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CONTAMINATION AND PHYSIOLOGICAL EFFECT OF NITRATE IN GROUNDWATER IN THE KANPUR REGION

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ABSTRACT
Water pollution is a major global problem. It has been suggested that it is the leading worldwide cause of deaths and diseases and that it accounts for the deaths of more than 13,700 people daily in Kanpur U.P India. Nitrate and Nitrite pollution is one of the groundwater's most identified contaminants, an indicator of serious pollution as they are associated with septic waste and agricultural endeavors, leading to numerous health problems for human beings and animals. Fast urban growth, without proper arrangements for waste management, led to serious problems of contamination of groundwater in many urban centers of India. The present study indicates how uncollected and mismanaged waste contaminates the groundwater. A detailed survey of nitrate levels in groundwater was carried out in Kanpur to assess the magnitude of the problem in different areas. Nitrate, which may cause methemoglobinemia or "blue baby" disease, is found much above the drinking water limits prescribed by WHO and the Bureau of Indian Standards. 46% of the samples showed values higher than the prescribed limit of 45 mg/l as per BIS: 10500-2004. Since groundwater is the source of drinking in many parts of the city as the municipal water supply is inadequate due to the growing demand for drinking water, the dependence on groundwater is inevitable. Thus, exposure of the population to high nitrate cannot be ruled out. In this paper different areas of the Kanpur, the region were studied. The main objectives are to find out the health impact of consuming high nitrate groundwater in different parts, especially in an industrial area.

KEYWORDS: Nitrate, Groundwater, Methemoglobinemia, Fertilizer, Hazardous, Nutrients.

INTRODUCTION
Healthy soil, clean water, and air are the soul of life. Soil, water, and air are no longer clean and pure, today pose human health risks. Comprising over 70% of the Earth's surface water is undoubtedly the most precious natural resource that exists on our planet. It is essential for everything on our planet to grow and prosper. Water pollution remains one of the most visible and persistent signs of our impact on the natural world.

Ganga river in Kanpur city in India, receives huge quantities of untreated waste, from industrial effluents to domestic discharge, the river becomes more of a flowing dumping yard for the 15 smaller and bigger towns in its catchment area which affects badly human health.[1] The contamination of the environment with toxic metals has become a worldwide problem, affecting crop yields, soil biomass, and fertility.[2] Drains are the main source of water pollution, especially for rivers flowing within the city carry industrial effluent, domestic waste, sewage, and Medicinal waste results in pouring the water quality.[3] The specific contaminants leading to pollution in water include a wide spectrum of chemicals, pathogens, and physical or sensory changes such as elevated temperature and discoloration. While many of the chemicals and substances that are regulated may be naturally occurring (calcium, sodium, iron, manganese, etc.) the concentration is often the key in determining. Water pollution can cause by both organic and inorganic pollutants. Nitrate is an inorganic compound that can be a natural or manmade contaminant in drinking water Nitrite and Nitrate pollution is due to excessive amounts of nitrate in surface or groundwater because of agricultural practices.

Farmers and homeowners using nitrate-bearing fertilizers often use a variety of pesticides and herbicides which may migrate to groundwater supplies. Due to its high solubility in water, nitrate and nitrite are the most common contaminants in rural and suburban areas. Fertilizer use has led to greater contamination of surface and groundwater with nitrates essentially dissolved

nitrogen fertilizer that has not been taken up by plants. Nitrate (NO3) is the main form in which nitrogen occurs in groundwater, although dissolved nitrogen may also be present as nitrite (NO2), ammonium (NH4), nitrous oxide (N2O), and organic nitrogen.[4] Groundwater is a vital source of water that supports human health, agriculture, and industrial development and plays a critical role in the sustainability and functioning of ecosystems due to a lack of clean surface water (7; 8). The industrial revolution and the rise in anthropogenic activities over the past decades have increased the need for groundwater more than ever before.[11] The uncontrolled population growth provokes a rapid increase in socioeconomic activities, which may emit contaminants into the environment, thus posing a threat to groundwater quality. Fertilizers, effluent runoff from industries, chemical dumping, and domestic sewage are the primary sources of groundwater pollutants and waterborne diseases.[11] Approximately 25,000 people around the globe die every day due to lack of water or consumption of polluted water, and nearly one- third of the urban population in developing countries lacks safe drinking water.[13] Of all the groundwater pollutants, nitrate has emerged as one of the most dangerous and widespread contaminants of groundwater in arid and semi-arid regions.[5; 10,11,12; 15]

