Current Research in Health Sciences, 4(2):1–12, 2026. DOI: 10.58613/crhs421

Current Research in Health Sciences

ISSN (Online): 2584-1084

Journal homepage: https://www.gpub.org/journal-details.php?journal-id=47

ISSN (E): 2584-1084

Current Research in Health Sciences

Gyps Publication

Research Article

Geochemistry of Three Evaporites Utilities in Nigeria and their Consequences on the Liver of Wistar Rats

Julius Kayode Bankole [1*], **Olumuyiwa Michael Ajibade**[2], **Samuel Ifedioranma Ogenyi** [3] **and Ejeatuluchukwu Obi** [4]

[1]*Department of Histopathology and Cytopathology, Faculty of Medical Laboratory Science, College of Medical Sciences, Ambrose Alli University, Ekpoma, Edo State, Nigeria.*
[2]*Department of Earth Sciences, Olabisi Onabanjo University, Ago-Iwoye, Ogun State.*
[3]*Department of Histopathology and Cytopathology, Faculty of Medical Laboratory Sciences, College of Health Sciences and Technology, Nnamdi Azikiwe University, Nnewi Campus, Anambra State, Nigeria.*
[4]*Department of Clinical Chemistry, Faculty of Medical Laboratory Sciences, Nnamdi Azikiwe University, Awka, Nigeria.*
[*]*Corresponding author: stkennyconsult@gmail.com*

Article Info

Keywords: *Geochemistry, Evaporites, Liver, Wistar Rats, Trona.*

Received: *01.06.2026;*
Accepted: *10.07.2026;*
Published: *18.07.2026*

Abstract

The health hazards on different organs of the body from the long continuous use of Trona have been the major concern in recent times in Nigeria. This study is to qualitatively and quantitatively analyze three types of Trona to determine their geochemistry and their effects on the liver. Jakanwa, Kanwa Balma and Kanwa Manda samples were derived from Local market in Ekpoma, Edo State and Katsina, katsina state. Twenty-four (24) rats of both sexes, with average weight of 200g were randomly assigned into three treatment groups (B, C and D) and Control group (A), each group containing six (6) rats. Each treatment groups received 12g, 36g and 60g of trona mixed growers mash respectively for three weeks while the rats in the control received animal feeds only. The rats were given the water liberally for these periods and sacrificed by cervical dislocation on the first and third week of the experiment. The Liver was carefully dissected out and quickly fixed in 10% formal saline for histological study in pre-acute and acute phases. The result of the analysis showed that sodium was predominant metal and constitutes about 70% of the total composition of the potash samples. Other elements present in the samples include K^+, Fe^{2+}, Ca^{2+}, Mg^{2+}, ${CO_3}^{2-}$, ${HCO_3}^-$, Cl^- and ${SO_4}^{2-}$. The pH ranges from (10-10.3) in the three trona samples revealing an alkaline rock mineral. Trona occurrence as polyhalite considering the concentration and combinations of these cations and anions in their different compounds: indicated a compound salt as the rock salt which include: carnalite, sylvite, trona and natron. The histological results indicate the rats in groups B, C and D showed some varying degree of distortion and disruption of the Liver structure. There were observable pathologic conditions which include vacuolations, cellular necrosis, haemorrhage, vascular carbon deposit, wavy cardiac myofibrils, mild fibrolysis, cardiac infarction with deposit of carbon as well as mild Oedema in both the pre-acute and acute phases when compared to the control group. Although the level of trona (kanwa) consumed in most homes may not be toxic until it is been taken continuously or repeatedly beyond human tolerant level. Thus, continuous consumption should be discouraged as accumulation of high-level potash could cause serious harmful effects to human health.

How To Cite: J.K. Bankole, O.M. Ajibade, S.I. Ogenyi and E. Obi. Geochemistry of Three Evaporites Utilities in Nigeria and their Consequences on the Liver of Wistar Rats. *Current Research in Health Sciences*, 4(1):1–12, 2026. https://doi.org/10.58613/crhs421

1. Introduction

In Nigeria, the renewed government interest in solid mineral exploration may possibly explain the reason for the use of naturally occurring inorganic salts for diverse purposes. Hence, there is an increased use of geological mineral substances in human and animal foods as evidence in recent scientific reports. Evaporites are water-soluble mineral sediment generally derived from sedimentary environment that results from concentration and crystallization by evaporation from an aqueous solution. Two types of evaporite deposits had been identified: marine and non-marine. Marine types of evaporates are described as ocean deposits while those found in standing water bodies such as lakes and rivers are regarded as non-marine evaporites. These are considered as sedimentary rocks and they are referred to as chemical sediments. Formation of evaporite rocks is the restriction of water bodies in an environment where water input into such an area remains below the net rate of evaporation. This occurs usually in desert area with a small basin fed by a limited input of water. This resulted in enriched salts, and become precipitated leading to evaporites deposits. Non marine evaporites are edible and they are known as Trona. They are formed in inland brine lakes especially in the northern part of Nigeria. The use has been to soften hard leafy and vegetables in African foods most especially in all Nigeria households. There is decline in the use of this mineral as food additives because of the newly discovered toxicity nature when consumed in foods [1, 2]. The negative effects of this have been checked in kidney making this mineral to be injurious to human health. Other effects on the liver organ are the focus of this work.

This mineral salt (trona or natron) occur in abundance in Nigeria known by various names as akanwu, kaun and kawe. It occurs as a mixture of different substances with Na constituting about 30% and other elements such as K, Fe and Zn in varying proportions. There are different varieties of this mineral salt and its geochemistry varies with respect to their localities, environment of deposition and geology. There are various uses of trona which include: as a food tenderizer [3], to curdle milk, in the tanning industry and in the preparation and enhancement of flavour of local beverages and snuff [4], extensively in ethno-veterinary practices for the treatment of skin diseases and digestive problems; serves as a salt lick and mineral supplement in ruminants [5] and used in the treatment of reproductive ailments; difficulty in urination and abortions in pregnant animals [6] (Alawa et al., 2010). The historical use of (trona and natron) as an aid in childbirth has been well documented. In the kanuri tribe of Borno, it is used to increase uterine contractility and motility for safer childbirth [7]. In the Hausa-Fulani tribe of northern Nigeria, it is used in forty-days postnatal care of the puerperium as nursing mothers (Sanderson et al., 1979); peripartum cardiac failure (PPCF) (Davidson et al., 1974). Potash is also known as sesquicarbonate with traces of metals like Ca, Mg, Fe, Zn, S, Cl, Si, P, K, Al as well as other elements [8].

Furthermore, some studies have investigated the biochemical and physiological effects of potash but there is still paucity of data concerning its dietary and compositional effects in humans. Although potash is widely used in Cameroon Ghana, Nigeria and several other West African countries, no documented study has been reported of its mineralogy.

