Determination of Trace Metals in Locally Bread Samples Collected From Bakeries in Basra City

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SUMMARY

Locally bread samples (flat bread and stone bread) were collected from Basra city and analyzed by flame atomic absorption spectrophotometer for four potentially hazardous heavy metals, Lead (Pb), zinc (Zn) ,iron (Fe) and cadmium (Cd). The mean concentrations of Pb levels in flat bread and stone breads were(0.0051 mg kg^{-1}) and(0.005 mg kg^{-1})dry weight, respectively. Also, the mean concentrations of Zn levels at these breads were (4.6 mg kg^{-1}) and (2.96 mg kg^{-1}) dry weight, respectively. while for Fe were (2.82 mg kg^{-1})and (2.26 mg kg^{-1}) dry weight, respectively, Cd was not detected in all samples. The high levels of daily intake of Pb, Cd , Fe and Zn may cause public health problems, Monitoring heavy metals is imperative during wheat production, storage, mill flour and baking bread for reduction of public health concerns.

Key word: Determination, trace metals, locally Iraqi breads, public health concern

Introduction

Bread is an important diet cereal products provide as much as 50-90% of total caloric and protein intakes (9).

Several reports have focused on residues of numerous heavy metals in food stuffs (3,19). Other reports have delineated on the heavy metal contamination of cereal and cereal products (28, 29). (14)reported that the major route of man's exposure to heavy was ingestion. Trace heavy metals are significant in nutrition ,either for their essential nature or their toxicity(17) , toxic effects of these heavy metals have been widely described by many workers . Elements such as Cd ,Cr ,considered carcinogenic, while Fe, Cu, Zn, Ni, and Mn are considered as essential metals, however, if the concentration of the later elements are higher than their permissible limits they may create toxic effects in human (11)Toxic metals set up condition that lead to inflammation in arteries and tissues ,causing more calcium to be drawn to the area as a buffer, contributing to

hardening of the artery walls with progressive blockage of the arteries and osteoporosis in general ,heavy metals have no function in the body and can be highly toxic .they are systemic toxins with specific neurotoxic ,nephrotoxic ,fetotoxic and teraogenic effects (16). The effect of environmental pollution on contamination of foods and on their safety for human consumption is a serious global public issue and widely addressed (2, 1, 21) Lead (Pb)is present in the environment because of air, soil and water pollution(26) . Major sources of lead are exhaust fumes from vehicles, industrial gases and liquid effluents, some phosphate fertilizers and pesticides. (13, 20). These metals are not only toxic to humans, but they are persistent in the environment once discharged , and when absorbed stay in the human body with a long half-life of about one year. Zinc is the most abundant trace element in the cytoplasm of humans, but 90%of the mineral is located in the muscle, bone and liver(17), its makes strong, exchangeable complexes with organic molecules, including proteins, nucleic acids and membranes. Zinc requirements are highest during periods of greatest growth such as pregnancy, infancy and early childhood (8,27). Zinc toxicity may result from excessive ingestion of the element in food or drink although the margin of safety is large (20). The aim of this study is to determine quantitatively four microelements such as Fe, Pb, , Cd, and Zn in locally bread samples in order to focusing on the daily intake of these metals and its public health concern, Moreover, to improve of breads quality.

. materials and methods

Sample collection: Basra city has high intensive population. It has many traditional bakeries which supply the bread needed by people. These bakeries produce breads such as flat bread and stone bread . six bread pieces of flat bread and six bread pieces of stone bread samples were collected from bakeries at different regeain (Al-ashar, Al-zuber, Al-hartha, Al-karmat-Ali -, Al-juniyna, Al-muqal)in 2009.

Sample preparation, examination and analysis:

Bread samples were prepared and exanimate according to (18). After that samples were analyzed by flam atomic absorption spectrophotometer model(phoenix -986 Biotech. engineering management Co.UK) for four potentially hazardous heavy metals Pb ,Zn ,Fe and Cd in Soil Department, College of Agriculture, University of Basra, the flame conditions for AAS measurements summarized for Fe ,Pb, Zn and Cd in table (1).

