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Potassium Bromate Content of Bread Samples in Lagos City

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ABSTRACT

Levels of potassium bromate in fourteen different bread samples from Lagos city and suburbs were determined using spectrophotometric techniques. The concentration of potassium bromate in these bread samples ranged between 0.05 ± 0.01 µg/g and 1.99 ± 0.01 µg/g. All the bread samples analysed had potassium bromate level above the maximum concentration allowed by the National Agency for Food, Drug Administration and Control (NAFDAC) which is 0.02 µg/g. Using the Pearson Product Moment Correlation (PPMC), a weak positive relation (r= 0.25) was shown between the level of potassium bromate and the price of the bread samples. The price or status of bread samples did not affect the level of potassium bromate present. There is therefore need for more aggressive monitoring by the regulatory bodies especially at sale points in other to ensure the safety of the consumers in the Lagos city and suburbs.

Key words: Potassium bromate, bread, wheat flower, baking, nutrition

INTRODUCTION

Bread is a staple food in many homes in Nigeria. All genders, all ages, all tribes, both the rich and the poor consume bread, and it comes in various sizes, shapes, compositions and price tags to meet the needs of different categories of consumers (Etim. 2017). Bread is the product of baking, a mixture of flour, water, salt, sugar, flavours, yeast and other ingredients. The aims of the bread making processes are to produce dough that will rise easily and have properties required in making good bread for the consumer (BIRT, 2016). In a quest to harness the natural variability of wheat flour, bakers started using chemical oxidizing agents to strengthen gluten proteins. Oxidizing agents primarily affect sulfur-containing amino acids, ultimately helping to form disulfide bridges between the gluten molecules. (Bakerpedia, 2018). The addition of these agents to flour will create stronger dough. Potassuim bromate is such an oxidizing agent; other oxidizing agents include ascorbic acid, azodicarbonamide, and potassium iodate. Among all these oxidizing agents, potassium bromate is the most attractive to bakers because it is cheap, possibly the most efficient oxidizing agent (Osuji, 2006) and increases the shelf life of bread (Van Staden, *et al.*,2004). Potassium bromate is a flour improver used to strengthen dough and enhance its elasticity thus giving uniform and whitened bread (Pilla, 2016) which is usually the consumers' desire. Under normal conditions, baking alters its chemical composition and renders it harmless, leaving no trace in the finished product (Abu-Obaid *et al*., 2016). However, if too much is added, or if the bread is not baked long enough at a high enough temperature, then a residual amount will remain, which may be harmful if consumed (Pilla, 2016). Potassium bromate has been implicated in kidney damage (Ali, *et al.,* 2018), genotoxic, carcinogenic and toxic effects (Starek and Starek-Swiechowicz, 2016). Potassuim bromate has also being found to degrade the nutrients such as vitamins A1, A2, B1, B2, E and niacin which are the main vitamins available in bread (FOA,1992) when used for baking. Furthermore, the inhalation of potassium bromate has also been found to cause the development of cough, sore throat, abdominal pain, diarrhoea, nausea, vomiting, kidney failure, hearing impairment, bronchial and ocular problems, haemolysis, extreme irritation and injury to tissues especially those of the central nervous system and kidneys (Oyekunle *et al*., 2014). Armed with all these information on the harmful effects of potassium bromate the National Agency for Food, Drug Administration and Control (NAFDAC) the agency saddled with the responsibility of regulating drugs and foods and allied products in Nigeria in 2004 like most such agencies in the world reiterated banned the use of potassium bromate in bread which had been since 1993(Akunyili, 2004). This has not however deterred bakers in this country from the use of this product especially in excess amounts. Various researchers (Abubakar *et al*., 2008; Ifiora *et al*., 2015, Aletan and Okon, 2018) have consistently found potassium bromate in bread samples from various parts of the country above the recommended limit.

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This study is aimed at the determination of potassium bromate levels in bread samples from parts of Lagos state. This would be of use in ascertaining the level of compliance to safety regulations by bakers in Lagos state with respect to the potassium bromate ban.

MATERIALS AND METHOD

Bread Samples

A total of fourteen bread samples were purchased from bakeries and outlets located in the city centre as well as suburbs in Lagos. All the bread samples except one were registered with NAFDAC evidenced by their registration number. The bread samples were categorized into three uneven groups based on their prices as:

High priced: ₦300- ₦350 for 800 g of bread
Medium priced: ₦250 for 800 g of bread
Low cost: ₦180 - ₦200 for 800 g of bread

Except for the unregistered bread sample which had no label, all the bread samples were marked as "bromate free".

