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Research Article

Studies on the Antibiotic Usage in Aquaculture Practices of Selected Areas in Andhra Pradesh, India

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Abstract: Diseases are the major concern of the aquaculture industry in AP. Aquaculture industry faces a major problem with particularly bacterial diseases and its leads to increase in the production cost, decreased quality and quantity of yields. For overcoming these issues large quantities of chemicals and antibiotic products are frequently used to counteract this. Antibiotics are used in aquaculture either to treat infection or as prophylactic measure. The Environmental issues and human health are hazards associated with disease occurrence and treatment involving these synthetic drugs). Further the use of antibiotics in aquaculture is a major concern in the export sector of India. Rejections of consignments by the foreign buyers have been recurrent for the last couple of years due to detection of these banned antibiotics. In view of this, the fish and, shrimp farmers were interviewed with well-structured Questionnaires. During the study period (2018-2019) conducted interviews on selected fish and shrimp farmers of targeted 24 villages of East Godavari, West Godavari and Nellore district Andhra Pradesh. This study shows that the fish and shrimp farmers in targeted areas used approved and banned antibiotics in their farms. Of the 241 shrimp farmers interviewed, 21% used antibiotics in shrimp pond management and 25% out of the 228 fish farmers used at least one antibiotic at any time in the production cycle. Most farmers used them in therapeutic purpose, some are in prophylactically and at least four different classes of antibiotics were in use. Many farmers were not well informed about efficient and safe application practices. The study reveals that farmers did not deliberately use those banned antibiotics, but these chemicals were detected in many *L. vannamei* samples in the years 2018, 2019 in Andhra Pradesh.

Keywords: Antibiotic residues, Aqua farming, Drug resistance, Banned antibiotics.

1. Introduction

Indian fisheries and aquaculture is an important sector of food production, employment and flourishing sector with varied resources and potentials. The Fishery sector contributes around 1% to India's Gross Domestic Product (GDP) and over 5.3% to the agricultural GDP, according to Food and Agriculture Organization (FAO, 2016).

Andhra Pradesh rank third in global shrimp production (0.03 million tons) and sixth in aquaculture production (1.57 million tons) (NFDB -2018). Andhra Pradesh is the top producers of freshwater fish in the country producing around 15 lakh of fish, of which 92% is supplied to other states (Jayasankar, 2014). Frequent occurrence of disease is one of the major constraints to aquaculture and may eventually become a limiting factor for aquaculture development (Walker *et al.*, 2010).

According to the estimates of Marine Products Export Development Authority (MPEDA), 10,000 to 15,000 metric tons of shrimp worth about US $ 60-70 million is lost annually due to disease problems in India. To avoid such huge losses, fish farmers use antibiotics and other antimicrobial agents mostly for the prevention and treatment of diseases in fish (Sapkota *et al.,* 2008).

Hence, the farmers and the hatchery operators have resorted to the use of various remedial measures, including use of antimicrobials and drugs like Nitrofurans, Chloramphenicol, Tetracyclin, Malachite green, Crystal violet etc. for controlling the disease in hatcheries and scientific farms more than in traditional farms (Nowsad, 2007; Shamsuzzaman *et al.*, 2012). Indiscriminate use of antibiotics therapy in fish may lead to adverse effects to consumers. Side effects may reflect the pharmacological or toxicological properties of the antibiotic or may involve in hypersensitivity or allergic reactions.

A adverse effects range from fever and nausea to major allergic reactions, including photodermatitis and anaphylaxis (NHS-2014). The problem is more serious in developing countries like India. The prophylactic and therapeutic use of antibiotics results in the occurrence of Antibiotic Resistant Bacteria (ARB) and Antibiotic Resistance Genes (ARGs) in the aquaculture environment. Antimicrobial resistance (AMR) is recognized as one of the greatest threats to human health worldwide (Ritter *et al.,* 2008; Manage and Liyanage, 2019)**.**

Seafood exporters across India are cautious. The European Union (EU) and the US FDA has regularly been rejecting white leg shrimp *L. vannamei* consignments from the country, due to presence of banned antibiotics and other pharmacologically active Substances (MPEDA-2019).

The present study is focused and conducted questionary interview on East Godavari, West Godavari and Nellore district shrimp and fish farmers because this area contribute 40-45% of fish and shrimp production in Andhra Pradesh.

2. Materials and Method

2.1. Study area and target groups

The study, based on questionnaires, interviews conducted on fish, shrimp farm owners in 24 villages of Nellore, East Godavari and West Godavari districts (Figure 1).

2.2. Questionary interviews and participatory appraisal

A total of 469 targeted fish and shrimp farmers interviewed during the study period (2018-2019). Most of the interviewees participated along with technicians of different feed, chemical companies and processing units.

The interviews were conducted by means of meeting with farmers, personal contact, production related data collection, data validation through crosscheck interview, etc. with the help of local level DoF personnels and MPEDA officials.

