African Journal of Biology and Medical Research
ISSN: 2689-534X
Volume 7, Issue 1, 2024 (pp. 78-84)
www.abjournals.org

BACTERIAL LOAD ASSESSMENT OF POTASH SOLUTION (NGOR) AND ITS PRACTICES IN SOME PARTS OF EASTERN NIGERIA.

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Cite this article:

Osuoha C. B., Helen I. U., Treasure N. N., Igiri V. C., David C. I. (2024), Bacterial Load Assessment of Potash Solution (NGOR) and its Practices in some Parts of Eastern Nigeria. African Journal of Biology and Medical Research 7(1), 78-84. DOI: 10.52589/AJBMR-TMASVXEN

Manuscript History

Received: 19 Oct 2023

Accepted: 17 Jan 2024

Published: 23 Feb 2024

ABSTRACT: *Bacterial load of potash solution and its practices were assessed in some parts of eastern Nigeria to determine the presence of bacteria contaminants and their counts, as well as investigate the sourcing of water and materials during production. Standard methods were used, which include microscopy, culture and biochemical identification. The bacteria isolates encountered were Escherichia coli 06 (18.75%), Staphylococcus aureus 09 (28.13%), Bacillus subtilis 04 (12.5%), Klebsiella species 08 (25%), and Proteus mirabilis 05 (15.63%). The total mean colony forming units (TCFU) counted ranged from* 1.75×10^4 *and* 8.90×10^3 *which were above the WHO standard for potable water.*

KEYWORDS: Bacterial load, Potash solution, Ngor (potash type), Eastern Nigeria, Assessment, Practices.

INTRODUCTION

Potash is used for many purposes in Nigeria. It is used as a tenderizer, flavouring agent, food preservative and prophylactic as well as for improving protein digestibility of cowpea [1] (Omueti *et al.*, 2015; Uzogara *et al.*, 2015). Apart from being taken in food, it is also used as a component of some Nigerian medicinal concoctions and sometimes it is chewed raw with high potency in treatment of cough, tooth and stomach aches and constipation. [2] (Sodipo *et al.*, 2016).

In Nigeria, potash solutions of certain vegetable matter or agricultural waste have been used locally in the production of an instant emulsion called *ncha* used in preparing dishes such as *Nkwobi*, *isi-ewu*, *kpomo, ugba*, *abacha* and *otong [3].* These agricultural wastes such as unripe banana peels, unripe plantain peels, maize cob and palm fruit bunch contain a good percentage of potash alkali especially for a wide range of uses comparable to the conventional and inorganic potash salt locally called *akanwu* in igbo or *kawu* in Yoruba language [4].

The use of poor water for washing in food processing and preparation can introduce microorganisms into food. [5]. Another avenue through which foods get contaminated during processing and preparation is infected food handlers and their unhygienic practices [6]. Handlers who do not wear gloves commonly spread Staph bacteria to meat, cream-filled desserts, potato salads and egg products [7]. Food containing harmful microorganisms are responsible for more than 200 diseases ranging from diarrhea to cancers [8]. The extensive consumption of potash in uncooked meals, especially those sold by food vendors in the eastern parts of Nigeria, is a call for the assessment and continuous monitoring of possible public health hazards from such practices.

METHODS

This study was carried out in Abia State (Umuahia) and Imo State (Owerri and Mbaise), Nigeria. Umuahia is the capital city of Abia State in Southeastern Nigeria. Abia State and Imo State are indigenously Igbo. Owerri is the capital of Imo State while Mbaise is dominantly a rural area inhabited by farmers who largely practice subsistence farming with traditional farming methods. The area under study has a tropical climate and two main seasons, namely: Rainy and Dry season [9] (City Population, 2022).

