MONITORING OF PCB's AND ORGANOPHOSPHOROUS PESTICIDE RESIDUES IN MILK

By

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ABSTRACT

Samples from packed and bulk milk were collected from Cairo, Giza and Qualiobia. Samples were analyzed for the determination of PCB's and Organophosphorous pesticide residues.

One step extraction and clean up method was conducted.

GLC apparatus equiped with electron capture detector and flame ionisation detector was used for the determination of both PCB's and Organophosphorous pesticide residues.

Data indicate that all the bulk and packed milk samples tested were free from 5 PCB's residues (Archlor 1016, Archlor 1221, Archlor 1242, Archlor 1248 and Archlor 1254).

Results also show that no Malathion residues were detected in all samples tested.

Dimethoate residues were detected in 14.29% of packed milk samples, while bulk milk samples were free from dimethoate.

INTRODUCTION

Milk and its products are the main constituent of the daily diet, especially for vulnerable groups such as infants, school-age children, pregnant and lactating, women and old age (Davies et al., 1986). Furthermore, the average annual consumption of milk is 41.4 Kilagrams per person, constituting a major component of his total diet (FAO, 1991).

Polychlorinated biphenyls (PCB's) are a class of aryl halides widely distributed in the environment (Gomez-Catalan, et al., 1991). Concerns on the presence of PCB's in milk have arisen because of a widely used of it in industry for 40 years particularly as industrial insulation and heat exchange agents in transformers and capacitors (Savage, 1976).

They may be significant contaminants of milk because a high fat solubility and slow rate of metabolism and excretion (Broomhall and Kovar, 1986).

Median levels of PCB's in foods are low in the 14 countries as reported in GEMS although extremely high levels have been found in isolated cases. The highest concentrations were found in fish from inland waters, estuaries and enclosed seas. Such levels were less than or slightly above 100 ug/kg. PCB levels in animal fat were in the range of 50 to 400 ug/kg in reporting countries (GEMS, 1991).

PCB's were seldom detected in vegetables and vegetable oils, fruits, eggs and cereals (GEMS, 1991). However high levels have been reported in cereals in Sweden which was attributed to contamination by packaging material. (WHO, 1976).

High daily intakes of PCB's in New Zealand from dairy products were reported by Pickston et al. (1985). Median levels of PCB's in 14 countries as reported in GEMS/food were below 20 ug/kg in dairy milk and were substantially higher in human milk. A general decreasing trend is seen in several countries except for Germany and Sweden where it is increasing (GEMS, 1991).

Results in national surveillance program in Poland indicated that large amounts of DDT and PCB's were detected in human milk and fat. PCB's were detected frequently in animal tissues, but cow's milk contained concentrations lower than those in human milk, (Jaszkiewicz, 1982).

Many authers determined the PCB's in water, sediments of river, fish, human milk, fruits and vegetables (i.e. Mess and Davies, 1978; Savage, 1976; Newton and Greene, 1972; Frank et al., 1985; Frank and Braun, 1989; Lan et al., 1990; Gomez-Catalan, 1991). Persistance of PCB's within the environment lead to significant contamination of food especially milk, (WHO, 1972 and Al Omar, 1986).

Bluthgen et al. (1984) reported that cow milk samples, contained antibiotics, sulphonamides, anthelmentics, insecticides, toxic trace elements, nitrate, nitrite, nitrosamines, mycotoxins, detergents, disinfectants and PCB's.

Hence, monitoring of the PCB's and some pesticide residues in milk is of utmost importance due to both its high consumption and its aformentioned hazards (WHO, 1972 and GEMS, 1991).

MATERIALS AND METHODS

Milk samples:

Total of 525 primary milk samples were collected from the governorates forming greater Cairo (Cairo, Giza and Qualiobia governorates) during September-October, 1991.

Samples of bulk milk comprising of fresh milk in bulk were collected from producers/ farmers, whole salars and retailers. Packed milk from the kind of ultrahigh treated (UHT) were collected from the production of different factories.

The samples were kept in deep-freezer under-18°C until analysis.

The recommended methods of sampling for the determination of pesticide residues (FAO, 1982) were employed throughout the sampling procedures.

Standards used:

The following primary standard's were obtained from the repository of the U.S environment protection Agency of research triangle park, N.C. These standards included. Arclor, 1016, 1221, 1242, 1248 and 1254. The standards of insectisides were, Dimethoate and Parathion.

The working standards solutions of three concentrations were prepared daily (1, 2 and 4 nanograms per microliter) with pesticide quality hexane solvent.

Extraction and clean up:

One step extraction and clean up was conducted according to the modified multiresidue method of Langlois et al., 1964 as reported by Stijve and Cardinale, 1974.

GC detection:

Hewlett Packard, Model "HP 5890 A" programable gas chromatograph with HP- 101 methyl silicone fluide 25 mm x 0.2 mm columns, equipped with an electron capture detector and a flame lonization detector were used under the operating conditions, initial temperature, 150°C ; Temperature rate 5°C per min.; final oven temperature, 240°C; oven maximum temperature 220°C; Detector temperature 300°C; flow of carrier gas 40 ml N_2 per min.

