

Content of Fluorine in Drinking Water in FYR Macedonia

SUMMARY

From all the methods applied in preventing dental caries, the most significant is the use of fluorides. Nowadays, 6 decades after its massive use, it can certainly be argued that it is the most efficient, cheapest and safest way of preventing dental caries, confirmed by more than 150 longitudinal studies. In order to determine the presence of fluorides in drinking water, in coordination with the Institute for Public Health of the FYR Macedonia in 2009, we conducted a research for determining the presence of fluorides in drinking water from the public water supply in the country.

The results from the research showed that concentration of fluorine in drinking water in our country is under 0.3ppm (0.3 mg per litre of water), which indicates a really low amount in accordance to the WHO standards. Optimal concentration was registered in only few water supply facilities in less settled areas, while hyper-fluorinated water was registered in few village wells, which were put out of use after they were located.

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Introduction

The massive use of fluorine in stomatology has started after a long period of clinical trials by which their efficiency in preventing dental caries was documented^{3,5,13,15}.

The human organism is exposed to fluorides through 3 ecological media: **water, air and food**.

Fluorides are mostly imported into human organism through **drinking water**¹. Depending on geological conditions, concentration of fluorides in drinking water around the world varies from suboptimal, optimal to hyper-fluorinated. Around 126 million people in the USA consume fluoride-water through water supply facilities, and other 9 million drink naturally fluoride-water. The coverage of population drinking fluoride-water in the USA is 65%⁹.

Fluorides in the air exist as the gas hydrogen fluoride. In polluted industrial areas, this gas is present in greater amount (near factories for aluminium production, glass, fertilizers etc.).

Food products contain fluorides in different amounts. Plants that grow on more acid soil have more

fluorides. Some types of fish, teas and wine have more fluorides.

Different **dental products** contain various amounts of fluoride. Nowadays, fluorides can be found in different types of toothpastes¹² and dental materials (significant amount of fluoride in glass-ionomer cement¹⁰).

The amount of fluorine imported in the organism through water, air, food or some dental products (tooth paste, dental preparation and medicaments...) is determined as a **total amount of fluorine**.

Starting from the fact that the fluorides are mostly imported in the organism through drinking water, we did a determination of concentration of fluorides in drinking water in coordination with the Institute for Public Health, as a first step for determining the total display of fluorides in the population.

Material and Method

To determine fluorine concentration in public water supply, water samples were taken and submitted to the

Institute for Public Health. The determination of content of fluorine was conducted with ion selective electrode. The ion selective electrode is composed of 2 electrodes put in 2 separate containers, 1 of which is a container where the electrode calibrates with TISAB II, and the other is sunk in the water sample which is examined. The electrodes are sunk to the middle (recommendation from the manufacturer). Then, a low electricity volume runs at first, and later the volume intensifies. The other end of the electrodes is connected with a computer and a suitable programme. The values of fluorine in ion condition are directly read on the screen. The concentration of fluorine in water is expressed in ppm, where 1 ppm is equal to 0.0001% F.

Results and Discussion

The obtained results from the determined content of fluorine in drinking water from public water supply systems in FYR Macedonia are presented in table 1. This table clearly states that in all the utility water supply facilities, the water didn't contain optimal amounts of fluorine needed to prevent caries - its concentration varied from 0.05 ppm in Ohrid to 0.04 ppm in Gradsko. In Shtip, Krushevo, Demir Hisar and Star Dojran it was even less. In the part of the country where predominant population lives, concentration of fluorine in water was around 0.1 ppm, which is the amount 10 times less than optimal (the optimal concentration of fluorine in drinking water should be around 1mg/l F, which equals 1ppm F = 0.0001%)⁹.

Concentrations of fluorine in drinking water under 0.3 ppm, according to WHO recommendations, are inconsiderably low and aren't taken into account for determining individual daily dosage for fluorides import into organism¹⁵.

Fluorine provides efficient reduction in the incidence of dental caries. Its optimal presence in the water supply utility facilities, in many countries, resulted in rapid reduction of the incidence of dental caries from 20-40%². The obtained results of fluorine concentration in drinking water from water supplying utility facilities in our country have shown that drinking water is fluorine-poor and has almost no influence in preventing dental caries in the population. According the newest epidemiological examinations, the DMFT index in children aged 12 in the FYROM is 6.88, which ranks our country as a country with extremely high prevalence of dental caries according the WHO (DMFT in children aged 12 shouldn't be higher than 3). Yet, we must underline that these high DMFT values in population of our country aren't just a consequence of the deficit of fluorine in drinking water, but a significant share have the poor oral hygiene status and uncontrollable import of sugar, especially by children^{6,14}.

From 1970, parallel with the increased ingestion of fluorides and reduction of prevalence of dental caries, in some areas of the world, the increased prevalence of dental fluorosis is registered. In Hong Kong, after registered increased prevalence of fluorosis by 5% in 1978, the optimal concentration of fluorides in water was reduced from 1ppm to 0.7ppm, and in 1988 the additional reduction of the fluorine level was found from 0.4 - 0.5 ppm. The ingestion of fluorides from tooth pastes and dental solution during brushing teeth can also be a cause for dental fluorosis⁷.

Table 1. Content of fluorine in drinking water from public water supply in RM - 2009

Number	Public utilities	Concentration of fluorine in ppm
1	Berovo	0.20
2	Bitola	0.15
3	Bogdanci	0.05
4	Valandovo	0.20
5	Vinica	0.10
6	Gevgelija	0.10
7	Gostivar	0.10
8	Debar	0.10
9	Delchevo	0.15
10	Demir Kapija	0.11
11	Demir Hisar	0.30
12	Star Dojran	0.35
13	Kavadarci	0.10
14	Kichevo	0.10
15	Kochani	0.05
16	Kratovo	0.10
17	Kriva Palanka	0.10
18	Krushevo	0.30
19	Kumanovo	0.10
20	Makedonski Brod	0.10
21	Negotino	0.10
22	Struga	0.10
23	Ohrid	0.05
24	Prilep	0.10
25	Probishtip	0.20
26	Radovish	0.10
27	Resen	0.10
28	Sveti Nikole	0.15
29	Gradsko	0.40
30	M. Kamenica	0.05
31	Pehchevo	0.20
32	Strumica	0.20
33	Tetovo	0.10
34	Veles	0.10
35	Shtip	0.30
36	Skopje	0.10

Source: Institute for Public Health (num.09.2155/2) 12-05-2009

In 1990 Gjorgjev registered dental fluorosis in several settled areas near Kumanovo, Prilep and Veles as a consequence of consuming hyper-fluoridated water from the village fountains and wells. After they were located, the water from these springs wasn't used anymore for drinking. New cases of dental fluorosis haven't been registered FYROM⁴.

In order to determine the possible risk of overdosing fluorides from all possible sources (water, air, food, fluoride tablets, and swallowing tooth paste by children during brushing), on our personal initiative and for the needs of the WHO, the National Institute of Public Health conducted a monitoring for excretion of fluorides through urine as a relevant indicator for expose of the organism to fluorides from all possible sources. The results of this study will be presented soon.

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