Effects of mandatory iodization on the iodine content of retailer and household salt in South Africa.

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Voluntary iodization of table salt prior to 1995 had a beneficial effect on the prevalence of goitre in some areas in South Africa. However, it was, due to limited availability and unequal access, unsuccessful in eradicating iodine deficiency and endemic goitre. Against this background the international focus on the eradication of IDD stimulated the introduction of mandatory iodization of table salt in South Africa at the end of 1995 at a higher iodine concentration than before. Within one year the availability of iodized salt at the retail level increased considerably and the iodine content of iodized salt more than doubled from 14 to 33 ppm, accompanied by considerable variation in the iodine concentration. In a national study more than 2 years after the introduction of mandatory iodization the mean iodine concentration of household salt was 27 ppm and the median 30 ppm, and 62.4% of households used adequately iodized salt. These improvements, both at the retail and household level, in the iodine content and coverage of iodized salt after the introduction of mandatory iodization could be further enhanced by eliminating the factors responsible for the use of inadequately iodized salt, with a particular focus on low socio-economic households.
Descriptors: iodine deficiency, mandatory salt iodization, retail salt, household salt.

Introduction

The iodization of salt was the cornerstone of the international drive to virtually eliminate Iodine Deficiency Disorders (IDD) globally by the turn of the century. Mandatory iodization of table salt was, against the background of limited information on the prevalence of iodine deficiency and endemic goitre, introduced in South Africa as part of this international drive to eliminate IDD. This paper describes the motivation for introducing mandatory iodization and summarises the effects of mandatory iodization on the iodine content of retail and household salt.

Historical perspective

Endemic goitre was reported for the first time in South Africa in 1927. This was followed by a number of goitre investigations countrywide, culminating in the 1950's in the work of the South African Goitre Research Committee (1). Endemic goitre occurred as a number of geographical "pockets" or goitrous areas inland along the eastern coast and across the northern part of the country. Cretins were not reported in the literature, but high goitre prevalence rates supported the likelihood of cretins in some areas. Based on the findings of this committee, optional iodization of table salt was introduced in the country in 1954 at a level of 10 to 20 ppm.

During the next four decades, following the introduction of optional iodization in 1954, very little additional research on endemic goitre or iodine deficiency was conducted in South Africa. As knowledge about the epidemiology of iodine deficiency and endemic goitre in the country was lacking in the early nineties, an alternative approach was taken by investigating the production, distribution and legislative control of iodized salt in South Africa (2). Approximately 60 salt producers made South Africa self sufficient by producing enough salt for domestic and industrial use, and for export. Only 9% of the total amount of salt produced in the country was used as table salt, part of which was voluntarily iodized. The assessment in 1994 of the iodized salt situation showed that only about

30% of table salt was iodized, with unequal access to iodized salt. At that time the amount of table salt being iodized was dependent on consumer and trade demand rather than on legislative control or health needs (2).

Factors responsible for unequal access to iodized salt included a low level of awareness of the health benefit of iodized salt resulting in a low consumer demand in rural areas, price sensitivity particularly amongst low-income people purchasing cheap non-iodized salt brands, cultural and urban/rural differences in the amount of salt used. These factors suggested that people in rural areas, who were predominantly lower income consumers, may not have had ready access to iodized salt and as a result were getting less iodine through salt usage than the urbanized more affluent people. A 1995 study in four communities of varying socio-economic status showed low proportions, varying from 4 to 25%, of households using iodized salt in three low socio-economic communities, compared to almost half of households in the high socio-economic community (3).

Revised salt legislation

In the absence of national goitre prevalence estimates, several factors justified the revision of the South African health legislation on iodized salt. The major factors were:

(1) An increased awareness from 1990 onwards amongst health planners and decision-makers about the importance of implementing national IDD elimination programmes. This awareness was, to a large extent, the consequence of adopting and endorsing the international goal of virtually eliminating IDD by the year 2000 at a series of high level meetings at the beginning of the decade, e.g. the World Summit for Children (1990), the Policy Conference on Hidden Hunger (1991), and the International Conference on Nutrition (1992).

(2) Historical evidence of endemic goitre existed in South Africa (1). As mentioned earlier, several investigations conducted before 1955 reported goitre endemias in various geographical areas of the country.

(3) The limited availability of, and unequal access to iodized salt, suggested that the consumption of iodized salt was probably insufficient to prevent iodine deficiency, particularly in rural areas.

(4) A few isolated studies conducted in 1994 and 1995 indeed substantiated the assumption of inadequate iodine intake and reported endemic goitre in widely varying geographical areas in South Africa (3-5).

