Original Research Article

Assessment of the Effect of Hydro-Ethanolic Extracts of *Xylopiaaethiopica* and *Zingiberofficinale* on Some Haematological and Biochemical Profiles in Wistar Rats

ABSTRACT

In recent years, plant-derived natural products have gained significant attention for their diverse pharmacological benefits.This study assessed the effect of hydro-ethanolic extracts of *Xylopiaaethiopica (locally called Uda)*and *Zingiberofficinale*on some haematological and biochemical profiles in Wistar rats. A total of 55 albino rats weighing about 120g were assigned to five groups. The first group acted as the control, while the other four groups received a daily dose of 100mg/kg body weight of *Xylopiaaethiopica* and *Zingiberofficinale* extracts, along with the drug Astymin, for 28 days. Blood samples were collected through cardiac puncture from each animal to assess specific biochemical and haematological parameters. The statistical analysis used was Graph Pad Prism version 9.02.The results showed that extracts, both individually and in combination, significantly reduced renal and liver inflammation, as indicated by lower levels of creatinine, urea, chloride, potassium, and aminotransferases (AST and ALT). Both extracts reduced cardiovascular disease risk by lowering total cholesterol and triglycerides while increasing HDL-cholesterol. *Xylopiaaethiopica* reduced triglycerides to 0.68±0.01 mmol/L, while *Zingiberofficinale* reduced them to 0.95±0.01 mmol/L, both significantly lower than the control value of 1.16±0.03 mmol/L. For HDL-cholesterol, *Xylopiaaethiopica* increased it to 1.18±0.01 mmol/L, *Zingiberofficinale* to 0.81±0.01 mmol/L, and the combination to 1.23±0.02 mmol/L, all significantly higher than the control level of 0.98±0.01 mmol/L. The study indicates that both extracts, at a 100 mg/kg dose for up to 4 weeks, are safe for therapeutic use without causing organ toxicity.

Keywords: *Xylopiaaethiopica*,*Zingiberofficinale*, cardiovascular, inflammation

1.0 INTRODUCTION

The use of plants and plant-derived products in traditional medicine has spanned centuries, serving as essential tools for treating various ailments and maintaining overall health. Across many cultures, different plant parts, including seeds, roots, leaves, barks, and fruits, have been utilized for their therapeutic benefits [1]. The integration of herbal medicine into healthcare systems has also significantly contributed to the discovery and development of modern pharmacological agents. Indeed, more than 50% of contemporary drugs are derived from plants, with their therapeutic efficacy rooted in the presence of bioactive phytochemicals such as alkaloids, tannins, flavonoids, and phenolic compounds [2][3][4].

In many developing regions, particularly in Africa, herbal medicine plays a crucial role in primary healthcare, with approximately 85% of the population relying on traditional remedies for disease management. This reliance stems not only from accessibility but also the recognized pharmacological properties of medicinal plants, including antioxidant, anti-inflammatory, and antimicrobial activities [5][6]. Despite the wide utilization of medicinal plants, a significant number remain underexplored, leaving gaps in the scientific understanding of their therapeutic potential[3][7].

Two plants of notable interest in West African traditional medicine are *Xylopiaaethiopica* and *Zingiberofficinale*. *Xylopiaaethiopica*, commonly known as "uda" in southeastern Nigeria, is a slender tree native to regions including Nigeria, Ghana, and Cameroon. Its seeds and leaves have been employed for managing conditions such as rheumatism, asthma, neuralgia, and colic pain, as well as in promoting postpartum recovery [8][6]. The reported pharmacological properties of the plant include anti-malarial, analgesic, antioxidant, anti-inflammatory, and antibacterial effects [9][8]. Additionally, its fruit-derived aromatic oils have found applications as insect repellents [10].

