Comparing Groundwater Fluoride Level with WHO Guidelines and Classifying At-Risk Age Groups; Based on Health Risk Assessment

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Abstract : The main route of fluoride uptake is drinking water. Fluoride absorption in the acceptable range (0.5-1.5 mg L^{-1}) is suitable for the body, but it's too much consumption can have irreversible health effects. To compare fluoride concentration with the WHO guidelines, 112 water samples were taken from groundwater aquifers in 22 villages of Garmsar County, the central part of Iran, during 2018 to 2019.Fluoride concentration was measured by the SPANDS method, and its non-carcinogenic impacts were calculated using EDI and HQ. The statistical population was divided into four categories of infant, children, teenagers, and adults. Linear regression and Spearman rank correlation coefficient tests were used to investigate the relationships between the well's depth and fluoride concentration in the water samples. The annual mean concentrations of fluoride in 2018 and2019 were 0.75 and 0.64 mg $^{-1}$ and, the fluoride mean concentration in the samples classifying the cold and hot seasons of the studied years was 0.709 and 0.689 mg L^{-1}, respectively. The amount of fluoride in 27% of the samples in both years was less than the acceptable minimum (0.5 mg L^{-1}). Also, 11% of the samples in2018 (6 samples) had fluoride levels higher than 1.5 mg L^{-1}. The HQ showed that the children were vulnerable; teenagers and adults were in the next ranks, respectively. Statistical tests showed a reverse and significant correlation ($R2 = 0.02$, < 0.0001) between well depth and fluoride content. The border between the usefulness/harmfulness of fluoride is very narrow and requires extensive studies.

Keywords : fluoride, groundwater, health risk assessment, hazard quotient, Garmsar

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