

The Evaluation of the Iodine Content of Table Salt in Lesotho

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SUMMARY

The objective of the study was to investigate the iodine content of salt at both retail and household levels before the introduction of the universal salt iodisation legislation in Lesotho. A cross sectional study was conducted. 300 salt samples were collected from systematically selected households and 100 salt samples were collected from retailers situated in the same villages as the households selected for this study, in all ten districts of Lesotho. An iodometric titration method was used for analysing the iodine content of the salt samples. The mean iodine content of salt at both retail and household level of 37 ppm ranged from 29 ppm to 48 ppm and from 31 ppm to 45 ppm in the different districts at retail and household level respectively. Uniformity of iodisation was lacking as indicated by the large variation in the mean iodine content among brands (ranging from 1-46 ppm at household level and 1-53 ppm at retail level) as well as within brands (ranging from 7-97 ppm at household level and 12-76 ppm at retail level). 4% of households used non iodised salt. 18.2 % of the household salt samples were below the adequate iodisation level of 15 ppm. 81.8% of the households use adequately iodised salt. This however does not meet WHO criteria for elimination of IDD as a public health problem since less than 90% of effectively iodised salt is being used at household level.

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Introduction

Iodisation of all edible salt is a long term sustainable preventative solution to eliminate Iodine Deficiency Disorders (IDD) [1, 2]. Remarkable success attributed to effective legislation has been achieved by the use of iodised salt to correct iodine deficiency in many countries [3, 4]. For example, the United Nations' Children Fund states that of the countries that had IDD problems in 1990, 26 countries now iodise over 90% and 14 countries iodise more than 50% of their edible salt [5]. It is further estimated that up until 1990, about 40 million children were born each year at some risk of

mental impairment due to iodine deficiency in their mothers' diets. By 1997 that figure was probably closer to 28 million, which is still too high but represent a clear rapid decrease.

The goal of virtual elimination of IDD as a public health problem by the year 2000 was accepted by the United Nations systems in 1990 [6]. This goal was reaffirmed by the International Conference on Nutrition in 1992, which also provided a strategic guidance, including emphasis on salt iodisation [7]. In response to this international health goal many countries developed legislation on salt iodisation. Although countries

iodised at different levels, it is suggested that all salt for human and animal consumption in all regions where iodine deficiency is known or suspected, should be iodised at reasonable levels (usually 30-100ppm) at factory level [1].

Studies in Lesotho have shown mild to severe IDD since 1960 [8-11]. After the National Micronutrient survey in 1993 [10], which indicated severe IDD in primary school children aged between age 6 and 16 years, iodised oil capsules were distributed as a short term intervention and the legislation on universal salt iodisation was drafted as a long term intervention. This legislation was promulgated in 1999 a year after the present study was conducted. The draft legislation stated that all salt, which is imported or marketed in Lesotho for human or animal consumption must be iodised with potassium iodate and contain not less than 40ppm and not more than 50ppm of iodine at point of entry.

Lesotho imports all its salt from South Africa. The current legislation in South Africa states that salt produced or imported shall contain between 40 and 60 ppm of iodine on entering the country and the salt, which is exported from the country may contain more than 60ppm of iodine. The exemptions on this regulation include salt intended for use in the manufacture of compound foodstuffs, which is packed in bags of 20 kg or more and salt available in pharmacies in packages of 1 kg or less which are labelled "non iodised salt". It is possible therefore that salt iodisation in South Africa influenced the availability of iodised salt in Lesotho. The aim of this study was to estimate the iodisation level of salt available in Lesotho before the introduction of the universal salt iodisation.

Materials and Methods

Data collection at household level

Stratified selection was used to select 3 villages in each of the 10 districts of Lesotho. This resulted in 30 villages

selected in the whole country. Villages were grouped into categories of the prevalence of goitre obtained from the 1993 National Micronutrient survey. In each village, 10 households were systematically chosen using the chief's house as the centre point, resulting in 300 households for the whole country. A structured questionnaire which generated information on brand name of salt, whether it was labelled "iodised salt" or not, the reason for using the brand, method of salt storage and the socio-economic status of the household was administered to the mothers. Approximately 15 g (3 teaspoons) of salt was obtained from each household and kept in a closed plastic bag until analysis.