Zingiberofficinale, or ginger, is another extensively utilized plant with a longstanding history in traditional and modern medicine. A member of the Zingiberaceae family, ginger is prized for its culinary and medicinal properties. The rhizome is rich in phytochemicals such as gingerols, shogaols, and paradols, which exhibit potent antioxidant, anti-inflammatory, and cardioprotective effects [11] [12]. These bioactive constituents make ginger effective in managing gastrointestinal disorders, metabolic syndromes, and inflammatory conditions [13][11]. Furthermore, its high concentrations of minerals, trace elements, and fibre contribute to its classification as a nutraceutical [14].

Figure 1: Rhizome of Ginger Plant [12]

a b c d

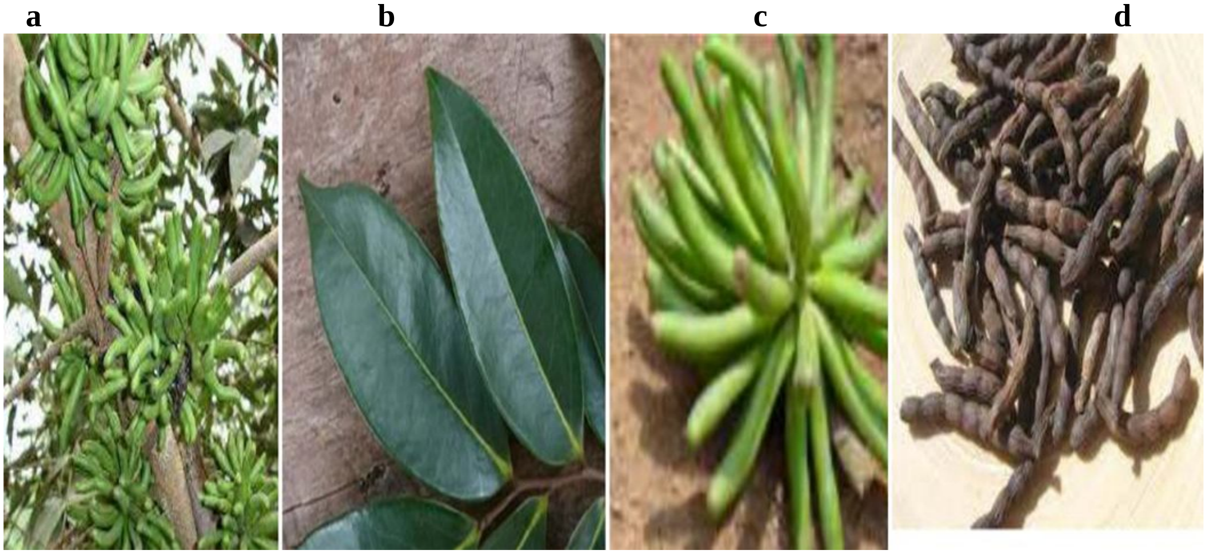

Figure 2: Various forms of *Xylopiaaethiopica* (Uda) including its fruits on the tree (a), leaves (b), fruit clusters (c), and dried fruits (d) [15]

Given the diverse pharmacological potentials of *Xylopiaaethiopica* and *Zingiberofficinale,* this study seeks to assess the effect of their hydro-ethanolic extracts on some haematological and biochemical profiles in Wistar rats. Knowing the effects of these extracts could provide insights into their possible therapeutic applications and safety, further supporting their use in traditional and modern medicine.

2.0 MATERIALS AND METHODS

2.1 Plant Identification, Procurement, and Crude Extract Preparation

Xylopiaaethiopica and *Zingiberofficinale* were procured from a Market in Port Harcourt Nigeria, and authenticated by the Department of Plant Biology and Biotechnology, Rivers State University, Port Harcourt, Nigeria. The plant materials were sun-dried and ground into a fine powder using a laboratory mortar. One kilogram of the powdered sample was mixed with 500 mL of distilled water and 500 mL of 100% alcohol in a sealed glass container, stored at room temperature away from sunlight, and shaken daily for two weeks. The resulting tincture was filtered to remove plant residues and evaporated under pressure with a Rotary Evaporator to yield a dry extract. The prepared extracts were stored and later administered intragastrically at a dose of 100 mg/kg body weight. The dose was prepared by dissolving 500 mg of dry extract in 5 mL of distilled water to achieve a 100 mg/mL concentration.

