Research Article
Sciences of Phytochemistry

Evaluation of the Anti-Inflammatory, Antidepressant and Antioxidant Activity of Schweinf. ex Hiern *Fadogia ancylantha* Plant Leaf Extracts

Gillian Gumindoga, Farisai Chidzwondo, Rumbidzai Mangoyi

[The author informations are in the declarations section. This article is published by ETFLIN in Sciences of Phytochemistry, Volume 5, Issue 2, 2026, Page 298-307. DOI: 10.58920/sciphy0502720]

Received
16 June 2026

Revised
11 July 2026

Accepted
26 July 2026

Published
29 October 2026

Editor
Pra Panca Bayu Chandra

Keywords: Fadogia ancylantha, Postpartum depression, Cyclooxygenase-1, Sucrose preference test, Tail suspension test, Phenolic content.

CC BY 4.0

AUTHOR (2026)

Abstract: *Fadogia ancylantha* is an indigenous African medicinal plant widely used in traditional medicine for immune boosting and the treatment of infections and inflammation. This study investigated the phytochemical composition, antioxidant, anti-inflammatory, and antidepressant activities of ethanol and methanol leaf extracts of *F. ancylantha*. Phytochemical analyses were conducted using standard chemical screening and spectrophotometric methods. Antioxidant activity was evaluated using the DPPH assay whilst anti-inflammatory activity was done using the carrageenan-induced paw oedema model in rats and the cyclooxygenase assay. Antidepressant activity was assessed using the tail suspension, forced swim, and sucrose preference tests. Both ethanol and methanol extracts contained saponins, tannins, flavonoids, and phenolic compounds. The ethanol extract exhibited higher TPC (0.3914 ± 1.8 mg GAE/g) than the methanol extract (0.2183 ± 1.4 mg GAE/g). Similarly, the ethanol extract showed a higher TFC (0.27373 ± 1.31 mg QE/g) than the methanol extract (0.26587 ± 1.31 mg QE/g). The ethanol extract demonstrated concentration-dependent DPPH radical scavenging activity comparable to ascorbic acid. The extract produced dose-dependent anti-inflammatory effects, with higher doses exhibiting greater activity than lower doses. The extract also reduced COX-1 activity in a concentration-dependent manner, with the 200 µg/mL concentration showing activity comparable to indomethacin. In behavioural studies, treatment produced a dose-dependent reduction in immobility time in the tail suspension test and significantly increased sucrose preference, with the 400 mg/kg dose showing the strongest antidepressant-like effect. These findings suggest that the ethanol leaf extract possesses significant antioxidant, anti-inflammatory, and antidepressant properties, supporting its potential for therapeutic development in depressive disorders.

Introduction

Postpartum Depression (PPD) is a prevalent mental health disorder affecting millions of individuals worldwide. The current pharmacological treatments for depression often have side effects and may not be effective for every person. *Fadogia ancylantha*, commonly known as Makoni tea, is a medicinal plant belonging to the Rubiaceae family, traditionally used in various African folk medicine systems for treating inflammatory conditions, pain, and other ailments. This shrub, native to tropical regions of Africa, has garnered increasing scientific attention due to its rich phytochemical profile, which includes alkaloids, flavonoids, tannins, and other bioactive compounds.

Recent pharmacological investigations have revealed that *F. ancylantha* possesses significant anti-inflammatory and analgesic properties, making it a promising candidate for the development of natural therapeutic agents. The plant's traditional use as a remedy for inflammatory disorders has provided the impetus for researchers to explore its molecular mechanisms of action, particularly its potential to modulate key inflammatory pathways (1, 2).

Cyclooxygenase (COX) enzymes play a pivotal role in the inflammatory cascade by catalysing the conversion of arachidonic acid to prostaglandins and thromboxanes, which are important mediators of inflammation, pain, and fever. There are two main isoforms: COX-1, which is constitutively expressed and involved in homeostatic functions, and COX-2, which is predominantly induced during inflammatory responses. Many plant-derived compounds have demonstrated the ability to inhibit these

enzymes through various mechanisms, including competitive inhibition at the active site, allosteric modulation, or interference with enzyme expression. Plants, as natural COX inhibitors, offer several advantages over synthetic drugs, including potentially fewer side effects and multi-target activity due to their complex phytochemical compositions. The inhibition of COX enzymes by plant extracts and isolated compounds represents a significant mechanism underlying their anti-inflammatory effects (3).

Previous studies on *F. ancylantha* have mainly reported its traditional uses and general phytochemical composition; however, limited information is available regarding its biological activities. In particular, the anti-inflammatory, antidepressant, and antioxidant potential of its leaf extracts has not been extensively investigated. Furthermore, the relationship between its phytochemical constituents and these pharmacological effects remains poorly understood. Therefore, this study was conducted to provide further scientific evidence on the therapeutic potential of *F. ancylantha* leaf extracts by evaluating their anti-inflammatory, antidepressant, and antioxidant activities. The antioxidant properties of plants constitute another key aspect of their therapeutic potential, as oxidative stress and inflammation are closely interconnected pathways in pathophysiology (4). Plant secondary metabolites, particularly phenolic compounds like flavonoids, phenolic acids, and tannins, exhibit potent antioxidant activity by scavenging free radicals, chelating metal ions, and enhancing endogenous antioxidant defense systems. This antioxidant capacity complements the anti-inflammatory effects of plants by breaking the vicious cycle between oxidative stress and inflammation, where reactive oxygen species promote inflammatory responses, and inflammatory mediators further generate oxidative damage (5).

