Determination of the Levels and Hepatic Effects of Potassium Bromate in Bread Samples sold in Awka Metropolis, Nigeria.

Chike S. Okafor, PhD; Desmond Okeke, BSc; Chike C. Okoli, BSc.
Dept. of Applied Biochemistry, Nnamdi Azikiwe University, Awka, Nigeria

ABSTRACT

This study determined the levels and hepatic effects of Potassium bromate in Bread samples sold in Awka Metropolis, Nigeria. Potassium bromate is an additive widely employed by bread makers to improve bread quality. On account of its deleterious effect and carcinogenicity in humans, certain levels of potassium bromate are not allowed in bread. The present evaluation was carried out in Awka Metropolis where consumption of bread is relatively high. Ten (10) different samples of bread obtained from different locations were analysed for potassium bromate and were then fed to Wistar rats for toxicological analysis. The quantitative assessment showed that all the bread samples contained potassium bromate in quantity that exceeded the minimum allowed by the FDA. The level of bromate in the bread samples ranged between 5.309 ± 0.023ppm to 9.136 ± 0.024ppm. The result of the toxicological study showed that there were significant increases (p<0.05) in the ALT and AST activities of the animal groups fed with bread samples containing 8.52 and 9.14ppm of potassium bromate. This showed that the bread samples containing potassium bromate at the levels of 8.52 and above were unsafe for human consumption. So bread markers should avoid using potassium bromate as bread improver.

(Key words: Bread, Wistar rats, ALT, AST and potassium bromate).
(Abbreviations: NAFDAC, National Agency for Food, Drug Administration and Control, ALT, Alanine Amino Transferase, AST, Aspartate Amino Transferase).

INTRODUCTION:

Food additives are any substance including any source of radiation, the use of which results or may reasonably be expected to result in that substance or its byproducts becoming a part of or affecting the characteristics of a food [1]. Food additives when used in proper amounts may still pose a health hazard for specific small but vulnerable groups in [2]. Potassium bromate is a food additive classified as an improver [3]. It is an oxidizing agent that is utilized in flour primarily for dough improvement. Under the right proportion, which is 60mg/kg, potassium bromate will prevent the attack of the flour by weevils, microbial agents and mites and so it can act as preservative[4]. It is a food additive used to improve the preservative qualities, flavor, colour, texture, appearance and stability of food most especially flour and dough [4]. Most flour milling companies add bromate to their products to improve the quality of flour produced[5]. Despite a ban on potassium bromate in flour by the World Health Organization, some nations are allowing its use as oxidizer in baked foods at very low levels [6]. It was observed that many bakeries in Nigeria are not NAFDAC compliant in terms of bromate use in bread, exposing the population to the effects of bromate[5]. Bakers associations maintain that potassium bromate is converted to harmless potassium bromide during the baking process[6]. The improving action does not take place until the flour is made into dough[3].

During storage, flour increases in strength and there is a consequent improvement in the baking qualities. The addition of ‘Improvers’, however, produce some what similar changes in the properties of the gluten (in the dough) in a matter of hours [3]. The improvement in the baking quality of flour by potassium bromate has endeared bakers to potassium bromate, hence the resistance to desist from using it. The study carried out by[7] on the potassium bromate content of Bread and flour samples in...
Uyo metropolis showed the presence of potassium bromate in some of the samples. Research findings have shown that potassium bromate decomposes vitamins A, B₁, B₂, and E in bread [¹]. Rats administered potassium bromate in drinking water at various concentrations up to 10,000mg/l showed significant signs of liver and kidney toxicity [⁸]. The effect of potassium bromate on liver is questionable [⁹].

Apart from its use in flour, potassium bromate is used in permanent hair wave neutralizing solutions and the dying of textiles using sulfur dyes [¹⁰]. It may be formed in water during ozonation when the bromide ion is present [¹¹]. Some natural foods like flour have natural content of bromine. Flour has 2.4-7.7mg/kg of bromine [⁷].

1.1 AIM AND OBJECTIVES:

This study aimed at determining the levels and hepatic effects of Potassium bromate in bread samples sold in Awka Metropolis, Nigeria.

EXPERIMENTAL

Reagents. All reagents used were of analytical grade. The potassium bromate used was produced by, chemika fluka chemical, Buchs, SwitzerLand.

Sample collection. Bread samples were purchased from open markets, bus stops, bread stores and from bread vendors in Awka Metropolis. A total of ten(10) different samples of bread were used in this study. Wistar albino rats used were purchased from the Department of Veterinary Medicine, University of Nigeria, Nsukka, Enugu State, Nigeria.