A Questionnaire survey was also carried out at the veterinary medicinal drug (VMD) shops to get an idea about selling on antibiotics for aquaculture farming in the study area. The study explained the status of such antibiotic business and its market fit.

Figure 1. Study area of Andhra Pradesh (Nellore, East Godavari and West Godavari).

3. Results and Discussion

There are a number of fresh and brackish water farmers that use antibiotics in raising fish and shrimp. During the study period (2018-2019) conducted an interview on selected shrimp (*L. vannamei*) farmers belongs to targeted areas of East Godavari, West Godavari and Nellore district. Total covered 24 villages and 760 ha in south east coast of Andhra Pradesh were covered during the study. It was observed stocking density for *L. vannamei* 25–50 postlarvae per square meter; pond area 0.1–1 ha; and a production of 3–6 tons/ha/crop or they had an even higher stocking density and a production rate.

The study noticed that high stocking densities lead to frequently observed disease conditions affecting cultured shrimps by White spot syndrome virus (WSSV), White faecal syndrome (WFS), Black gill disease (BGD), Loose shell syndrome (LSS), Running mortality syndrome (RMS), and Enterocytozoon hepatopenaei (EHP); 86% of farmers had experienced problems with bacterial and/or viral disease outbreaks. Among them Vibrio bacteria and white spot virus were most common. Total interviewed shrimp farmers (n=241), 52 (21.5%) of them used at least one antibiotic at any time in the production cycle and 189 out of the 241 farmers are not using any antibiotics (Table 1). Farmers used different classes of antibiotics to treat bacterial disease (Table 3). Forty four (84.6%) farmers out of 52 used for therapeutic purpose and 8(15.4%) farmers used as prophylactic application for antiviral and no one used daily basis.

Table 1. Survey result of Shrimp farmers using antibiotics with different purpose in the selected study areas.

S. No	Area	Number of villages covered	Total culture area covered (ha)	Number of Shrimp farmers interviewed		Number of Shrimp farmers using antibiotics		Purpose of antibiotic Use by farmers (%)		
				2018	2019	2018	2019	Preventive use	Daily Use	As antiviral
1	East Godavari	8	210	33	41	13	10	19	0	4
2	West Godavari	8	250	22	37	12	8	18	0	2
3	Nellore	8	300	55	63	4	5	7	0	2
	Total	**24**	**760**	**110**	**141**	**29**	**23**	**44 (84.6%)**	**0**	**8 (15.4%)**

Total 228 fresh water fish farmers interviewed during the study (2018-2019) in the selected 3 coastal districts covering total 8 villages and 850 ha. It was observed that stocking density for IMC fishes was 4-5 numbers per 10 square metre. Some farmers were using along with *L. vannamei* 10-15 postlarvae per square metre (poly culture); pond area 4–10 ha; and obtaining a production of 6–8 tons/ha/crop or they had an even higher stocking density and production rate.

During the study, noticed that bacterial diseases like motile *Aeromonas septicaemia, Edwardsiellosis, Pseudomonas septicaemia, Flexibacteriosis* observed, among them motile *Aeromonas septicaemia* locally called as red disease, is considered to be the most common and troublesome among all bacterial diseases.

In the survey, 61 (26.7%) out of 228 farmers reported the use of antibiotics in the culture cycle (Table 2) and 167 out of the farmers had never experienced any disease outbreak on their farms. Fifty three (91%) farmers out of 61 used for therapeutic purpose and 8 (9%) farmers used as prophylactic application for antiviral and no one used daily basis.

Different classes of antibiotics like oxytetracyclin, erythromycin, enroflaxin, Oxolinic acid used for treat bacterial diseases (Table 3).

Table 2. Survey result of fish farmers using antibiotics with different purpose in the selected study areas.

S. No	Area	Number of villages covered	Total culture area covered (ha)	Number of fish farmers interviewed		Number of fish farmers using antibiotics		Purpose of antibiotic Use by farmers (%)		
				2018	2019	2018	2019	Preventive use	Daily Use	As antiviral
1	East Godavari	8	200	32	40	14	13	23	0	4
2	West Godavari	8	350	20	38	13	11	22	0	2
3	Nellore	8	300	36	42	4	6	8	0	2
	Total	**24**	**850**	**98**	**130**	**31**	**30**	**53 (91%)**	**0**	**8 (9%)**

Farmers in the study area were using both approved and banned antibiotics during the production cycle. The antibiotics were generally in a powder form that was mixed with the feed and distributed manually into the water. It was difficult to document the quantity of antibiotics used in terms of volume or weight. Only a few farmers have information on the doses of antibiotics they used.

