



Protective effects of an ethanolic leaf extract from *Ficus capensis* against phenylhydrazine induced anaemia in Wistar rats

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ABSTRACT

Introduction: *Ficus capensis* has been used in traditional medicine to treat anaemia, tuberculosis, convulsion, pains, wounds, respiratory disorders, and other health challenges. This study investigated the effect of *F. capensis* ethanolic leaf extract in phenylhydrazine (PHZ)-induced anaemia in Wistar rats.

Methods: Induction of anaemia was done by intraperitoneal administration of PHZ (40 mg/kg for 48 hours). A normal group and an anaemic group were treated daily with a single dose of 20 mL/kg of distilled water and considered as control and anaemic (non-treated) groups. Then, the remaining groups were treated with 100, 200, and 400 mg/kg of ethanol extract of *F. capensis* leaves for 21 days, respectively. Blood samples from the rats were run in three batches of baseline, post anaemia induction, and post-treatment. Phytochemical screening and acute toxicity tests of the extract were also carried out following standard procedures.

Results: The results showed a consistent significant increase in haematological parameters among various experimental groups. Haemoglobin (Hb), red blood cell (RBC) count, mean corpuscular volume (MCV), packed cell volume (PCV), mean cell haemoglobin (MCH) and Mean cell haemoglobin concentration (MCHC) values of treated rats were significantly increased compared to the anaemic control. The secondary metabolites of leaf extract were alkaloids, saponins, tannins, steroids, flavonoids, phenols, and reducing sugar, while the acute toxicity test was found to be non-toxic at 5000 mg/kg in rats.

Conclusion: The ethanolic leaf extract of *F. capensis* might provide an alternative cure for anaemia and boosts blood count.

Implication for health policy/practice/research/medical education:

Ficus capensis ethanol leaf extract significantly demonstrated high antianaemic activities. Hence, the compounds present in this plant might be considered for characterization and isolation for the possible development of new drugs against anaemic disorders.

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Introduction

Anaemia is a common haematological disorder that affects all ages; however, those at risk are the elderly, women of childbearing age, and infants. This condition occurs as a result of a decrease in the oxygen-carrying capacity of the blood due to the reduced number of circulating red blood

cells (RBCs) and haemoglobin (Hb) components of the RBCs (1). Though not a disease, it is a reflection of the functional, structural, and numerical abnormality of RBCs (2). Anaemia is often associated with dietary deficiencies of vitamin B12, folate, and iron, as well as diseases related to organs of erythropoietic importance like liver and renal

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diseases (3,4). Other diseases associated with anaemia such as cancers, an overactive spleen/hypersplenism with increased RBC destruction, bleeding from tracts and organs, genetic diseases caused by sickle cell disease, thalassemia, red cell membrane and enzyme abnormalities as seen in glucose-6-phosphate dehydrogenase (G6PD) deficiencies (5). Anaemia is more prevalent in developing countries because of poor nutrition habits, infections, and diseases that may cause widespread health problems (6). Anaemia, being one of the world's most widespread health problems, has brought serious economic consequences and obstacles to national development by affecting more than 30% of the world population, especially pregnant women and children (7,8). Anaemia negatively affects normal development in children, and this constitutes a major health challenge in developing countries (9). The severity of anaemia depends on nutritional factors, overall health status, and speed of onset (1).

A good number of medicinal plants are traditionally employed to treat different diseases. These herbal remedies are currently being considered as alternative to synthetic products, leading to an increase in their demand as natural medicine (10).

Phenylhydrazine (PHZ) is an agent, which can cause hemolysis of the red cell by the formation of aryl and hydroxyl radicals when it interacts with erythrocytes (7). Exposure to chemicals and drugs has been associated with the destruction of RBCs (11). PHZ, also called hydrazinobenzene, is a potent chemical that inflicts toxicity on different cells at various levels. Its administration results in haematotoxicity, which leads to the lysis of RBCs (12). PHZ-induced anaemia is one of the experimental models for the study of the haematonic effects of drugs (13,14).

