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EVALUATION OF TOXIC EFFECTS OF POTASH ADDED TO JUTE LEAF ON SOME BIOLOGICAL PARAMETERS IN ALBINO RATS

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ABSTRACT

Potash is a common food tenderizer widely used in developing countries for its ability to improve the texture and palatability of food. Although its culinary and health benefits are often emphasized, excessive or prolonged consumption of potash may pose potential health risks. This study was designed to evaluate the effects of potash on the liver and kidney functions of albino rats. Twenty (28) albino rats were randomly divided into four (4) groups. Group A received potash alone; Group B received potash + jute leaves; Group C received jute leaves alone, while Group D received distilled water (control). After 14 days of treatment, blood samples were collected for biochemical analyses, including aspartate aminotransferase (AST), alanine aminotransferase (ALT), gamma-glutamyl transferase (GGT). Liver and kidney tissues were also harvested for histopathological examination. There were significant increases ($p < 0.05$) in the levels of AST, ALT and GGT in rats treated with potash compared to control group, indicating hepatic and renal impairment. Histological examination of the liver from potash-treated rats showed sinusoidal congestion, hepatocellular degeneration characterized by deep eosinophilic staining, enlarged nuclei and disorganized hepatic cords. Similarly, kidney sections from potash-treated rats revealed degeneration of collecting ducts and inflammation of the glomeruli.

Keywords: Albino rat; Jute leaves; Potash; Biochemical, contents; Kidney; Liver,

INTRODUCTION

Potash, commonly referred to as Kaun in many African regions, is a naturally-occurring alkaline salt traditionally used in food processing, agriculture and indigenous medicine. In Northen Nigeria, it is known as Kanwa. The term "potash" broadly encompasses potassium bearing salts, such as potassium carbonate, potassium chloride and potassium sulfate, which play critical roles in soil fertility, food security and human nutrition (Olanrewaju *et al.,* 2022). Potash (Kaun) has long been valued for its diverse applications in food preparation, traditional medicine and household practices across many African cultures. Its usefulness is rooted in both its chemical composition and functional properties, particularly its alkaline nature and high potassium content (Eze *et al.,* 2022). In food science, potash is widely utilized as a tenderizing and emulsifying agent in the preparation of indigenous dishes such as ewedu, ogbono and gbegiri soups, as well as in beans and vegetable processing (Bamidele and Sanni, 2021). The alkaline nature of potash reduces cooking time by softening hard food materials such as cowpeas, beans and certain leafy vegetables. It also improves the palatability and texture of meals (Aliyu *et al.,* 2022). Kaun is often added to local delicacies such as "okro soup" and "ewedu" to enhance viscosity, giving the soup a desirable slimy texture (Yakubu *et al.,* 2020).

Potash also plays a role in food preservation. Its alkaline property can inhibit microbial growth, thereby extending the shelf life of some local food preparations. However, its ability to break down fibrous plant tissues enhances texture and palatability, thus improving food quality and digestibility (Oladipo *et al.,* 2021). Several studies have highlighted that moderate consumption of potash, when properly purified, can contribute trace amounts of potassium beneficial for cardiovascular and muscular health (Hassan *et al.,* 2024).

In traditional medicine, Kaun is commonly employed for its perceived therapeutic effects. It is used to relieve heartburn, stomach upset and constipation, owing to its mild alkalinity that can neutralize excess gastric acid (Ojo and Adekunle, 2023). Its alkaline nature provides antacid and antimicrobial properties, which can neutralize gastric acid and inhibit bacterial growth (Oloruntoba *et al.,* 2022). Despite these benefits, unregulated consumption or prolonged exposure to impure potash has been linked to renal, hepatic and gastrointestinal toxicity (Adebayo *et al.,* 2020).

Adequate potash intake is associated with reduced blood pressure, improved cardiovascular health and protection against osteoporosis and kidney stones (Whelton *et al.,* 2021). Some local healers apply potash as an ingredient in herbal remedies for coughs, toothache and skin infections, attributing antimicrobial and soothing effects to it (Eze *et al.,* 2022). Potash also serves as an essential ingredient in indigenous soap and detergent production, acting as a natural saponifying agent (Bamidele and Sanni, 2021). Beyond culinary and medicinal applications, the mineral salts in potash contribute to biochemical processes such as enzyme activation, carbohydrate metabolism and cellular osmotic balance (Adeyemi *et al.,* 2023). Potassium ions help in maintaining membrane potential and intracellular homeostasis, which are fundamental to neuromuscular and cardiac functions (Olawale *et al.,* 2021). Hence, when consumed responsibly and in refined form, Kaun can play a supplementary role in human nutrition and health.

