

Salt fluoridation in Central and Eastern Europe

Summary

For decades Central European countries have been interested in preventive dentistry. Water fluoridation played a major role in the former German Democratic and Czechoslovak Republics and a minor one in Poland. These schemes were abandoned after 1989. Extensive research on all aspects of salt fluoridation was conducted in Hungary from 1966 to 1984 but attempts to introduce it in the country have had little success. Salt fluoridation was implemented in the Czech and the Slovak Republics in the mid-nineties. The market share of the fluoridated domestic salt appears to have reached 35% in the Czech Republic; it became eventually part of a preventive strategy comprising school-based dental health education including topical fluoride. Another four countries have been considering salt fluoridation but schemes did not materialize. Antifluoridation activities occasionally impeded caries prevention, and for years some respected dentists declared their position against fluorides. Caries prevalence in 12-year old children is by 1 to 3 DMFT higher than in Western Europe. For many years to come, modern fluoride-containing toothpastes and dentifrices may not be affordable for the lower socio-economic strata of the populations in Central and Eastern Europe. It is concluded that salt fluoridation, which is by far the cheapest means of lowering caries prevalence, could markedly improve the oral health situation even if the economical situation is slow to improve.

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Introduction

The larger Central European countries have populations of 10 (Czech Republic) to 40 millions (Poland). (The Russian Federation and Southern Balkan states are not dealt with here.) Central Europe comprises several smaller countries like the three Baltic states, Slovakia, Slovenia and Croatia. In the mid-nineties the average DMFT scores were higher than in most countries of Western Europe (KÜNZEL 2001). Table I shows the most recent average DMFT scores as available through Internet from the WHO. Slovenia has been most successful in lowering caries prevalence over long periods of time. The main reason is the excellent school dental service, which has been maintained for

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Tab.1 Mean DMFT of children aged 12 in Central and Eastern Europe

Country	Year	DMFT	Trend
Albania	2000	3.0	up
Belarus	2000	2.7	down
Bosnia & Herz.	1997	6.2	?
Bulgaria	2000	4.4	up
Croatia	1999	3.5	up
Czech Rep.	2002	2.5	down
Estonia	1998	2.7	down
Georgia	1990	2.4	?
Hungary	1996	3.8	down
Latvia	2002	3.5	down
Lithuania	2001	3.6	down
Macedonia	1999	3.0	down
Moldova	1992	2.3	stable
Poland	2000	3.8	down
Romania	1998	7.3	up
Russia	1995	3.7	?
Slovakia	1998	4.3	stable
Slovenia	1998	1.8	down
Ukraine	1992	4.4	up

From <http://www.whocollab.od.mah.se/euro.html>
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decades and repeatedly adapted to modern principles and methods of caries prevention including fluorides (VRBIC 2000).

Attempts between 1994–2004 to introduce salt fluoridation as a caries preventive measure in Hungary

In Hungary, research on salt fluoridation started in 1966. A considerable series of scientific publications dealt with all aspects of caries prevention with fluoridated salt (FS). The publication "Caries Prevention by Domestic Salt Fluoridation" by Karoly Tóth (1984) summarized the results obtained in Hungary. Until his death in 1992, K. Tóth undertook several attempts to introduce FS in Hungary. In the following ten years after this milestone publication, however, the topic salt fluoridation disappeared from the agenda.

In 1994 *Jolán Bánóczy* visited the saltworks in *Záhony* (north-eastern Ukrainian border of Hungary), where the director showed interest and willingness for the production of FS. Since the saltworks already produced iodized salt, there seemed to be no difficulties to add the devices for the fluoridation of salt at no significant additional expense. Soon afterwards, the salt factory was privatized, and the new owners (Douwe-Egberts) showed no interest in this non-profit activity; they were even afraid of the toxicity of fluoride, regardless of several discussions with *Judit Szöke*, chief of the Budapest School Dental Service who had been personally active in fluoride research.

In 1994 a request was presented by *Jolán Bánóczy* (at that time president of the Hungarian Dental Association) and other eminent dentists to the College of Dentistry (the counsellor body existing in every discipline of medicine and dentistry, pertaining to the Ministry of Health). In January 1995, the College (led by *Prof. Miklós Kaán*, then *President of the College*) considered the introduction of salt fluoridation in Hungary mandatory as a most effective preventive method against caries on the basis of four previous positive resolutions between 1972–1977 (under the initiative of K. Tóth). This decision was approved by the College

of Public Health in March 1995. On the 15th October 1997, a scientific session was organized at the *Medical Department of the Hungarian Academy of Sciences* with the participation of *Jolan Bánóczy*, *András Fazekas*, *János Szabó* and *Judit Szöke*, under the presidency of *Károly Méhes*, professor of pediatrics. At this session it was resolved that "salt fluoridation as a caries preventive method should be introduced in Hungary, and that this method should be realized as early as possible". In those years *Thomas Marthaler* visited Hungary several times, and in discussions with prominent persons (Prof. *Morava*, Chief Public Health Officer and other leaders) the usefulness of FS for caries prevention in Hungary was acknowledged.

