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# IMMUNOSTIMULATORY PROPERTIES OF THE AQUEOUS EXTRACT OF *Jathropha tanjorensis* ON HAEMATOGICAL PROPERTIES OF WISTAR RATS

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**Abstract**

Medicinal plants remain a vital source of therapeutic agents due to their bioactive compounds and minimal side effects. The aim of this study was to investigate the immunostimulatory effects of the aqueous extract of *Jatropha tanjorensis* on hematological parameters in Wistar rats. Thirty rats were divided into four groups: one control and three treatment groups administered varying doses of the extract. Standard laboratory methods were employed for proximate, phytochemical, and mineral analyses, while hematological indices were assessed using an automated analyzer. Results showed high carbohydrate content (77.733±0.314%), Protein (714.181±0.098%), Moisture (9.668±0.208%), Ash content (5.877±0.043%), Crude fat (1.753±0.133%) and crude fibre (0.125±0.003%). Qualitative result of the aqueous extract of *Jatropha tanjorensis* showed the presence of saponins, phenols, eugenols, terpenoids, alkaloids, flavonoids, tannins and reducing sugar. Quantitative screening revealed alkaloids as (10.918±0,050), flavonoids (57.780±0.092), saponins (16.662±0.034), tannins (8.090±0.318), phenolics (1.429±0.014). The mineral content revealed elements like Mg (40.656±0.183), Ca (14.884±0.138), P (12.827±0.022), Na (12.818±0.141), K (16.337±0.293), N (11.930±7.000) and Fe (7.657±0.088) Hematological analysis demonstrated increased red blood cell count, hemoglobin concentration, and packed cell volume in treated groups, indicating enhanced erythropoiesis. Medicinal plants like *Jatropha tanjorensis* possesses significant immunostimulatory and hematological benefits, supporting its traditional use as a medicinal plant.

**Keywords**: *Jatropha tanjorensis*, Immunostimulatory, Haematology, Medicinal plants, Phytochemicals, Wistar rats

## INTRODUCTION

Medicinal plants have remained an indispensable component of healthcare systems globally due to their rich repository of bioactive compounds and therapeutic properties. Over the years, the reliance on plant-derived remedies has increased significantly, particularly in developing countries where accessibility and affordability of conventional medicine remain limited. According to the World Health Organization, approximately 80–88 % of the global population depends on traditional herbal medicine for primary healthcare (WHO, 2022). This widespread usage underscores the importance of scientifically validating the pharmacological potential of medicinal plants. Plants synthesize a wide range of secondary metabolites such as alkaloids, flavonoids, tannins, saponins, and phenolic compounds, which are responsible for their biological activities, including antioxidant, antimicrobial, anti-inflammatory, and immunomodulatory effects (Edeoga et al., 2005; Falodun *et al.*, 2013). These compounds contribute significantly to disease prevention and treatment, making medicinal plants a valuable resource for drug discovery and development (Newman and Cragg, 2020).

One such plant of interest is *Jatropha tanjorensis*, a member of the Euphorbiaceae family, commonly referred to as "hospital too far" due to its extensive use in traditional medicine. It is widely distributed in tropical regions of Africa and is used for the management of various ailments, including anemia, diabetes, hypertension, and infections (Omoregie and Osagie, 2011; Falodun *et al.*, 2013). Ethnobotanical reports suggest that the leaves of Jatropha tanjorensis possess blood-enhancing properties, which have been attributed to their rich phytochemical composition and mineral content, particularly iron (Orhue *et al.*, 2008). Previous studies have demonstrated that extracts of *Jatropha tanjorensis* exhibit antimicrobial, antioxidant, antiplasmodial, and anti-inflammatory activities (Viswanathan *et al.*, 2012; Omoregie and Sisodia, 2011). Additionally, research has shown that the plant can significantly improve hematological parameters such as red blood cell count, hemoglobin concentration, and packed cell volume in experimental animals, suggesting its potential role in the management of anemia and immune-related disorders (Ndem *et al.*, 2019; Danborno *et al.*, 2019).