2.2 Procurement, Handling, and Treatment of Animals

A total of 55 male and female Wistar albino rats, each weighing approximately 120 g, were obtained from the University of Port Harcourt Animal Farm for the study. The rats were acclimatized for one week in accordance with the guidelines of the National Institute for the Use of Animal Experiments. They were housed in groups of seven per standard cage, measuring 40 × 60 mm, and provided with 8 mm feed pellets of 20g/day and unlimited access to cool clean water. Housing conditions included a 12-hour light/dark cycle, ambient temperature of 22 ± 2°C, and humidity maintained at 50 ± 10%. Strict hygiene practices were upheld to ensure reliable experimental outcomes.

2.3 Experimental Design

The animals were divided into five groups, each consisting of eleven randomly selected rats. The treatment regimenwas administered over four weeks with specific dosages. Group 1, served as the control, received 1 mL of distilled water daily. Group 2 was treated with *Xylopiaaethiopica* extract at a dosage of 100 mg/kg, equivalent to 0.12 mL per 120 g rat administered daily. Group 3 received *Zingiberofficinale* extract at the same dosage and administration schedule as Group 2. Group 4 was treated with a combined dosage of *X. aethiopica* and *Z. officinale* extracts, each at 100 mg/kg. Finally, Group 5 received Astymin at a dosage of 100 mg/kg, or 0.12 mL per 120 g rat, administered daily for the four-week duration (28 days).

2.4 Sample Collection, Preparation, and Analysis

At the end of the treatment period, the animals were fasted overnight and subsequently anesthetized with chloroform. A total of seven millilitres (7 mL) of whole blood were collected via cardiac puncture. Out of this, 3 mL of the blood was placed in lithium heparin tubes for biochemical analysis, while 2 mL was placed in EDTA tubes for haematological analysis. The remaining 2 mL was transferred into fluoride oxalate bottles for the immediate measurement of fasting blood glucose (FBG). Plasma was separated from the lithium heparin samples by centrifugation at 3,500 rpm for 10 minutes and transferred into plain tubes using a Pasteur pipette. All samples were stored at 2–4°C until analysis. The haematological analysis was done using the SYSMEX pocH-100i Automated Haematology Analyzer. Biochemical parameters were analysed as follows: Alanine Aminotransferase (ALT) and Aspartate Aminotransferase (AST) using the Reitman & Frankel Method, urea using the Urease-Berthelot Colorimetric Method, creatinine by the Picrate Method, electrolytes (Sodium, Potassium, Chloride, and Bicarbonate) using the Selective Electrode Method, triglycerides, total cholesterol, and high-density lipoprotein (HDL) by enzymatic methods.

2.6 Statistical Analysis

The raw data collected from the laboratory analyses were statistically processed using GraphPad Prism Version 9.02. The results were presented as Mean ± SD. For inferential statistics, One-

Way ANOVA, Pearson correlation, and Student's t-test were employed. A p-value of less than 0.05 was considered statistically significant.

3.0 RESULTS

Results of Biochemical and Haematological Parameters from Different Treatment Groups

The biochemical and haematological parameters in rats treated with Uda alone, Ginger alone, Uda and Ginger combination, and Astymin alone demonstrated notable differences compared to the control group, as shown in **Tables 1, 2, and 3**.