However, it is important to emphasize that the benefits of potash are dose-dependent. While small amounts may aid digestion and mineral replenishment, excessive intake or consumption of unrefined forms can negate its usefulness due to impurities and high alkalinity (Hassan *et al.,* 2024). Kaun is commonly used as an antacid for the treatment of stomach discomfort, heartburn, and peptic ulcer symptoms (Aliyu *et al.,* 2022). It is also applied externally to wounds and skin infections due to its perceived antiseptic properties. Among women in northern Nigeria, Kanwa??? is traditionally used during postpartum care, believed to aid in uterine cleansing and recovery (Yakubu *et al.,* 2020).

Excessive consumption of potash has been linked to electrolyte imbalance, kidney impairment and gastrointestinal disturbances (Adebayo *et al.,* 2020). Thus, while potash holds cultural and nutritional importance, its potential toxicological effects highlight the need for stricter quality control and regulated consumption. Global demand for potash has increased in recent years due to rising population pressures and intensification of agriculture (Huang *et al.,* 2021).

Potash (Kaun) embodies a complex duality of usefulness and risk. Its agricultural, nutritional and industrial applications remain indispensable, yet its environmental and health effects necessitate careful evaluation. Contemporary research emphasizes a balance between its benefits in enhancing food security and industrial productivity and the pressing need to mitigate its adverse ecological and toxicological impacts (Musa *et al.,* 2023). This dual perspective underscores potash not merely as a mineral of economic value but as a subject of global health, environmental sustainability and policy discourse. Therefore, controlled use and public education on its safe application remain critical for maximizing its benefits while minimizing risks.

Albino Wistar rats are often used as model organisms to evaluate the physiological and biochemical effects of potash consumption due to their genetic uniformity and predictable metabolic response (Adewale *et al.,* 2022). Studies involving Wistar rats have demonstrated that chronic administration of potash can induce alterations in hematological parameters, oxidative stress biomarkers, and tissue histopathology, particularly affecting the liver, kidney, and hematopoietic systems (Adebayo *et al.,* 2020)). Potash ingestion in experimental rats caused a significant reduction in red blood cell count and hemoglobin concentration, indicating possible hemolytic effects (Ojo *et al.* 2021). Reported that repeated oral exposure to potash induced dose-dependent hepatic and renal impairments, as evidenced by elevated levels of serum transaminases and creatinine (Okafor *et al.,* 2022). Oladipo *et al.* (2024) demonstrated that potash exposure increases lipid peroxidation and reduces antioxidant enzyme activities, suggesting that oxidative stress plays a key role in its mechanism of toxicity.

Corchorus olitorius L., commonly referred to as jute mallow, Jew's mallow, or "ewedu" in West Africa, is a leafy vegetable belonging to the Malvaceae family. It is widely cultivated and consumed in tropical and subtropical regions, where it serves both as a food crop and a medicinal plant (Mohammed and Musa, 2022). Beyond its culinary appeal, *C. olitorius* has garnered considerable scholarly interest for its nutritional richness, ethnopharmacological value and potential applications in sustainable agriculture and food security (Teshome *et al.,* 2020).

Nutritionally, *C. olitorius* is an excellent source of dietary fibre, vitamins A, C, E, and folate, as well as essential minerals such as calcium, iron and potassium (Yeboah *et al.,* 2021). Its mucilaginous leaves are widely used in soups, sauces and stews, providing both functional food value and textural properties appreciated in traditional cuisines across Africa, the Middle East and Asia (Osei *et al.,* 2020). The vegetable has also been highlighted for its role in combating micronutrient deficiencies, especially iron-deficiency anemia and vitamin A deficiency, which remain public health concerns in low-income regions (Bello *et al.,* 2023).

Medicinally, *C. olitorius* has long been valued in ethno medicine. The plant is used traditionally to manage fever, dysentery, stomach pain and inflammatory conditions (Khalid *et al.*, 2020). Recent pharmacological studies confirm its antioxidant, anti-inflammatory, hypoglycemic and antimicrobial activities (Hossain *et al.,* 2021). Bioactive compounds such as flavonoids, carotenoids and polyphenols present in *C. olitorius* are being investigated for their potential role in reducing the risk of chronic diseases, including diabetes, hypertension and cardiovascular illnesses (Oladipo *et al.,* 2021).

Economically, *C. olitorius* contributes to livelihood and household food security. It is cultivated as a short-cycle vegetable crop, fitting well into smallholder farming systems and providing an affordable source of nutrition to rural and urban populations (Adeyemi *et al.,* 2022). Its rapid growth, resilience to harsh climatic conditions and adaptability make it a climate-smart crop suitable for addressing global food insecurity (Adebisi *et al.,* 2023). In some regions, dried leaves are packaged and traded, extending its shelf life and commercial importance (Ahmed *et al.,* 2020). This paper evaluated the potential health risks associated with potash consumption and propose strategies for improving the safety, efficiency and sustainability of Kaun utilization.

