Article

Bacterial Community Composition and Prevalence of *Aeromonas dhakensis* in Four Tilapia Freshwater Aquaculture Systems in Malaysia

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Abstract: The tilapia (*Oreochromis*) aquaculture industry in Malaysia has expanded rapidly to meet the increasing demand for animal protein. However, this growth is challenged by microbial infections, particularly those caused by the emerging pathogen *Aeromonas dhakensis*. This study aimed to investigate the microbial community composition across four distinct tilapia farming systems and assess associated water physicochemical parameters, with a focus on detecting the presence of *A. dhakensis* and elucidating its environmental associations. Water physicochemical parameters were measured to evaluate environmental conditions, microbial communities were characterized through 16S rDNA metabarcoding, and *A. dhakensis* was detected using both microbiological and molecular approaches. Principal component analysis (PCA) and canonical correspondence analysis (CCA) were employed to explore the influence of environmental variables and microbial community dynamics on pathogen occurrence. Our results indicated that floating cages exhibited higher levels of temperature, ammonium, and fecal coliform, while cement tanks showed signs of nutrient accumulation. PCA revealed that both systems were associated with degraded water quality. A total of 45 *A. dhakensis* strains with distinct fingerprints were isolated. The 16S metabarcoding revealed Proteobacteria, Actinobacteria, and Planctomycetota as the dominant phyla. Alpha diversity did not differ significantly among pond systems, while beta diversity revealed variations in microbial assemblages across aquaculture systems. CCA identified dissolved oxygen, temperature, macronutrients (phosphate, ammonium, nitrate, and nitrite), and turbidity as significant environmental drivers shaping the microbial community structure across the pond systems. In conclusion, this study highlights the importance of environmental factors, particularly dissolved oxygen, temperature, and nutrient levels, in shaping microbial community composition and potentially influencing the presence of pathogenic bacteria such as *A. dhakensis*. These findings underscore the need for improved environmental management in tilapia aquaculture to mitigate disease risks and support fish health.