Discussions by *Judit Szöke* and *Monika Gyenes* with the Salt Works of Austria resulted in the authorization to import Austrian FS. In 1999, a visit of leading Hungarian dentists and journalists to the Austrian Salt Works in *Bad Ischl* (Austria), with the participation of Prof. *Marthaler*, seemed to accelerate this process. Since then fluoridated and iodized salt has been available in certain shop-chains; however, due to its higher price and the lack of promotion in the media, the consumption is marginal.

In 2000, the Hungarian health minister *István Mikola* included the use of FS and its promotion in his public health program. Due to the death of *Alán Pintér*, head of the Public Health Institute of Hungary, some years later and a change in the person of the Health Minister salt fluoridation was not carried over into the new program.

Based on the initiative of Dr. *Monika Gyenes*, pediatric dentist and part-time school dentist, a local salt fluoridation program was established in *Mosonmagyaróvár* (some 80 km East of Vienna) in January 2003. After basic urinary fluoride assessments (carried out by the Dental School of the *Semmelweis University* in *Budapest*) indicating a generally low fluoride intake, kindergarten and primary school children received their school-meals prepared with FS (offered by *Salinen Austria*). However, some parents raised the well-known unsubstantiated antiferrous arguments and accused Dr. *Gyenes* of poisoning their children. Subsequently, the program was stopped. Although the interruption was proclaimed to be temporary, no decision regarding re-introduction of the program has been taken by the authorities in the capital *Budapest*.

To this day the salt fluoridation program in Hungary has remained at a standstill. On the one hand, the program is approved by most pediatricians, but on the other, it is opposed or disregarded by a majority of dentists. Other reasons may be a lack of official personalities supporting the measure, insufficient information of the public and the tendency of important companies for oral hygiene to prevent dental caries exclusively by the use of topical fluoride products, particularly dentifrices.

Czech and Slovak Republics: From water fluoridation to salt fluoridation

Up to 1989, the Czech Republic (then still connected with the Slovak Republic) had a water fluoridation policy. An apparatus for fluoridation in medium-sized cities was developed. Water fluoridation in Czechoslovakia started in the small town *Tabor* in 1958 and was subsequently introduced in many medium-sized cities. In *Brno*, the second largest city, fluoridation began in 1960 and in the capital *Prague* in 1962. About ten smaller cities followed in 1963–65. In the ensuing years, approximately one-third of the population benefited from water fluoridation. For rural areas, the daily intake of fluoride tablets was recommended and in part carried out.

With the end of the communist regime in 1989, efforts in favor of public health dentistry, particularly the school dental services, were discontinued. Water fluoridation was abandoned in general but was maintained in a few towns until 1993. Subsequent surveys indicated an increasing caries prevalence after these changes.

Soon after the fall of the iron curtain, two Czecho/Swiss dentists residing in Switzerland since 1968 made tenacious efforts to introduce preventive programs the effectiveness of which they had experienced in Switzerland for two decades. Attempts were made to introduce supervised toothbrushing exercises in schools with concentrated fluoride preparations, similar to those in Switzerland. The exercises began in 1995 and the two dentists travelled several times per year to their former home country to monitor school-based prevention. The contacts thus established with the health ministries of both Republics offered the opportunity to suggest the introduction of salt fluoridation. FS was also discussed at two-day seminars on preventive dentistry with Prof. W. Künzel of Erfurt (highly respected in the Czech Republic), Dr. Pollak and Prof. Marthaler as main speakers. The seminars were organized in conjunction with the Czech Dental Association and the dental schools of the local Universities (Prague, 1996; Olomouc, 1997; Brno, 1999). Production of FS started in Olomouc in the Czech Republic in 1994. FS imported from Germany has also been on sale since 1994. In the last few years the market share of FS among the domestic salt has been approximately 35%. Leaflets, CDs and other means for promoting FS were created. Dentists have not been very active in recommending the use of fluoridated domestic salt.