METHODOLOGY

Study Area

This study was carried out at the Department of Crop and Environmental Protection Research Laboratory, Faculty of Agricultural Sciences, Ladoke Akintola University of Technology, Ogbomoso, Nigeria. The Guide of the National Institute of Health for the Care and Use of Laboratory Animals was followed throughout this investigation. Healthy adult albino Wistar rats were sourced from the Physiology Department, Ladoke Akintola University of Technology. The protocol for this investigation was approved by the Ethical Research Committee of the Faculty of Agricultural Sciences, Ladoke Akintola University of Technology, Nigeria (ERC Approval Number: CEP/UG/LAUTECH: 200570/10/2025). Potash and jute leaves were sourced from the local market in Ogbomoso.

Animal Housing and Grouping

This study utilized twenty-eight (28) healthy adult albino Wistar rats (*Rattus norvegicus*). The selected rats were 120–150 grams in body weight and approximately 8–10 weeks old at the start of the study. The animals were randomly assigned to each of the four experimental groups A, B, C and D (7 rats per group) and housed in standard plastic cages with netted covers, containing adequate space to promote movement and social interaction under standard laboratory conditions with 12 h day/night cycle. The cages were lined with soft wood shavings to enhance comfort and reduce stress. Drinking water and rat feed were made available to the rats at liberty. (i.e unrestricted access to water and a normal rat diet). Before the commencement of the trial, they had two weeks to become acclimated to the laboratory. This phase allowed the animals to adjust to their new environment, reducing stress-induced physiological changes that could affect the study's outcomes. During this time, the rats were monitored daily for health status, including activity level, grooming, social behavior, and signs of distress such as lethargy or abnormal posture. Any abnormalities were documented and only healthy rats were included in the experimental phase to ensure data reliability.

Environmental conditions were carefully controlled throughout the study to create an optimal living environment. Temperature was maintained at 22 ± 2°C, humidity at 55–65%, and a 12-hour light/dark cycle was implemented to maintain natural circadian rhythms. The rats were fed standard laboratory pellets formulated to meet their nutritional needs; clean drinking water was provided *ad libitum*.

Experimental design

The rats were randomly assigned into four groups. Group A received 1.36 ml of Potash Alone; group B received 1.36 ml of Potash + Jute soup; Group C received 1.36 ml of Jute soup Alone; and Group D received 1.36 ml of Distilled Water Alone (control).

Each group received 1.36 ml/ day???? of the treatment for fourteen days (14)

Group A: Potash Alone

Group B: Potash + Jute soup

Group C: Jute soup Alone

Group D: Distilled Water Alone (control)

Treatments were administered orally using a calibrated syringe fitted with a flexible cannular needle to ensure precision and avoid injury.

Sample Preparation

Treatment Group A- Administered Potash Alone:

Potash was obtained from a local commercial outlet in powdered form. To simulate traditional culinary use, 34 mg of the potash powder was dissolved in 2 ml of distilled water (Ref.???)

Treatment Group B- Administered Potash Combined with Jute Leaves:

34 mg of potash was added during the boiling process of the jute leaves , mimicking common local culinary practices where potash is used to enhance the viscosity of the soup. The resulting mixture was thoroughly stirred to ensure uniformity.

Treatment Group C- Administered Jute Leaves (Corchorus olitorius) Alone:

Fresh jute leaves were purchased from a local vegetable vendor. The leaves were manually sorted to remove impurities, thoroughly washed, and then boiled for 10–15 minutes in minimal water to mimic traditional cooking methods. After cooking, the soup was cooled and homogenized into a paste-like consistency.

Control Treatment Group D- Distilled Water Only:

This treatment group received only 1.36 ml of distilled water

Collection of Blood Samples

Upon completion of the 14-day treatment period, blood samples were collected for laboratory analysis. Prior to sample collection, the rats were humanely sacrificed under mild anesthesia. Cardiac puncture was performed using sterile syringes to obtain pure blood from the heart which was then transferred into heparinize capillary tube to prevent clotting. The sample collection process was executed with utmost care to minimize discomfort and ensure the integrity of the samples. The collected blood samples were promptly transported to the laboratory for Biochemical evaluations.

Data measured were: Alanine aminotransferase (ALT); Aspartate aminotransferase (AST); Gamma - glutamyl transaminase (GGT).

Parameters Assessed in Biochemical Analysis

The responses of the experimental animals to the administered substances were assessed through Biochemical methods; kidney and liver samples were collected and examined. These parameters served to evaluate the overall impact of the treatments on both systemic and cellular levels.

Biochemical Assessment

At sacrifice (Day 14), the spleens were carefully excised, rinsed in saline and preserved in chloroform for microscopic examination. This histological evaluation was carried out using an automated analyzer to identify any cellular or structural alterations, such as necrosis, inflammation, or degeneration. These findings were compared against those from the control treatment group to determine the extent of tissue damage or protection conferred by the various treatments.

Histological Assessment

At sacrifice (Day 14), the Liver and Kidney were carefully excised, rinsed in saline and preserved in chloroform for microscopic examination. This histological evaluation was carried out using an automated analyzer to identify any cellular or structural alterations, such as necrosis, inflammation, or degeneration. These findings were compared against those from the control treatment group to determine the extent of tissue damage or protection conferred by the various treatments.