Hematological parameters serve as essential indicators of physiological and pathological states, providing valuable insight into the health status of an organism. Alterations in these parameters may reflect underlying conditions such as infections, nutritional deficiencies, or immune dysfunction (Etim *et al.*, 2014). Therefore, evaluating the effect of medicinal plants on hematological indices is crucial in determining their therapeutic potential. Despite the extensive traditional use of *Jatropha tanjorensis*, there is still a need for more experimental studies to validate its immunostimulatory properties and establish its safety profile (Etim *et al.*, 2014; Danborno *et al.*, 2019). This study, therefore, aims to investigate the effects of the aqueous extract of *Jatropha tanjorensis* on hematological parameters in Wistar rats, as well as to evaluate its proximate, phytochemical, and mineral composition.

## MATERIALS AND METHODS

### Plant Material Collection and Identification

Fresh leaves of *Jatropha tanjorensis* were collected from the University of Benin premises and identifies by a botanist Prof. Akinnebosun H. from the Department of Plant Biology and Biotechnology, Faculty of Life Sciences, University of Benin, Benin City, Edo State, Nigeria.

### Preparation of Plant Extract

The leaves were air-dried in the laboratory at room temperature for about 2 months and then pulverized into fine powder. The powdered sample was extracted using distilled water by maceration for 72 hours. The extract was filtered and concentrated for analysis (Odey *et al.*, 2012).

### Proximate Analysis

Proximate composition (moisture, ash, crude protein, crude fat, crude fibre, and carbohydrate) was determined using standard methods of A.O.A.C. (2023).

### Phytochemical Analysis

Qualitative and quantitative phytochemical analysis were carried out to determine the presence and concentration of bioactive compounds such as alkaloids, flavonoids, tannins, saponins, and phenolic compounds using standard procedures (Sofowora, 2008).

### Mineral Analysis

Mineral elements including sodium, potassium, calcium, magnesium, phosphorus, iron, and nitrogen were analyzed using standard laboratory techniques of A.O.A.C. (2023).

### Experimental Animals

Thirty (30) adult Wistar rats weighing between 180–250 g was used for the study. The animals were housed under standard laboratory conditions with free access to food and water

### Experimental Design

The rats were divided into control and treatment groups. The control group received distilled water, while the treatment groups received varying doses of the aqueous extract of *Jatropha tanjorensis*. Administration was carried out orally for 14 days.

### Hematological Analysis

Blood samples were collected into anticoagulant bottles and analyzed using an automated hematology analyzer to determine red blood cell count (RBC), white blood cell count (WBC), hemoglobin concentration (Hb), hematocrit (HCT), and platelet count (PLT) (Dacie and Lewis, 2011).

### Statistical Analysis

The research data was analyzed with Graph prism version 6.0. Data were presented as Means=S.E.M. and statistical significance was calculated using 0ne-way ANOVA.

## RESULTS

The results in Table 1 shows the proximate composition of aqueous extract of *Jathropha tanjorensis* leaf which revealed the Proximate contents such as Moisture content, Ash content, Crude fat, Crude fibre, Protein, Carbohydrates. The results in Table 2 shows the qualitative phytochemical screening of aqueous extract of *Jathropha* leaf which revealed the presence of the phytochemical components such as alkaloid, tannins, glycoside, phenols, saponins, flavonoids, eugenols, steroids, terpenoid. The result in Table 3 shows the preliminary qualitative phytochemical constituent. The result in Table 4 shows the quantitative phytochemical analysis of aqueous extract of *Jathropha tanjorensis* which revealed flavonoid to be present in high concentrations. Table 5 shows the results of the mineral analysis of aqueous extract of *Jathropha tanjorensis.*

**Table 1: The proximate composition of aqueous extract of *Jathropha tanjorensis*.**

| Proximate content | Aqueous extract (%) |
|---|---|
| Moisture content | 9.668 ± 0.208 |
| Ash content | 5.877 ± 0.043 |
| Crude fat | 1.753 ± 0.133 |
| Crude fiber | 0.125 ± 0.003 |
| Protein | 14.181 ± 0.098 |
| Carbohydrates | 77.733 ± 0.314 |

Values were expressed in Mean ± SEM of the figure obtained in triplicate (n=3)