Oxidative stress and chronic inflammation are key drivers of depression, as excessive reactive oxygen species and inflammatory mediators disrupt neuronal function, neurotransmitter balance, and overall brain health. Consequently, agents with combined antioxidant and anti-inflammatory properties can mitigate these pathological pathways and exert antidepressant effects. Unlike single-target synthetic drugs, multi-target plants like *F. ancylantha* provide holistic therapeutic advantages by addressing multiple disease mechanisms simultaneously. Therefore, this study evaluated the interconnected antioxidant, anti-inflammatory, and antidepressant activities of methanolic and ethanolic *F. ancylantha* leaf extracts.

Methodology

Plant Collection and Extraction

F. ancylantha leaves were collected from Sawi village, Gokwe Centre, Zimbabwe (18.22°S, 28.94°E). Identification of the plant was done at the Harare Botanical Gardens. The leaves were dried in the oven for four days at 40 °C and were ground into powder using a pestle and mortar. Extraction of phytochemicals was done using maceration. Thirty gram of plant material was separately mixed with ethanol and methanol solvents in a ratio of 1: 5 (w/v). This ratio ensured sufficient solvent volume to fully immerse the plant material, facilitating efficient diffusion of bioactive compounds into the solvent. The mixtures were left to macerate at room temperature for three days with occasional shaking to maximise extraction efficiency. After maceration, the extracts were filtered using Whatman 1 filter paper to separate the liquid extract from the plant residue. The filtrates were then concentrated by evaporating the solvents using the Buchin Rota vapor RII, and the resulting extracts were air-dried and stored at room temperature.

Phytochemical Analysis

Qualitative Tests

The tests were done according to (6, 7, 8).

Test for Saponins: The Froth Test

A volume of 6 mL of distilled water was added to 0.5 g of each of the methanol and ethanol extracts in separate test tubes. The mixtures were shaken vigorously for about 5 min. A persistent foam that stays for at least 10 min would indicate a positive test for saponins.

Test for Flavonoids: The Alkaline Reagent Test

To 2 mL of extract in a test-tube, 4 drops of 10% NaOH were added. An intense yellow colour, which turns colourless upon addition of a few drops of HCl, would indicate the presence of flavonoids.

Test for Tannins: The Ferric Chloride Test

To 1 mL of extract in a test-tube, 2 mL of distilled water was added, followed by the addition of 4 drops of 10% ferric chloride ($FeCl_3$). Formation of a blue, green or blackish colour would indicate the presence of tannins.

Test for Alkaloids: Wagner's Test

Into a test-tube, 1 mL of the extract was added, followed by 3 drops of Wagner's reagent on the side of the test tube. Observation of a reddish-brown precipitate would indicate the presence of alkaloids.

Test for Phenolics: Salkowski Test

In a test tube, 1 mL of extract was mixed with 2 mL of chloroform, followed by drop- wise addition of concentrated H_2SO_4, without shaking. A reddish colour at the interface would indicate the presence of phenolic compounds.

Test for Glycosides: The Acetic Acid Test (Keller-Killani Test)

To 1 mL of the extract, 2 mL of glacial acetic acid were added, followed by a drop of $FeCl_3$. Four drops of concentrated H_2SO_4 were added. A positive glycoside test would be indicated by the appearance of a reddish-brown ring at the junction of the two liquid layers.

Quantitative Tests

Estimation of Total Phenolic Content: Folin-Ciocalteu Method

The determination of total phenolic compounds was done using the Folin-Ciocalteu spectrophotometric method as described by Sharma and Bandiola (6, 8). A 1 mL (1 mg/mL) aliquot of each of the methanol and ethanol extracts was pipetted into test-tubes. Then 10 mL of distilled water was added to each of the test-tubes,

$$C = C_{\text{std}} \times \frac{v}{m} \quad \textbf{(Eq. 1)}$$

$$\%Inhibition = \frac{\text{A}control - \text{A}sample}{\text{A}control} \times 100 \quad \textbf{(Eq. 2)}$$

followed by 2 mL of Folin-Ciocalteu reagent solution (0.2 M) Sigma F9252. A blank was prepared the same way using distilled water. The solutions were left to stand for 5 min, after which 10 mL of 7.5% sodium carbonate was added. The calibration curve to obtain the concentration data of phenolic compounds was constructed using different concentrations of gallic acid (0, 50, 100, 150, 250 and 500 mg/L), prepared in the same manner as the methanolic and ethanolic plant extracts. The solutions were incubated in the dark for 45 min and absorbance was measured at 760 nm in a UV-Vis spectrophotometer. The total phenolic content was expressed as mg of gallic acid equivalents per g of sample (mg GAE/g) using **Equation 1**, where: C = concentration of phenols in mg GAE/g, C_{std} = concentration from the standard curve, v = volume of extracts used, and m = mass of extracts in gram.

Estimation of Total Flavonoid Content: Aluminium Chloride Method

The total flavonoid content (TFC) of the plant extract was determined using the aluminium chloride colorimetric method as described by (9, 10). Quercetin was used as the standard. Into separate test-tubes, were placed 1 mL (1 mg/mL) of plant extract, and 1 mL of the standard at varying concentrations (0.1, 0.2, 0.5, 0.8 and 0.9 mg/mL), followed by dilution with 4 mL of methanol. Then 1 mL of 10% aluminium chloride was added to all test-tubes, followed by 1 mL of 1 M sodium acetate. The blank was prepared using distilled water. The contents were given a quick spin on the vortex and then incubated in a dark space at room temperature for 45 min. The absorbance of the mixture was read at 450 nm and the TFC values were expressed as quercetin equivalents mg QE/g of plant extract.

