

An Evaluation of DDT and DDT Residues in Human Breast Milk in the Kariba Valley of Zimbabwe

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The organochlorine pesticides commonly used in Zimbabwe include DDT (only as a vector control agent in some areas. The amount of DDT used has been reduced from 300 tonnes per year in 1981 to 5 tonnes by 1991), aldrin (not registered for aerial application), dieldrin (very restricted), endrin, heptachlor, toxaphene, chlordane, lindane (restricted use on edible crops) and endosulfan.

The general use of DDT as a broad spectrum insecticide against pests like the stalkborer and snout beetles in maize crops or cut worms and army worms in groundnuts and soyabeans was banned in Zimbabwe in 1982. However, DDT is still used as a vector control agent in the tse-tse fly control programmes. It is used in the Kariba basin of Zimbabwe for this purpose (Nhachi et al 1995). The Kariba basin lies along the Kariba dam (one of the biggest man-made lakes in the world), on the Zambezi river to the north-west of the country. The basin has an altitude of 500 to 700 meters and is characterised by hot average temperatures of 30°C.

DDT has been used as a 75% wettable powder and applied selectively at a concentration of 4% to give a coverage of 200 g per hectare of sprayed area and spraying is mostly aerial (Mpofo, 1987). As a result high levels of DDT in the Kariba lake fauna have been reported (Mathiessen, 1994). The objective of this current study was to determine the incidents and the levels of DDT and its metabolites in the breast milk of mothers living in the Kariba area of Zimbabwe.

MATERIALS AND METHODS

Milk samples were collected from each breast-feeding mother by manual expression. The milk was collected into teflon vials with 50 ml of 30% formalin for every 10 mls of milk to preserve. The samples were frozen until ready for analysis. The mothers who gave milk had lived in the area for at least five years. Most of the mothers had been educated to grade seven only and

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their staple food is sadza (thick maize-meal porridge), fish caught from the lake, and locally grown vegetables.

The criteria for selecting mothers to provide milk consisted of mothers who were between the ages of 16 - 32 (average 23); mothers nursing their first, second or third child; mothers who had had a normal delivery and both mother and child were healthy. Milk samples were collected at the same time, 10:00 - 12:00 every day. In all 39 mothers participated (with consent) in the study. DDT and the DDT metabolizes were determined by use of gas chromatography following the method used previously by Chikuni, et al, 1989. The method is based on sample extraction with a solvent mixture of cyclohexane and acetone. Extraction is done by treatment with ultrasonic probe. The sample extract is then cleaned up with acid or alkaline and identification is done by Electron Capture (ECD) - Gas Chromatography.

RESULTS AND DISCUSSION

The mean levels of DDT and its metabolizes, pp-DDE and pp-DDT were expressed as milligrams per kilogram of milk fat (mg/kg milk fat). The results were also expressed as a ratio of sum of DDT over total DDT.

Table 1. Mean levels of pp-DDE, pp-DDT, sum DDT and the ratio of sum DDT/pp-DDE.

| Country (year) | pp-DDE (mg/kg milk fat) | pp-DDT | sum DDT | <u>sum DDT</u> pp-DDE |
|-----------------------------------|----------------------------|-----------|------------|--------------------------|
| Zimbabwe (mean) 1994 | 4.49±0.25 | 1.33±0.20 | 6.50±0.91 | 1.44 |
| Zimbabwe Kariba area (1994) | 13.60±1.10 | 9.07±1.14 | 25.26±2.33 | 1.86 |
| Nigeria (1986) | 1.33 | 2.37 | 3.83 | 2.88 |
| Kenya (1994) | 2.95 | 3.73 | 6.99 | 2.37 |

The mean fat content of the milk was calculated at $3.29 \pm 1.40\%$. The Kariba milk samples show a three fold, seven fold and four fold increase in pp-DDE, pp-DDT and sum DDT levels respectively over and above the average national levels. This in a way was expected since Kariba is the only area in Zimbabwe where DDT is still being actively applied. The high sum DDT/pp-DDE ratio of 1.87 is an indication of the recent application of DDT.

The levels of DDT and its metabolites found in this study are much higher than those found in studies in Nigeria (Autuma and Vaz, 1986), and Kenya (Heyce, 1994). Aerial and ground spraying with DDT in the Kariba area is done mostly during the rainy season. The wash out from the rivers assist to distribute the DDT, which eventually finds its way into lake Kariba. The lake is the major source of water to the nearby town, township and rural dwellings. It is also the main supplier of fish to the local population and the people also eat vegetables from backyard gardens which is another possible source of DDT pollution. It seems therefore that the main source of exposure to DDT is diet (Mathiessen, 1984).

The acceptable daily intake (ADI) for DDT has been set at 5.0 µg/kg. The estimated daily intake (EDI) for the Kariba was 114.93 µg/kg body weight. This is about 23 times more than the ADI. One of the interesting questions which arises out of the present results is the effect of such high DDT levels in breast milk to the suckling babies. This is perhaps an area which needs further studies.

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