**Original Research Article**

**HEPATIC ALTERATIONS AND HAEMATOLOGICAL CHANGES FOLLOWING THE ADMINISTRATION OF *TELFAIRIA OCCIDENTALIS* AND *JATROPHA TANJORENSIS* EXTRACTS IN ALBINO RATS**

**ABSTRACT**

*Aims:* This study investigates the hepatic and hematological changes following the oral administration of combined ethanolic extracts of *T. occidentalis* and *J. tanjorensis* in albino rats.

Place and Duration of Study: Histology Unit, Department of Anatomy, Basic Medical Sciences, Olabisi Onabanjo University, Sagamu, Ogun State, Nigeria between October 2024 and May, 2025.

Study design: Twenty-four albino rats were randomly divided into four groups: a control group and three treatment groups receiving 250 mg/kg(GA), 500 mg/kg(GB), and 750 mg/kg(GC) respectively of combined extracts for 6 weeks. Liver function tests (ALT, AST, ALP, Bilirubin), hematological profiling (WBC, Haemoglobin, PCV), and histological evaluations (H&E and Perl’s Prussian Blue stains) were conducted to assess treatment effects and (P = .05) was considered significant.

Result: At 2 weeks, body weight decreased significantly in all treated groups (GA: 179 ± 0.72 g, GB: 137 ± 2.08 g, GC: 135 ± 1.81 g) compared to control (203 ± 0.96 g; p = 0.05), while liver weight was significantly reduced in GB (4.53 ± 0.56 g) and GC (5.15 ± 0.04 g) relative to control (5.72 ± 0.63 g; p = 0.04). At 4 and 6 weeks, body weight increased across treated groups (e.g., 6-week GC: 183 ± 1.86 g vs. control: 160 ± 1.41 g; p = 0.04), but liver weights remained statistically unchanged (p = 0.06). Hematologically, 2-week WBC counts (p = 0.04) were significantly altered, with GC showing elevated WBC (5900 ± 0.14). By 4 and 6 weeks, PCV and HB increased significantly across treated groups with p = 0.04 and p = 0.03 respectively). WBC remained statistically unchanged (p = 0.71). Liver enzymes showed significant reductions in AST (p = 0.01) and ALP (p = 0.02) at 6 weeks, with non-significant ALT changes (p = 0.19). Histological examination showed preserved hepatic architecture across groups, Perl’s staining revealed mild to no physiological iron deposition.

Conclusion: The combined administration of *T. occidentalis* and *J. tanjorensis* did not induce hepatic or hematological toxicity at the studied doses and durations. Instead, the extracts exhibited a potential synergistic effect in preserving liver integrity and hematopoietic function.

Keywords: Telfairia occidentalis, Jatropha tanjorensis, Hepatoprotective effects, Hematological parameters, Albino rats,

**Introduction**

*Telfairia occidentalis*, commonly known as fluted pumpkin, is a dioecious perennial climber from the family Cucurbitaceae. In Nigerian culinary practice, its leaves are a key ingredient in the popular *edikang ikong* soup. Traditionally, the plant is used to manage anemia due to its high iron content, and the seeds are reputed to possess anti-diabetic properties [1].

Recent scientific investigations have explored the pharmacological properties of *T. occidentalis*, reporting its antioxidant, anti-inflammatory, and hepatoprotective effects. Extracts from the leaves and seeds also show antimicrobial activity against several pathogenic bacteria and fungi [2].

Nutritionally, *T. occidentalis* is valued for its rich composition of vitamins, minerals, and phytochemicals. Its leaves contain high levels of vitamins A, C, and E, as well as essential minerals such as iron, calcium, potassium, and phosphorus, making them a valuable dietary component for preventing iron-deficiency anemia [3] [4]. The seeds, on the other hand, are notable for their high protein and lipid content, including omega-3 and omega-6 fatty acids, along with significant levels of zinc, magnesium, and selenium. The presence of phytochemicals such as flavonoids, phenolic acids, saponins, and tannins contributes to the plant’s pharmacological profile, with bioactive compounds like gallic acid, caffeic acid, and quercetin identified in leaf extracts[4]

*Jatropha tanjorensis*, commonly referred to as "hospital too far," "iyana-ipaja," or "Catholic vegetable," is a shrub belonging to the Euphorbiaceae family. It is widely distributed across southern Nigeria and other parts of West Africa [5] Traditionally, the plant is employed in Nigerian folk medicine to treat malaria, hypertension, diabetes, and anemia [6]. Its leaves are rich in bioactive compounds such as alkaloids, tannins, saponins, and flavonoids, which are believed to be responsible for its therapeutic effects, particularly in liver and blood-related conditions [7].

