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Lead Uptake from Beer in India

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Trace metal contamination is common in all foodstuffs and beverages including alcohols (Sherlock et al. 1986). Human intake of trace metals from foods varies geographically depending upon the dietary habit (Louenkari and Salminen 1986) and environmental pollution (Harrison and Laxen 1984). Regular consumption of alcoholic beverages also shows significant elevation of blood lead in population not occupationally exposed to lead (Dally et al. 1986 and Hense et al. 1992). Among the various alcoholic beverages wine contains higher concentrations of lead than beer and spirits (Smart et al. 1990). However, elevation of lead in human blood was also detected following ingestion of beer (Newton et al. 1992). Thus, intake of lead from different alcoholic beverages depends upon consumption pattern which differs from place to place (Martin and Nirenberg 1991).

In developing countries, the alcohol consumption over the last 30 yr has been steadily increasing (WHO 1985). Survey made earlier in India reports absentation rates 50 to 70% (Mohan et al. 1980; Sundaram et al. 1984) and consumption of commercial alcohol per head during 1985 in India was only 0.01 l/head (ARF 1985). However, in the recent past alcohol consumption in India has increased significantly especially among the youth in the metropolitan cities. Chilled beer is more popular drink than spirits and wines in India due to its low cost and suitability to Indian tropical conditions. Therefore, it is desirable to establish lead levels in the popular market brands of bottled beers to assess the lead intake through alcoholic beverages in India. The results are discussed in this report.

MATERIALS AND METHODS

Samples of beer were obtained from retail liquor shops. Although a number of brands were available only 5 popular brands which have wide consumption range were taken up for the study. Approximately 10 ml of the beer sample was taken from the bottle into the polyethylene screw capped container. These containers were earlier tested for any lead contamination and

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were found to be free from lead. The samples were acidified with 1% nitric acid following the procedure of Smart et al. (1990) and stored prior to analysis absorption was read at 283.3 nm using lead hallow cathode lamp on a Perkin-Elmer graphite furnace atomic absorption spectrophotometer.

In the present study a "standard beer" containing an appreciable level of known amount of lead was measured with every 5-8 samples to assess the precision of analytical instrument. The mean value obtained for the standard was 50±3 µg/l. Two aliquots of this material was digested with 1% nitric acid before analysis by ICP which gave a duplicate value of 45 and 50 µg/l by the method of standard addition. This is almost in agreement with AAS values. A detection limit of 2 µg lead/l was obtained in this study. This is calculated on the basis of the concentration giving a reading equivalent to twice the standard deviation of the background signal for a beer containing no measurable lead.

A strict analytical quality control programme was employed in the study. In every batch of 10 samples, two blanks and two reference material were included. Beer sample with known concentration of lead was used as a reference material. Further, 'blind duplicates' were prepared dividing samples into parts which analyst could not identify and analysed as real samples.

Recovery studies were also conducted by adding lead to 12 samples of beer in the concentration ranging from 1.2 to 2.5 µg/ 100 ml. Based on all the 12 values, the mean recovery of lead was 101%, with a range of 97 to 107% as shown in table 2.

RESULTS AND DISCUSSION

The data for lead concentration in different market brands are given in table 1. Results in table 1 show that majority of the

Table 1. Lead in various popular brands of beer in India

Sl. No.	Brand	Range of Lead concentration/ µg/l	Lead concentration* µg/l	S.D
1.	Brand No. 1	8.0-12.5	10.4	1.8
2.	Brand No. 2	12.5-13.5	13.0	1.2
3.	Brand No. 3	9.4-12.0	10.6	2.8
4.	Brand No. 4	13.0-17.5	15.3	4.0
5.	Brand No. 5	12.5-18.0	15.7	5.6
6.	Blank	Nil	Nil	Nil

*Each value represents a mean value of ten samples.

brands of beer have lead concentration of over 10 µg/l with mean of 13.2 µg/l. The mean concentration of lead in beer is slightly higher than those found in bottled beers of U.K. The mean lead concentrations over all types beer of U.K. in 1985-86 was 9.8 µg/l (Smart et al. 1990).

Table 2. Recovery of lead added to the beer samples

No. of samples	Lead added g/100 ml	Lead recovered	% Recovery mean and range
3	1.20	1.21	101 (100-103)
3	1.80	1.87	103 (100-105)
3	2.40	2.44	102 (98-104)
3	2.50	2.52	101 (97-107)

Sherlock (1986) has reported that the normal lead intake of an adult is about 180 µg/week, excluding lead from alcoholic drinks. The provisional tolerable weekly intake for lead in adults according to FAO/WHO (1984) is 50 µg/kg body weight or 3 mg/week for 60 kg adult. In this context it is noteworthy to mention that in India the prevention of adulteration act (PFA 1990) does not mention or recommend any permitted lead level in alcoholic beverages.

Reports on absorption of lead from the gastrointestinal tract indicate that absorption of lead from food is about 10%, whereas absorption of lead from beer is about 20% (Heard et al. 1983). Considering lead levels in beer as 13 µg/l (mean value from table 1), the uptake of lead from beer as 20% and a consumption levels of 1.5 and 10 l/week by three types of consumers can be derived.

Lead uptake from food = 0.1 x 180 µg = 18 µg/week
Lead uptake from beer
For consumption level 1 l/week = 0.2 x 13 µg = 2.6 µg/week
For consumption level 5 l/week = 0.2 x 5 x 13 µg = 13 µg/week
For consumption level 10 l/week = 0.2 x 10 x 13 µg = 25 µg/week

From the uptake data on lead from beer it can be seen that only moderate to heavy beer consumption will lead to elevated concentration of lead in blood and occasional drinkers of beer will not be significantly affected. However, this report is a snapshot and the lead content in beer may change from year to year and it may influence the uptake of lead.

Since wine consumption in India is negligible, lead intake from alcoholic beverages comes primarily through consumption of beer. Although beer does not contain appreciable concentration of lead, but since its consumption is high it contributes significantly to the total intake of lead. Probably, lower alcoholic content of beer is responsible for its increased consumption and thereby contributing to enhanced intake of trace metal. From our study we observed that lead concentration in the popular market brand of Indian beer is not significantly high, but it does contribute to increased body burden among regular consumers. Therefore, continuous monitoring of lead in beer is required to tackle the adverse effects arising out of beer consumption.

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