2. Methods

Three trona (kanwa) samples in common use were bought from the local market in Ekpoma, Edo State. They were identified as A-Jakanwa B- kanwaBalma, and C-kanwaManda. The physical properties were observed and the samples pulverized with pestle and mortar and sieved through a 9 μ-pore size sieve. Samples were weighed on a Mettler AE 160 model weighing balance, mixed thoroughly and stored in a stoppered bottle under room temperature until they were analyzed both quantitatively and qualitatively for their chemical composition using analytical reagent grade chemicals and distilled water.

Quantitative analysis was used to determine the cations or metallic elements present in each trona sample. The sample solutions were quartered and made up to the 1 litre mark in the conical flask with distilled water. 0.004 M-lanthanum chloride was introduced into the sample solutions of trona (kanwa) for the detection of Na and K. Using flame photometer while Unicam atomic absorption spectrophotometer (Model 969) for Mg, Mn, Zn, Fe, Ca and Pb. The instrument was adjusted for optimum flow of flame gas and test solutions. The capillary tube was aspirated with distilled water initially then with air to clear the liquid passage. The calibrations involved the aspiration of the blank solution and setting it to zero reading after which the concentrated standards were aspirated. The readings were taken and these were used in the construction of the calibration curves. Qualitative analysis is used to determine the anions present in the samples. Standard methods of qualitative analysis were used and this involved titration against standards using colour indicators such as methyl orange and checked against those obtained by pH titrations.

2.1. Potash Administration to Experimental Animals

Twenty-four Wister rats with average weight of 150-250g were randomly assigned into four groups: A, B, C and D of six in each group. Group A served as the control while Group B, C and D served as test groups. Animals in each group were further sub-grouped into 1, 2, 3, 4, 5and 6. The group A (control) animals were fed normally with growers' mash while those in group B, C and D were fed with freshly graded doses of potash (12g, 36g and 60g) mixed with 50g of growers' mash respectively daily. Feeding was performed two (2) times daily for three weeks.

2.2. Sample Collection for Histological Study

All the animals were euthanized at the end of the third week after been anaesthetized using chloroform as sedative. Tissue samples were thereafter collected from the liver. These tissue samples were preserved in 10% neutral buffered formalin and were later processed using standard histopathology techniques and sectioned accordingly (As used in OAUTHC Ile-Ife).

After the last timing, the tissues were removed from their plastic cassettes and placed at the centre of the metallic tissue mould and then filled with molten paraffin wax. They were also left to solidify after which they were now placed in the refrigerator at 5°C for 15 minutes. After the blocks were cool in the refrigerator for the time stated above (15 minutes), the blocks were then removed from the metallic case using a knife and after which the paraffin wax at the side of the blocks were removed.

The blocks were then trimmed and cut serially at 3μm on a rotary microtome. The sections were floated in water bath at 55°C and picked up by the use of a clean frosted end slides. The frosted end slides were now placed on the hot plate for 40 minutes for adequate attachment of the sections on the slides after which the sections were de-waxed, hydrated, air dried and stored in a slide box before it was stained with Haematoxylin and Eosin techniques. The sections were cleared in xylene, air-dried and mounted with dibuthylphthalate propylene xylene (DPX) as used in OAUTHC Ile-Ife. The slides were examined and photomicrographs were taken.

3. Results

3.1. Geochemistry and Physical Properties of Trona (Evaporite/Potash) Samples

The trona samples were crystalline in texture with luster and the colours which varied from white, light grey and light pink colourations indicating different varieties of trona Table 1. The results of physico-chemical analysis presented the amount of cations, anions and other parameters in Table 1. The measured pH, range from 10-10.3 in the three trona samples revealing an alkaline rock mineral. Sodium levels were high in all the samples with an approximate value of 70% indicating this mineral as trona/natron and an evaporite. The highest occurrence of Na was observed in Ja Kanwa signifying this type as high quality trona. Potassium levels were low (less than 10%) with highest occurrence found in KanwaBalma indicating a less quality natron than that of JaKanwa. Fe^{2+} was present in all the samples but in low levels (less than 1%); while the highest occurrence was in KanwaManda. Ca^{2+} occurred in all the samples in appreciable amounts and significantly high in KanwaManda and JaKanwa where it ranges from 30-59%. The highest concentration of Mg^{2+} was recorded in JaKanwa (6%) but occurred in other samples in less than or approximately 1% derived from other locations. High levels of carbonates ($CO_3{}^{2-}$) were detected in all the samples signifying this mineral salt as a carbonate mineral of mainly natron. The presence of bicarbonates ($HCO_3{}^{-}$) indicating the presence of natron except in KanwaManda in which bicarbonate occurred in low amounts. The trona of JaKanwa and KanwaBalma are more alkaline due to the presence of $HCO_3{}^{-}$ in these samples (Na_2CO_3•$NaHCO_3$•$2H_2O$). This also influenced the total alkalinity in these two samples. These results were in line with the submission of Alawa et al., (2012). The entire samples contained sulphates ($SO_4{}^{2-}$) in appreciable small amounts with KanwaManda containing the highest amount (188mg/l) while Cl^- was also detected in all the samples but in appreciable quantity indicating the presence of halite in the trona samples. However, no acidity was observed in any of the analyzed samples but the pH values of all the samples signify potash as an alkaline salt.

3.2. The Electrical Conductivity

The presence of Na, Mg, K and Ca in the three trona samples revealed this mineral salt as polyhalite. This may possibly contain common salt-NaCl, carnallite-$MgCl_2$•KCl•$6H_2O$ and sylvite-KCl. The occurrence of trona as polyhalite considering the concentration of these elements in this compound: $2CaSO_4$•$MgSO_4$•K_2SO_4•$2H_2O$ indicated the presence of sulphate salts in the rock salt. The hygroscopic character of this rock salt indicates its solubility. The combinations of the cations present and its biochemical activities in human body might be toxic when the tolerant limit is exceeded due to their high concentrations in the rock salt.

Histological Findings: The control presented normal hepatic cyto-architecture with intact parenchyma. The tissue plate in Group B revealed hepatic necrosis, hepatic infarction and exudation.

In Group C: The tissue plate revealed severe hepatic necrosis much more pronounced than in group B, exudation (haemorrhagic exudation), parenchyma erosion and thrombosis.

While Group D tissue revealed vacuolations, haemorrhagic exudation and severe hepatic necrosis.