**Table 2: Preliminary qualitative phytochemical screening of aqueous extract of *Jathropha tanjorensis***

| Phytoconstituents | Aqueous extract |
|---|---|
| Glycosides | – |
| Saponins | + |
| Phenols | + |
| Eugenols | + |
| Terpenoids | + |
| Steroids | – |
| Alkaloids | + |
| Flavonoids | + |
| Reducing sugar | + |
| Tannins | + |

Keys: Negative (-) and Present (+)

**Table 3: Quantitative Phytochemicals analysis of aqueous extract of *Jathropha tanjorensis***

| Phyto-constituent | Units | Aqueous extract |
|---|---|---|
| Alkaloids | (%) | 10.918 ± 0.050 |
| Tannins | mg/kg | 8.090 ± 0.318 |
| Saponin | mg/kg | 16.662 ± 0.034 |
| Phenolics | mg/kg | 1.429 ± 0.014 |
| Flavonoids | mg/kg | 57.780 ± 0.092 |

Values were expressed in Mean ± SEM of the figure obtained in triplicate (n=3)

**Table 4: Mineral Analysis of aqueous extract of *Jathropha tanjorensis***

| Phytoconstituent | Aqueous extract (mg/kg) |
|---|---|
| Sodium (Na) | 12.819±0.141 |
| Potassium (K) | 16.337±0.293 |
| Calcium (Ca) | 14.884±0.138 |
| Magnesium (Mg) | 40.656±0.183 |
| Potassium (P) | 12.827±0.022 |
| Iron (Fe) | 7.657±0.088 |
| Nitrogen (N) | 11.93±7.000 |

Values were expressed in Mean ± SEM of the figure obtained in triplicate (n=3)

**Table 5: Effect of aqueous extract of *Jathropha tanjorensis* on haematological variation of Wistar rats**

| | Normal Control | Negative Control | 100 mL Aqueous | 200 mL Aqueous |
|---|---|---|---|---|
| WBC ($10^3$/µL) | 6.750±0.4907 | 4.500±0.8660 | 10.30±0.05774 | 12.65±1.415* |
| LYM% | 70.70±1.386 | 61.50±2.944 | 77.80±4.850 | 79.20±2.829* |
| MID% | 12.75±0.9526 | 14.20±1.963 | 17.00±3.464 | 18.90±1.155 |
| GRAN% | 3.550±0.4330 | 4.300±0.9815 | 5.200±1.386 | 8.400±0.8083* |
| LYM | 5.550±0.3753 | 7.800±0.9815 | 8.050±0.5485 | 8.900±0.6351 |
| MID | 0.8500±0.1118 | 1.300±0.04472 | 1.750±0.2907* | 2.650±0.4249* |
| GRAN | 0.2500±0.02887 | 0.4000±0.05774 | 0.5000±0.1155 | 1.100±0.2309** |
| RBC ($10^6$/µL) | 4.205±0.09526 | 2.465±0.2338 | 6.560±0.2425 | 8.945±0.03753** |
| HGB (g/dL) | 16.50±0.1155 | 15.55±0.6640 | 19.00±0.3464* | 21.10±0.1732** |
| HCT (%) | 34.10±0.4619 | 30.05±1.645 | 39.35±0.4330 | 37.50±0.9238 |
| MCV (fL) | 58.55±1.415 | 62.00±0.2887 | 60.20±1.559* | 63.15±1.184* |
| MCH (pg) | 22.90±0.4619 | 20.00±0.1732 | 22.85±0.4907 | 23.65±0.1443 |
| MCHC (g/dL) | 39.15±0.1443 | 32.80±0.05774 | 38.10±0.1732 | 37.60±0.4619 |
| RDW-SD (fL) | 40.60±3.695 | 38.10±0.6351 | 40.60±1.212 | 44.85±1.241* |
| RDW-CV (%) | 17.75±1.241 | 15.00±0.3464 | 17.35±0.08660 | 18.45±0.2598 |
| PLT ($10^3$/µL) | 398.5±82.27 | 323.5±92.09 | 450.0±162.8 | 514.5±77.65** |
| MPV (fL) | 7.750±0.02887 | 7.550±0.08660 | 7.600±0.2887 | 8.150±0.08660 |
| PDW (%) | 9.850±0.3753 | 9.750±0.1443 | 9.200±0.2887 | 10.35±0.8372 |
| PCT (%) | 0.2950±0.06062 | 0.3900±0.07506 | 0.4600±0.07506 | 0.4100±0.05774 |
| P-LCR (%) | 6.200±1.443 | 7.150±1.934 | 9.750±2.511 | 11.90±0.4041* |