Antioxidant Assay

A stock solution of DPPH was prepared by dissolving 24 mg of DPPH in 100 mL of methanol to obtain a concentration of 0.24 mg/mL. The solution was stored in a dark glass container at 4°C. Ascorbic acid solutions were prepared at concentrations of 50, 100, 50, 250, and 500 µg/mL in distilled water to serve as positive controls. *F. ancylantha* methanol and ethanoic extracts were prepared at concentrations of 50, 100, 250, and 500 µg/mL by serial dilution in their respective solvents. A control concentration of 0 µg/mL (solvent only) was also prepared for each extract type (11).

DPPH Radical Scavenging Assay

The antioxidant activity was evaluated using the DPPH radical scavenging method. In a 96-well microplate, 100 µL of each test sample (extract concentrations of 0, 50, 100, 250, and 500 µg/mL) was mixed with 100 µL of freshly prepared DPPH solution (0.24 mg/mL). Similarly, 100 µL of ascorbic acid solutions at various concentrations was mixed with 100 µL of DPPH solution for the positive control. The reaction mixtures were incubated in a dark cupboard at room temperature for 30 min.

Absorbance Measurement

After incubation, the absorbance was measured at 517 nm using a UV-Visible spectrophotometer. The % of DPPH radical scavenging activity (% inhibition) was calculated using **Equation 2**, where, $A_{control}$ = Absorbance of the DPPH solution without extract (control) and A_{sample} = Absorbance of DPPH solution with plant extract.

Anti-inflammatory Activity: Carrageenan-Induced Paw Oedema Model

The assay was done according to Ghosh and Gupta (12) with some modifications. To assess the anti-inflammatory activity of *F. ancylantha* ethanol leaf extract, eight-week-old Wistar rats, male and female, with weights ranging from 120-150 g were grouped into six groups, five rats per group. The animals had free access to food and water. The ethanol extract of *F. ancylantha* was dissolved in water and administration was done via the oral route for seven days. To induce inflammation, sub-plantar injection of 1 mL carrageenan into the paw was done, followed by measurement of paw volume changes to determine the extent of inflammation at (0, 1, 2, 4 and 20) h. Change in paw volume was measured using a venier calliper. After the treatment period, animals were anaesthetised using chloroform and euthanised by cervical dislocation. Tissue organs such as the brain, liver, and kidney were collected for further analysis. The animal models were used according to the guidelines of the OECD at the University of Zimbabwe Animal House. The six groups were categorised as follows:

- Group 1 (Negative control): received normal saline.
- Group 2 (Positive Control): 10 mg/kg, standard drug indomethacin.
- Group 3: received (100 mg/kg), low dose of *F. ancylantha* extract.
- Group 4: received (200 mg/kg) medium dose of *F. ancylantha* extract.
- Group 5: received (400 mg/kg) high dose of *F. ancylantha* extract.
- Group 6 (disease control): Carrageenan-induced inflammation

Antidepressant Activity

Tail Suspension Test

A tail suspension test (TST) was performed by the method described by Bahta (1). For TST, the rats were suspended 50 cm above the floor using an adhesive tape placed approximately 1 cm from the tip of their tail. The immobility time was recorded during the last 4 min of a 6-min test using a stopwatch. Only three rats from each group were randomly selected to participate in this test. A stopwatch was used for recording the time.

Forced Swim Test

Antidepressant activity of the *F. ancylantha* ethanol extract was assessed using the forced swim test. A forced swimming test (FST) was performed using the method described by (1, 13) with some modifications. Two swim sessions were conducted. An initial 15-min pre-test was

followed 24 h later by a 6-min test. Each rat received a respective dose of the plant extract 1 h before the test, and the rat was placed in the dish again for 6 min. The following behaviours were recorded during the last 4 min: immobility swimming and climbing. Only three rats from each group were randomly selected to participate in this test. A stopwatch was used for recording the time.

Sucrose Preference Test

Thirty rats were equally grouped into six groups. The rats were grouped into control and treatment groups, followed by subjection to chronic unpredictable stress. The rats were allowed to consume both water and (1%) sucrose solutions before being deprived of food and water for 24 h. Both sucrose solution and water were offered simultaneously to each group for 2 h and the positions of the bottles were changed every 30 min (13). The volumes consumed of each fluid were then recorded. The sucrose preference was calculated **Equation 3**.

Cyclooxygenase Assay

Cyclooxygenase (COX) inhibitory activity of the plant extracts was determined using a colorimetric assay based on the oxidation of N,N,N′,N′-tetramethyl-p-phenylenediamine (TMPD). The reaction was performed in a 96-well microplate format.

Preparation of Plant Extracts

The plant extracts were prepared in the respective alcohol and diluted to final concentrations of 100, 200, and 400 µg/mL. All concentrations were freshly prepared prior to the assay. The assay mixture was prepared in each well of a 96-well plate to a final reaction volume of 200 µL. The reaction was initiated by the addition of arachidonic acid substrate. Control wells contained all reagents except the plant extract (vehicle control), while blank wells contained buffer instead of enzyme to account for background absorbance.

Incubation and Measurement

Following the addition of arachidonic acid, the plate was incubated at room temperature for 10 min. The oxidation of TMPD by prostaglandin endoperoxide produced during the COX reaction resulted in a colour change. Absorbance was measured at 590 nm using a microplate reader after fifteen min.

Calculation of COX-1 Inhibition

The % inhibition of COX activity by the plant extracts was calculated using **Equation 2**, where $A_{control}$ = Absorbance or enzyme activity of the control (without inhibitor/extract) and A_{sample} = Absorbance or enzyme activity in the presence of the plant extract.

Statistical Analysis

All experiments were performed in triplicate, and the results were expressed as mean ± standard deviation. Statistical analyses and graphical representations were performed using GraphPad Prism 8® (Version 8.0, GraphPad Software Inc. , San Diego, USA). Differences between groups were analyzed using one-way and two-way analysis of variance (ANOVA), followed by Tukey's multiple comparison test where appropriate. An independent sample t-test was used for comparisons between two groups. A p-value of < 0.05 was considered statistically significant.

