ASSESSMENT OF ANTI-NUTRITIONAL AND BROMATE CONTENT IN SOME SELECTED UNLABELLED BREADS SOLD IN OKO TOWN AND ENVIRONS

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ABSTRACT
This study investigated the levels of anti-nutritional substances and potassium bromate (KBrO3) in unlabelled bread samples from Oko town and its surrounding areas. Standard methods were used to analyze ten samples, revealing that eight exceeded the recommended KBrO3 level of 0.02 mg/kg set by the US Food and Drug Administration. Elevated levels of cyanides, oxalates, and tannins were also detected, posing health risks including cancer, kidney damage, and cellular oxidation inhibition.
Keywords: Potassium bromate, bread samples, anti-nutritional, food additives, Oko town

INTRODUCTION

Bread, a staple food consumed across socio-economic groups, is typically produced by baking mixed flour of wheat, Indian corn, or barley with yeast, salt, water, and flour improvers (Emeje, Ifiora, Ezenyi, & Ofoefule, 2015). Standard bread is considered a complete food, with gluten comprising 75-85% of its protein content (Moreno & Vélez, 2017).

with water, it forms a film structure in the dough, enabling it to be expanded by carbon dioxide gas produced during yeast fermentation.

Other components of bread include:

Water - or some other liquids, like clarified products such as fruit juice, potato water or beer (Suas, 2014);

Sugar - with other sweeteners like honey, jams and dried fresh fruits (Suas, 2014);

Yeast - which brings about aeration of dough during fermentation of sugars in the flour to produce ethanol and gas - carbon dioxide which causes dough to rise during process of baking (Sekhon and Choudhary, 2017);

Eggs - add food value, protein, colour and flavour to bread;

Fat (shorterners) - makes bread tender, moist, modifies the taste and texture of the bread, prevents the formation of excess gluten and increases the quality of bread loaf, preventing it from drying out too quickly (Airaodion et al, 2019);

Flavourings - orange, lemon, grapefruit peel, as well as alcohol, though added in minute quantity to so as not retard yeast activity (Sekhon and Choudhary, 2017);

Salt (NaCl) - improves bread taste, reduces rate of fermentation, modifies colour and prevents growth of microorganisms (Jay, Loessner & Golden, 2017);

Flour-improver - As a result of the wide varieties in the composition of flour, various treatments and supplements, conditioning agents (bread improvers) are added to simplify the work of the baker (Zhou, Therdthai and Thomas, 2017).

They optimize or facilitate the functional characteristics of the bread by boosting the dough, enhancing machinability and reinforcing tolerance during different manufacturing stages (Zhou, Therdthai and Thomas, 2017). The overall effect is to smooth out the dough, make bread rise in the oven, increase loaf volume and texture (Blinder and Kaur, 2022).

Common flour improvers used in bread production include calcium peroxide, ascorbic acid, potassium bromate (KBrO3), potassium iodate, azodi carbonamide, and calcium iodate (Zhou et al., 2017). Potassium bromate enhances flour quality by modifying dough rheology and gluten protein structure (Fennema & Damodaran, 2017). Potassium bromate's consumption has detrimental health effects, including:

- Vitamin degradation (Zhou et al., 2017)

- Potential carcinogenicity (IARC, 1999; JECFA, 1992)

- Nephrotoxicity and ototoxicity (Bolarinwa et al., 2016)

Nigeria's National Agency for Food and Drug Administration and Control (NAFDAC) limits potassium bromate in bakery products to 0.02 mg/kg (Mahmud et al., 2021).

Excessive potassium bromate used in bread production poses significant health risks to consumers, despite regulatory guidelines.

METHODOLOGY

This study investigated the anti-nutritional and potassium bromate content in selected unlabelled breads sold in Oko town and its environs to assess bakers' compliance with NAFDAC guidelines.

Sample Collection and Preparation

Ten smallest-size unlabelled breads ("Quench My Hunger") were purchased from retail outlets in Oko and its environs, labeled A-J for identification. Each bread was dried at 75°C for 1 hour, ground into fine powder, and 1g was mixed with 20cm³ distilled water.

Qualitative Analysis

Potassium bromate presence was detected using 2ml 0.01M promethazine and 0.6ml 12M hydrochloric acid (HCl), indicated by a pink color change (Airaodion et al., 2019).

Quantitative Analysis

Spectrophotometric method (El Harti et al., 2011) was employed using analytical-grade chemicals (AOAC, 2005). Absorbance was measured at 515nm, and concentration calculated from standard solutions' linear regression curve.

Procedure

1. 8ml filtrate solution + 1ml 0.01M promethazine + 0.2ml 12M HCl

2. Shaken for 1 minute

3. Measured absorbance using spectrophotometer

Results reported are mean values of three replicate determinations.

Anti-Nutritional Analysis: The ten (10) bread samples bought from Oko and its environs were tested for the presence of the phytocompounds: alkaloids, cyanides, tannins and phytates. Quantitative and qualitative analysis were done using standard methods of determination of each component (Harbone, 1998; Onwuka, 2015; Kelle, 2019).

RESULTS

The qualitative and quantitative evaluation of potassium bromate concentration in ten bread samples sold in Oko town and its environs are presented in Table 1.

Table 1: Qualitative and Quantitative Evaluation of Potassium Bromate Concentration.

