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EFFECTS OF *IRVINGIA WOMBOLU* LEAF EXTRACT ON SERUM LIPID PROFILE AND HEPATIC BIOMARKERS IN MALE WISTAR RATS

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ABSTRACT

Despite the well-documented nutritional value of *Irvingia wombolu* seeds, limited research has explored the biochemical impact of its leaves. This study assessed the effects of aqueous leaf extract of *Irvingia wombolu* on lipid profile, total protein, albumin, and bilirubin levels in male Wistar rats. Twelve rats were randomly assigned into three groups: a control group receiving distilled water, and two treatment groups receiving 200 mg/kg and 400 mg/kg body weight of the extract orally for 28 days. Blood samples were collected on days 0, 1, 14, 21, and 28 to analyze serum lipid and hepatic biomarkers. The results showed no statistically significant changes ($p < 0.05$) in lipid parameters or hepatic biomarkers between control and treated groups, with all values remaining within normal physiological ranges. These findings suggest that *Irvingia wombolu* leaf extract is biochemically safe at the tested doses, although further research is needed to explore higher doses and longer durations for potential therapeutic effects.

KEYWORDS: *Irvingia wombolu, Lipid profile, Albumin, Biomarkers, Hepatic, Orally.*

INTRODUCTION

In recent years, there has been a growing global demand for plant-based, natural alternatives to synthetic drugs, particularly in managing metabolic and liver-related disorders. This resurgence of interest in traditional medicine has emphasized the need for scientific validation of ethnomedicinal plants. Medicinal plants are frequently used for their affordability, accessibility, and cultural acceptance, especially in developing countries. According to the World Health Organization (WHO), more than 70% of the global population relies on traditional medicine, with medicinal plants constituting a significant component (D'Almeida et al., 2024).

One such plant of interest is *Irvingia wombolu*, a member of the *Irvingiaceae* family, commonly known as bitter bush mango. While the seeds of this plant are widely used in West African culinary practices as thickeners in soups (e.g., ogbono), its leaves are relatively underutilized despite their potential nutritional and medicinal value. Traditionally, parts of the *Irvingia* species have been used in the treatment of various ailments, including fever, pain, gastrointestinal disorders, and infections (Nguena-Dongue et al., 2023). The leaves are believed to possess antioxidant, anti-inflammatory, and lipid-lowering properties due to their phytochemical content, including flavonoids and saponins (Anbessa et al., 2024; Omale et al., 2024).

Lipid metabolism and liver function are essential aspects of human health, with dysregulation often leading to diseases such as hyperlipidemia, atherosclerosis, and hepatic dysfunction. Key biomarkers like total cholesterol, LDL (low-density lipoprotein), HDL (high-density lipoprotein), triglycerides, total protein, albumin, and bilirubin serve as indicators of these conditions. Plant-based agents capable of modulating these parameters without toxicity are of considerable therapeutic interest.

However, most studies on *Irvingia* focus on its seeds, leaving a knowledge gap regarding the safety and potential biochemical effects of its leaves. Addressing this gap, the present study investigates the impact of aqueous leaf extract of *Irvingia wombolu* on serum lipid profile and hepatic biomarkers in male Wistar rats, aiming to evaluate its potential as a safe dietary or medicinal agent.

MATERIALS AND METHODS

Plant Preparation and Extraction

Fresh leaves of *Irvingia wombolu* were collected, washed, air-dried, and ground into powder. Aqueous extraction was carried out, and the extract was stored under refrigerated conditions until use.

Animal Grouping and Treatment

Twelve healthy male Wistar rats were randomly divided into three groups (n = 4 each).

- Group A (Control): Distilled water
- Group B (Low dose): 200 mg/kg of extract
- Group C (High dose): 400 mg/kg of extract

All administrations were oral and continued daily for 28 days.

Sample Collection and Biochemical Analysis

Blood samples were collected from the submandibular vein on days 0, 1, 14, 21, and 28. Serum was separated and analyzed for total cholesterol, triglycerides, HDL, LDL, total protein, albumin, and bilirubin using standard enzymatic and colorimetric methods.

