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Status of Disease Prevalence, Drugs and Antibiotics Usage in Aquaculture at Noakhali District, Bangladesh

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Abstract: This research aimed to investigate the present status of disease prevalence and usage of aqua drugs for various aquaculture operations in the Noakhali region of Bangladesh. To gather data, a combination of methods was employed, including questionnaire interviews, personal contacts, market surveys and participatory rural appraisal techniques like focus group discussions (FGDs). The study engaged with a diverse range of stakeholders, including fish hatchery owners, nursery and culture farmers, retailers of aqua medicine and representatives of pharmaceutical companies. Common fish diseases in the area, as indicated by the respondents, include tail and fin rot, as well as necrosis. About nineteen different drugs were identified and found to be used for multiple purposes in the region. These purposes included artificial pond preparation, water quality management, insect-killing, disinfection, fish breeding and disease treatment. Lime and Zeolite were commonly used for pond preparation and water quality management. Fish toxicants such as rotenone, phostoxin tablets, bleaching powder and endrin were employed, with rotenone being the most widely used among nursery farmers and grow-out farmers. Insecticides, sumithion, Malathion, diesel and dipterex, were applied by a significant number of farmers. Triple super phosphate and urea emerged as the most commonly used fertilizers. Disinfectants like formalin, bleaching powder and EDTA were utilized. Additionally, four types of feed additives were frequently employed in cultural activities. The study revealed that the majority of chemicals were used for fish health management and disease treatment. Lime, salt, potash, malachite green, copper sulfate and formalin were the chemicals used for disease treatment. Oxytetracycline was the most widely used antibiotic, with chlortetracycline and amoxicillin also being employed for disease treatment. One of the major challenges identified in the Noakhali District was the lack of knowledge regarding the appropriate use of chemicals, including dosage, application methods and the indiscriminate use of chemicals. These findings emphasize the importance of promoting awareness and providing guidance to farmers to ensure the responsible and effective use of chemicals in aquaculture practices. The study provides valuable insights into the utilization of chemicals in freshwater aquaculture activities in the Noakhali District. By addressing the knowledge gaps and promoting responsible practices, it is possible to enhance the sustainability and efficiency of aquaculture operations in the region.

Key words: Freshwater Aquaculture · Aqua Medicine · Antibiotics · Sustainability · Awareness

INTRODUCTION

In the year 2020, the global production of fisheries and aquaculture achieved an unprecedented milestone, reaching a record-breaking 214 million tonnes with an approximate value of USD 424 billion [1]. The production of aquatic animals in 2020 surpassed the average of the 1990s by more than 60 percent, significantly exceeding the

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global population growth rate [1]. This remarkable growth can be primarily attributed to the substantial increase in aquaculture production.

Aquaculture, comprising fish hatcheries, nurseries and culture farms, is critical to Bangladesh's fisheries sector. Fish farmers heavily employ aqua drugs to combat various diseases and ensure the well-being of their fish populations. Proper administration of these medications is crucial to minimize the development of drug resistance and safeguard the environment and human health. Antibiotics, in particular, are indispensable in combating bacterial, viral and parasitic diseases that can have detrimental effects on fish populations [2-10].

The effective and responsible use of aqua drugs necessitates adherence to prescribed dosage and application methods guidelines. Responsible fish farmers prioritize proper administration to maintain fish health effectively. Regulatory frameworks and guidelines are in place to oversee the distribution and use of aqua drugs, ensuring quality control and the welfare of fish populations. This section emphasizes the significance of responsible practices in minimizing risks associated with aqua drug usage and promoting the sustainability of aquaculture operations.

Despite the importance of aqua drugs in fish health management, Bangladesh's aquaculture industry faces unresolved disease problems [11-16]. The lack of vaccination and proper health management practices leaves farmers with no choice but to resort to a range of chemicals and medicines. The inadequate monitoring of drugs and antibiotics used in the sector has led to negative consequences [17-24], such as the emergence of antibiotic-resistant strains. Addressing these challenges is vital to ensure the sector's long-term sustainability.