Potassium Bromate determination

The method reported by Emeje *et al*. (2009) was adapted; 1g of each bread sample was weighed and transferred into a test tube, 10 ml of distilled water was added into each test tube, shaken vigorously and allowed to stand for 20 min at a temp of 28 ± 5 ºC, 5 ml of the solution was decanted into another test tube, then 5 ml of 0.5% prepared potassium iodide solution in 0.1N HCl was added to the solution. Any color change was noted. The presence of potassium bromate was indicated by change in color from light yellow to purple. The absorbance of the sample was taken at 620 nm in a UV-vis spectrophotometer (Camspec M106 Spectrophotometer) absorbance of the sample was converted to concentration with reference to Beer's calibration curve previously constructed for potassium bromate using the pure sample. Analysis was done on the replicates for each of the samples using spectrometry principle.

Statistical analysis: The data collected were analyzed for their central tendencies (mean) using descriptive statistics; values were expressed as mean ± standard deviation of the observations. The Pearson Product Moment Correlation (PPMC) was used to determine the relationship between price and potassium bromate level.

RESULTS

Table 1 shows the result of the determination of the potassium bromate level in the bread samples. All the samples under study were registered with NAFDAC as evidenced by the NAFDAC registration number on the materials used for their packaging. From the results, potassium bromate was found in all the bread samples studied above the maximum limit approved by NAFDAC (0.02 µg/g).

Table 1: Level of Potassuim Bromate in the bread samples

Sample I.D	Registration Status	Cost	Price (₦)	Colour	Concentration(µg/g)
I	Registered	Low priced	200	Light purple	0.05 ± 0.01
II	Registered	High priced	350	Light purple	0.08 ± 0.01
III	Registered	Low priced	200	Light purple	0.05 ± 0.01
IV	Registered	Low priced	200	Light purple	0.22 ± 0.01
V	Registered	Medium priced	250	Light purple	0.24 ± 0.01
VI	Registered	Low priced	200	Purple	0.34 ± 0.00
VII	Not Registered	Low priced	180	Light purple	0.80 ± 0.00
VIII	Registered	Medium priced	250	Light Purple	0.84 ± 0.01
IX	Registered	High priced	300	Purple	0.99 ± 0.01
X	Registered	High priced	350	Purple	1.08 ± 0.01
XI	Registered	High priced	350	Purple	1.18 ± 0.01
XII	Registered	Medium priced	250	Purple	1.33 ± 0.00
XIII	Registered	Medium priced	250	Purple	1.92 ± 0.01
XIV	Registered	Medium priced	250	Purple	1.99 ± 0.00

DISCUSSION

This study has been carried out to determine the potassium bromate level in fourteen samples of bread consumed in Lagos city and suburbs. The presence of potassium bromate was qualitatively indicated by the change in colour from light yellow to various degrees of purple coloration in the reaction medium due to the addition of potassium iodide. Potassium iodide complexes with potassium bromate to give the purple colorations whose intensity is directly

proportional to the level of potassium bromate present in the sample (Emeje *et al.*, 2009).The presence of potassium bromate was detected at various concentrations in all the fourteen samples of bread studied.

The bread samples have been categorized based on their price into three groups. Regrettably, all the bread samples irrespective of their price had potassium bromate level above the maximum level permissible by Food and Drug Administration FDA and NAFDAC which is (0.02 mg/Kg) 0.02 µg/g. (Akunyili,2005; Ekop *et al*.,2008). The highest level of potassium bromate (1.99 ± 0.00 µg/g) was found in sample XIV. This sample was categorized as Medium priced based on the price and thus could be affordable and may be preferred by the lower middle class members of the community. The lowest level of potassium bromate (0.05 ± 0.01 µg/g) was found in samples I and III. Ironically these two were categorized as low priced due to their prices. These Low priced bread samples are readily available by roadsides and bus stops. The High priced bread samples are usually made and sold by special bakeries, chain stores and eateries usually patronized by the upper middle class as well as the wealthy in the society. On further analysis, using the Pearson Product Moment Correlation (PPMC) a weak positive relation (r= 0.25) was found between the level of potassium bromate and the price of the bread samples. This weak relationship thus indicates that the level of potassium bromate is not determined by the price of the bread. Thus, the level of potassium bromate is not affected by the price or 'status' of the bread. This sad reality implies that consumers in Lagos are gradually but surely been poisoned by these bakers.

Although the levels of potassium bromate (between 0.05 ± 0.01 and 1.99 ± 0.01 µg/g) obtained in bread samples from this study are low compared to those obtained by Uwague &Oghenekohwoyan (2017) from bread samples in Sapele (between 1.00 ± 0.00 µg/g and 4.216 µg/g) and those obtained by Ifiora *et al.* 2015 which range between 1.01 ± 0.15 µg/g and 12.67 µg/g, most of the values were still more than ten times higher than the approved maximum limit (0.02 µg/g). This sad reality implies that consumers in Lagos are gradually but surely been poisoned by these bakers.

CONCLUSION

The study assessed the potassium bromate levels of bread sold and consumed within Lagos and suburbs. The results revealed that the bakers do not conform to the ban on potassium bromate as stipulated by both NAFDAC and WHO even when they mark the loaves as potassium bromate free on their labels. Furthermore, the level of potassium bromate was not affected by the price of the bread.

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