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Original Research Article

Comparative Anti-Anaemia Efficacy of *Jatropha tanjorensis* and *Telfairia occidentalis* Leaf Extracts in Aluminium Chloride ($AlCl_3$) Induced Anaemia in Albino Rats

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ABSRTACT

Anaemia is a blood illness that threatens public health. The anti-anaemia property of *Jatropha tanjorensis* and *Telfairia occidentalis* is known. However, information on their respective measures of anti-anaemia potential is veiled. Comparing the anti-anaemia potential of extracts from the said plants is pivoted in this investigation. *J. tanjorensis* (JTLE) and *T. occidentalis* (TOLE) leaves were ground into a fine powder and then macerated. Twenty-one (21) mature male albino rats were divided into seven groups of three (3) rats per group. Anaemia was induced in groups II-VII, after which extracts were administered orally for 21 consecutive days. Group I (normal control) and Group II were not administered extract. The third and fourth groups received 200 mg/kg of *T. occidentalis* and *J. tanjorensis* leaf extract, respectively. Groups V and VI received 400 mg/kg of *T. occidentalis* and *J. tanjorensis* leaf extracts, respectively. Group VII received extract composite (1:1). Standard techniques were used to evaluate the major anaemia indices. Findings regarding the relative anti-anaemia effectiveness of *J. tanjorensis* and *T. occidentalis* leaf extracts revealed that the extracts did not prevent the treated animals' body weight from increasing. Additionally, 200 mg/kg of the composite extract was found to significantly ($p< 0.05$) raise blood parameters above those reported for their respective components. PCV value recorded with 400 mg/kg bw of TOLE was considerably ($p < 0.05$) greater than that reported for JTLE. In conclusion, *T. occidentalis* had a better anti-anaemia potential.

Keywords: Anaemia, *Jatropha tanjorensis*, Blood, Hemoglobin, *Telifera occidentalis*

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Introduction

Anaemia is caused by a lack of haemoglobin in red blood cells.[1] It is a prominent public health issue in third-world nations, impacting people of all ages and playing a significant role in the high rates of morbidity and mortality observed in developing countries.[2,3] In addition to being extremely expensive, synthetic drugs developed to treat anaemia have drawbacks like mutagenicity and iron overload.[4] This has led to the development of herbal alternatives, which are believed to be safe for human consumption, reasonably priced, easily accessible, and locally sourced, among many other benefits.[5] This is evidenced by medications made from plants being used to treat an estimated 80% of the population in developing countries.[6]

The herb *Jatropha tanjorensis* (Euphorbiaceae), also referred to as "hospital too far" in Nigeria, has been effectively employed by local medical practitioners to cure a variety of illnesses, including anaemia, diabetes, and malaria.[7.]

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The plant has been primarily domesticated. The leaf is predominantly employed in the majority of regional cuisines.[8] Alkaloids, flavonoids, tannins, cardiac glycosides, anthraquinones, and saponins.[9] are among the phytochemicals found in *J. tanjorensis* leaf, which are of excellent health importance and have been shown by science to be safe for ingestion by both humans and animals.[10, 11, 12]

Telfairia occidentalis belongs to the *Cucurbitaceae* family. In Nigeria, it is called ugu, fluted gourd, or fluted pumpkin. Among other things, it provides fibre, protein, carbohydrates, vitamins, and minerals.[13] Anaemia has been treated locally with the leaf extract from *T. occidentalis*.[14, 15] The need for this study is urgent because, while research has demonstrated the anti-anaemia potential of *Jatropha tanjorensis* and *Telfairia occidentalis*, two common vegetables used locally to treat the condition as mentioned above, no effort has comparatively weighed such potential to have a clear direction in research efforts geared towards discovering a more reliable source of candidate anti-anaemia compounds.

Materials and Methods

Collection and Identification of Plant Material

From a home garden in Gwagwa (9.0752° N, 7.3112° E), Federal Capital Territory, Abuja, Nigeria, fresh leaves of *Jatropha tanjorensis* and *Telfairia occidentalis* were collected in July 2020. The leaves were identified by a taxonomist, Dr. Namadi Sanusi, at the Department of Botany in the Faculty of Life Sciences, Ahmadu Bello University's Herbarium Unit. They were assigned the voucher numbers ABU090623 and ABU0194 for *Jatropha tanjorensis* and *Telfairia occidentalis*, respectively.

