

DDT AND PYRETHROID RESIDUES IN HUMAN BREAST MILK FROM KWAZULU-NATAL, SOUTH AFRICA



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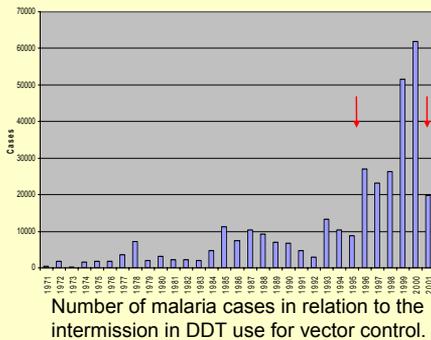


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Background

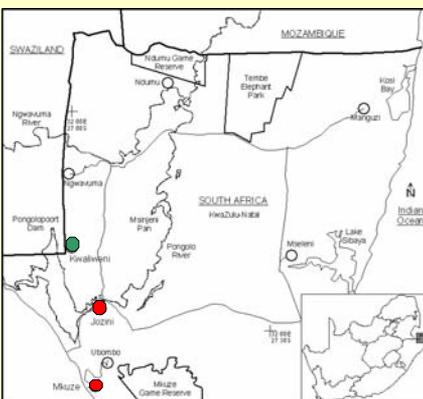
Malaria is a major concern in Africa and many other developing countries, and finding ways of effective vector control is a high public health priority. For many years, DDT was the major insecticide for vector control in most of Africa. But because of its negative environmental effects there has been much international work to reduce the use of DDT and replace it with other insecticides.

In 1995 the South African malaria vector control programme stopped using DDT, replacing it mainly with pyrethroids. Immediately after this the number of malaria cases rose drastically because of the invasion of mosquitoes resistant to pyrethroids from Mozambique. This led to the reintroduction of DDT in the vector control programme in 2001, after which the number of malaria cases decreased again.



Methods

A total of 152 samples were taken from three clinics, two, Jozini and Mkuzi, serving areas with malaria, and one, Kwaliweni, serving an area without malaria, and frozen immediately after collection. The samples were collected between April and November of 2002, a period between indoor spraying operations, just after the application of DDT was first resumed. For QC the analytes were added to milk samples that were treated in the same manner as the other samples. The samples were extracted with hexane after denaturing the proteins with acetonitrile. The DDTs were determined after cleanup of the hexane extract with concentrated sulphuric acid. Cleanup for the pyrethroids included partitioning the hexane extract with acetonitrile, and fractionation on silica. Quantification for the various DDTs, permethrin, cyfluthrin, cypermethrin and deltamethrin was done using GC-MS.



Conclusions

Both DDT and pyrethroids are transferred from mother to infant via breast-milk. The DDT exposure seemed to be from vector control activities, while the pyrethroids seemed to come from a different source. For DDT the advisable daily intake was exceeded. Little is known of synergistic effects on infants of the combination of DDT and pyrethroids. Carbamate insecticides are currently used in the vector control programmes, and even less is known of possible combination effects of these three compound classes. Therefore, we raise a concern for toxicant interactions. Even so, breastfeeding remains the best source of nutrition for infants and should be regarded safe under prevailing conditions and knowledge.



Rural dwelling in KwaZulu-Natal. Insecticides for malaria vector control are normally applied by 'spray team' under the eaves of the huts and indoors on walls.

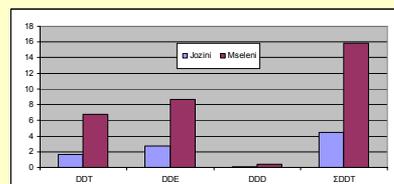
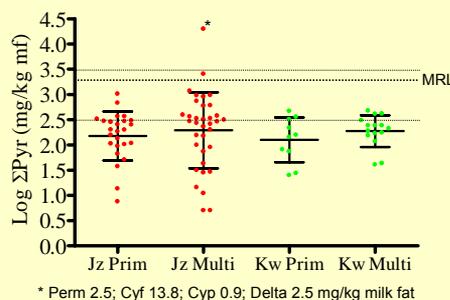
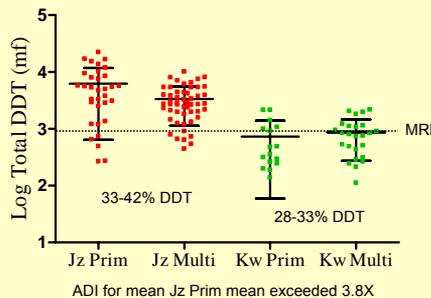


Results

All DDT congeners were found in all the samples from Jozini, with the highest concentrations occurring in Jozini and the lowest in Kwaliweni (where DDT is not needed for vector control); the levels in Mkuzi were intermediate. Average concentrations in milk from primiparae were higher than levels in milk from multiparae. Compared to a study in the same area of KwaZulu-Natal from the mid 1980s, the levels have gone down 75%. Even so, the average levels of DDT in milk from the area where it is used for malaria control, is above the Acceptable Daily Intake for humans.

The pyrethroids were found in about 70% of the samples from Jozini, 60% of the samples from Kwaliweni, and 20% of the samples from Mkuzi. No major differences were found between the clinics and seemed to be related more to use in agriculture than in vector control. The levels were generally below the ADI. However, synergistic effects between pyrethroids and DDT on neonate mice have been reported (Eriksson P, Talts U. *Neurotoxicology* 2000;21:37).

Currently, work is continuing to replace DDT in vector control with carbamate insecticides. However, little is known of combination effects between DDT and carbamates and even less if also combined with pyrethroids. Various exposure routes will exist for the foreseeable future. Risk assessment, weighing the deadly consequences of malaria against the effects of insecticides, remains a major challenge.



Comparison between two towns: Mseleni 1985/6 and Jozini (2000)
(p,p'-compounds - mg/kg milk fat)



There are many other pathways of exposure of women and children to pesticides. Women and children perform much of the farm work, and infants are often taken out in the field.

Recommendations

- Other pyrethroids and current-use insecticides are known to be used in agriculture, and residues should be measured in breast milk and the environment.
- The residue levels of pyrethroids under malaria control conditions should be investigated.
- Longitudinal studies should look at time-trends in individuals.
- The source and route of uptake of the various insecticides should be investigated.
- Cumulative risk assessment tools should be developed to accommodate developing country scenarios, specifically for mothers and infants.
- The health and environmental implications of any chemical used in malaria control should be investigated during trials and development.

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