Unfortunately, monitoring drugs and antibiotics used in the country's aquaculture industry has received limited attention, resulting in negative consequences for the sector. Representatives from pharmaceutical companies encourage farmers to use their medicines on this occasion. However, most farmers apply these chemicals without understanding their requirements, efficacies and proper administration methods. To address this issue, a recent study was conducted to evaluate the prevalence of diseases and identify the different types of chemicals and antibiotics used in fish health management, including their purposes and dosages, along with potential concerns.

MATERIALS AND METHODS

Study Design: Between March and September 2022, an extensive cross-sectional study was conducted to collect data on aqua-drug usage in selected fish farms within the Noakhali district. To ensure comprehensive coverage, three sub-districts (Chowmuhani, Mannan Nagor, Steamer Ghat) with the highest concentration of fish farms were strategically identified, based on consultations with fish feed dealers and our field team. A total of 10 fish farms were enrolled, resulting in 38 fish farmers being interviewed. Given the absence of a reliable initial list of fish farms, a snowball sampling approach was adopted to identify the desired number of farms in each sub-district. To begin the survey, feed dealers operating in the selected sub-districts were requested to provide a list of prominent fish farms along with their addresses. Starting with the enrollment of the first fish farm, the nearest fish farm was identified by asking the farmer and subsequently approached for recruitment. This process of searching for farms continued until the desired sample size was reached. Feed dealers were purposively chosen as they represented larger-volume sellers of fish feed and medicine in their respective areas. During visits to these feed dealers, which were ideally scheduled during their busiest hours when farmers frequented their shops, enumerators observed and recorded the dispensing practices of drugs through interactions with five consecutive fish farmer clients per feed dealer. Additionally, the available antibiotic brands for sale in each feed dealer's shop were also recorded at the time of the visit.

Data Collection: Data were collected through questionnaire interviews with various stakeholders in the hatchery industry, including hatchery owners, culture farms, chemical sellers and medical representatives from pharmaceutical companies. The researchers conducted on-site visits to hatcheries, nurseries and culture ponds, carefully considering several key aspects related to the use of chemicals and fish toxicants. These aspects encompassed the intended purpose of chemicals or toxicants, the diverse methods of application, the effectiveness of these substances, their potential side effects, variations in the applied doses, governmental restrictions on their usage, the price and availability of chemicals, as well as specific remarks and recommendations concerning their use. In addition, valuable information was obtained from the survey section of the Department of Fisheries (DoF) office in Noakhali. This supplementary data shed light on the quantity and geographical coverage of hatcheries and nurseries, as well as the utilization of drugs and chemicals within the industry. The data collection process employed a range of techniques, including semi-

structured questionnaires, personal interactions, market surveys and participatory rural appraisal methods such as focus group discussions (FGDs). By employing these comprehensive methods, the researchers ensured a holistic approach to data collection, enabling a thorough exploration of the various factors influencing the use of chemicals and fish toxicants in the hatchery industry.

Data Analysis: Following data collection, a thorough verification process was conducted to identify and rectify any errors or inconsistencies. Any inconsistencies detected in the collected data were carefully examined and excluded from the dataset. Subsequently, the collected data underwent processing and analysis utilizing a tabular method. To ensure consistency, local units of measurement were converted into international units before analysis. Microsoft Excel 2010 was utilized for data calculations, providing a reliable and widely-used tool for this purpose.