RESULTS

Results indicated that PCB's (Arclor 1016, Arclor 1221, Arclor 1242, Arclor 1248 and Arclor 1254) were not detected in any of the packed or Bulk milk samples.

Figure 1 (a - e), showed the gas chromatogram by injecting the PCB's and fig 2 (a and b) illustrate that nondectable amounts of all the used Arclor in both bulk and packed milk samples.

No detectable residues for malathion were found in any of the packed milk samples or the bulk milk samples collected from greater Cairo.

The only detected residues were the Dimethoate residues. In 14.29% of packed milk samples Dimethoate was detected in range from 0 to. 0.2573 mg/kg at mean value 0.0368 mg/kg with a standard deviation of ±0.0973. Dimethoate residues were not detected in all bulk milk samples.

DISCUSSION

The rapidly growing problems with food contamination facing Egypt are forcing planners of national policy to recognize that food laws and control programmes are now more needed than ever before.

Food laws are needed to encourage the production of safe food and to deal with the increasing risks of chemical contamination and attendant health hazards.

Powder milk was added to 44% of packed milk. In this study, PCB's residues were not detected in all milk samples. This contradicts with results reported by Claus and Acker (1975) who found PCB's in milk products sampled from Germany during the period 1972 - 74, the range was 0.25 - 0.54 mg/kg with a mean of 0.38 mg/kg.

The food and drug administration in an extensive study on the level of PCB's in foods as reported by WHO (1976) found PCB's in 7% of milk samples at a range of 0.1 - 27.8 mg/kg with a mean of 2.3 mg/kg.

The average of total PCBs in milk was within detectable levels, but lower than the MRL, with a few high levels in isolated cases, as reported by ten countries to GEMS/food.

However, such levels were only reported from developed countries such as Japan and Germany, where the commercial production and use of PCBs is high. However, comparison of data regarding individual congeners with total PCBs is difficult. (WHO 1976 and GEMS 1991).

Moreover, data for PCBs level in Egypt or any developing country was not available for comparison.

Furthermore, the absence of PCBs residues in packed milk indicate the use of good quality packaging materials as high levels of PCBs in packed foods was attributed to migration from packing material (WHO, 1976 and GEMS, 1991).

Malathion residues were not detected in all milk samples. This is in accordance with the reviewed literature as organophosphorus pesticide residues, if any, are always below detection level, and no countries reported to GEMS/food any such residues (GEMS 1991).

This is also in accordance with Matsumura (1976) who found that more polar, degradable pesticides (such as organophosphorus and carbamate pesticides) are not likely to accumulate in milk.

Dimethoate residues ranging from 0 to 0.2573 mg/kg with an average detected residue (ADR) of 0.0368 mg/kg were detected in 14.29% of packed milk samples. None was detected in bulk milk samples. The average ADR for all samples was 0.0117 mg/kg. This is in accordance with the results of Mathio (1989) who detected residues of organophosphorous insecticides in cow and buffalo milk in Kenya. The same was also observed by Dhaliwal (1990), Singh and Singh (1990) and Verma (1990).

However, this contradicts with most of the reviewed literature as organophosphorus pesticide residues, if any, are always below detection level, and no countries reported to (GEMS, 1991). However, the source could be from the use of pesticides during milking or direct application to dairy herds according to Frank et al (1970) or during packaging (WHO 1985).

The Estimated Daily Intake (EDI) of Dimethoate residues for Egyptians from milk was less than 0.2% of the established Acceptable Daily Intake (ADI) being 0.000019 mg/kg bw and 0.000016 mg/kg bw based on both FAO

Figure 1: Standard of PCB's, Gas chromatogram of aroclor 1254 (a); aroclor 1221 (b); aroclor 1016 (c); aroclor 1242 (d) and aroclor 1248.

