

Nitrite, Iron Deficiency Anaemia and Methemoglobinemia

P.L. KEMPSTER

Hydrological Research Institute, Directorate of Water Affairs, Private Bag X313, Pretoria 0001

In a recent issue of this journal a literature review was given by Adam (1980) on the problem of nitrate in drinking water in causing nitrite induced methemoglobinemia in infants. Although a number of reasons were given as to why infants are particularly susceptible to methemoglobinemia, one rather important fact was omitted *viz.* that infants often suffer from iron deficiency anaemia (reduction in haemoglobin levels). Wintrobe and Lee (1970) estimate that as many as 64% of infants have some degree of iron deficiency anaemia. This has an important bearing on the occurrence of methemoglobinemia in infants, as iron deficiency predisposes them to the detrimental effects of nitrite. Under normal conditions iron is partitioned in the body between the iron in the blood stream and iron in the tissues, particularly the liver. Thus a nitrite burden can be shared between iron bound to nitrite in the liver stores and iron bound to nitrite in the blood stream. The detrimental effect of nitrite in reducing the concentration of available circulating haemoglobin is thereby restricted. However, in iron deficiency states the liver iron stores are the first to be depleted (Goodman and Gilman, 1965) and any nitrite burden is then borne almost entirely by the circulating haemoglobin-iron as methemoglobin. Adam (1980) mentions that, "A varied diet, rich in vitamin C, is highly recommended for the prevention of health complications caused by nitrate (or nitrite)." It is noteworthy that ascorbic acid (vitamin C) is a known preventative of iron deficiency anaemia. Ascorbic acid achieves this by promoting the absorption of iron from the gastrointestinal tract (Wintrobe and Lee, 1970).

The susceptibility of infants to disturbances of iron metabolism is not only confined to nitrate/nitrite. Infants are also very susceptible to overdosages of iron salts, which can often be fatal (Goodman and Gilman, 1965).

In conclusion, the common occurrence of iron deficiency anaemia in infants predisposes them to nitrate/nitrite induced methemoglobinemia. Their already strained iron reserves (depleted liver iron stores and reduced haemoglobin level) are further taxed by the reduction of an already critical blood oxygen carrying capacity by the formation of methemoglobin. A diet rich in vitamin C helps prevent both iron deficiency anaemia and susceptibility to nitrate/nitrite induced methemoglobinemia.

References

- ADAM, J.W.H. (1980) Health aspects of nitrate in drinking-water and possible means of denitrification (literature review). *Water S.A.* 6(2) 79–84.
- GOODMAN, L.S. and GILMAN, A.G. (1965) *The Pharmacological Basis of Therapeutics*, 3rd edition, Macmillan Co., New York, 1401–1405.
- WINTROBE, M.M. and LEE, G.R. (1970) Iron deficiency anemia and other hypochromic microcytic anemias, ch 336. In: *Harrison's Principles of Internal Medicine*, 6th edition, edited by Wintrobe, M.M., Thorn, G.W., Adams, R.D., Bennett, I.L., Braunwald, E., Isselbacher, K.J., Petersdorf, R.G., McGraw-Hill New York, 1589–1593.

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