Data collection at retail level

10 shops were selected in the three selected villages in each district, which resulted in 100 shops selected in the whole country. A structured questionnaire which generated information on brand names of all salt in stock and out of stock, their prices, whether they were labelled iodised salt or not and duration of storage for each brand was administered to the shop owner. A 500 g or alternatively 1 kg of iodised salt sample packed in sealed plastic bag was purchased and sticker used to identify the sample. Salt samples purchased in all the shops in each village included all the different brands available in that village.

Chemical analysis of salt

An iodometric titration method [12] was used for analysing the iodine content of the salt samples. This was done at Medical Research Council (Cape Town) laboratory. In this laboratory the coefficient of variation for this method is 0.68 at 20 ppm and 1.05 at 60 ppm. 10 g of salt was dissolved in distilled water and made up to 50 ml solution. 1 ml of 2N sulphuric acid and 5ml 10% potassium iodide were added. The liberated iodine was titrated with sodium thiosulfate

solution using 1ml of 1% starch indicator near the end of titration. The level of thiosulfate in the burette was recorded and converted to parts per million (ppm) using a conversion table. Epi Info version 6 was used for statistical analysis of the results.

This study was approved by the ethics committee of the University of Cape Town. In addition, the secretariat to the ministry of local government and chiefs of the study villages gave written permission to conduct the study.

Results

All the salt samples collected were analysed for iodine content. At household

level 15.3% of the salt samples were labelled "non iodised salt". The mean iodine content for the whole country was 37 ppm with the highest mean iodine content of 45 ppm (in Buthabuthe district) and the lowest mean iodine content of 31 ppm (in Thabatseka and Qachasnek districts) (Table 1). Samples containing no iodine were obtained from five districts (Mohareshoek, Mokhotlong, Qachasnek, Quthing and Thabatseka) and the maximum iodine content was 97 ppm obtained in Leribe district. There was a large variation in the mean iodine content between and within brands (ranging from mean iodine content of 1-46 ppm and 7-97 ppm respectively) at household level.

Table 1. Results on samples analysed on district basis at household level

DISTRICTS	Number of samples (n)	Mean iodine content (ppm)	Range of iodine content (ppm)
BEREA	30	34 +/- 26.08	1-77
BUTHABUTHE	30	45 +/- 15.33	14-93
LERIBE	30	42 +/- 19.40	1-97
MAFETENG	30	35 +/- 17.92	2-78
MASERU	30	38 +/- 21.35	3-80
MOHALESHOEK	30	33 +/- 21.56	0-83
MOKHOTLONG	30	41 +/- 20.69	0-74
QACHASNEK	30	31 +/- 18.53	0-67
QUTHING	30	37 +/- 18.31	0-69
THABATSEKA	30	31 +/- 25.39	0-89
TOTAL	300	37 +/- 21.04	

The graph on fig 1 gives the distribution of iodine content in samples collected at household level. No iodine could be detected in 4% of the samples. 52% were below the minimum iodisation level required by the Lesotho draft legislation (40 ppm). 19% were within the proposed specification (40-50 ppm) and 29% exceeded the specified range for Lesotho draft legislation. 18.8% of the samples were below 15 ppm, which is used as the cut off level for defining adequately iodised salt at household level [13].

All salt samples collected at retail level were labelled "iodised salt". The

mean iodine content at retail level for the whole country was 37 ppm with the highest mean iodine content of 48 ppm (in Thabatseka district) and the lowest mean iodine content of 29 ppm (in Mafeteng district) (Table 2). The minimum iodine content at retail level was 1 ppm and the maximum was 76 ppm. Similar to the household level there was a large variation in the mean iodine content between and within brands (ranging from mean iodine content of 1-53 ppm and 12-76 ppm respectively) at retail level. The standard deviations were high for both retail and household levels implying non uniformity of the iodisation process.

Figure 2 indicated that 60% of the samples were below the minimum iodisation level required by the Lesotho draft Legislation. 20% were within the

specifications and 20% exceeded the specified range for Lesotho draft legislation.