Results

Phytochemical Screening

Phytochemicals such as saponins, flavonoids and tannins were present in ethanolic and methanolic extracts. Phenolic compounds were observed to be moderately present, whilst glycosides were absent in both extracts in **Table 1**.

Total Phenolic Content (TPC)

The ethanol extract had high total phenolic content as compared to the methanol extract, as shown in **Table 2**. Phenolic concentrations were calculated as Gallic Acid Equivalents (mg GAE/g) and data are presented as mean ± SEM (n = 3). The ethanol extract exhibited a significantly higher TPC compared with the methanol extract ($p < 0.001$, unpaired two-tailed t-test).

$$\text{Sucrose preference} = \frac{sucrose\ consumption}{total\ fluid\ consumption} \times 100 \quad \textbf{(Eq. 3)}$$

Table 1. Qualitative phytochemical screening of ethanol and methanol extracts of *F. ancylantha*.

Phytochemical	Test type	Ethanol extract	Methanol extract
Saponins	Froth test	+++	+++
Flavonoids	Alkaline test	++	++
Tannins	Ferric chloride test	+++	+++
Alkaloids	Wagner's test	-	-
Phenolics	Salkowski test	+	+
Glycosides	Acetic acid test	-	-

Note: The intensity of detection was graded as follows: +++ = high/strong presence, ++ = moderate-to-strong presence, + = moderate presence, and − = absence.

Table 2. Total Phenolic Content (TPC) analysis of ethanol and methanol extracts.

Extract	Absorbance (Mean ± SEM)	TPC (Mean ± SEM, mg GAE/g of extract)
Ethanol	0.532 ± 0.0023	0.3914 ± 1.8
Methanol	0.307 ± 0.0017	0.2183 ± 1.4

Total Flavonoid Content (TFC)

The ethanol extract had high total flavonoid content as compared to the methanol extract, as shown in **Table 3**. Flavonoid concentrations were calculated as Quercetin Equivalents (QE, mg/g) and data are presented as mean ± SEM (n = 3). Statistical analysis using an unpaired two-tailed t-test revealed that the total flavonoid content of the ethanol extract was significantly higher than that of the methanol extract ($p < 0.05$).

DPPH Radical Scavenging Activity

In **Figure 1**, the graph shows the % inhibition of the ethanol and methanol extracts at different concentrations (µg/mL) and compares their antioxidant activity with the standard curve of ascorbic acid. In both extracts, the % inhibition increases as the concentration of the extracts increases, indicating a concentration- dependent antioxidant activity. The % inhibition that was exhibited by the ethanolic extract was slightly higher than that of the ascorbic acid. Data represent mean ± SEM for n = 3. Statistical analysis was performed using two-way ANOVA followed by Tukey's multiple comparisons test. Significant differences were observed between the ethanol and methanol extracts (****$p < 0.0001$), whereas no significant difference was found between the ethanol extract and ascorbic acid (ns, $p = 0.1511$). Significance was set at $p < 0.05$.

Anti-inflammatory Activity

The carrageenan-induced paw oedema test in rats demonstrated no significant anti- inflammatory activity across all three doses of the extract (100, 200, and 400 mg/kg) as shown in **Figure 2**. Paw thickness increased in all groups after inflammation induction. Although the treatment groups showed a tendency toward reduced paw eodema compared with the untreated group, these differences were not statistically significant, $p > 0.05$. Data are expressed as mean ± SEM (n = 5 rats per group).

Antidepressant Activity

There was a dose-dependent reduction in immobility time in the tail suspension test. The rats exhibited distinct behavioural patterns throughout the six-min test period. Treated groups showed reduced immobility compared to

Table 3. Total Flavonoid Content (TFC) analysis of ethanol and methanol extracts.

Extract	Absorbance (Mean ± SEM)	TFC (Mean ± SEM, mg QE/g of extract)
Ethanol	0.209 ± 0.001	0.27373 ± 1.31
Methanol	0.203 ± 0.001	0.26587 ± 1.31

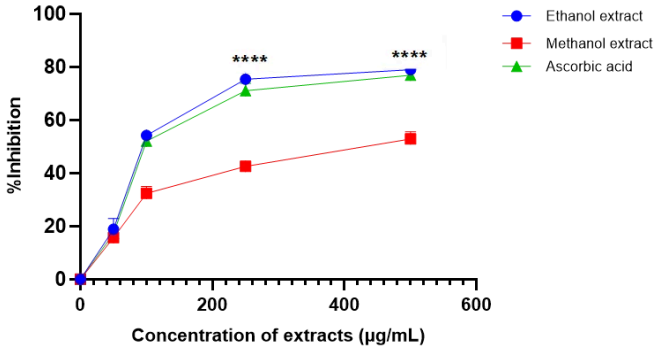


Figure 1. Percentage inhibition of DPPH radicals by ethanol and methanol plant extracts of *F. ancylantha* at varying concentrations, indicating their antioxidant activity.

