

AVERAGE DAILY INTAKE OF SOME PESTICIDE RESIDUES FOR MILK FED EGYPTIAN INFANTS

A. E. Ezz*, Z. M. Selem**, A. A. Abdel Gawaad***
*TTPS/UNDP, Egypt; **Faculty of Agriculture, Minia University; ***Faculty of Agriculture, Moshohor, Zagazig University

ABSTRACT

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The average daily intake of some pesticide residues for milk fed Egyptian infants (first three months of life) was estimated based on the average daily intake of milks as was assessed in a previous survey and the detected residue levels of some organochlorine insecticides in samples of both human milk and powder milk formulas. The results show that the estimated daily intake for Dieldrin and Endrin were 0.001431 and 0.0011053 mg/kg B.W. respectively. While the DDT residues were the largest quantities of residues in both human and powder milk but the estimated daily intake (0.0055124 mg/kg B.W.) was less than the established ADI.

The estimated daily intake for Heptachlor and Lindane were also accepted compared with the ADI.

INTRODUCTION

As malnutrition continues to remain the major international health problem (WHO 1990), a balanced nutrition provided by a productive agriculture contributes to the health and well being of man, improves his resistance to disease, and enhances his capability for productivity. A variety of pests reduce agricultural productivity as much as 50% or more and are also vectors of human diseases. Pest control, therefore, is essential to the well-being of the society. Chemicals are extensively used for pest control, but when improperly used, would markedly contribute to both health and environmental problems (Davies et al., 1982).

Pesticides have proven acute and chronic toxic effects, as well as their mutagenic, oncogenic and teratogenic effects (FAO and WHO 1985 a, b; 1986 a, b; 1987 a, b; 1988 a, b; 1989 a, b; 1990). Moreover, pesticides may also influence the dietary and nutritional status by the decrease of appetite; induction of weight loss; alteration of nutrient requirements; effect on micro and macro nutrient storage sites; and distribution in organ systems which have nutrient digestive, utilization, absorption and excretion functions. Furthermore, pesticides may also influence the dietary and nutritional status by their effect on specific metabolic pathways; competition for a specific blood-binding site of a micro nutrient; bondage with any moiety of nutritional significance; triggering of a metabolic effect which increases the risk of disease; injure microsomal fractions necessary for enzyme induction, which in turn are required for metabolic and detoxifying processes (Davies, et al., 1982).

In the period from 1952 up-to 1990, Egypt had used 690,000 metric

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tons of about 182 pesticides from all groups of insecticides, fungicides and herbicides. Nearly 50% of such pesticides found their way into the soil and are constituting a permanent persistent source of contamination affecting plants, soil fertility, air, water and useful fauna (Abdel-Gawaad, 1985; CAPMAS, 1991). Persistence of such pesticides within the environment leads to significant contamination of foods and mainly milk and its products which are the main constituent of the daily diet of pregnant and lactating women (Al-Omar, et al., 1986 and Abdel Gawaad and Shams El-Dine, 1989).

Breast milk and powder milk are the sole sources of nutrition in young infants. There is increasing evidence that environmental pollutants are often present and concentrated in it. Also, pollutants may be present (possibly in greater concentrations) in cow's milk and water used to reconstitute powdered milk (Broomhall and Kover, 1986).

DDT is one of the first environmental chemical to be detected in human milk (Laug, et al., 1951). The average concentration in rural areas nears 50ppb and in urban areas is 100ppb (Newton and Green, 1972). In areas where DDT remains in use, levels of 200 to 300ppb have been reported (Olisyna-Marzys, 1978) and may be as high 1000ppb where anti-malarial spraying is common (Kalara and Chawla, 1981).

Sakurai, et al. (1979) found a relative high level of organochlorine insecticides in human milk and cow milk in Japan. DDT was 18.8 folds higher in the breast milk than in cow milk. Also, in Japan Inoue et al., 1979 and FAO/WHO, 1981; reported a significant quantities of organochlorine insecticides in breast milk.

In Costa Rica, Umaña and Constenla (1984), detected DDT and DDE in nursing mother milk at quantities from 0.12 to 2.60ppm. The high concentrations of DDE indicated chronic contaminations.

