

Fluoride Concentration in Potable Groundwater in Rural Areas of Khaf City, Razavi Khorasan Province, Northeastern Iran

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Abstract

Long-term exposure to high concentrations of fluoride is associated with several adverse effects on human including dental and skeletal fluorosis. We studied all the groundwater wells located in rural areas of Khaf city, Razavi Province, northeastern Iran between 2009 and 2010. Fluoride concentration of water samples was measured by SPADNS method. We found that in rural areas the fluoride concentration ranged from 0.11 to 3.59 ppm—the level was less than the permissible limit in 31% of studied samples, higher than the permissible limit in 4% of the samples, and within the optimum limit of 1 to 1.5 ppm in 65% of water samples.

Keywords: Fluorides; Groundwater; Fluorosis, dental

Introduction

Almost 200 million people from 25 countries are at risk of health problems for high concentration of fluoride in their drinking water.^{1,2} Many epidemiological studies have shown that long-term consumption of drinking water with a high fluoride concentration (>4 ppm or mg/L) leads to many adverse effects on human including dental and skeletal fluorosis, so that the World Health Organization (WHO) set the desirable level of fluoride in potable water as 0.5–1.5 ppm.³⁻⁵

Knowledge of fluoride level in potable groundwater is important for health care personnel and policymakers. However,

there are only few studies on the level of fluoride in drinking water in Iran.⁶⁻¹⁰ We therefore conducted this study to determine the fluoride concentration in groundwater sources used for water supply in rural areas of Khaf city, Razavi Khorasan Province, northeastern Iran between 2009 and 2010.

Materials and Methods

Khaf is an area approximately 10 000 km² wide with more than 100 000 people in Razavi Khorasan Province, northeastern Iran. In this cross-sectional study, all water resources in rural area in Khaf were identified and studied. Under standard conditions, 62 samples were taken from

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Table 1: Fluoride concentration in drinking water of rural areas of Khaf, northeastern Iran, 2011

Water source	n	Fluoride concentration (ppm)	
		Mean±SD	Range
Well	25	0.90±0.66	0.15–3.59
Spring	2	0.74±0.32	0.32–1.10
Subterranean	4	0.62±0.30	0.38–0.85
Total	31	0.88±0.62	0.11–3.06

32 water sources in summer and fall of 2009 and 2010. The samples of groundwater were collected in sterile polythene bottles after running (ring well and deep well) for at least half an hour from different villages of Khaf; the samples were then transported to the laboratory for water and sewage, Torbat Heidarieh. The samples were stored at 4–8 °C and analyzed within 48 hours of sampling. Fluoride concentration of water samples was determined by SPADNS method.¹¹ Data were analyzed by SPSS® for Windows® ver 18.5. A $p < 0.05$ was considered statistically significant.

Results

Fluoride concentration in studied water samples ranged from 0.11 to 3.59 ppm (Table 1)—31% of the samples had a fluo-

ride level less than the permissible limit, 4% had higher than the permissible level, and 65% of the samples had a level within the optimum limit of 1 to 1.5 ppm (Table 2). The lowest mean±SD fluoride concentration of 0.11±0.62 ppm was observed in *Sadeh* village; the highest value of 3.59±0.66 ppm was observed in *Mahabad* village.

Discussion

This study showed that in many parts of rural areas of Khaf, the fluoride of drinking water is lower than the standard set by WHO. Similar studies have been conducted in Iran and other parts of the world. For example, Poureslami and colleagues in 2007 studied the fluoride content in drinking water of various cities in Kerman province, southeastern Iran and reported that all samples had fluoride levels below the minimum acceptable value.¹² Their results are in keeping with our findings. In another study conducted from 2008 to 2009 on drinking water sources in southern Khorasan, the mean±SD fluoride concentration was 0.52±0.24 ppm; the mean±SD fluoride level in the drinking water was 0.45±0.15 ppm in urban areas and 0.58±0.27 ppm in rural areas.⁸ In another study conducted in northern India, it was shown that the fluoride concentration in almost half of the studied water

For more information on fluoride level in well water of Enugu, Nigeria see www.theijoem.com/ijoem/index.php/ijoem/article/view/123/263

Table 2: Distribution of water sources according to their fluoride concentration

Source	Relative to permissible range		
	Less than	Within	More than
Deep well	8 (31%)	17 (65%)	1 (4%)
Spring	2 (50%)	2 (50%)	—
Subterranean	1 (50%)	1 (50%)	—

TAKE-HOME MESSAGE

- Knowledge of fluoride level in potable groundwater is important for health care personnel and policymakers.
- Long-term consumption of drinking water with a high fluoride concentration leads to many adverse effects on human including dental and skeletal fluorosis.

samples was within the optimum range.¹³ Another study on groundwater samples obtained from India reported that 52% of the studied water samples had an optimum fluoride level.¹⁴ It seems that water fluoridation is the best method to manage this condition.

Conflicts of Interest: None declared.

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