Lead Content of Indian Tea

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Introduction

Lead is a cumulative poison and its excessive ingestion causes colic, wrist drop, stippling of red cells and anaemia HUNTER (1969). TANQUEREL DES PLANCHES (1848) was perhaps the first to report significant amounts of lead in tea leaves. KEHOE et al. (1940); KEHOE et al. (1933) and BAGCHI et al. (1940) determined the lead content of foodstuffs and beverages and found high amounts of lead in tea. Therefore, it was considered worthwhile to determine the amount of lead ingested by drinking tea and thereby evaluate the possible lead hazard from this source.

Materials and Methods

Equipment

1. UNICAM SP-500 spectrophotometer
2. Corning glassware was used after removing lead by keeping it in 10% nitric acid for a week.

Reagents

Lead-free analytical grade reagents and double-glass distilled water was used.

Method

1. Estimation of lead in tea leaves

One gram of tea leaves was taken in a platinum crucible, charred carefully and ignited in a muffle furnace at 500°C for five hours CARLO (1964-66). After cooling, 0.2 ml nitric acid was added and the contents

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were evaporated to dryness. This was repeated twice. The colorless ash was dissolved in 10 ml of 0.3% nitric acid and lead was estimated by Dithizone method (ANONYMOUS 1958).

2. Estimation of lead in tea decoction.

Decoctions, prepared by adding one g. of tea in 100 ml of boiling water, were kept at different temperatures for one hour, filtered and acidified with 0.1 ml of nitric acid. This solution was concentrated on a water bath and transferred to a platinum crucible. For studying the effect of pH on the amount of lead in tea decoctions one ml each of 5 N hydrochloric acid, distilled water and 5 N sodium hydroxide was added to 100 ml of boiling water along with one g. of tea leaves and kept for one hour. The pH of the prepared decoction was measured after cooling. Lead was estimated by the method given above.

Results

Fifteen samples of tea of different brands available in the local market were analyzed by the above method. The amount of lead determined in tea leaves ranged from 0.4 to 1.6 ppm and lead concentration in tea decoctions ranged from 0.002 to 0.012 mg/liter (Table 1). The amount of lead in tea decoctions kept at 30°, 50°, 70° and 90°C was found to be 0.008, 0.009, 0.010 and 0.011 mg/liter respectively (Figure 1). In another experiment the lead concentration was found to be 0.015, 0.008 and 0.006 mg/liter at pH values of 4.0, 6.7 and 9.0 respectively (Table 2). The water used to prepare the tea decoctions had a lead content of 0.002 mg/liter.

Discussion

BAGCHI et al. (1940) reported 1.8 mg/liter and 2.4 mg/liter of lead in tea packed in tins and in lead foil respectively. KEHOE et al. (1940) reported 43.2 mg/liter of lead in the leaves packed in corroded lead foil and 0.02 mg/liter in Ceylon hand picked tea. The present study gives lead values ranging from 0.002 to 0.012 mg/liter in tea decoction and 0.4 ppm to 1.6 ppm in tea leaves (Table 1). Both the above workers argued that higher values were due to contamination from corroded foil, but in the present study we found no marked difference in the lead concentration of tea kept in metallic foil or in paper package. Our values are less than those reported by the above workers and within the maximum allowable limits accepted in Great Britain MORGAN and RAWLINGS (1943) and in India (ANONYMOUS 1971).

The amount of lead leached from tea leaves in the decoctions in one hour shows a constant increase with increase in temperature (Figure 1). Hence it is felt that unfiltered decoctions should not be kept for a long time at high temperatures since they leach out more lead.

The amount of lead in the decoction decreases with increase in pH (Table 2). Therefore, addition of citrus juices in the decoctions is likely to increase the lead contamination.

The present study shows that there is no serious health hazard due to lead in tea and tea decoctions under Indian conditions.

Table 1

Amount of Lead in Indian Tea

Sample No.	Packing*	Number of samples	Tea Leaves (ppm)	Tea decoction mg/liter
1	P	3	1.6	0.012
2	P	3	1.6	0.011
3	P	3	1.4	0.009
4	M	3	1.3	0.010
5	M	3	1.3	0.006
6	P	3	1.2	0.009
7	P	3	1.2	0.009
8	M	3	1.1	0.004
9	M	3	1.0	0.004
10	P	3	0.9	0.003
11	M	3	0.8	0.004
12	M	3	0.7	0.003
13	M	3	0.5	0.003
14	M	3	0.4	0.002
15	M	3	0.4	0.002

*P - refers to paper packing; M - refers to metal foil packing.

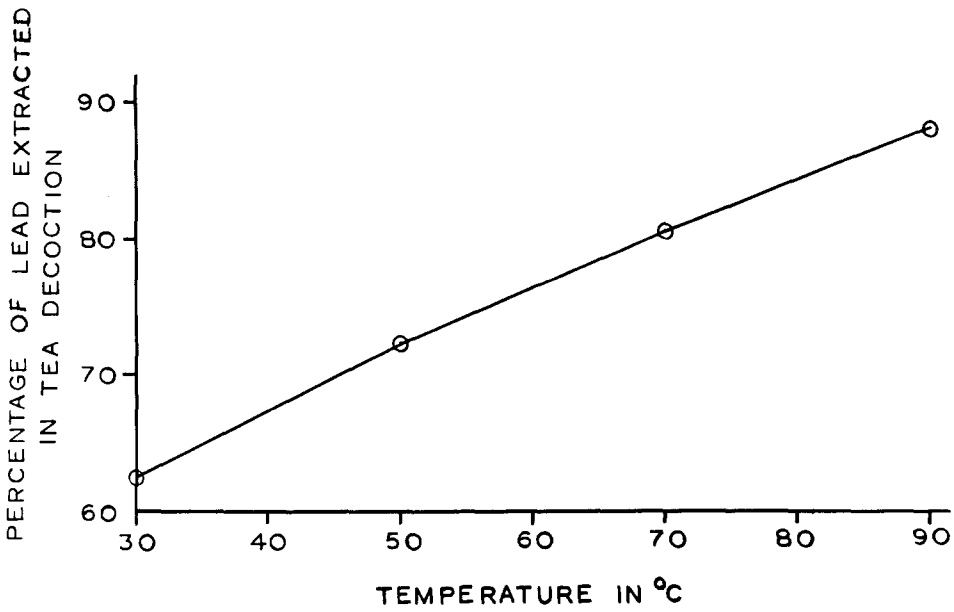
Table 2

Amount of Lead in Tea Decoction at Various pH Levels

pH of the decoction	Number of samples	Average concentration of lead in mg/liter
4.0	3	0.015
6.7	3	0.008
9.0	3	0.006

Figure 1

VARIATION OF LEAD IN TEA DECOCTION WITH TEMPERATURE



Summary

A random survey was conducted to determine lead content in Indian tea and its decoctions. Lead content of various samples of tea was found to be between 0.4 to 1.6 ppm and in decoctions it was between 0.002 - 0.012 mg/liter. The effect of temperature and pH was also studied and it was found that larger amount of lead was leached out in the decoctions at low pH and at high temperature.

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