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Investigation of Potassium bromate and Anti-Nutrient Contents of Flour and Bread in Ikot Ekpene Metropolis

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Abstract

Potassium bromated and anti- nutrient content of some bread within Ikot Ekpene metropolis was investigated in this study. Four samples of raw flour and bread samples produced from the flour from different companies were randomly collected in replicates for this investigation. The samples were analysed for the present of potassium bromates, oxalate, tannin, phytate and hydrogen cyanide. Mean concentrations of potassium bromated in the bread samples ranged from 0.108 to 0.378 mg/100 g while concentrations in the flour samples ranged from 0.108 to 0.216 mg/100g. The results indicated that all the samples contained potassium bromated and anti- nutritional factors and the concentrations in the bread samples were slightly lower than concentrations in the raw flour. This may be attributed to effect of the oven temperature during the baking processes. The study indicated that the ban on the use of potassium bromated in bread making has not been effectively implemented. An effective processing method should be designed to reduce anti-nutrient content of the flour and that deliberate addition of potassium bromated should be avoided because of is detrimental to human health.

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Introduction

Bread is a unique food and widely acceptable meal to all classes of citizen in Nigeria (Eddy *et al*., 2012). The nutritional values of bread have been adequately reviewed by several researchers (Appendix 1). However, two factors may limit its nutritional factors, namely, the present of anti-nutrient, which may limit the bioavailability of its nutrients and the addition of potassium bromated (Adeniyo *et al.,* 2009). Potassium bromate is a known nephrotoxic and cancerous compound but is commonly used by food, cosmetic and water treatment (disinfection) industries (Alli *et al*., 2013). Potassium bromate is a colourless, tasteless and odourless white crystal that is commonly added as additives to food.

The use of potassium bromate as additives in bread has been reported in some locations within Nigeria. For example, Ekop*et al*. (2008) reported the presence of trace concentration of potassium bromate in some bread samples purchased from Uyo metropolis in Akwa Ibom state. Alli*et al*. (2013) also reported significant presence of potassium bromated in bread within Gwagwalada area of the Federal republic of Nigeria. In Awka, Okafor *et al*. (2013) found that the level of concentration of $KBrO_3$ in bread samples were within the range 5.309to 9.136 ppm. Potassium bromate increases dough strength and leads to higher rising and uniform finish in bread and other baked products (Ifiroa *et al*., 2015). Inspite of this advantage, the use of potassium bromated in bread has been banned in some countries because of their nephrotoxocity. In Nigeria, the use of potassium bromate as additive in bread was banned in 2014 by NAFDAC (Ifiora *et al., 2015)*. Inspite of the banned, studies carried out by Ifiora *et al*. (2015), and a year after the banned indicated that some bread samples still contain significant amount of potassium bromated. Therefore, the present study is aimed at investigating the potassium bromate and anti-nutrient contents of some flours (and bread produced from them) in IkotEkpene metropolis, Akwa Ibom State, Nigeria.

Materials and methods

Four samples of flour (E, F, G and H) commonly sold in Ikot Ekpene market were used to bake twelve different set of breads (three for each sample of flour) using the baking method described by Eddy *et al*. (2007). Concentrations of potassium bromated and anti-nutrients (phytate, oxalate, hydrogen cyanide (HCN) and tannin) in the bread and flour samples

were analysed using recommended methods. These were, the alkaline titration method recommended by A.O.A.C (1984) for the determination of the hydrocyanic acid content, while the tannin content was determined using the Vanillin-HCl reagent method recommended by Burns (1971) for tannin, the potassium permanganate titration method of Dye (1956) for oxalate and the method of McCance and Widdowson (1953) for phytate. The potassium bromate content of the samples was determined using the AOAC (1984) titration method.

Results and Discussion

Table 1 presents concentrations of potassium bromated and anti-nutrients in flour and bread samples. Mean concentrations of bromated in the bread samples ranged from 0.108 to 0.378 mg/100 g while concentrations in the flour samples ranged from 0.108 to 0.216 mg/100g. The reduction in concentration of bromated in the bread may be due to effect of the oven temperature on the decomposition of $KBrO_3$. In the heat of the baking oven, potassium bromate is reduced to potassium bromide, which is considered to be innocuous in the finished baked product as shown in the equation below,

$$KBrO_3 \rightarrow 2KBr + 3O_2$$

However, the reduction of the added bromated to bromide is dependent on the oven temperature, the duration of exposure at that temperature, the amount of azodicarbonamide present and the quantities of potassium bromate used. Therefore, it has been confirmed that some bromate residue are presence in the finished product.

