve water quality

Serial no	Trade name	Chemical ingredient	Recommended Dose	Company	Price (Tk.)
01	Zeolite gold	SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ , CaOMgO, Na ₂ O,	400-500 g/dec	Fishtech bd ltd	410/10 kg
02	JV zeolite	SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ , CaO, MgO, Na ₂ O	6-7/kg/33 dec	Eon animal health products ltd	350/10 kg
03	Mega zeo	SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ , CaO, MgO, Na ₂ O, K ₂ O, MN	200 g/dec	ACI	340/10 kg
04	Zeolite	SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ , CaO, MgO, Na ₂ O	400-500 g/dec	National Agricare Imp. Exp. Ltd.	410/10 kg
05	Acme's zeolite	SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ , CaO, MgO, NaO	10-15 kg/acre for 3-4 ft depth	Acme	375/10 kg
06	Biomim aquaboost	Amino Acid, Natural Immune-Stimulating Substance	100 g/100 kg feed	Renata ltd	480/kg
07	Rotenone	C ₂₃ H ₂₂ O ₆	15 g/dec/ft depth	Samco ltd	250/kg
08	Aqua kleen	Brominated Organic Salts, Amino Nitrogen, Benzalconium	0.5-1 litre/acre	Square	480/kg

3.2 Chemicals as Disinfectant

The most popular disinfectants were polgard plus, timsen, virex, aquakleen, deletix, pond safe in Moulvibazar. The advantages of the utilization of disinfectants in fish and shellfish culture were to prevent various sorts of bacterial, parasitic and viral diseases including dropsy, tail rot, gill rot etc. Chemicals used to maintain healthy conditions in pond dike and floors. From the study, five types of commonly applied drugs i.e. polgard plus, virex, timsen, pond safe and deletix were found in chemical shops (Table 2) and the percentage of farmer applied polgard plus (18%), virex (7%), timsen (7%), pond safe (16%) and deletix (11%). Besides these magic fos (11%), sunsure (13%), virocid (4%) and aqua kleen (13%) used by the farmers in this region. According to Rahman (2011), polgard plus, lenocide, bactisal, emsen, virex, bioguard, timsen, aqua cleaner plus, bleaching powder and formalin are applied as disinfectants [8]. From the study of Sheriff et al. (2000), it was known that chemicals, for example, traditional lime, tea seed cake, fonnalin, benzalkonium chloride, malachite green, and hypochlorite were used as disinfectants [9]. A drug company conduct a leaflet advertisement of timsen, where timsen applied as preservative procedures for viral, bacterial and also fungal infections. The animal health products sales representative mentioned that formalin regulates protozoan diseases and

efinol apply as stress-resistant [10]. It was referenced that formalin was active contrary to a wide scope of living beings, for instance, growths, microbes and ecto parasite [11]. Both study areas lime was applied as disinfectant. A few specialists saw that fish farmer utilized lime as a disinfectant and formalin as a disinfectant in addition to limit protozoan contaminations [12].

3.3 Chemicals as Antibiotic

An antibiotic is a substance formed by one microorganism that selectively prevents the development of another microorganism. Renamycin, aquamysine, oxy-d vet, novamix-104 are found as antibiotics that are found at chemical shops in Moulvibazar (Table 3). In the present study, most the farmers about 32% farmer used renamycine for its cheap rate and very highly effective against bacteria like *Aeromonas* or *Vibrio* spp and diseases like columnaris, edwardsiellosis, and EUS. The percentages of the other aqua drugs used were aquamycine 22%, oxy-d vet 14%, and sulfatrim 11%. 21 % farmer also found to claim for not used any antibiotics. Furthermore, in Mymensingh district antibiotics activities were found for fish health management. It was found that oxy-sentin using rate was 15%, orgacycline using rate was 15%. Besides these, acimox (vet) powder, ws cotrim-vet, bactitab, contrim vet, oxin, bolus, otetra vet power 50, sulfatrim etc.

were also used as antibiotics. Generally sulphadiazine, oxytetracycline, amoxicillin, chloro-tetracycline, co-trimoxazole and sulphamethoxazole are the active ingredients of such antibiotics. It was stated that chlorsteclin and fish cure assumes a vital part in increasing fish growth along with viable compared to infections like tail and fin rot, dropsy, gill rot of fish etc. [6]. The success of aquacultures largely depend on judiciously and responsibly used of drugs and chemicals specifically antibiotics. To treat infectious diseases of fish initiated by a variety of bacterial pathogen, antibiotics are used prophylactically [3].