Experimental studies have demonstrated the hematopoietic and hepatoprotective potentials of *J. tanjorensis*. Omoregie and Osagie [8] reported significant increases in packed cell volume (PCV), hemoglobin (Hb), platelet count, total protein, and albumin levels in rats administered with the leaf extract, indicating its relevance in treating anemia. Similarly, Iroanya et al. [9] showed that ethanolic extracts of the leaf protected against acetaminophen-induced liver damage in rats, evidenced by reduced levels of serum liver enzymes. These findings were further corroborated by Omoregie et al. [9], who demonstrated strong antioxidant activities of the plant both in vitro and in vivo. However, there are also conflicting reports. Iyare et al. [10] advised caution, suggesting that prolonged use of *J. tanjorensis* may reduce hemoglobin levels and cause liver damage rather than provide therapeutic benefit.

The liver, a vital organ located in the upper right quadrant of the abdomen, plays an essential role in metabolism, detoxification, protein synthesis, and bile production [11]). It consists primarily of hepatocytes organized into hepatic lobules, facilitating a range of metabolic functions [12]. Maintaining liver health is critical, as dysfunction can result in conditions such as hepatitis, cirrhosis, and hepatocellular carcinoma [13]. Contributing factors to liver disease include viral infections, alcohol abuse, exposure to hepatotoxins, obesity, diabetes, and autoimmune disorders [14] [15] [16].

Histomorphological and immunohematological alterations in the liver—such as hepatocellular degeneration, inflammation, fibrosis, and cytokine imbalance—can profoundly impact hepatic function [17] [18] [19]. These changes often exacerbate liver injury and impair homeostasis, emphasizing the need for therapeutic strategies that target these underlying mechanisms [20]. Technological advances, including CRISPR-Cas9 gene editing, have further enhanced the utility of albino rat models for investigating liver pathophysiology and drug metabolism [21].

**MATERIALS AND METHODS**

**Materials**

The materials used in this study included twenty-four (24) adult albino rats aged 8–10 weeks and weighing between 150–200 grams. Fresh leaves of *Telfairia occidentalis* and *Jatropha tanjorensis*, standard rat chow and clean drinking water. Additional equipment and reagents included oral gavage needles, surgical instruments for tissue collection, 10% neutral buffered formalin, paraffin wax, embedding materials, an automatic tissue processor, oven, microtome, slide dryer, histological stains (hematoxylin and eosin, Perl’s Prussian blue), a light microscope with digital imaging capabilities, EDTA and serum separator tubes for blood collection, a centrifuge, automated hematology analyzer, and biochemical assay kits for liver function analysis.

**Study Area**

The study was carried out in the Histology Unit of the Department of Anatomy at Olabisi Onabanjo University, Sagamu, Ogun State, Nigeria. The laboratory is geographically located at latitude N6°55.5201′ and longitude E3°52.6013′ [22].

**Procurement of Animals**

Twenty-four (24) adult albino rats were sourced from the Animal House of the Faculty of Basic Medical Sciences at Olabisi Onabanjo University, Sagamu. All animals were maintained under standard laboratory conditions and given a two-week acclimatization period before the experiment began.

**Preparation of *Telfairia occidentalis* Ethanolic Extract**

Fresh leaves of *Telfairia occidentalis* were collected from a local farm and identified in the Department of Pharmacology, Olabisi Onabanjo University. It is then washed with distilled water to remove debris, and air-dried at ambient temperature (25–30°C) for 5 to 7 days until completely dry. The dried leaves were ground into a fine powder using an electric grinder. A hundred grams (100 g) of this powder were soaked in 1000 ml of 80% ethanol in a 1:10 weight/volume ratio and left to macerate for 48 hours with intermittent shaking. The resulting mixture was filtered using Whatman No. 1 filter paper, and the filtrate was concentrated using a rotary evaporator at 40°C. The extract was stored at 4°C in airtight containers and freshly reconstituted in distilled water each day before administration at dosages of 400 mg/kg and 800 mg/kg as guided by the protocol of Gull et al [23].

**Preparation of *Jatropha tanjorensis* Ethanolic Extract**

Similarly, *Jatropha tanjorensis* leaves were harvested, washed with distilled water, and air-dried at room temperature for 7 to 10 days. The leaves were ground into powder and 100 g of the powder were soaked in 1000 ml of 70% ethanol (1:10 w/v). The mixture was left to macerate for 72 hours with intermittent agitation. After filtration through Whatman No. 1 paper, the filtrate was concentrated at 40°C using a rotary evaporator. The final extract was stored in airtight containers at 4°C. Working solutions were freshly prepared daily by diluting in distilled water and administered at 250 mg/kg and 500 mg/kg body weight, according to previously established protocols [9]

**Experimental Design**

The experiment was conducted using a randomized, controlled design. The 24 rats were randomly divided into four groups of six animals each. Control group received only standard rat chow and clean water throughout the study duration. Group A(GA) received a low-dose combination of *Telfairia occidentalis* and *Jatropha tanjorensis* extracts at 250 mg/kg. Group B(GB) was administered a mid-dose combination of the two extracts at 500 mg/kg, while Group C(GC) received a high-dose combination totaling 750 mg/kg. All treatments were administered daily by oral gavage for a continuous period of 42 days, and evaluations were conducted at 14-day intervals (i.e., after 2, 4, and 6 weeks).

