

Overview of salt fluoridation in Switzerland since 1955, a short history

Summary

After an early start in 1955, the introduction and acceptance of fluoridated salt (FS) for domestic use was slow in Switzerland because up to around 1980 there was no consistent strategy for the support of the use of FS. Part of the dental community still supported water fluoridation, while others criticized the insufficient concentration of fluoride in the salt (90 ppm). All Swiss cantons have a historical monopoly on salt trade, and until 1983 most cantonal governments resolved to authorize the sale of fluoridated domestic salt. Some of the cantonal governments made fluoridated salt the only available type of "kitchen salt" in 1-kg packages. After the concentration had been increased to 250 ppm in 1983, the use of FS gained further acceptance. A temporary setback occurred in 1992–1994, but was successfully met with by making the FS available in several package sizes, while other types of salt (with or without iodine) were available in 500 g packages only. By 2004, the market share of fluoridated domestic salt reached 88%. Further endeavours aim at increasing the use of FS by large kitchens. FS is available in portions of 12.5 kg (since 2001) and 25 kg (since 1976).

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Introduction

In Switzerland, addition of iodine to salt for human consumption started in 1922 (see accompanying article by BÜRGI & ZIMMERMANN 2005). Due to public awareness of the frequency of goitre in many parts of Switzerland, all but two cantons had authorized the sale of iodized salt by 1927. Five of the total of 25 cantons (now 26 cantons) actually banned the sale of uniodized salt, whereas there were still five cantons where less than 7% of the salt was iodized. This diversity was due to the fact that every Swiss canton retains its historical monopoly on all salt trade. In 1937, variations between cantons were extreme. In six cantons, less than 16% of domestic salt was iodized; in eight cantons, all salt was iodized based on resolutions of the respective cantonal governments. The cantonal governments and a few very active

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private medical practitioners were the main driving forces for the gradual comprehensive introduction of iodized salt. By 1952, thirty years after the start of production, 86% of the domestic salt in Switzerland was iodized.

Based on the excellent results with the iodized salt, a renowned gynaecologist named Wespi, who had been one of the main promoters of the use of iodized salt since the nineteen thirties, suggested in 1950 that "kitchen salt", or generally domestic salt, should not only be iodized, but also fluoridated for the prevention of dental caries (WESPI 1950). It was mainly due to Wespi's initiative that in 1955 the United Swiss Saltworks (Vereinigte Schweizerische Rheinsalinen, Schweizerhalle, Pratteln) built an apparatus for the addition of sodium fluoride to salt, at a concentration of 90 ppm fluoride. Besides, a special "table salt" (iodized but not fluoridated, with special free-flowing properties) has been on sale in 500 g packages, but it constitutes less than 10% of the total of "domestic salt".

The Canton of Zurich was the first political unit world-wide to authorize the sale of salt with both iodine and fluoride. In its resolution of July 7th, 1955, the Cantonal Government stated explicitly that this salt be put on sale "with additives of fluoride and iodine for their preventive effect against caries and goitre in packages of one kilogram at the same price as iodized salt". From 1956 to 1982, the authorizations of FS (fluoridated salt) spread from canton to canton and FS conquered the market as the iodized salt did 33 years earlier. The increase in percentage of FS among the total of domestic salt is illustrated in Figure 1.

Until about 1970, FS was mainly promoted by physicians, among them many gynaecologists like Wespi. The dental profession, by contrast, hesitated to support FS for two reasons: (1) Up to the mid-sixties, caries prevention was focused on water fluoridation which was introduced in the Canton of Basle in 1962 (but replaced by FS in 2003, MARTHALER & MEYER 2004). (2) In professional circles, the concentration of 90 ppm fluoride was considered grossly insufficient, an opinion which was justified. A special issue of the Swiss Dental Journal (Schweizerische Monatsschrift

für Zahnheilkunde, No. 6, June 1967) published in 1967 with the title "Fluoride and Caries in Switzerland" did not even mention salt fluoridation, in spite of the fact that in those years close to two-thirds of the domestic salt sold in the country was fluoridated. Subsequently, Wespi who felt the need to promote professional awareness of the importance of salt fluoridation, was invited to report on the status of FS and to express his view in the "Swiss Dental Journal" (WESPI 1968).