3.4 Chemicals as Oxygen Supplier

Dissolved oxygen is one of the most important factors of pond water for aquaculture practices. Various chemicals were found easily obtainable in the chemical retailers to utilize for growing demand of dissolved oxygen in the aquaculture pond. The oxidizing agent and hydrogen peroxide is key active ingredient of oxygen supplier

chemicals. In Moulvibazar district, oxygold, oxyrich tab, oxy-a, oxylife, bio care, bio-ox, naf oxy, oxygen plus, oxymora, quick oxygen, oxy-plus have been found (Table 4). Again, farmers of low income (19%) cannot afford these on account of their exorbitant cost and they utilized a few customary and mechanical strategies for increment dissolve oxygen in the culture pond, such as swimming, sprinkling water surface by bamboo, use aerator etc. About 28% and 16% of farmers used oxy gold and oxy rich tab respectively. Also 13%, 12%, 9%, and 3% farmer used oxi-a, oxymax, bio care, and naf-oxy. It was found that in Mymensingh district as oxygen supplier oxyflow, oxymax, oxy plus, oxygen plus, oxy more, quick oxygen, oxy grow, oxy gold, o₂-marine, biocare, bio-ox and o-plus are available [6]. It was observed that oxymax and oxyflow were utilized to eliminate hardness as well as toxic gases [10]. As indicated by the investigation, aqua drugs like bio care, oxy-gold, oxy plus, oxy life, oxymax, and pure oxy were applied towards increment dissolved oxygen. Hydrogen peroxide remained as the significant dynamic ingredient [8].

Table 2. List of chemicals available as disinfectants

Serial no	Trade name	Chemical ingredient	Recommended Dose	Company	Price (Tk.)
01	Polgard plus	3methyl, 4 alkyl two chain brominates compounds	500 ml/acre	Fish Tech Bd Ltd.	460/200 ml
02	Virex	Potassium peroximonosulphate 50%	100-150 g/33dec	ACI	520/200 ml
03	Timsen	N-alkyl dimethyl benzyl ammonium	20 g/33dec	Eon	670/100 ml
04	Pond safe	Alkyl dimethyl benzyl ammonium chloride 80, inert ingredients 20%	500-800 ml/acre	Fish Tech Bd Ltd.	380/100 ml
05	Deletix	Deltamethrin	25-30 ml/acre	Fish Tech Bd Ltd.	250/100 g

Table 3. List of chemicals available used as antibiotic

Serial no	Trade name	Chemical ingredient	Recommended Dose	Company	Price (Tk.)
01	Aquamycine	Oxytetracycline HCl 25%	1-2 g/kg feed	ACI	70/100 g
02	Renamycin soluble powder	Oxytetracycline 200 mg	50 mg/kg body wt.	Renata ltd.	72/100 g
03	Oxy-d vet	Oxytetracycline 20% doxycyclin 10%	5-10 g/kg body wt.	Eon	172/100 g
05	Novamix-104	Oxytetracycline, Amoxicillin	5-10 g/kg feed	Fish Tech Bd Ltd.	465/100 g

Table 4. List of chemicals available as oxygen supplier

Serial no	Trade name	Chemical ingredient	Recommended Dose	Company	Price (Tk.)
01	Oxygold	Sodium percarbonate	250-500 gm/acre	Fish tech BD Ltd.	1000/Kg
02	Oxymax	Calcium peroxide	250-300 g/acre	Eon	900/Kg
03	Bio care	Sodium lorile ether sulphate	80-120 ml/100 dec	ACI	975/ Kg
04	Bio-ox	Sodium percarbonate	10g/ dec	ACI	1095/Kg
05	Oxy-a	Sodium percarbonate	300/400 g/acre	Acme	1480/Kg
06	Oxylife	O ₂ precursors, prebiotics, detoxificant	400 g/acre	Square	640/Kg
07	Oxymore	Sodium carbonate peroxy-hydrate 90%	General dose 250 - 500 g/acre, in case of high deficiency 750 - 1000 g acre-1	SK+F	940/Kg
08	Oxy plus	Na ₂ O ₂ +AlOH Na ₂ O ₂ -90%	500 g/acre	Navana	900/Kg
09	Oxygen plus	O ₂ promoter	250-500 g/acre	Avon	975/ Kg
10	O ₂ -marine	H ₂ O ₂ 10%	33-40 tab /33 dec.	Organic pharma	1480/Kg
11	Quick oxygen	Sodium per carbonate+ free oxygen	General dose 250-350 g/acre; in case of high deficiency 500 g/acre	Organic pharma	1095 /Kg
12	Oxyflow	H ₂ O ₂ 10%	General dose 250-350 g/acre	Novartis	945/ Kg