A total of 50 potash solutions were obtained from different vendors from various markets in Umuahia, Owerri municipal and Mbaise. The potash solutions (Ngor) from various sources were collected from different vendors from the different markets in the study areas—three markets in Umuahia, Abia State; one market in Owerri; and one market in Mbaise, Imo State, namely: Isi-gate, Umuahia; Orieugba Market, Umuahia; Nkwoegwu Market, Umuahia; Douglas Market, Owerri; and Afor-Ogbe Market, Mbaise. Control samples were prepared in the national soil plants and water laboratory, Umudike, Abia State. One kilogram (1kg) of plantain peel and a bunch of palm were washed and dried in the sun for 4 days and finally in an electric oven at 65^{o}C for 6 hours. The dried sample was burnt to ashes and soaked with 1000 ml of distilled water for about 24 hours. The samples were filtered and stored in sample bottles which were used in the analysis as the control samples. The total bacterial colony-forming unit (TCFU) was determined using the serial dilution method under aseptic conditions as described

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by [10] Wollum (1982). One millilitre (1ml) of each sample (inoculum) was diluted to 10ml using sterile distilled water, and subsequently 1ml of the 10ml diluent was serially diluted to get the 7th (10^{-7}) diluent. The diluents were streaked on prepared media (CLED, SSA, blood agar and chocolate agar using sterile wire loop). The plates were incubated at 37ºC for 24-48 hours. Preliminary identification was based on colony characteristics of the organism such as size, shape, colour, elevation, haemolysis on blood agar, odour and changes in physical appearance in media. Isolates were identified based on their gram reaction and biochemical test results. The bacterial colonies were counted using the colony counter and the total coliform count was calculated [11].

RESULTS

Demographic Characteristics of Vendors

A total of 50 vendors participated in this research: 6 (12%) males and 44 (88%) females. The participants were aged 15-65 years, with 40 (80%) residing in urban areas and 10 (20%) residing in rural areas (Table 4.1).

None of the vendors had tertiary education; however, 15 (30%) had secondary education, 33 (66%) had primary education, and 2 (4%) had no formal education at all.

Vendor Sourcing of Materials

The potash solutions used in this were from palm bunch and plantain peel. Thirty 30 (60%) were from palm bunch while 20 (40%) were from plantain peel. With regard to the water sources, 8 (16%) were from the stream, 36 (72%) were from boreholes and 6 (12%) were from rain water. Regarding sourcing of bottles, 5 (10%) were new bottles, 6 (12%) were picked from bins and 39 (78%) were used bottles from shops/stores.

Mean pH of the Potash Solution

The mean pH of potash solutions of palm bunch was 10.44±0.05 while the mean pH of potash solutions of unripe plantain peel was 10.39±0.12.

Total Mean Bacterial Count (Cfu/Ml) of Bacteria Isolated from the Potash Solutions (Ngor) Purchased from Various Markets

The total mean bacterial count (cfu/ml) of bacteria isolated from the potash solutions (Ngor) purchased from various market were as follows: 1.75×10^4 (Isi-gate Market), 8.63×10^3 (Orieugba Market), 6.97×10^3 (Nkwoegwu Market), 1.15×10^4 (Douglas Market) and 8.90×10^3 (Afor-Ogbe Market).

Bacteria Isolates Present in the Potash Solutions

The bacteria isolates present in the potash solutions were: *Escherichia coli* 06 (18.75%), *Staphylococcus aureus* 09 (28.13%), *Bacillus subtilis* 04 (12.5%), *Klebsiella species* 08 (25%), and *Proteus mirabilis* 05 (15.63%).