**Ethical Approval**

Prior to the commencement of the study, ethical clearance was obtained from the Institutional Animal Care and Use Committee (IACUC) of Edo State University, Uzairue. All experimental procedures followed the guidelines of the National Research Council’s *Guide for the Care and Use of Laboratory Animals* (24) to ensure humane treatment.

**Histomorphological Analysis**

At the end of each treatment period (14, 28, and 42 days), rats were humanely sacrificed through cervical dislocation. Liver tissues were excised immediately and fixed in 10% neutral buffered formalin for at least 24 hours. The samples were processed using an automated tissue processor, following standard dehydration and clearing steps in ascending concentrations of alcohol (70% to absolute), xylene, and paraffin wax. Embedding was done using paraffin blocks, and tissue sections were cut at 10µm and subsequently at 4–5 µm thickness using a rotary microtome [25].

For histological evaluation, sections were stained with hematoxylin and eosin (H&E). Slides were dewaxed in two changes of xylene (10 minutes each), rehydrated in descending grades of alcohol (100% to 70%), stained in Harris hematoxylin for 5 minutes, differentiated in 1% acid alcohol for 15 seconds, and blued under running tap water for 10 minutes. This was followed by counterstaining with 1% eosin for 2 minutes, dehydration in ascending alcohol concentrations, clearing in xylene, and mounting in DPX. Stained slides were examined under a light microscope and photomicrographs were obtained.

**Perl’s Prussian Blue Staining for Iron**

For detection of iron deposits, sections were stained using Perl’s Prussian blue method. Deparaffinized and hydrated sections were immersed in a freshly prepared 1:1 mixture of 2% hydrochloric acid and 2% potassium ferrocyanide for 20 minutes. After rinsing in distilled water, sections were counterstained with nuclear fast red for 5 minutes, dehydrated through ascending alcohol concentrations, cleared in xylene, and mounted with DPX. Microscopic observations were made under ×10 and ×40 magnification.

**Hematological and Biochemical Assays**

Blood samples were collected at the end of each treatment period via retro-orbital or cardiac puncture, depending on ethical requirements. Samples were collected into EDTA tubes for hematological analysis and into plain tubes for serum separation.

Hematological assessments included was hemoglobin (Hb), packed cell volume ( PCV), white blood cell (WBC).

For biochemical evaluation, serum was analyzed for liver function indicators, including alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP), total and conjugated bilirubin using standard diagnostic kits in accordance with manufacturer instructions.

**Data Analysis**

Data were presented as mean ± standard deviation (SD). Statistical comparisons among groups were carried out using one-way analysis of variance (ANOVA) in SPSS version 20 (IBM Corp., Armonk, NY, USA). A *p*-value less than 0.05 was considered statistically significant.

**RESULT**

**TABLE 1. AVERAGE BODY WEIGHT AND LIVER WEIGHT (2 Weeks)**

| **Parameter** | **Control** | **GA 2wks**  **250mg/kg** | **GB 2wks**  **500mg/kg** | **GC 2wks**  **750mg/kg** | **F-value** | **P-value** |
| --- | --- | --- | --- | --- | --- | --- |
| **Body**  **Weight (g)** | 203 ±  0.96 | 179  ± 0.72ᵃ | 137 ±  2.08ᵃᵇ | 135  ± 1.81ᵃᵇ | 0.367 | 0.05\* |
| **Liver Weight (g)** | 5.72  ± 0.63 | 6.21 ±  1.88 | 4.53  ± 0.56ᵃᵇ | 5.15 ±  0.04ᵇ | 86.095 | 0.04\* |

Table 1 presents the mean ± standard deviation values for body weight and liver weight across experimental groups.Superscripts indicate significant differences at p < 0.05. At 2 weeks, body weight was significantly reduced in all treated groups (GA, GB, and GC) compared to the control group (p = 0.05). This shows a dose-dependent reduction in weight, more pronounced at higher doses (GB and GC). Liver Weight was significantly lower in GB compared to Control (ᵃ) and GA (ᵇ), and GC was significantly lower than GA (ᵇ).(p = 0.04).

**Keys:** GA=Group A(250mg/kg), GB=Group B(500mg/kg), GC=Group C (750 mg/kg). (ᵃ = vs. Control, ᵇ = vs. GA, ᶜ = vs. GC).

**TABLE 2. AVERAGE BODY WEIGHT AND LIVER WEIGHT (4 Weeks )**

| **Parameter** | **Control** | **GA 4wks**  **250mg/kg** | **GB 4wks**  **500mg/kg** | **GC 4wks**  **750mg/kg** | **F-value** | **P-value** |
| --- | --- | --- | --- | --- | --- | --- |
| **Body Weight (g)** | 160 ±  1.41 | 178  ± 1.83ᵃ | 186  ± 2.12ᵃ | 183  ± 1.86ᵃ | 0.63 | 0.04\* |
| **Liver Weight (g)** | 7.67  ± 1.86 | 6.25 ±  0.98 | 6.69 ±  1.63 | 6.23 ±  1.83 | 0.09 | 0.06 |

Table 2 presents the mean ± standard deviation values for body weight and liver weight across experimental groups.Superscripts indicate significant differences at p < 0.05. At 4 weeks, body weight increased significantly in all treated groups compared to control (p = 0.04), suggesting a reversal of the earlier weight loss seen at 2 weeks.