With the help of the two dentists who emigrated to Zurich in 1968 and held more than one hundred lectures on preventive dentistry (almost every dentist in the two Republics has been attending such lectures, and the two dentists have been granted lecturerships at university dental schools) supervised toothbrushing programs are now in operation in schools. Usage of toothbrushes and fluoridated toothpastes has increased. In addition, two schools for dental hygienists were initiated in the early nineties (1994, Usti nad Labem and Prague).

In the Slovak Republic, the situation has been similar. Since 1994, supervised toothbrushing exercises based on the Swiss system were introduced in kindergartens and schools. Two schools for dental hygienists were created (the first one in 1994 in Presov) and showed great interest in prevention. In 1994, production of FS started in the salt factory of Presov, Eastern Slovakia. The market share of the domestic FS seems to be at approximately 5% and is increasing.

Other countries

Romania

Projects for the introduction of FS were discussed in the mid-nineties. Experts from abroad suggested its use to the Ministry of Health. In fact, several university members envisaged local projects aiming at creating bases for nation-wide studies of its feasibility. A survey on natural occurrence of fluoride showed that only a small fraction of the population is exposed to fluoride occurring in concentrations above 0.5 or 0.7 ppm in the drinking water. Results of urinary fluoride excretion studies on children in Bucarest and of both children and elderly persons in Timisoara indicated a low supply of fluoride. On average, 0.17 to 0.27 mgF/24h were excreted.

In 2000, several tons of FS were provided by Switzerland for respective studies. This salt was used in institutions for children

and old people. The incidence of dental caries was monitored in children but scientific reports have not been published. At a conference on scientific dentistry in Constanta in May 2004, prevention programs with topical fluorides, including toothbrushing exercises in school, met with considerable interest. Salt fluoridation, however, was not on the agenda.

Slovenia

Since fluoride levels in the drinking water in Slovenia are low (0.01–0.24 ppm, VRBIC 2000) there has been an interest in salt fluoridation among public health and preventive dentistry professionals in the nineties. A urinary excretion study on children living in different parts of Slovenia was performed as part of a project for the introduction of FS. Mean daily urinary fluoride excretion was 0.19 mgF/24 h (ranging between 0.04 and 0.59 mgF/24 h), and it was concluded that the exposure of children to fluoride was low (ZOREC-KARLOVSEK et al. 2004). The salt fluoridation project was not pursued further. The actual policy is to support the use of fluoridated toothpastes under supervision and the application of fluoride gels or solutions as part of school-based preventive programs. Topical application of fluoride varnish is performed by the dentists. Fluoride tablets are prescribed individually to children in cases where the intake of fluoride from other sources is not considered to be excessive.

Croatia

Until 1990, Croatia was part of the former Republic of Yugoslavia. At that time fluoridation of drinking water was the official policy. For technical reasons such as lack of centralized water systems fluoridation was not implemented. Since 1990, fluoride toothpastes were in the center of interest, and use of dentifrices under supervision of dental professionals is preferred, beginning in kindergartens. Croatia produces sea salt. In spite of attempts for production of FS, such salt is not on the market.

Poland

Until about 1990, Poland favored a water fluoridation policy. The possibility of fluoridation of salt was temporarily considered but not pursued any further. After the political changes in 1989/90, the policy has been to rely on fluoridated toothpastes, to be used under supervision after eruption of the first teeth. Fluoride rinsing is still carried out in schools.

The three Baltic states

In the Baltic countries preventive dentistry follows the principles practiced in the Scandinavian countries with which there exists a long tradition of cultural contacts. The Baltic states rely mainly on topical fluorides, especially those in dentifrices.

Personal observations (of TMM)

There has been some interest for salt fluoridation in several other countries. Travelling in Eastern Europe in 1989, TMM saw preparations for technical installations for fluoridation of salt in Western Ukraine. In Belarus, the machinery for fluoridation was built and was in function in 1993. It used a continuous process, apparently based on that of the United Swiss Saltworks. In the latter country, labelled packages of FS from Poland have also been on sale for some time. Apparently, salt refineries in these countries were ready to start investments in the production of FS (whether the obtained fluoride concentration would live up to Western standards is not known). However, health politics, customarily formulated by both politicians and dental health advisors, did not follow up on the initiatives taken by some salt

producers under the communist regime or thereafter. In recent years, anti-fluoridationist messages available through the Internet have become an obstacle, and university libraries often lack pertinent scientific journals and academic personnel to counter such tendencies.

Discussion

In at least six central European countries (Hungary, the Czech and the Slovak Republics, Croatia, Slovenia and Romania) there has been some interest in salt fluoridation. However, a noteworthy usage of approximately 35% of FS was obtained only in the Czech Republic. In the Slovak Republic, the saltworks have built the apparatus for producing FS. In the remaining four countries, attempts to introduce FS were not successful. Frequent political changes and difficulties as well as insufficient knowledge of caries prevention through fluorides seem to be the main reasons.