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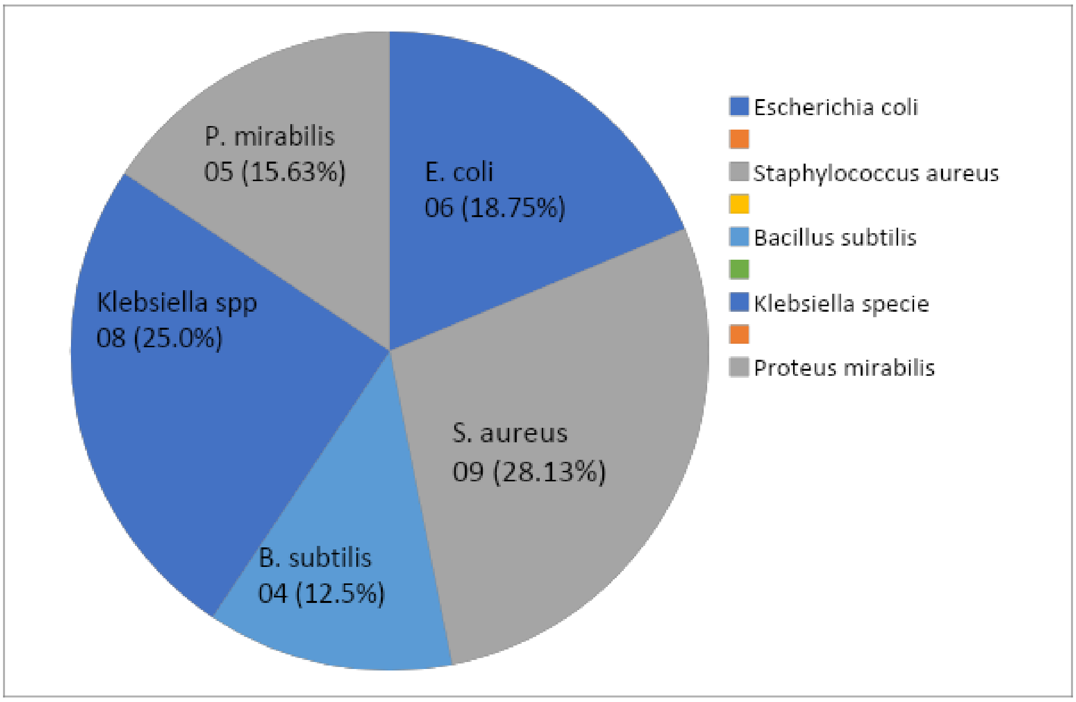

Figure 1: Pie chart of bacteria isolates present in the potash solutions

BACTERIA ISOLATES PRESENT IN THE POTASH SOLUTIONS FROM THE DIFFERENT SITES OF COLLECTION/MARKETS

Among the bacteria isolated from the potash solutions, *Staphylococcus aureus* had the highest frequency of 9 (28.13%) with its presence in the different markets as follows: Isi-gate Market 1 (3.1%), Orieugba Market 2 (6.25%), Nkwoegwu Market 2 (6.25%), Douglas Market 1 (3.1%) and Afor-Ogbe Market 3 (9.4%). *Klebsiella species* had a frequency of 8 (25%), with its presence in the different markets as follows: Isi-gate Market 1 (3.1%), Orieugba Market 2 (6.25%), Nkwoegwu Market 2 (6.25%), Douglas Market 1 (3.1%) and Afor-Ogbe Market 2 (6.25%). *Escherichia coli* had a frequency of 6 (18.75%), with its presence in the different markets as follows: Isi-gate Market 1 (3.1%), Orieugba Market 2 (6.25%), Nkwoegwu Market 1 (3.1%), Douglas Market 0 (0%) and Afor-Ogbe Market 2 (6.25%). *Proteus mirabilis* had a frequency of 5 (15.63%) with its presence in the different markets as follows: Isi-gate Market 2 (6.25%), Orieugba Market 0 (0%), Nkwoegwu Market 1 (3.1%), Douglas Market 2 (6.25%) and Afor-Ogbe Market 0 (0%). *Bacillus subtilis* had a frequency of 4(12.5%), with its presence the different markets as follows: Isi-gate Market 1 (3.1%), Orieugba Market 1 (3.1%), Nkwoegwu Market 1 (3.1%), Douglas Market 1(3.1%) and Afor-Ogbe Market 0 (0%).