Liver weights, however, showed no statistically significant differences (p = 0.06). (ᵃ = vs. Control, ᵇ = vs. GA, ᶜ = vs. GC).

**TABLE 3. AVERAGE BODY WEIGHT AND LIVER WEIGHT (6 Weeks)**

| **Parameter** | **Control** | **GA 6wks** | **GB 6wks** | **GC 6wks** | **F-value** | **P-value** |
| --- | --- | --- | --- | --- | --- | --- |
| **Body Weight (g)** | 201  ± 1.63 | 216  ± 2.17 | 224 ±  0.38 | 196  ± 2.08 | 0.28 | 0.08 |
| **Liver Weight (g)** | 7.0 ±  0.72 | 7.2 ±  2.13 | 8.5  ± 0.16ᵃᵇᶜ | 6.8 ±  0.04 | 0.23 | 0.04\* |

Table 3 presents the mean ± standard deviation values for body weight and liver weight across experimental groups. Superscripts indicate significant differences at p < 0.05. At 6 weeks, body weight was not significantly different among groups (p = 0.08). The GB group recorded the highest mean body weight (224 ± 0.38 g), followed by GA (216 ± 2.17 g), Control (201 ± 1.63 g), and GC (196 ± 2.08 g). Despite these numerical differences, they did not reach statistical significance.Liver weight showed a significant difference across groups (p = 0.04). The GB group had the highest mean liver weight (8.5 ± 0.16 g), which was significantly elevated compared to the other groups.( ᵃ = vs. Control, ᵇ = vs. GA, ᶜ = vs. GC).

**TABLE 4. HEMATOLOGICAL PARAMETERS (FULL BLOOD COUNT) 2 WEEKS**

| **Parameter** | **Control** | **GA 2wks**  **250mg/kg** | **GB 2wks**  **500mg/kg** | **GC 2wks**  **750mg/kg** | **F-value** | **P-value** |
| --- | --- | --- | --- | --- | --- | --- |
| **PCV (%)** | 38.33  ± 0.74 | 36.45 ±  0.03 | 41.54  ± 0.002 | 40.43 ±  1.90 | 40.25 | 0.08 |
| **HB (g/dL)** | 12.72  ± 0.54 | 12.01 ±  0.01 | 13.71  ± 0.002 | 13.3 ±  0.002 | 112.67 | 0.92 |
| **WBC (cells/μL)** | 5100  ± 0.13 | 3500  ± 0.004ᵃ | 4600  ± 0.002ᵃ | 5900  ± 0.14ᵇᶜ | 1211.00 | 0.04\* |

Table 4 Statistical analysis of Packed cell volume (PCV), hemoglobin concentration (HB) and white blood cell count (WBC) were compared across groups, with values expressed as mean ± standard deviation.Superscripts indicate significant differences at p = 0.05). Packed Cell Volume (PCV) shows no statistically significant difference (p = 0.083) Haemoglobin (HB) shows significant difference was observed (p = 0.92), but higher haemoglobin values were recorded in GB (13.71 ± 0.002 g/dL) and GC (13.30 ± 0.002 g/dL) compared to the control (12.72 ± 0.54 g/dL). White Blood Cells (WBC) shows no significant overall effect (p = 0.043), with GA (3500 ± 0.04ᵃ) and GB (4600 ± 0.02ᵃ) showing lower counts compared to control (5100 ± 0.13), while GC (5900 ± 0.14ᵇᶜ) had significantly elevated WBC. ᵃ = vs. Control, ᵇ = vs. GA, ᶜ = vs. GC.

**HEMATOLOGICAL PARAMETER (4 WEEKS)**

TABLE 5. Statistical analysis of Full Blood Count for the rats of the 4 weeks period for the 4 groups

| **Parameter** | **Control** | **GA 4wks**  **250mg/kg** | **GB 4wks**  **500mg/kg** | **GC 4wks**  **750mg/kg** | **F-value** | **P-value** |
| --- | --- | --- | --- | --- | --- | --- |
| **PCV (%)** | 36.32  ± 1.16 | 41.35  ± 2.06ᵃ | 41.54  ± 2.02ᵃ | 42.35  ± 0.04ᵃ | 42.24 | 0.03\* |
| **HB (g/dL)** | 12.21  ± 1.61 | 13.80  ± 1.39ᵃ | 13.81  ± 0.25ᵃ | 14.41  ± 0.54ᵃ | 36.67 | 0.04\* |
| **WBC (×10³/μL)** | 10.11  ± 1.61 | 9.41  ± 0.09 | 10.01  ± 1.66 | 10.31  ± 0.60 | 1421 | 0.06 |