Research on the potential of salt fluoridation started at the Zurich Dental School. Detailed analyses of the American data revealed that the protective effect of water fluoridation was predominantly topical rather than systemic (MARTHALER 1960). MÜHLEMANN (1965, 1967) was one of the first scientists to adopt this view and to realize the potential of FS as a public health measure. Gradually, the idea gained ground that salt fluoridation was appropriate for Swiss conditions in view of its few large cities and many complex networks for water distribution.

The choice of the fluoride concentration of 250 ppm for salt

An important political step was taken in 1969, when the Canton of Vaud (500,000 inhabitants at the time) decided to fluoridate all salt for human consumption to a level of 250 ppm F. This decision was favoured by the fact that the Canton of Vaud has its own salt factory, supplying exclusively the population of the canton. Since 1970, all salt destined for human consumption in Vaud has contained 250 ppm F. In 1972 it was decided that a similar project should be started in the Canton of Glarus in order to obtain further data to assess the cariostatic effect of FS. Glarus has a population of 40,000 and consists of three relatively secluded valleys. Since 1986, all domestic salt and the salt for bakeries, large kitchens and hospitals has been fluoridated to 250 ppm F in this canton. In the case of Glarus, it was the United Swiss Saltworks which produced the salt containing 250 ppm F (until 1983, all other cantons, except Vaud, used salt with only

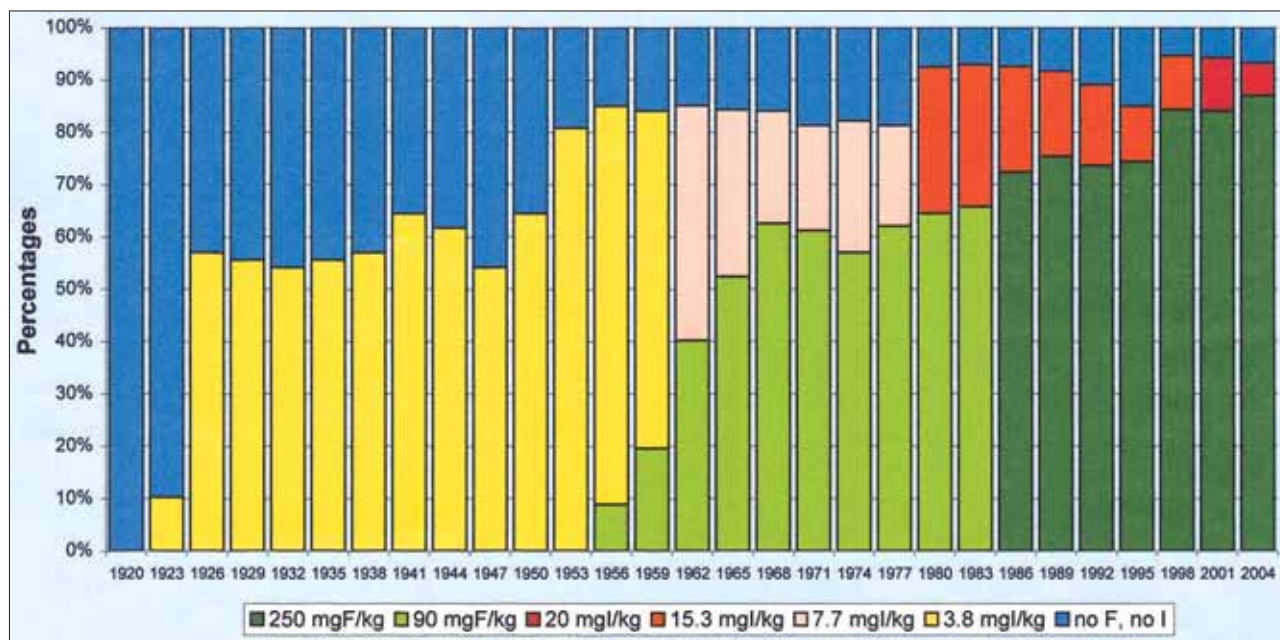


Fig. 1 Percentage of domestic salt (packages up to 1 kg, including a special type of "table salt" in 500 g boxes containing a free-flowing agent) with fluoride and iodine, iodine only or none of the 2 trace elements, sold 1922–2004 (United Swiss Saltworks). Values for 2001 represent means of 1999–2001, those for 2004 means of 2002–2004.