DISCUSSION

In Africa, potash solutions are diversely used for both domestic and commercial purposes. It is used in the preparation of African dishes and production of local soap. It is often used as a tenderizer in cooking, an ingredient in certain foods and medicinal preparations, a mordant in dyeing, and a purgative in drinking water for livestock [12].

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The potash solutions were sourced from market vendors, who were mostly primary school leavers. Out of the 50 potash solutions (Ngor) purchased from the various markets, 32 yielded bacterial growths. Five microorganisms were isolated: *Escherichia coli* (18.75%), *Staphylococcus aureus* (28.13%), *Bacillus subtilis* (12.5%), *Klebsiella species* (25%), and *Proteus mirabilis* (15.63%). The total mean bacterial count (cfu/ml) in the potash sample solution from the various markets were 1.75×10^{-4} (Isi-gate Market), 8.63×10-3 (Orieugba Market), 6.97×10^{-3} (Nkwoegwu Market), 1.15×10^{-4} (Douglas Market) and 8.90×10^{-3} (Afor-Ogbe Market). These total mean bacterial counts (cfu/ml) were within the WHO permissible limits for water bacteria count. However, *Escherichia coli* is indicative of feacal contamination while *Klebsiella species* and *Proteus mirabilis* are pathogenic organisms. According to Okeke *et al.* [13], unhygienic practices such as sneezing, coughing during processing stages of food production, not washing the hands after defecation, and use of dirty water and containers are the surest ways of introducing microbes and other contaminants into food products prepared for human consumption. Afor-Ogbe Market showed the highest total mean bacterial counts (cfu/ml) (8.90×10^{-3}) while Douglas Market was the lowest (1.15×10^{-4}). Afor-Ogbe Market is located in a rural domicile unlike Douglas Market that is located in an urban area. Unavailability of clean water and unhealthy practices could be the reasons for this higher total mean bacterial count (cfu/ml).

The mean pH of the potash solutions (Ngor) purchased from the various markets was 10.44±0.05 for potash solutions of palm bunch and 10.39±0.12 for potash solutions of unripe plantain peels (Table 4.3), while the mean pH of the control potash solution was 8.5±0.14. This indicates that potash solutions are primarily alkaline. The difference between the alkalinity of the ones purchased from the various markets and the control sample may be due to variations in the plants' geographic locations, ages, and the amount of nutrients in the soils where the plants used for the preparation of the potash solution were planted. In their research, [14] reported a higher pH value of 11.29 for potash solutions of unripe plantain peels and 12.73 for potash solutions of palm bunch. The inhibitory activity of alkaline solutions to bacterial growth could be the reason why the organisms did not grow beyond the observed numbers (cfu/ml) in the potash solutions [15].

It was observed that there were more females 44 (88%) than males 6 (12%) in this study. Preparation of potash solution is perceived as a domestic activity and therefore seen as feminine activity in the Southeastern part of Nigeria. Out of the 50 vendors, only 5 (10%) had knowledge that potash solution (Ngor) serves as a source of potassium but all of them knew it as a tenderizer and had used it in meal preparation. The potash solutions were sourced from market vendors, who are not literate enough to know the content of the potash solution, as none of the vendors had tertiary education, although 15 (30%) had secondary education and 33 (66%) had primary education. With regard to the water used in preparing the potash solution, 43 (86%) of the participants believe that the type of water used in dissolving Ngor ashes matters; this could be seen in their water sourcing as a higher percentage of them, 36 (72%) sourced water from borehole while 8 (16%) sourced from stream, and 6 (12%) from rain water. Moreover, most of the participants, 40 (80%) reside in urban areas where boreholes are available.

