Jatropha tanjorensis Euphorbiaceae Ethanolic Leaves Extract Reverses Phenylhydrazine Induced Haematological Alterations in Albino Wistar Rats

Abstract

Introduction

Phenylhydrazine has been used in many studies to evaluate its modulatory effects in various biochemical parameters in whole blood and red blood cell lysate. *Jatropha tanjorensis* Euphorbiaceae have high antioxidants properties; its leaves phytochemical analysis shows the presence of flavonoids, tanins, terpenoids, saponis. This study investigated the ameliorative effects of *Jatropha tanjorensis* Euphorbiaceae on phenylhydrazine induced haematological alterations in albino Wistar rats.

Materials and Methods

Wistar rats of both sexes (180-200g) were divided into 4 groups (n=5). Group 1 received rat chow; Group 2 received (200 mg/kg) of *J. tanjorensis* orally. Group 3 received phenylhydrazine only (10 mg/kg). Group 4 received phenylhydrazine (10 mg/kg) + *J. tanjorensis* (250 mg/kg). All animals were allowed free access to clean drinking water and normal rat chow ad libitum for 35 days. After which animals were sacrificed and blood samples collected for biochemical analysis.

Results

Results obtained showed that phenylhydrazine induced normochromic anemia with significant increase in white blood cell count, and neutrophil counts, eosinophils (insignificant) count with a

significant reduction in lymphocyte count. However, *J. tanjorensis* extract reversed the adverse haematological changes induced by phenylhydrazine.

Conclusion

In conclusion, *Jatropha tanjorensis* Euphorbiaceae demonstrated antioxidant, anti-inflammatory, and anti-thrombotic effects and reversed the haematological alterations brought upon by phenylhydrazine administration.

Keywords: anemia, anti-inflammatory, *Jatropha tanjorensis*, phenylhydrazine, Wistar rats

1. Introduction

"The incidence of anemia is a universal occurrence that cuts across populations of all ages throughout the world. It is a pathologic condition, which leads to decrease in red blood cell counts or a decrease in the hemoglobin level. Unarguably, further iron depletion affects the production of other protein containing Fe^{2+}, cytochromes, myoglobin, catalase and peroxidases" (Ogbe *et al* 2010; Crawley, 2004). "The incidence of this disorder is more prevalent in developing countries relative to the developed ones, due to poverty and lack of hygiene" (Ogbe *et al* 2010). This situation is aggravated by lack of good nutrition, parasitic gastrointestinal infections, malaria, haemoglobinopathies and sometimes in combination Crawley, 2004; De Benoist *et al* 2008). "Wistar albino rats (Rattus norvegicus) is one of the most commonly used animals in biomedical research. Over the years, rats have been used in many experimental

studies, which have added to our understanding of genetics, diseases, the effects of drugs, and other topics in health and medicine" (Laboratory rats, 2022).

J. tanjorensis belongs to the *Euphorbiaceae* family and is known in southern Nigeria as "hospital too far" or "Catholic vegetable" (Omoregie and Osagie 2012). "*J. tanjorensis* has largely been used for many purposes and is mostly cultivated in southern Nigeria a (latitude 7º 15' - 7º 29' N and longitude 7º 11'- 7º 32' E; altitude of 410 – 430 m)" (Oboh *et al* 2009). "Although, *J. tanjorensis* develops more extensively in the sandy-loam and clay-loam soils than in sandy soil, it maintains a consistent root to shoot ratio and root system architecture across all types of soil" (Ofelia *et al* 2013). "Many scientific evidences abound on the medicinal properties of this plant. Leaf extract of *J. tanjorensis* have been reported to contain phytochemical constituents capable of lowering blood cholesterol level which is useful in the treatment of cardiovascular diseases caused by hyperlipidemia" (Oyewole and Akingbala 2011). "The plant's leaves are edible and are used as spice in diets. It is also used as a tonic in herbal medicine, with the idea that it increases blood volume" (Omoregie and Sisoda 2011). "It has become naturalized in many tropical and subtropical areas, including Africa, for use in treatment of diseases such as anemia" (Prabakaran and Sudjatha 1999). "Phytochemical studies revealed the presence of flavonoids, alkaloids, tannins, saponins, terpernoids, cardiac glycosides and anthroquinones in the leaf extract of *J. tanjorensis"* (Ebe *et al* 2019).