3.5 Chemicals as a Growth Promoter

The growth promoter is used to accelerate the body growth of fish and also to boost the productivity of fish. From the study, it was found that charger gel, rapid grow, aqua boost, fish grow are highly available and highly used in the moulvibazar district. Besides these, there is also available rena c, megavit aqua, aqua boost, orgavit aqua, aqua savor, nutrigel, panvit-aqua in the chemical retailers (Table 5). Vitamins are important ingredients for the prevention of malnutrition of fish and growth promotion and increase the FCR (feed conversion ratio) of fish. These chemicals help to increase body weight, growth, and diseases resistant power of fish. Because of the high price of vitamins and minerals, small scale farmers try to avoid it. Large farm owners which contain own feed formulation technology maintain a balanced diet by mixing vitamins with feed. Whereas, small scale farmers cannot maintain a balanced diet because of using the supplementary feed. The percentage amounts of farmers using charger gel, rapid grow, fish grow, aqua boost, rena c,

nutrigel and panvit aqua were about 23%, 20%, 18%, 13%, 10%, 8%, and 8% respectively. Faruk et al., (2008) found that aqua savor, megavit aqua, vitamin premix, aqua boost, fibosoel, grow fast, orgavit aqua, aqua-cell, aqua grow-g, fish vita plus, aqua grow-1, growmax, nature aqua gp, f aqua, acmix, vitamix and some others chemicals also have been used as growth promoters to expand production. From the various study, bio- grow, charger gel, aqua boost and grow fast was observed to be used as growth promoters [8]. All the growth promoters assumed an imperative part of the fast development of fishes. According to both study areas chemical sellers, aqua boost and ac mix super-fish are utilized to repel ailment in fish. Besides, aqua savor and aqua grow-p were applied in contradiction of unhealthiness to grow the soundness of fish [5].

3.6 Chemicals as Gas Remover

The commonly available toxic gas reducers are aqua magic, gasonex plus, yuka, zeolite and acme's zeolite at the chemical shops in

Moulvibazar district (Table 6). In the current survey, it was seen that 15% farmer was not used any drug as gas remover and comprehended 85% of the absolute uses gastrap (28%), gasonex plus (21%), aqua magic (15%), yuka (6%), zeolite gold (6%) and acme's zeolite (9%).

It was found in Bogura district, around 7 chemical substances to utilize as harmful gas removers such as gas stop, gastrap, gasonex furthermore, ammonil [13]. It was mentioned that for the upgrading of water quality concerning freshwater aquaculture actions bio-aqua 50 was utilized [6].

Table 5. List of chemicals available as a growth promoter

Serial no	Trade name	Chemical ingredient	Recommended Dose	Company	Price (Tk.)
01	Rena c	Ascorbic acid	99 g 1-2 g/kg feed	Renata	1725/kg
02	Aqua boost	Organic acid, beta, glucan, manna, oligosaccharide	500 g/ ton feed	Novartis	580/kg
03	Rapid grow`	B- glucan, mannan-oligosaccharide, vitamins, and minerals	50 gm/100 kg	Fish tech BD Ltd.	1000/kg
04	Charger gel	1-3 d-glucan, polysaccharides,	6-8 g/kg feed	Fish tech BD Ltd.	1060/kg
05	Fish grow	S+Co+Mg+K+N+P+Ca	400 ml/acre	Bismillah enterprise	1026/kg
06	Megavit aqua	Vitamin A, Ca, P, Na, etc.	100 g/100 kg feed	Novartis	360/kg
07	Aqua boost	Organic acid, beta glucan, manna, oligosaccharide	500 g/ton feed	Novartis	580/kg
08	Orgavit aqua	Vitamin, mineral and amino acid supplement	100 g/100 kg feed	Organic pharma	460/kg
09	Aqua savor	Amino acid premix	2-3 kg /ton feed	Eon	540/kg
10	Nutrigel	Vitamin, mineral and amino acid supplement	50 gm/100 kg	Fish tech BD Ltd.	630/kg
11	Panvit-aqua.	Vitamin A, B, D, ascorbic acid, etc	5-10 ml/kg feed	Square pharmaceuticals ltd.	125/100 ml