Table 1: Physico-chemical parameters of the Trona Samples

	Parameters	Jakanwa(A)	Balma (B)	Manda (C)
Cations mg/l	**Na**	2060	1630	2050
	K	245	882	159
	Fe	1.3	0.52	1.6
	Mg	6	1	1
	Ca	30	20	59
Anions mg/l	**SO_4**	24	6.4	188.8
	PO_4	85.6	70.4	79.2
	Cl^-	24.78	111.51	814.2
	$HCO_3{}^-$	1895	1245	170
	$CO_3{}^{2-}$	3615	1945	225
	Total Alk.	5510	3190	395
	pH	10	10.2	10.3
	Ec (ushos)	22×10^3	18×10^3	26×10^3
	Appearance	Aggregates	Aggregates	Crystalline
	Colour	Light Pink	Light Grey	White

3.3. Physico-chemical Parameters of the Trona Samples

Table 1 presents the chemical composition and physical characteristics of the three evaporite samples (Jakanwa, Balma, and Manda). The analysis revealed variations in the concentrations of major cations, anions, alkalinity, pH, electrical conductivity, appearance, and colour among the samples.

The results showed that sodium (Na^+) was the predominant cation in all samples, with Jakanwa (2060 mg/L) and Manda (2050 mg/L) having higher concentrations compared with Balma (1630 mg/L). This indicates that these evaporites are rich in sodium-based minerals, which is a common characteristic of trona deposits. Potassium levels varied considerably, with Balma recording the highest concentration (882 mg/L), suggesting differences in mineral composition and environmental conditions during formation.

Among the anions, carbonate (CO_3^{2-}) and bicarbonate (HCO_3^-) showed considerable variation. Jakanwa recorded the highest carbonate concentration (3615 mg/L) and bicarbonate level (1895 mg/L), contributing to its high total alkalinity (5510 mg/L). This suggests that Jakanwa possesses stronger alkaline properties compared with the other samples. Manda, however, showed a comparatively lower carbonate and bicarbonate concentration but had the highest chloride content (814.2 mg/L), indicating a greater presence of chloride-based salts.

The pH values of all samples were alkaline, ranging from 10.0 to 10.3, confirming the strongly basic nature of the evaporites. The electrical conductivity values also indicated considerable ionic content, with Manda showing the highest conductivity, suggesting a higher concentration of dissolved salts. Differences in colour and physical appearance (light pink, light grey, and white crystalline forms) indicate variations in mineral impurities and composition.

Overall, the findings demonstrate that although the three samples belong to the same group of evaporite minerals, their chemical compositions differ significantly, which may influence their biological effects when consumed.

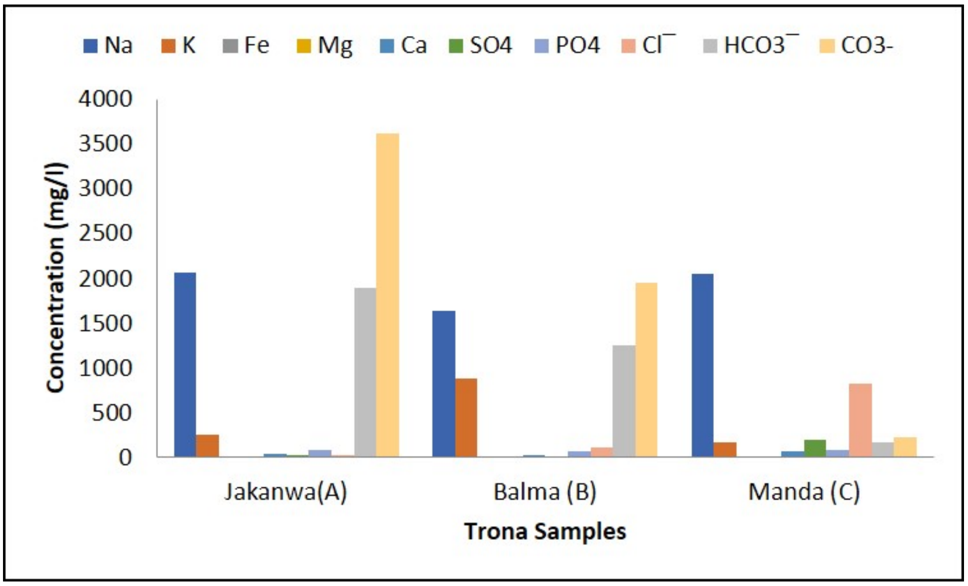

Figure 1: Physico-chemical parameters of the Trona Samples

Figure 1 provides a graphical comparison of the concentrations of different chemical constituents in Jakanwa, Balma, and Manda samples. The figure highlights the dominance of sodium, carbonate, and bicarbonate ions compared with other elements.

The higher concentration of carbonate and bicarbonate observed in Jakanwa explains its greater alkalinity and suggests stronger buffering capacity. The figure also demonstrates that chloride concentration was particularly elevated in Manda, distinguishing it chemically from the other evaporites. These variations indicate that consumption of different trona sources may expose individuals to different mineral loads.

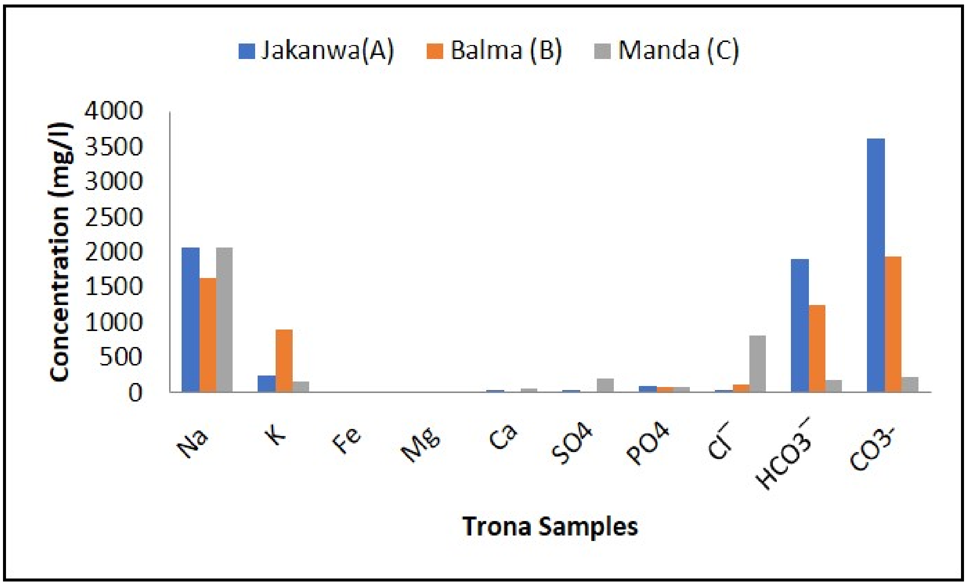

Figure 2: Physico-chemical parameters of the Trona Samples with electrolytes

Figure 2 compares the electrolyte distribution among the three samples. The pattern confirms that sodium and carbonate ions constitute the major components of the evaporites. Jakanwa demonstrated higher carbonate-related electrolytes, while Manda showed increased chloride concentration.

