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Evaluation of the Toxic Effects of Goko Cleanser on Hepatic, Renal and Haematological Parameters in Adult Male Wistar Rats

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Abstract

Herbal medicine has been the most widely practiced medicine in Nigeria, Africa and other parts of the world. The use of herbs for treatment requires scientific knowledge of its phytochemical and histopathological effects. This study evaluated the potential toxic effects of Goko Cleanser, a widely used herbal remedy, on various organs and blood markers in male Wistar rats. A total of twenty rats weighing 160g - 250g were used. The rats were divided into four experimental groups (G1 – 4) according to their body weight. Group 1 rats were given 10ml/kg of normal saline/ distilled water orally, group 2 rats were given1000mg/kg of Goko cleanser, group 3 rats were given 1500mg/kg of Goko cleanser and group 4 rats were given 2000mg/kg of Goko cleanser orally for a period of 21 days. Results showed liver and kidney function tests revealed elevated enzyme levels and structural changes in treated groups. Histological analysis showed inflammation and damage to liver, and kidney tissues at higher doses, though blood cell counts remained mostly unchanged. In conclusion, this study indicated that prolonged or high doses of Goko Cleanser may have risks for liver, kidney, and haematological Parameters, warranting caution in its therapeutic use.

Keywords:

Goko Cleanser, Hepatic Toxicity, Renal Toxicity, Haematological Parameters, Wistar Rats.

Introduction

In both developed and developing nations, herbal medicine is the most widely utilized alternative medicine, particularly in rural areas (Hughes et al., 2021). Herbal medicine has therefore gained a lot of attention lately, which has increased demand for it (Molassiotis et al., 2024). Plants include a variety of poisonous compounds whose harmful effects have long been

disregarded, despite the fact that they typically contain bioactive molecules thought to be responsible for their therapeutic effects (Elhassan et al., 2024). A blend of herbs, including Vernonia amygdalina, Saccharum officinarum, Allium sativum, Cajanus cajan, Caramel, and Zingiber officinale, the Goko cleansing mixture is believed to be utilized to heal a number of illnesses (Amandeep et al., 2015; Gazuwa et al., 2013). Squash plants include Vernonia amygdalina, bitter leaf (known locally as onugbu in Igbo). Since the juice from the leaves is typically applied to new cuts or wounds in some rural communities to aid in the healing process, it has great therapeutic potential (Adeolu et al., 2014). According to Adeolu et al. (2014), Vernonia amygdalina is also used to treat diabetic mellitus, fever, and joint discomfort related to AIDS. Saccharum officinarum, sometimes known as sugar cane, is a huge, robust grass species in the genus Saccharum. Sugarcane juice and its unrefined byproducts, such as brown sugar, molasses, and jaggery, have been reported to contain phenolic compounds including flavonoids, phenolic acids, and other glycosides which possess pharmacological activities (Amandeep et al., 2015).

Garlic, Allium sativum, is known for its antibacterial and antifungal properties and contains sulfur and other biologically active compounds (Gazuwa et al., 2013). Ginger, Zingiber officinale, is commonly used for the treatment of nausea, vomiting and mild gastrointestinal disturbances. Cajanus cajan, also known as pigeon pea, contains biologically active compounds such as tannins, flavonoids, glycosides, sterols and saponins which have protective effects on body organs (Onyejike et al., 2018). The liver is a vital organ responsible for the metabolism of drugs, food substances and environmental toxins. During these metabolic processes, the liver may be exposed to toxic insults which can result in hepatocellular injury (Onaolapo et al., 2013). Drug-induced liver injury remains one of the major causes of liver dysfunction and may present as acute or chronic hepatitis, cholestasis or elevated liver enzymes (Alempijevic et al., 2017). Elevated serum levels of alanine aminotransferase, aspartate aminotransferase and alkaline phosphatase are commonly used indicators of liver damage (Dufour and Qazi, 2012).

The kidneys play essential roles in detoxification, maintenance of fluid and electrolyte balance, and excretion of metabolic waste products. Exposure to toxic substances may result in nephrotoxicity, characterized by impaired renal function and elevated serum urea and creatinine levels (Al-Kuraishy et al., 2019; Qu et al., 2018). Since creatinine is primarily eliminated by the kidneys, increased serum creatinine levels indicate compromised renal function (Godswill et al., 2020). Haematological parameters are important indicators of systemic toxicity. Alterations in packed cell volume, haemoglobin concentration, red blood cell count and white blood cell count may reflect interference with normal haematopoiesis and immune function following exposure to toxic substances (Ajagbonna et al., 2005).

This study therefore investigated the toxic effects of Goko Cleanser on hepatic enzymes, renal function indices and haematological parameters using adult male Wistar rats as an experimental model.

Statement of the Problem

Goko Cleanser is used in the treatment of various diseases such as diabetes mellitus, fever, mild stomach ache, joints pain, prevention or treatment of nausea and vomiting associated with motion sickness, and others like weight loss and appetite control. Although it contains some useful substances, it could also contain compounds capable of exerting toxic effects on vital

organs. In most cases, when used in the treatment of a particular ailment, it could pose serious threats to general human health and body functions. Hence, there is a need to determine the possible toxic effects of Goko Cleanser on hepatic, renal and haematological parameters.

Objectives of the Study

The general objective of this study is to evaluate the toxic effects of Goko Cleanser on hepatic, renal and haematological parameters in adult male Wistar rats.

The specific objectives are to:

1. Determine the effects of Goko Cleanser on liver enzyme activities.
2. Assess the effects of Goko Cleanser on renal function parameters.
3. Evaluate the effects of Goko Cleanser on haematological indices.