RESULTS

The results of the present study are presented in tables 3.1, 3.2 3.3 3.4, 3.5, 3.6 and 3.7 below. Tables 3.1, 3.2 3.3 3.4, 3.5 show the changes in serum Total cholesterol, triglycerides, HDL, LDL, total protein, albumin and bilirubin, respectively, in male Wistar rats administered with aqueous leaf extract of *Irvingia Wombulu* for 28 days.

Table 3.1: Changes in serum Total cholesterol(mg/dl) concentration in male Wistar rats administered with aqueous leaf extract of *Irvingia Wombulu* for 28 days.

	Normal control	*Irvingia Wombulu* (200mg/kg)	*Irvingia Wombulu* (400mg/kg)
DAY 0	141.99±5.23[a]	143.10±3.12[a]	141.06±4.76[a]
DAY 7	140.97±4.07[a]	142.77±6.21[a]	140.86±4.76[a]
DAY 1	142.53±3.21[a]	141.90±2.78[a]	139.75±5.02[a]
DAY 14	140.66±3.82[a]	142.75±3.76[a]	142.56±3.48[a]
DAY 21	138.34±3.12[a]	142.55±2.87[a]	140.07±3.18[a]
DAY 28	140.56±3.22[a]	140.44±3.78[a]	139.66±4.28[a]

The data are presented as the mean ± standard Deviation (SD) for a sample size of 4. Different superscripts (a, b, c, d, e) indicate statistical significance ($p < 0.05$) among means within the same row.

Results showed that administration of aqueous leaf extract *Irvingia wombulu* (200 mg/kg extract, and 400 mg/kg) did not cause a significant (p<o.o5j change in serum total cholesterol at all time point of the study. All groups showed comparable baseline total cholesterol levels (Control: 141.99 ± 5.23, 200 mg/kg: 143.10 ± 3.12 and 400 mg/kg: 141.06 ± 4.76 respectively). There were minor fluctuations within a narrow range (138.34–142.53) across days, reflecting normal physiological variability. 200 mg/kg group remained stable (140.44–143.10), with no consistent upward or downward trend. Similarly, 400 mg/kg group was stable (139.66–142.56), compared to the control group.

Table 3.2: Changes in serum Triglycerides (mg/dl) concentration in male Wistar rats administered with aqueous leaf extract of *Irvingia Wombulu* for 28 days.

	Normal control	*Irvingia Wombulu* (200mg/kg)	*Irvingia Wombulu* (400mg/kg)
DAY 0	4.25±0.43[a]	4.08±0.51[a]	4.30±1.86[a]
DAY 0	4.34±0.02[a]	4.40±0.36[a]	4.22±0.87[a]
DAY 1	4.18±0.16[a]	4.31±1.24[a]	4.36±1.04[a]
DAY 14	4.22±0.72[a]	4.20±0.66[a]	4.28±0.38[a]
DAY 21	4.38±0.52[a]	4.26±0.57[a]	4.27±1.17[a]
DAY 28	4.27±1.18[a]	4.22±0.49[a]	4.23±0.47[a]

The data are presented as the mean ± standard Deviation (SD) for a sample size of 4. Different superscripts (a, b, c, d, e) indicate statistical significance ($p < 0.05$) among means within the same row.

Results showed that Aqueous leaf extract of *Irvingia wombulu* (at 200 mg/kg and 400 mg/kg) did not significantly affect serum triglyceride levels in male Wistar rats over 28 days relative to normal control. All groups (Normal control, 200 mg/kg, and 400 mg/kg) had similar triglyceride levels (4.08–4.40 mg/dl). Over the 28 days, no significant changes in triglyceride levels were observed in any group: Values remained stable (4.18–4.38 mg/dl) across all time points (Days 1, 14, 21, 28).

Table 3.3 Changes in serum HDL (mg/dl) concentration in male Wistar rats administered with aqueous leaf extract of *Irvingia Wombulu* for 28 days.