Table 5 Statistical analysis of Packed cell volume (PCV), hemoglobin concentration (HB) and white blood cell count (WBC) were compared across groups, with values expressed as mean ± standard deviation.Superscripts indicate significant differences at p < 0.05). Packed Cell Volume reveal no statistically significant increase across all treatment groups compared to the control (p = 0.03), all showed elevated PCV values relative to the control. Haemoglobin (HB) shows significant increase in haemoglobin concentration was also observed (p = 0.04). Treated groups demonstrated elevated levels compared to the control (12.21 ± 1.61). White Blood Cells (WBC) shows statistically significant difference was noted (p = 0.06), though a slight decrease in WBC was observed in GA (9.41 ± 0.09) compared to the control (10.11 ± 1.61), while GB (10.01 ± 1.66) and GC (10.31 ± 0.60) remained comparable. ᵃ = vs. Control, ᵇ = vs. GA, ᶜ = vs. GC.

**HEMATOLOGICAL PARAMETERS (6 WEEKS)**

TABLE 6. Statistical analysis of Full Blood Count for the rats of the 6 weeks period for the 4 groups.

| **Parameter** | **Control** | **GA 6wks**  **250mg/kg** | **GB6wks**  **500mg/kg** | **GC 6wks**  **750mg/kg** | **F-value** | **P-value** |
| --- | --- | --- | --- | --- | --- | --- |
| **PCV (%)** | 38 ± 0.94 | 42 ± 2.08ᵃ | 43 ± 1.92ᵃ | 45 ± 0.31ᵃ | 27.54 | 0.04\* |
| **HB (g/dL)** | 12.8 ± 0.49 | 14.2 ± 1.54ᵃ | 14.5  ± 0.54ᵃᵇ | 15.0  ± 1.90ᵃᵇᶜ | 142.63 | 0.03\* |
| **WBC (cells/μL)** | 10,700  ± 0.025 | 10,200  ± 0.004 | 10,100  ± 0.24 | 11,600  ± 0.04 | 1021 | 0.71 |

Table 6 Statistical analysis of full blood count tests for the rats of the 6 weeks period for the 4 groups. PCV shows that there was a significant increase in PCV across all treatment groups.All showed elevated PCV values compared to the control (38 ± 0.94). HB levels increased significantly(p = 0.03) with treatment Groups showing progressively higher haemoglobin concentrations relative to the control (12.8 ± 0.49).WBC shows no statistically significant change in WBC counts (p = 0.71). ᵃ = vs. Control, ᵇ = vs. GA, ᶜ = vs. GC.

**LIVER FUNCTION TESTS 2 WEEKS**

TABLE 7. Statistical analysis of liver function tests for the rats of the 4 weeks period for the 4 groups

| **Parameter** | **Control** | **GA 2wks**  **250mg/kg** | **GB 2wks**  **500mg/kg** | **GC 2wks**  **750mg/kg** | **F-value** | **P-value** |
| --- | --- | --- | --- | --- | --- | --- |
| **AST (U/L)** | 9 ± 1.03 | 6 ± 0.02ᵃ | 7 ± 0.50ᵃ | 7 ± 0.72ᵃ | 14.21 | 0.01\* |
| **ALT (U/L)** | 5 ± 1.43 | 4 ± 0.76 | 4 ± 1.88 | 3 ± 1.03 | 2.00 | 0.19 |
| **ALP (U/L)** | 353 ±  1.63 | 283 ±  1.41ᵃ | 243 ±  0.56ᵃᵇ | 323 ±  0.20ᵃᶜ | 5.924 | 0.02\* |
| **T.Bil (mg/dL)** | 0.43± 1.68 | 0.43 ±  1.45 | 0.43 ±  0.54 | 0.43 ±  0.54 | 0.363 | 0.36 |
| **Conj.Bil (mg/dL)** | 0.1 ± 1.88 | 0.2 ± 1.74 | 0.1 ± 1.90 | 0.1 ± 0.80 | 22.18 | 0.20 |

Table 7: presents the mean ± standard deviation values for various liver function parameters across experimental groups. GA: Low dose (250 mg/kg), GB: Medium dose (500 mg/kg) and GC: High dose (750 mg/kg). AST was significantly reduced in all treated groups (GA, GB, GC) compared to control (p = 0.01). ALT showed no significant difference across all groups (p = 0.19).ALP levels were significantly lower in GA and GB compared to control (p = 0.02), while GC showed a partial reversal. There was no significant difference in total bilirubin levels across all groups (p = 0.36). Although the F-value was high (22.18), the p-value (0.20) indicates a non-significant difference. ᵃ = vs. Control, ᵇ = vs. GA, ᶜ = vs. GC.