J. tanjorensis Euphorbiaceae has received a lot of attention due to its potential health benefits, availability and affordability. The aqueous leaf extract of *J. tanjorensis* leaves may enhance haemopoiesis. Therefore the rich phytochemical content of *J. tanjorensis* was exploited to see if it could reverse the hematological alterations caused by phenylhydrazine administration in albino Wistar rats.

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2. Materials and Methods

2.1 Procurement of chemicals

Phenylhydrazine dihydrochloride was obtained from Micro Labs Limited, New Alliance fine Chem Private imited. Vile Parle, Mumbai, Maharashtra, India 19.0760^0N, 72.8777^0E and stored below 25^0C

2.2 Plant Materials

J. tanjorensis Euphorbiaceae fresh leaves (6 kg) were bought from Watt market in Calabar South, Cross River State, 4°57'6.12"N, 8°19'19.2"E. Nigeria. The leaves were freshly cut and air dried to constant weight at room temperature after which they were ground into powder using an electric blender. 500g of the powdery plant material was dissolved in 3.0 liters of ethanol for 14 days after which the extract was filtered through a Whatman filter paper (125mm). Concentrated extract was obtained by the removal of ethanol in a water bath and the resulting paste collected. The filtrate was allowed to evaporate to dryness using a vacuum rotatory evaporator. The extract was stored in refrigerator at 4°C for experimental use.

2.3 Experimental Animals

Twenty (20) adult Wistar rats (both sexes) of weight (180-200g) were obtained from the animal house of PAMO University of Medical Sciences, Nigeria, and maintained in the animal facility at a temperature of 27 ± 2°C and 12 h light/dark cycles. The animals were acclimatized for one

week before the commencement of the experimental procedures. All animals had free access to water and food pellets.

2.4 Experimental Design

Twenty (20) rats used for the study were divided into four groups of 5 rats each. Group 1 (control) received distilled water. Group 2 (*J. tanjorensis* Euphorbiaceae) received 200 mg/kg of *J. tanjorensis* Euphorbiaceae daily via oro-gastric intubation. Group 3 (Anemia group) Anemia was induced in experimental animals by intraperitoneal (*i.p.*) injection of phenylhydrazine dihydrochloride (PHZ, 10 mg/kg). Group 4, (PHZ, 10 mg/kg, *i.p.*) + (*J. tanjorensis*, Euphorbiaceae 250 mg/kg, oro-gastric intubation)) Treatment was done once daily for 35 days after which the animals were sedated with ketamine (70 mg/kg) and euthanized by cervical dislocation, and the blood samples were collected for biochemical analysis.

2.5 Haematological Indices

Haematological indices identify and measure the different blood cells and the deferential count which include the indices of the red blood cells which carry oxygen, a differential test of white blood cells which fight infection. The concentration of hemoglobin - the oxygen carrying protein in red blood cells, hematocrit, platelets which help blood clotting. Packed cell volume was determined by microhematocrit technique using capillary tube according to Brain (Brain *et al*. 2016).

2.5.1 Hematology

Blood was obtained via cardiac puncture from anesthetized animals and placed in EDTA-coated bottles. The blood samples were analyzed using an automated hematology analyzer (ABX

Micros 60 from Horiba ABX, France). Red blood cell (RBC), packed cell volume (PCV), hemoglobin concentration (Hb), mean corpuscular hemoglobin concentration (MCHC), mean corpuscular hemoglobin (MCH) and mean corpuscular volume (MCV), white blood cell (WBC), lymphocytes, neutrophil count, eosinophil count, and platelet count were assessed.

