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Dietary Herbal Supplementation Improves Growth Performance and Haematological Responses in *Clarias gariepinus*

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International Journal of Aquaculture, 2026, Vol.16, No.4 doi: [10.5376/ija.2026.16.0017](https://doi.org/10.5376/ija.2026.16.0017)

Received: 6 May, 2026

Accepted: 23 Jun., 2026

Published: 10 Jul., 2026

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Preferred citation for this article:

Awhefeada O.K., Akpomughe E., and Umehai M.C., 2026, Dietary herbal supplementation improves growth performance and haematological responses in *Clarias gariepinus*, International Journal of Aquaculture, 16(4): 203-212 (doi: [10.5376/ija.2026.16.0017](https://doi.org/10.5376/ija.2026.16.0017))

Abstract Dietary composition can influence both the growth performance and haematological parameters of aquaculture species. This study evaluated the welfare benefits of dietary supplementation with ginger (*Zingiber officinale*), garlic (*Allium sativum*), and neem (*Azadirachta indica*) powder on behavioural responses, growth performance, and haematological profile of African catfish juveniles (*Clarias gariepinus*). The use of plant-based phytogetic additives in aquaculture feeds is increasingly recognized as a sustainable alternative to synthetic growth promoters and chemotherapeutic agents, with potential benefits for fish health. Four experimental diets were formulated: a control diet (0%) and three treatment diets supplemented with 2% ginger, 2% garlic, and 2% neem powder respectively. Juvenile *C. gariepinus* were fed these diets for a three-month period (12weeks). Growth parameters, length–weight relationship, and haematological indices were measured, while behavioural indicators such as feeding activity, behaviour, and general vitality were observed as indicators of welfare status. Fish fed the garlic-supplemented diet recorded the highest values of Packed Cell Volume (PCV), haemoglobin (Hb), and Red Blood Cells (RBC), while the neem-supplemented diet produced the highest White Blood Cell (WBC) counts, suggesting improved immune response. Behavioural observations also indicated stronger feeding responses and greater activity in garlic and neem treatments. Overall, phytogetic supplements improved physiological condition and behavioural welfare of *C. gariepinus*.

Keywords Supplemented; Phytogetic additives haematological; Synthetic growth promoters; Chemotherapeutic

1 Introduction

African catfish (*Clarias gariepinus*) is one of the most commercially important freshwater species cultured in Africa. Its widespread cultivation is attributed to its rapid growth, efficient feed utilization, high fecundity, and strong tolerance to a wide range of environmental conditions (Langi et al., 2024; Klimuk et al., 2024). These characteristics have supported the expansion of catfish farming across sub-Saharan Africa, where increasing demand for affordable animal protein continues to drive aquaculture development (Kwikiriza et al., 2025). In addition, selective breeding programmes have improved the growth potential and productivity of cultured stocks, further enhancing the economic value of the species in intensive production systems (Imron et al., 2020; Srimai et al., 2020; Ovie et al., 2025).

Despite these advantages, the rapid expansion and intensification of catfish farming have introduced several health and management challenges. Intensive production practices frequently expose fish to stress arising from fluctuations in water quality, temperature, salinity, and other environmental factors (Khieokhajokhet et al., 2022; Zidan et al., 2022). Such conditions can disrupt physiological processes, impair growth performance, and compromise fish homeostasis, ultimately reducing production efficiency (Khieokhajokhet et al., 2022; Klimuk et al., 2024).

In recent years, fish welfare has received considerable attention because it is closely associated with productivity, survival, and resistance to disease (Ojelade et al., 2022). Modern approaches to welfare assessment extend beyond growth measurements and incorporate indicators of physiological balance, immune function, and adaptive capacity