**LIVER FUNCTION TESTS 4 WEEKS**

TABLE 8. Statistical analysis of liver function tests for the rats of the 4 weeks period for the 4 groups

| **Parameter** | **Control** | **GA 4wks**  **250mg/kg** | **GB 4wks**  **500mg/kg** | **GC 4wks**  **750mg/kg** | **F-value** | **P-value** |
| --- | --- | --- | --- | --- | --- | --- |
| **AST (U/L)** | 13.0  ± 1.61 | 9.5 ± 0.65ᵃ | 9.1 ± 1.01ᵃ | 8.9 ± 0.18ᵃ | 23.42 | 0.026\* |
| **ALT (U/L)** | 3.4 ± 0.87 | 3.0 ± 1.71 | 3.3 ± 1.16 | 3.4 ± 0.65 | 18.61 | 0.27 |
| **ALP (U/L)** | 34 ± 1.41 | 33 ± 2.06 | 32 ± 0.07 | 36 ± 1.86 | 3.39 | 0.080 |
| **T.Bil (mg/dL)** | 0.71  ± 1.43 | 0.14  ± 0.63ᵃ | 0.10  ± 2.08ᵃ | 0.10  ± 0.04ᵃ | 0.53 | 0.05\* |
| **Conj.Bil (mg/dL)** | 0.36  ± 0.65 | 0.12  ± 0.58ᵃ | 0.06  ± 1.39ᵃ | 0.04  ± 1.86ᵃ | 16.28 | 0.03\* |

Table 8: Statistical analysis of liver function tests for the rats of the 4 weeks period for the 4 groups. presents the mean ± standard deviation values for various liver function parameters across experimental groups. There was a significant reduction in AST levels in all treatment groups (GA, GB, and GC) compared to the control (p = 0.03). ALT levels showed no significant difference across the groups (p = 0.26). ALP levels showed no statistically significant changes among groups (p = 0.08), though there was a mild increase in GC. A significant reduction in total bilirubin was observed in all treated groups relative to control (p = 0.05). Conjugated bilirubin was significantly decreased in GA, GB, and GC (p = 0.030). ᵃ = vs. Control, ᵇ = vs. GA, ᶜ = vs. GC.

**LIVER FUNCTION TESTS 6 WEEKS**

TABLE 9. Statistical analysis of liver function tests for the rats of the 6 weeks period for the 4 groups.

| **Parameter** | **Control** | **GA 6wks**  **250mg/kg** | **GB 6wks**  **500mg/kg** | **GC 6wks**  **750mg/kg** | **F-value** | **P-value** |
| --- | --- | --- | --- | --- | --- | --- |
| **AST (U/L)** | 10.0  ± 1.39 | 10.6  ± 1.92 | 11.0  ± 0.96 | 9.9 ± 0.07 | 6.26 | 0.10 |
| **ALT (U/L)** | 4.3  ± 0.47 | 3.6  ± 1.39 | 2.9  ± 0.85ᵃᵇ | 4.1 ± 0.06 | 18.61 | 0.05\* |
| **ALP (U/L)** | 48 ± 0.94 | 42 ± 1.84 | 37 ± 1.64 | 36 ± 0.63 | 0.42 | 0.061 |
| **T.Bil (mg/dL)** | 0.16  ± 0.47 | 0.15  ± 0.72 | 0.12  ± 2.08 | 0.11  ± 0.40 | 0.28 | 0.086 |
| **Conj.Bil (mg/dL)** | 0.04  ± 0.47 | 0.04  ± 0.43 | 0.06  ± 0.52 | 0.05  ± 0.25 | 21.33 | 0.130 |

Table 9: Statistical analysis of liver function tests for the rats of the 6 weeks period for the 4 groups. presents the mean ± standard deviation values for various liver function parameters across experimental groups. Superscripts indicate significant differences at p = 0.05.). Aspartate Aminotransferase shows no significant difference among groups (p = 0.10). Alanine Aminotransferase (ALT) shows significant reduction in GB (2.9 ± 0.85 U/L) compared to control and other groups (p = 0.05). ALP levels were lower in all treated groups, especially GC (36 ± 0.63 U/L), though not statistically significant (p = 0.06). T.Bil shows slight reductions in treated groups, particularly GC (0.11 ± 0.40 mg/dL), with no statistical significance (p = 0.09). Conjugated Bilirubin shows no significant changes observed (p = 0.130). ᵃ = vs. Control, ᵇ = vs. GA, ᶜ = vs. GC.