2.6 Statistical analysis

Data obtained was expressed as Mean ± SEM (Standard error of mean). One-way analysis of variance (ANOVA) was used to compare the mean differences. A P-value ≥ 0.05 was considered statistically significant and all the results were analyzed using the Statistical Package for Social Scientist (SPSS version 23).

3. RESULTS

3.1 Effect of ethanolic leaf extract of *J. tanjorensis* Euphorbiaceae on red blood cell count in rats treated with phenylhydrazine

The effect of *Jatropha tanjorensis* on phenyl hydrazine induced alteration in red blood cell count (RBC) is shown in Table 1. There was a significant increase ($p<0.05$) in RBC count in *Jatropha tanjorensis* treated group when compared with control and phenylhydrazine treated (anemic) group respectively. However, RBC count was significantly ($p<0.05$) higher in the *Jatropha tanjorensis* + phenylhydrazine treated group when compared with anemic group.

Table 1 Effect of ethanolic leaf extract of *Jatropha tanjorensis* on red blood cell count in rats treated with phenylhydrazine

Group	Pre-induction (million/mm3)	Post treatment (million/mm3)
Control		4.2 ± 0.17
J. tanjorensis (JT)	4.4 ± 0.13	5.8 ± 0.19 ###
Anemic	4.3 ± 0.21	3.9 ± 0.56 ***
Anemic + JT	4.2 ± 0.28	4.4 ± 0.31 ^^^

Values are expressed as mean ± SEM n = 5, ###p<0.05 vs. control, ***p<0.05 vs. JT, ^^^p<0.05 vs. Anemic group

3.2 Effect of ethanolic leaf extract of *J. tanjorensis* Euphorbiaceae on hemoglobin concentration in rats treated with phenylhydrazine

The effect of *Jatropha tanjorensis* on phenyl hydrazine induced alteration in haemoglobin is shown in Table 2. There was a significant decrease ($p<0.05$) in hemoglobin concentration in phenylhydrazine treated (anemic) group when compared with control and *Jatropha tanjorensis* group respectively. However, hemoglobin concentration was significantly ($p<0.05$) higher in the *Jatropha tanjorensis* + phenylhydrazine treated group when compared with anemic group.

Table 2 Effect of ethanolic leaf extract of *J. tanjorensis* Euphorbiaceae on hemoglobin concentration in rats treated with phenylhydrazine

Group	Pre-induction (g/dl)	Post treatment (g/dl)
Control		105.9 ± 1.89
J. tanjorensis (JT)	106.1 ± 1.03	117.6 ± 0.75 ###
Anemic	105.8 ± 1.21	97.5 ± 1.29 ***
Anemic + JT	104.9 ± 2.28	107.8 ± 2.06 ^^^

Values are expressed as mean ± SEM n = 5, ###p<0.05 vs. control, ***p<0.05 vs. JT, ^^^p<0.05 vs. Anemic group

3.3 Effect of ethanolic leaf extract of *J. tanjorensis* Euphorbiaceae on packed cell volume in rats treated with phenylhydrazine.

The effect of *J. tanjorensis* Euphorbiaceae on phenyl hydrazine induced alteration in packed cell volume (PCV) is shown in Table 3. As shown in the result, treatment with phenylhydrazine caused a significant ($p<0.05$) decrease in (PCV) as compared to normal control and *Jatropha tanjorensis* group respectively. While treatment with *Jatropha tanjorensis* significantly ($p<0.05$) reversed the effect of phenylhydrazine on PCV when compared with anemic group.

