

Importance of Monitoring and Surveillance of AMR in Shrimp Farming

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SUMMARY

Antimicrobial resistance (AMR) is a growing threat to shrimp aquaculture, and the overuse of antibiotics in animals has been identified as a major risk factor. The aquaculture is thought to have high levels of antibiotic use, although exact figures for much of the industry are hard to confidently establish due to the lack of surveillance. The government focuses on surveillance of usage of antibiotics in shrimp farming, possible risk mitigation strategies, in order to increase the sustainability of the shrimp industry and minimize its contribution to the growing global AMR problem.

INTRODUCTION

Shrimp aquaculture stands out as one of the rapidly expanding food sectors, contributing significantly to global shrimp production. Among the most prominent species in aquaculture is the Pacific white shrimp, *Litopenaeus vannamei*, valued for its broad salt tolerance, rapid growth, and other attributes conducive to intensive farming (Wang et al., 2020). However, this industry faces a persistent threat from bacterial diseases, with one of the most detrimental being noted by Valente and Wan (2021). The widespread use of antibiotics in shrimp farming is driven by several factors: shrimp's vulnerability to pathogens due to their compromised immune systems, their limited response to vaccination compared to other fish species and the soaring demand for shrimp in the global market (Thornber et al., 2020).

Antimicrobial resistance (AMR)

AMR, or antimicrobial resistance, refers to the ability of microorganisms to withstand the effects of antimicrobial substances. While this capability can arise naturally as microbes adapt to their environment, the inappropriate and excessive use of antimicrobials in both human healthcare and the animal sector has fueled its escalation (Van Boeckel et al., 2015). Antimicrobials are employed in animal and fish production for disease management and as growth promoters, often at sub-therapeutic levels. However, AMR undermines the efficacy of disease treatments, exacerbates the severity of illnesses, reduces productivity, and results in economic losses. Moreover, the use of antimicrobials can leave residues in edible animal and fish products, posing a significant public health risk (Klein et al., 2018).

Antibiotic usage in shrimp aquaculture

The antibiotics and other antimicrobials, including heavy metals, fungicides and antiparasitics, are used in shrimp aquaculture. An accurate antimicrobial sales and usage data are difficult to obtain since antibiotics are freely available over the counter without a veterinary prescription, and can be of varying quality (Tran et al., 2018). Many shrimp farmers do not have easy access to professionals or facilities for accurate disease diagnosis, and obtain advice on treatments from farm supply shops, neighbouring farmers, government representatives, nongovernmental organizations such as Worldfish ([https:// www.worldfishcenter.org/](https://www.worldfishcenter.org/)) or drug manufacturers/vendors that are also known to provide financial incentives. The antibiotic usage may fluctuate greatly from year to year, even in the same regions, due to climate and disease outbreaks.

Indian Network of Fisheries and Animal Antimicrobial Resistance (INFAAR)

The INFAAR is aimed to document AMR in different production systems, describe the spread of resistant bacterial strains and resistance genes, identify trends in resistance and generate hypotheses about sources and reservoirs of resistant bacteria through a structured national surveillance programme (Laxminarayan et al., 2016).

INFAAR is currently operational through 18 organizations (15 ICAR institutions and three State Agriculture Universities) in 20 centres (nine centres from fisheries and 11 from the livestock sector) spread across the country.

- Undertake surveillance of AMR in target microorganisms isolated from healthy farmed animals and fish/shellfish to quantify its burden, and monitor the spatial and temporal trends of AMR in India.
- Improve awareness and understanding of AMR among the farming community, veterinary and fish health professionals and policy-makers through effective communication, education and training to promote the judicious use of antimicrobials in farmed food animals and fish.

World Health Organisation Network (WHONET)

WHONET is free software developed since 1989 by the WHO collaborating Centre for Surveillance of Antimicrobial Resistance for laboratory-based surveillance of infectious diseases and antimicrobial resistance. The software can be used by individual laboratories or as part of a national and international surveillance network. WHONET is an effective computerized microbiology laboratory data management and analysis program that can provide guidance for empiric therapy of infections, alert clinicians of trends of antimicrobial resistance, guide drug-policy decisions and preventive measures.

Regulate antibiotic sales/usage

For effective prevention and better control over the use of antibiotics in aquaculture, national and international level regulatory frameworks on the sales, use and quality of antimicrobial agents are required. All of the top 10 shrimp-producing countries do have regulations in place for the use of antibiotics in aquaculture, but there is a huge disconnect between regulation and enforcement. The veterinarians, or other licensed fish health professionals, would prescribe antimicrobials, and licensing would be enforced and guided by qualified fisheries and animal health professionals. However, although export restrictions undoubtedly help to reduce antibiotic usage, they only detect antibiotic usage immediately prior to harvesting, and do not apply pressure to hatcheries and shrimp destined for domestic markets (Behera 2018). The significant progress in the development of AMR action plans, a significant barrier to reducing antibiotic usage in the major shrimp-producing countries is the lack of resources to implement the regulations that are already in place.

Standardization of surveillance of antimicrobial usage and AMR in shrimp aquaculture

- Antimicrobial Use in Aquaculture and Antimicrobial Resistance' identified that there was a need for both more national and regional data on AMR, antimicrobial residues and antimicrobial usage, as well as for more knowledge on the spread of AMR genes from aquatic and fish bacteria to human pathogens.
- Improved surveillance has been identified as key to reducing antimicrobial usage across all human and animal health sectors, and is an integral part of national AMR action plans.
- Surveillance of antimicrobial usage and resistance would cover the entire shrimp industry and would not be restricted to products destined for export.
- Standardization of the methods used to both measure sensitivity to antibiotics and then interpret the resultant antimicrobial sensitivity testing (AST) data
- It is strongly recommended that Clinical and Laboratory Standards Institutes.

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