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CONCLUSION

The results of this study showed that there was bacterial contamination of potash solutions sold in the market, the counts of which were above the WHO approved minimum standard. Unhygienic practices could be the major route through which the bacterial contaminants are introduced. It is necessary therefore to create awareness on the dangers of food handling by vendors in addition to the proper enforcement of standardization in consumables sold in the local markets.

REFERENCES

1. Mubaiwa J, Fogliano V, Chidewe C, Linnemann AR. Hard-to-cook phenomenon in bambara groundnut (Vigna subterranea (L.) Verdc.) processing: Options to improve its role in providing food security. Food Reviews International. 2017 Mar 4;33(2):167-94.
2. Gbile ZO, Adesina SK. Nigerian flora and its pharmaceutical potential. Journal of ethnopharmacology. 1987 Jan 1;19(1):1-6.
3. Uzodinma E.O., Onwueluzo J.C. and Abugu S.N. (2014). Production and Evaluation of instant emulsion base (ncha) from oil palm biogenic waste. African Journal of Biotechnology, 13(49): 4529-4535.
4. Olabanji O., Oluyemi E.A and Ajayi S.O. (2012). Metal analysis of ash derived alkalis from banana and plantain peels (Musa spp) in soap making. African Journal of Biotechnology, 11 (99): 16512-16518.
5. Tropea, A.; Potortì, A.G.; Lo Turco, V.; Russo, E.; Vadalà, R.; Rando, R.; Di Bella, G. Aquafeed Production from Fermented Fish Waste and Lemon Peel. Fermentation 2021, 7, 272
6. Kaarina, A. (2007). Effect of maintenance routines in food Processing on production hygiene: In Microbial Contaminants & Contamination Routes in Food Industry. Gun Wirtanen & Satu Salovtt (eds), VTT Espoo, Finland. Pp 36-38. ISBN 978-951-38-6319-7
7. Alum, E.A, Urom, S.M.O.C, Ben, C.M.A (2016). Microbiological Contamination of Food: The Mechanisms, Impacts and Prevention. International Journal of Scientific & Technology Research 5(3): 65-78
8. Bryan, F.L. (1982). Diseases Transmitted by Foods‖. Atlanta: Centers for Disease Control; 1982.
9. Olaniran OJ. A study of the seasonal variation of rain-days of different categories in Nigeria in relation to the Miller station types for tropical continents. Theoretical and applied climatology. 1987 Dec;38:198-209.
10. Nm
11. Cheesbrough, M. (2006). District laboratory Practice in tropical countries part 2, 2nd edition. Butterworth Cambridge University Press, 440p
12. Alaribe C.S., Oladipupo A.R., Cibedamosi S., Emaejeroke J.T. and Bashiru K.A. (2019). Determination of metals by atomic absorption spectrometry in unripe plantain peels ash and comparative geno toxicity studies with kawu "potash" using gel electrophoresis and diphenylamine assay. Annals of Science and Technology 7(2): 73-77.

Article DOI: 10.52589/AJBMR-TMASVXEN
DOI URL: https://doi.org/10.52589/AJBMR-TMASVXEN

13. Okeke O., Ezeh E., Ozuah A.C. and Ezehiofor C.C. (2019). Effect of processing on the microbial load of cassava meal products sold within Enugu metropolis. J. Chem. Biol. Phy. Sci., 9(3): 414-425
14. Okeke O, Aniobi C.C, Ezeh E, Ochuba C.O, Ezejiofor C.C (2020). Microbial and Heavy Metal Evaluation of Solutions of Ash Produced From Unripe Plantain Peels and Oil Palm Fruit Bunch Sold in Market Outlets within Afikpo South L.G.A. in Ebonyi State. International Journal of Science and Research (IJSR) 9(4):1670-1676
15. Padan E., Bibi C., Ho M. and Krulwich T. (2005). Alkaline homeostasis in bacteria and fungi: New insights. Bio Che. Biophys. Acta., 1717(2): 67-88.

Article DOI: 10.52589/AJBMR-TMASVXEN
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