Table (1): Flame conditions for the AAS* measurements of Pb, Zn, Fe and Cd

Elements	Wave length (nm)	Flame-Gas	Detection limit mg/L	Sensitivity in mg/L	Optical density & conc. range mg/L
Pb	283.3	A-Ac**	0.05	0.5	1-20
Zn	213.9	A-Ac	0.005	0.02	0.05-2
Fe	248.3	A-Ac	0.02	0.12	0.3-10
Cd	228.8	A-Ac	0.002	0.02	0.2-15

*Flame Atomic Absorption Spectrophotometer
** A: Air, Ac: Acetylene

Statistical analysis:

The statistical methods were done using the software SPSS, version 11.5. Analysis of variance ANOVA was employed after logarithmic conversion when necessary to detect significant differences among means .

results & discussion

The results of analysis for flat bread shows that the concentration of heavy metals of Fe ,Pb and Zn to be (0.22-5.21 mg/kg), (0.004-0.006 mg/kg)and (2.90-11.16 mg/kg)dry weight, respectively (Table 2), while for stone bread The results shows that the concentration of heavy metals of Fe ,Pb and Zn to be (0.45-5.21 mg/kg), (0.003-0.008 mg/kg)and (2.10-3.73 mg/kg)dry weight, respectively (Table 3). The results of analysis showed that Zn has the highest concentration in the both types of bread followed by Fe , and Pb which has the least concentration, While Cd was not detected(**Nd**) in the all samples .

Table (**2**): Content of trace elements in **flat bread** collected from bakeries of Basra city (mg/kg dry weight)

Sample No.	Fe	Pb	Zn	Cd
1	3.85	0.006	11.16	Nd
2	5.213	0.005	3.50	Nd
3	0.22	0.004	2.90	Nd
4	1.81	0.006	3.83	Nd
5	0.90	0.004	3.06	Nd
6	4.98	0.006	3.15	Nd

Table (3): Content of trace elements in stone bread collected from bakeries of Basra city (mg/kg dry weight)

Sample No.	Fe	Pb	Zn	Cd
1	1.13	0.004	3.37	Nd
2	3.39	0.003	2.43	Nd
3	0.45	0.008	3.43	Nd
4	5.21	0.003	2.73	Nd
5	2.26	0.008	3.73	Nd
6	1.13	0.004	2.10	Nd

According to statistical analysis of data at present study ,the results showed that the mean standard deviation for Zn ,Pb and Fe in flat bread and stone bread is not significant at the $p< 0.05$ level (Table 4).

Table (**4**): Statistical Analysis of trace elements content in breads collected from Bakeries Basra city (mg/kg dry Weight)

Type of Bread	No. of Samples	Elements			
		Pb	Zn	Fe	Cd
		Mean ± SD	Mean ± SD	Mean ± SD	Nd
Flat	6	5.16^{-03}±5.45^{-03}	4.6±1.32	2.829±0.875	Nd
Stone	6	5^{-03}±5.94^{-03}	2.96±0.26	2.26±0.726	Nd

This study summarizing the Pb ,Fe and Zn contents in two types of locally bread collected from bakeries of Basra city, Pb level is lower, but it has been a public health concern. In a study conducted in Romania, Pb levels in wheat bread have been obtained 0.22 mg kg^{-1}(22).in Iranian study for four types of flat breads the levels of Pb ranged (0.42-0.52)mg kg^{-1}(18). Pb levels in bread samples of our study are less than Romania and Iranian study. it can be concluded that the levels of some toxic metals in breads exceed the maximum allowance concentration of metals recommended by the Codex Alimentarius (4). In the present study the levels of Fe ranged (2.26- 2.82) mg kg^{-1} were shown to be highest than those reported by (5)which found that Fe levels ranged (0.020-0.040)mg kg^{-1} and nearest from that obtained by (6,7); (24). Also the Present study shows that the zinc contents in bread types is less than zinc levels compared with other countries except Nigeria (table 5).