	Normal control	*Irvingia Wombulu* (200mg/kg)	*Irvingia Wombulu* (400mg/kg)
DAY 0	89.88±5.03[a]	92.36±4.11[a]	90.76±2.44[a]
DAY 7	90.11±4.09[a]	90.88±5.15[a]	92.86±5.05[a]
DAY 1	90.68±3.69[a]	90.68±5.02[a]	93.04±5.29[a]
DAY 14	89.58±4.88[a]	91.38±3.78[a]	91.54±2.22[a]
DAY 21	92.08±3.27[a]	90.84±3.82[a]	92.46±4.05[a]
DAY 28	91.45±1.18[a]	90.44±4.71[a]	91.95 ±3.86[a]

The data are presented as the mean ± standard Deviation (SD) for a sample size of 4. Different superscripts (a, b, c, d, e) indicate statistical significance ($p < 0.05$) among means within the same row.

Results revealed that Aqueous leaf extract of *Irvingia wombulu* (200 mg/kg and 400 mg/kg) did not significantly alter serum HDL levels in healthy male Wistar rats over 28 days. At baseline HDL Levels (Day 0), all groups started with similar HDL levels (~89.88–92.36 mg/dl). Over the 28 days, no significant changes in HDL levels were observed in any group (control, 200 mg/kg, or 400 mg/kg). Values remained stable (~89.58–93.04 mg/dl) across all time points (Days 7, 14, 21, 28).

Table 3.4: Changes in serum LDL (mg/dl) concentration in male Wistar rats administered with aqueous leaf extract of *Irvingia Wombulu* for 28 days.

	Normal control	*Irvingia Wombulu* (200mg/kg)	*Irvingia Wombulu* (400mg/kg)
DAY 0	69.98±2.64[a]	72.26±4.11[a]	70.73±3.87[a]
DAY 1	67.55±4.02[a]	70.44±3.86[a]	68.96±4.01[a]
DAY 7	69.44±4.66[a]	71.85±4.44[a]	69.67±3.55[a]
DAY 14	70.11±2.89[a]	72.18±5.02[a]	71.03±4.02[a]
DAY 21	68.95±3.52[a]	71.97±2.85[a]	70.76±3.11[a]
DAY 28	70.12±4.66[a]	70.86±4.22[a]	70.45 ±3.58[a]

The data are presented as the mean ± standard Deviation (SD) for a sample size of 4. Different superscripts (a, b, c, d, e) indicate statistical significance ($p < 0.05$) among means within the same row.

Results showed that all groups started with comparable LDL levels (69.98–72.26 mg/dl), indicated by Over 28 Days, no significant changes in LDL levels were observed in any group (control, 200 mg/kg, or 400 mg/kg). Values remained stable (67.55–72.18 mg/dl) across all time points (Days 1, 7, 14, 21, 28) when compared with the normal control.

Table 3.5 Changes in serum Total protein (g/dl) concentration in male Wistar rats administered with aqueous leaf extract of *Irvingia Wombulu* for 28 days.

	Normal control	*Irvingia Wombulu* (200mg/kg)	*Irvingia Wombulu* (400mg/kg)
DAY 0	9.11±1.02[a]	7.95±1.75[a]	7.77±1.02[a]
DAY 1	8.85±1.21[a]	8.21±1.86[a]	7.95±1.41[a]
DAY 7	8.90±0.89[a]	8.42±1.62[a]	8.08±2.21[a]
DAY 14	8.64±1.85[a]	8.46±2.07[a]	8.26±1.60[a]
DAY 21	8.44±2.12[a]	7.88±1.88[a]	8.42±1.22[a]
DAY 28	9.22±1.96[a]	8.08±1.26[a]	7.98±1.42[a]

The data are presented as the mean ± standard Deviation (SD) for a sample size of 4. Different superscripts (a, b, c, d, e) indicate statistical significance ($p < 0.05$) among means within the same row.

Results reveal that the aqueous extract of *Irvingia wombulu* at 200 mg/kg and 400 mg/kg did not significantly alter serum total protein levels in Wistar rats over 28 days compared to normal controls. Normal control group had the highest initial total protein (9.11 ± 1.02 g/dL), while both treatment groups started at lower levels (200 mg/kg: 7.95 ± 1.75 g/dL; 400 mg/kg: 7.77 ± 1.02 g/dL). Over 28 Days of the study, normal control fluctuated slightly but remained near baseline (8.44–9.22 g/dL), ending at 9.22 ± 1.96 g/dL on Day 28. 200 mg/kg group showed minor variations (7.88–8.46 g/dL) with no clear upward/downward trend, ending at 8.08 ± 1.26 g/dL. 400 mg/kg group showed similarly variable (7.95–8.42 g/dL), ending slightly lower (7.98 ± 1.42 g/dL) than baseline.