Nitrate is a form of nitrogen and originates naturally in the environment from atmospheric nitrogen, final ion by plants, and lightning storms. It can also appear as the result of anthropogenic activities like fertilizers, septic tanks, sewage, and improper use of animal manures for agriculture. NO3 is innocuous to human beings, and its formation is a fundamental part of the nitrogen cycle.[14] Nitrate, which is ingested through drinking water, however, is reduced from nitrate to nitrite in the gut by bacteria. This causes methemoglobinemia, more generally known as blue baby syndrome in newborn babies, a life-threatening condition that decreases the ability of blood to carry oxygen through the body. Nitrite converted from nitrate, can also react with organic compounds to form amines and amides through intrastation in the stomach, and the interaction of nitrous acid with secondary and tertiary amides, amines, and nitrogen-containing compounds forms N-nitroso compounds, widely considered to cause gastric cancer. In addition, there are many other diseases such as thyroid dysfunctions, breathing problems, nuisance and tiredness, and multiple sclerosis that can result from high nitrate intake.[2,3,5,6,7]

MATERIALS AND METHOD

Sample

The sampling of groundwater was taken from four different areas of the Kanpur region. 10 samples were collected from the deep well hand pump in each area to find out the concentration of nitrate. The four sample stations were Ganga bairaj, Parmat, Ranighat, and Jajmau. Samples were collected in 2-liter Plastic Bottles and labeled at the site. All samples were analyzed for nitrate concentration within 24 hours of sampling to obtain the best result without altering the nature of the water sample. The presence of nitrate is normally observed by yellow and pink color intensity produced by salicylic acid and N-diamine dihydrochloride 1 Napthlethylene.[16]

Analytical Method

Nitrate was analyzed by U.V. Spectrophotometry. The UV method was found suitable because the interference of dissolved organic matter was less than 10% (APHA 1998) in water. The absorbances were taken both at 220 and 275nm. The testing of all samples found that 9% of samples showed nitrate levels greater than the Bis limit of 10.2mg/l as Nitrate-N. While15% of the samples in Ganga bairaj and their surroundings have Nitrate levels more than the maximum permissible limit of 23.2mg/l as Nitrate-N. Parmat ghat also has the maximum level of nitrate due to waste materials disposal. However, Ranighats and Jajmau Nitrate -N exceed 24.5mg/l and 26.7mg/l ranging from 30 to 86 mg/l. Near this area, crops are grown like musk melon, watermelon, cucumber, and some vegetables too on large scale.

In Ganga bairaj most of the tube wells were within 200m of the agricultural farm and every householding had one or two dairy cows. This is also one of the main sources of extraordinary high levels of Nitrate -N Due to agriculture 100- 150 kg/ha of nitrogen fertilizer is applied every year. These all things are the major sources of high concentration of Nitrate-N.

CONCLUSION

We find that on average, increased agricultural activity (especially in conventionally cultivated crops) leads to higher nitrate contamination in groundwater. Additionally, environmental factors such as precipitation and temperature play an important role. Higher average maximum temperatures lead to lower nitrate pollution of groundwater, possibly because of increased evapotranspiration. Additionally, higher average precipitation increases crops' nitrogen uptake as well as the dilution effect and thus lowers nitrate concentration. Nitrate leaching from agricultural land uses is usually considered a non-point source pollution problem, making the specific polluter hard to identify.

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