(5) Iodine deficiency and endemic goitre prevailed in all of South Africa's neighbouring countries, one of which is landlocked by South Africa. Although variation in prevalence rates occurred within these countries, this information nevertheless indicated the likelihood of iodine deficiency and endemic goitre in parts of South Africa.

Mandatory iodization of table salt was introduced, with the encouragement of international agencies such as the United Nations Children's Fund (UNICEF) and the International Control Council for Iodine Deficiency Disorders (ICCIDD), in South Africa at the end of 1995. The regulation related to salt of the relevant act was revised to replace optional with mandatory iodization, and to increase the iodine concentration of iodized salt from between 10 and 20 ppm to between 40 and 60 ppm iodine in the form of potassium iodate. This legislation applied to salt for human consumption, and not to agricultural salt for animal use, mainly because the legislative control for human and animal foodstuffs is vested in different governmental ministries.

Consequences of mandatory iodization

On retail salt: In a follow-up study of the iodine content of retail salt, 187 salt samples were purchased from food shops in 47 districts situated in 3 of the 9 provinces of the country in the month before the introduction of mandatory iodization. To evaluate the effectiveness of mandatory iodization at a higher iodine level than before, 287 salt samples were obtained a year later at the same sites and again analysed for the iodine content using the titration method (6).

The introduction of mandatory iodization in South Africa impacted favourably on both the availability and the iodine content of iodized salt at retail level. Iodized salt was available in virtually all grocer shops and non-iodized salt in very few shops that stocked both iodized and non-iodized salt. Theoretically this means that virtually all people in the country had access to iodized salt. Factors previously responsible for unequal access to iodized salt therefore no longer restricted the availability of, and accessibility to, iodized salt. Observations in a four community study illustrated a dramatic increase from 15.5% of households reporting the use of iodized salt, to a situation where 82,4% of households used salt with an iodine concentration exceeding 20 ppm, (and 90.9% exceeding 10 ppm), a year after the introduction of mandatory iodization at a higher concentration than before (7).

The revised salt legislation not only resulted in a greatly improved availability of iodized salt, but also resulted in an increase in the mean iodine content of salt at the retail level in the 3 provinces studied, from 14 to 33ppm within one year. In the two coastal provinces in the study the iodine content increased to 35 ppm, and in the inland province to 27 ppm.

Despite these favourable changes in the availability and iodine content of salt, there was concern about several issues. Although the mean iodine content of salt more than doubled, these levels did not increase to the level required by the revised legislation. Admittedly the legal requirement refers to the site of production, but the mean iodine content in one of the three provinces was 32.5% below the legally required level, and 12.5% below in the other two provinces. These mean values were accompanied by large variation in the iodine concentration, with only 24% complying with the legal requirement. However, this variation was considerably smaller than was found in Kenya where only 16% of samples complied with their legal specification and some of the samples had excessively high concentrations of iodine (8). Fortunately, in South Africa, the percentage of samples exceeding the upper limit of the legal requirement was relatively small, 9.8%, and the high values did not reach toxic levels and therefore did not pose a public health threat.

A weak but significant correlation between the price and the iodine content of iodized salt was found both before and after the introduction of mandatory iodization. This positive correlation indicated slightly higher iodine levels in more expensive salt brands. It also implied that the low socio-economic people, often in greater need of adequately iodized salt, are exposed to lower iodine concentration in salt because often only the cheaper salt brands are available in poor communities.

On household salt: The introduction of mandatory iodization in South Africa was also expected to impact on the iodine content of household salt. Therefore, in 1998, just more than 2 years after the introduction of mandatory iodization, the iodine concentration of household salt was assessed in a national study in South Africa. In a multi-stage, stratified, cluster survey 2043 household salt samples were obtained and analysed using the titration method, and questionnaire information collected by means of a personal interview conducted with an adult of each selected household. The sampling frame was designed to provide a representative sample of households in the 9 provinces of the country, and also to be representative of all residential areas, and therefore of the various socio-economic strata of the population.

Nationally the mean iodine concentration of household salt was 27 ppm, varying in the 9 provinces from 17 to 34 ppm. The national median value of 30 ppm, varying from 6 to 42 ppm in the different provinces, differed from the mean values because of the skew iodine distributions. These national mean and median values suggested a sufficient daily iodine intake at the national level for the prevention and control of IDD, even if some iodine losses occur during the preparation of food. However, the marked variation in iodine concentration amongst provinces, and the wide variation within provinces, revealed vulnerable subgroups within the population exposed to under- or non-iodized salt.