Statistical Analysis

Data were expressed as mean ± standard deviation (SD) and tested for normality using the LSD post hoc analysis test. One-way ANOVA was used to compare differences across treatment groups, followed by Tukey's post hoc test for pairwise comparisons. Statistical significance was set at $p < 0.05$. Analyses were performed using SPSS version 25 and GraphPad Prism software.

RESULTS AND DISCUSSION

Biochemical Parameters

All three treatments significantly altered serum liver enzyme levels compared to the distilled water control group (Table 1). Rats administered jute leaves alone exhibited ALT (80.97 U/L) and AST (55.96 U/L) levels comparable to those of the control group (81.15 U/L and 55.31 U/L, respectively), with no significant difference.

In contrast, potash administration alone resulted in markedly elevated levels of ALT (101.84 U/L), AST (67.82 U/L), and GGT (7.45 U/L), all significantly higher than the control, suggesting potential hepatotoxicity. Complementary administration of potash and jute leaves partially mitigated these elevations (ALT: 90.22 U/L; AST: 63.19 U/L; GGT: 6.26 U/L), with values significantly lower than potash alone but still higher than control or jute-only groups (Table 1).

These findings indicate that potash may exert adverse effects on hepatic integrity, as reflected by elevated transaminases and GGT enzymes commonly used as biomarkers of liver injury (Giannini *et al.,* 2022). ALT and AST are released into circulation upon hepatocellular damage, while GGT elevation often signals cholestatic or oxidative stress related liver dysfunction (Liu *et al.,* 2021). The observed hepatotoxic effect of potash aligns with prior reports on high potassium salt intake, which can disrupt electrolyte balance and induce oxidative stress in hepatic tissues (Olatunji and Soladoye, 2020).

Jute leaves (*Corchorus olitorius*) appear to possess hepatoprotective properties. The near-normal enzyme levels in the jute only group corroborate findings by Adeneye *et al.* (2021), who reported that aqueous extracts of jute leaves significantly reduced CCl_4-induced liver damage in rats through antioxidant mechanisms, including enhanced glutathione levels and reduced lipid peroxidation. The polyphenolic compounds, flavonoids and ascorbic acid abundant in jute leaves are known to scavenge free radicals and modulate detoxification enzymes (Ismail *et al.,* 2022).

The combination of potash and jute leaves yielded intermediate enzyme levels (Table 1), suggesting a partial protective effect of jute against potash induced hepatotoxicity. This interaction implies that dietary antioxidants from jute may counteract oxidative stress triggered by excessive potash intake. Similar protective interactions have been reported with other plant based antioxidants; for example, co-administration of *Moringa oleifera* with hepatotoxic agents significantly attenuated ALT and AST elevations in rodent models (Olayaki *et al.,* 2023).
In the broader context of recent literature, the dual role of dietary minerals and phytochemicals in liver health is increasingly recognized. While essential minerals like potassium are vital for physiological functions, their excess especially in the form of processed salts like potash (potassium carbonate) can overwhelm homeostatic mechanisms (World Health Organization [WHO], 2023). Conversely, leafy vegetables such as jute are promoted in nutritional guidelines for their antioxidant and anti-inflammatory benefits (FAO, 2022).
Collectively, these histopathological observations corroborate previously reported biochemical alterations such as elevated serum alanine aminotransferase (ALT), aspartate aminotransferase (AST), creatinine and urea levels in potash-exposed groups (Adeyemi *et al.,* 2022). The exacerbated tissue damage observed in the potash jute leaves co-administration group underscores a potential synergistic toxic interaction, possibly mediated by enhanced bioavailability or altered metabolic processing of potash constituents in the presence of phytochemicals from jute leaves. These results highlight the toxicological risks associated with the unregulated dietary use of potash, particularly when combined with commonly consumed leafy vegetables such as jute.

This study demonstrates that potash administration induces subclinical hepatotoxicity in rats, while jute leaves exhibit hepatoprotective effects. The partial amelioration observed with combined treatment underscores the potential of dietary phytochemicals in mitigating chemical-induced liver stress. These results support the integration of antioxidant-rich vegetables in diets where high mineral salt consumption is common, particularly in regions where potash is used traditionally in food processing.

Table 1: Effects of Potash, Jute Leaves, and Their Combination on Liver Enzymes (ALT, AST, and GGT) in Albino Wistar Rats

Parameters	Treatment Value			
	Potash alone	potash+ jute	Jute alone	Distilled water (control)
ALT (U/L)	101.84^{c}	90.22^{b}	80.97^{a}	81.15^{a}
AST	67.82^{c}	63.19^{b}	55.96^{a}	55.31^{a}
GGT (U/L)	7.45^{c}	6.26^{b}	4.76^{a}	4.83^{a}

Mean with the same alphabet along the row are not significantly different using ANOVA at 5% probability level.