The majority of Western European experts favor the introduction of fluoride toothpastes as the key measure for improving public dental health in Central and Eastern Europe. It is generally recognized that the twice daily use of fluoridated toothpastes is the most important single factor leading to the decline of dental caries prevalence in the highly industrialized countries. Accordingly, the sale of such toothpastes which can be trusted to be cariostatic because of their fluoride content is a big step forward in Central and Eastern Europe. From the products offered in supermarkets and shops it is evident that twice daily toothbrushing may become a frequent or even a standard habit in the years to come. This development is thought to take place most rapidly in those ten countries who became new members of the European Union in 2004; powerful sale promotions by international companies may have markedly contributed to this success.

Irrespective of public acceptance of this standard, the cost of toothpaste and toothbrushes is a problem in the countries dealt with in this paper. Wages are only one-third to one-sixth of those common in Western European countries. On the other hand, most fluoride toothpastes are products of multinational enterprises, and their price – and hopefully their quality – is not substantially lower than in Western Europe. Western toothbrushes are predominant on the shelves; locally produced ones are cheaper but sold less frequently. Toothbrushes manufactured in the Czech Republic or Hungary (hardly visible on the shelves) are about half as expensive as the imported ones, which appear more attractive to the customer. That means that the Western standard of two toothbrushings per day in combination with fluoride toothpastes may be practiced in households of the higher while it is hardly affordable for the lower socio-economic layers. The WHO Technical Report of 1994 (WHO 1994) states that “since the use of fluoridated toothpastes is a public health measure, it would be in the ultimate interest of countries to exempt them from the duties and taxation applied to cosmetics”. Nevertheless, with price reductions of no more than 10–20%, one cannot expect substantial increases in the use of toothbrushes and dentifrices.

In the light of the high caries prevalence and the financial burden of dental treatment it would obviously be reasonable to introduce salt fluoridation, which does not interfere with the desired use of fluoridated toothpastes.

Comparative cost/benefit calculations regarding fluoridated toothpastes and FS are shown in Table II. Based on an average dentifrice consumption of 200 g a year, which is somewhat less

Tab. II Approximate cost per person and year in euro of fluoridated dentifrices and of salt fluoridation and number of teeth saved from caries by 1.0 euro

Cost	F-dentifrice	F-salt
Cost of production	0.50	0.10
Cost of package and commerce	0.50	0.00
Cost of advertising	0.50	0.01
Total cost (c)	1.50	0.11
Paid by government	0	0.11?
Paid by customer	1.50	0.11?
Reduction of DMFT increment	60%	30%
Teeth saved in comparison (T)	1.0*	0.5*
Cost per tooth saved, (C)/(T)	1.50	0.22
Teeth saved per 1.0 euro	0.67	4.54

* If a 60% reduction (through toothbrushing twice a day with a fluoridated toothpaste) corresponds to 1.0 saved tooth, then the increment in the absence of prevention is 1.67 DMFT (likewise, 0.5 teeth saved by a 30% reduction through fluoridated domestic salt leads to 1.67 DMFT in the absence of prevention). An increment of 1.67 may be assumed to occur in 2 years. This corresponds to an increment of 5.0 DMFT in 6 years. This corresponds to reality in Central and Eastern Europe: 12-year-old children (that is after 6 years of exposure of permanent teeth to oral conditions) show typically 5 DMFT in some Eastern European countries (see Tab. I).

than that in highly industrialized countries, cost of production may be assumed to be 0.5 euro each. The total cost for toothpaste – with fluoride of course – per year of 1.5 euro which includes quality control, packaging and marketing is paid by the consumer (the cost of toothbrushes which are the main instrument against gingivitis and periodontitis is not taken into account in this cost model). Caries reduction is assumed to be 60%, and under realistic circumstances (illustrated in Tab. II), 1.0 teeth will be saved from becoming carious when 1.5 euro is invested in fluoride dentifrices.

Production cost of FS is very low, approximately 0.1 euro per year (GILLESPIE & BAEZ 2005, GILLESPIE & MARTHALER 2005). The cariostatic effectiveness is assumed to be a 30% reduction. This is only half the hypothetical 60% reduction to be obtained from toothbrushing twice a day with fluoridated toothpastes. Accordingly, only 0.5 teeth are saved from becoming carious under conditions in which the use of fluoridated toothpastes would prevent 1.0 DMFT. Respective calculations are put together in Table II. It is seen that the cost per 1.0 tooth saved is 1.5 euro in the case of toothbrushes but only 0.22 euro in the case of salt fluoridation. Conversely, the investment of 1 euro saves 0.67 teeth when using fluoride dentifrices whereas 1 euro saves 4.5 teeth when using FS.

