Toxicity Study of Potash Extract, “jar Kanwa”: An Earthy Material Consumed for Remedy of various Ailments in Northern Nigeria

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ABSTRACT

Potash comprises potassium bearing minerals. These minerals are traditionally used for treatments of many ailments in Northern Nigeria with little knowledge of their safety profile. Acute toxicity (LD50) study of the potash extract was carried out on adults Wister rats. Based on the result of LD50; four groups of Wister rats; Group I, II, III and IV, each containing six males were formed. Group I was administered distilled water while group II was administered 20% (1,000 mg/kg) of the highest non-lethal dose. Group III and IV were administered 10% (500 mg/kg) and 5% (250 mg/kg) of the highest non-lethal dose respectively. These were done continuously for 28 days. Intakes of food and water were recorded daily while weights of animals were recorded weekly. There was no mortality at both phase 1 & 2 of the LD50. Results of chronic toxicity revealed two mortalities recorded in group II. Acute toxicity studies of potash extract showed that it is generally safe but in sub-chronic toxicity study, the extract was lethal on the experimental animals at higher doses. Therefore, consumption of this earthy material on a long term basis should be discouraged due to its lethal effects on animal studies.

Keywords: Consumption, Potash Extract, Safety Profile, Wistar Rats

INTRODUCTION

Potash is a broad term that covers all the bases when looking at potassium-bearing minerals. These minerals are naturally found in large evaporate deposits from ancient lake and sea beds or in rock formations.1 Literally potash means potassium compounds and potassium bearing materials. The word potash was derived in 1477 from the Middle Dutch word “potaschen” meaning pot ashes.2 Several health benefits of potash have been unraveled. It has been used for the treatment of cough, tooth ache relief, fungicidal, abortifacient and as a preservative.1 It is widely consumed by Nigerians, particularly those in the Northern part of the country with the belief that it suppresses sexual desire and provides some contraceptive properties. Conversely, potash poses health hazards on human beings, especially when consumed in a large quantity. Recent reports based on expert opinions believed that consumption of potash suppresses steroidogenesis and the high sodium content could also cause pathological changes to the liver and kidneys.3 There are different types of potash namely; sylvite (KCl, called regular potash or Muriate of potash),...
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polyhalite or potassium sulfate (K₂SO₄) /sulphate of potash, Carnallite (potassium magnesium chloride and water), Langbeinite (potassium magnesium) named sulfate of potash magnesia (SOPM), arcaneite, arcanuni, salduplicatum, vitriolic tartar, Glaser's salt, Sal polychrestum Glaseri or potash of sulfur. Many types of mineral such as Polyhalite, Leonite, Kainite, Glaserite, Schöniite, Langbeinite and potassium sulfate, can be separated from the potash.

There is paucity of options and nomenclature of water soluble mineral salts especially by Hausas, of Northern Nigeria. Most evaporites including potash are called kanwa in Hausa language. The evaporites used in Northern Nigeria, locally called farar kanwa, jar kanwa, ungurnu are Tronas; Natron is classified as dutse dan Libya while manda is polyhalite.

In Nigeria, kanwa deposits are commonly found in northern part of the country, particularly in Kano, Maiduguri areas extending to border countries like Niger and Chad. It has varieties of uses such as food supplement and as a medicine. Farmers also use it as salt lick for animals in Northern Nigeria. Potash is referred to as kaum in Yoruba language and is commonly known as akanwu in Igbo language. All the three major Nigerian tribes (Hausa, Igbo and Yoruba) use potash in soups, legumes and meat mainly to faster tenderize tough cuts of meat and legumes, to colloid oil and water and to increase viscosity in some types of soups.