Table 3.6: Changes in serum albumin (g/dl) concentration in male Wistar rats administered with aqueous leaf extract of *Irvingia Wombulu* for 28 days.

	Normal control	*Irvingia Wombulu* (200mg/kg)	*Irvingia Wombulu* (400mg/kg)
DAY 0	4. 68±0.56[a]	5.11±1.14[a]	5.02±0.91[a]
DAY 1	4.75±1.02[a]	5.08±1.10[a]	5.16±0.85[a]
DAY 7	5.12±1.22[a]	4.97±0.98[a]	5.21±1.88[a]
DAY 14	5.02±0.42[a]	4.86±0.42[a]	5.26±0.58[a]
DAY 21	4.86±0.97[a]	5.21±0.72[a]	5.00±1.07[a]
DAY 28	5.12±0.92[a]	5.20±1.06[a]	4.88±0.63[a]

The data are presented as the mean ± standard Deviation (SD) for a sample size of 4. Different superscripts (a, b, c, d, e) indicate statistical significance ($p < 0.05$) among means within the same row.

Results revealed that the aqueous extract of *Irvingia wombulu* at 200 mg/kg and 400 mg/kg did not significantly alter serum albumin levels in Wistar rats over 28 days compared to normal controls.At Day 0), The normal control group started with an albumin level of 4.68 ± 0.56 g/dL, while the treatment groups had slightly higher baseline values (200 mg/kg: 5.11 ± 1.14 g/dL; 400 mg/kg: 5.02 ± 0.91 g/dL). Over the 28 days, normal control group fluctuated within a narrow range (4.68–5.12 g/dL), peaking on Day 7 (5.12 ± 1.22 g/dL) and ending at 5.12 ± 0.92 g/dL on Day 28. 200 mg/kg group remained stable (4.86–5.21 g/dL) with a slight increase by Day 28 (5.20 ± 1.06 g/dL). 400 mg/kg group showed minor variations (4.88–5.26 g/dL), with the highest level on Day 14 (5.26 ± 0.58 g/dL) and a slight decline by Day 28 (4.88 ± 0.63 g/dL).

Table 3.7: Changes in serum total bilirubin (g/dl) concentration in male Wistar rats administered with aqueous leaf extract of *Irvingia Wombulu* for 28 days.

	Normal control	*Irvingia Wombulu* (200mg/kg)	*Irvingia Wombulu* (400mg/kg)
DAY 0	0.43±0.02[a]	0.38±0.01[a]	0.42±0.02[a]
DAY 1	0.40±0.02[a]	0.38±0.01[a]	0.37±0.01[a]
DAY 7	0.42±0.02[a]	0.41±0.02[a]	0.40±0.02[a]
DAY 14	0.44±0.01[a]	0.40±0.02[a]	0.41±0.01[a]
DAY 21	0.39±0.02[a]	0.39±0.01[a]	0.44±0.02[a]
DAY 28	0.41±0.02[a]	0.42±0.01[a]	0.42±0.01[a]

The data are presented as the mean ± standard Deviation (SD) for a sample size of 4. Different superscripts (a, b, c, d, e) indicate statistical significance ($p < 0.05$) among means within the same row.

Results revealed that aqueous extract of *Irvingia wombulu* at 200 mg/kg and 400 mg/kg did not significantly alter serum total bilirubin levels in Wistar rats over 28 days compared to normal controls. At baseline Levels (Day 0), the normal control group started with a bilirubin level of 0.43 ± 0.02 mg/dL, while the treatment groups had slightly lower values (200 mg/kg: 0.38 ± 0.01 mg/dL; 400 mg/kg: 0.42 ± 0.02 mg/dL). Over 28 Days, normal control fluctuated minimally (0.39–0.44 mg/dL) with no consistent upward or downward trend, ending at 0.41 ± 0.02 mg/dL on Day 28. 200 mg/kg group remained stable (0.38–0.42 mg/dL) with a slight increase by Day 28 (0.42 ± 0.01 mg/dL). 400 mg/kg group showed minor variations (0.37–0.44 mg/dL), peaking on Day 21 (0.44 ± 0.02 mg/dL) and stabilizing by Day 28 (0.42 ± 0.01 mg/dL).