Table 3: Effect of ethanolic leaf extract of *J. tanjorensis* Euphorbiaceae on packed cell volume in rats treated with phenylhydrazine

Group	Pre-induction (%)	Post treatment (%)
Control		39.43 ± 1.21
J. tanjorensis (JT)	37.44 ± 1.03	45.08 ± 0.52 ###
Anemic	38.21 ± 0.14	36.53 ± 0.41 ***
Anemic + JT	39.12 ± 0.13	37.75 ± 0.62 ^^^

Values are expressed as mean ± SEM n = 5, ###p<0.05 vs. control, ***p<0.05 vs. JT, ^^^p<0.05 vs. Anemic group

3.4 Effect of ethanolic leaf extract of *J. tanjorensis* Euphorbiaceae on mean corpuscular volume alteration in rats treated with phenylhydrazine.

The effect of *J. tanjorensis* Euphorbiaceae on phenyl hydrazine induced alteration in Mean corpuscular volume (MCV) is shown in Table 4. As shown in the result, treatment with phenylhydrazine did not cause any significant change in (MCV) as compared to normal control and *J. tanjorensis* group respectively. Also, treatment with *J. tanjorensis* and phenylhydrazine did not yield any significant effect on MCV.

Table 4 Effect of ethanolic leaf extract of *J. tanjorensis* Euphorbiaceae on mean corpuscular volume alteration in rats treated with phenyl hydrazine

Group	Pre-induction (μm^3)	Post treatment (μm^3)
Control		61 ± 1.0
J. tanjorensis (JT)	60 ± 1.3	67 ± 1.2 ###
Anemic	59 ± 1.4	56 ± 1.8 ***
Anemic + JT	59 ± 1.2	60 ± 0.7 ^^^

Values are expressed as mean ± SEM n = 5, ###p<0.05 vs. control, ***p<0.05 vs. JT, ^^^p<0.05 vs. Anemic group

3.5 Effect of ethanolic leaf extract of *J. tanjorensis* Euphorbiaceae on mean corpuscular hemoglobin alteration in rats treated with phenyl hydrazine.

The effect of *J. tanjorensis* Euphorbiaceae on phenyl hydrazine induced alteration in mean corpuscular hemoglobin (MCH) is shown in Table 5. As shown in the result, treatment with phenylhydrazine did not cause any significant change in (MCH) as compared to normal control and *J. tanjorensis* group respectively. Also, treatment with *J. tanjorensis* and phenylhydrazine did not yield any significant effect on MCH.

Table 5 Effect of ethanolic leaf extract of *J. tanjorensis* Euphorbiaceae on mean corpuscular hemoglobin alteration in rats treated with phenyl hydrazine

Group	Pre-induction (pg/cell)	Post treatment (pg/cell)
Control		19 ± 0.28
J. tanjorensis (JT)	20 ± 1.7	21 ± 0.34
Anemic	18 ± 1.8	19 ± 0.14
Anemic + JT	18 ± 1.7	19 ± 0.36

Values are expressed as mean ± SEM n = 5

3.6 Effect of ethanolic leaf extract of *J. tanjorensis* Euphorbiaceae on mean corpuscular hemoglobin concentration alteration in rats treated with phenylhydrazine.

The effect of *J. tanjorensis* Euphorbiaceae on phenylhydrazine induced alteration in Mean corpuscular hemoglobin concentration (MCHC) is shown in Table 6. As shown in the result, treatment with phenylhydrazine did not cause any significant change in (MCHC) as compared to normal control and *J. tanjorensis* Euphorbiaceae group respectively. Also, treatment with *J. tanjorensis* and phenylhydrazine did not yield any significant effect on MCHC.

Table 6 Effect of ethanolic leaf extract of *J. tanjorensis* Euphorbiaceae on mean corpuscular hemoglobin concentration alteration in rats treated with phenylhydrazine.

Group	Pre-induction (g/dl)	Post treatment (g/dl)
Control		320.2 ± 2.28
J. tanjorensis (JT)	319.7 ± 2.31	320.3 ± 2.27

Anemic	318.6 ± 2.95	317.7 ± 2.98
Anemic + JT	320.1 ± 2.83	320.2 ± 2.18

Values are expressed as mean ± SEM n = 5,

3.7 Effect of ethanolic leaf extract of *J. tanjorensis* Euphorbiaceae on total white blood cell count alteration in rats treated with phenylhydrazine.