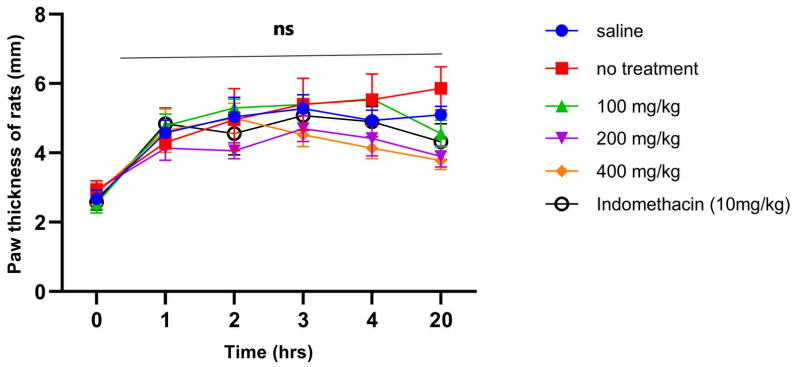


Figure 2. Effect of plant extracts on carrageenan-induced paw oedema in rats. Changes in paw thickness (mm) were measured at 0, 1, 2, 3, 4, and 20 hours following subplantar injection of 0.1 mL of 1% carrageenan solution into the right hind paw.

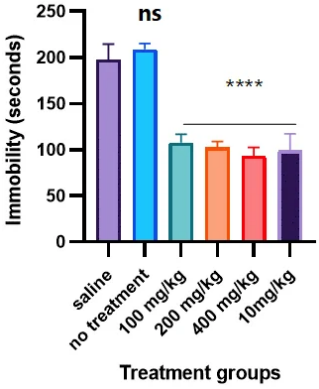


Figure 3. Effect of different treatments on immobility time in the tail suspension test.

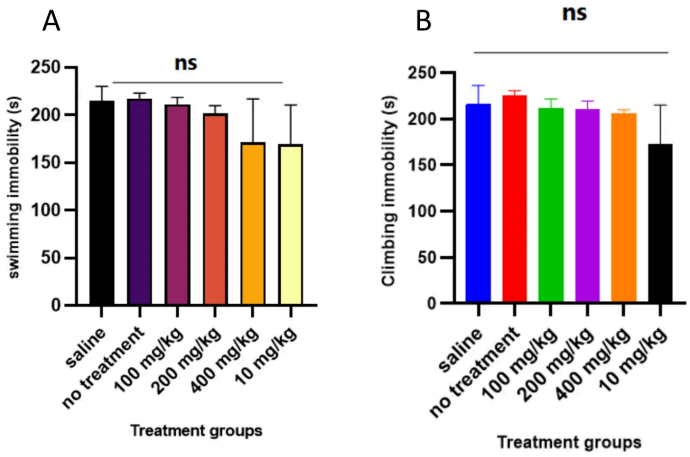


Figure 4. Effect of different treatments on (A) immobility time and (B) climbing time during the Forced Swim Test (FST).

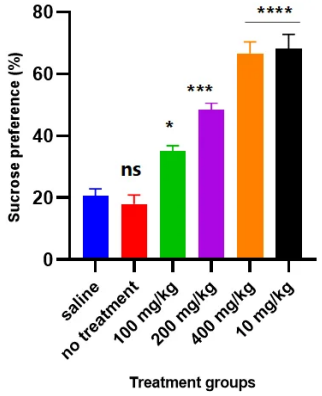


Figure 5. Effect of different treatments on sucrose preference in the Sucrose Preference Test (SPT).

the controls. Data are presented as mean ± SEM (n = 3 rats/group). Statistical analysis was performed using one-way ANOVA followed by Tukey's multiple comparisons test. ****p < 0.0001 compared with the control group.

Tail Suspension Test

In the tail suspension test (TST), no significant difference (ns) in immobility duration was observed between the saline group (~196 s) and the no-treatment group (~208 s) (**Figure 3**). Conversely, treatment doses of 100 mg/kg (~106 s), 200 mg/kg (~102 s), and 400 mg/kg (~93 s), as well as the 10 mg/kg group (~95 s), significantly reduced immobility time compared to the vehicle/control groups (****, p < 0.0001).

Forced Swim Test

Swimming immobility and climbing immobility time was comparable across all treatment groups. Although at 400 mg/kg treatment and the standard drug groups showed a tendency toward reduced immobility compared with the saline and untreated groups, these differences were not statistically significant (p > 0.05). Overall, no significant effect of treatment on swimming immobility and climbing immobility was observed as shown in **Figures 4A** and **4B**, Data represent mean ± SEM for n = 3 rats per group.

Sucrose Preference Test

The sucrose preference test (SPT) results demonstrated a clear dose-dependent increase in sucrose preference across therapeutic doses, **Figure 5**. Data are presented as mean ± SEM. Statistical analysis was performed using one-way ANOVA followed by Tukey's multiple comparisons test. No significant difference was observed between the saline and no-treatment groups (ns, p = 0.9427). Compared with the saline group, sucrose preference was significantly increased in the 100 mg/kg (*, p = 0.0213), 200 mg/kg (***, p = 0.0007), 400 mg/kg (****, p < 0.0001), and 10 mg/kg (****, p < 0.0001) treatment groups.

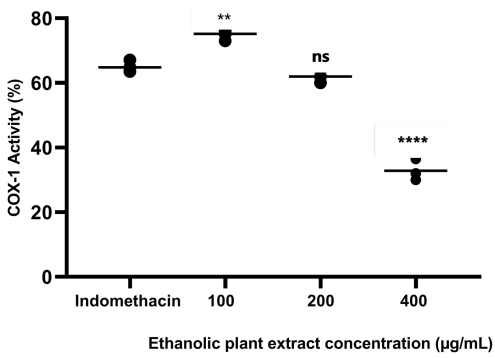


Figure 6. Effect of the ethanolic plant extract on cyclooxygenase-1 (COX-1) activity.