Research Hypotheses

1. Goko Cleanser has no significant effect on liver enzyme activities in adult male Wistar rats.
2. Goko Cleanser has no significant effect on renal function parameters in adult male Wistar rats.
3. Goko Cleanser has no significant effect on haematological parameters in adult male Wistar rats.

Materials and Methods

Procurement of Experimental Substance

Goko Cleanser was purchased from a registered herbal medicine outlet and stored according to the manufacturer's instructions before use.

Experimental Animals

Twenty adult male Wistar rats weighing between 150 and 200 g were obtained and housed under standard laboratory conditions. The animals were allowed to acclimatize for two weeks and were provided with food and water ad libitum.

Experimental Design

The animals were randomly divided into control and treatment groups and administered graded doses of Goko Cleanser orally for a period of twenty-one days.

Table 1: Experimental grouping and dosage regimen of Goko Cleanser

EXPERIMENTAL GROUP	NO OF RATS	TREATMENT	DOSAGE /kg/body weight	DURATION
GROUP1 (NORMAL CONTROL)	5	Distilled water	10ml/kg	21days
GROUP 2	5	Goko Cleanser	1000mg/kg / (orally once daily)	21days
GROUP 3	5	Goko Cleanser	1500 mg/kg (orally once daily)	21days
GROUP 4	5	Goko Cleanser	2000 mg/kg (orally once daily)	21days

Sample Collection

At the end of the experimental period, the animals were anaesthetized and blood samples were collected via cardiac puncture for biochemical and haematological analyses.

Biochemical Analysis

Serum alanine aminotransferase, aspartate aminotransferase, alkaline phosphatase, urea and creatinine levels were determined using standard laboratory methods.

Haematological Analysis

Haematological parameters including packed cell volume, haemoglobin concentration, red blood cell count, white blood cell count and platelet count were determined using standard procedures.

Statistical Analysis

Data obtained were analyzed using statistical package for social science (SPSS) version 25. Data obtained were presented as mean ± standard error of mean. A one way ANOVA with Tukey's multiple comparisons test were used for the analysis. Significance was set at $p<0.05$*.

Results

Effects of Goko Cleanser on Liver Enzyme Activities

The results showed variations in the serum levels of alanine aminotransferase (ALT), aspartate aminotransferase (AST) and alkaline phosphatase (ALP) among the treated groups when compared with the control group following oral administration of Goko Cleanser.

Table 2: Mean ± SEM of Serum Hepatic Enzymes Levels by Group

Groups	G1	G2	G3	G4	p-value
ALT (u/l)	24.30 ± 0.51	25.21 ± 0.51	25.53 ± 0.36	24.50 ± 0.30	0.22
AST (u/l)	26.63 ± 0.98	24.57 ± 1.24	27.70 ± 0.81	25.77 ± 0.13	0.16
ALP (u/l)	29.97 ± 0.32	29.94 ± 0.48	30.62 ± 0.37	27.24 ± 0.94a*b*c*	0.01

ALT = alanine transaminase; AST = Aspartate transaminase; ALP = Alkaline phosphatase
***** = sig at p<0.001; ** = sig at p<0.01; * = sig at p<0.05**

The result from table 2 above shows that the value of ALT from group G1 – G4 are 24.30 ± 0.51, 25.21 ± 0.51, 25.53 ± 0.36, and 24.50 ± 0.30 respectively. The value of G2 and G3 are higher than the values of G1 and G4 but there was no significant difference observed across group. The values for AST from G1- G4 are 26.63 ± 0.98, 24.57 ± 1.24, 27.70 ± 0.81, and 25.77 ± 0.13. These values are within normal range. The value in G3 is higher than G1 followed by G4 and G2 but there was no significant difference seen across group. The ALP values from G1- G4 are 29.97 ± 0.32, 29.94 ± 0.48, 30.62 ± 0.37, 27.24 ± 0.94a*b*c*. The value in G1 is higher followed by G2, G3 and G4. There was a significant difference in the mean value across group with G4 significantly lower compared to G2, G3 and G1. The value of G4 was significantly lower than the G3 (p=0.0144), the G2 (p=0.0443) and the control group G1 (p=0.0422).

Effects of Goko Cleanser on Renal Function Parameters

The serum urea and creatinine levels of the treated groups showed changes when compared with the control group. These changes were dose-dependent, indicating possible impairment of renal function following administration of Goko Cleanser.

Table 3: Mean ± SEM of Creatinine and Urea Levels by Group

Groups	G1	G2	G3	G4	p-value
Creatinin (mg/dl)	0.70 ± 0.04	0.60 ± 0.02	0.69 ± 0.02	0.55 ± 0.01c*	0.03
Urea (mg/dl)	33.38 ± 0.22	32.68 ± 0.22	31.33 ± 0.54a*	34.34 ± 0.61 c**	0.008

***** = sig at p<0.001; ** = sig at p<0.01; * = sig at p<0.05**

The result from table 3 above revealed that the values for creatinin from G1- G4 are 0.70 ± 0.04, 0.60 ± 0.02, 0.69 ± 0.02 and 0.55 ± 0.01c*. The values of G1 and G3 are higher than G2 and then the G4. However, there was a statistically significant difference in creatinin levels within group with G4 significantly lower compared to G3. The values of Urea from G1- G4 are 33.38 ± 0.22, 32.68 ± 0.22, 31.33 ± 0.54a*, 34.34 ± 0.61 c**. The value of G4 is higher than G1 then followed by G2 and G3. There was a statistically significant difference across group with G4 significantly higher compared to G3, and G3 significantly lower compared to G1.