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Plant preparation and extraction

Fresh leaves of *Telfairia occidentalis* and *Jatropha tanjorensis* were thoroughly cleaned and separated from their stalks. The leaves were left to dry in the laboratory before being ground into a fine powder using a blender. 300 g each of *T. occidentalis* and *J. tanjorensis* powdered sample was steeped in 800 mL of 70% ethanol at room temperature for 72 hours. Subsequently, ethanol was removed over a water bath at 80 $^{\circ C}$ to obtain 120 g and 128 g of *T. occidentalis* and *J. tanjorensis* leaf extracts, respectively. The extracts were preserved at 4°C before use. Extract yields of 40 g/100 g and 42.6 g/100 g for *T. occidentalis* and *J. tanjorensis* were determined using the formula below.

$$Yield(g/100\ g) = \frac{W1 \times 100}{W2}$$

W2 is the weight of the powdered plant material, and W1 is the weight of the extract residue after the solvent has been removed.

Experimental animals

Twenty-one (21) mature male albino rats, weighing between 125 and 180 grams, were acquired from the Federal University of Technology's animal house in Minna, Niger State, Nigeria. The rats were housed in clear plastic cages and were allowed unhindered access to food and water. The rats were acclimatised for two weeks before the study started. The experiment's procedures followed the guidelines for the welfare and care of study animals[16] after permission from the Niger State Ministry of Health Ethical Review Committee had been granted (ERC PIN/13/06/2020).

Induction of Anaemia

For three (3) consecutive days, an intraperitoneal dose of aluminium chloride at precisely 0.5 mg/kg body weight was administered.[17] Rats' blood samples were collected and examined to ensure anaemia was induced. Rats were deemed anaemic after a 30% decrease in the haemoglobin content and red blood cell count.[18] All groups were induced anaemia except group I.

Experimental Design

Seven randomly selected groups of three adult male albino rats each were created as follows:

Group I: 2 mL of distilled water was given to the normal control group.
Group II: (Untreated control) was devoid of extract administration
Group III: received 200 mg/kg of TOLE orally
Group IV: was given 200 mg/kg of JTLE orally
Group V: received an oral dose of 400 mg/kg of TOLE.
Group VI: administered 400 mg/kg of JTLE orally
Group VII: Induced anaemia, treated with 200 mg/kg of JTLE and TOLE (1:1) orally

Body Weight Determination

Treatment lasted 21 days, during which their body weights were determined weekly using Tm Balance (Max 2100 g) SN: B433917796, Thermo Fisher Scientific USA.

Blood Sample Collection for Haematological Analysis

The albino rats were made to lose consciousness by chloroform anaesthesia. Blood was drawn from their tails and placed in sterile EDTA bottles. The microhaematocrit method was used to calculate PCV,[19] the Sahli's or acid haematin method was used to measure haemoglobin concentration using a haemoglobinometer, [20] and the visual red cell count was used to assess red blood cells.[21]

Statistical Analysis

The tests were conducted in triplicate, and the results were reported as mean ± standard deviation. The Tukey HSD test was employed after statistical comparisons were made using one-way analysis of variance (ANOVA). A statistically significant difference was established at the 95% confidence level ($p < 0.05$).

Results and Discussion

Anaemia is a medical condition characterised by decreased haemoglobin (Hb) content and red blood cells below normal levels.[3] Factors that affect red blood corpuscles always impact haematocrit, or packed cell volume, and haemoglobin concentration.[22] Red blood cells, one of the many biological components of blood, are essential for identifying and treating anaemia. Often, clinicians use red blood cell counts, haemoglobin levels, and packed cell volume anomalies to identify possible main haematological diseases.[25] These metrics can provide important information that helps doctors diagnose and treat blood-related conditions. Table 1 shows the changes in haematological parameters observed in anaemic rats administered ethanol leaf extracts of *T. occidentalis* and *J. tanjorensis* for three weeks. The results showed a significant ($p< 0.05$) increase in PCV, Hb, and RBC of groups III, IV, V, VI, and VII administered extracts of *J. tanjorensis* and *T. occidentalis* compared to the untreated control (group II), which was not administered extract. However, there was no significant ($p> 0.05$) difference in the PCV, Hb, and RBC of groups III, IV, and VI administered varying doses of extracts of *J. tanjorensis* and *T. occidentalis* in comparison to the first group (normal control). The value of PCV reported for group V administered 400 mg/kg of TOLE significantly ($p< 0.05$) differed from that recorded in group V administered 400 mg/kg JTLE. In contrast, no significant ($p> 0.05$) difference in the Hb and RBC was reported for groups IV and V. The PCV, Hb, and RBC reported for group VII treated with a composite extract of *J. tanjorensis* and *T. occidentalis* (1:1) at 200 mg/kg body weight were significantly ($p < 0.05$) higher compared to those reported with the individual extract components irrespective of the concentration. The bioavailability of some of *Telfairia occidentalis'* active principles may cause the plant's remarkable anti-anaemia properties. The capacity of *Telfairia occidentalis* leaf to alleviate sickle cell conditions demonstrates their exceptional anti-anaemic properties.[26]

