Environmental Science and Pollution Research
https://doi.org/10.1007/s11356-024-32859-0

LETTER TO THE EDITOR

Comments on: "Spatio-temporal evolution of groundwater quality and its health risk assessment in Punjab (India) during 2000–2020" by Praise Shukla Dericks, *10.1007/s11356-023–29200-6*

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Received: 15 December 2023 / Accepted: 7 March 2024

Letter to Editor

The authors of this paper have reported their findings using spatio-temporal analysis based on groundwater quality data of 315 sites, taken from the reports of Central Groundwater Board (CGWB), Government of India. The non-carcinogenic health risk due to F^- and nitrate contamination in groundwater has been assessed by estimating hazard quotient HQ. For this purpose, authors have collected data from secondary sources which may not be reliable. Results reported under the heading *Health risk of fluoride and nitrate and Fig. 7* are contradictory to our findings (Nizam et al. 2022; Virk 2022, 2023).

Authors report high F^- concentration in the Malwa region of Punjab consisting of Bathinda, Mansa, Fazilka, and Sangrur districts in the year 2000. Similarly, during the year 2020, 5 sampling sites in the Bathinda district and 1 location in Mansa and Sangrur each have F^- concentration > 4 mg/l. It can be observed in Fig. 7 that during 2020, the health hazard quotient for F^- shows the groundwater is unsafe in districts Moga, Barnala, Bathinda, Sangrur, and Mansa. We have no objection to results of Malwa region districts.

Figure 7 of authors' paper shows Patiala District as a safe zone for both Fluoride and Nitrate with HQ < 1. There is no discussion about these contaminants for Patiala district in authors' paper. In our study (Nizam et al. 2022), we found about 98% of groundwater samples of Patiala district with fluoride concentrations > 1.5 mg/L, and about 23% of the samples contain > 4 mg/L fluoride, with HQ values > 1 in all cases. A study undertaken by Kaur et al. (2020) of 1600 school children of Patiala city shows the adverse effects of fluoride in the prevalence of dental caries in 40% cases. Patiala district has higher fluoride contamination compared with Malwa districts.

Results of our investigations (Virk 2022, 2023) for Nitrate contamination in groundwater of Patiala district are also in contradiction with authors' paper. Patiala district is found to be a 'hot spot' of nitrate contamination of groundwater. Authors report Patiala district in safe zone with HQ value < 1 (Fig. 7). Our study reports $HQ_{Nitrate}$ values of 45.59 and 106.38 for adults and children, respectively, corresponding to maximum concentration of Nitrate in groundwater of Patiala district (Virk 2022). Out of seven districts investigated for health hazards of nitrate in groundwater, including some from the Malwa region studied by authors, Patiala district recorded maximum contamination due to nitrate occurrence in its groundwater (Virk 2022).

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Published online: 03 April 2024