In the case of dentifrices, promotion of the brand name (advertising in the print media, via television and other promotional channels, including attractive packaging) may make up for more than one third of the retail price of a dentifrice. For salt fluoridation, less than one-tenth, or 0.1 euro, would be sufficient for very generous promotion of FS. For the Slovakian population of 5 million for instance, a promotion budget of 0.01 euro per person and year would translate into 50,000 euro. This may be compared with Germany, where for years the annual budget for successful promotion of FS was somewhat less than 100,000 euro. Even when assuming that fluorides in dentifrices are twice as cariostatic than domestic use of FS, the latter would be 6 to 7 times cheaper per one tooth protected (see second last row in Table II: $1.50/0.22=6.8$).

Zusammenfassung

In den mitteleuropäischen Ländern bestand während Jahrzehnten Interesse an der Präventivzahnmedizin. Die Wasserfluoridierung spielte in der Deutschen Demokratischen und der Tschechoslowakischen Republik eine wichtige Rolle, eine weitaus geringere in Polen. Diese Anlagen wurden nach der Wende 1989 in kurzer Zeit abgeschaltet. Ausgedehnte Forschungen über alle Aspekte der Salzfluoridierung erfolgten in Ungarn von 1966 bis 1984; Anstrengungen zu ihrer Einführung hatten indessen geringen Erfolg. Die Salzfluoridierung wurde aber Mitte der Neunzigerjahre in der Tschechischen und der Slowakischen Republik eingeführt. Das fluoridierte Haushaltsalz scheint in Tschechien nunmehr 35% auszumachen; tatsächlich ist es Teil einer präventiven Strategie, die auch Zahnbürstübungen mit fluoridhaltigen Präparaten in Schulen einschliesst. Die slowakische Saline stellt ebenfalls fluoridiertes Speisesalz her. Vier weitere Länder haben die Salzfluoridierung in Erwägung gezogen oder sich dafür interessiert, allerdings ohne konkrete Schritte zu unternehmen. Fluorgegnerische Aktivitäten behinderten gelegentlich die Fortschritte in der Kariesvorbeugung, und während Jahren sprachen sich namhafte Zahnärzte gegen Fluoride aus. Die Kariesprävalenz 12-jähriger Kinder ist um 1 bis 3 DMFT höher als in Westeuropa. Auf Jahre hinaus werden fluoridhaltige Zahnpasten und Zahnbürsten von den unteren sozioökonomischen Schichten in Mittel- und Osteuropa kaum zu bezahlen sein. Daraus ergibt sich die Schlussfolgerung, dass die Salzfluoridierung, als weitaus billigste Massnahme zur Senkung der Kariesprävalenz, die Mundgesundheit deutlich verbessern könnte, und dies unabhängig von der ökonomischen Entwicklung.

Résumé

Les pays de l'Europe centrale s'intéressent à la médecine dentaire depuis des dizaines d'années. La fluoruration de l'eau a joué un rôle dans l'ancienne République démocratique allemande et la République tchécoslovaque, ainsi qu'à un certain degré en Pologne. Ces projets ont été abandonnés après 1989. En Hongrie, bien que d'amples recherches sur tous les aspects de la fluoruration du sel (FS) aient été entreprises de 1966 à 1984, les tentatives de l'introduire n'y ont pas eu grand succès. La FS a été mise en train dans les Républiques slovaque et tchèque vers 1995. Le sel domestique fluoruré semble avoir atteint le 35% des ventes de sel dans la République tchèque; ce développement s'inscrit dans une stratégie de prévention comprenant des programmes de soins dentaires introduits aux écoles (y compris des exercices avec brosses à dent et produits fluorurés). Quatre autres pays ont pris en considération la FS, sans toutefois réaliser les projets proposés. Quelque résistance a parfois entravé la prévention de

la carie, certains dentistes réputés se prononçant contre la fluoruration pendant des années. La prédominance de la carie parmi les enfants de 12 ans dépasse celle de l'Europe occidentale de 1 à 3 DMFT. Les populations moins privilégiées de l'Europe centrale et orientale ne pourront peut-être pas se permettre l'emploi de pâtes et autres dentifrices modernes durant bien des années encore; on peut donc conclure que la FS – qui est de loin le moyen le moins coûteux de réduire la prévalence de la carie – pourrait améliorer la santé orale indépendamment de la situation économique.

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