Cyclooxygenase Activity Assay

Figure 6, shows the % of COX-1 activity remaining after exposure to different doses of the plant extract (100, 200, and 400) µg/mL. The results indicate a dose-dependent reduction in COX-1 activity as the concentration of the extract increased. Indomethacin (100 µg/mL) served as the positive control. Data are presented as mean ± SEM (n = 3). Statistical analysis was performed using one-way ANOVA followed by Tukey's multiple comparisons test. No significant difference was observed between the indomethacin and 200 µg/mL extract groups (ns, $p = 0.4210$). Compared with the indomethacin group, the 100 µg/mL (**, $p = 0.0041$) and 400 µg/mL (****, $p < 0.0001$) extract groups exhibited significantly higher COX-1 activity.

Discussion

The qualitative screening demonstrated a comprehensive phytochemical composition with notable similarities between ethanol and methanol extracts. Both solvents effectively extracted saponins and tannins, while flavonoids and phenolic showed moderate presence. The absence of alkaloids and glycosides suggests a relatively safe phytochemical profile for therapeutic applications as these phytochemicals may result liver damage and neurotoxicity. Ethanol and methanol are both polar solvents effective at extracting phenolic and flavonoid compounds, with methanol often showing higher extraction efficiency for phenolic due to its polarity, while ethanol is favoured for its lower toxicity and broader solubility range (6, 7). Using a 1: 5 ratio of plant material to solvent is common and supports higher extract yields by increasing solvent contact with plant tissues. This method is simple, cost- effective, and suitable for extracting a wide range of phytochemicals, including phenolics, flavonoids, alkaloids, and terpenoids, which can be further anaylsed qualitatively and quantitatively (8, 14).

The phytochemical profile suggests promising potential for developing an antidepressant formulation, particularly for postpartum depression. Flavonoids are known for neuroprotective effects and mood regulation. Phenolic compounds have been reported to demonstrate antioxidant properties beneficial for neurological health and saponins can modulate neurotransmitter activity (6, 7). The graph showed the % inhibition of the ethanol and methanol extracts at different concentrations (µg/mL) and compared their antioxidant activity with the previously obtained standard curve of ascorbic acid. In both extracts, the % inhibition increased as the concentration of the extracts increased, indicating a concentration-dependent antioxidant activity.

At lower concentrations (around 50 µg/mL), the ethanol extract showed approximately 20% inhibition, while the methanol extract presented slightly lower activity at about 15%. As the concentration increased to 100 µg/mL, the ethanol extract exhibited a sharp increase in inhibition to about 55%, whereas the methanol extract reached around 30%. At higher concentrations (250 µg/mL and 500 µg/mL), the ethanol extract continued to demonstrate stronger activity, with approximately 72% and 80% inhibition respectively. In comparison, the methanol extract exhibited moderate activity, increasing gradually to about 42% at 250 µg/mL and about 55% at 500 µg/mL.

When these results are compared with the previously established standard curve of ascorbic acid, it is evident that the antioxidant activity of the plant extracts is lower than that of the standard. The ascorbic acid standard achieved about 80% inhibition at 500 µg/mL and approximately 50% inhibition at around 100 µg/mL, indicating a stronger radical scavenging ability. Between the two extracts, the ethanol extract shows activity that more closely approaches the standard curve, suggesting that ethanol may be more effective in extracting antioxidant compounds from the sample than methanol (15).

Overall, the results suggest that both extracts possess antioxidant properties, but the ethanolic extract demonstrated a higher free radical scavenging activity compared to the methanolic extract. This difference may be attributed to the varying polarity of the solvents, which affects the types and amounts of antioxidant compounds extracted. The findings support the conclusion that ethanol extraction may yield a higher concentration of bioactive compounds responsible for antioxidant activity (16).

In the present study anti-inflammatory and antidepressant effects of *F. ancylantha* ethanol leaf extract was studied. The leaf extract of this plant showed that it has both anti-inflammatory and antidepressant activity. Carrageenan-induced rat paw oedema model is a suitable test for evaluating anti-inflammatory drugs. Carrageenan is a strong chemical used for the release of inflammatory and pro-inflammatory mediators such as prostaglandins,

leukotrienes, histamine, bradykinin, and alpha-TNF. The course of acute inflammation is biphasic. The first phase starts with the release of histamine, serotonin, and kinins after the onset of inflammation, while the second phase is related to the release of prostaglandin-like substances in 2-3 h. Prostaglandins are the main culprit responsible for acute inflammation (12, 17, 18).

Although the ethanolic extract appeared to reduce paw thickness over the experimental period, these reductions were not statistically significant compared with the saline control ($p > 0.05$). Similarly, no significant differences were observed between the extract-treated groups and the indomethacin-treated group. These findings suggest that, under the given experimental conditions, the ethanolic extract did not demonstrate significant anti-inflammatory activity in the carrageenan-induced paw oedema model. The lack of statistical significance may be attributed to factors such as the dose range tested, sample size, variability in the inflammatory response, or insufficient concentrations of bioactive constituents. Nevertheless, the slight reduction in paw thickness observed in some treatment groups may indicate a biological effect that warrants further investigation using higher doses and larger sample sizes (1, 18).

The inhibition of cyclooxygenase is more effective in reducing carrageenan-induced inflammation than lipoxygenase inhibitors. Therefore, the extract might have inhibited the cyclooxygenase enzyme involved in the synthesis of prostaglandins. The oral administration of the plant extract significantly downregulated the pro-inflammatory cytokines while it upregulated the anti-inflammatory cytokines (12, 17).

