

Leaching of Lead From Ceramics

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The toxic effects of lead are well recognized (CHISOLM 1971). Leaching of lead from food and beverage containers, such as glazed ceramics, aluminum, etc., has been shown to be a potential source of lead ingestion (HENDERSON and ANDREWS 1975, SETH *et al.* 1973, KLEIN *et al.* 1970, HARRIS and ELSEA 1967). In 1970 the Food and Drug Administration set a standard of 7 mg/liter of lead as the maximum allowed leaching of lead from glazed ceramics. In this work several glazed ceramic items intended for culinary use were tested for leaching of lead to determine if the FDA standards were being met.

MATERIALS AND METHODS

Samples

Various glazed ceramic items, such as cups, bowls, etc. were chosen for analysis. Imported, domestic commercial, and domestic homemade ceramic objects were included in the testing program.

Equipment

A Perkin-Elmer Model 303 Atomic Absorption Spectrophotometer was used for all analyses.

Reagents

Analytical-grade reagents and doubly-distilled water were used.

Method

The glazed ceramic containers were rinsed with distilled water and then filled with 5% acetic acid solution. The samples were covered with lead-free Saran film and maintained at 85°C for one hour. At the end of the treatment the volume of each extractant was made up to its original volume.

RESULTS

The amount of lead leached from the various ceramic containers ranged from less than 0.5 to 260 mg/liter of extractant (Table 1). In only a few instances did the concentration of lead leached from commercial samples, either domestic or imported, exceed 0.5 mg/liter and no samples

exceeded the FDA standard of 7 mg/liter. On the other hand, many of the homemade ceramic items leached excessively large amounts of lead.

TABLE 1

Lead Concentration in 5% Acetic Acid Extractant
After Storage in Ceramic Containers for One Hour at 85°C

Type of Ceramic	Number of Samples	Lead Concentration In Extractant, mg/liter			
		<0.5	0.5-7	7-100	>100
Imported	16	12	4	0	0
Domestic, Commercial	55	49	6	0	0
Domestic, Homemade	33	8	6	8	11

DISCUSSION

As the data in Table 1 show, the commercial glazed ceramic items were all well within the FDA standard for food containers. However, over one-half of the homemade ceramic containers exceeded the FDA limits, with some of the samples substantially over the standard. While excessive lead release from homemade ceramic containers still appears to be a problem, leaching of lead from commercial glazed ceramic containers has shown significant improvement since a 1970 study (Table 2, KLEIN *et al.* 1970) in which it was found that about 50% of domestic and imported ceramics leached lead in excess of FDA standards.

TABLE 2

Previous Results on Lead Extraction from Ceramic Containers

Author	Type of Ceramic	Number of Samples	Lead Concentration In Extractant, mg/liter			
			<0.5	0.5-7	7-100	>100
KLEIN et al. 1970	Imported	29	9	5	12	3
	Domestic, Commercial	48	17	7	19	5
	Domestic, Homemade	40	10	4	10	16
LEONARD and LYNCH 1958	Imported	4	0	1	3	0
SETH et al. 1973	Imported	231	0	231	0	0

SUMMARY

The amount of lead leached from various glazed ceramic was determined by extraction with 5% acetic acid for one hour at 85°C. All commercial ceramic items, both domestic and imported, were below the FDA standard of 7 mg/liter lead in the extractant. On the other hand, almost 60% of the domestic homemade ceramic items exceeded FDA standards. Comparison with previous studies show significant reduction in lead leaching from commercial ceramic containers. However, homemade ceramic items continue to pose a potential hazard of excessive lead release.

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