

Book reviews

Nitrate and Man: Toxic, Harmless or Beneficial? J. L'Hirondel and J.-L. L'Hirondel. Oxford: CABI Publishing. 2002. Hardback, pp. 168 £35. ISBN 0-85199-566-7

For a number of years, the perception has been that nitrates, while present in fruits and vegetables, sometimes at quite high levels, are environmental pollutants with adverse health effects that must be kept to a minimum, particularly in our water supplies. This short monograph seeks to question the evidence and the assumptions behind this perception. It is an updated version of a book entitled *Les Nitrates et l'Homme. Le Mythe de Leur Toxicité*, which was published in 1996. It is mainly the work of Professor Jean L'Hirondel, who died in 1995, and revised by his son, Jean-Louis L'Hirondel.

The book starts off quietly enough. The first four chapters provide a short natural history of nitrate: the history of nitrates in medicine; nitrate, the N cycle and the fertility of nature; the metabolism of nitrate and nitrate in body fluids. It is in the following chapters that the authors seek to be more controversial by critically reviewing the data put forward for the detrimental effects of dietary nitrates, examining the regulations on nitrate and then looking at the evidence for a beneficial action of nitrate. This is followed by a short summary and conclusions together with a series of appendices giving more detailed background information, including nitrate intake from food, kinetics, and summaries of epidemiological studies on the health effects of N.

The two main adverse health effects associated with exposure to nitrates are methaemoglobinaemia in infants (the so-called 'blue baby syndrome') and possible increased risks of cancer, particularly of the stomach. Other claims against nitrates include increases in fetal mortality, congenital malformations, enlargement of the thyroid gland, tendency toward early hypertension and increase in childhood diabetes.

The increased level of methaemoglobin, the oxidised form of haemoglobin, which does not bind oxygen, is due to the presence of nitrite, with infants particularly sensitive as they have low levels of methaemoglobin reductase. Nitrite is produced endogenously from nitrate, and high intakes of nitrate via certain vegetables or contaminated well water (no cases have been seen in UK areas with tap water) are considered to be the cause of the infant methaemoglobinaemia. This has led to the setting of maximum nitrate levels in water.

The authors make the case that it is microbiological contamination of the water leading to exogenous production of nitrite (still from nitrate present in the water) by bacteria which is responsible, plus a high incidence of unreported enteritis, also a cause of infant methaemoglobinaemia. Evidence in support of this theory includes the lack of

correlation between water nitrate levels and cases of methaemoglobinaemia and the poor conversion of nitrate to nitrite in the infant gut, although this remains controversial. The conclusion the authors draw is that the maximum water levels and the acceptable daily intake for nitrates are set too low. The debate particularly on the former point currently continues within the pages of *Environmental Health Perspectives* and this is touched on in the book.

The link between nitrate and cancer, particularly of the stomach, is through the increased presence of nitrite and its reaction with amines and other organic groups to form *N*-nitroso compounds, which are potentially carcinogenic. A review in the book of the epidemiological literature indicates that the evidence from geographical studies is equivocal, while the case-control studies suggest no association between cancer and nitrate levels. However, the concern is still present, as we have seen recently in the UK newspapers, where headlines have been made from possible links between nitrate-rich fruits and vegetables, the incidence of oesophageal cancer, and the role of saliva in the conversion of nitrate into carcinogens at the gastro-oesophageal junction.

The chapter on the beneficial effects of nitrates is much shorter owing to the paucity of data. Many of the effects seen are confounded by the nitrate being present in fruits and vegetables, the beneficial effects of which now seem clear but are not considered to be due to high nitrate levels. The benefits suggested are anti-infection, lowered blood pressure and reduced cardiovascular disease, plus effects on the gastric system including anticancer. A number of these potential effects are via NO and the multiple functions of this molecule have renewed interest in nitrate and nitrite. Many of the conclusions are suggestive and much less rigorously assessed than the data upon which the harmful effects are based.

It is always good to question continually the evidence upon which assumptions are based. The question in the title of this book remains unanswered. As regards the regulations on water and food levels of nitrate, the authorities have always regarded these as cautious and I suspect that this is how we will continue to treat this whole field. The book endeavours to be accessible to a wide readership but remains completely referenced; in some places in the early chapters it appears almost too stuffed with facts. It probably still has too much unexplained jargon for a non-scientist, but it is an easy way for a non-specialist to get into the complex literature on all aspects of nitrate plus the chance to assess an ongoing controversy.

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