The effect of J. *tanjorensis* Euphorbiaceae on phenyl hydrazine induced alteration in total white blood cell count (TWBC) is shown in Table 7. As shown in the result, treatment with phenyl hydrazine caused a significant ($p<0.05$) increase in TWBC as compared to normal control and *J. tanjorensis* Euphorbiaceae group respectively. However, treatment with *J. tanjorensis* caused significant ($p<0.05$) reduction in TWBC relative to the anemic group.

Table 7 Effect of ethanolic leaf extract of *Jatropha tanjorensis* on total white blood cell count alteration in rats treated with phenylhydrazine

Group	Pre-induction ($x10^9$/L)	Post treatment ($x10^9$/L)
Control		5.7 ± 0.43
J. tanjorensis (JT)	5.6 ± 0.32	5.4 ± 0.62 $^{###}$
Anemic	5.8 ± 0.11	7.8 ± 0.38 ***
Anemic + JT	5.7 ± 0.68	6.7 ± 1.03 $^{\wedge\wedge\wedge}$

Values are expressed as mean ± SEM n = 5, $^{###}p<0.05$ vs. control, $^{***}p<0.05$ vs. JT, $^{\wedge\wedge\wedge}p<0.05$ vs. Anemic group

3.8 Effect of ethanolic leaf extract of *J. tanjorensis* Euphorbiaceae on neutrophil count in rats treated with phenylhydrazine.

Table 8 shows the effect of *J. tanjorensis* Euphorbiaceae on phenylhydrazine induced alteration in neutrophil count. As shown in the result, treatment with phenylhydrazine produced a significant ($p<0.05$) increase in neutrophil count when compared to normal control and *J. tanjorensis* Euphorbiaceae group respectively. However, treatment with *J. tanjorensis* leaf extract significantly ($p<0.05$) reversed (reduced) the trend when compared with the anemic group.

Table 8 Effect of ethanolic leaf extract of *J. tanjorensis* Euphorbiaceae on neutrophil count in rats treated with phenylhydrazine

Group	Pre-induction (cells/mcL)	Post treatment (cells/mcL)
Control		0.29 ± 0.03
J. tanjorensis (JT)	0.27 ± 0.32	0.28 ± 0.04
Anemic	0.28 ± 0.15	0.57 ± 0.06 ***
Anemic + JT	0.28 ± 0.16	0.41 ± 0.18 ^^^

Values are expressed as mean ± SEM n = 5, *** $p<0.05$ vs. control and JT, ^^^ $p<0.05$ vs. Anemic group

3.9 Effect of ethanolic leaf extract of *J. tanjorensis* Euphorbiaceae on eosinophil count in rats treated with phenylhydrazine.

The effect of *J. tanjorensis* Euphorbiaceae on phenylhydrazine induced alteration in eosinophil count is shown in Table 9. Phenylhydrazine treatment caused an insignificant increase in eosinophil count in rats compared to control. However, treatment with *J. tanjorensis* Euphorbiaceae caused a significant ($p<0.05$) increase in eosinophil count as compared to normal control and anemic groups respectively.

Table 9 Effect of ethanolic leaf extract of *J. tanjorensis* Euphorbiaceae on eosinophil count in rats treated with phenylhydrazine

Group	Pre-induction (cells/mcL)	Post treatment (cells/mcL)
Control		0.27 ± 0.04
J. tanjorensis (JT)	0.28 ± 0.03	0.29 ± 0.19
Anemic	0.28 ± 0.17	0.44 ± 1.02 ***
Anemic + JT	0.28 ± 0.11	0.54 ± 0.12 ^^^

Values are expressed as mean ± SEM n = 5, *** $p<0.05$ vs. control and JT, ^^^ $p<0.05$ vs. Anemic group

3.10 Effect of ethanolic leaf extract of *J. tanjorensis* Euphorbiaceae on Lymphocyte count in rats treated with phenylhydrazine.