Histopathological Assessment of Kidney Tissues in Albino Wistar Rats Following Exposed to potash and jute.

Potash Alone

Kidney sections from rats administered potash alone exhibited early histological indicators of nephrotoxicity (Figure I). Glomerular tufts demonstrated marked shrinkage accompanied by conspicuous widening of Bowman's spaces, consistent with glomerular atrophya hallmark of early glomerular injury (Zhou *et al.,* 2022). Renal tubules displayed mild epithelial degeneration, characterized by focal loss of apical brush border integrity and modest dilation of tubular lumens, features commonly associated with proximal tubular stress (Liu *et al.,* 2023). The interstitial compartment revealed sparse infiltration of mononuclear inflammatory cells, suggestive of an incipient inflammatory response (Fig. I). Collectively, these findings indicate that potash exposure exerts direct nephrotoxic effects, potentially mediated through oxidative stress pathways and tubular epithelial dysfunction, as previously reported for alkali-induced renal injury (Adebayo *et al.,* 2021; Wang *et al.,* 2024). The kidneys displayed severe tubular degeneration, glomerular congestion, and interstitial edema. These findings are consistent with patterns of chemically induced organ toxicity reported in prior toxicological studies (Adewole *et al.,* 2019, Ogundele *et al.,* 2021).

Potash and Jute Leaves

More severe renal lesions were observed in rats co-exposed to potash and jute leaves (Figure II). Histopathological examination revealed marked glomerular shrinkage, with several glomeruli exhibiting complete collapse. Renal tubules displayed extensive epithelial desquamation and necrosis. Prominent interstitial edema and dense inflammatory cell infiltration were evident, particularly in the peritubular regions surrounding affected nephrons. Tubular lumens were occluded by proteinaceous casts and cellular debris, consistent with acute tubular injury (Fig. II). Collectively, these pronounced histopathological changes indicate a synergistic nephrotoxic effect resulting from the combined exposure to potash and jute leaves, paralleling the exacerbated hepatic damage observed in the same experimental group.

Jute Leaves Alone

The renal histology of rats treated with jute leaves alone appeared normal (Figure III). Glomeruli retained their structural integrity and were centrally located within Bowman's capsules. Tubular epithelial cells were intact with no signs of cellular degeneration, inflammation, or luminal obstruction. There was no evidence of glomerulosclerosis, fibrosis or interstitial damage. This further supports the non-toxic nature of jute leaves under acute exposure conditions and confirms the safety of its consumption when not combined with potash. In contrast, rats administered jute leaves alone demonstrated histological profiles comparable to those of the control group, which received distilled water. Both groups exhibited intact hepatic cords, normal hepatocellular morphology, well-defined renal glomeruli, and preserved tubular epithelium, with no evidence of inflammation or necrosis (Fig. III). This suggests that jute leaves, when consumed independently, do not exert hepatotoxic or nephrotoxic effects under the experimental conditions employed.

Distilled Water

Histological examination of kidney tissues in the control group revealed no pathological abnormalities (Figure IV). The glomerular and tubular structures were well-organized, with uniform epithelial cells and no visible degenerative changes. Bowman's capsules and interstitial areas remained clear, indicating optimal renal health and validating the control setup (Figure IV).