Fig 1. The distribution of iodine content at household level

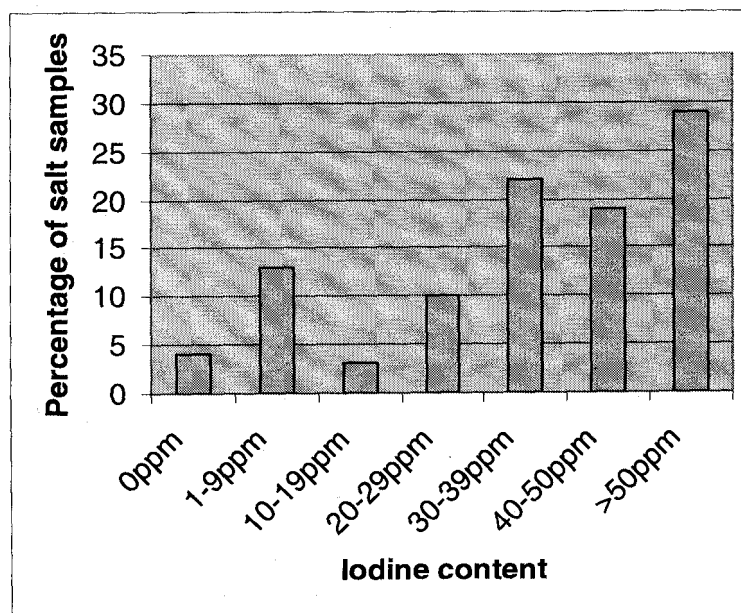


Table 2. Results on samples analysed on district basis at retail level

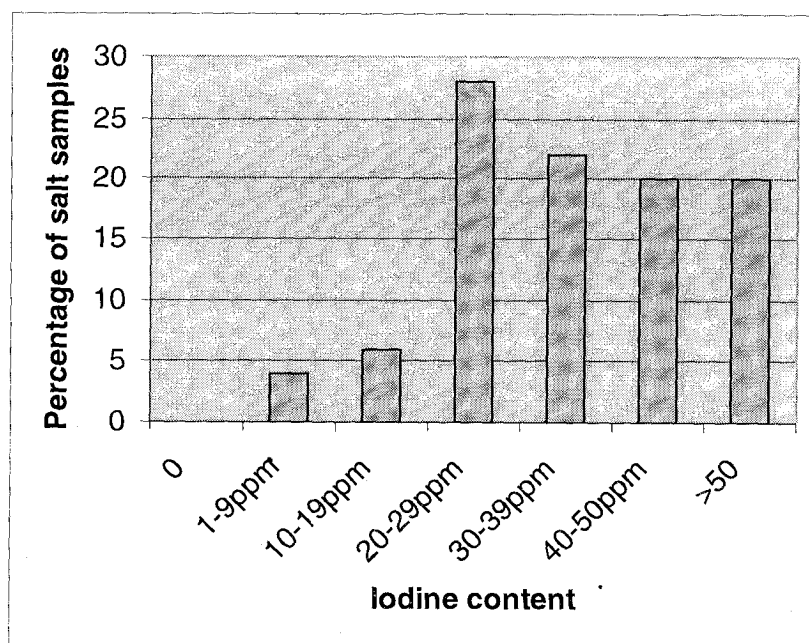
DISTRICTS	Number of samples (n)	Mean iodine content (ppm)	Range of iodine content (ppm)
BEREA	10	34 +/- 15.63	9 - 61
BUTHABUTHE	10	33 +/- 11.89	15 - 54
LERIBE	10	42 +/- 13.98	14 - 60
MAFETENG	10	29 +/- 10.76	13 - 55
MASERU	10	35 +/- 16.87	9 - 64
MOHALESHOEK	10	30 +/- 10.02	19 - 54
MOKHOTLONG	10	37 +/- 23.84	1 - 73
QACHASNEK	10	39 +/- 11.71	21 - 58
QUTHING	10	36 +/- 16.75	13 - 72
THABATSEKA	10	48 +/- 14.49	28 - 76
TOTAL	100	37 +/- 15.48	

Discussion

Data from this study revealed that the mean iodine content of salt at both retail and household level is 37 ppm. This is expected at household level due to the factors known to influence the stability of iodine in salt, such as the duration of storage, size of salt crystals, impurities, moisture of salt, ambient temperature, humidity and sunlight exposure [13]. The duration of storage from the production area to consumer level was not covered in this study and need to be investigated in the future. However it was found in this

study that most of households in Lesotho store salt in uncovered containers such as glass bottles, cups, mugs and tins thus exposing salt to high climatic temperatures, moisture, heat and sunlight. It was also observed during analysis that some of the salt samples contained some impurities, which might have affected their iodine content. The impurities were probably from the salt containers in the households, which had been used before to store other food-stuffs such as flour, spices processed fruits and vegetables.