Effects of Goko Cleanser on Haematological Parameters

The haematological analysis revealed alterations in packed cell volume, haemoglobin concentration, red blood cell count, white blood cell count and platelet count across the treated groups relative to the control group.

Table 4: Mean ± SEM of Blood Hematological Indices by Group

Groups	G1	G2	G3	G4	P-value
RBC X10*12/L	7.20 ± 0.06	7.20 ± 0.10	7.03 ± 0.12	7.27 ± 0.27	0.76
WBC X10*6/mm3	5933 ± 176.40	6333 ± 176.40	6533 ± 176.40	5500 ± 173.2bc*	0.01
Platelet X10*9/L	86.67 ± 1.20	88.67 ± 1.33	88.67 ± 1.76	91.00 ± 2.08	0.38
Hb g/dl	12.53 ± 0.24	12.20 ± 0.23	12.40 ± 0.34	12.80 ± 0.23	0.49

***** = sig at p<0.001; ** = sig at p<0.01; * = sig at p<0.05**

The result from table 4.4 above shows that the value of RBC from G1- G4 are 7.20 ± 0.06, 7.20 ± 0.10, 7.03 ± 0.12, and 7.27 ± 0.27 respectively. The G4 value is slightly higher followed by G1, G2 and G3 with no statistically significant difference observed across group. The values of WBC from G1- G4 are 5933 ± 176.40, 6333 ± 176.40, 6533 ± 176.40, and 5500 ± 173.2bc*. The G3 value is higher than the G2 followed by G1 and G4. The G4 shows a statistically significant difference with G2 and G3 between groups. The value of platelet from G1- G4 are 86.67 ± 1.20, 88.67 ± 1.33, 88.67 ± 1.76, and 91.00 ± 2.08. There was a progressive decrease in the value of platelet for G4 to G1 but no statistically significant difference seen between groups. The value of haemoglobin from G1- G4 are 12.53 ± 0.24, 12.20 ± 0.23, 12.40 ± 0.34, and 12.80 ± 0.23. There was a slight difference in value seen in G4 among groups but was not statistically significant.

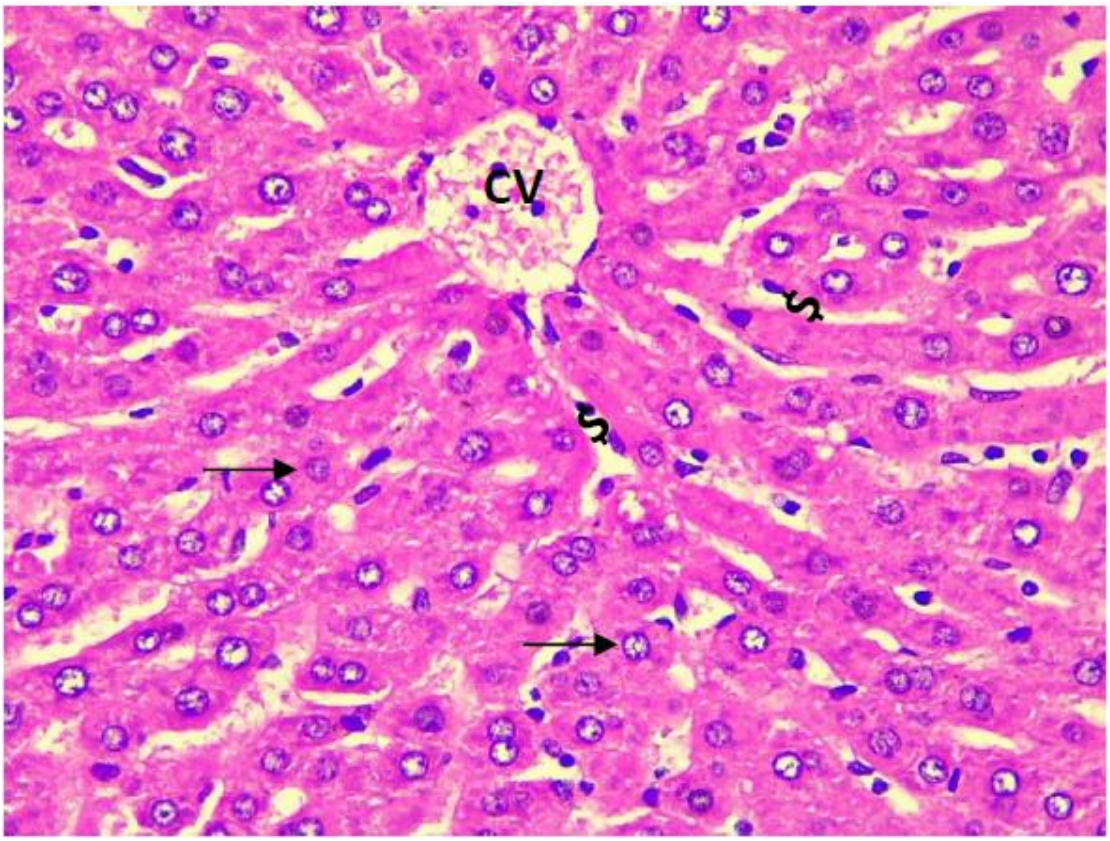

Plate 1: Photomicrograph of liver tissue in Group 1 (Control group)

The photomicrograph of the liver section from the control group (Group 1) demonstrates a normal hepatic architecture, characterized by well-arranged hepatocyte plates (thin arrows) radiating from the central vein (cv). The hepatic sinusoids are clearly visible, and there is no evidence of congestion, inflammatory infiltrates, or cellular degeneration. The hepatocytes appear uniform in size and shape, and the overall parenchymal organization is intact, reflecting the normal functional state of the liver. The staining with Hematoxylin and Eosin (H&E) at x400 magnification provides clear visualization of both cellular and structural components, including central veins and sinusoidal spaces.