Ficus capensis Thunb, which belongs to the family Moraceae, is commonly found in Cape Verde, Senegal, Cameroon, and the Central African Republic. The plant is a deciduous tree with spreading roots, branches, and broad green leaves. It usually grows from 5 to 12 meters and produces fleshy fruits all year round, and the fruits are edible to humans as well as animals. The plant is commonly used in traditional medicine throughout its area of distribution. *Ficus capensis* is locally called Uwaryara (Hausa), Akokoro (Igbo), Ooto (Yoruba), Obada (Edo), and Rima bichehi (Fulani). In Nigeria, this plant is widely used to prepare traditional medicine that has an anti-bacterial (15), anti-sickling (16), anti-abortifacient (17), immune-stimulatory (18), and anti-diarrhoea (19) activities. The leaves of *F. capensis* have been used as an antioxidant and pro-fertility to treat azoospermia (20, 21). The leaf of *F. capensis* is also used in traditional medicine for the treatment of anaemia.

The present study, therefore, seeks to evaluate the anti-anaemic potential of *Ficus capensis* leaves on PHZ-induced anaemia and to determine the effect of the extract on the blood cell morphology of drug-induced anaemia in Wistar rats.

Materials and Methods

Chemicals, kits, and drugs

Ethanol, PHZ (Sigma Chemicals, Germany), cell pack, cell sheath, stromatolyser, and cell clean (Mindray chemical, India), Leishman stain (Spectrum chemicals, USA), and Immersion oil (Morrison Chemicals, Nigeria) were prepared and used.

Plant material

Fresh leaves of *Ficus capensis* were collected on 18th June 2018 from local farmland in Abakaliki town, Ebonyi State, Nigeria, identified and authenticated by a taxonomist at the Botany unit of the Department of Applied Biology, Faculty of Biological Sciences, Ebonyi State University, Abakaliki. A voucher specimen (number EBSU-H-009) was prepared and deposited in the herbarium of the department for reference. The international plant number index (IPNI) is *Ficus capensis* Thunb., Ficus 13. (1786).

Preparation of leaf extract

The leaves were washed thoroughly to remove contaminants from the farmland. They were dried in an airy shade away from direct sunlight to avoid damage to the bioactive constituents. Upon drying, the leaves were ground to powder using a laboratory grinding mill. Six hundred and forty grams (640 g) of the crude powder was macerated in 2 L of ethanol. The mixture was placed on a mechanical shaker for 24 hours, after which it was sieved into a clean glass tube using filter paper. The filtrate was dried on a water bath at a reduced temperature of 45°C to recover the extract. The yield was 9.84% w/w semi-solid light green powder. The dried extract was stored in airtight sterile containers in a refrigerator until the experimental period (22).

Phytochemical screening

The qualitative and quantitative phytochemical screening of *F. capensis* leaf ethanol extract was done for different secondary metabolites, including alkaloids (Mayer's and Dragendorff reagent test), tannins (Ferric chloride test), steroids (Liebermann-Burchard test), saponins (Froth test), terpenoids (Salkowski test), glycosides (Keller-Kiliani test), flavonoids (Ammonia and sulphuric acid test), reducing sugars (Fehling's test), anthraquinones (Borntrager's test), and phenolic compounds (Ferric chloride test) (23,24).

Acute toxicity

Acute toxicity was evaluated using a previously described method (25). This study was conducted in two phases using 12 Wistar rats of both sexes weighing 180-220 g. In the first phase, 3 groups of 3 rats in each cage were administered 100, 600, and 1000 mg/kg of the ethanol leaf extract orally. Rats were observed for signs of toxicity such as hyperactivity, salivation, paw-licking, writhing hyperactivity, muscle paralysis, respiratory distress, and

mortality within 24 hours with particular attention during the first 4 hours of the experiment. The second phase was followed in similar conditions by the administration of 2000, 3000, and 5000 mg/kg to the next 3 groups of one rat in each cage to detect the signs and symptoms of toxicity and mortality during 24 and 72 hours, respectively.

Experimental animals

A total of 30 Wistar rats weighing 180-220 g of both sexes were sourced from the animal house of Anatomy Department, Ebonyi State University, Abakaliki were used for the experiment. The animals were kept at the animal house of the Department of Pharmacology, Ebonyi State University, Abakaliki. The rats were housed in cages at room temperature of 25-28°C and moisture control under a naturally illuminated environment of 12:12 hours dark/light cycle. They were fed on standard feed and water *ad libitum*. The study protocol was carried out as per the rules of the National Institute of Health Guide for the care and use of Laboratory Animals (26).

Induction of anaemia in Wistar rats

Induction of anaemia was done by intraperitoneal administration of PHZ (Sigma Chemical Co., St. Louis MO, USA) in distilled water (40 mg/kg for 48 hours) (27). All the animals were weighed and divided into six groups, each group containing five animals in a cage.