**Histology Results (H & E)**

Comparative liver sections of albino rats administered graded doses of Telfairia occidentalis and Jatropha tanjorensis extract for 2 weeks (X400)

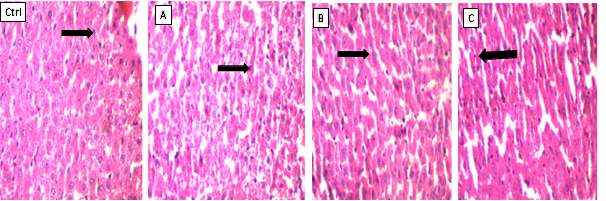


PLATE 1: Ctr- Contrrol,A- Group A, B- Group B, C- Group C sections: Showing hepatocytes (arrow) with eosinophili ccytoplasm surrounding a centrally normochromic nuclei with distinct nucleoli. All features in keeping with normal hepatocytes.

Comparative liver sections of albino rats administered graded doses of *Telfairia occidentalis* and *Jatropha tanjorensis* extract for 4 weeks (X400)

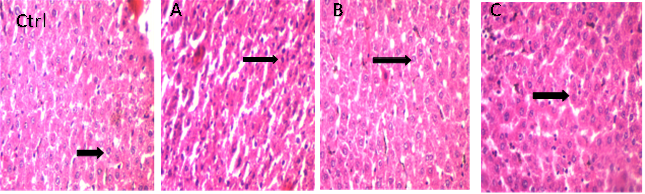


PLATE 2: Ctr- Contrrol,A- Group A, B- Group B, C- Group C sections: Showing hepatocytes (arrow) with eosinophiliccytoplasm surrounding a centrally normochromic nuclei with distinct nucleoli. All features in keeping with normal hepatocytes.

Comparative liver sections of albino rats administered graded doses of *Telfairia occidentalis* and *Jatropha tanjorensis* extract for 6 weeks (X400)

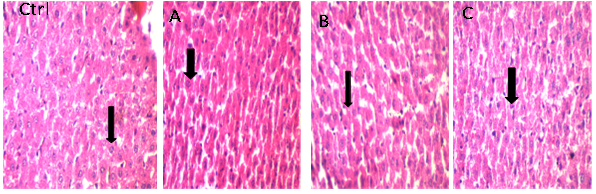


PLATE 3: Ctr- Contrrol,A- Group A, B- Group B, C- Group C sections: Showing hepatocytes (arrow) with eosinophiliccytoplasm surrounding a centrally normochromic nuclei with distinct nucleoli. features in keeping with normal hepatocytes.

**Perl’s Prussian Blue**

Composite Liver Histology of Albino Rats Administered *Telfairia occidentalis and Jatropha tanjorensis* Extracts, Showing Hepatic Iron Deposition (Perl’s Prussian Blue, x400)

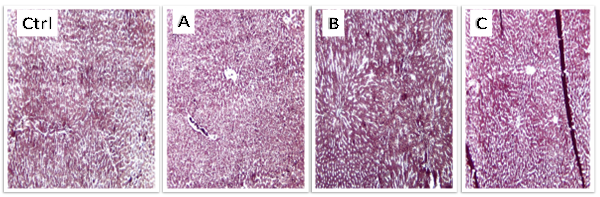


Plate 4: Ctr- Contrrol,A- Group A, B- Group B, C- Group C. Sections of liver shows mild, diffuse blue staining of hepatocytes indicative of physiological iron distribution. No abnormal or excessive hemosiderin acccumulation is observed, reflecting normal hepatic iron metabolism.

**DISCUSSION**  
The liver is a pivotal organ involved in metabolic homeostasis, detoxification, protein synthesis, and the regulation of hematopoietic function. Due to its central role and high metabolic demand, it remains particularly susceptible to damage from xenobiotics, oxidative stress, and inflammatory stimuli [26]. While conventional pharmaceuticals offer effective treatment options for hepatic and hematologic disorders, their prolonged use has often been associated with hepatotoxicity [15].

This study aimed to address that gap by evaluating the hepatic and hematological effects of co-administered T. occidentalis and J. tanjorensis extracts in albino rats. The experimental design involved three doses (250, 500, and 750 mg/kg) administered over durations of 2, 4, and 6 weeks, closely mimicking traditional co-administration practices. Evaluations were carried out using a comprehensive approach that included biochemical assays, hematological profiling, and histological analyses using Hematoxylin and Eosin (H&E) and Perl’s Prussian Blue staining.

The results demonstrated that the combined administration of these extracts led to a progressive reduction in liver enzyme levels—specifically ALT, AST, and ALP—as well as in bilirubin concentrations, indicating a potential hepatoprotective effect. Hematological indices, including packed cell volume (PCV), hemoglobin levels, and white blood cell were either stable or improved, suggesting no evidence of hemolysis or bone marrow suppression. The biochemical markers assessed—ALT, AST, ALP, total and conjugated bilirubin—are known to be sensitive indicators of liver integrity. In the present study, ALT and AST levels were consistently elevated in the untreated control group compared to the extract-treated groups across all durations, indicating hepatocellular leakage in untreated animals. In contrast, the decline in enzyme levels among the treated groups implied a protective effect on hepatocyte membranes, possibly due to membrane stabilization and decreased oxidative injury. The downward trend in AST and ALT with increasing dose and duration was especially marked at 500 and 750 mg/kg after six weeks of treatment. These observations align with previous findings by Airaodion et al. [1], who reported reduced liver enzyme activities following T. occidentalis administration in diabetic rats, as well as Iroanya et al. [9], who observed hepatoprotection from J. tanjorensis against acetaminophen-induced toxicity.