This variation is important because excessive intake of highly alkaline or mineral-rich substances may disturb physiological balance and may contribute to tissue injury, particularly in organs involved in metabolism and detoxification, such as the liver.

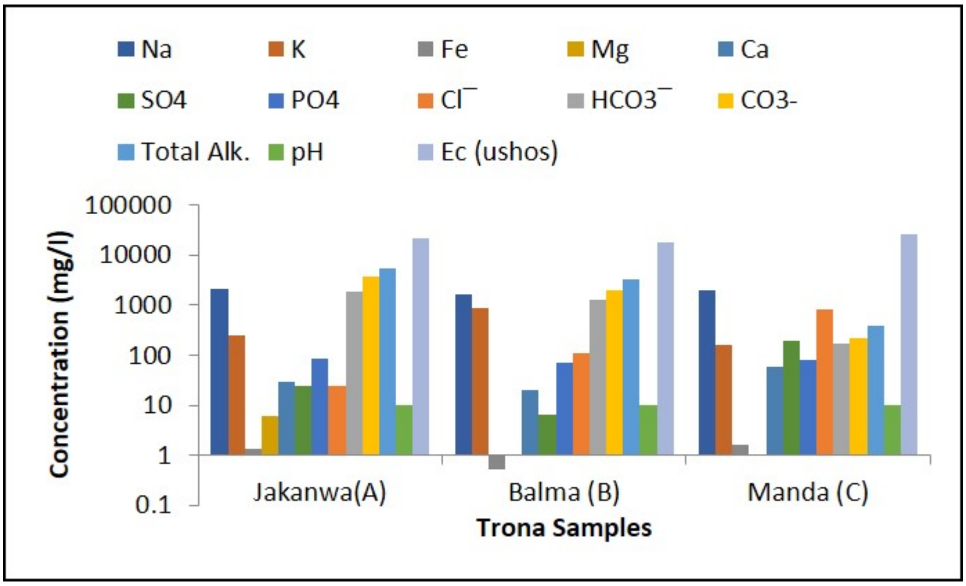

Figure 3: Physico-chemical parameters in relation to different kanwa samples

Figure 3 presents the relationship between the chemical characteristics of the samples, including total alkalinity, pH, and electrical conductivity. All samples showed high alkaline values, confirming their chemical nature as alkaline evaporites.

The elevated alkalinity indicates that regular consumption of these substances could potentially alter normal physiological processes. Since the liver plays a major role in processing absorbed substances, prolonged exposure to highly alkaline mineral compounds may contribute to hepatic stress.

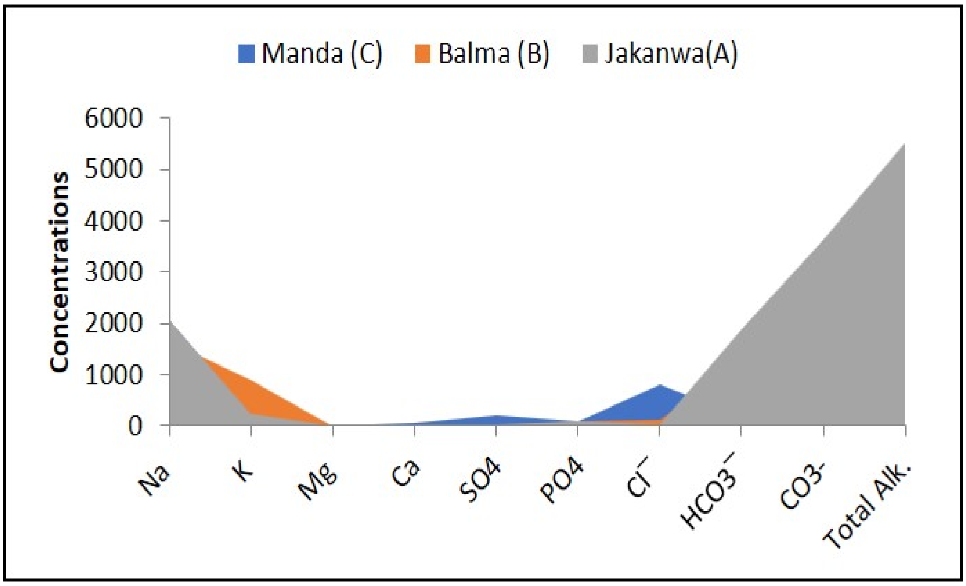

Figure 4: Electrolyte concentration of the different kanwa samples

Figure 4 compares electrolyte concentrations among the evaporites. The results demonstrate that Jakanwa had the highest total electrolyte concentration, particularly due to carbonate and bicarbonate ions. Balma showed high potassium content, while Manda had increased chloride concentration.

These differences suggest that each evaporite source possesses unique chemical characteristics that may influence its toxicity profile. The variation in mineral composition may explain differences in the severity of liver changes observed among experimental groups.

3.4. Histological Effects of Potash (Kanwa) on the Liver of Wistar Rats

Table 2 demonstrates the effects of different doses of potash administration on liver tissue structure. The control group showed normal hepatic architecture, indicating healthy liver cells without evidence of tissue damage.

However, experimental groups exposed to increasing doses of potash showed progressive liver alterations. Animals receiving 12 g of potash (Group B) showed evidence of hepatic necrosis and haemorrhagic exudation. At higher exposure levels (36 g and 60 g groups), more severe pathological changes were observed, including extensive necrosis, haemorrhagic changes, thrombosis, parenchymal erosion, and vacuolation.

The findings indicate a dose-dependent toxic effect, where increased potash exposure resulted in greater liver tissue damage. This suggests that excessive consumption of evaporites may overwhelm normal liver protective mechanisms, leading to cellular injury.

3.5. Photomicrography

Figures 5, 6, 7, 8 demonstrate liver changes observed in animals exposed to 12 g potash. The tissues showed parenchyma, hepatic necrosis, infarction-like changes, and haemorrhagic exudation.

These findings indicate that even moderate exposure to evaporites can initiate cellular injury. Necrosis suggests irreversible damage to hepatocytes, while haemorrhagic exudation indicates disruption of normal vascular integrity.

Figures 9, 10, 11, 12 show more pronounced liver damage following exposure to 36 g potash. Severe hepatic necrosis, haemorrhagic exudation, parenchymal erosion, and thrombosis were observed.

The severity of these lesions suggests that increased mineral exposure accelerates hepatic damage. The presence of thrombosis indicates possible impairment of blood circulation within liver tissues, which may further worsen cellular injury.