Sample collection

The samples were collected in three batches. The first batch was the baseline assessment of the complete blood count after two weeks of acclimatization, the second batch was collected after the induction of anaemia and lastly, and the third batch was after twenty-one days (3 weeks) of treatment with the leaf extract. Three milliliters of blood sample was collected by ocular puncture using capillary tubes and was dispensed directly into a commercially prepared Ethylene Ethylenediaminetetraacetic acid (EDTA) container. The samples were analyzed using a haematology autoanalyzer (Mindray B12 right med biosystem, India).

Experimental design

Following the confirmation of anaemia, the animals were randomly distributed into six groups with 5 rats ($n = 5$) in each cage. Group 1: normal control (without treatment) administered 20 mL/kg distilled water, Group 2: anaemic control (without treatment), but also received 20 mL/kg distilled water, Group 3: anaemic rats treated with 100 mg/kg of the leaf extract (*F. capensis*), Group 4: anaemic rats treated with 200 mg/kg of the extract, Group 5: anaemic rats treated with 400 mg/kg of the leaf extract, Group 6: non-anaemic rats treated with 400 mg/kg of the leaf extract. The rats were orally treated by gastric intubation daily for 21 days (28).

Determination of haematological parameters

At the end of 3 weeks of treatment, blood samples were collected in EDTA and analyzed using a haematology autoanalyzer (Mindray B12 right med biosystem, India). The haematological parameters, including packed cell volume (PCV), Hb, RBC, mean corpuscular haemoglobin (MCH), mean corpuscular volume (MCV), mean corpuscular haemoglobin concentration (MCHC), white blood cells (WBCs), platelet count (PLC), differential count (lymphocytes, neutrophil, monocytes, basophil, and eosinophil) were determined. Thin blood films were also smeared and used for RBC morphology studies.

Statistical analysis

Results were expressed as means \pm SEM and analyzed by one-way analysis of variance (ANOVA) followed by Dunnett's multiple comparison test, using the Statistical Package for Social Sciences (SPSS version 20). A difference in the mean was considered statistically significant at $P < 0.05$.

Results

Phytochemical tests

The qualitative and quantitative phytochemical screening of the ethanol leaf extract of *F. capensis* revealed the presence of alkaloids (8.13%), saponins (28.09%), tannins (4.50%), steroids (2.09%), flavonoids (20.47%), phenol (9.77 mg), while terpenoids and glycosides were absent.

Acute toxicity studies

There was no mortality after the oral administration of the ethanol leaf extract of *F. capensis* up to 5000 mg/kg. The LD_{50} may be greater than 5000 mg/kg in rats.

Pharmacological response

Table 1 shows the level of haematological parameters in the experimental rats before induction of anaemia with PHZ. There was a significant ($P < 0.05$) decrease in the levels of RBCs, Hb, PCV, MCV, MCH, and MCHC following the induction of anaemia with PHZ for 48 hours (Table 2). The levels of WBCs, neutrophils, monocytes, lymphocytes, eosinophils, basophils, and platelets were also significantly increased in Wistar rats (Table 3).

The levels of RBCs, Hb, PCV, MCV, MCH, and MCHC significantly increased after 21 days of administration of *F. capensis* ethanolic leaf extract (Table 2). WBCs increased after the induction of anaemia and decreased significantly after treatment, while the platelet level increased (Table 3).

Discussion

Herbal medicine has remained an alternative treatment to available synthetic drugs for the treatment of diseases possibly due to low cost, availability, and comparatively fewer adverse effects, and thus has been perceived its effectiveness in developing countries (29). Research has shown that *F. capensis* has a variety of pharmacological

Table 1. Baseline haematological profile (red cells and their differentials, white blood cells and its differentials and platelets) before induction of anaemia in Wistar rats