DISCUSSION

The present study investigated the effects of aqueous leaf extract of *Irvingia wombulu* on selected serum biochemical parameters in male Wistar rats over a 28-day period. Parameters assessed included total cholesterol, triglycerides, high-density lipoprotein (HDL), low-density lipoprotein (LDL), total protein, albumin, and total bilirubin concentrations.

Administration of *Irvingia wombulu* extract at 200 mg/kg and 400 mg/kg did not cause any statistically significant changes ($p < 0.05$) in serum total cholesterol levels compared to the normal control group throughout the study period. Cholesterol levels in all groups remained relatively stable, fluctuating only within a narrow physiological range. These findings suggest that *Irvingia wombulu* does not exert hypercholesterolemic or hypocholesterolemic effects in healthy rats under normal physiological conditions. This observation aligns with previous studies indicating that certain plant extracts can maintain lipid homeostasis without causing significant deviations in cholesterol levels when administered under non-pathological conditions (Souid *et al*., 2024).

Similarly, no significant alterations in serum triglyceride concentrations were observed across the groups. Triglyceride values remained consistently within a stable range (4.08–4.40 mg/dL) throughout the study period. The stability of triglyceride levels further supports the notion that the aqueous extract does not adversely affect lipid metabolism in normal physiological states. These results are comparable to findings from other studies

evaluating natural extracts with neutral or protective effects on lipid profiles (Oyepata, *et al*., 2024).

HDL levels, a critical marker of cardiovascular protection, were also not significantly affected by *Irvingia wombulu* administration. Baseline HDL values were similar among groups and remained within a narrow physiological range (~89.58–93.04 mg/dL) across the 28 days. Maintenance of HDL concentrations without a decline suggests that the extract neither impaired HDL synthesis nor promoted its catabolism, further indicating a lack of dyslipidemic risk associated with its use.

Regarding LDL cholesterol, which is commonly implicated in atherogenesis, no significant changes were recorded. LDL values remained stable between 67.55–72.18 mg/dL across all groups and time points. The lack of LDL elevation may imply that *Irvingia wombulu* does not promote lipid peroxidation or atherogenic processes under normal conditions, thereby supporting its potential cardiovascular safety profile.

In the evaluation of serum total protein, no significant differences were observed between the control and treated groups. Although the control group exhibited slightly higher initial total protein levels, the variations observed during the study were minor and lacked a consistent trend. Protein levels remained within normal physiological limits, suggesting that *Irvingia wombulu* does not impair protein metabolism or synthesis in the liver, an organ primarily responsible for maintaining serum protein concentrations (Wen *et al*., 2024).

Serum albumin, a critical protein involved in maintaining oncotic pressure and transporting various endogenous and exogenous substances, also remained unaffected by extract administration. Across all groups, albumin concentrations fluctuated slightly but showed no significant or clinically relevant trends. This further suggests that the extract does not compromise hepatic synthetic function.

Similarly, serum total bilirubin levels, an indicator of liver function and hemolysis, remained stable throughout the study. Minor fluctuations observed in bilirubin levels did not differ significantly between control and treated groups. The absence of bilirubin elevation indicates that *Irvingia wombulu* extract does not induce hepatocellular injury or excessive erythrocyte breakdown during the 28-day administration period.

CONCLUSION

Overall, the results demonstrated that *Irvingia wombulu* aqueous leaf extract at both 200 mg/kg and 400 mg/kg doses is biochemically safe in healthy male Wistar rats over a 28-day administration period. The extract did not induce dyslipidemia, protein imbalance, or liver dysfunction, thus supporting its potential safety for use. However, it is important to note that the lack of significant biochemical changes does not preclude potential therapeutic effects under pathological conditions (e.g., hyperlipidemia or hepatic dysfunction), which were not evaluated in this study.

These findings are consistent with previous reports highlighting the relative biochemical safety of other *Irvingia* species, such as *Irvingia gabonensis*, in experimental models. Nevertheless, further studies involving histopathological evaluations, oxidative stress markers, and disease models are warranted to fully elucidate the pharmacological and toxicological profiles of *Irvingia wombulu*.

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