Figures 13, 14, 15 illustrate the effects of the highest potash dose (60 g). The liver sections showed extensive vacuolation, haemorrhagic exudation, and severe hepatic necrosis.

The widespread tissue destruction observed at this dose demonstrates a clear dose-dependent toxic effect. Vacuolation reflects cellular degeneration, while severe necrosis indicates significant loss of functional liver cells.

The study demonstrates that the three Nigerian evaporite samples possess varying chemical compositions, with high levels of alkaline minerals, particularly sodium, carbonate, and bicarbonate. These chemical differences influenced the biological effects observed in experimental animals. The histological findings revealed that increasing doses of kanwa resulted in progressive liver damage, ranging from mild cellular injury to severe necrosis.

The results suggest that although evaporites are traditionally used for culinary and domestic purposes, excessive consumption may pose risks to liver health. Proper regulation, controlled usage, and further toxicological evaluation are therefore recommended to ensure consumer safety.

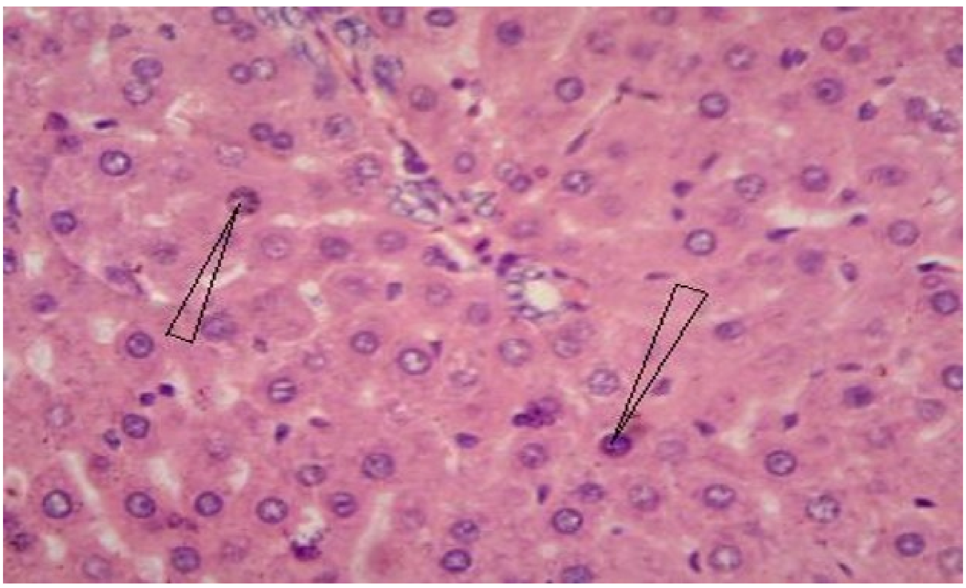

Figure 5: Control section of the liver (H & E × 400) showing normal hepatic cyto-architecture with intact parenchyma

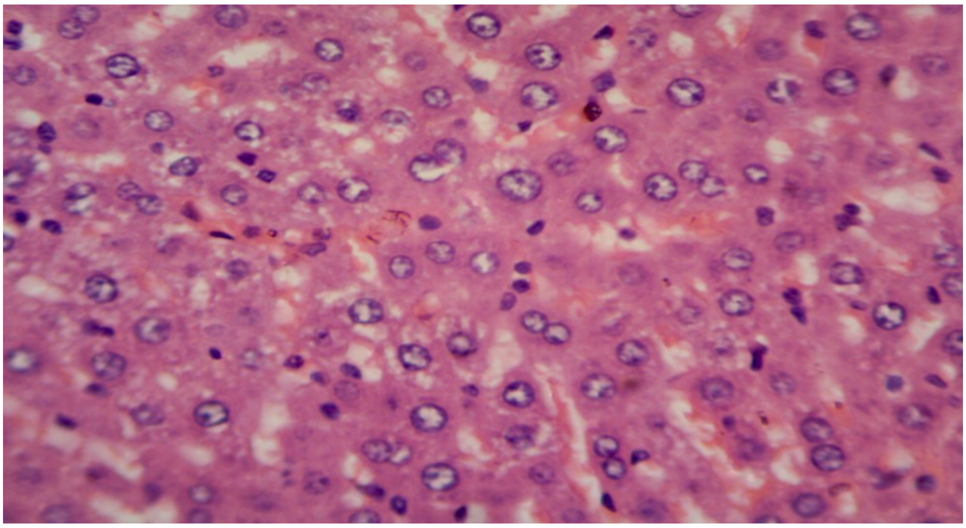

Figure 6: Test group B liver section (H & E × 400) showing hepatic (liver) necrosis