For creatinine levels, Uda alone (48.98 ± 0.56mmol/L)and Ginger alone(42.75 ± 1.20mmol/L)resulted in significantly lower values compared to the control, while the Uda and Ginger combination and Astymin alone showed significantly higher values. Regarding urea concentration, Uda alone caused a significant decrease, while Ginger alone, Uda and Ginger combination and Astymin alone led to significantly higher levels compared to the control. In terms of potassium levels, all treatment groups (Uda alone, Ginger alone, Uda and Ginger combination, and Astymin alone) exhibited significantly lower values than the control. Uda alone had the lowest potassium levels, followed by Ginger alone, Uda and Ginger combination, and Astymin alone. For chloride, Uda alone, Ginger alone, and Astymin alone showed significantly lower values compared to the control, while the Uda and Ginger combination had significantly higher values. Additionally, Uda alone had significantly lower chloride levels compared to the Uda and Ginger combination.

When considering AST, all treatment groups exhibited significantly lower values compared to control, but Uda alone and the Uda and Ginger combination had higher values compared to Ginger alone and Astymin alone. Ginger alone showed the lowest AST values. Regarding ALT, Ginger alone and Astymin alone produced significantly lower values, whereas Uda alone and the Uda and Ginger combination led to significantly higher ALT levels compared to control. Furthermore, Ginger alone, the Uda and Ginger combination, and Astymin alone caused significantly lower ALT values when compared to Uda alone.

In the case of glucose, Uda alone, Ginger alone, Uda and Ginger combination, and Astymin alone caused significantly higher levels compared to the control. However, Uda alone had significantly lower glucose levels compared to Ginger alone, Uda and Ginger combination, and Astymin alone. Ginger alone exhibited significantly higher glucose levels compared to the Uda and Ginger combination and Astymin alone. Regarding total cholesterol (TC), Uda alone, Uda and Ginger combination, and Astymin alone caused significantly higher TC levels compared to control, while Ginger alone exhibited significantly lower TC levels. Uda alone had higher TC values compared to Ginger alone and Astymin alone, while the Uda and Ginger combination had higher values than all other groups. For triglycerides (TG), Uda alone, Ginger alone, and Astymin alone exhibited significantly lower TG levels, while the Uda and Ginger combination had significantly higher levels compared to the control. Also, Ginger alone, Uda and Ginger combination and Astymin alone showed significantly higher TG values compared to Uda alone. In addition, the Uda and Ginger combination and Astymin alone had higher TG levels compared to Ginger alone, while Astymin alone exhibited lower levels compared to the Uda and Ginger combination.

For HDL, Uda alone and the Uda and Ginger combination showed significantly higher levels, while Ginger alone had significantly lower levels compared to the control group. When comparing Uda alone to other treatments, Ginger alone and Astymin alone exhibited significantly lower HDL levels. Furthermore, both the Uda and Ginger combination and Astymin alone had significantly higher HDL levels compared to Ginger alone, with Astymin alone showing significantly lower HDL levels compared to the Uda and Ginger combination.

Haematological parameters, such as Hb showed significantly higher values in all treatment groups compared to the control, with Uda alone showing the highest levels. For Mean Corpuscular Volume (MCV)Uda alone and the Uda and Ginger combination had significantly lower values compared to control, while ginger alone and Astymin alone exhibited significantly higher MCV levels. Additionally, both Ginger alone and Astymin alone had significantly higher MCV values compared to Uda alone, and Astymin alone showed significantly higher MCV values compared to both Ginger alone and the Uda and Ginger combination.

Finally, when examining Mean Corpuscular Haemoglobin MCH and Platelet (PLT), Uda alone and the Uda and Ginger combination had significantly lower values compared to the control, while Astymin alone exhibited significantly higher values. Ginger alone, the Uda and Ginger combination, and Astymin alone had significantly higher MCH and PLT values compared to Uda alone. In addition, the Uda and Ginger combination showed significantly lower MCH and PLT values compared to Ginger alone, while Astymin alone exhibited significantly higher values compared to the Uda and Ginger combination.