90 ppm F from the United Swiss Saltworks). In both these cantons DMF -statistics were obtained.

In 1982, the new results and other aspects of salt fluoridation were presented and discussed in a second special issue of the Swiss Dental Journal (Issue No. 4, April 1982) entitled "Salt Fluoridation and Caries Prevention in Switzerland". Based on the recent reports of the decline of caries in the Canton of Vaud obtained from 1970 to 1978 (DE CROUSAZ et al. 1980) and on the decline in the Canton of Glarus from 1974 to 1979 (MARTHALER & STEINER 1981), the use of domestic salt (cooking salt) containing 250 mg fluoride per kg of salt (250 ppm F) was recommended for the entire country. In early 1983, production was switched from 90 ppm F to 250 ppm F, the concentration which had brought about the strong decline of caries prevalence in the cantons of Vaud and Glarus.

For the first time, the dental profession was unanimous and active in recommending the use of the new FS salt instead of salt without this trace element. The rise of the fluoride concentration met with little opposition from antifuoridationist circles. It should be noted, however, that unfluoridated salt was always available. As shown in Figure 1, there was a sudden increase in the market share of fluoridated salt from around 65 to 73%. The package size had been left unchanged at 1 kg for all "kitchen salt" (Tab. I, first line). The concentration rise was made public through newspapers and leaflets which the dental practitioners placed in their waiting rooms. There were hardly any antifuoridationist protests, which corresponded to the easily accepted introduction of "universal" fluoridation in the cantons of Vaud (1969/70) and Glarus (1974). One explanation is that besides the salt produced by the United Swiss Saltworks and by the Vaud Saltworks, about 5% imported sea salt is consumed. This type is iodized but not fluoridated, is available in organic food shops and in part of the

Tab. I Package sizes of the various types of domestic salt in Switzerland

	With fluoride and iodine	Only with iodine	No fluoride, no iodine
1968–92 (Sept./Oct.)	1 kg	1 kg	1 kg
1992–93 (Jan./Feb.)	500 g	500 g	1 kg
1993 onwards	500 g, 1 kg	500 g	500 g

Besides these packages of "kitchen salt", 500 g packages of "table salt" containing a "free-flowing" agent have always been available; among the packages of salt up to 1 kg (i. e. domestic salt), its market share has been below 10% since 1983.

supermarkets and provides an alternative for anyone intimidated by antifuoridationists' warnings.

In September 1992, the United Swiss Saltworks introduced a new packaging concept. The idea, or rather conviction, of the marketing experts was that the housewives would prefer the 500 g packages for kitchen and table and that the 1 kg packages, which from then on did not contain iodine and fluoride any more, would be used for water softening in dishwashers and other household machines (see second line in Tab. I). As a consequence, the market share of the 1 kg packages of salt lacking both fluoride and iodine increased from approximately 8% to 32% within three months (in% weight, see Fig. 2). This development alarmed the "Fluoride and Iodine Commission of the Swiss Academy of Medical Sciences" (an advisory body for the medical profession and the Federal Office of Public Health) because it represented a threat of insufficient supply of iodine and fluoride to the population. The commission recommended a new marketing concept (see the third line of Tab. I) and finally succeeded in convincing the United Swiss Saltworks to adopt it. In January