Parameters	Normal control	Anaemic control	100 mg/kg <i>F. capensis</i>	200 mg/kg <i>F. capensis</i>	400 mg/kg <i>F. capensis</i>	Non-anaemic (400 mg/kg) control
Hb (g/dL)	15.20 ± 1.10	13.90 ± 2.60	15.60 ± 0.50	15.40 ± 0.90	15.50 ± 0.60	13.40 ± 1.10
RBC (×10 ¹² /L)	8.94 ± 0.35	8.24 ± 1.71	8.8 ± 0.54	9.07 ± 0.29	8.97 ± 0.40	8.00 ± 0.36
PCV (%)	44.90 ± 3.00	41.70 ± 6.50	44.20 ± 3.10	44.90 ± 4.30	45.90 ± 1.70	39.10 ± 3.10
MCV (fl)	51.40 ± 2.20	50.20 ± 2.90	51.20 ± 1.80	51.30 ± 1.80	51.60 ± 2.30	49.10 ± 4.30
MCH (pg)	17.60 ± 0.50	17.50 ± 1.34	18.00 ± 0.40	18.00 ± 0.80	17.80 ± 0.40	16.80 ± 1.10
MCHC (g/dL)	34.20 ± 1.26	36.50 ± 4.60	35.30 ± 1.40	34.10 ± 0.90	34.40 ± 0.50	34.20 ± 0.50
WBC (×10 ⁹ /L)	13.60 ± 1.60	14.90 ± 1.50	13.90 ± 1.00	15.10 ± 1.50	13.40 ± 1.00	14.10 ± 1.50
Lymphocyte (%)	64.23 ± 2.10	60.60 ± 2.49	65.49 ± 3.20	64.40 ± 2.35	62.30 ± 3.10	70.39 ± 3.40
Monocyte (%)	17 ± 4.30	14.22 ± 1.33	15.79 ± 0.48	16.48 ± 0.12	16.54 ± 0.52	17.22 ± 0.58
Granulocyte (%)	29.46 ± 3.27	31.19 ± 2.55	30.54 ± 2.50	29.64 ± 1.17	31.28 ± 3.80	23.69 ± 2.45
Platelet (×10 ⁹ /L)	900.20 ± 3.42	935.60 ± 8.62	1033.57 ± 6.77	876.40 ± 51.89	907.20 ± 71.53	871.60 ± 35.95

Values are expressed as mean ± SD (n=5).

Hb, Haemoglobin; RBC, Red blood cells; PCV, packed cell volume; MCV, Mean cell volume; MCH, Mean cell haemoglobin; MCHC, Mean cell haemoglobin concentration; WBC, White blood cell.

Table 2. The effect of phenylhydrazine induced anaemia and 21 days of treatment with ethanol extract of *Ficus capensis* leaves on haematological profile (red cells and their differentials) in Wistar rats

Parameters	Normal control	Anaemic control	100 mg/kg <i>F. capensis</i>	200 mg/kg <i>F. capensis</i>	400 mg/kg <i>F. capensis</i>	Non-anaemic (400 mg/kg) control
Hb (g/dL)	15.80 ± 0.50 14.90 ± 0.30	12.20 ± 4.30 ^a 12.20 ± 1.00 ^a	13.50 ± 2.80 ^a 16.30 ± 1.20 ^b	13.30 ± 0.60 ^a 16.90 ± 0.90 ^b	14.70 ± 0.50 ^a 17.00 ± 0.60 ^b	15.40 ± 1.10 ^b 17.90 ± 0.70 ^b
RBC (×10 ¹² /L)	8.97 ± 0.37 8.72 ± 0.42	4.73 ± 1.50 ^a 6.38 ± 0.20 ^a	5.32 ± 1.26 ^a 8.20 ± 0.26 ^b	5.53 ± 1.10 ^a 8.59 ± 0.26 ^b	5.10 ± 0.42 ^a 8.85 ± 0.40 ^b	8.00 ± 0.36 ^b 9.17 ± 0.10 ^b
PCV (%)	46.00 ± 1.80 47.00 ± 2.10	23.20 ± 7.90 ^a 43.30 ± 3.10 ^b	26.40 ± 6.80 ^a 49.40 ± 1.50 ^b	28.4 ± 3.30 ^a 53.80 ± 1.30 ^b	22.70 ± 3.20 ^a 54.20 ± 2.40 ^b	45.00 ± 3.10 ^b 57.30 ± 1.90 ^b
MCV (fl)	51.40 ± 2.30 54.00 ± 0.70	42.70 ± 2.00 ^a 47.80 ± 1.80 ^a	44.50 ± 3.90 ^a 65.10 ± 2.50 ^b	46.20 ± 4.39 ^a 68.40 ± 2.50 ^b	46.80 ± 7.10 ^a 69.20 ± 3.10 ^b	50.68 ± 4.40 ^b 71.10 ± 1.80 ^b
MCH (pg)	27.60 ± 0.60 17.10 ± 0.50	20.40 ± 2.70 ^a 14.70 ± 0.30 ^a	22.60 ± 2.10 ^a 19.70 ± 0.60 ^b	23.10 ± 6.30 ^a 20.10 ± 0.60 ^b	23.90 ± 1.90 ^a 19.70 ± 0.50 ^b	28.40 ± 0.80 ^b 21.00 ± 1.00 ^b
MCHC (g/dL)	34.40 ± 0.50 31.70 ± 0.80	22.30 ± 4.60 ^a 24.40 ± 8.70 ^a	23.70 ± 4.80 ^a 30.30 ± 0.40 ^b	25.10 ± 5.10 ^a 31.40 ± 1.20 ^a	24.80 ± 9.10 ^a 31.20 ± 1.10 ^b	34.90 ± 0.80 ^b 32.60 ± 1.80 ^b