RESULTS

This study focused on documenting the availability and usage of various chemicals in Noakhali for aquaculture activities, including pond preparation, fish poisoning, insect control, disinfection and fish disease treatment. Common fish diseases in the area, as indicated by the respondents, include tail and fin rot, as well as necrosis The major area where these compounds were extensively used as fish disease treatment. Local animal feed and pharmaceutical shops served as the main sources of these chemicals in the Noakhali region. A total of 19 different chemical types were found to be used in this area (Table 1). Lime, zeolite, fish toxins, insecticides and fertilizers were commonly used for pond preparation and water quality management. Lime, in particular, was highly effective and affordable, making it popular among farmers. Rotenone was the most widely used fish toxicant, followed by phostoxin, bleaching powder and endrin. Despite the ban on Endrin and phostoxin, they were still frequently used. Sumithion and dipterex were the preferred insecticides, with varying usage percentages among nursery and culture farmers. Triple super phosphate and urea were the most commonly used fertilizers to increase primary productivity. Lime, salt, potash, malachite green, copper sulfate and formalin were used in fish disease treatment. Oxytetracycline was the most widely used antibiotic, along with chlortetracycline and amoxicillin (Figure 1). The study highlighted the lack of knowledge regarding the proper use of chemicals, appropriate dosages and application methods as major problems in the Noakhali District.

Table 1: List of Chemicals with their purpose of use and doses in the study area

Aqua drugs	Name	Dose
Antibiotics	Amoxicillin	4-7 mg/kg feed
	Oxytetracycline	3-6 mg /kg feed
	Chlortetracycline	3-7 mg/kg feed
Chemicals	Potassium (potash)	6-17 mg/dec
	Lime	0.5-1 kg /dec
	Copper sulfate	12-22 mg/dec
	Malachite green	1-4 mg/dec
	Salt	0.5-1 kg/dec
Disinfectants	EDTA	0.1-1 mg/kg
	Formalin	1-5 mg/kg
	Bleaching powder	300-400 g /dec
Insecticide	Sumithion (Fenitrothion)	2-3 ml /dec
	Dipterex (Trichlorfon)	6-12 ml /dec
	Malathion	2-3 ml /dec
Toxicants	Rotenone	15-35 g /dec
	Phostoxin	3-5 tablets /dec
	Endrin	50-60 ml /dec
Others	Fertilizer	50-70g/dec
	Vitamin	0.1-0.3 g /kg feed

DISCUSSION

The research study focused on investigating the availability and usage of various chemical compounds in Noakhali for aquaculture activities. It encompassed a range of practices such as pond preparation, fish poisoning, insect control, disinfection and fish disease treatment. The findings revealed that the primary area where these chemicals were extensively utilized was in the treatment of fish ailments. The study identified local establishments involved in animal feed and pharmaceuticals as the main sources of these chemicals in the Noakhali region. A comprehensive range of nineteen distinct chemical types was discovered to be in use, indicating a diverse array of substances employed for aquaculture purposes. Similar types of chemicals were found in different studies [25-29]. In terms of pond preparation and water quality management, substances such as lime, zeolite, fish toxins, insecticides and fertilizers were commonly deployed. Lime stood out as a particularly notable compound due to its high effectiveness and affordability, making it a popular choice among farmers. Among the various fish toxicants, rotenone emerged as the most widely used, followed by phostoxin, bleaching powder and endrin. According to Chowdhury *et al.* [30], similar chemicals were identified [30]. Interestingly, despite the ban on endrin and phostoxin, the study found that they were still being employed with considerable frequency. Insecticides such as sumithion and dipterex were the preferred choices, with usage percentages