Table 1: Comparison of Renal Parameters and Liver Enzymes Among Treatment Groups and Control

	Creatinine mmol/L	Urea mmol/L	Potassium mmol/L	Chloride mmol/L	AST UI	ALT UI
Control	51.70 ± 0.91^{a}	6.58 ± 0.08^{a}	8.05 ± 0.08^{a}	103.98 ± 0.75^{a}	186.88± 5.16^{a}	64.02 ± 0.83a
Uda 100mg/kg	48.98 ± 0.56^{ac}	6.29 ± 0.13^{ac}	4.76 ± 0.6^{bc}	100.29 ± 0.81^{bc}	130.73 ± 1.1^{bc}	67.32 ± 0.80^{bc}
Ginger 100mg/kg	42.75 ± 1.20^{bde}	7.78 ± 0.4^{bde}	5.22 ± 0.41^{bde}	100.69 ± 0.36^{bce}	104.90 ± 0.51^{bde}	61.85 ± 0.36^{bde}
Uda& Ginger100mg/kg	52.98 ± 0.96^{adfg}	6.83 ± 0.08^{adfg}	5.54 ± 0.32^{bdfg}	113.22 ± 0.16^{bdfg}	145.14 ± 4.31^{bdfg}	66.65 ± 0.35^{bceg}
Astymin 100mg/kg	52.17 ± 0.31^{acfg}	7.05 ± 0.06^{bdeh}	5.79 ± 0.09^{bdfh}	95.46 ± 1.85^{acfg}	145.13 ± 2.44^{bdfg}	58.18 ± 2.32^{bdfh}
p-values	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
F-values	23.47	56.85	45.87	49.33	38.47	37.71

Note: The superscripts in the same column “a, c, e & g” do not vary significantly from the control and the various groups, while superscripts “b, d, and h” vary significantly from the control and various groups.

Table 2: Comparison of Blood Glucose and Lipid Profiles Among Treatment Groups and Control

	Glucose mmol/L	TC mmol/L	TG mmol/L	HDL mmol/L
Control	4.22 ± 0.08^{a}	1.60 ± 0.03^{a}	1.16 ± 0.03^{a}	0.98 ± 0.01^{a}
Uda 100mg/kg	5.77 ± 0.06^{bc}	1.82 ± 0.01^{bc}	0.68 ± 0.01^{bc}	1.18 ± 0.01^{bc}
Ginger 100mg/kg	7.81 ± 0.11^{bde}	1.20 ± 0.01^{bde}	0.95 ± 0.01^{bde}	0.81 ± 0.01^{bde}
Uda& Ginger100mg/kg	6.50 ± 0.08^{bdfg}	1.92 ± 0.01^{bdfg}	1.37 ± 0.02^{bdfg}	1.23 ± 0.02^{bcfg}
Astymin 100mg/kg	4.74 ± 0.04^{bdfh}	1.65 ± 0.01^{bdfh}	1.12 ± 0.01^{bdfh}	1.02 ± 0.01^{adfh}
p-values	<0.0001	<0.0001	<0.0001	<0.0001
F-values	33.49	24.76	36.16	34.23

Note: The superscripts "a, c, e & g" do not vary significantly from the control and the various groups, while superscripts "b, d, and h" vary significantly from the control and various groups.

Table 3: Comparison of Haematological Parameters Among Treatment Groups and Control

	Hbg/dL	MCVfL	MCH pg	PLT (10^9/L)
Control	11.63 ± 0.05^{a}	56.45 ± 0.08^{a}	18.02 ± 0.06^{a}	637.69 ± 7.69^{a}
Uda 100mg/kg	12.52 ± 0.05^{bc}	53.41± 0.16^{bc}	16.81 ± 0.03^{bc}	608.41 ± 7.31^{bc}
Ginger 100mg/kg	12.25 ± 0.02^{bde}	56.72 ± 0.13^{ade}	18.69 ± 0.02^{bde}	616.43 ± 7.14^{ace}
Uda& Ginger100mg/kg	12.03 ± 0.02^{bdfg}	54.42 ± 0.14^{bcfg}	17.61 ± 0.4^{bdfg}	519.97 ± 2.22^{bdfg}
Astymin 100mg/kg	15.84 ± 0.38^{bdfg}	57.0 ± 0.16^{bdgh}	20.55 ± 0.41^{bdfh}	671.33 ± 2.18^{bdfh}
p-values	<0.0001	<0.0001	<0.0001	<0.0001
F-values	45.13	25.7	39.9	36.23

