

NITRATES EXPOSURE AND CHILDREN: CONTAMINATION OF SUB-SURFACE WATER IN SOME AREAS OF NORTH WEST FRONTIER PROVINCE (NWFP) PAKISTAN

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ABSTRACT:

The use of nitrogen fertilizers for improved crop yields has been increasing rapidly both in Pakistan and globally, also resulting in increased nitrate levels in drinking water. In Pakistan the consumption of nitrogenous fertilizers increased from 843.0 N tonnes in 1980 – 81 to 2285.3 N tonnes in 2001-02 (in North West Frontier province NWFP; 63.5 N tonnes in 1985 - 86 to 152.8 N tonnes in 2002 – 02). Other sources of nitrate contamination of water include intensive livestock operations that produce large amounts of animal waste, sub-standard human septic systems and municipal waste streams. Shallow and poorly constructed wells in rural areas of Pakistan are at greatest risk of nitrate contamination. Drinking water being the main source, other sources of inorganic nitrate/nitrite exposure to children and adults are considered to be vegetables (spinach, cabbage, carrots), meat preservatives, burn creams, industrial salts and cold packs (anti-corrosives). Sources of organic nitrate/nitrite include inhalants, room deodorizers, pharmaceuticals, laundry ink, industrial solvents and antibiotics. Toxicity and physiological effects of excess of nitrates and nitrites in water are well known and have been reported in many reports and publications. Nitrates do not cause methemoglobinemia but nitrites formed mostly due to reduction of nitrates and/or oxidation of ammonia, convert ferrous iron in haemoglobin to ferric iron resulting in methemoglobin, an abnormal dark brown haemoglobin incapable of carrying oxygen. Infants younger than 4 months are at the greatest risk for methemoglobinemia. Several cases of infants methemoglobinemia (causing impairment of oxygen transport) with death rate of 10% of the affected infants have occurred in America, Canada and Europe. Methemoglobin level as low as 3% results in cyanosis. Higher levels are known to cause headache, fatigue, weakness, respiratory depression, hypotension and shock. In vivo and in the natural environment, nitrous acid formed due to nitrites, react with amines and amides, producing highly carcinogenic nitrosoamines. In many parts of the world, nitrate-nitrite contamination of underground water has been delineated to excessive use of nitrogenous fertilizers or leaching from open disposal and storage of agricultural, animal and human wastes. In Punjab, the province of Pakistan known for its fertile soil and very high food and cash crops yields, the nitrate

concentration of underground water in 1967 was generally found to be less than 3 mg/L. However, a recent study in Chaj Doab (Punjab) area indicated nitrate concentration of shallow ground water as low as 2mg/L to as high as 450 mg/L. In North West Frontier Province (NWFP) of Pakistan, more than half of six million people of Peshawar, Mardan, Charsadda and Nowshera districts have no excess to clean drinking water. The remaining half draw their water from some 590 tube wells, most of which are shallow and liable to contamination from agricultural run-offs and other neighbouring sources.

Over the past few years water quality, especially nitrate-nitrite contamination, of sub-surface water samples from Peshawar, Charsadda, Mardan and Nowshera districts of North West Frontier Province (NWFP) has been studied. Whereas, Peshawar city area in 1987 showed a decreasing level of nitrate contamination of sub-surface water, it appeared to be on the increase in water samples from the outskirts areas of Peshawar along Peshawar-Charsadda road. No uniform increasing or decreasing patterns of nitrate contamination were observed for water samples from Peshawar Cantonment, University and Hayyatabad areas and areas under study in Mardan, Charsadda and Nowshera. A few sub-surface water samples from Peshawar city, Mardan and Nowshera areas indicated high concentration of nitrite, which is alarming in view of the earlier reports showing absence of nitrite in water samples from these areas.

Details of the above studies, results achieved, measures to control water contamination and recommendations to minimize health impacts of contaminated water on public in general and children in particular would be described and discussed.

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