Values are expressed as mean ± SD (n=5). ^a *P* < 0.05 compared to the control group; ^b *P* < 0.01 compared to the control group.

functions and activities.

In this study, there was a significant reduction in the levels of haematological indices (Hb, RBC, PCV, MCV, MCH, and MCHC) after two days of induction of anaemia with 40 mg/kg of PHZ. This is in agreement with previous reports (30,31). However, treatment with different doses of *F. capensis* ethanol leaf extract elevated the values of these haematological parameters in anaemic rats within 21, thus demonstrating the positive haematinic effects of the leaf extract. These results are in agreement with previous studies by Njoku-Oji et al (32) and Umeokoli et al (16); though both authors did not induce anaemia with any agent, while anaemia was induced with PHZ in the present study. An essential correlation with diagnostic values has been reported for RBC, Hb, PCV, and red cell differentials (MCV, MCH, and MCHC) in humans

and rats (33). Thus, a decrease in these parameters indicates anaemia in both animals and humans (34). Oral administration of *F. capensis* suggested that the leaf extract could stimulate erythropoietic factors capable of influencing the synthesis of blood in the bone marrow. Erythropoietin is a maturation factor of RBC synthesis, which increases the number of erythropoietin-sensitive committed stem cells in the bone marrow that is converted to RBCs and subsequently mature erythrocytes (9). There was a significant increase in monocytes as compared to the normal control group. Lymphocytes and granulocytes showed no significant differences between the normal control group and the groups that were administered PHZ. The platelets showed no significant difference across the groups. This may probably be attributed to the short life span of platelets, which is 8 days, as they

Table 3. The effect of phenylhydrazine induced anaemia and 21 days of treatment with ethanol extract of *Ficus capensis* leaves on haematological profile (white blood cells and its differentials and platelet) in Wistar rats

Parameters	Normal control	Anaemic control	100 mg/kg <i>F. capensis</i>	200 mg/kg <i>F. capensis</i>	400 mg/kg <i>F. capensis</i>	Non-anaemic (400 mg/kg) control
WBC ($\times 10^9/L$)	13.40 \pm 1.40 16.60 \pm 3.10	33.90 \pm 15.00 ^a 15.60 \pm 1.60 ^a	33.40 \pm 5.60 ^a 15.40 \pm 1.10 ^b	28.80 \pm 10.70 ^a 15.40 \pm 1.60 ^b	30.80 \pm 3.4 ^a 15.10 \pm 1.60 ^b	13.40 \pm 1.60 ^a 15.20 \pm 1.70 ^a
Lymphocyte (%)	64.51 \pm 5.12 66.48 \pm 5.66	56.68 \pm 7.11 ^a 60.59 \pm 3.23 ^a	57.49 \pm 7.22 ^a 69.77 \pm 5.05 ^b	60.40 \pm 5.32 ^a 64.48 \pm 3.56 ^b	58.32 \pm 6.10 ^a 63.87 \pm 3.45 ^b	70.39 \pm 3.40 ^a 67.88 \pm 4.16 ^a
Monocyte (%)	8.40 \pm 3.22 17.20 \pm 0.20	14.30 \pm 2.19 ^a 15.22 \pm 0.33 ^b	13.45 \pm 2.67 ^a 19.45 \pm 0.30 ^b	12.57 \pm 3.22 ^a 20.48 \pm 0.32 ^b	13.67 \pm 3.65 ^a 22.54 \pm 0.10 ^b	7.70 \pm 1.13 ^a 21.22 \pm 0.20 ^b
Granulocyte (%)	29.50 \pm 4.30 27.52 \pm 3.13	21.54 \pm 6.30 ^a 20.35 \pm 2.34 ^a	23.65 \pm 6.23 ^a 26.44 \pm 1.55 ^b	22.87 \pm 8.11 ^a 28.29 \pm 2.33 ^b	23.68 \pm 3.59 ^a 31.69 \pm 2.90 ^b	28.83 \pm 3.44 ^a 27.73 \pm 2.66 ^a
Platelet ($\times 10^9/L$)	906.60 \pm 72.56 950.36 \pm 28.88	893.60 \pm 71.38 ^a 881.75 \pm 24.40 ^a	809.00 \pm 92.68 ^a 991.40 \pm 15.50 ^b	872.80 \pm 71.53 ^a 920.00 \pm 80.19 ^b	918.40 \pm 82.53 ^a 907.40 \pm 30.92 ^a	872.60 \pm 86.51 ^a 942.00 \pm 32.27 ^b