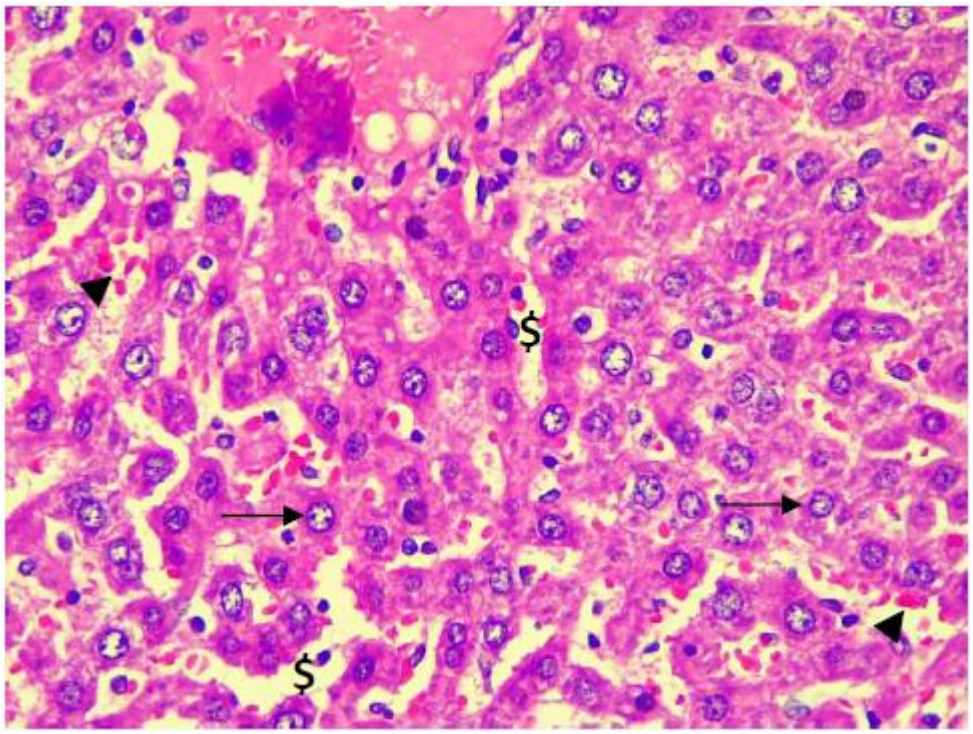

Plate 2: Photomicrograph of liver tissue in Group 2 (Low Dose group)

The photomicrograph of the liver section from the low dose group (Group 2) reveals notable deviations from the normal hepatic architecture observed in the control group. The hepatocytes remain largely arranged in plates, but the hepatic sinusoids appear mildly dilated and exhibit congestion with erythrocytes (arrowhead), indicating early signs of vascular stress. The central vein (CV) is also dilated and congested, suggesting that the low dose of Goko Cleanser may have begun to affect hepatic blood flow and possibly impair bile or metabolite transport. The H&E staining at x400 magnification allows for clear visualization of both hepatocyte organization and sinusoidal changes, providing a baseline to assess dose-dependent hepatic effects in subsequent groups.

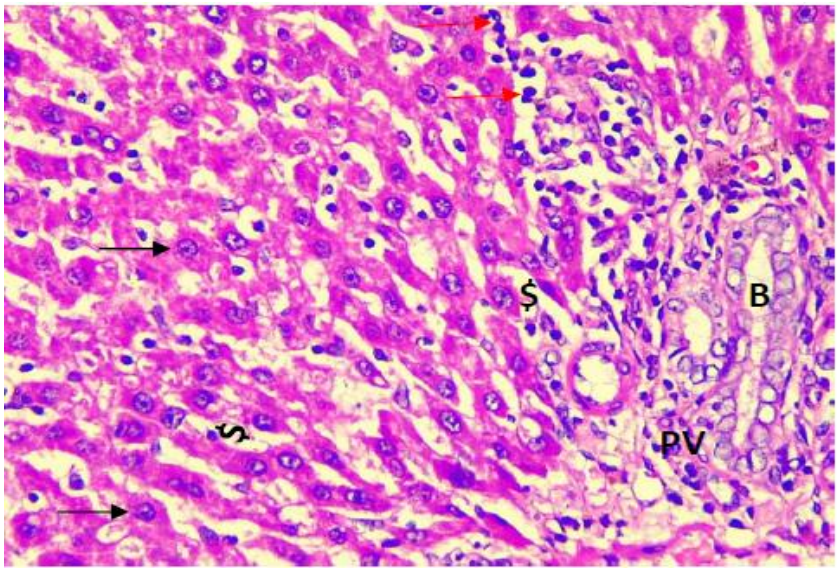

Plate 3: Photomicrograph of liver tissue in Group 3 (Medium Dose group)

The photomicrograph of the liver section from the medium dose group (Group 3) shows more pronounced histopathological changes compared to the control and low dose groups. The hepatocytes (black arrow) remain generally organized in plates, but the sinusoids ($) are noticeably widened, suggesting increased congestion and potential disruption of microcirculatory flow. A focal periportal inflammatory infiltration (red arrow) is evident, indicating the initiation of an immune response likely triggered by the Goko Cleanser. Additionally, the portal vein (PV) is dilated and congested, reflecting increased hemodynamic stress in the hepatic vasculature. The hepatocytes, while still largely intact, are under subtle stress, and the presence of inflammatory cells suggests activation of hepatic immune defenses. The H&E stain at x400 magnification provides detailed visualization of these features, allowing clear assessment of dose-dependent effects. Compared to Plate 2 (low dose group), Plate 3 demonstrates that increasing the dose of Goko Cleanser is associated with more evident structural disruptions and early inflammatory responses, which may progress to more severe hepatocellular injury with prolonged exposure.