There was a significant difference in the level of MPV, MID in the group treated with 200 mL aqueous extract when compared to the normal control (*p<0.05). There was a significant difference in the level of WBC, GRAN%, HGB, MCHC, GRAN and RBC in the group treated with 200 mL extract (*p<0.05; *p<0.01). WBC - white blood cells, RBC - red blood cells, LYM - lymphocytes, GRAN - granulocytes, MID - combined value of other types of white blood cells not classified as lymphocytes or granulocytes, HGB - haemoglobin, HCT ¬ hematocrit, PLT - platelet, MCV - mean corpuscular volume, MCH - mean corpuscular haemoglobin, MCHC- mean corpuscular haemoglobin concentration, MPV - mean platelet volume, P-LCR - platelet large cell ratio, PCT - procalcitonin, RDW-C, RDW-S - red cell distribution width.

Values are represented as Mean ± S.E.M, n=3

## DISCUSSION

Medicinal plants have become a major source of getting treatment from many illnesses in our environment today. In this study, Table 1 reveals the proximate composition of the aqueous extract of *Jatropha tanjorensis* leaf. The result in this study reveals that carbohydrate content (77.733 ± 0.314%) having the highest among all the proximate components, while crude fibre (0.125 ± 0.003%) was the lowest. The high carbohydrate content suggests that this plant could serve as an important energy source. This finding agrees with the research of Ebun-Oluwa and Alade (2007), who reported that leafy vegetables contribute significantly to dietary carbohydrate intake. The research of Udinyiwe and Aghedo (2022) reported a carbohydrate content of a medicinal plant to be 71.55 ± 0.10). The research of Udinyiwe and Salami (2025) reported a carbohydrate content of aqueous extract of *Citrus sinesis* to be 70.5401± 0.0669). The research of Udinyiwe and Ayanru (2021) reported a carbohydrate content of aqueous extract of a medicinal plant to be 77.88. These results help to justify the result of this study that medicinal plants can be a source of energy. The relatively high protein content observed in this study further supports the nutritional importance of the plant and is higher than values reported for *Ocimum gratissimum* and Amaranthus species (Islam *et al*., 2004; Olumakaiye, 2011), indicating that *Jatropha tanjorensis* could serve as a supplementary protein source. In this study, Table 2 shows the qualitative phytochemical constituents of the aqueous extract. The results indicate the presence of saponins, phenols, eugenols, terpenoids, alkaloids, flavonoids, reducing sugars, and tannins, while glycosides and steroids were absent. The presence of these bioactive compounds suggests that the plant possesses significant pharmacological potential. The research of Udinyiwe and Omoregie (2024) revealed the presence of phytochemicals such as saponins, phenols, eugenols, alkaloids, flavonoids as reported in this study. The research of Udinyiwe and Salami (2025) in the qualitative study carried out also reported the presence of similar phytochemicals reported in this study. The results in Table 3 in this study presented the quantitative phytochemical composition of the aqueous extract of *Jathropha tanjorensis*, where flavonoids was found to be the most abundant (57.780 ± 0.092 mg/kg), followed by alkaloids (10.918 ± 0.050%), saponins (16.662 ± 0.034 mg/kg), tannins (8.090 ± 0.318 mg/kg), and phenolics (1.429 ± 0.014 mg/kg) as the least. The high flavonoid content observed in this study agrees with the research of Falodun *et al.* (2013), who reported that *Jatropha tanjorensis* is rich in flavonoids. Flavonoids are known for their antioxidant and immunostimulatory activities, which may contribute to the observed improvement in hematological parameters. The research of Udinyiwe and Salami (2025) had flavonoid (6.9993 ± 0.0127 mg/kg) as the highest quantitative parameter for the plant used. The research of Udinyiwe and Omoregie (2024) revealed the quantity of flavonoid as 59.75±0.30 mg/kg as the highest phytochemicals parameters gotten in that study. This validates the presences and high value that flavonoids can have in plant materials. The quantitative presence of alkaloids, saponins, tannins and phenols reported in this study were also reported by the research of Edeoga *et al*. (2005), who associated these compounds with antimicrobial and therapeutic properties. The research of Udinyiwe and Omoregie (2024); Udinyiwe and Omoregie (2025) and Udinyiwe and Salami (2025) reported similar quantitative results showing notable high values of alkaloids, saponins, tannins and phenols in the plant materials used in the study. In this study, Table 4 shows the mineral composition of the aqueous extract where Magnesium was the most abundant mineral (40.656 ± 0.183 mg/kg), and the lowest iron (7.675 ± 0.088 mg/kg). The presence of these essential minerals supports the nutritional and physiological importance of the plant. This finding agrees with Oboh and Masodje (2009); Ebun-Oluwa and Alade (2007), who reported that leafy vegetables are important sources of minerals necessary for metabolic functions. The research of Etukudo and Osim (2018) on the leaf of *Jathropha tanjorensis* reported the presence of similar minerals as reported on *Jathropha tanjorensis* in this study. The research of Udinyiwe and Aghedo (2022); Udinyiwe and Omoregie (2024) revealed the presence of similar minerals as reported in this study, indicating the richness of minerals in plants.In this study, Table 5 shows the effect of the aqueous extract of *Jatropha tanjorensis* on hematological parameters of Wistar rats. The results indicate a significant increase in white blood cell (WBC) count, especially in the group treated with 200 mL extract (12.65 ± 1.415 $\times 10^3/\mu L$) compared to the normal control (6.750 ± 0.4907 $\times 10^3/\mu L$). Similarly, red blood cell (RBC) count, hemoglobin (HGB), and hematocrit (HCT) levels were improved in treated groups.