Histology of the kidney

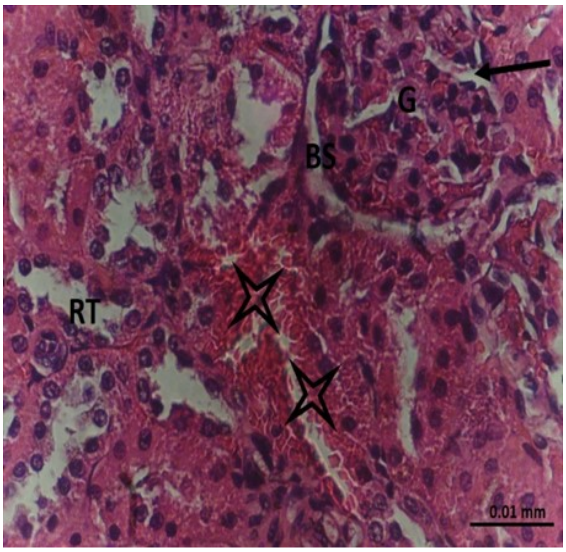

Figure I: Diagram of Kidney Treated with Potash alone

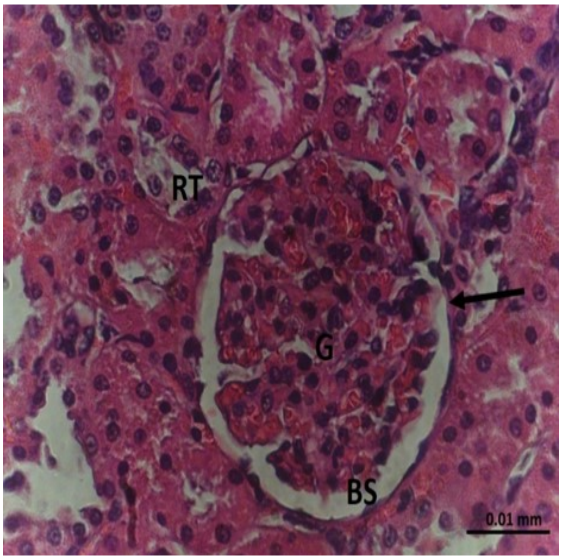

Figure II: Diagram of Kidney Treated with Potash and Jute

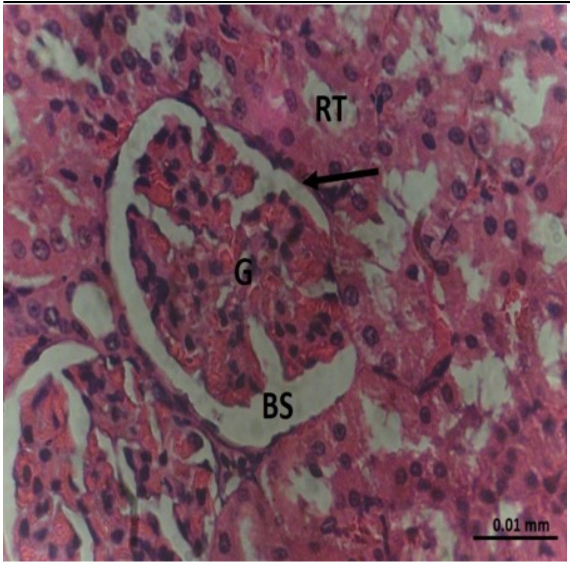

Figure III: Diagram of Kidney Treated with Jute alone

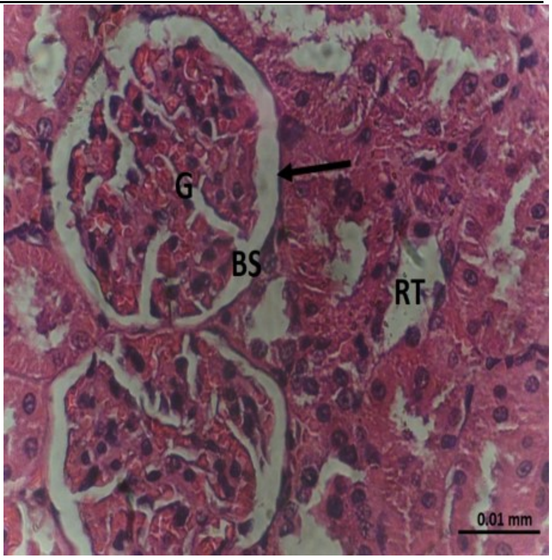

Figure IV: Diagram of Kidney Treated with Distilled water

Histopathological Assessment of Liver Tissues in Albino Wistar Rats Following Exposed to potash and jute.

Potash Alone

The liver sections of rats administered potash alone exhibited marked histopathological alterations indicative of acute hepatocellular damage (Figure V). Histological examination revealed extensive disorganization of hepatic cords, accompanied by prominent cytoplasmic vacuolation within hepatocytes a morphological hallmark often associated with lipid accumulation or cellular swelling due to metabolic stress (Ibrahim *et al.,* 2020). The presence of pyknotic nuclei, characterized by condensed chromatin and nuclear shrinkage, strongly suggests ongoing apoptotic or necrotic cell death (Kumar *et al.,* 2020). These morphological changes are consistent with hepatotoxicity potentially mediated by oxidative stress or direct chemical insult from potash exposure. These histopathological findings correlate well with the elevated serum levels of liver enzymes (e.g., ALT, AST, and ALP) observed in the biochemical analyses which are widely accepted biomarkers of hepatocellular damage (Giannini *et al.,* 2005). Collectively, the data support the conclusion that potash administration induces significant structural and functional hepatic impairment in this experimental model (Figure V).

Potash and Jute Leaves

The combination of potash and jute leaves induced more severe hepatic injury compared to potash administration alone (Figure VI). Histopathological examination revealed marked disruption of hepatic architecture, characterized by extensive hepatocyte necrosis, hemorrhagic foci, and loss of sinusoidal integrity. Numerous hepatocytes displayed karyolysis and intensely eosinophilic cytoplasm morphological features indicative of irreversible cellular damage. Dense leukocytic infiltration was observed in perivascular regions and surrounding areas of necrosis. The pronounced severity of hepatic lesions in the co-exposure group suggests a potential synergistic interaction between potash and bioactive constituents present in jute leaves, leading to enhanced hepatotoxicity. Histopathological evaluation revealed that dietary exposure to potash either administered independently or in conjunction with jute leaves elicited significant structural damage in both hepatic and renal tissues. Specifically, the group treated with potash combined with jute leaves exhibited the most pronounced pathological changes. These included extensive areas of coagulative necrosis, marked inflammatory cell infiltration, cytoplasmic vacuolization, and loss of cellular architecture in the liver (Figure VI).