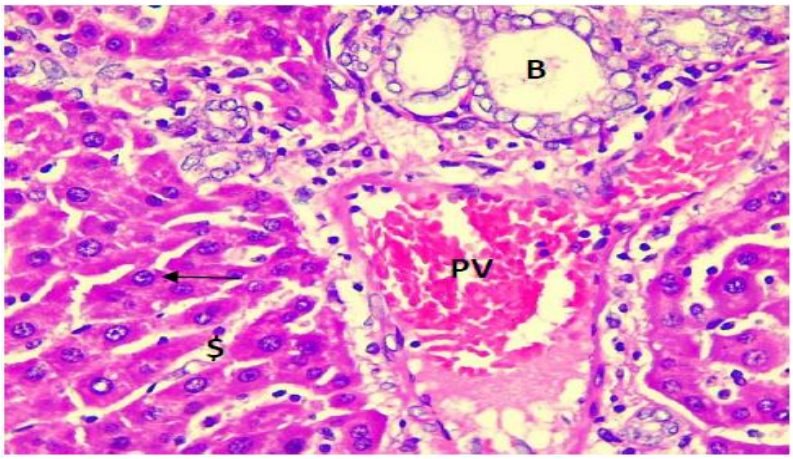

Plate 4: Photomicrograph of liver tissue in Group 4 (High Dose group)

The photomicrograph of the liver section from the high dose group (Group 4) demonstrates more severe histopathological changes compared to the control, low, and medium dose groups. The portal vein (PV) and bile duct (B) at the portal triad (PT) are markedly dilated and congested, suggesting significant hemodynamic disturbance and potential impairment of bile flow. The liver parenchyma exhibits widened sinusoids ($) filled with congested erythrocytes and diffuse inflammatory infiltrates (red arrow), indicating ongoing immune activation and tissue stress. Interestingly, the hepatocytes (black arrow) largely retain their normal morphology, suggesting that, at this stage, the structural integrity of the parenchymal cells is maintained despite the vascular and inflammatory changes. However, the diffuse congestion and inflammation point to a higher risk of functional compromise if exposure continues. The H&E stain at both x100 and x400 magnifications allows detailed visualization of both gross and cellular architecture, emphasizing the dose-dependent nature of Goko Cleanser's effects on the liver.

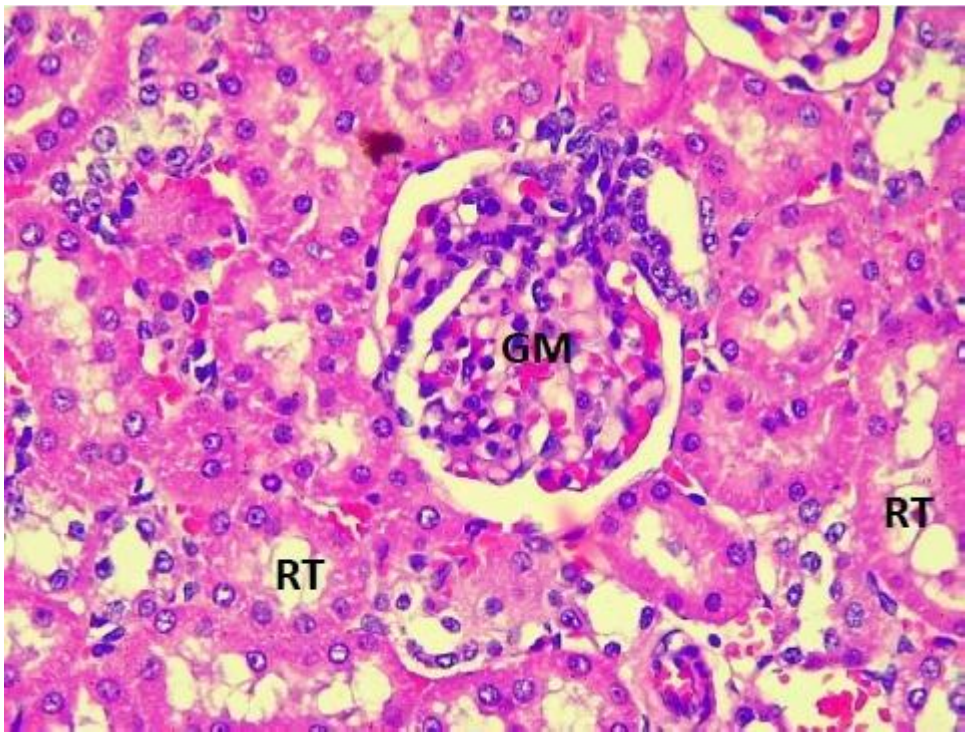

Plate 5: Photomicrograph of renal tissue in Group 1 (Control group)

The photomicrograph of the kidney section from the control group (Group 1) demonstrates normal renal architecture. The glomeruli (GM) are well-defined, with intact Bowman's capsules, and the renal tubules (RT) show uniform epithelial lining and clearly organized lumens. There is no evidence of cellular degeneration, tubular dilation, necrosis, or inflammatory infiltration. This normal histological appearance reflects the baseline structural integrity of the kidney in untreated animals and serves as a reference for evaluating potential nephrotoxic effects in treated groups. The H&E stain at x400 magnification provides clear visualization of both glomerular and tubular structures, allowing for detailed assessment of renal parenchymal health.