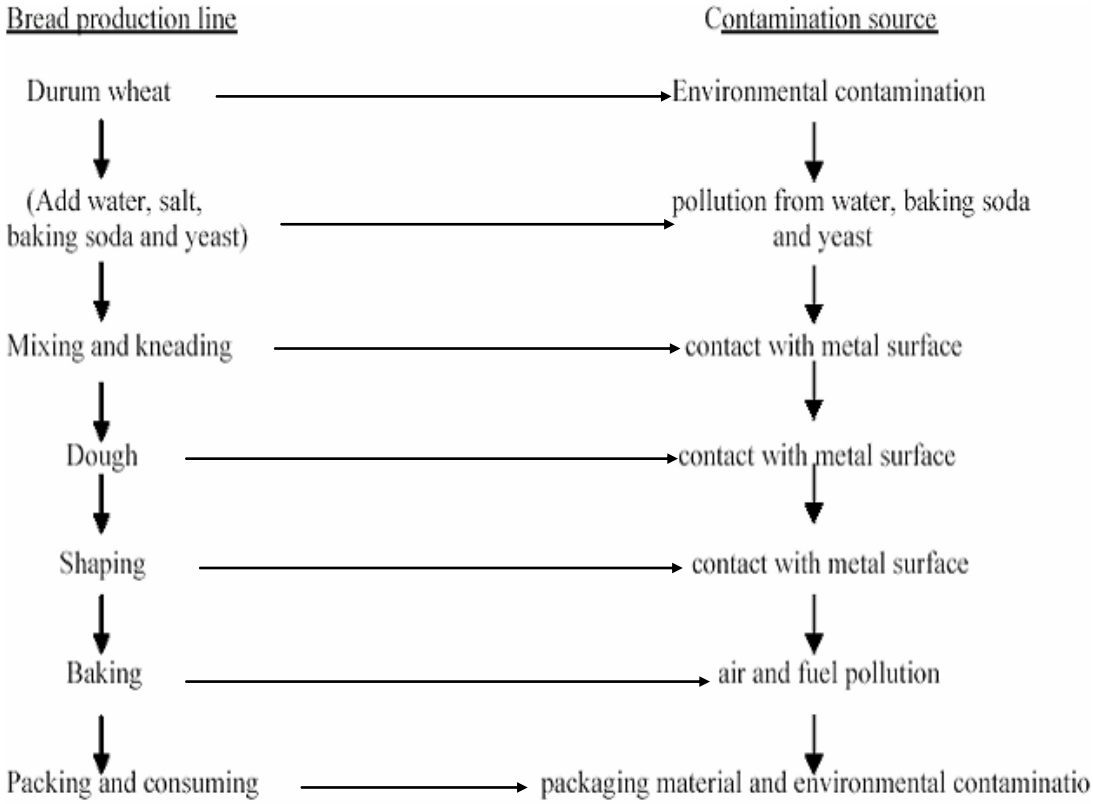
Table (5): Comparison of Zn levels (mg/kg) in bread in another countries

Country	Zn levels mg/kg	References
Egypt	8.2	15
Iran	7.32-12.17	10
Romania	13-93	22
Nigeria	2.93	23
USA	7.2	25
Present Study	2.96-4.61	

This variation in heavy metals contents may be related to contamination of wheat flour and bread making. Wheat plants may be contaminated by trace metals and transferred to bread. The embryo, bran and the aleurone layer of wheat are richer in minerals and metals than the endosperm. About 61% of all minerals in grain are contained in the aleurone layer (12) .As a results the separation of these parts in wheat flour production, storage, mill flour and baking bread produced different type of flour, these types may be rich or poor in heavy metals . Heavy metal food intoxications are generally associated with one of three patterns of occurrence, environmental pollution, accidental inclusion during processing and contamination during processing or storage of food (10). Elimination of contamination sources in the production stage and replacement of old equipment can decrease the level of Pb contamination. Generally, the locations of bakeries in indoor city and near to industrial zones and the traffic density of city are important to contamination problems.

In the light of the results ,the possible contamination sources along processing line are schematically represented in Figure 1.

Figure (1): Possible Contamination sources during flat bread production



Reference: Khaniki, G. R. J., 2005

conclusion

In conclusion, the present study provides useful guide bread preparation taking into consideration the heavy metal toxicity effects. In general during bread production, the possible sources of contamination are metal surfaces in contact with the material and those present in air and environment. Kind of baking fuel is also influence on residues of heavy metals.

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