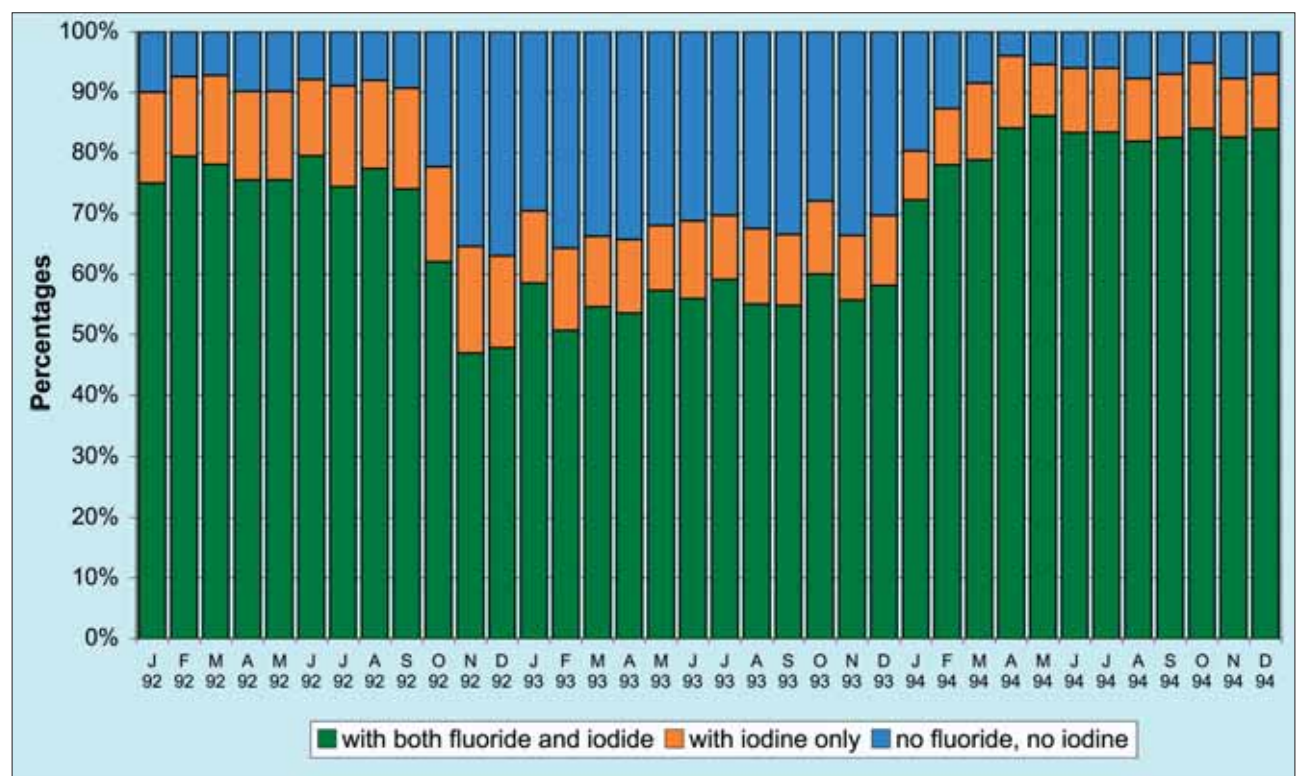


Fig. 2 Percentage of domestic salt (packages up to 1 kg, including "table salt") with fluoride and iodine, iodine only or none of the 2 trace elements, sold from January 1992 to December 1994 (United Swiss Saltworks)

1994, production was switched to this concept with overwhelming success (see Fig. 2). Within a few months, the market share of plain salt (containing neither iodine nor fluoride) fell from 32% to approximately 6%, whereas that of the salt with both iodine and fluoride (sold in both 500 g and 1 kg packages) rose to 83%, to the relief of all interested circles. The increase from 84% (2003) to 88% (2004) (see Fig. 1) is in part due to the switch of the Canton of Basle from water fluoridation to salt fluoridation in the summer of 2003. The 25 kg sacks of FS, originally made for the project in the Canton of Glarus in 1976, are increasingly used by large kitchens. Besides the packages up to 1 kg for domestic use, the United Swiss Saltworks made FS available in amounts of 12.5 kg in 2001.

Scientific results

The surveys on caries prevalence in the Cantons of Vaud and Glarus were repeated several times in intervals of four or five years up to the early nineties. The results documented a continued decline of dental caries prevalence. Among the many reports on caries epidemiology published throughout the years, five key publications presented the final results (DE CROUSAZ et al. 1985, 1993, MARTHALER & STEINER 1981, MENGHINI et al. 1995, in part summarized by BURT & MARTHALER 1996). A specific difficulty regarding a detailed interpretation of the decreasing caries prevalence was the intensive use of topical fluorides both in dentifrices and in toothbrushing exercises with concentrated fluoride preparations (fluoride-gels with 12,500 ppm F) at school. However, many statistical data were available to support the hypothesis that fluoridated salt contributed notably to the general decline of caries prevalence in Switzerland. In view of the decline of 80 to 90% of DMFT-experience in Switzerland (MARTHALER et al. 2005), it is obvious that the usage of FS was a smaller factor when compared to the use of combined topical fluorides. Additional studies based on modern methods of comparing the magnitude and rapidity of caries declines may result in more precise assessments of the role of FS.