The increase in RBC count and hemoglobin concentration suggests enhanced erythropoiesis. This finding agrees with Ndem *et al*. (2019), who reported that *Jatropha tanjorensis* extract significantly increased RBC and hemoglobin levels in Wistar rats. It also supports the traditional claim that the plant has blood-boosting properties (Orhue *et al*., 2008). The improvement in hematocrit values further confirms increased red cell mass and improved oxygen-carrying capacity of the blood. The significant increase in WBC count observed in treated groups indicates enhanced immune response. This finding is consistent with the work of Danborno *et al*. (2019), who reported increased leukocyte levels following administration of Jatropha extracts. The immunostimulatory effect may be attributed to the presence of phytochemicals such as flavonoids and saponins, which have been shown to stimulate immune cell activity (Bharati *et al*., 2020). Additionally, platelet count (PLT) was higher in treated groups (514.5 ± 77.65 $\times 10^3/\mu L$) compared to the control (398.5 ± 82.27 $\times 10^3/\mu L$), suggesting improved hemostatic function. This may be beneficial in preventing bleeding disorders and promoting wound healing. However, some variations observed in parameters such as MCHC and RBC in certain groups

may indicate dose-dependent effects of the extract. This suggests that while the plant has beneficial effects, its activity may vary depending on concentration.

Overall, the results from all Table 5 demonstrate that *Jatropha tanjorensis* possesses significant nutritional, phytochemical, and hematological properties. These findings support its traditional use as a medicinal plant for boosting blood levels and enhancing immune function. However, caution is necessary as previous studies (Oyewole *et al*., 2012) have reported potential toxic effects at high doses, indicating the need for further research to establish safe dosage levels.

## CONCLUSION

This study demonstrates that the aqueous extract of *Jatropha tanjorensis* is rich in nutrients, phytochemicals, and essential minerals, which contribute to its biological activity. The extract significantly improved hematological parameters, including red blood cell count, hemoglobin concentration, and white blood cell count, indicating enhanced erythropoietic and immunostimulatory effects. These findings support the traditional use of the plant as a blood-enhancing and immune-boosting agent. However, further studies are required to establish its safety profile and optimal dosage for therapeutic application

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