Table 6. List of chemicals available as gas remover

Serial no	Trade name	Chemical ingredient	Recommended Dose	Company	Price (Tk.)
01	Gastrap	Lactic acid <i>Bacillus</i> sp <i>Bacillus subtilis</i>	200 mg/acre	Square pharmaceuticals	3000/kg
02	Gasonex plus	Na- lorile ether sulfate	200-400 mg kg-1 zeolite	Fish tech BD Ltd.	125/50g
03	Aqua magic	<i>Azobactorchorococum Bacillus subtilis, Candida utilis</i>	5 kg acre-1	Fish tech BD Ltd.	580/100g
04	Zeolite gold	SiO ₂ Al ₂ O ₃ , Fe ₂ O ₃ CaOMgO, Na ₂ O,	400-500 g/dec	Fish tech BD Ltd.	360/100g
05	Acme's zeolite	SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ , CaO, MgO, NaO	10-15 kg/acre for 3-4 ft depth	Acme	580/200g

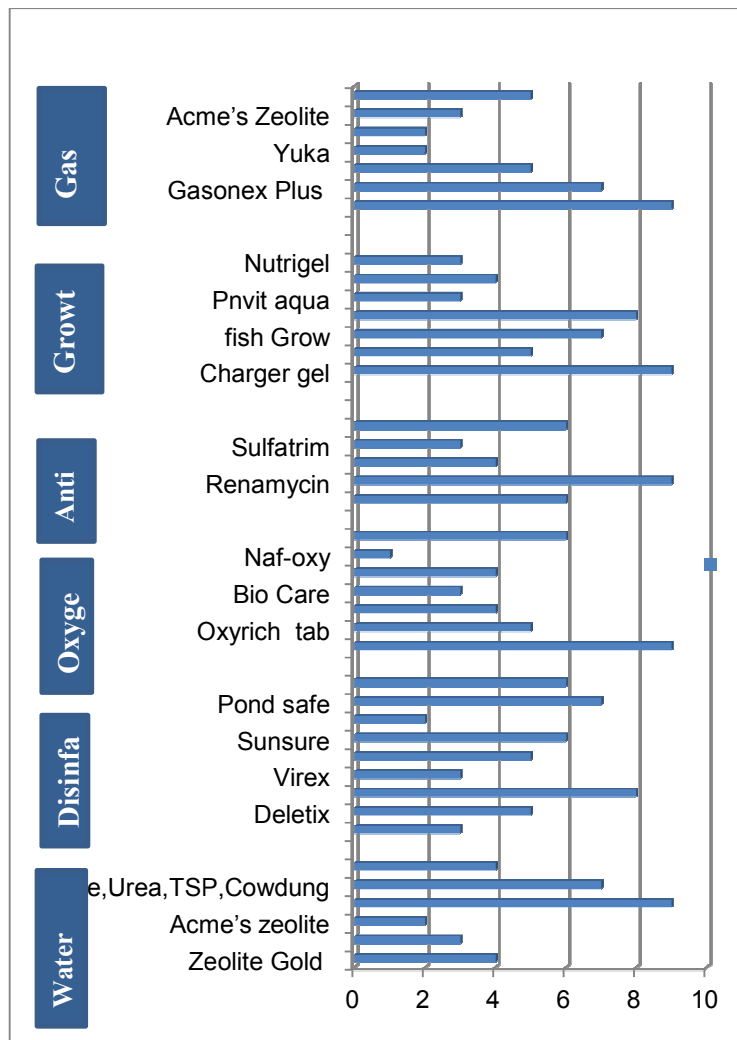


Fig. 2. Chemicals used by the farmer in the study area

3.7 Different Pharmaceutical Companies Sharing Market in the Study Area

Around 15 drug organizations were found manufacturing, delivering, or advertising items particularly aqua drugs focusing on fish and shellfish culture in the Moulvibazar region. Fish tech (bd) ltd., ACI animal health, eon animal health product ltd., the acme laborites ltd., novartis pharmaceutical ltd., navana pharmaceutical ltd., sk+f Bangladesh ltd., opsonin pharmaceutical ltd., renata pharmaceutical ltd., square pharmaceutical ltd., national agricare imp/exp. ltd., nafco, avon animal health, organic pharmaceutical ltd., one pharma, etc. were selling numerous products as of diverse