Table 1: Haematological parameters of anaemic rats treated with *T. occidentalis* and *J. tanjorensis* leaf extracts

GROUPS	PCV (%)	RBC (x10^{12}/L)	Hb (g/dL)
Group I (Normal ctrl)	47.32±0.82^{a}	4.49±0.04^{b}	14.87±0.01^{b}
Group II (Untreated ctrl)	27.25±0.18^{a}	3.66±0.01^{a}	10.78±0.02^{a}
Group III (Anaemia+200 mg/kg TOLE)	47.07±0.14^{b}	4.31±0.01^{b}	14.81±0.03^{b}
Group IV(Anaemia+200 mg/kg JTLE)	47.61±0.47^{b}	4.22±0.01^{b}	14.13±0.02^{b}
Group V(Anaemia+400 mg/kg TOLE)	48.53±0.27^{c}	5.22±0.02^{b}	14.97±0.00^{b}
Group VI (Anaemia+400 mg/kg JTLE	47.35±0.15^{b}	4.71±0.01^{b}	14.42±0.01^{b}
Group VII (Anaemia+200 mg/kg JTLE & 200 mg/kg TOLE	49.16±0.24^{d}	4.99±0.01^{b}	14.59±0.03^{b}

Results are expressed as mean ± standard deviation. Values with the same superscript in a row are significantly different.
Key: JTLE [*Jatropha Tanjorensis* leaf extract], TOLE [*Telfairia occidentalis* leaf extract], Ctrl [Control]

The weight changes of anaemic rats given leaf extracts of *T. occidentalis* and *J. tanjorensis* for 21 days are presented in Table 2. There was a significant increase ($p< 0.05$) in the body weight of the experimental rats in groups III, IV, V, VI, and VII treated with leaf extracts of the plants mentioned above. In contrast, a pronounced body weight decrease was seen in the untreated control. The decreased body weight in the anaemic untreated rats could be attributed to diminished appetite resulting from the anaemic condition. This is consistent with the finding that reported declined appetite in patients suffering from iron deficiency anaemia.[23] The significant ($p < 0.05$) increase in body weight of rats administered *J. tanjorensis* and *T. occidentalis* extracts may be attributed to the intactness of appetite evident by the observed body weight increase, a pointer to the absence of anaemia in the said groups. This is in tandem with the outcome of a work that showed that a *Moringa oleifera* leaf extract increased Hb concentration and RBC in anaemia-induced models. [24]

Table 2: Body weight of anaemic rats treated with *T. occidentalis* and *J. tanjorensis* leaf extracts

GROUPS	Day 0	Day 7	Day 14	Day 21
Group I (Normal ctrl)	199.04±1.92^a	202.40±2.06^b	204.82±2.04^c	207.49±2.06^d
Group II (untreated ctrl)	172.04±0.64^a	162.48±0.46^b	159.41±0.45^c	155.41±0.43^d
Group III (Anaemia+200 mg/kg TOLE)	160.92±0.18^a	164.92±2.054^b	167.60±0.14^c	169.65±0.06^d
Group IV(Anaemia+200 mg/kg JTLE)	185.33±0.32^a	188.89±0.34^b	191.30±0.35^c	191.60±0.35^c
Group V(Anaemia+400 mg/kg TOLE)	176.73±0.41^a	179.67±5.93^b	179.27±0.49^b	180.20±0.45^c
Group VI (Anaemia+400 mg/kg JTLE	178.42±0.26^b	179.57±0.36^b	183.30±0.29^b	184.75±0.28^c
Group VI (Anaemia+200 mg/kg TOLE & 200 mg/kg JTLE	174.61±0.93^a	176.02±0.63^b	181.69±0.61^c	181.93±0.29^c

Results are expressed as mean ± standard deviation. Values with the same superscript in a column are significantly different.
Key: JTLE [*Jatropha Tanjorensis* leaf extract], TOLE [*Telfairia occidentalis* leaf extract], Ctrl [Control]

Conclusion

In conclusion, this study establishes the variation in the anti-anaemia efficacy of *Telfairia occidentalis* and *Jatropha tanjorensis* at a higher dose. The study showed that *Telfairia occidentalis* leaf extract outperformed *Jatropha tanjorensis* leaf extract at a higher dose. This implies that researchers interested in developing a dependable anti-anaemic compound should prefer *Telfaira occidentalis* leaf as a source plant. This study also established that *the Telfairia occidentalis and Jatropha tanjorensis composites* demonstrated a better anti-anaemia effect.

Conflict of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

Declaration of the Authors

The authors hereby attest that the work contained in this article is original and that we will be held liable for any claims pertaining to its content.

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