In the course of 50 years of use of FS in Switzerland, numerous reports were published on many aspects of salt fluoridation in addition to the surveys of caries prevalence. Investigations on urinary fluoride were an important topic. Prior to the concentration rise from 90 to 250 ppm in FS, spot urinary samples confirmed that fluoride exposure was low in most parts of Switzerland (MARTHALER et al. 1982). Beginning in 1981, exposure to fluoride was assessed via urinary fluoride excretion (HEFTI & MARTHALER 1981, BÜHLER-MANNER & HEFTI 1988, MARTHALER & SCHULTE 2005). Other aspects studied were public acceptance of salt fluoridation (SPINNLER 1982), accumulation of fluoride in bone (HEFTI & MARTHALER 1981, MARTHALER et al. 1982) and frequency of enamel fluorosis in connection with fluoridated salt (DE CROUSAZ et al. 1982, Steiner et al. 1995, MENGHINI 2005). Besides the publications cited above, a large number of progress reports and reviews of Swiss results were published, most of them in German, few in English and some in French.

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Zusammenfassung

Nach einem frühen Beginn im Jahre 1955 verlief die Einführung der Salzfluoridierung langsam, weil eine einheitliche Befürwor-

tung dieser Massnahme noch fehlte. Ein Teil der Zahnärzte strebte noch immer die Fluoridierung des Trinkwassers an, während andere den niedrigen Fluoridgehalt im Salz (90 ppm) bemängelten. Alle Kantone besitzen ein historisch bedingtes Salzmonopol, und bis 1983 bewilligten die meisten den Verkauf fluoridierten Salzes. Einige Kantone liessen einzig das fluoridhaltige Kochsalz in den damals üblichen 1 kg-Paketen zu. Nachdem die Konzentration 1983 auf 250 ppm F erhöht worden war, stieg der Gebrauch des fluoridierten Salzes weiter an. Ein vorübergehender Abfall ergab sich 1992 durch ungünstige Änderungen bei den Paketgrössen. Seit 1994 wird einzig das fluoridierte Salz in mehreren Paketgrössen bis zu einem Kilogramm vermarktet, die anderen Salzsorten (mit und ohne Jod) dagegen nur in 500 g-Paketen. Im Jahre 2004 erreichte der Anteil des fluoridierten Haushaltsalzes («Kochsalz») 88%. Neuere Bemühungen zielen darauf hin, den Gebrauch fluoridierten Salzes auf Grossküchen auszudehnen. Fluoridiertes Salz ist seit 2001 auch in Eimern zu 12,5 kg und (seit 1976) in Säcken zu 25 kg erhältlich.

Résumé

L'introduction en Suisse de la fluoruration du sel à l'usage domestique commença en 1955 déjà, mais elle fut entravée jusque vers 1980 par l'absence d'une stratégie concertée. Certains dentistes insistaient sur la fluoruration de l'eau, tandis que d'autres jugeaient insuffisante la concentration de fluorure dans le sel (90 ppm). Ce sont les cantons qui détiennent le monopole de la vente du sel, et jusqu'en 1983 la plupart décidèrent d'autoriser la vente de sel fluoruré (SF), certains même le vendant exclusivement dans les emballages courants d'un kilo, portant la désignation «sel de cuisine». Une fois la concentration élevée à 250 ppm (en 1983), l'emploi de SF fut plus généralement accepté. Il y eut toutefois un ralentissement de ce procès en 1992–1994; on y mit un terme en lançant des portions diverses, alors que d'autres types de sel (avec ou sans iodine) ne se vendaient qu'en portions de 500 g. En 2004, le SF à l'usage domestique constituait le 88% des ventes. Il s'agira à l'avenir d'augmenter l'usage de SF par les grandes cuisines, pour lesquelles on a lancé des portions de 12,5 (en 2001) et de 25 kg (en 1976).

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