Research on the health benefits of potash is limited in the literature. However, understanding of its use in the world major fertilizer production firms, and inhalation of its dust by workers led to the investigation of the relationship between atmospheric dust levels and workers’ health. Findings in relation to its effect where unremarkable. In an attempt to investigate the effects of potash consumption on kidneys, a study was conducted in southern Nigeria on Wistar rats. Findings from the study showed that at varying concentration of potash, there were progressive tubular and vascular changes, cellular necrosis and glomerular degeneration and these imply that potash is cytotoxic to the kidney tissues of wistar rats. They concluded that excessive consumption of this earthy material may lead to its accumulation that could cause severe and irreparable damage to the kidneys and disrupt normal body functions. This research was aimed at determining the toxicity of potash extract among male wistar rats.

MATERIALS AND METHODS

This research was conducted in the Pharmacology laboratory of Bayero University Kano from 1st June, 2018 to 31st October, 2018. A pure potash extract was collected from Haji Bukaran, an area of Nguru Local Government area of Yobe State. The collected pure sample of potash was grinded to a powdered state using pestle and mortar. Three kilogrammes of powdered potash was dissolved in 2 liters of distilled water. The solvent was filtered using No 1 Whatmann's filter paper, size 12.5 micron and allowed to dry in desiccators at 45°C. The process was repeated until adequate potash extract was obtained.

Adults Wistar rats were purchased from the Animal House of Ahmadu Bello University (ABU) Zaria with a weight of 110-130g each. The rats were kept at the animal house of Pharmacology department of Bayero University Kano (BUK) under normal laboratory conditions. They were allowed unrestricted access to standard feed (Vital feed growers) obtainable from Grand Cereals and Oil Mills Ltd, Bukuru, Jos, Nigeria and water ad libitum throughout the experimental period. They were handled in accordance with the guidelines for the care and use of laboratory animals. The animals were randomly selected and marked to allow individual identification and kept in their cages for five days prior to the experiment to allow for acclimatization to the laboratory conditions.

Acute toxicity (LD50) study of the potash was carried out using the method described by Lorke. This method entertained two phases as follows:

Phase 1: This phase required nine Wistar rats which were divided into three groups of three animals each. Each group was administered different doses (10, 100 and 1000 mg/kg) of the potash solution. The rats were fasted for 18 hours prior to dosing. The potash solutions were administered to the rats once orally using 22-gauze oral feeding needle based on their weights. The Wistar rats were then placed under observation for 24 hours to monitor their behavior as well as if mortality would occur.

Phase 2: This phase involved the use of three wistar rats, which were distributed into three groups of one animal each. These wistar rats were administered higher doses (1600, 2900 and 5000 mg/kg) of potash extract solution and then observed for 24 hours for behavior as well as mortality.

Then the LD₅₀ was calculated by the formula:

\[ \text{LD}_{50} = \sqrt{(D_{100} - D_{0})} \]

Here, \( D_0 \) = Highest dose that gave no mortality,

\( D_{100} \) = Lowest dose that produced mortality.

Based on the result of LD50; four groups of wistar rats; Group I, II, III and IV, each containing six males were formed.
Group I were administered distilled water while group II were administered 20% of the highest non-lethal dose. Group III and IV were administered 10% and 5% of the highest non-lethal dose respectively. These were done continuously for 28 days. Intakes of food and water were recorded daily while weights of animals were recorded weekly. Approval for the study was obtained from the ethical committee of Bayero University Kano (BUK /CHS/ REC/ VI/ 56), after due consideration of animal health and the advancement of knowledge on humans or animals weighed against the potential impacts on the welfare of the animals. Following the approval, the researcher was under obligation to ensure that laboratory animals were treated according to high ethical and scientific standards.

### RESULTS

Results of LD<sub>50</sub> showed no mortality at both phase 1 & 2. Therefore, the maximum dose of 5,000 mg/kg was found to be non-lethal to the wistar rats. In the results of chronic toxicity, Group II, III and IV of the wistar rats were given 1,000 mg/kg, 500 mg/kg and 250 mg/kg of potash extract daily over a period of 28 days while group I (control) was on food and water only (Table 2). There were no significant changes in weight of the wistar rats, intake of food and water during the period of the study. There were two mortalities recorded in group II. Figure 1 and 2 depict the crude potash (*jar kanwa*) and the extract respectively.