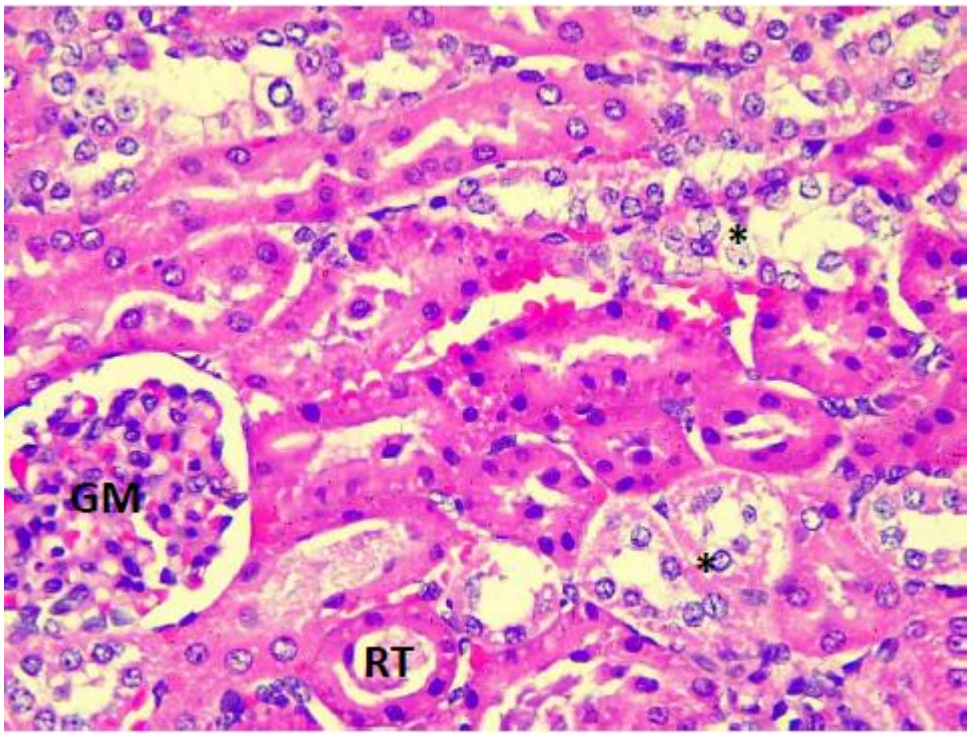

Plate 6: Photomicrograph of renal tissue in Group 2 (Low Dose group)

The photomicrograph of the renal cortex from the low dose group (Group 2) shows early signs of renal stress compared to the control group. The glomeruli (GM) remain largely intact, and the overall tubular arrangement (RT) is maintained. However, sporadic tubular degeneration is evident, characterized by epithelial vacuolation (asterisk), indicating early cytoplasmic changes within some tubular epithelial cells. Additionally, areas of congestion (C) are observed within the cortical vasculature, suggesting mild disruption of renal blood flow. These subtle alterations suggest that even at low doses, Goko Cleanser may begin to affect renal tissue integrity, although the changes are not yet widespread. The presence of vacuolation and focal congestion may reflect mild toxic insult or early adaptive responses of the kidney to the herbal mixture. The H&E staining at x400 magnification allows clear visualization of both glomerular and tubular structures, making it possible to identify early histopathological changes that could progress with higher doses or prolonged exposure.

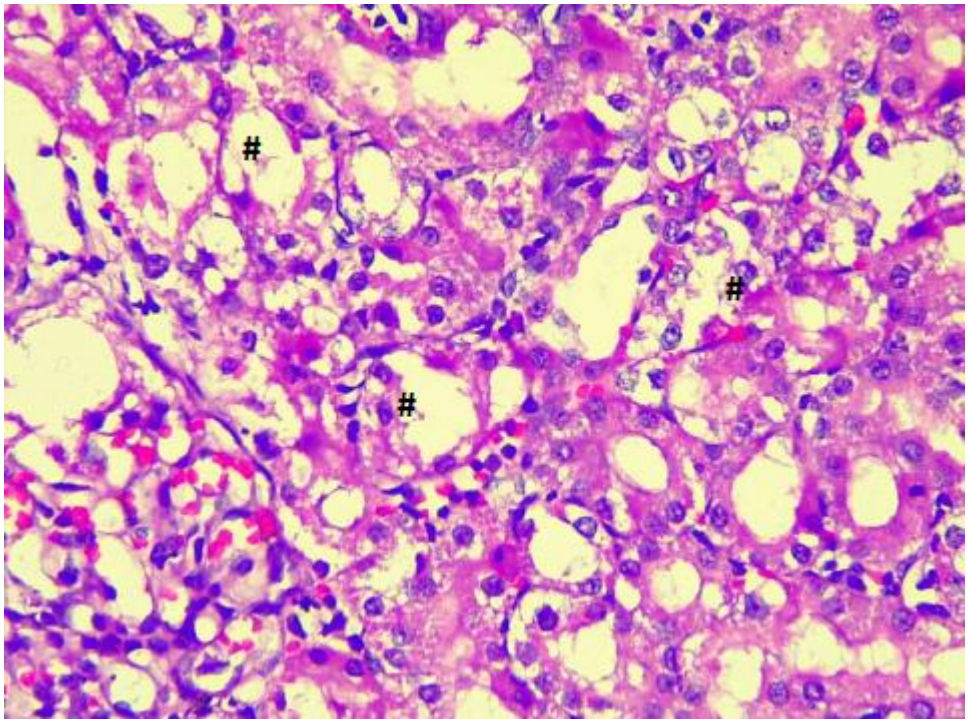

Plate 7: Photomicrograph of renal tissue in Group 3 (Medium Dose group)