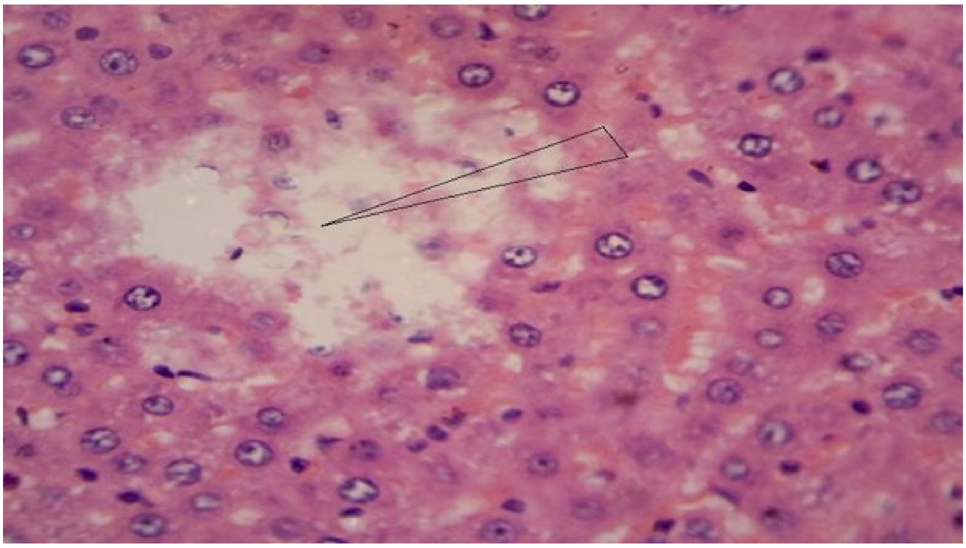

Figure 7: Test group B liver section (H & E × 400) showing hepatic infarction

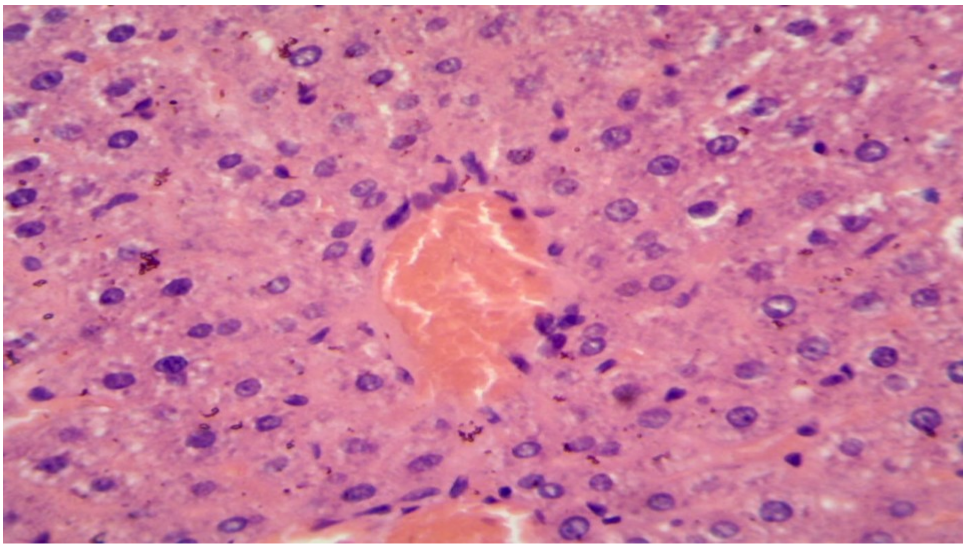

Figure 8: Test group B liver section (H & E × 400) showing exudations

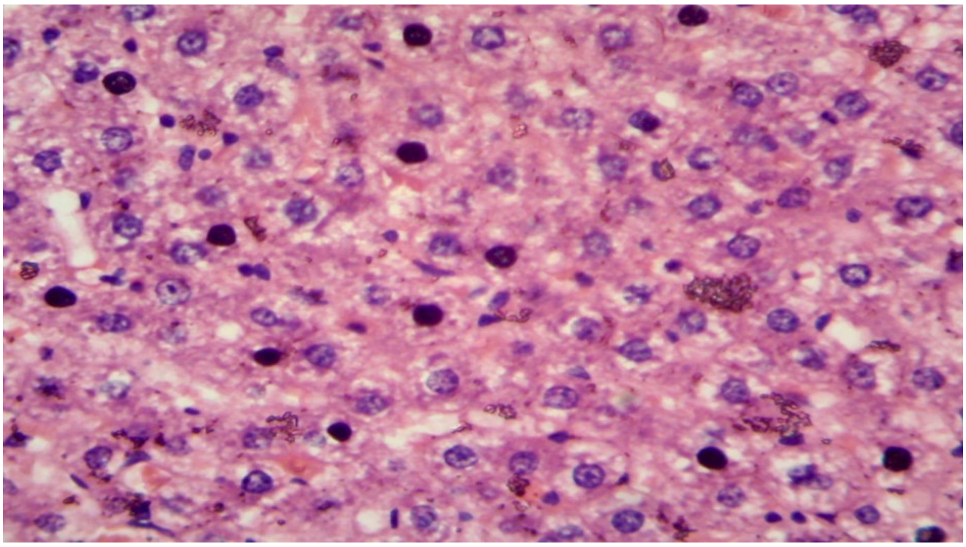

Figure 9: Test group C liver section (H & E $\times$ 400) showing severe hepatic (liver) necrosis

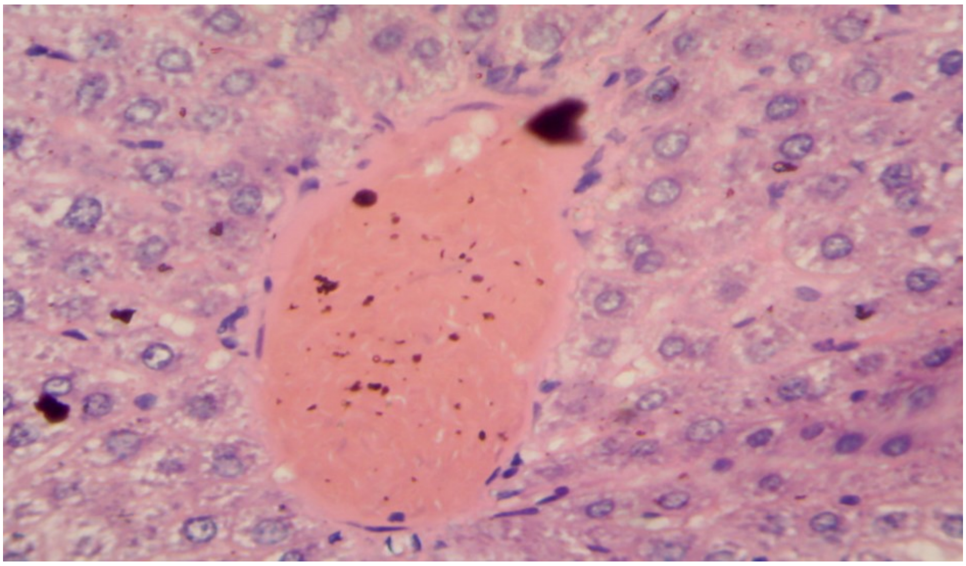

Figure 10: Test group C liver section (H & E $\times$ 400) showing haemorrhagic exudations

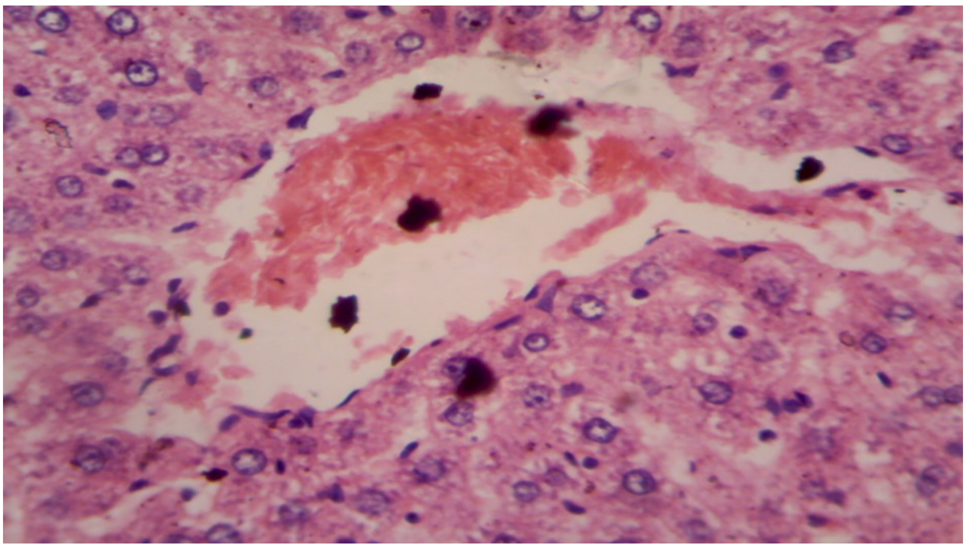

Figure 11: Test group C liver section (H & E $\times$ 400) showing parenchyma erosion