Nationally 62.4% of households used adequately iodized salt containing more than 15 ppm of iodine. As in the case of the mean and median values, this measure of coverage also varied amongst provinces,

with a coverage of 75% in the 2 southern coastal provinces compared to a coverage of less than half of households in the 3 northern inland provinces using adequately iodized salt. Provinces with low mean and median iodine values and a low coverage of adequately iodized salt, were also the provinces with the highest proportions of households using non-iodized salt. Nationally 24.4% of households used salt with less than 2 ppm of iodine, ranging from 9.1% in a southern coastal province to 43.8% in a northern inland province. Geographical variation in the iodine concentration of salt, and in the availability or use of iodized salt, appear to be a world wide problem and therefore is not unique to South Africa. Even in Bolivia, a country that has virtually eliminated IDD as a public health problem at the national level, geographical variation in the availability of iodized salt still occurred in some rural areas near the Andes (9).

In addition to the three northern provinces in South Africa being identified as the most vulnerable geographic areas, the national study also revealed that the low socio-economic households and people living in rural areas were more likely to use under- or non-iodized salt. The vulnerable groups identified in this study were not mutually exclusive, and the factors responsible for the consumption of inadequately iodized salt therefore cut across the vulnerable groups. Factors that emerged from this study included the following:

- Salt inadequately iodized at production level affected the iodine content of household salt in all the provinces to a lesser or greater extent.

- Non-iodized agricultural salt was used in 6.5% of households, and insufficiently iodized salt obtained directly from producers in 0.8% of households, particularly in the three northern provinces. This practice of obtaining non-iodized salt from agricultural sources or directly from producers is called leakage.

- The mean iodine concentration of fine salt was 31 ppm (median 32 ppm) and that of coarse salt was 20 ppm (median 16 ppm). Therefore, the use of coarse salt constituted another factor contributing to the inadequacy of iodine in some household salt samples.

- Possible iodine losses during transport and during retail and household storage in the hot and humid summer climate of the three northern provinces could have contributed to some extent to low iodine concentrations at household level.

These factors could serve as efficient pointers indicating the appropriate actions required to increase the country's proportion of households using adequately iodized salt above the current level of 62.4%.

Discussion

The introduction of mandatory iodization at a higher level than before resulted in major improvements in both the availability and the iodine content of salt in South Africa. Already after one year the iodine content more than doubled from 14 to 33 ppm. Furthermore, the proportion of table salt that was iodized increased from about 30% before the introduction of mandatory iodization to a situation where 62.4% of households used salt with at least 15 ppm of iodine. To strengthen this trend a multi-pronged approach need to be adopted to eliminate the barriers preventing the country from achieving a coverage of 90% of households using adequately iodized salt of at least 15 ppm.

The salt producers, or distributors iodizing table salt received from small producers or from importers, must be seen as the primary role player implementing the salt regulation. It is in their hands to increase the accuracy of iodization and to reduce the variation observed in iodine concentration. To assist the producers in this role, effective liaison between the producers, the health authorities and scientists should be strengthened to enhance the mutual flow of information in a concerted effort to achieve the international goal of 90% adequately iodized salt. Regular monitoring of the iodine concentration at the production site, as well as at the retail and household level, should be an accepted part of the liaison amongst these role players.

One of the key issues that require attention is the vulnerability of low socio-economic groups to under- or non-iodized salt. A particular focus needs be developed to ensure a sustainable supply of adequately iodized salt to the poorer sector of the population. Low socio-economic people tend to

purchase the cheaper salt brands that contain less iodine, which also include coarse salt. It is therefore of great importance that the salt produced for this segment of the market is adequately iodized, particularly in view of the general susceptibility of low socio-economic people to iodine deficiency (10). Increasing the knowledge and awareness of producers regarding the prevention and control of IDD via the correct iodization of salt may further strengthen their commitment towards the production of salt iodized according to the legal requirement.

Leakage of non-iodized agricultural salt occurred predominantly amongst the low socio-economic households in the three northern provinces, presumably because it is a cheap source of salt to those who have access to it. Unfortunately mandatory iodization does not apply to agricultural salt used for animal nutrition and other agricultural purposes in South Africa. Therefore, a practical way to counteract the consequence of leakage, i.e. depriving vulnerable people from consuming iodine fortified salt, would be to iodize agricultural salt. This would also benefit animal production in iodine deficient areas. Leakage from salt producers occurred to a limited extent. It should nevertheless be minimized through close collaboration between health authorities and producers, particularly small producers distributing non-iodized salt locally.

At this stage it is uncertain if the hot and humid summer climate of the three northern provinces played a role in the loss of iodine from household salt. More research is needed to answer this question.

In conclusion, the introduction of mandatory iodization at a higher iodine concentration than before, resulted in a favourable increase in the iodine content of retailer salt and in the coverage of adequately iodized household salt within a relatively short period in South Africa. The challenge in the new decade for producers and health officials is to eliminate factors precluding a coverage of 90% adequately iodized salt in the country.

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