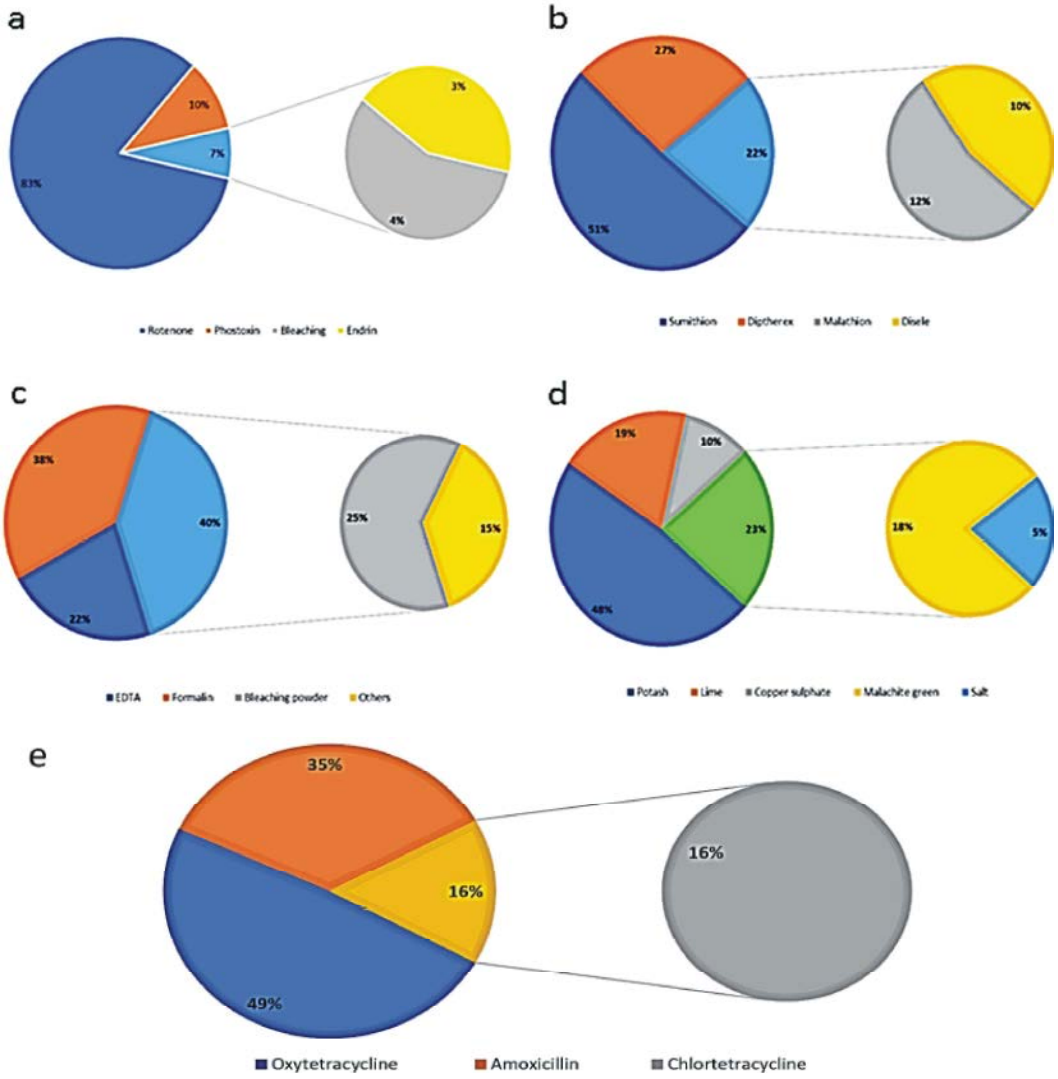

Fig. 1: Chemicals use in aquaculture with special emphasis on fish health management of Noakhali district.

varying depending on whether farmers were involved in nursery or culture operations. For enhancing primary productivity, fertilizers like triple super phosphate and urea were commonly adopted by aquaculture farmers. In the realm of fish disease treatment, a range of chemicals including lime, salt, potash, malachite green, copper sulfate and formalin were employed. Among antibiotics, oxytetracycline was identified as the most extensively used, along with chlortetracycline and amoxicillin. One notable finding highlighted by the study was the lack of knowledge regarding the proper utilization of chemicals, appropriate dosages and application methodologies. This knowledge gap was identified as a significant issue in the Noakhali District. Overall, the findings of the study shed light on the prevalent use of diverse chemical compounds in aquaculture activities in Noakhali, while also emphasizing the need for improved understanding and practices surrounding their usage to address the challenges faced in the region.

CONCLUSION

The findings underscore the diverse range of chemical compounds employed in aquaculture activities in Noakhali and emphasize the need for improved knowledge and practices to ensure the responsible and effective use of these chemicals. Addressing the knowledge gap can contribute to sustainable aquaculture practices and mitigate potential environmental and health risks in the region.

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