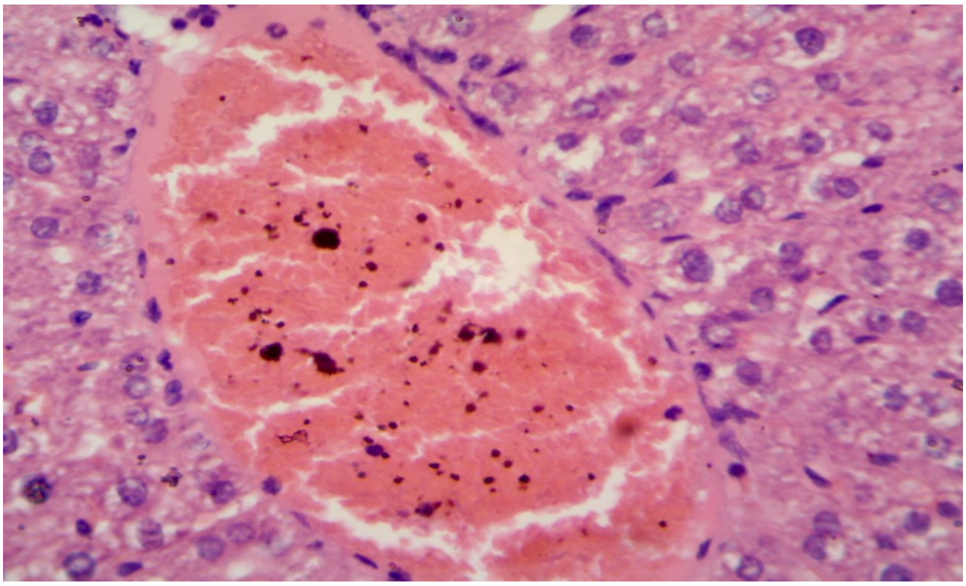

Figure 12: Test group C liver section (H & E $\times$ 400) showing thrombosis

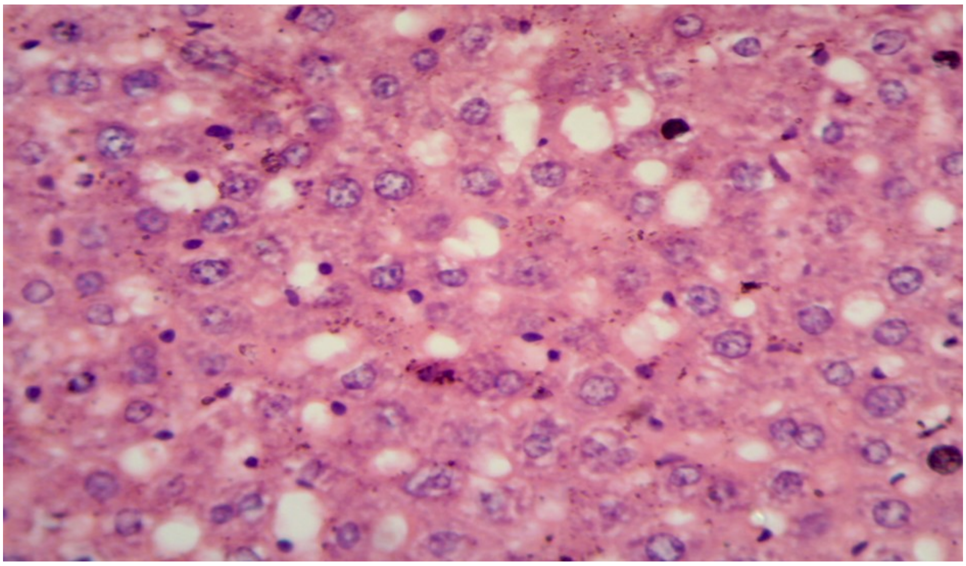

Figure 13: Test group D liver section (H & E $\times$ 400) showing vacuolations

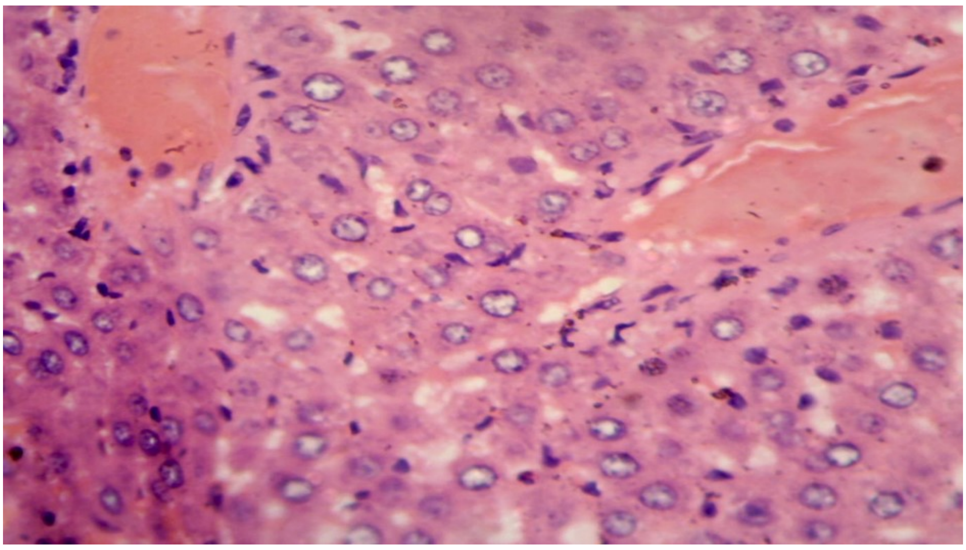

Figure 14: Test group D liver section (H & E $\times$ 400) showing haemorrhagic exudation

