THE DIALY INTAKE OF LEAD BY THE EGYPTIAN PEOPLE

By

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ABSTRACT

The daily intake of the Egyptian people of lead through respiration is varied greatly according to rural or urban areas. While the daily intake of Egyptian person in middle Cairo through respiration is 0.034 mg/person it was 0.009, 0.02 and 0.003 mg/person in Dokki, Shobra El-Khema and Moshtohor village. The daily intake of the Egyptian person from water is 1.316 mg/person where the Egyptian person drink 2.810 litre/daily. The daily intake of lead through meal diet was estimated to be 0.592 mg/person. This means that the daily intake of the Egyptian person from lead is varied betwen 2.911 and 2.246 mg/person.

Data show that daily intake of the Egyptian person is below the acceptably daily intake which is recommended by WHO.

WHO established a PTWI of lead as 50 µg/kg bw (3.5 mg/person; 70 kg).

Because of the special concern for infant and children WHO later evaluated the health risks of lead to this group and established a PTWI of 25 µg/kg bw. This level refers to lead from all sources.

INTRODUCTION

Galal Gorchew, 1991 reported that average dietary intake of lead exceeding or approaching the PTWI are reported for adults and infants and children in some countries. Foodstaffs which contribute most to the intake of lead vary from country to country and have been identified as being alternately drinking water, beverages, cereals, vegetables and fruit.

Galal Gorchew, 1990 reported than in Denmark, the average adult weekly intake was 8 µg/kg bw. while in United Kingdom the total intake of lead was 48 µg/kg bw/wk in comparison to a nationwide average of 7 µg/kg bw/wk.

Foodstuffs which contribute most of the total intake of lead by adults vary from country to country and have been identified as being alternately drinking water, beverages, cereals, vegetables and fruit. In spite of high levels of lead that may be found in canned food, these foods because of their relatively low consumption were not identified as major contributors to the intake. Infants lead intakes can be strongly influenced by the lead content of water and by storage of infant formulas in lead - soldered cans. Mean intakes for in excess of the PTWI (in the 100 µg/kg bw/wk range) were obtained in studies carried out in Germany 1980 and the UK 1981 in areas with high lead content in the tap water. This increase in dietory lead results from the water added to dehydrated infant formulas and infant cereals as well as the water which is consumed directly.

In several countries, the lowest intake is reported for infants consume only breast milk.

In poland, the intake of children living in industrial areas amounted to 33 µg/bw/wk and was double that of children living in non-industrial areas.

The haematopoietic system shows effects at lower Pb-B levels than any other system. The effects are in order of sensitivity, inhibition of erythrocyte ALAD, elevation of erythrocyte protoporphyrin IX (FEP), rise in urinary α-aminolevulinic acid (ALA) and coproporphyrin (CP) excretion, inhibition of erythrocyte sodium - potassium adenosine triphosphatase and fall in haemoglobin level. A fall in haemoglobin level is clearly as indication of adverse effects (WHO 1977).

The renal affects of lead are of two general types, the first is tubular characterized by the Fanconi triad of aminoaciduria, hyperphosphaturia, and glycosuria. It occurs with relatively short-term exposure and is reversible. The second type of renal effect is characterized anatomically by sclerotic changes and interstitial fibrosis. Functionally, filtration capacity is reduced. These changes are of a progressive nature and may lead to renal failure (WHO, 1977).

Thomas and Brogan, 1983 reported that even modern - day civilizations have not entirely escaped lead ingestion since paints, gasoline storage batteries and certain industrial processes still represent high risks for poisoning.

Kohoe et al., 1933 found lead in every item of food in both industrial and primitive societies. It seems to be about as much variation within specific items of food as between different categories of foods. For example Schroeder and Balassa, 1961 found that the range was 0 - 1.15 mg/kg for condiments, 0.2 - 2.5 mg/kg for food and seafood, 0 - 0.37

mg/kg for meat and eggs, 0 - 1.39 mg/kg for grains and 0 - 1.3 mg/kg for vegetables.

Daily faecal lead excretion can also be used as a means of estimating daily lead ingestion, since only approximately 10 % of dietary lead is absorbed (Kohoe, 1961).

The concentration of lead in milk is a matter of special concern because milk is a major dietary constituent for infants. Mitchell & Aldous, 1974 reported an average of 40 µg/litre in whole bulk milk.

The ambient air lead levels at 15 national sampling stations in Japan in 1973 were 0.30 µg/m^3 for the average 24 hour value, 2.72 µg/m^3 for the maximum 24 hour - value, and 0.01 µg/m^3 for the minimum (Environment Agency Japan, 1975).

Brito et al., 1990 reported that the mean levels of Mn, Ni, Cu and Zn found in pork liver paste were significantly higher than in the rest of the products but no significant differences were observed for Cd and Pb.

Piscator, 1985 reported that with regard to cadmium, the majority of human beings are exposed to this heavy metal via food, water and air.

Schuhmacher, et al., 1991 reported that the total daily intakes of lead and cadmium were 114.77 µg/day and 56.31 µg/day respectively.

In Egypt, peoples who live in close proximity to dense automobile traffic are exposed to appreciable higher concentrations 3.4 µg/m^3 than others 0.9 µg/m^3 (EAP, 1992).

The ambient air lead levels in Cairo were 3.4 µg/m^3 for average 24 hour value, 9.5 µg/m^3 for the maximum 24 hour-value (EAP, 1992).

MATERIALS AND METHODS

Lead Levels in Air :

The report of the national Specialized higher council which was published in 1992 indicated that mean level of lead in the ambient air in Cairo was 3.4 µg/m^3 in the middle of toun, 0.9 µg/m^3 in Dokki, 2.1 µg/m^3 in the industrial areas and 1.2 µg/m^3 in Shoubra El-Khema.