Values are expressed as mean \pm SD (n=5). ^a $P < 0.05$ compared to the control group; ^b $P < 0.01$ compared to the control group.

could easily replace the loss. Platelets are responsive cells essential for the maintenance of vascular integrity and participating in hemostasis, thrombosis, and host immune responses. However, with a lifespan of 8-10 days, they are continuously synthesized from the bone marrow megakaryocytes, which release platelets into the bloodstream to maintain their levels in the blood.

Red cell indices are markers used generally to determine the toxicity or safety of an agent and also used in evaluating the health status of animals (35). The increase in WBC count in rats treated with the leaf extract could be an indication of leukopoietic relevance and its possible immunomodulatory properties, which enhances the production of more WBCs (36). This process will improve the antibodies generating potential of the animals through phagocytosis, hence leading to high resistance to infection and diseases (37). More so, the leaf extract of *F. capensis* has also been reported to possess high erythropoietic and anti-sickling properties (16).

However, the anti-anaemic activities observed in this study might be connected with the bioactive constituents such as saponins, flavonoids, and other secondary metabolites present in the leaf. These phytoconstituents are known for their various protective and therapeutic effects (38). Saponins have been reported to improve haematopoiesis by promoting survival through focal adhesion kinase and extracellular signal-regulated kinase activation and modulating cytokine production in the bone marrow (39). The presence of saponin in the ethanol leaf extract of *F. capensis* could also play the same role in improving haematopoiesis and promoting the survival of blood cell lines. Some of the biological functions of flavonoids include protection against allergies and platelet aggregation microorganisms. Most importantly, the ethanol leaf extract did not produce any toxicity; hence the LD50 of the extract was greater than 5000 mg/kg in rats.

The blood morphology of treated Wistar rats showed

that the non-anaemic treated rats had 100% normocytic normochromic RBCs and 100% anisopoikilocytosis, whereas Heinz bodies were observed in other groups. Different sizes and shapes of RBCs showed evidence of haemolysis. Exposure of Wistar rats to PHZ has been associated with inclusion bodies on erythrocytes (40). WBCs were normal and adequate for the normal control and non-induced groups, whereas the other groups that were induced showed 20% leucopenia, moderate monocytosis, 80% moderate leukocytosis, and moderate monocytosis. Platelets showed normal and adequate cells for the normal control group and non-induced, while 20% thrombocytopenia, 80% normal and adequate cells for the induced groups.

The protective effect of the extract on haematological parameters increased with an increase in the dosage. The effect of the extract on RBCs, WBCs, and platelet parameters can be seen in table 3. At 100 mg/kg, the haemoglobin concentration was 16.30 ± 1.20 , and at 400 mg/kg body weight, the value was 17.90 ± 0.70 . These findings were similar to other parameters in this study, which suggests that the extract boosts haematological parameters in anaemic conditions.

Conclusion

The findings showed that ethanol leaf extract of *Ficus capensis* could cure anaemia to a significant level and also repair damages induced on blood cells by chemical toxicants. It is, therefore, appropriate as an effective and affordable agent to manage anaemic conditions, especially for many poor people in developing countries such as Nigeria. Further investigations are needed to understand the mechanism (s) involved in *F. capensis* anti-anaemic action.

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Authors' contributions

OEI conceived the research idea and GCA designed the work. OEI and GCA carried out the experiment, EFC wrote the first draft of the manuscript, MOE carried out the literature search, CEI carried out the statistical analysis, while NA supervised the study. All authors read and approved the final manuscript for publication.

Conflict of interests

The authors declare no conflict of interest.

Ethical considerations

The study protocol was carried out as per the rules and regulations of the Institutional Animal Ethical Committee (EBSU/REC/HST/19/03/004), Faculty of Health Science and Technology, Ebonyi State University, Abakaliki

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