Table 10 shows the effect of *J. tanjorensis* Euphorbiaceae on phenylhydrazine induced alteration in Lymphocyte count. Phenylhydrazine treatment significantly ($p<0.05$) reduced the level of lymphocytes in rats. Conversely, treatment with *J. tanjorensis* Euphorbiaceae leaf extract caused a significant ($P<0.05$) increase in lymphocyte count as compared with the anemic group.

Table 10 Effect of ethanolic leaf extract of *J. tanjorensis* Euphorbiaceae on lymphocyte count in rats treated with phenylhydrazine

Group	Pre-induction (cells/mcL)	Post treatment (cells/mcL)
Control		4.8 ± 0.28
J. tanjorensis (JT)	4.7 ± 0.13	5.2 ± 0.16 ###
Anemic	4.7 ± 0.17	4.5 ± 1.03 ***

Anemic + JT	4.7 ± 0.15	4.9 ± 1.08 ^^^

Values are expressed as mean ± SEM n = 5, ###p<0.05 vs. control ***p<0.05 vs. control and JT, ^^^p<0.05 vs. Anemic group

3.11 Effect of ethanolic leaf extract of *J. tanjorensis* Euphorbiaceae on platelet count in rats treated with phenylhydrazine.

Table 11 shows the effect of *J. tanjorensis* Euphorbiaceae on phenylhydrazine induced alteration in platelet count. Phenylhydrazine treatment caused a significant (p<0.05) decrease in platelet count in rats. However, *J. tanjorensis* Euphorbiaceae treatment caused a reversal effect by increasing platelet count when compared with the anemic group.

Table 11 Effect of ethanolic leaf extract of *J. tanjorensis* Euphorbiaceae on platelet count in rats treated with phenylhydrazine

Group	Pre-induction (cells/mcL)	Post treatment (cells/mcL)
Control		489 ± 15
J. tanjorensis (JT)	485 ± 39	504 ± 31 ###
Anemic	486 ± 35	465 ± 28 ***
Anemic + JT	487 ± 33	494 ± 35 ^^^

Values are expressed as mean ± SEM n = 5, ###p<0.05 vs. control ***p<0.05 vs. control and JT, ^^^p<0.05 vs. Anemic group

4. DISCUSSION

This study investigated the ameliorative effect of *Jatropha tanjorensis* Euphorbiaceae against phenylhydrazine induced anemia in rats. The results of our finding revealed that ethanolic leaf extract of *J. tanjorensis* Euphorbiaceae administration for thirty-five days reversed hematological alterations caused by repeated administration of phenylhydrazine, as evident in increased red blood cell count, hemoglobin concentration, packed cell volume, mean corpuscular volume, and decreased total white blood cell count, neutrophil, eosinophil and lymphocyte count respectively. However, no significant changes were observed in the mean corpuscular hemoglobin and mean corpuscular hemoglobin concentration respectively.

"J. tanjorensis Euphorbiaceae has received a lot of attention due to its potential health benefits, availability and affordability. Phytochemical analysis of the leaves showed the presence of flavonoids, tannins, terpenoids, saponins, anthraquinone, alkaloids and cardiac glycosides" (Oyowole and Akingbala 2011). "These bioactive constituents may be responsible for the observed therapeutic effect of the plant. Atansuyi, have equally reported that *J. tanjorensis* leaves contain a high water and low protein content with trace elements, zinc, iron, and selenium required for healthy growth in humans" (Atansuyi *et al* 2012). "These phytochemical ingredients, they reported have hypolipidemic properties in the blood of rats. Okereke *et al* (2015) had also suggested that plant derived medicines are relatively safer than synthetic alternative, offering profound therapeutic benefits and more affordable treatment; *J. tanjorensis* readily provide such benefits".