The behavioural test results demonstrated significant antidepressant-like activity across multiple paradigms. In the tail suspension test (TST), rats showed a marked reduction in immobility time, with active behaviours including escape-oriented movements. The forced swim test did not demonstrate significant antidepressant-like effects, although a non-significant trend toward decreased immobility and increased active behaviours was observed. The sucrose preference test (SPT) provided complementary evidence of antidepressant activity, showing increased sucrose preference percentages across treatment groups. As reported by (18, 19), the mechanisms by which the plant extracts exert these anti-depressant effects are not yet fully understood. However, some studies have reported that the extract might enhance the norepinephrine neurotransmission, which promotes locomotor activity. These consistent findings across behavioural paradigms strongly support the antidepressant potential of the plant extract, with results showing statistical significance ($p < 0.05$, $p < 0.0001$) compared to control groups. The dose-dependent nature of these effects, with clear dose-response relationships observed in all three tests, further validates the therapeutic efficacy of the treatment.

The graph illustrates the % of COX-1 activity remaining after exposure to different doses of the plant extract. The results indicated a dose-dependent reduction in COX-1 activity as the concentration of the extract increased. At a dose of 100 µg/mL, COX-1 activity remained relatively high at approximately 75%, suggesting minimal inhibition of the enzyme at this lower concentration. When the dose increases to 200 µg/mL, the remaining COX-1 activity decreases to about 62%, indicating moderate inhibition. A further increase in the dose to 400 µg/mL results in a substantial decrease in enzyme activity to approximately 32-35%, demonstrating a strong inhibitory effect of the plant extract at higher concentrations.

The decreasing trend in COX-1 activity with increasing extract concentration suggests that the plant extract possesses compounds capable of inhibiting the COX-1 enzyme. Cyclooxygenase-1 (COX-1) plays a key role in the synthesis of prostaglandins, which are involved in inflammatory responses (3, 19). Therefore, inhibition of COX-1 activity may indicate potential anti-inflammatory properties of the plant extract.

The ethanol plant extract was able to inhibit the activity of cyclooxygenase in a dose- dependent pattern. The inhibitory activity of the plant extract increased progressively with concentration, indicating that higher doses of the extract are more effective in suppressing enzyme activity. The observed trend suggests that the plant extract contains bioactive compounds capable of inhibiting COX-1, which may indicate potential anti-inflammatory properties.

Conclusion

The findings of the present study suggest that the ethanolic extract possesses promising pharmacological properties that may support its therapeutic potential in depression. The compound demonstrated significant antioxidant activity (DPPH, $p < 0.0001$) and significant cyclooxygenase (COX) inhibitory activity ($p < 0.05$), indicating antioxidant and anti-inflammatory mechanisms that are implicated in the pathophysiology of depression. Furthermore, a significant improvement in sucrose preference ($p < 0.05$) suggests an attenuation of anhedonia, a core symptom of depression. The tail suspension test showed a significant reduction in immobility time ($p < 0.0001$), further supporting a potential antidepressant-like effect. However, the forced swim test (swimming and climbing immobility) and carrageenan-induced paw oedema test did not show statistically significant differences ($p > 0.05$), although trends toward improvement were observed. Collectively, these findings indicate that the extract exhibits partial antidepressant-like activity, which may be mediated through its antioxidant and COX inhibitory properties. Nevertheless, additional studies involving larger sample sizes, chronic treatment paradigms, mechanistic investigations, and complementary behavioral assessments are required to confirm its antidepressant efficacy and elucidate its mechanism of action.

Abbreviations

COX-1 = Cyclooxygenase -1; SPT = Sucrose Preference Test; TST = Tail Suspension Test; FST = Forced Swim Test.

Declaration

Author Information

Gillian Gumindoga, Department of Biotechnology and Biochemistry, Faculty of Science, University of Zimbabwe, Harare, +263, Zimbabwe. **Contribution:** Investigation,

Writing – Original Draft .

Farisai Chidzwondo, Department of Biotechnology and Biochemistry, Faculty of Science, University of Zimbabwe, Harare, +263, Zimbabwe. **Contribution:** Validation, Supervision.

Rumbidzai Mangoyi *(*Corresponding author)*, Department of Biotechnology and Biochemistry, Faculty of Science, University of Zimbabwe, Harare, +263, Zimbabwe. **Contribution:** Project Administration, Supervision, Validation.

Acknowledgment
We would like to thank the Department of Biotechnology and Biochemistry at the University of Zimbabwe for providing equipment used during the study. The authors would also like to acknowledge the use of artificial intelligence tools in the preparation of this work. AI assistance was utilized during the writing and studying processes for brainstorm ideas, structuring arguments, refining prose and grammar, and summarizing relevant literature. All final concepts, interpretations, and conclusions remain the authors, and the authors take full responsibility for the accuracy and integrity of the presented work.

Conflict of Interest
The authors declare no conflict of interest.

Data Availability
All data generated or analyzed during this study are included in this published article and its supplementary information files.

Ethics Statement
Not applicable.

Funding Information
This work received no external funding.

References
1. Bahta T, Karim A, Periasamy G, Gebremedhin G, Bitew H, Hagazi K. Analgesic, anti-inflammatory and *in-vitro* hyaluronidase inhibitory properties of the leaf extract and solvent fractions of *Otostegia fruticosa* (Forssk.) Schweinf. ex Penzig. Iranian Journal of Pharmaceutical Research: IJPR. 2020;19(1):218-230. doi: 10.22037/ijpr.2019.14657.12569.

2. Yang Y, Wang X, Kong Y, Pan Y, Yang X, Zhang Z, Li Z. Modulating M1/M2 macrophage polarization with plant metabolites: a therapeutic strategy for rheumatoid arthritis. Frontiers in Pharmacology. 2025;16:1651763. https://doi.org/10.3389/fphar.2025.1651763

3. Jachak SM, Gautam R, Selvam C, Madhan H, Srivastava A, Khan T. Anti-inflammatory, cyclooxygenase inhibitory and antioxidant activities of standardized extracts of *Tridax procumbens* L. Fitoterapia. 2011;82(2):173-7. https://doi.org/10.1016/j.fitote.2010.08.016

4. Prior RL, Wu X, Schaich K. Standardized methods for the determination of antioxidant capacity and phenolics in foods and dietary supplements. J Agric Food Chem. 2005;53(10):4290-302.