Bread Sample	Reaction with KI (Colouration)	Qualitative Result	Quantitative Result (mg/kg)
A	Purple	+	0.57
B	Dark	+	0.11
C	Purple	+	0.88
D	Dark Purple	+	0.21
E	Light Purple	+	0.25
F	_	_	0.03
G	Purple	+	0.32
H	Dark Purple	+	0.37
I	_	_	0.01

J	Dark Purple	+	0.26

The qualitative evaluation of phytochemical constituents of bread samples is presented in Table 2.

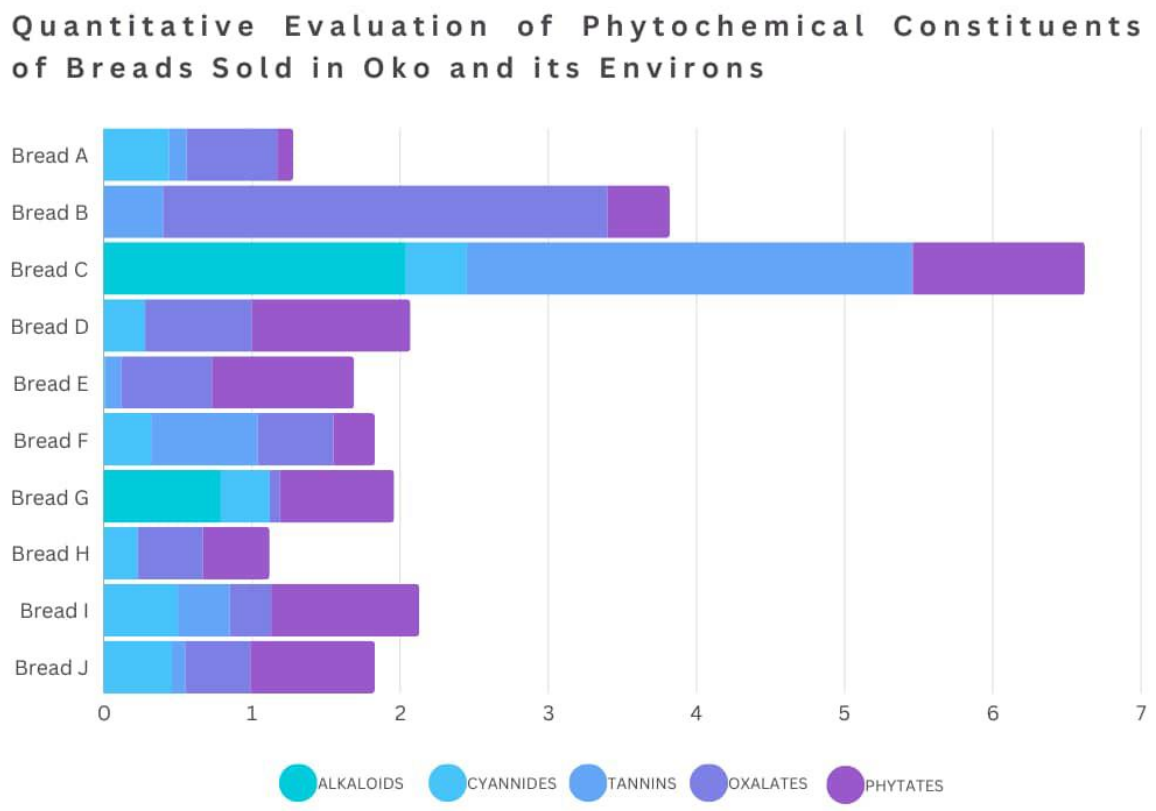
Table 2: Qualitative Evaluation of Phytochemical Constituents

Bread Samples	Alkaloids	Cyanides	Tannins	Oxalates	Phytates
A	–	+	+	+	+
B	–	+	+	+	–
C	+	+	+	+	+
D	–	–	–	+	+
E	–	+	+	+	+
F	–	+	+	+	–
G	–	+	+	+	–
H	+	+	–	+	–
I	–	+	+	+	+
J	–	+	+	+	–

The quantitative evaluation of phytochemical constituents of bread samples is presented in Table 3.

Table 3: Quantitative Evaluation of Phytochemical Constituents (mg/kg)

Bread Samples	Alkaloids	Cyanides	Oxalates	Phytates
A	_	**0.44**	**0.12**	**0.61**
B	_	_	**0.40**	**3.00**
C	**2.04**	**0.41**	**3.00**	**0.01**
D	_	**0.28**	_	**0.72**
E	_	**0.01**	**0.11**	**0.61**
F	_	**0.32**	**0.72**	**0.51**
G	**0.79**	**0.33**	_	**0.07**
H	_	**0.23**	_	**0.44**
I	_	**0.50**	**0.35**	**0.28**
J	_	**0.46**	**0.09**	**0.44**



DISCUSSION

The presence of potassium bromate in bread samples from Oko town poses significant health risks, including cancer, kidney damage, and liver dysfunction. The alarming fact that 80% of the samples exceeded the permissible limit of 0.02 mg/kg set by regulatory agencies like NAFDAC and the US FDA underscores the need for stricter regulations.

Potassium bromate, classified as a category 2B carcinogen by the International Agency for Research on Cancer (IARC), has been linked to nephrotoxicity, liver damage, and various health issues. These include renal cancer, thyroid follicular tumors, reproductive abnormalities, neurobehavioral changes, hearing loss, inner ear damage, and birth defects.

To mitigate these risks, regulatory agencies must take prompt action. Key measures include enhancing regulatory measures, regular monitoring and testing of food products, public

awareness campaigns, and research into alternative dough conditioners and strategies to reduce potassium bromate levels in bread.

CONCLUSION

By implementing these measures, we can minimize the risks associated with potassium bromate and ensure a safer food supply.

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