

THE RELATIONSHIP BETWEEN WATER CONSUMPTION AND ORAL PATHOLOGY IN TRANSYLVANIA

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Abstract: This paper presents the investigation of the chemical quality of drinking water from centralized water supply sources distributed to the population and individual sources in Transylvania between 2009 and 2014. In accordance with national health legislation, water samples (N = 289) were collected by the beneficiaries from distribution network of drinking water and from water sources (wells) for individual consumption in 9 counties in Transylvania. We aimed at the chemical parameters established for the quality of drinking water stipulated by the Romanian Law no. 458/2002, republished, which regulates drinking water quality, in order to protect the human health against the effects of any type of contamination of drinking water by providing clean water.

INTRODUCTION

Water is a resource that is not only a basic biological human need, it represents an important lever for the development of modern society. The main route of fluoride intake into the body is via water, the food is only a secondary way. For an individual, the level of exposure to fluoride by drinking water is directly proportional to the quantity of fluoride present in the water and to the daily amount of water consumption.(1,2)

For the assessment of the water sources in health and safety terms, a particular importance must be paid to the natural content of mineral substances because those are actively involved in the vital processes of the body and their sources come from the environment, including the water.(3,4)

PURPOSE

Considering that drinking water is a significant source of fluoride and the water consumption and the prevalence of dental cavities and dental fluorosis have been increasing, the objective of this paper is the chemical quality assessment of the drinking water in order to evaluate the fluoride levels in centralized water supply sources and individual sources (wells) in 9 counties of Transylvania: Alba, Bihor, Bistrița, Cluj, Maramureș, Mureș, Sălaj, Satu Mare and Sibiu. The results are important to the practicing dentists to establish the doses of fluoride given to children and youth for caries prophylaxis in order to avoid the effects of excess fluoride, according to the intake of fluoride from environmental factors.

MATERIALS AND METHODS

This paper presents the investigation of the chemical quality of drinking water from centralized water supply sources distributed to the population and from individual sources (wells) in Transylvania between 2009 and 2014.

The chemical parameters of water quality studied are:

- anorganic compounds that can affect health: fluoride, nitrites / nitrates;
- Other chemical parameters: alkalinity, organic substances (mg O₂/l), ammonium ions, calcium, magnesium,

potassium, sulphur, phosphorus, boron, chlorine.

The determination of anions and cations of water samples (F⁻, Cl⁻, Br⁻, NO₂⁻, NO₃⁻, PO₄³⁻, SO₄²⁻ and Li⁺, Na⁺, NH₄⁺, K⁺, Mg²⁺, Ca²⁺) was done by ion chromatography method using a Shimadzu ion chromatograph (high-pressure pump isocratic and gradient mode, conductometric detector, ultraviolet (UV) detector, inside the thermostatic columns, autosampler, suppressor).

In accordance with national health legislation, water samples (N = 289) were collected by the beneficiaries from the distribution network of drinking water and from water sources (wells) for individual consumption.

Water analyses were performed by the Chemical Laboratory of Regional Public Health Center Cluj-Napoca. We aimed at the chemical parameters established for the quality of drinking water stipulated by the Romanian Law no. 458/2002, republished, which regulates drinking water quality, in order to protect the human health against the effects of any type of contamination of drinking water by providing clean water.

RESULTS

The limit of the fluoride detection method (LOD) is 0.03 mg / l and the limit of quantification (LOQ) is 0.15 mg/l.

The concentrations of fluoride in drinking water in Romania are between 0.7 and 1.2mg F/l water. Lower concentrations (0.5mg F/l) are correlated with the occurrence of endemic caries, and higher levels (more than 1.5mg F/l) are related to the emergence of a risk to fluorosis, which affects teeth (dark brown stains) and all human bone tissue by a process through which calcium from hard tissues is replaced with fluoride.(2)

In the analysed water samples (N = 289 samples) from the area of Transylvania the results highlight an average of fluoride 0.27±0.43mg F/l in the well water and 0.17±0.23 mg F/l in the network water. Of the investigated samples, 6 samples (2.076%) have high fluoride levels that exceed the maximum permitted quantity(QMA) and the risk of dental fluorosis is increased for the consumers of this waters. The fluoride values obtained in Transylvania defines it as an area that is cariential in

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fluorine. The lowest fluoride concentrations were registered in the county of Cluj (N = 81 samples) (28.03%) in network water supply (0.16 ± 0.17 mg F/l) and in water samples from individual sources (0.20 ± 0.25 mg F/l). In Cluj County, the fluoride values do not exceed the QMA (figure no.1).