The photomicrograph of the renal cortex from the medium dose group (Group 3) demonstrates more pronounced histopathological changes compared to the control and low dose groups. The renal tubules exhibit noticeable dilation and epithelial degeneration (#), indicating a higher degree of tubular stress and early cytotoxic effects. In addition, areas of epithelial hyperplasia (HY) are evident, suggesting a compensatory regenerative response by the tubular epithelium in reaction to the mild injury. These structural alterations imply that medium doses of Goko Cleanser can impair renal function by affecting tubular integrity, potentially compromising the kidney's ability to concentrate urine and maintain electrolyte and fluid balance. The glomeruli, although largely preserved, are surrounded by these affected tubules, highlighting the localized impact on renal cortical architecture. The H&E stain at x400 magnification allows for detailed assessment of both cellular and tubular alterations, emphasizing the dose-dependent progression of nephrotoxicity.

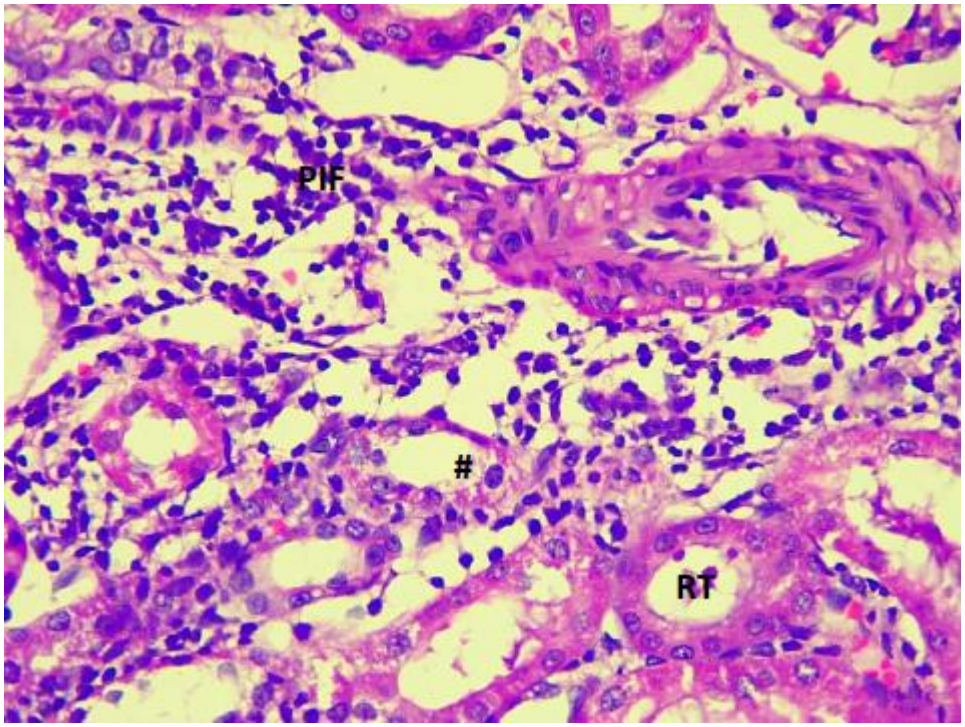

Plate 8: Photomicrograph of renal tissue in Group 4 (High Dose group)

The photomicrograph of the renal tissue from the high dose group (Group 4) reveals marked histopathological alterations, indicating significant nephrotoxic effects of Goko Cleanser at higher concentrations. The renal parenchyma appears distorted, with widespread tubular dilation and extensive epithelial degeneration (#), reflecting severe disruption of tubular integrity. Additionally, perivascular inflammatory infiltrates (PIF) are evident, suggesting activation of the renal immune response and localized inflammation around blood vessels. These changes indicate that high-dose exposure compromises both structural and functional aspects of the kidney, potentially impairing its ability to filter blood, regulate fluid and electrolyte balance, and maintain acid-base homeostasis. The observed perivascular infiltration further suggests that the kidney mounts an inflammatory response to counteract the insult, which, if persistent, may exacerbate tissue injury and lead to chronic renal dysfunction. The H&E stain at x400 magnification allows for detailed assessment of both cellular and tubular alterations, emphasizing the dose-dependent progression of nephrotoxicity.

Discussion

The present study investigated the toxic effects of Goko Cleanser on hepatic, renal and haematological parameters in adult male Wistar rats. The findings reveal a nuanced picture of the potential risks associated with this widely used herbal mixture. Liver function tests indicated that ALT levels were higher in groups 2 and 3 compared to the control group, while group 4 showed lower ALT levels than the control. Although these differences were not statistically significant, the trend suggests a possible influence of the herbal formulation on hepatocellular integrity. AST levels showed a similar pattern, with group 3 exhibiting the highest values, followed by groups 4 and 2, and the control group recording the lowest levels. Elevated liver enzymes, even when modest, serve as early warning signs that hepatocytes may be under stress or beginning to experience functional compromise (Onwuegbuchunam et al., 2021).