Cetinkaya and Thiemann (1985) found that DDT in Sivas (Turkey) at high levels indicating a possible danger to the health of infants.

Rogan et al., 1986 detected the DDE in maternal serum, cord blood, placenta and breast milk in USA. All samples of breast milk showed detectable levels of DDE. The higher levels showed in older women, black woman, cigarette smokers, and who consumed sport fish during pregnancy. The larger effects were due to age and race.

Cyclodiene insecticides (Aldrin, Dieldrin, Heptachlor, Chlor-dane) and their metabolites can be detected in breast milk samples, high level was found in Southern States of America but low levels have been found in human milk samples from Europe (Bakken and Seip, 1976; Haver W Van and Gordis, 1977; and from America (Savage, et al., 1981).

Lora et al., 1979 detected a high concentrations of Heptachlor in hu-

man milk in Spain.

New born infants died as a result of intoxication from mother's milk.

HCB concentrations were recorded as high as 700ppb. (Peters, et al.,

1982 and Cripps et al., 1980). Also, HCH found in high levels in Europe,

generally less than 20ppb (Westoo and Noren, 1972; Bakken and Seip,

1976; FAO/WHO, 1981 and Haver W Van and Gordts, 1977; up to

100ppb in Japan and excessive concentration in breast milk have reported

from Israel (Weisenberg, et al., 1980).

In this study, we aim to monitor the average pesticide residue level

of some persistent pesticides in milk. Furthermore, the average daily in-

take of such pesticides for milk-fed infants in the first 3 months of life

will be estimated on the basis of the established Egyptian average daily

intake of milk for such age group, the average residue levels detected, and

the average weight of Egyptian infants, in relation to the established inter-

national acceptable daily intake.

MATERIALS AND METHODS

Samples:

Fifty samples of human milk were collected from 50 women, 15 - 30

days post partum. Women were varied in social class, age and number of

births. Collected samples were kept at -18°C until analyses.

• Powder milk samples of all available formulae in the Egyptian mar-

ket were collected.

Analyses of Samples:

A) Extraction:

A modified AOAC method reported by Zazuki et al., (1979), was

used. Subsamples of 50ml each were then mixed with 0.5g potassium ox-

alate and 50 ml ethanol. Fat was extracted three times with 50 ml portions

of ethyl ether : petroleum ether (1 : 1). The combined organic layers were

washed with water, dried and concentrated to 25 ml. To determine the ex-

tract weight, one ml. of the concentrate was used. To a separatory funnel

ten ml. were transferred and pesticides were extracted 4 times with 20 ml.

portions of acetonitrile saturated with petroleum ether.

Combined acetonitrile extracts were diluted with 450 ml of water and

the aqueous phase was reextracted twice with 8 ml. portions of petroleum

ether. Petroleum ether solutions were combined, dried and concentrated to

10 ml. A 4 ml extract was submitted to Florisil column for clean-up.

B) Clean-up

Column chromatography was used to separate the organic chlorine and

organophosphorus compounds from extracts. Smole loose plug of glass wool was placed in the tip of a chromatographic column (25 mm i.d. X 400 mm). The column was packed with 5g of sodium sulfate. Then 50 g of deactivated Florisil were added. Addition of 5 g of sodium sulfate were added to the top of the Florisil. The column was washed with 50 ml of petroleum ether and the washings were discarded.

Four ml of the extract were transferred to the column and allowed to penetrate the upper portion of the Florisil. Elution was then performed with 200 ml portion of 7 % diethylether in petroleum ether. The elute which contained organic chlorine compounds was collected in a Kuderna-Danish flask for concentration and dryness. The concentrates were finally dissolved in 1ml acetone for G.C. analysis.

C) Gas Chromatography Determinations

Analysis were performed on a gas liquid chromatograph equipped with electron capture detector under the following conditions:
Columns: Glass column, 6 mm O.D. by 4 mm I.D., 183 cm long, packed with OV-17.

Carrier gas: Pure nitrogen at a flow rate of 30 ml/min.
Operating temperature: Injector: 250°C, Column : 230°C, Detector : 250°C.