Figure no. 1. Average concentration of fluoride samples investigated in Transylvania, Cluj

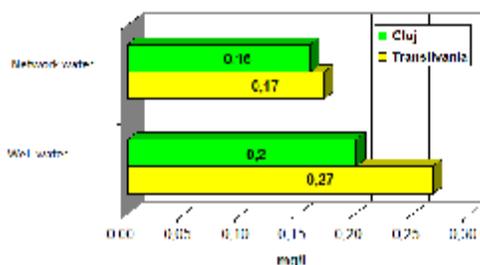
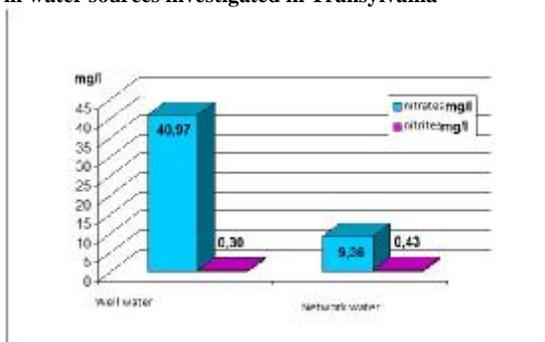


Figure no. 2. The average values of nitrates and nitrites from in water sources investigated in Transylvania



In the water samples with low fluoride concentrations, we also found low concentrations of Na, Ca and Mg, showing a poor overall mineralization of water, which, together with a general lack of fluoride, has a potential negative impact on the health of consumers, including oral-jaw system. We can say that the waters investigated in Transylvania present a low grade mineralization, both in terms of macro (Ca, Mg, Na) and of some microelements (especially F) (table no. 1).

In the well water samples taken from the county of Cluj we found 6 water samples (7.14%) with a high concentration of nitrates (NO_3), over QMA. The average amount of nitrates found in well water samples was 40.97 ± 7.19 mg/l, a value that almost reach the QMA (figure no. 2).

DISCUSSIONS

In principle, the sources of water at higher risk for both excess and deficiency of fluoride are represented by the individual sources (wells). This study revealed the presence of fluoride in low water network.

Since fluoride is a chemical element that may be present in other products, such as bottled mineral water, soft drinks, food, medicines, food supplements, tooth paste, it is important that in the nutritional declaration on the label of the product to be declared the fluoride content in order to properly inform the consumers.(5)

The concentration of fluoride in well water (0.27) is higher than the concentration of fluoride in network water (0.17), but both values that are below the optimal content. Those values demonstrate the necessity of the water fluoridation and the profilaxy of decay in general population, especially in children and youth by using medical products.(6)

The lower values of macro- and microelements found in water samples show a poor overall mineralization of water. Therefore, the statistical parameters Ca and Na are higher in well water comparative to the network water, but Mg and K are lower.(7)

The level of nitrates in well water is 40.97 (a value that almost reached the QMA) compared to 9.36 in network water and towards the level of nitrites is higher in the network water (0.43) compared to the well water (0.30). Those values are important being related to the use of those waters in artificial feeding of infants because a high content of nitrates can produce infant methemoglobinemia. In adults, excess nitrates and nitrites may form nitrosamines, potentially carcinogenic substances in the stomach.

These results are important to the practicing dentists in the area of Transylvania for the prophylaxis of tooth decay and dental fluorosis taking into account all sources of fluoride, including the water.

Fluoride has little significance in industrial waters, but in amount of 1 to 1.2mg/l in drinking water is an effective preventive of dental caries. Above this amount, fluoride may cause dental and skeletal fluorosis. Such water should be de-fluoridated to reduce the fluoride concentration in water to the acceptable levels. In the present study, fluoride concentrations varied from 0.10 to 0.60mg/l.

Table no. 1. The statistical analysis of all microelements water sources investigated in Transylvania

Water (well) N= 72	Statistical parameters	Calcium mg/l	Magnesium mg/l	Natrium mg/l	Potassium mg/l
Transylvania	Mean	76.88	17.46	258.76	12.09
Network water N=217	Median	59.48	18.09	23451	13.32
	Standard deviation	22.79	4.08	21.90	3.21
Transylvania N=289	Statistical parameters	Calcium mg/l	Magnesium mg/l	Natrium mg/l	Potassium mg/l
	Mean	34.92	28.82	25.19	66.09
	Median	21.21	25.33	15.00	53.06
	Standard deviation	12.85	9.107	12.02	6.49

CONCLUSIONS

1. From the results of the present study, we conclude that Transylvania is a carential area in fluoride with an increased risk of tooth decay among the population. That is why, a surveillance of fluoride intake from all sources of F made by the consumers is recommended in addition to other methods of prophylaxis on dentists' indication.
2. Many population studies have shown that using food supplements unattended by a specialist, with fluoride addition in the first 6 years of life is a risk factor for developing dental fluorosis.
3. Recent studies demonstrated that the cariostatic posteruptive effect of fluoride is almost exclusively. In this context, there is no justification for the use of food supplements with fluorine. Exceptions are children with increased caries risk, residents in areas without fluorine, and who do not have access to other sources of fluoride.
4. Prevention of dental caries has become a priority in public health programmes, in promoting oro-dental health. It falls within the objectives of effective and responsible practice activities of a dentist.
5. Fluoridation of water supplies reduces the number of decayed, missing and filled teeth in children and adults.

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