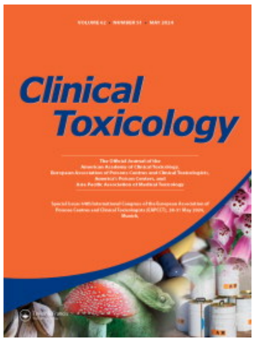

Journal of Toxicology: Clinical Toxicology

ISSN: 0731-3810 (Print) (Online) Journal homepage: informahealthcare.com/journals/ictx19

Setting Provisional Concentration Levels

Clinical Toxicology, 33(3), 285-286 (1995)

LETTER TO THE EDITOR

Setting Provisional Concentration Levels

To the Editor:

Values for the average daily dietary intake (DI) of a chemical compound or element in food are available in reports published by the US Food and Drug Administration (FDA) (1). One may assume that such amounts are safe or, at least, "the best one can get" levels.

There may be times when there is a need to assign concentration limits for chemicals in a source of intake when few or no toxicological data are available. I suggest a means of setting such values by using a dietary equivalent concentration (DEC). The DEC is the concentration of a chemical in a food item, water or the air, which after ingestion or inhalation, provides a daily amount to the body equal to the dietary intake reported by the FDA. It is the ratio of the DI times the fractional or % absorption to either the average daily amount of food one eats, volume of water one drinks or the volume of air inhaled times the respective % absorption (equation 1).

$$\text{DEC} \times \text{S} \times \text{A} = \text{DI} \times \text{A'}$$

DI is in μg; A is the fractional or % absorption for a route of entry; A' is the fractional or % absorption of the chemical after ingestion in the diet. S is the daily quantity ingested or inhaled. For water and air these do not vary and are taken to be 2.5 L and 15 m^3 respectively, but for food the quantity varies from item to item. For fish, the example used here, we assume 20 g per day.

Table 1

Dietary Food Equivalent Concentration Values for Metals Present in Air, Water and Fish

	Fish (μg/g)	Water (μg/L)	Air ($\mu g/m^3$)
Mercury	0.16	1.3	0.02
Arsenic	2.3	18.4	3.1
Cadmium	1.4	11.2	0.48
Lead	2.9	22.3	0.70
Chromium	3.8	3.0	5.0

DEC units vary with the source of intake: i.e. μg/g for fish, μg/L for water and $\mu g/m^3$ for air. Absorption values, A and A', cancel in the determination of a DEC value for food and water, but not air. I have used as examples a report of five metals: mercury, arsenic, cadmium, lead and chromium. If absorption is overlooked or 100% absorption is assumed, significant differences in a DEC could result. This can be shown with mercury. After oral intake of mercury 7% is absorbed while 80% of inhaled mercury vapor is absorbed (2).

An absorption value for an ingested compound can be determined from blood data after two routes of administration, usually oral and IV (3). Such data are frequently available in the literature. Similar information for inhalation, which involves deposition of a compound in lung and transfer to blood is not generally available. Such information could be obtained by performing animal and human experiments similar to those reported respectively by Shanker and Burton (4) and Chamberlain *et al.* (5).

This DEC method provides a practical approach to setting a "safe" concentration of a chemical when a health based standard does not exist. As the DEC would be proportionate to an accepted daily intake or reference dose (6), it inherently encompasses a concept of risk. The DEC would be used only on an interim basis until toxicological data become available to set a reference dose. DEC values calculated for five metals in fish, water and air are shown in Table 1.

ACKNOWLEDGEMENT

The author gratefully acknowledges the assistance Dr. Joseph Reinert for his review and comments. The author also thanks Dr. Donn Viviani, Acting Director, Waste and Policy Division, and Mr. Ronn Dexter, Acting Chief, Pesticide Policy Branch, for permission to communicate this work.

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6. Reference doses (RfDs) can be obtained from the Integrated Risk Information System (IRIS), EPA office of Research and Development, Cincinnati, Ohio and from the Peer Review Workshop on Mercury issues, EPA Summary Report, Environmental Criteria Assessment Office, Cincinnati, Ohio, Oct 26-27, 1987.