

Manganese Deficiency and congenital Malformations : Could there be a relationship?

Recently Saner et al (1) have postulated a low manganese status in infants with congenital malformations and their mothers. Whilst they used the still controversial method of hair analysis for their assessment of manganese status they do seem to show a significantly low level of this mineral in mothers of babies with congenital malformations when compared to control group.

From their study they implant that:

- 1) Manganese deficiency might play a role as one potential factor in intra-uterine malformations.
- 2) Manganese is supplied to the foetus by a homeostatic mechanism which is mainly dependent on the manganese status of the mother.
- 3) Pre-natal manganese analysis of maternal hair MAY prove to be a reliable indicator for the risk of intra-uterine malformations.

If it is accepted that manganese deficiency could be a factor in embryonic growth and development (and there is some evidence for this from animal studies (2-6)) how and why does manganese deficiency arise? Generally the element is widely distributed in foods but may not always be available for absorption.

A number of factors are recognized as interfering with the availability and uptake of this important mineral e.g. excessive zinc intake, raised levels of

copper in the body and recently suggestions that organophosphate insecticides may reduce the uptake of manganese, and lead to possible deficiencies in man (7). It is reported (8) that in premature children and newborn infants there is a marked increase in the intestinal absorption of manganese. There is good evidence to suggest that the intestinal barrier to manganese is not fully developed in the new born, particularly if the child is premature. Thus excessive manganese in the new born is to be avoided. Collipp et al (9) have found that the concentration of manganese in the hair of normal newborn infants significantly increased from birth to six weeks of age only when fed infant formulae compared to breast milk. Many infant formulae do contain high levels of this element. They suggest that the level of manganese be reduced to 200 $\mu\text{g}/\text{l}$ or less in all infant formulae and this now seems to have been accepted by the FDA (10).

However, it might also be argued that the poor intestinal barrier to manganese seen in the new born is a finding suggesting an increased demand for this mineral at this important time of development.

Over the last few years there has been an increased use of organophosphorus pesticides. Such compounds are used for many different agricultural and veterinary purposes. Perhaps one of the most common uses is as a pour-on warble fly dressing for cattle.

The most obvious targets for organophosphorus compounds are the cholinesterase enzyme systems which are able to hydrolyse acetylcholine and other associated esters. The largest part of the biological activity of

organophosphorus compounds is their ability to inhibit acetylcholinesterase, an enzyme that is specific for acetylcholine and which is located at cholinergic synapses in the central, peripheral and autonomic nervous system. (11). As a result of the inhibition of the acetylcholinesterase a build up of acetylcholine occurs. In addition it seems that many choline containing enzymes are involved in the uptake and metabolism of manganese.

Thus it seems a reasonable assumption that if a person is exposed to raised levels of organophosphorus pesticides their uptake and utilization of manganese will be reduced. This could be particularly important in the new born when there seems to be a greater need for manganese.

The symptoms of organophosphorus pesticide poisoning in many ways seems to resemble those suggested for a manganese deficiency. E.g. abnormal development of the foetus, deformed spines with a swelling of the basal brain stem, epileptic fits and sweating, shivering and stilted movements.

With the increased sudden infant death (SID) figures over recent years it is interesting to speculate that the increased use of organophosphorus pesticides, and the possibly resulting reduced manganese uptake are related in some way to the increased SID's possibly because of malformations occurring in the foetus in utero or in the newborn.

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