Jute Leaves Alone

Rats administered with jute leaves alone show relatively preserved hepatic histology (Figure VII). Hepatocytes were organized in typical radial cords surrounding the central veins, displaying well-demarcated cellular boundaries and morphologically normal nuclei. No histopathological alterations such as cytoplasmic vacuolation, hepatocellular necrosis, or inflammatory cell infiltration were observed. Furthermore, the hepatic sinusoids remained patent and uniformly distributed. This histologically unremarkable architecture suggests that, under the experimental conditions and duration of this study, jute leaf administration alone does not exert hepatotoxic effects (Figure VII). These findings are corroborated by the concomitant stability of serum liver enzyme levels observed in the biochemical analyses (Giannini *et al.,* 2022).

Distilled Water

The liver sections from rats in the control group demonstrated preserved hepatic cytoarchitecture, located, basophilic nuclei and granular, eosinophilic cytoplasm features consistent with healthy (Figure VIII) Hepatocytes displayed normal morphology, characterized by centrally hepatic parenchyma (Kiernan, 2015).

These results challenge the assumption that the nutritional and antioxidant properties of jute leaves inherently counteract the toxicity of potash. Instead, they suggest that the alkaline environment created by potash during cooking may alter the phytochemical composition of jute leaves, potentially generating or enhancing toxic metabolites. This interaction could increase the bioavailability of harmful compounds or impair detoxification pathways, thereby exacerbating organ damage. The discrepancy between moderately elevated liver enzymes and severe histological lesions in the combination group underscores the importance of integrating both biochemical and microscopic analyses in toxicological assessments, as enzyme levels alone may underestimate the extent of tissue injury.

The study further confirms the safety of jute leaves when consumed without additives, reinforcing their value as a nutrient-dense, antioxidant-rich component of traditional diets. Conversely, the observed toxicity of potash both alone and in combination with jute raises serious concerns about its unregulated use in food preparation, particularly in communities where it is routinely added to soups and stews. Given the cultural entrenchment of this practice across West Africa, these findings have significant public health implications.