ALP, an enzyme often linked to bile duct integrity and cholestatic processes, showed significant reductions in group 4 compared to the other groups. This pattern implies that the herbal mixture may impact hepatic excretory pathways, altering bile flow and possibly causing subtle cholestatic conditions over time. Comparable elevations or reductions in liver enzymes following exposure to polyherbal preparations have been documented in previous studies, underscoring the fact that "natural" does not always equate to safe (Alempijevic et al., 2017; Michael et al., 2022). Histological evaluation provided a deeper insight into the organ-level effects of Goko Cleanser. Liver tissue from treated groups exhibited sinusoidal congestion and diffuse inflammatory infiltrates, while the control group maintained normal architecture. These findings align with prior reports by Afolabi et al. (2021) and Olowofela et al. (2021), who described inflammatory changes, hepatocellular degeneration, and necrosis in animals administered herbal formulations. The presence of such structural alterations suggests that, while biochemical markers may remain within near-normal ranges initially, underlying tissue damage may be occurring silently. This reinforces the concept that routine biochemical assays should be complemented by histopathological analysis to fully understand organ-specific toxicity.

Kidney function was similarly affected, though in a complex and dose-dependent manner. Creatinine levels were generally higher in the control group compared to the treated groups; however, significant differences were observed between groups 4 and 3, while urea levels were highest in group 4. These findings indicate that Goko Cleanser may influence renal filtration and excretion, potentially compromising the kidneys' ability to remove metabolic waste efficiently. Nkechi et al. (2020) and Onwuegbuchunam et al. (2021) have similarly linked alterations in creatinine and urea levels to exposure to herbal mixtures, highlighting potential nephrotoxic effects. Histologically, kidney tissues of treated animals showed tubular dilation, epithelial degeneration, and vacuolation, which are classic indicators of structural damage. These observations are consistent with those reported by Afolabi et al. (2021) and Olawunmi et al. (2022), who noted glomerular degeneration, tubular necrosis, and interstitial inflammation following herbal treatment. Such changes suggest that prolonged or high-dose use of Goko Cleanser could impair critical renal functions, including urine concentration, electrolyte regulation, and acid-base balance. The combined biochemical and histological data strongly indicate that the kidneys are particularly vulnerable to sustained herbal exposure, even when outward symptoms are not immediately apparent.

Haematological assessment revealed relatively stable red blood cell counts, haemoglobin concentration, platelet count, and packed cell volume across the groups, suggesting that moderate doses of Goko Cleanser may not drastically impair erythropoiesis. However, an increase in white blood cell counts in the low and medium dose groups signals an activated immune response, possibly reflecting systemic inflammation in response to herbal-induced stress. This aligns with the findings of Nkechi et al. (2020) and Afolabi et al. (2021), who reported similar mild leukocytosis in animals exposed to herbal mixtures, while higher doses have been associated with anemia and reduced haemoglobin levels (Onwuegbuchunam et al., 2021). The variation in response across doses highlights the importance of dosage regulation when using herbal products.

Taken together, these results underscore an important consideration: although herbal formulations like Goko Cleanser are often marketed as natural and safe, they are not free from potential adverse effects. The evidence from this study suggests that repeated or high-dose

consumption can subtly compromise liver and kidney function, provoke inflammatory responses, and alter immune parameters, even in the absence of overt clinical symptoms. The histopathological changes observed in this study serve as a warning that tissue-level damage may precede detectable biochemical alterations. The implications of these findings extend beyond laboratory animals. In many communities, Goko Cleanser and similar herbal mixtures are widely used without standardized dosing or safety monitoring. This study highlights the critical need for awareness and caution among consumers, health practitioners, and policymakers. It also emphasizes the importance of integrating scientific evaluation of traditional medicines with cultural practices to ensure that beneficial properties are harnessed safely, while minimizing potential risks. While herbal remedies can provide therapeutic advantages, they must be used responsibly, with careful attention to dosage, duration, and individual health status.

Goko Cleanser has demonstrable effects on hepatic and renal function and may trigger subtle haematological changes in a dose-dependent manner. While some effects may appear mild, histological evidence points to underlying organ stress and potential toxicity. This underscores the importance of combining biochemical and tissue-level assessments in toxicological studies and provides a foundation for future research aimed at establishing safe usage guidelines for herbal preparations.

Conclusion

This study demonstrated that prolonged oral administration of Goko Cleanser induced measurable alterations in hepatic enzymes, renal function indices, and haematological parameters in adult male Wistar rats. Specifically, variations in serum levels of ALT, AST, and ALP indicated potential disturbances in liver function, while changes in urea and creatinine levels suggested compromised renal function. Although some haematological parameters such as RBC count, hemoglobin concentration, and platelet count remained relatively stable, the observed fluctuations in WBCs point to subtle immune modulation or inflammatory responses.These findings suggest that Goko Cleanser possesses toxic potentials that could adversely impact key physiological systems, particularly the liver and kidneys, when consumed over an extended period or at higher doses. The histopathological evaluations further support these functional alterations, revealing dose-dependent vascular congestion, tubular degeneration, inflammatory infiltration, and periportal changes in hepatic and renal tissues. This underscores the importance of exercising caution in the prolonged or excessive use of herbal mixtures like Goko Cleanser, as their bioactive compounds, while potentially therapeutic, may also elicit toxic effects that compromise organ integrity and overall physiological homeostasis.

Recommendations

Based on the findings of this study, it was recommended that Regulatory agencies should enforce quality control and safety evaluation of herbal products before commercialization. Further studies are also recommended to evaluate the long-term effects of Goko Cleanser and to establish safe dosage limits.

DECLARATION

The products used for this research are predominantly used products in our area of research and country. There is no conflict of interest in any way between the authors and producer of the product. We do not intend to use this product as an avenue for litigation but for learning and advancement of knowledge. It is of interest to note that, the research was not funded by the producing company but was funded by personal efforts of the authors.

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