The maximum levels for the same areas for 24 hr. were 9.5 µg/m^3, 2.5 µg/m^3, 5.2 µg/m^3 and 3.5 µg/m^3 respectively.

Lead Levels in Food Stuffs:

Fifty samples of total diet were collected. Each sample comprised Egyptian bread, meat (fish, beef, poultry) vegetable (tomatoes, potatoes) milk and milk products, oil and fruits.

Thirty grams of each food stuff were kept in offen at 450°C for 3 hrs to be transformed to ash.

The ash was treated with 5 ml hot concentrated hydrochloric acid and filtered and made up to 50 ml with deionized water in volumetric flask.

Determination were carried out by flame atomic-absorption spectrophotometry.

Lead Levels in Tap Water :

As many factors affecting the lead levels in tap water (i.e. the old of water net, the type of pipes, the storage of water in storage tanks ... etc.) about 1000 samples were taken to high lights about the level of lead in drinking water in different areas.

Each sample of water was 1 litere. Samples were taken from Rural and Urban areas, also from old and new houses, from houses having storage tanks or have not, from houses have a plastic net water pipes, or iorn net water pipes, early in the morning or in mid day or at night.

Samples were also taken from the treatment units stations or from underground water stations, also from the begining of the water net or from the end of the water net.

The same conventional atomic absorption spectrophotometry was used to determine lead in tap water.

Estimated daily intake of lead/person is based on the three sources of intake air, water and food.

The normal Egyptian person (70 kg) consume 10 000 cu.L of air for respiration and drink 2-8 L of water daily.

Data were collected from a statistical survey conducted by the Egyption Nutrition Institute (Ministry of Public health) about the quantity of food in the daily diet of Egyptian adults.

RESULTS AND DISCUSSION

The average diet / person / day is tabulated in table 1. Bread is the main food 48% of the Egyptian daily diet while meat constitutes only 3-3% of the Egyptian diet.

Table 1: Average composition of the Egyptian person's total daily diet

Food group	Average weight (g/day)
Drinking water	2810
Whole milk	83.3
Milk products	16.7
meat, fish or poultry	33.3
Bread	480.0
Potatoes	100.0
Vegetables	116.7
Fruits & fruit Juices	73.3
Oils & fats	13.3
Sugar and adjuncts	86.7

The average lead level in the ambient air in different parts of Cairo is tabulated in table 2 as reported before in the official report by National Specialized higher Council (1992).

Data indicate that the daily intake of the Egyptian person through respiration is 0.034 mg, 0.009 mg, 0.021mg and 0.012 mg for person living in middle Cairo, Dokki, industrial area, and Shobra El-Khema respectively, while the daily intake in Moshtohor village was 0.003 mg/person.

Table 2: Average lead levels in ambient air of Cairo (microgram/m³/air)

Area	Mean level /year	Maximum Concentration in month	Calculated daily intake/ Egypt on person
Middle - Cairo	3.4	9.5	0.034 µg
Dokki	0.9	2.5	0.009 µg
Industrial areas	2.1	5.2	0.021 µg
Shoubra El-Kema	1.2	3.5	0.012 µg
Moshtohor	0.3	3.3	0.003 µg

Data in table 3 show that all the tested food stuffs contained lead residues.

Table 3: Lead level in food stuffs and the daily intake mg/person

	Mean lead level	mg/person
Milk	0.020	0.002
Dairy products	0.060	0.005
Meat, fish, poultry	0.260	0.009
Bread	0.800	0.384
Potatoes	0.600	0.060
Vegetables	0.700	0.081
Fruits & fruit juices	0.700	0.051
Oil and fats	-	
Sugar & Adjumets	-	
Total		0.592

The daily intake of lead through food stuffs is tabulated in table 3.

Table 4: Lead level in tap water µg/litre

Level	Lead level mg/L.	mg/person (70 kg)
Minimum	0.118	-
Mean	0.470	1.316
Maximum	0.945	-

The daily intake of lead through respiration, drinking water and total diet/day/person was calculated to be between 2.911 and 2.246 mg/person. While the acceptable daily intake/person (70 kg) is 3.5 mg/person.

WHO, 1977 reported that a number of studies have been made which indicate that 35% of the lead inhaled by man is deposited in the lungs. But when sustained Pb-β is used as a measure of lead absorption, it can be assumed from human data that the continuous exposure to 1 µg of lead/m³ of air would contribute lead levels at about 1.0 - 2.0 µg/100 ml of blood.

About 10% of lead taken in from food and beverages sources is absorbed, however using data from the detary contribution to Pb-B can only be roughly estimated as 6 - 18 µg of lead per 100 ml of blood per 100 µg of dietary lead intake.

The body burden of lead can be subdivided into a large, slow-turnover compartment and a smaller more rapidly - exchanging compartment. Anatomically, the larger compartment is mainly located in bones. The amount of lead in this compartment increases throughout life. The smaller compartment consists of the soft tissues and included the blood. Lead levels in soft tissues and in blood continue to increase up to early adult hood and then change little. Elimination of lead from the body is mainly by way of the urine (about 76%) and the gastrointestinal tract (about 16%). The other 8% is excreted by miscellaneous routes (sweat, exfoliation of the skin, loss of hair).

From the recent results we can estimate that the continuous exposure of the Egyptian person to 3.4 µg/m³ of air will contribute lead levels at about 3.4 - 6.8 µg/100 ml of blood and in the same time through 190.8 µg of lead consumed by each person, the level of lead in the blood can be estimated to be 11 - 34 µg of lead per 100 ml blood.

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