Sample treatment. The different bread samples were dried under room temperature (30⁰c) for 72 hours and ground via the manual grinding machine.

Potassium bromate content determination. The Potassium bromate content determination was done using the method [¹²].

TOXICOLOGICAL STUDIES:

Twenty(20) adult male Wistar albino rats weighing 109 ± 8.35g used for the study were first acclimatized for one week and divided into 5 groups of 4 rats each; group A (control), group B, group C, D and E (treatment groups). Groups A, B, C, D, and E were fed with composed feed rations composed of 20% growers marsh and 80% bread samples containing 0ppm, 7.04ppm, 8.40ppm, 8.52ppm and 9.14ppm respectively. Water and feed were given to the animals ad libitum.

Sacrifice and sample collection.

The animals were fed for 4 weeks and then sacrificed. The animals were starved over night prior to sacrifice. Sacrifice was done using cotton wool soaked in a little chloroform which was put in a transparent plastic bucket together with the animals. The bucket was covered and the animal observed for signs of suffocation. Following suffocation blood was extracted from the animal through heart puncture using syringe and needle. The blood samples were equally collected in non-anticoagulant sample tubes.

The rats were handled in line with the ethical guidelines governing the handling of animals.

Alanine Amino Transferase (ALT) content determination. The Alanine Amino Transferase activity determination was done using the method [¹³].

Aspartate Amino Transferase (AST) content determination. The Aspartate Amino Transferase activity determination was done using the method [¹³].

RESULTS.

QUANITATIVE ANALYSIS

The results for the quantitative assessment of the 10(ten) bead samples are shown in the table 1. The result showed that all the bread samples contained potassium bromate.
Table 1: Potassium bromate(KBrO₃) content of bread samples

<table>
<thead>
<tr>
<th>Sample</th>
<th>Quantity of KBrO₃ (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S₁</td>
<td>8.395± 0.018</td>
</tr>
<tr>
<td>S₂</td>
<td>6.543± 0.017</td>
</tr>
<tr>
<td>S₃</td>
<td>5.679± 0.013</td>
</tr>
<tr>
<td>S₄</td>
<td>8.642± 0.036</td>
</tr>
<tr>
<td>S₅</td>
<td>5.432± 0.023</td>
</tr>
<tr>
<td>S₆</td>
<td>8.519± 0.049</td>
</tr>
<tr>
<td>S₇</td>
<td>7.037± 0.020</td>
</tr>
<tr>
<td>S₈</td>
<td>8.395± 0.018</td>
</tr>
<tr>
<td>S₉</td>
<td>9.136± 0.024</td>
</tr>
<tr>
<td>S₁₀</td>
<td>5.309± 0.023</td>
</tr>
<tr>
<td>Mean ± standard deviation</td>
<td>7.310± 1.482</td>
</tr>
</tbody>
</table>

Values presented above are mean of four determinations per sample.

Fig1: The Aspartate Amino Transferase activities of the experimental Wistar rats

Fig2: The Alanine Amino Transferase activities of the experimental Wistar rats
DISCUSSION.
This study determined the levels and hepatic effects of Potassium bromate in Bread samples sold in Awka Metropolis, Nigeria.

Result of the study showed that all the bread samples used for the study contained potassium bromate. The result showed that the potassium bromate content of the bread samples ranged between 5.309±0.023ppm and 9.135±0.024ppm. All the 23 bread samples purchased from the eastern part of Nigeria used for their study contained potassium bromate at levels exceeding the maximum allowed by Food and Drug Agency (FDA)\[14\]. The maximum amount of potassium bromate allowed in bread by the FDA is 0.02µg/g\[7]\.

The result of the animal model study showed a significant increase(p<0.05) in the AST enzyme activity of the rat groups D and E fed with potassium bromate containing diet at the levels of 8.52 and 9.14ppm respectively compared with the control group A. Also there was a significant increase(p<0.05) in the ALT enzyme activity of the rat group E fed with potassium bromate containing diet at the level of 9.14ppm compared with the control group A, while there was no significant increase(p=0.052) in the ALT enzyme activity of the rat groupD fed with potassium bromate containing diet at the level of 8.52ppm. Rats administered potassium bromate in drinking water at various concentrations up to 10,000mg/l showed significant signs of liver and kidney toxicity\[8]\ .\[9]\ observed that the effect of potassium bromate on the liver is questionable.

CONCLUSION
The results of the study showed that bread sold in Nigeria contained potassium bromate at harmful levels and may undermine the health of the consumers. So regulatory agencies should strictly enforce the ban on the use of potassium bromate in flour and its products.

REFERENCES


