# Multifunctional chitosan nanoparticles: Zn 2+ adsorption, antimicrobial activity, and promotion of aquatic health

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# Supplementary material

## S1 Feed consumption and growth measurement

Each tank fish that had been fed chitosan-loaded CSNPs/kg of diet were collected, quantified, and documented after 45 days of feeding experiment analysis. The number of fish in each tank was counted, and this allowed us to calculate the fishes survival rate. Based on the equations (1) through (7) suggested by Abdel-Tawwab et al.,[19], the effectiveness of fish production and dietary intake metrics including weight gain (WG), specific growth rate (SGR), feed consumption (FC), feed conversion ratio (FCR), and protein efficiency ratio (PER) was calculated

$$\text{Weight gain (g)} = W2 - W1(\text{g}), \tag{1}$$

$$\text{Weight gain (\%)} = \frac{100(W2 - W1)}{W2}, \tag{2}$$

$$\text{Specific growth rate (SGR)} = 100\frac{[\text{Ln}W2(\text{g}) - \text{Ln}W1(\text{g})]}{T}, \tag{3}$$

$$\text{Feed intake (FI) (g feed/fish)} = \frac{\text{Summation of diets provided to fish throughout the number of the experiment}}{\text{fish number}}, \tag{4}$$

$$\text{Feed conversion ratio (FCR)} = \frac{\text{Feed consumption (g)}}{\text{Weight gain (g)}}, \tag{5}$$

$$\text{Fish survival (\%)} = \frac{100(\text{Fish number at final})}{\text{Fish number at initial}}, \tag{6}$$

$$\text{Protein efficiency ratio (PER)} = \frac{\text{Total wet weight gain (g)}}{\text{Crude protein fed (g)}}, \tag{7}$$

where $T$ is the overall experiment's time (d), $W1$ is the fish's initial weight (g), and $W2$ is its end weight (g).

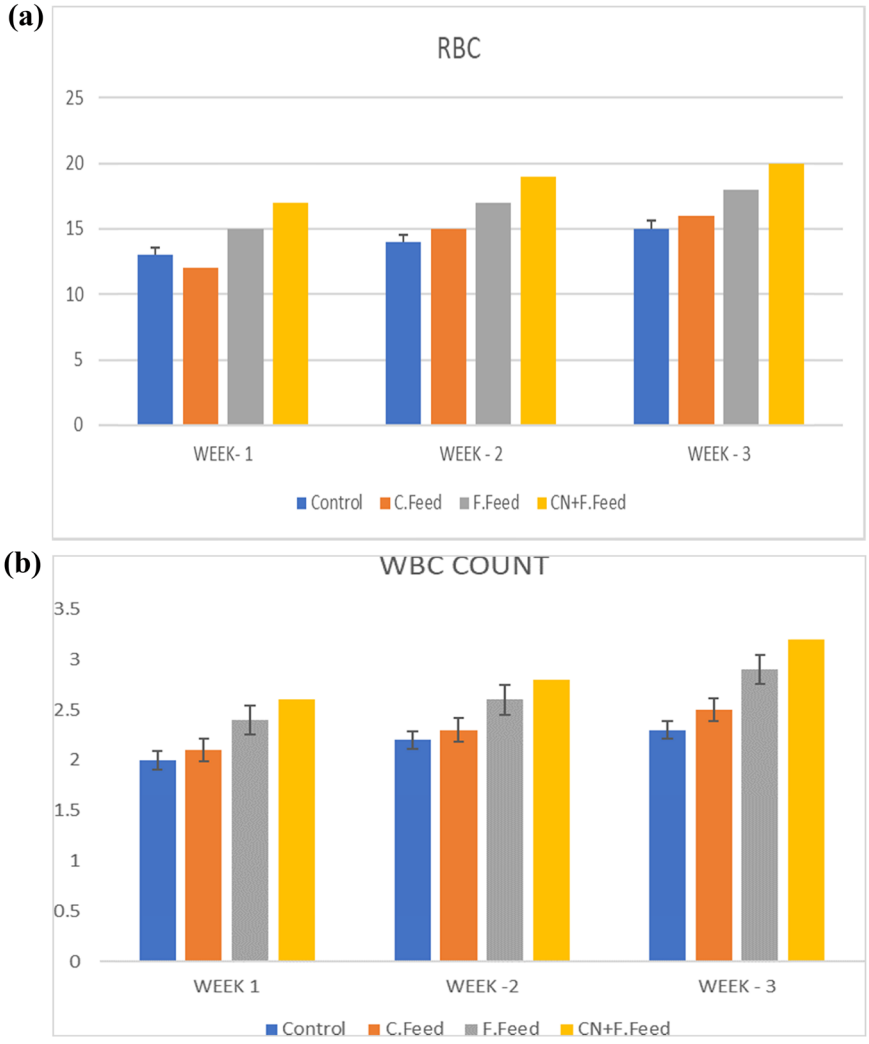


**Figure S1:** Effect of commercial feed, formulated feed and chitosan nanoparticles (CSNPs) formulated feed supplemented for *O. niloticus* showing (a) RBC count (b) WBC count.