Histology of the liver

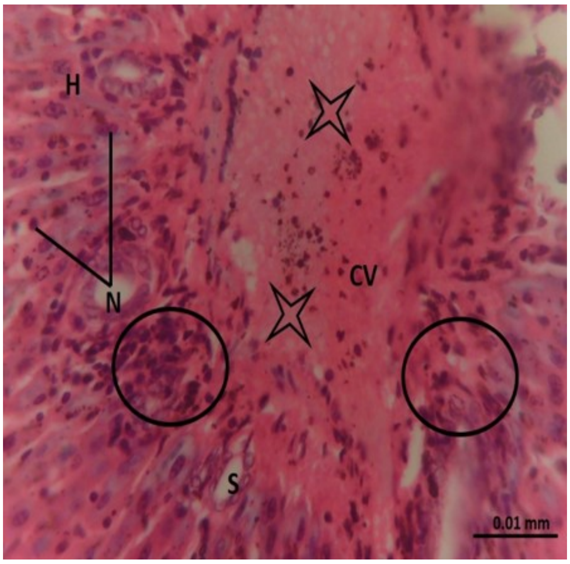

Figure V: Diagram of liver Treated with Potash alone

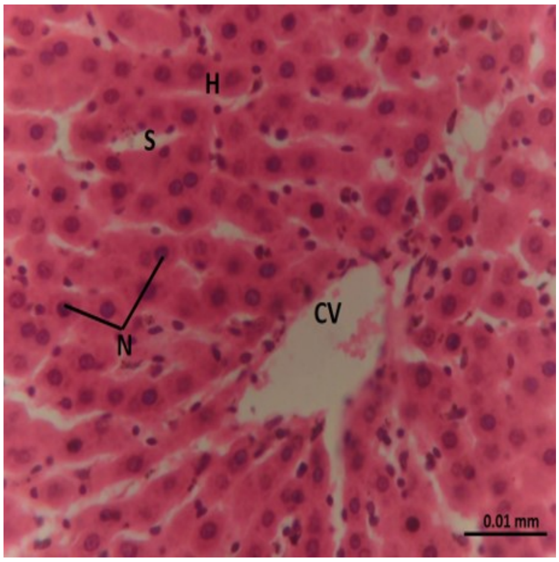

Figure VI: Diagram of liver Treated with Potash and Jute

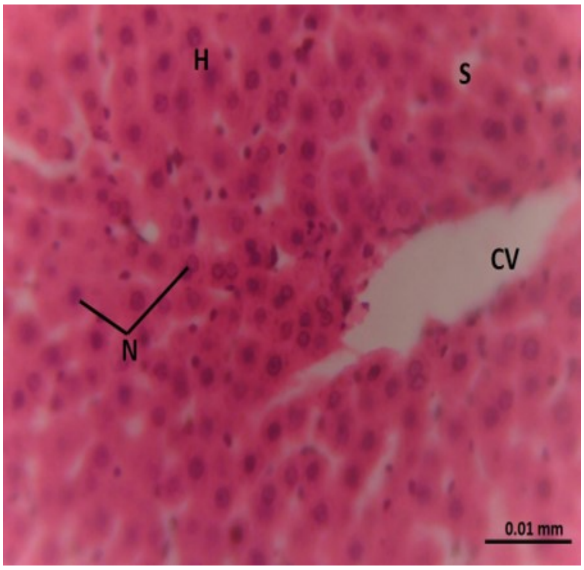

Figure VII: Diagram of liver Treated With Jute alone

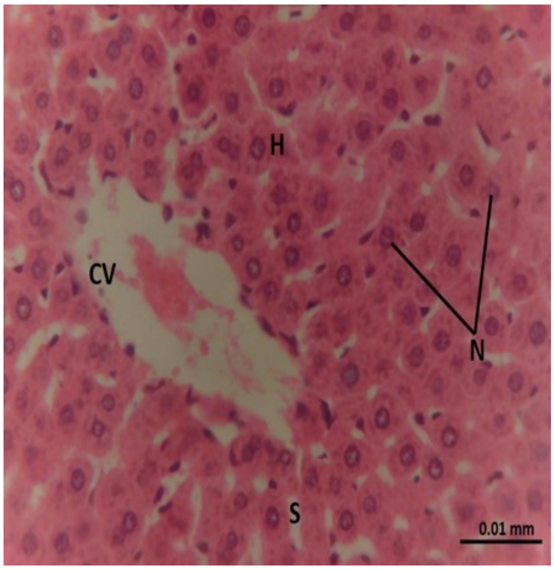

Figure VIII: Diagram of liver Treated with Distilled Water

CONCLUSION

This study evaluated the toxic effects of potassium carbonate (potash), *Corchorus olitorius* (Jute leaves or Ewedu) and their combination on key biochemical and histopathological parameters in albino Wistar rats.

Jute leaves administered alone exhibits no adverse effects and may possess hepatoprotective properties.
Potash administered independently induces significant hepatic and renal toxicity.
Co-administration of potash with jute leaves results in more severe tissue damage than potash alone, indicating a potential synergistic toxic interaction rather than a protective effect.

Biochemically, rats treated with potash alone show significantly elevated serum levels of liver enzymes alanine aminotransferase (ALT), aspartate aminotransferase (AST) and gamma-glutamyl transferase (GGT) compared to the control group, consistent with hepatocellular injury.

Although jute leaves alone maintain enzyme levels comparable to the control, the potash + jute combination group displays intermediate elevations, suggesting only partial mitigation of liver stress. However, this biochemical trend is contradicted by histopathological findings, implying that the potash–jute group suffers the most extensive hepatic and renal damage.

Liver sections exhibit widespread coagulative necrosis, cytoplasmic vacuolation, inflammatory infiltration and loss of hepatic architecture.

Kidney tissues show severe tubular degeneration, glomerular atrophy, interstitial edema and proteinaceous casts hallmarks of acute nephrotoxicity.

Addition of potash to jute leaves, though intended to improve texture and palatability, appears to compromise the safety and health benefits of this traditional dish. The synergistic hepatorenal toxicity observed in this study warrants urgent attention from health authorities, nutritionists, and community educators.

Recommendations

Based on the findings of this study, several evidence-based recommendations are proposed to mitigate potential health risks associated with the dietary use of potassium carbonate (potash), particularly when combined with jute leaves (*Corchorus olitorius*).

Public health authorities and community nutrition programs should prioritize awareness campaigns that educate households especially in rural and semi-urban regions about the toxicological implications of unregulated potash use in food preparation.

Culinary practices should be revised to minimize or eliminate the addition of potash during the preparation of jute leaves and other fibrous vegetables.

Alternative, safer methods such as extended cooking times, mechanical tenderization, or the use of natural thickeners like okra can achieve similar sensory outcomes without compromising organ health.
Encouraging the use of alternatives through community cooking demonstrations, school-based nutrition education and media outreach could significantly reduce inadvertent exposure to toxic levels of alkaline salts.

Regulatory agencies such as the National

Agency for Food and Drug Administration and Control (NAFDAC) in Nigeria should consider establishing clear guidelines on the permissible levels of potassium carbonate in both household and commercially prepared foods. Monitoring its presence in processed foods, traditional remedies, and even non-prescription antacids would help control total daily intake and prevent cumulative toxicity, especially among vulnerable populations including children, pregnant women, and the elderly.

Future research should focus on elucidating the biochemical mechanisms underlying the observed synergistic toxicity between potash and jute leaves. Long-term studies are needed to assess the effects of chronic low-dose exposure, while in vitro models could help identify whether alkaline conditions degrade beneficial phytochemicals in jute or generate novel toxic compounds. Such investigations would provide a stronger scientific foundation for dietary guidelines and food safety policies.

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