"Five weeks of administration of ethanolic leaf extract of *J. tanjorensis* Euphorbiaceae showed marked improvement in hemoglobin concentration, packed cell volume, red blood cell count, and mean corpuscular volume in anemic rats when compared with control". (Danborno *et al* 2019).

"Hemoglobin (Hb) plays an important role in the delivery of oxygen rich blood to various tissues, organ - system of the body for aerobic respiration to provide energy for metabolism. From the results obtained the Hb concentration in the anemic+ *J. tanjorensis* Euphorbiaceae treated group showed increased level as compared to anemic group. This implies that *J. tanjorensis* Euphorbiaceae consumption improved the Hb concentration in the animal. Similar trend was observed with the packed cell volume, mean corpuscular volume and red blood cell counts. There was however, no significant difference in the MCH and MCHC among the groups. The MCHC is an indicator of changes in size and color intensity of the red cells. This may imply that consumption of *J. tanjorensis* Euphorbiaceae may not affect the size or color intensity of RBCs". (Umoren *et al* 2020).

White blood cell is an important component of total blood cell count of the body (Maton *et al* 1997). "Various reports have shown that an increase in the number of leukocytes over the upper limits is usually linked to response to infection or inflammation, whereas a decrease below the lower limit weakens the immune system" (Alberts *et al* 2002). This implies that consumption of *J. tanjorensis* Euphorbiaceae in an anemic condition may increase the leuckocyte count and invariably, boost the immune system. This result agrees with the report of (Danborno *et al* 2019).

"Lymphocytes are one of the body's main types of immune cells found in blood and lymph tissues" (Berrington *et al* 2005; Ribatti *et al* 2006). "Lymphocyte counts below the normal range (1,000 and 4,800) can be temporary. This can occur after a cold or another infection, or by intense physical exercise, severe stress, or malnutrition" (Jacobs *et al* 2010). From the result obtained, the lymphocyte count in the anemic group showed significant decrease when compared to the *J. tanjorensis* group. This effect may be attributable to the ethnopharmaceutical content of the leaves extract towards enhancement of the immune system of the body. The neutrophils

count in the anemic group was significantly higher as compared to the *J. tanjorensis* Euphorbiaceae group. Similar trend was obtained in the eosinophil count. Neutrophils are usually increased during infections Waugh and Wilson (2008), also emotional stress (Rosado *et al* 2011; Barer 2012). They are usually the first line of action during bacterial infection. In this study, the *J. tanjorensis* Euphorbiaceae consumption caused a significant decrease in neutrophil count as well as eosinophil count. This effect causes down-turn in infection load in blood, resulting in improved immunologic response to good health. This observed increase in platelets count from the *J. tanjorensis* group and *J. tanjorensis* + anemic group as compared to anemic and control groups respectively, may be due to the increased release of the hormone thrombopoeitin, resulting in platelets synthesis. The vitamins and polyphenols in the leaves extract may be responsible for this action (Hoang *et al* 2021; Umoren *et al* 2023). It has been documented that in a toxic state the body's defences will physiologically increase and thereby trigger those mechanisms to combat the toxic condition Zulfiqar *et al* 2021; Umoren *et al* 2023) .[25] The molecular mechanism of action of *J. tanjorensis* Euphorbiaceae on the enhancement of erythropoiesis in anaemic rats was a limitation to the scope of our study. Therefore, further works to elucidate this aspect is hereby recommended.

5. CONCLUSION

The results of this study revealed the anti-amnesic properties of *Jatropha tanjorensis* Euphorbiaceae leaves extract in rats treated with phenylhydrazine, which is a pointer to its hemopoeitic ability especially in anemic condition. It is hereby recommended that more research should be carried out to ascertain the correct dosage for the extract administration.

Ethical Approval

The OECD guideline was strictly adhered to, and the experiments were conducted in strict accordance with the National Research Council's regulation for the care and use of laboratory animals (2011), and were authorized by the PAMO University of Medical Sciences' Ethical Guidelines (approval number: PUMS-AREC/2021/028).

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