RESULTS AND DISCUSSION

Data were collected from a survey conducted by the Egyptian Nutrition Institute of the Ministry of Public Health regarding the ratio of breast fed to formula milk fed Egyptian infants, in the first three months of their life. The Egyptian infant is basically breast fed as the ratio of breast milk to formula milk is 3.69:1. An amount of 120 gm/kg B.W. was used as an average for the daily diet for milk fed infant as recommended by WHO (GEMS, 1988).

Chlorinated hydrocarbon insecticide residues detected in the samples of human milk included DDT (in forms of DDT, DDE and DDD) Dieldrin; Endrin; Lindane and Heptachlor. DDT and DDE were found in all samples, while DDD was in 32% only. Dieldrin and Endrin were in 76% of samples. Lindane and Heptachlor were found in 32 and 28% respectively. Many other compounds were found in undetectable quantities. The average amounts of detected compounds were tabulated in table I.

Table I
ESTIMATED PESTICIDE RESIDUES
IN

HUMAN MILK AND POWDER MILK FORMULAS

Pesticide detected	human milk (mg/kg)	powder milk formula (mg/kg powder)	MRL (mg/kg)
DDT	0.05690	0.43800	0.050000
Dieldrin	0.01513	0.00800	0.006000
Endrin	0.01170	0.00200	0.000800
Heptachlor	0.00086	0.00100	0.006000
Lindane	0.00080	0.04200	0.010000

The above results showed that DDT, Dieldrin and Endrin were at more high levels indicating a possible danger to the health of infants. These high residues in human milk may be related to the high intake of organochlorine pesticides by lactating mothers basically through their feeds. Abdel-Gawaad and Shams El Dine (1989) were detected a high chlorinated hydrocarbon residues in total diet of Egyptian peoples. Also El-Sheikh, et al., (1989) concluded that the chlorinated hydrocarbon insecticides constitute a major hazard leading to pollution of breast milk. A noticeable result that all the analyzed samples contained one or more insecticide residue in a high level exceeding the Maximum Residue Limit (MRL) established by FAO/WHO (CAC, 1986). The average of estimated residues in powder milk samples appeared that residues of DDT, Dieldrin, Endrin and Lindane were over the MRL but the residues of Heptachlor found less than the MRL.

Table II
ESTIMATED DAILY INTAKE OF PESTICIDE RESIDUES
FROM
HUMAN MILK AND POWDER MILK FORMULAS

Pesticide detected	human milk (mg/kg body weight)	powder milk formula ADI
DDT	0.0068280	0.006570
Dieldrin	0.0018156	0.000120
Endrin	0.0014040	0.000030
Heptachlor	0.0001032	0.000015
Lindane	0.0000960	0.000030

The comparison between residues in human milk and powder milk appeared that powder milk contained higher quantities of DDT, Lindane and Heptachlor than human milk. The quantities of DDT in powder milk reached more than seven folds of the DDT in human milk and more than eight folds of the MRL.

The estimated daily intake for the detected residues in milk fed Egyptian infants was calculated in table II. We found that the human milk contained Dieldrin and Endrin in quantities exceeding the ADI established by FAO/WAO (IPCS, 1991). While in powder milk formula Dieldrin residues only were found more than the ADI.

Table III
AVERAGE ESTIMATED DAILY INTAKE OF PESTICIDE RESIDUES
FOR
MILK FED EGYPTIAN INFANTS

Pesticide detected	Pesticide residues in mg/kg body weight average estimated	AD I
DDT	0.0055124	0.020000
Dieldrin	0.0014311	0.000100
Endrin	0.0011053	0.000200
Heptachlor	0.0000815	0.000100
Lindane	0.0000889	0.008000

The final data of the average estimated daily intake of pesticide residues for milk fed Egyptian infant was compared with the ADI in table III. The comparison showed that Egyptian infants are fed with non acceptable residues of Dieldrin and Endrin.

Infants in Egypt like in all developing countries have extensive problems regarding the high level of pesticide residues in the breast milk and the fact that new born infants died as a result of HCB intoxication from mothers milk (Cripps, et al., 1980 and Peter, et al., 1982).

The established breast feeding benefits, added to the non acceptable residues limit in powder milk must be considered in any decision for infant feeding.

Finally, because of the complexity of the problem and the significance of the issues involved, it is essential that further studies should be standardized and controlled.

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