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POTASSIUM BROMATE CONTENT OF SOME BAKED BREADS SOLD IN MUSHIN LOCAL GOVERNMENT AREA OF LAGOS STATE, NIGERIA

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Abstract

The main objective of this work was to assess the potassium bromate residues of some baked breads sold in some selected streets of Mushin Local government areas (LGAs) of Lagos State. One hundred and fifty (150) bread samples; (ten from each street) were randomly selected from various retail outlets across Mushin LGAs over a three-month period. The samples were analysed for the presence of potassium bromate residues. Spectrophotometric method was used for the detection of potassium bromate residues based on the oxidation of Congo red and crystal violet dyes in a hydrochloric acid, absorbance was read at 515nm and the result was expressed in mean ± Standard deviation. Samples analysed from these three streets showed 71.15±49.57µg/g, 34.91 ± 15.23µg/g and 45.27±21.13µg/g, respectively of potassium bromate. Residual bromate concentration in samples from Ladipo and Ojekunle Streets were found to be significantly higher ($p<0.05$) than those from Olateju and Iyana Isolo Streets. Residual bromate concentration from Olateju and Iyana Isolo Streets were not significantly different ($p>0.05$). Samples were found to contain concentration of potassium bromate above the permissible limit of 0.02 µg/g by the Food and Drug Administration. This study showed high potassium bromate content in breads marketed in Mushin metropolis. This implies that consumers stand the risk of potassium bromate toxicity. It is therefore suggested that the need for continuous surveillance and enforcement of the ban on the use of potassium bromate in baking industry should be reinstated.

Keywords: Potassium bromate, Bread, Spectrophotometric method, Mushin, Lagos State, Nigeria

Introduction

Bread is an important source of food in Nigeria. It is consumed extensively in homes, restaurants and hotels [1]. It is a staple food of man [2], and one of the oldest known recipes. It is low in saturated fat, very low in cholesterol and also a good source of thiamin and folate [3]. It is also rich in protein, vitamins and minerals [2]. The basic ingredients of baked products are usually flour, liquid (water, milk or juice) fats, sugar, salt, eggs, leavening agents' flavourings, yeasts, and bread improver. Yeast feed on sugar to produce alcohol and carbon dioxide gas, this gas makes the bread to rise [4,5,6].

Potassium bromate [E 924] is an additive some bakers use to help bread rise rapidly and create a good texture in the finished product. Bromate gives more bulkiness to the dough development resulting in more loaves of bread being cut out. It also gives smoother and a more beautiful look (aesthetic value) than bread baked with other improvers [7]. The use of potassium bromate has been a common choice among flour-millers and bakers throughout the world because it is cheap and probably the most efficient oxidizing agent [8]. Potassium bromate ($KBrO_3$) is one of the food additives that have been used ID limited ways and amounts by the baking

industry for almost a century with no known 'health concern. It has been used in baking since 1914 when a patent was issued by the United States Patent Office [9].

Apart from been carcinogenic, potassium bromate has been found to be responsible for cough, sore throat on inhalation, abdominal pain, fibroid, diarrhoea, nausea, vomiting, kidney failure, hearing loss as well as redness and pain in both eye and skin [8]. Potassium bromate has been banned worldwide except in Japan and the United States [10]. The World Health Organisation in 1994 stated that this ingredient was no longer acceptable for use as it was found to be carcinogenic in human [11]. In Nigeria, use of potassium bromate in flour milling and baking has been banned by National Agency for Food Drug Administration and Control (NAFDAC) since 1993[12,13].

Available information indicated that potassium bromate is produced in Argentina, Brazil, China, Germany, India, Israel, Italy, Japan and Spain [14]; It was approved in the United States by the Food and Drug Administration (FDA), for use in bromated flour at 50 ppm under provisions of 21 CFR Parts 136 and 137 [15,16,17,18]. The amount of

potassium bromate used in baking may subsequently prove to be of little or no concern; however the baking industry still needs to take the necessary steps to reduce any potential of bromated residues .in 'finished products to safe levels. According to World Health Organization [19], potassium bromate (KBrO,) classified by the International Agency for Research on Cancer (IARC) as category 2B carcinogen, [20]. The aim of this research was to measure the- presence and concentration of residual potassium bromate in breads baked and consumed within Mushin local governments areas of Lagos State.

Materials and Methods

Sample Procurement

A hundred and fifty bread samples were randomly purchased from different retail outlets in three (3) Streets which were purposively selected because they densely populated and prominent in Mushin Local Government Areas of Lagos State. These streets are Ladipo - Ojekunle, Olateju and Iyana Isolo Street of Mushin Local Government Areas of Lagos State. Ten (10) representative samples were collected from Ladipo - Ojekunle, Olateju and Iyana Isolo Street of Mushin on once-a-week for

15weeks. Quantitative determination of potassium bromate content of the bread samples were carried out Spectrophotometrically at 515nm [21].