Farmers used oxytetracycline for disease treatment of Furunculosis, Columnaris and Vibriosis in the range of 50-80 mg/kg for feed/day and also using enrofloxacin/norfloxacin for disease treatment of Bacterial kidney disease and Columnaris in the range of 25-50 mg/kg feed /day, Chloromphenicol/Nitrofuran metabolites for disease treatment of Vibriosis and Furunculosis in the range of 50-80 mg/kg feed /day.

A majority of the farmers applied the antibiotic two times a day for 3–7 days and some farmers for 2-3 weeks.

Table 3. List of durgs and their dosages for the treatment of disease by oral administration through feed by the farmers of the study area during the study period.

S. No	Diseases	Causative agent	Anti-microbial-agent	Number of farmer rerespon-dents	Number of farmers used	Dosage mg/kg feed/ day	Period of Administration (days)
1	Vibriosis	*Vibrio* spp	Oxy tetracycline	52	14	50-80	5-7
			Chloromphen i-col	42	11	50-75	14-21
			Nitrofuran metabolites	35	9	50-80	14-21
2	Columnaris	*Flavobacterium columnare*	Oxy tetracycline	43	15	50-80	10-14
			Enroflaxin	45	9	50-80	10-14
			Nitrofuran metabolites	54	12	50-80	5-7
3	Bacterial kidney disease	*Renibacterium salmoninarum*	Erythromycin	32	15	25-50	4-7
4	Furunculosis	*Aeromonas salmonicida*	Oxy tetracycline	43	13	50-80	14-21
			Nitrofuran metabolites	34	16	50-80	14-21
			Oxolinic acid	35	11	50-80	14-21

Andhra Pradesh remains one of the top exporters of shrimp in India but the issue of excessive usage of antibiotics in its culture continues to affect the State as the number of consignment rejections have not gone down. This observed data shows that during 2018 from USA, 5 (62%) out of 8, from EU, 9 (69%) out of 13 and from Japan, 1 (25%) out of 4 consignments were rejected. Further, during the year 2019, from USA, 2 (100%) out of 2 and from Japan, 2 (100 %) out of 2 consignments were rejected. Official data also shows that during 2018 and 2019 there were a total of 19 (63%) out of 30 shrimp consignments from Andhra Pradesh rejected by the three major markets due to the presence of banned antibiotics (Table 4).

Table 4. Data on rejection from different markets during study period (MPEDA-2019)

S. No	Rejections	USA		EU		Japan	
		2018	2019	2018	2019	2018	2019
1	India	8	2	13	1	4	2
2	Andhra Pradesh	5	2	9	0	1	2
3	Percentage of Andhra Pradesh (%)	62	100	69	50	25	100

According to European Union legislation the Maximum Range Limit (MRL) approved for the oxytetracycline is 100 ppb and erythromycin 200 ppb in fish farming. For the other drugs Chloromphenicol and Nitrofurans metaboliies no maximum levels fixed and completely banned to be used in aquaculture production (European Commission, 2009). However seafood exports across India are cautious because extensive application of antibiotics results in residues in traded food. India is raising concerns about the rejection of its shrimp shipments by the US Food and Drug Administration (USFDA). The European Union (EU) has regularly been rejecting white leg shrimp (*L. vannamei*) consignment from the country for alleged use of banned antibiotics such as chloramphenicol and/or nitrofurans.

In 2000, the World Health Organization Report on Infectious Diseases declared that antibiotic resistance poses a severe threat to human health, and that the problem is growing and global.

4. Conclusions

The study covers three different regions of the Andhra Pradesh. Disease problems are serious in many areas where more intensive farms have been operating in the study area. To avoid huge losses, fish and shrimp farmers were using antibiotics irregularly. In the present study, diseases like White spot syndrome virus, White faecal syndrome, Black gill disease and Enterocytozoon hepatopenaei (EHP) in shrimp farms and Columnaris, Motile *Aeromonas septicaemia*, *Edwardsiellosis*, *Pseudomonas septicaemia*, *Flexibacteriosis* in fish farms were frequently observed. To control such diseases farmers were using different types of antibiotics, among Chloromphenicol, Nitrofuran, Oxytetracycline and Oxolinic acid are more common. Exported shrimp consignment rejections data from Andhra Pradesh during 2018 and 2019 was compared with the questionnaire survey results of the interviewed shrimp farmers in the years 2018 and 2019, and the major observed findings were *L. vannamei* farmers were using antibiotics more frequently than fish farmers in culture practices. Regulation of veterinary medicine and banned antibiotics administration to food animals should be sufficiently strict, so that potentially toxic antibiotics residues are unlikely to be found in commercially produced animal products.

The persistent and toxic properties of many of the antibiotics are all factors clearly contributing to the risks of resistance development and toxic actions influencing not only the environment, but also human health on a regional scale. Instead of antibiotics, the use of growth promoters, probiotics and digestive enzymes are more effective in infection control. In addition, farmers should follow the better management practices in each and every stage of culture practices to control the disease out breaks.

Conflicts of interest

The authors declare no conflicts of interest.

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