

HEAVY METAL CONTAMINATION OF COMMERCIALY PRODUCED BREADS

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Copper, zinc, manganese, cadmium and lead contents of ten brands of commercially produced breads were estimated by atomic absorption spectrophotometer. Heavy metal contents ranged from Cu 0.88 – 1.20; Zn 3.40–5.60; Mn 3.70–5.40; Cd 0.018–0.108; Pb 0.11–0.45 ppm. These amounts were below the maximum permissible limits.

Key words: Trace elements, Heavy metals, Breads.

INTRODUCTION

In recent years, the presence of heavy metals in the environment, their entry to the foodstuffs and their ill effects on human health have been shown: For example, lead and cadmium have been recognised as important environmental pollutants with toxic effects on humans, even at very low levels [1-4]. On the other hand, copper, zinc and manganese, although essential to man in micro-quantities [5-7], are toxic in higher levels. Therefore, it is important to analyse the level of these harmful trace elements in human diet.

Bread constitutes the bulk of our daily diet. The information on the heavymetal content of commercially produced breads in Pakistan is lacking at present. The present work was initiated to determine levels of heavy metals, essential as well as toxic, in Pakistani breads.

MATERIAL AND METHOD

Samples of ten brands of commercially produced breads were purchased from local market. All analyses were conducted in triplicate.

Acid leaching method of Puchyr and Shapiro [8] was used for sample preparation and for the determination of

heavy metals. The heavy metals were determined by a flame atomic absorption spectrophotometer (Hitachi Model 170-10). The analyses of copper, zinc, manganese, cadmium and lead were performed at wavelengths 324.8, 213.8, 279.5, 228.8 and 283.3 nm respectively.

RESULTS AND DISCUSSION

The results of bread analysis for heavy metals are summarized in Table 1. The concentration of copper in various brands of breads varied from 0.88–1.20 ppm. Copper content was minimum (0.8 ppm) in "5-Star" brand while it was maximum (1.20 ppm) in "Golden" brand. Copper level in all the brands was below the maximum permissible limit, i.e. 3.8 ppm (9). However, these were comparable with copper levels reported in the literature (10–11), i.e. 0.9–3.4 ppm.

Maximum amount of zinc (5.6 ppm) was recorded in "5-Star" brand, while "Shezan" brand contained the least (3.4 ppm). Presence of zinc in all the test samples was well within the recommended tolerable limits [12], i.e. 14 ppm. Similar results have been reported for bread by Wenlock *et. al* [10]. They studied zinc contents of various types of British bread and found zinc levels in the range of 5-6 ppm.

Table 1. Heavy metal content of commercially produced breads on dry weight basis

Bread variety	Moisture content(%)	Cu (ppm)	Zn (ppm)	Mn (ppm)	Cd (ppm)	Pb (ppm)
Bunny	38.70 ± 1.3	1.10 ± 0.35	3.80 ± 0.33	5.40 ± 0.33	0.036 ± 0.008	0.13 ± 0.008
Dona	30.80 ± 1.1	0.94 ± 0.31	5.10 ± 0.45	3.90 ± 0.24	0.022 ± 0.007	0.45 ± 0.007
5-Star	35.20 ± 1.2	0.88 ± 0.28	5.60 ± 0.49	4.20 ± 0.21	0.108 ± 0.009	0.11 ± 0.006
French	34.70 ± 1.3	1.17 ± 0.38	4.30 ± 0.38	4.10 ± 0.19	0.034 ± 0.003	0.25 ± 0.011
Golden	37.50 ± 1.4	1.20 ± 0.39	4.10 ± 0.36	4.80 ± 0.22	0.050 ± 0.004	0.41 ± 0.013
Mary Gold	38.20 ± 1.1	1.10 ± 0.34	3.60 ± 0.32	4.70 ± 0.17	0.045 ± 0.006	0.32 ± 0.010
Ravi	31.30 ± 0.8	1.08 ± 0.33	4.7 ± 0.42	3.70 ± 0.24	0.018 ± 0.003	0.34 ± 0.012
R.C.P.	36.10 ± 1.5	1.06 ± 0.29	4.8 ± 0.39	4.30 ± 0.18	0.080 ± 0.005	0.30 ± 0.014
Shezan	35.60 ± 1.3	0.90 ± 0.22	3.4 ± 0.31	4.40 ± 0.23	0.054 ± 0.003	0.28 ± 0.008
Sona	34.20 ± 0.7	1.00 ± 0.31	5.4 ± 0.48	5.20 ± 0.31	0.064 ± 0.007	0.18 ± 0.009