Sample Preparation

A circular sample of 2 cm in diameter from the center of a 15-mm thick slice of each bread sample was taken and dried in an oven for 72 hours at 55°C. The crust was ground to a fine powder with mortar and pestle. Five-gram of each powdered sample was weighed into a clean 250 cm' beaker and 50 cm' of distilled water was added. The mixture was centrifuged and the liquid fraction was diluted to 100 cm3 in a calibrated flask. The appropriate volume of the aliquot was taken for treatment under the proposed procedure. The chemical analysis of samples was carried out in triplicates according to photometric and fluorometric methods [23].

Chemical analysis

Four cm^3 of aliquot of each of the ten bread samples was measured into 10 separate 25 cm^3 calibrated flasks. Five-centimetre cube of 5 x 10^{-4}mol/dm^3 solution of Congo red dye/crystal violet dye was added, followed by 10cm^3

of 2M HCl solution. Each flask was diluted to 25cm3 with distilled water; and shaken gently prior to Spectrophotometric analysis [22,23].

Statistical analysis

Data for the residual bromate concentration across three LGAs were determined by one way analysis of variance (ANOVA) using the GraphPad Instat3 statistical software for windows 2006. Values were considered significant when $p<0.05$.

Results

The concentration of residual potassium bromate in bread sold in Ladipo and Ojekunle, Olateju and Iyana Isolo Street of Mushin local government areas of Lagos state were observed to be 72.51±0.26µg/g, 35.08±5.34µg/g and 44.79±21.35µg/g, respectively. The residual potassium bromated concentration in samples from Ladipo and Ojekunle Street was found to be significantly higher ($p<0.05$) than those from Olateju Street and Iyana Isolo Street. Residual bromate concentration from Olateju and Iyana Isolo Street were not significantly different ($p>0.05$).

Table 1. Potassium bromate content of the bread samples

Ladipo and Ojekunle Street	Bromated concentration (µg/g)	Olateju Street	Bromated concentration (µg/g)	Iyana Isolo Street	Bromated concentration (µg/g)
A1	53.72±23.74	B1	24.80±14.06	C1	47.00±21.47
A2	41.58±29.37	B2	35.39±3.71	C2	43.09±18.24
A3	35.65±9.93	B3	39.95±5.94	C3	47.01±16.93
A4	54.10±18.67	B4	38.96±6.25	C4	42.08±27.59
A5	177.52±169.63	B5	36.29±16.75	C5	44.80±22.51
Mean±SD	72.51±50.26[a]		35.08±15.34[b]		44.79±21.35[b]

FDA Standard: 0.02µg/g

A, B and C are replicates of the samples, Mean with the same superscripts are considered not significantly different (P>0.05)

Discussion

The concentrations of residual potassium bromate in breads sold at various locations within Mushin metropolis were observed to be higher than approved FDA limit of 0.02µg. The highest concentration recorded at Ladipo-Ojekunle Street might be due its higher population density compared to the other streets under study where demand is high. Though these concentrations fall within the non-carcinogenic and carcinogenic doses of 20 and 400µg/g respectively [24]. This clearly indicates that, none of the bread samples from the study areas is safe for human consumption as far as potassium bromate content is concerned. The presence of bromate in edible bread calls for concern because of its toxicological effect on

human [25]. The level of potassium bromate in bread samples was much higher than 3.7µg/g and 12.6pg/g for the lowest and highest level of KBrO3 found in bread samples consumed in Mushin Local government [26]. It is also different from the values of 1.2µg/g and 10.4µg/g, minimum and maximum quantity of potassium bromate, respectively, obtained from bread samples analyzed in other part of Lagos[l].

Alli*et al.* [27] and Obunwo and Konne [28] reported 3.6 µg/g and 9.2µg/g and between 0.12±0.08 µg/g and 7.28±2.14 µg/g from a study in Abeokuta, Nigeria. Comparable result of 14.7 µg/g and 56.20µg/g was however obtained from a study in Abuja metropolis Nigeria [39], According to the Food and Drug Administration (FDA), the maximum amount of potassium bromate allowed in bread is 0.02 µg/g. The implication of the result of this study therefore was that, none of the bread samples was safe for consumption and that many bread makers still use potassium bromate (at high concentration) as a bread improver.

Conclusion and Recommendations

This study confirmed that consumers of baked bread in Mushin local government stand a risk of toxicity from potassium bromate because above

safe level value was found in the bread produced. The need for continuous surveillance and enforcement of the ban on use of potassium bromate in baking industry in Nigeria is recommended. The agencies should educate people through public enlightenment on the danger in the use of potassium bromate as food additive.

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