DETERMINATION OF NITRATE AND NITRITE CONTENT IN POTABLE WATER AND BABY FOODS IN KENYA

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ABSTRACT

DETERMINATION OF NITRATE AND NITRITE CONTENT IN POTABLE WATER AND BABY FOODS IN KENYA

Nitrates and nitrites occur naturally in air, water, soil and other biological systems. Man's activities may increase the levels of these compounds in the environment. The presence of these compounds beyond certain acceptable levels in water and food may endanger man's health. Nitrites and nitrates when reduced to nitrites are quite toxic to infants, especially those below four months, and may cause a condition known as metheamoglobinemia (reduction of the blood's capacity to carry oxygen). In adults these same compounds have been identified as precursors in the formation of carcinogenic N-Nitroso compounds.

In the present study it was found that over 83% of the mothers interviewed were supplementing breastmilk with other foods at the age of three or less. It was, therefore felt that the exposure of infants to nitrates and nitrites from water and

food at a very early age might be more widespread than previously thought.

Nitrates and nitrites have therefore been determined in water (treated water, river water, borehole water and well water) and various baby foods. Nitrate in water has been determined using the UV absorption method and both nitrate and nitrite have been determined using the modified Griess colorimetric method. In the UV method, the minimum detection limit was 0.6 ppm $NaNO_3$. For a randomly chosen water sample containing 43.6 ppm $NaNO_3$, the coefficient of variation was about 0.3%.

In the modified colorimetric method, the detection limit was 0.01 ppm $NaNO_2$. The molar absorptivity (ε) of the azo dye at 542 nm was found to be $3.31 \times 10^4 \ell\ mol^{-1} cm^{-1}$. For a series of sodium nitrite standards containing 0.1 ppm $NaNO_2$ the coefficient of variation was 1.43% while for sodium nitrate standards containing 1.15 ppm $NaNO_3$ the coefficient of variation was 0.98%. With the colorimetric method, the detection limits for nitrate and nitrite in water were 0.06 ppm and 0.03 ppm as sodium nitrate and sodium nitrite,

respectively. For fluid food samples the detection limits for nitrate and nitrite were 0.3 ppm $NaNO_3$ and 0.1 ppm $NaNO_2$ while for solid food samples the detection limits for nitrate and nitrite were 1 ppm $NaNO_3$ and 0.5 ppm $NaNO_2$.

With the exception of well water samples, the nitrite content of most of the waters analysed was below the detection limit while the nitrate content was found to vary depending on the type of water:

treated water, from below 0.06-24.30 ppm

river water, from below 0.06-6.60 ppm

borehole water, from below 0.06-144.20 ppm

well water, from below 0.06-343.50 ppm.

A few borehole waters and a significant number of well water samples were found to have nitrate levels higher than the WHO upper limit for nitrate (ie. 62 ppm $NaNO_3$).

In the fluid and solid foods different amounts of nitrates and nitrites were found. The nitrate content of breastmilk was in the range below 0.3 to 15.0 ppm $NaNO_3$ with the nitrite content below 0.1 ppm $NaNO_2$. In cowmilk the nitrate and nitrite

content were below the detection limits.

In the infant formulae eg. Nan, Lactogen, Isomil the nitrite content varied from below the detection limit to 2.0 ppm $NaNO_2$ while the nitrate content ranged between 5 and 19 ppm $NaNO_3$. In other foods such as commercially prepared strained baby foods, fresh fruits and vegetables the nitrate and nitrite contents were up to 820 ppm and 18.5 ppm as sodium nitrate and sodium nitrite, respectively.

Although there are a few cases where the levels of nitrate and nitrite in water have been found to exceed the acceptable levels, in general the nitrate and nitrite levels are low and may not constitute a health hazard at present. The high levels found in vegetable foods especially are very similar to what has been reported elsewhere. However, with the increased use of nitrogenous fertilizers it may be necessary to monitor continously the levels of nitrates and nitrites in water and food. This practice will probably reduce the exposure of infants who are artificially fed at the age of four months or less to high levels of nitrates and nitrites which are detrimental to their health.