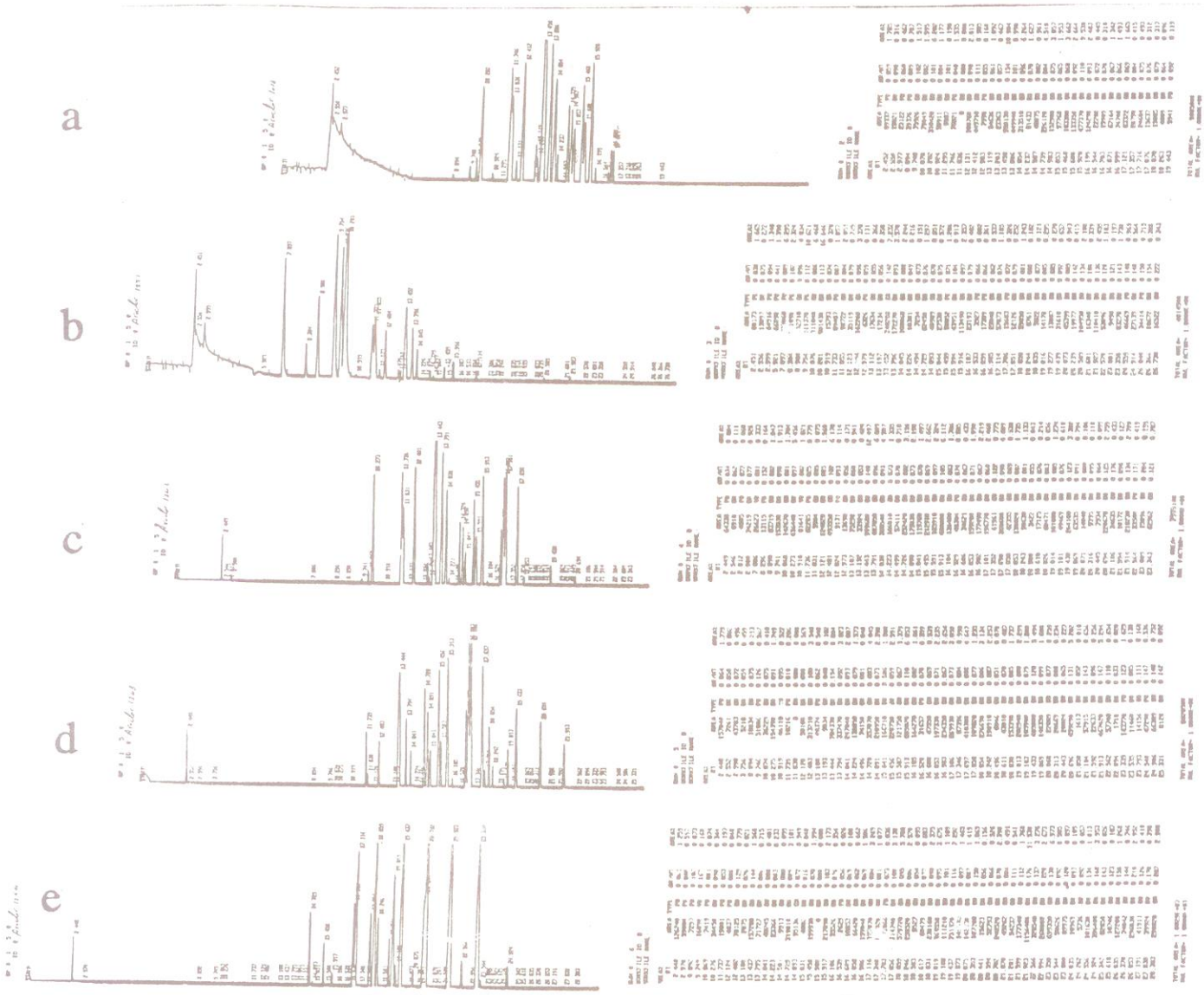
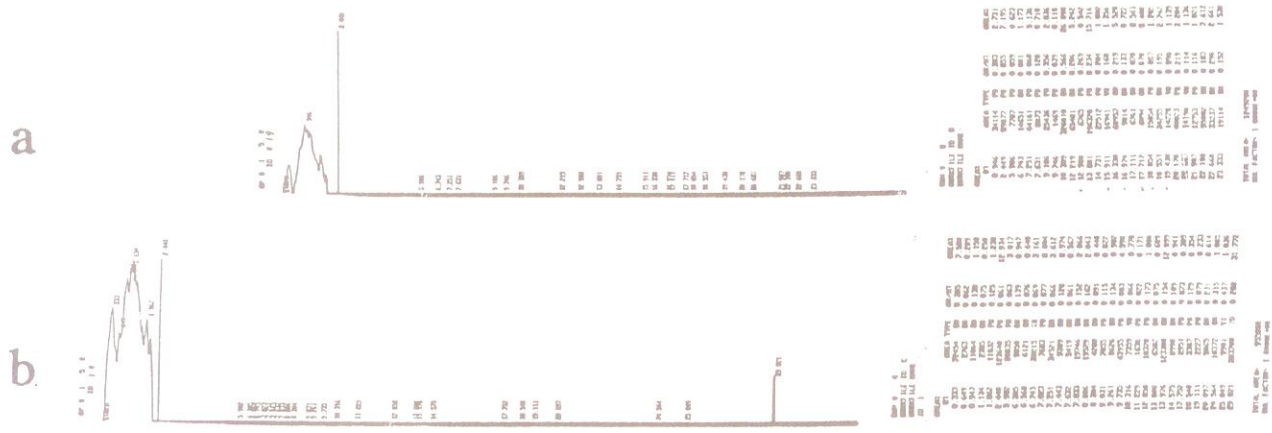


Figure 2: Gas chromatogram of a bulk milk sample extract (a) and a packed sample extract (b).



and CAPMAS estimates.

Whereas, the Estimated Daily Intake (EDI) of Dimethoate residues for Egyptian infants from milk was 15 times that of the general population, yet it was less than 3% of the established Acceptable Daily Intake (ADI) being 0.000243 mg/kg bw.

No data were available regarding dailly intakes of Dimethoate.

Finally, the pollution with pesticide should be avoided and take care through handling and packing will be done.

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