<table>
<thead>
<tr>
<th>Phase 1</th>
<th>Group I</th>
<th>Number of Wistar rats</th>
<th>Dose (mg/kg)</th>
<th>Period under observation (Hours)</th>
<th>Mortality/behavioral changes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3</td>
<td>10</td>
<td>24</td>
<td>Nil</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>100</td>
<td>24</td>
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</tr>
<tr>
<td></td>
<td>3</td>
<td>1,000</td>
<td>24</td>
<td>Nil</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>9</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Phase 2</th>
<th>Group I</th>
<th>Number of Wistar rats</th>
<th>Dose (mg/kg)</th>
<th>Percentage of highest non-lethal dose (%)</th>
<th>Duration (days)</th>
<th>Mortality/behavioral change</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>1</td>
<td>1,600</td>
<td>24</td>
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<td>28</td>
<td>2 Mortalities</td>
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<tr>
<td></td>
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<tr>
<td></td>
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<td>24</td>
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</tr>
<tr>
<td>Total</td>
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Table 2: Chronic Toxicity Study

<table>
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<tr>
<th>Groups</th>
<th>Number of Wistar rats</th>
<th>Dose (mg/kg)</th>
<th>Percentage of highest non-lethal dose (%)</th>
<th>Duration (days)</th>
<th>Mortality/behavioral change</th>
</tr>
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<tbody>
<tr>
<td>I</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>28</td>
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</tr>
<tr>
<td>II</td>
<td>6</td>
<td>1,000</td>
<td>20</td>
<td>28</td>
<td>2 Mortalities</td>
</tr>
<tr>
<td>III</td>
<td>6</td>
<td>5000</td>
<td>10</td>
<td>28</td>
<td>nil</td>
</tr>
<tr>
<td>IV</td>
<td>6</td>
<td>250</td>
<td>5</td>
<td>28</td>
<td>nil</td>
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</tbody>
</table>

Note: Highest non lethal dose based on acute toxicity study was 5,000 mg/kg
DISCUSSION
The result of lethal dose 50, the dose that kills 50% of test animals' population (wistar rats) when exposed to potash extract showed no mortality. This was similar to the findings of Imafidon and Omorogbe on toxicological and biochemical investigations in rats administered “kaun” (trona), a natural food additive used in Nigeria. 

S. Ika and colleagues in South-Southern Nigeria in a study on the effect of potash on liver function of wistar rats also reported no mortality on acute toxicity study following potash treatment. This shows that the potash is safe when consumes on short term basis but on long term use, it is lethal for we recorded two mortalities in the 28 day period of exposure. Furthermore, the mortality was recorded in the 1,000 mg/kg group, i.e., the group with highest dose (20% of the non lethal dose).

A toxicological and biochemical investigations in rats administered trona, a naturally occurring inorganic substances (salts), used mainly as food additive showed that no demonstrable significant toxic effects. And its administration to rats up to 5000 mg/kg resulted in no mortality of the test rats after 24 hours. Hence the LD₅₀ of this potash extract was estimated to be greater than 5000 mg/kg as they also found in trona. The LD₅₀ was not calculated in this study because there was no mortality at 5000 mg/kg dose level indicating that it is relatively safe under short term exposure. However, acute toxicity data are of limited clinical application since cumulative toxic effects especially at a dose of 1,000 mg/kg was found to be lethal due to the recording of two mortalities. Based on the findings of a study conducted on the effects of chronic exposure to lead, cadmium, and manganese mixtures on oxidative stress in rat liver and heart, it was concluded that exposure to these heavy metals could result in distribution and accumulation of these metals in the body and subsequent weakening of the immune system which could eventually lead to mortality as was noticed in this study.

CONCLUSION
Acute toxicity studies of potash extract showed that it is generally safe but in sub-chronic toxicity study, the extract was lethal on the experimental animals at higher doses. As part of our recommendation, we discourage consumption of these earthy materials on a long term basis due to its lethal effects on animal studies.

Acknowledgement
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Conflict of Interest
None declared.

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