

2.8 Statistical analysis

Data obtained from the experiments were collated and subjected to analysis of variance using SPSS version 20.0, with significance set at $p < 0.05$. Duncan's Multiple Range Test (DMRT) was used for comparison tests.

3 Results

3.1 Behavioural signs

The behavioural and morphological responses of *Clarias gariepinus* exposed to varying concentrations of *S. occidentalis* ethanolic extract are presented in Table 1.

Table 1 Results of behavioural responses

Behavioural response	Control	Treatment A	Treatment B	Treatment C
	0 mg/ 25 cL	3000 mg/25 cL	5000 mg/25 cL	7000 mg/25 cL
Fin deformation	-	+	+++	+++++
Barbel whitening	-	+++	+++	+++++
Air gulping	-	+	+++++	+++++
Stunned positioning	-	+	+++	+++
Aggression	-	-	+++	+++
Erratic swimming	-	+	+	+++
Loss of balance	-	-	+	+++

-: Normal; +: weak; +++: moderate; +++++: high

Throughout the experiment, behavioural and morphological changes in the test fish were noted at 12-hour intervals. While there was a slight whitening of the barbels in the fish in the treatment tanks, the treatment tanks showed distinct morphological and behavioural changes. For instance, the fish in treatment one showed modest alterations in the shape and orientation of their fins, and their barbels lightened somewhat. In contrast, the fish in treatment two gulped due to insufficient dissolved oxygen, turned hostile, displayed a stunned posture, and showed mild fin deformation. The fish in treatment three exhibited moderate stunned positioning, aggression, erratic swimming, loss of body balance, and a high degree of fin deformation, barbel whitening, and gill damage due to insufficient dissolved oxygen.

3.2 Results of haematological parameters

According to Iheanacho et al. (2017), haematological indices are vital health markers that show the condition of fish's health both before and after trials.

Table 2. showed that the values of Mean Corpuscular Volume (115.15-112.33 fL), Hemoglobin (12.31-9.50 g/dL), Red Blood Cell (3.30-2.13 x 10^{12/L}), White Blood Cell (15.82-10.90 x 10^{9/L}), Packed Cell Volume (38.31%-28.11%), and Mean Cell Hemoglobin concentration (34.71-32.27 g/dL) decreased as *S. occidentalis* concentrations increased relative to the control treatment, while Heterophile (28.02%-37.04%) increased as *S. occidentalis* concentrations increased.

4 Discussion

Hematological parameters serve as standard indicators of fish health under aquaculture conditions and in ecotoxicological studies (Witeska et al., 2022). Their diagnostic value was demonstrated by Bojarski et al. (2022), who found hematological indices to be the most sensitive biomarkers of toxicity in *Cyprinus carpio*. These parameters are sensitive and are indicators of physiological alterations in fish; they provide extensive information on oxygen transport, immune status, stress, cytotoxicity, and genotoxicity (Witeska et al., 2023). In the present study, *Clarias gariepinus* exposed to *Senna occidentalis* leaf extract exhibited significant alterations in white blood cells (WBCs), red blood cells (RBCs), haemoglobin (Hb), packed cell volume (PCV), and erythrocyte indices (MCV, MCH, and MCHC), indicating that phytochemicals from *S. occidentalis* can disrupt hematological homeostasis. This supports hematology as a practical biomarker for evaluating plant-based xenobiotics in aquaculture species under laboratory conditions.