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Manganese content of various breads ranged between 3.7 to 5.4 ppm. Highest level of Mn was detected in case of "Bunny" brand (5.4 ppm) while the lowest level (3.7 ppm) was in "Ravi" brand. No normal daily requirement has been established for Mn to date. However, these results are comparable with the levels of Mn reported by Wenlock *et al* [10] and Ranhotra *et al* [11] who studied manganese content in selected varieties of bread, commercially produced in U.S.A. and reported that it ranged from 4.7 ppm to 24.5 ppm.

The average cadmium level in breads ranged from 0.018 - 0.108 ppm. Cadmium content of "5-Star" brand was the highest (0.108 ppm), while the lowest value (0.018 ppm) was found in case of "Ravi" brand. Data on the presence of cadmium in breads are scarce. However, these values are below the maximum permissible level of cadmium in solid food [12], i.e. 5.5 ppm.

The maximum lead levels were present in "Dona" brand (0.45 ppm), while the minimum (0.11 ppm) was in "5-Star" brand. These concentrations are below the maximum permissible limits [13] (1.0 ppm). Lead may enter the breads during processing and due to the addition of various chemicals and its presence in bread, the staple food in Pakistan, is undesirable. However at present, it is found much below the maximum permissible limit.

It can be safely concluded on the basis of above results that the level of copper, zinc, manganese, cadmium and lead in commercially produced breads was less than the maximum permissible limits. These values will be helpful

in monitoring the bread samples for heavy metal contamination through various sources.

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Table I. Heavy metal content of commercially produced breads on dry weight basis

Bread variety	Manganese content (%)	Cu (ppm)	Zn (ppm)	Mn (ppm)	Cd (ppm)	Pb (ppm)
Bunny	38.70 ± 1.3	1.10 ± 0.32	3.80 ± 0.33	5.40 ± 0.33	0.038 ± 0.008	0.13 ± 0.008
Dona	30.80 ± 1.1	0.94 ± 0.31	2.10 ± 0.42	2.90 ± 0.24	0.022 ± 0.007	0.45 ± 0.007
5 Star	33.20 ± 1.2	0.88 ± 0.28	2.00 ± 0.49	4.20 ± 0.21	0.108 ± 0.009	0.11 ± 0.008
French	34.70 ± 1.3	1.17 ± 0.38	4.20 ± 0.38	4.10 ± 0.19	0.034 ± 0.003	0.22 ± 0.012
Golden	37.20 ± 1.4	1.20 ± 0.39	4.10 ± 0.36	4.80 ± 0.22	0.020 ± 0.004	0.41 ± 0.013
Mary Gold	38.20 ± 1.1	1.10 ± 0.34	2.60 ± 0.32	4.70 ± 0.17	0.042 ± 0.006	0.32 ± 0.010
Ravi	31.20 ± 0.8	1.08 ± 0.33	4.7 ± 0.42	3.70 ± 0.24	0.018 ± 0.003	0.14 ± 0.012
R.C.P.	36.10 ± 1.2	1.06 ± 0.29	4.8 ± 0.39	4.20 ± 0.18	0.080 ± 0.002	0.30 ± 0.014
Stream	32.00 ± 1.3	0.90 ± 0.22	2.4 ± 0.31	4.40 ± 0.23	0.024 ± 0.003	0.28 ± 0.008
Sona	34.20 ± 0.7	1.00 ± 0.31	2.4 ± 0.48	2.20 ± 0.21	0.064 ± 0.007	0.18 ± 0.009