Mean concentrations of oxalate, phytate, hydrogen cyanide (HCN) and tannin in the bread samples ranged from 12.0 to 25.2 mg/100 g, 188.21 to 200.01 mg/100 g, 3.01 to 5.60 mg/100 g and 112.98 to 125.76 mg/100 g respectively. However, mean concentrations in the flour samples were 17.6 to 48.4 mg/100g, 277.53 to 298.21 mg/100 g, 4.32 to 10.81 and 123.10 to 126.01 mg/100g respectively. Moktan and Ojha (2016) reported mean concentrations of tannin, oxalate and phytatein some bread to be 16.18, 10.23 and 3.18 mg/g, which are lower than values obtained in this study. Phytates are the principal storage form of phosphorus in most cereals that are raw materials for bread. The anti-nutritional role of phytatelies is its ability to form chealate with metals such as calcium, magnesium, zinc and iron and hence reduce their bioavailability (Eddy *et al*., 2007). This implies that since phytates maybe presence in some flour (as shown in the present study), there is need to fortified bread with these essential minerals in order to increase their bioavailability. Similar anti nutritional role has been reported for oxalates through their chelating or complexing effect with some major nutrient such as calcium (Nadeem *et al*., 2010). Ayivor*et al.* (2012) also found that bread samples in Ghana have some anti-nutrients including oxalate with mean concentration of 21.91 mg/100g and hydrogen cyanide with mean concentration of 18.58 mg/100g. However, this concentration is lower than the mean values obtained in this study. Judging from results obtained by Adenike (2013), the source of anti-nutrient in bread is the raw materials from which the bread flour was prepared from. This implies that poor processing of the flour can transfer significant contents of anti-nutrients to bread and consequently the bioavailability of some nutrients will be reduced.

A close examination of the anti-nutrient contents of the breads and flours sold within the study zone, reveals that the anti- nutrient content of the flour are relatively higher than those of the bread samples, which suggest that during the baking process, some of them must have been lost. Hassan *et al*. (2008) found that processes such as fermentation can lead to significant reduction in the concentration of anti-nutritional factors of bread.

Conclusion

Bread acquires potassium bromated as an additive that is either added to the flour during processing or during baking. However, most anti nutritional factors are naturally to the raw materials and are transferred to the bread after baking. The oven temperature has the capacity to reduce the concentrations of $KBrO_3$ and anti-nutrient during baking. Anti-nutrients have the capacity to reduce bioavailability of minerals and other nutrients. Therefore, proper processing of flour and avoidance of potassium bromated additive should be advocated in the bread production line.

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Table 1: Mean concentration of potassium bromated and anti-nutrients in some flour and bread samples

Samples	$KBrO_3$ (mg/100g) ± S.E	Oxalate (mg/100 g)	Phytate (mg/100 g)	HCN (mg/100g)	Tannins (mg/100 g)
A	0.108±S.E	20.8	200.01	5.60	125.76
B	0.216	25.2	197.15	3.01	112.98
C	0.108	16.4	188.21	5.51	114.88
D	0.054	12.0	195.23	3.35	113.97
E	0.378	26.4	298.21	8.70	126.01
F	0.270	26.4	277.53	4.32	123.10
G	0.108	48.4	298.32	10.81	124.87
H	0.135	17.6	297.3	7.11	121.47

** A to D stands for bread samples while E to G stands for flour sample. *** Results stands for mean of three replicate samples

Table 2: Approximate Nutrient Content of 100 g of Bread

Bread Type							
	White	Wholemeal	Wheat/Rye	Multi-grain	Multi-grain	Italian	Wheat / Oat
Protein (g)	7.30	8.1	9.1	7.70	8.80	9.60	9.6
Thiamin (mg)	0.33	0.66	0.84	0.4	0.30	0.14	0.4
Niacin (mg)	1.6	2.1	2.1	1.30	2	1.6	1.6
Riboflavin (mg)	0.09	0.16	0.19	0.15	0.12	0.03	0.1
Iron (mg)	1	1.7	1.7	1.6	1.40	1.4	2.10