Fig 2. The distribution of iodine content at retail level



There is a concern however, about the low mean iodine content of salt at retail level marketed in the usual plastic bags. A study in India showed that small iodine losses of 9-10% occurred within 15-20 days after packaging in polythene bags where after, the iodine content remained constant for 300 days [14]. It has also been indicated that potassium iodate which is used to iodise salt in South Africa is more stable than potassium iodide [15-17]. All the retailers reported

that they store salt for less than 6 months, therefore, for the purpose of this study it is assumed that there has been a minimal loss of iodine from the impermeable plastic bags due to storage and transportation. It is possible that salt is iodised at lower levels than specified in the Legislation for South Africa.

There is a large variation in iodine levels among and within brands, which was also found in other similar studies.

For example in Kenya the iodine content to 386.9 mg/kg [18]. In South Africa there was a range of 7-40ppm within brands and 0-80 ppm between brands [19]. This variation is expected at household level where there are different storage conditions. At retail level the large variations implies non uniformity in salt iodisation. Although the mean individual iodine levels varied in this study, the high values did not reach potentially toxic levels and therefore did not pose a public health threat.

The specified range of iodine levels in the legislation applies to the addition of iodate at the production site rather than at the retail or household levels where the samples were obtained. A considerable percentage of salt with iodine levels lower than 40 ppm is therefore expected. The percentage of households (81.2%) who use effectively iodised salt (more than 15 ppm) in this study is lower than the international recommendations of greater than 90% as the criteria for monitoring progress towards eliminating iodine deficiency disorders as a public health problem.

Despite the fact that the legislation allows iodisation of all salt for both human and animal consumption, this study revealed that 15.3% of the households use salt labelled "non iodised salt" of which 4% contained no iodine. This is because although not fortified with iodine, some of the samples were labelled "sea salt", therefore the natural iodine occurring in the sea in very small quantities not sufficient for nutritional purposes [1] was detected. The salt samples labelled "non iodised salt" were mostly salt packed in bags of 20kg or more as stipulated in the legislation for South Africa, which is usually meant for animal consumption (Stock salt). The main reason for buying non iodised salt in Lesotho was that it was cheap. This shows that people with low socio-economic status are at most risk of using non iodised salt. It was also found that

for Kensalt brand ranged from 6.2 non iodised salt was also exchanged for crops such as maize and sorghum and this is done mostly by farmers who mentioned they sometimes do not have enough money to buy iodised salt.

Of all the samples collected, only 19% and 20% at household and retail level respectively were within the specified range of the Lesotho draft legislation (40-50 ppm). Based on these results it is suggested that the draft legislation be amended regarding the maximum level of iodine (50 ppm be amended to 60 ppm). It is considered in this suggestion that it will possibly be not practicable for South African salt plants to iodise part of salt not exceeding 50 ppm while the legislation allows the maximum of 60 ppm and more for exported salt. It is also considered that the storage and transport from the production level to the consumer might have an influence on the levels of iodine and also that iodine content of 60ppm will not pose a public health threat.

Conclusion

A conclusion is drawn from the data that a sizable amount of the salt in shelves of retailers and at household level contains adequate iodine and contributes significantly towards prevention of IDD. This however does not meet WHO criteria for elimination of IDD as a public health problem since less than 90% of salt is effectively iodised and there is a number of people who use non iodised salt. There is a need for the legislation on universal salt iodisation in Lesotho to be promulgated as soon as possible. An effective monitoring program needs to be initiated to ensure that only iodised salt enters the country and is available for all households. Salt must be monitored regularly at production level, entry points, retail level and household level. This will ensure distribution of adequately iodised salt to the entire population.

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