Note: The superscripts “a, c, e & g” do not vary significantly from the control and the various groups, while superscripts “b, d, and h” vary significantly from the control and various groups.

4.0 DISCUSSION

This study evaluated the effects of hydro-ethanolic extracts of *Xylopiaaethiopica* (Uda) and *Zingiberofficinale* (Ginger) on renal, hepatic, metabolic, and haematological parameters in Wistar rats.

The rats treated with Uda (100mg/kg) showed significantly lower levels of creatinine and urea, indicating improved renal function. Increased plasma levels of creatinine and urea are typically associated with renal dysfunction, such as azotaemia and uraemia. These findings align with previous studies [16]. The reduction in creatinine and urea levels is likely linked to the antioxidant properties of the plant extracts, which help reduce reactive oxygen species [17]. Electrolyte imbalances (potassium and chloride) further suggest modified renal health, with altered levels potentially reflecting homeostatic changes, particularly in acid-base balance. This is consistent with the work of[18] and [19], who also highlighted the antioxidant and protective properties of these plants.

In terms of liver function, treatment with both ginger and Uda led to significantly lower AST levels at 100mg/kg. This decrease suggests the extracts do not cause liver inflammation or toxicity, confirming their protective effects on the liver. ALT and AST are key markers for liver injury, and their reduction indicates the absence of hepato-toxicity, in line with previous findings [20].

A significant increase in blood glucose levels was observed in all treatment groups, indicating a hyperglycaemic effect of both Uda and Ginger extracts. This finding contrasts with a previous study [21], which reported hypoglycaemic effects of *X. aethiopica*. The observed increase in glucose could result from the activation of enzymes that promote hepatic glycogen breakdown or inhibition of those involved in glycogen synthesis, as suggested by[22].

When administered separately or together, both Uda and ginger significantly reduced total cholesterol and triglycerides and increased HDL levels. These effects, observed in a dose-dependent manner, indicate beneficial effects on lipid metabolism. The observed hypolipidemic effects may be attributed to bioactive compounds like 6-shogaol and 6-gingerol, which inhibit lipogenesis and reduce plasma-free fatty acid concentrations. Increased HDL is particularly advantageous for cardiovascular health, as it helps transport lipids from blood vessels to the liver for metabolism [20].

Treatment with Uda and ginger significantly increased haemoglobin, mean cell haemoglobin (MCH), and platelet counts at100mg/kg. This change may be linked to the antioxidant and hematopoietic properties of the compounds, particularly 6-shogaol, which reduces oxidative stress and enhances erythropoiesis. This aligns with findings by [23] where 6-shogaol reduced free radical-induced cell damage, promoting blood cell production.

5.0 CONCLUSION

The treatment groups showed varied effects on renal, hepatic, metabolic, and haematological parameters. Uda alone improved renal function and haematological values, while the Uda and ginger combination and Astymin increased certain metabolic markers. Uda and ginger affected lipid levels differently, with Uda showing overall improvements in cholesterol and HDL, but the combination increased triglycerides. Blood glucose levels were elevated, with Uda alone showing the lowest. The findings suggest that Uda and ginger have complex, dose-dependent therapeutic effects that warrant further exploration.Uda and ginger seemed to show promising effects on renal, metabolic and haematological parameters, however, it is recommended that due to complex does dependent therapeutic further exploration is needed.

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