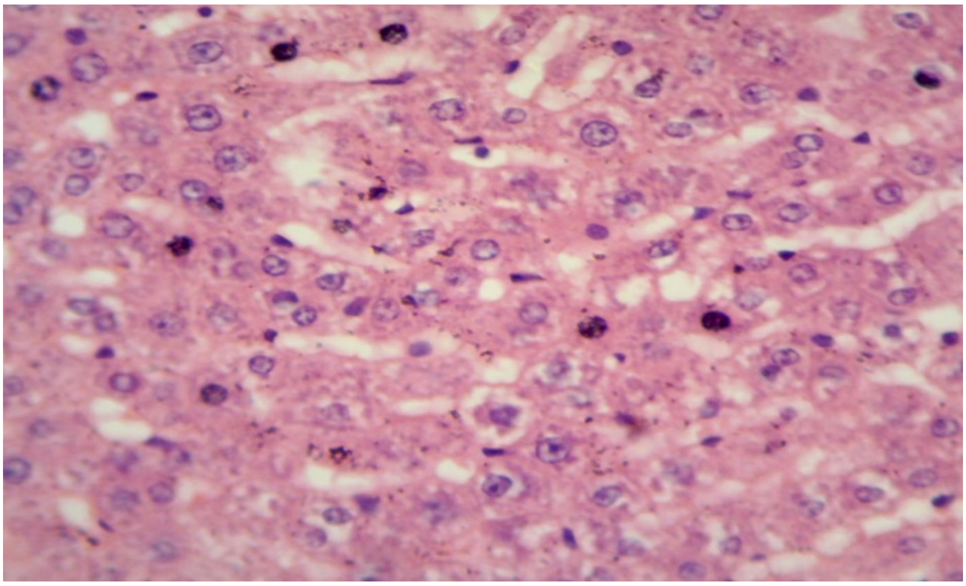

Figure 15: Test group D liver section (H & E $\times$ 400) showing severe hepatic necrosis

Table 2: Histological Observations of the Effect of Potash (Kanwa) on the Liver of Wistar Rats

HISTOLOGICAL OBSERVATION	GROUP A (CONTROL)						GROUP B TEST (12g)						GROUP C TEST (36g)						GROUP D TEST (60g)					
	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
Hepatic Necrosis	-	-	-	-	-	-	+	+	+	+	+	+	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
Hepatic Infarction	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thrombosis	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+	+	+	-	-	-	-	-	-
Haemorrhagic Exudation	-	-	-	-	-	-	+	+	+	+	+	+	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
Parenchyma Erosion	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+	+	+	-	-	-	-	-	-
Vacuolations	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+	+	+

4. Discussions

Histologically, the results of the Haematoxylin and Eosin staining (H & E) reactions showed that potash administration resulted in progressive hepatocellular alterations as seen in the cyto-architecture of the liver in the treated groups (B, C and D) which was at variance with that of the control group A. The micrograph of the liver sections in control group (A) showed normal histological features. However, the liver sections of group B animals fed with 12 g of potash showed that potash caused marked abnormalities such as hepatic necrosis, hepatic infarction and exudation. It could be inferred that the effect may have been caused by the administered potash. At the time of this research, there was no documented report to support my findings.

The liver sections of the treated group C showed severe hepatic necrosis, haemorrhagic exudation, parenchyma, erosion and thrombosis in the pre-acute phase. With these disruptions, it could be inferred that the administered potash may have acted as toxins by inducing cellular injury to the liver (hepatic) cells but there is no report to back up my findings. The liver sections of the treated group D at the pre-acute phase revealed vacuolations, haemorrhagic exudation and severe hepatic necrosis. From these effects, it has been noted that as the concentration increased, the effects became more severe.

5. Conclusion

From the result of this potash chemical analysis, it has been observed that sodium was the predominant metal in all the samples. Sodium constituted more than 70% of the total composition of the potash samples. These elements are known as the macro-elements and are mainly utilized in the body for structural purposes (calcium) or in maintenance of acid to base balance (sodium, potassium and chlorine). Potassium levels were low (ranging from 2.8 to 5.4%), as such, the name "potash" is actually a misnomer.

From the histopathologic distortion observed, it could be inferred from the results of this study that potash administration caused degenerative and destructive damages observed in the liver tissue sections. In view of the above observations, it is clear in this study that in every concentration of the administered potash caused considerable histological damages to the liver. It could, therefore, be deduced that the repeated consumption of potash by the experimental animals lead to serious toxicological implications on liver tissues and the extent of damages varies with potash concentration. The observed effects from this present study dispute the common believe that potash has no health implications. Further studies should be carried out to substantiate these findings.

Article Information

Acknowledgments: We acknowledged the support and assistance of staff of the department of Histopathology and Cytopathology, Faculty of Medical Laboratory Science, Ambrose Alli University, Ekpoma, Edo State and all the technical staff of St Kenny Research Consult, Ekpoma, Edo State, Nigeria for their excellent assistance and for providing medical writing/editorial support in accordance with Good Publication Practice (GPP3) guidelines.

Author Contributions: J.K.B. - Conceptualization, Methodology, Formal analysis, Writing – original draft, Writing – review & editing; O.M.A. - Methodology, Formal analysis; S.I.O. - Data curation; E.O. - Data curation, Writing – review & editing, Supervision.

Funding / Financial Support: The authors received no external funding.

Conflict of Interest (Competing Interests): The authors declare no competing interests.

Ethical Approval: The study was approved by the Ambrose Alli University Health and Ethics Committee.

Disclaimer (Artificial Intelligence): The author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.), and text-to-image generators have been used during writing or editing of manuscripts.

References

[1] C. M. Bankole J. K. Ngokere A. A. Ajibade O. M. Igunbor and C. C. V. Eloka. Degenerating effects of potash (Kaun-K2co3) on the kidney: Unabated continental challenge to human health in Nigeria. *Scholars Research Library, Annals of Biological Research*, 6(3): 12–18, 2015. URL http://scholarsresearchlibrary.com/archive.html.

[2] J. M. Nielsen. East African magadi (trona): Fluoride concentration and mineralogical concentration. *Journal of African Earth Sciences*, 29:423–428, 1999.

[3] S. O. Aribido, B. K. Ogunmodede, and C. A. M. Lakpini. Nutritional assessment of 'Gwanwarasa' Type of Natural Potash (Kanwa). *Nigerian Journal of Chemical Research*, 6(3):27–30, 2001.

[4] K. M. Buchanan and J. C. Purgh. *Land and People in Nigeria*. University of London Press, London, $7^t h$ edition, 1961. Pages 44-62.

[5] C. B. I. Alawa, A. M. Adamu, O. W. Ehoche, O. S. Lamidi, and O. O. Oni. Performance of Bunaji Bulls fed maize stover supplemented with urea and local mineral lick (Kanwa). *Journal of Agriculture and Environment*, 1(2):35–42, 2000.

[6] J. O. Gefu, P. A. Abdu, and C. B.I Alawa. Ethnoveterinary Practices of livestock producers in Nigeria. Pages 80 – 84, 1998.

[7] J. D. Fage. The Cambridge history of Africa: From the earliest times to 500BC. *Cambridge University Press*, 1:222–225, 1982.

[8] E. J. Ekanem. A preliminary analysis of samples of Kanwa for sodium, potassium and other minerals. *Journal of Biochemical Analysis*, 2(1):25–43, 1977.