5. Brand-Williams W, Cuvelier ME, Berset C. Use of a free radical method to evaluate antioxidant activity. LWT Food Sci Technol. 1995;28(1):25-30.

6. Sharma T, Pandey B, Shrestha BK, Koju GM, Thusa R, Karki N. Phytochemical screening of medicinal plants and study of the effect of phytoconstituents in seed germination. Tribhuvan Univ J. 2020;35(2):1-11. doi:10.3126/tuj.v35i2.36183.

7. Shaikh JR, Patil MK. Qualitative tests for preliminary phytochemical screening: an overview. Int J Chem Stud. 2020;8(2):603-8. doi:10.22271/chemi.2020.v8.i2i.8834.

8. Bandiola TM. Extraction and qualitative phytochemical screening of medicinal plants: a brief summary. International journal of pharmacy. 2018;8(1):137-43.

9. Ainsworth EA, Gillespie KM. Estimation of total phenolic content and other oxidation substrates in plant tissues using Folin–Ciocalteu reagent. Nature protocols. 2007;2(4):875-7. https://doi.org/10.1038/nprot.2007.102

10. Shaikh JR, Patil M. Qualitative tests for preliminary phytochemical screening: An overview. Int J Chem Stud. 2020;8(2):603–8. doi:10.22271/chemi.2020.v8.i2i.8834.

11. Moriasi G, Ireri A, Ngugi MP. *In vitro* antioxidant activities of the aqueous and methanolic stem bark extracts of *Piliostigma thonningii* (Schum.). Journal of evidence-based integrative medicine. 2020;25:2515690X20937988. https://doi.org/10.1177/2515690X2093798812.

12. Oyekunle OA, Okojie AK, Udoh US. Analgesic and anti-Inflammatory effects of an extract of *Fadogia agrestis* in rats. Neurophysiology. 2010;42(2):124-9. https://doi.org/10.1007/s11062-010-9140-x

13. Junchao Y, Zhen W, Yuan W, Liying X, Libin J, Yuanhong Z, Wei Z, Ruilin C, Lu Z. Anti-trachea inflammatory effects of diosgenin from *Dioscorea nipponica* through interactions with glucocorticoid receptor α. Journal of International Medical Research. 2017;45(1):101-13. https://doi.org/10.1177/030006051667672414.

14. Sharma T, Pandey B, Shrestha BK, Koju GM, Thusa R, Karki N. Phytochemical screening of medicinal plants and study of the effect of phytoconstituents in seed germination. Tribhuvan Univ J. 2020;35(2):1-11. doi:10.3126/tuj.v35i2.36183.

15. Azwanida NN. A review on the extraction methods use in medicinal plants, principle, strength and limitation. Med aromat plants. 2015;4(196):2167-0412. doi:10.4172/2167-0412.1000196

16. Wu Y, Liu Y, Jia Y, Feng CH, Zhang H, Ren F, Zhao G. Effects of thermal processing on natural antioxidants in

fruits and vegetables. Food Research International. 2024;192:114797. doi:10.1016/j.foodres.2024.114797.

17. Apak R, Ozyurek M, Guclu K, Çapanoğlu E. Antioxidant activity/capacity measurement. 1. Classification, physicochemical principles, mechanisms, and electron transfer (ET)-based assays. Journal of agricultural and food chemistry. 2016;64(5):997-1027. https://doi.org/10.1021/acs.jafc.5b04739.

18. Azarbaijani M, Kian M, Soraya H. Anti-inflammatory effects of memantine in carrageenan-induced paw edema model in rats. Journal of Reports in Pharmaceutical Sciences. 2021;10(1):60-5. DOI: 10.4103/jrptps.JRPTPS_37_20.

19. Potdar VH, Kibile SJ. Evaluation of antidepressant-like effect of Citrus maxima leaves in animal models of depression. Iranian journal of basic medical sciences. 2011;14(5):478. PMID: 23492865; PMCID: PMC3586848.

Additional Information

How to Cite

APA 7th Edition: Gumindoga, G., Chidzwondo, F. & Mangoyi, R. (2026). Evaluation of the Anti-Inflammatory, Antidepressant and Antioxidant Activity of Schweinf. ex Hiern Fadogia ancylantha Plant Leaf Extracts. Sciences of Phytochemistry, 5(2), 298-307. https://doi.org/10.58920/sciphy0502720

Vancouver: Gumindoga G, Chidzwondo F, Mangoyi R. Evaluation of the Anti-Inflammatory, Antidepressant and Antioxidant Activity of Schweinf. ex Hiern Fadogia ancylantha Plant Leaf Extracts. Sciences of Phytochemistry. 2026;5(2):298-307. https://doi.org/10.58920/sciphy0502720

Harvard: Gumindoga, G., Chidzwondo, F. & Mangoyi, R. (2026) 'Evaluation of the Anti-Inflammatory, Antidepressant and Antioxidant Activity of Schweinf. ex Hiern Fadogia ancylantha Plant Leaf Extracts', Sciences of Phytochemistry, 5(2), pp. 298-307. doi: 10.58920/sciphy0502720

Publisher Note

All claims expressed in this article are solely those of the authors and do not necessarily reflect the views of the publisher, the editors, or the reviewers. Any product that may be evaluated in this article, or claim made by its manufacturer, is not guaranteed or endorsed by the publisher. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Open Access

This article is licensed under a Creative Commons Attribution 4.0 International License. You may share and adapt the material with proper credit to the original author(s) and source, include a link to the license, and indicate if changes were made.