Similarly, ALP levels were reduced in the treated groups compared to controls. Since ALP elevation typically indicates biliary obstruction or cholestatic injury, its suppression in this context suggests maintained biliary function. These findings corroborate those of Falodun et al. [6], who reported that J. tanjorensis preserved biliary integrity in hepatotoxic rat models. Additionally, bilirubin levels, both total and conjugated, showed a decreasing trend across treated groups by the 4th and 6th weeks of administration, pointing to efficient hepatic uptake and conjugation processes. This suggests improved bilirubin metabolism and clearance, further supporting the protective role of the extracts.

The dose-dependent improvements observed in enzyme profiles and bilirubin levels also suggest that the medium and high doses of the extracts were more effective, particularly over longer durations. This cumulative effect may be attributed to phytochemicals such as flavonoids and saponins, which are known to possess antioxidant and anti-inflammatory properties [7].

Contrary to concerns raised by Iyare et al. [10] regarding hepatocellular damage at high doses of J. tanjorensis, no such adverse effects were evident in this study. This discrepancy may be explained by the protective influence of T. occidentalis, which is rich in antioxidant compounds such as quercetin and gallic acid [2], potentially mitigating any toxic effects through synergistic interactions.

The hematological analysis further emphasized the absence of toxic or suppressive effects.Hemoglobin levels, and hematocrit values were maintained within normal physiological ranges across all treated groups, suggesting preserved erythropoietic function. These observations are consistent with earlier findings showing that T. occidentalis enhances hematological parameters in anemia models [1]. WBC counts and differential analyses revealed moderate fluctuations, especially in neutrophil and lymphocyte percentages, which likely reflect immunomodulatory rather than inflammatory responses. This effect could be attributed to the immunoenhancing properties of flavonoids and alkaloids found in the extracts, as noted by Ndem et al. [27] and supported by previous observations by Omoregie and Osagie [5].

Perl’s Prussian Blue staining showed mild iron to no deposition in hepatic tissues across all groups, indicating physiological levels of iron storage. The slightly increased staining in extract-treated animals after 4 and 6 weeks may reflect enhanced iron uptake or metabolism, possibly mediated by improved erythropoiesis and hepatic iron regulation. This observation aligns with previous findings by Iyare et al. [10], who suggested that *J. tanjorensis* modulates systemic iron distribution.

Histopathological evaluation reinforced these findings, as liver sections stained with H&E demonstrated generally preserved hepatic architecture. Doses (250, 500 and 750 mg/kg) showed no histological abnormalities, indicating that co-administration at these doses is safe. These findings are in contrast to the hepatotoxicity reported by Iyare et al. [10] with J. tanjorensis alone, suggesting that T. occidentalis may provide a buffering or synergistic protective effect through its antioxidant mechanisms.

The observed mild hemosiderin staining was diffuse and did not exhibit dense zonal accumulation, suggesting intact iron regulatory mechanisms. Combined with normal bilirubin and hemoglobin values, this supports the interpretation that hepatic iron storage remained physiological and non-pathological.

A significant strength of this study lies in its evaluation of the combined effect of T. occidentalis and J. tanjorensis, reflecting the reality of their traditional use. The observed dose- and time-dependent trends in enzyme normalization, hematologic stability, and histological preservation strongly indicate synergistic effects between the phytochemicals of both plants. These compounds, including flavonoids, alkaloids, saponins, and phenolic acids, are known for their hepatoprotective and hematopoietic effects [7], and their co-administration likely enhances efficacy through complementary mechanisms.

Importantly, no signs of toxicity or antagonism were observed, even at the highest dose of 750 mg/kg for six weeks, affirming the safety of this combination.

These findings are consistent with previous studies that demonstrated hepatoprotective and hematopoietic benefits of both plants. Airaodion et al. [1] reported improved liver function and hemoglobin levels with T. occidentalis, while Omoregie and Osagie [8] confirmed the hematological and hepatic safety of J. tanjorensis. In contrast, Iyare et al. [10] observed liver damage and hemoglobin suppression following prolonged use of J. tanjorensis alone, suggesting that such risks may be mitigated by combining it with antioxidant-rich plants like T. occidentalis.

**CONCLUSION**

This study assessed the hepatic and hematological effects of co-administered Telfairia occidentalis and Jatropha tanjorensis extracts in rats over six weeks. Results showed no hepatotoxicity; instead, biochemical and hematological markers remained stable or improved, particularly at 500 and 750 mg/kg. Liver histology showed preserved architecture without inflammation or fibrosis.

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