countries like India, Thailand, USA, Indonesia, Malaysia, Spain etc.

3.8 Problems Identified in Using Drugs and Chemicals

The current investigation recognized issues related to the utilization of aquatic drugs and chemicals for aquaculture in Moulvibazar. Moreover, fish farmers are regularly been pressurized by drug organizations and pesticide merchants in this region. Problems also include the absence of mindfulness about the wellbeing issues in utilizing risky chemical compounds; absence of knowledge in the name of substance about conceivable danger; and absence of information about the remaining impact and expiry date.

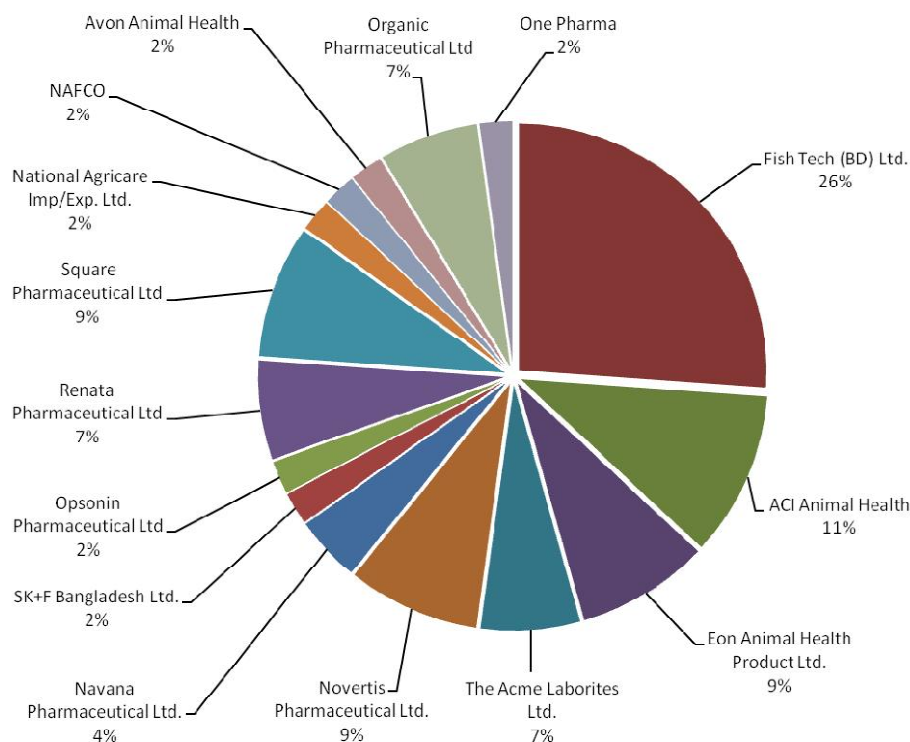


Fig. 3. Different pharmaceutical companies sharing market in the study area

4. CONCLUSION

From this study, there are known to have used about 48 drugs and chemicals for aquatic organisms' health management within Moulvibazar district, and lack of appropriate facts nearby the chemicals, uses and doses of these chemicals have identified some difficulties for the application of these chemicals. Alongside the extension of aquaculture and other fisheries activities, requirement to create awareness and limit the usage of the chemicals by using alternatives (probiotics, vaccine, and alternatives therapeutic) and so on. The private sector ought to likewise direct more innovative work towards diminishing the hurtful effects of aqua drugs and chemical compounds in fish and shellfish culture. Be that as it may, policy makers, analysts, and researchers should pay attention to alleviate the negative impacts of antibiotics and chemicals in fish and shellfish culture.

CONSENT

As per international standard or university standard, participant's written consent has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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