

## Effects of Probiotic *Pseudomonas fluorescens* on the Growth Performance, Immune Modulation, and Histopathology of African Catfish (*Clarias gariepinus*)

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**Abstract :** This study was carried out to determine the effects of probiotics *Pseudomonas fluorescens* on the growth performance, histology examination and immune modulation of African Catfish, (*Clarias gariepinus*) challenged with *Clostridium botulinum*. *P. fluorescens*, and *C. botulinum* isolates were removed from the gut, gill and skin organs of procured adult samples of *Clarias gariepinus* from commercial fish farms in Akure, Ondo State, Nigeria. The physical and biochemical tests were performed on the bacterial isolates using standard microbiological techniques for their identification. Antibacterial activity tests on *P. fluorescens* showed inhibition zone with mean value of 3.7 mm which indicates high level of antagonism. The experimental diets were prepared at different probiotics bacterial concentration comprises of five treatments of different bacterial suspension, including the control (T1), T2 ( $10^3$ ), T3 ( $10^5$ ), T4 ( $10^7$ ) and T5 ( $10^9$ ). Three replicates for each treatment type were prepared. Growth performance and nutrients utilization indices were calculated. The proximate analysis of fish carcass and experimental diet was carried out using standard methods. After feeding for 70 days, haematological values and histological test were done following standard methods; also a subgroup from each experimental treatment was challenged by inoculating Intraperitoneally (I/P) with different concentration of pathogenic *C. botulinum*. Statistically, there were significant differences ( $P < 0.05$ ) in the growth performance and nutrient utilization of *C. gariepinus*. Best weight gain and feed conversion ratio were recorded in fish fed T4 ( $10^7$ ) and poorest value obtained in the control. Haematological analyses of *C. gariepinus* fed the experimental diets indicated that all the fish fed diets with *P. fluorescens* had marked significantly ( $p < 0.05$ ) higher White Blood Cell than the control diet. The results of the challenge test showed that fish fed the control diet had the highest mortality rate. Histological examination of the gill, intestine, and liver of fish in this study showed several histopathological alterations in fish fed the control diets compared with those fed the *P. fluorescens* diets. The study indicated that the optimum level of *P. fluorescens* required for *C. gariepinus* growth and white blood cells formation is  $10^7$  CFU  $g^{-1}$ , while carcass protein deposition required  $10^5$  CFU  $g^{-1}$  of *P. fluorescens* concentration. The study also confirmed *P. fluorescens* as efficient probiotics that is capable of improving the immune response of *C. gariepinus* against the attack of a virulent fish pathogen, *C. botulinum*.

**Keywords :** *Clarias gariepinus*, *Clostridium botulinum*, probiotics, *Pseudomonas fluorescens*

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