Salt iodisation in Port Harcourt metropolis: a survey of households and markets

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Abstract

Background: Consequent on the recognition of the public health importance of Iodine Deficiency Disorders (IDD), especially in developing countries, the goal of iodising at least 90% of edible salts by 2000 was set at the 1990 World Summit for Children.

Aim: To determine the salt iodisation level in Port Harcourt.

Methods: In April 2000, using pre-tested questionnaires and MBI field test kits, traders from 8 markets and residents of 2181 households in Port Harcourt were interviewed and samples of their edible salts tested to determine their iodine content.

Results: The major salt brands of the 336 market and 2182 household samples were Union Dicon (70.54% and 25.52%) and Cassava (11.9% and 1.92%). About 17% of salt samples tested from markets compared to 72.55% from households, were of unknown brands (p=0.00000). Over 99% of samples from markets and households (99.7% and 99.13% respectively) had >30 ppm of iodine. All 27 traders interviewed were ignorant of salt iodisation programme and IDD; 92.6% had seen persons with 'goitre' but were ignorant of its causes and prevention.

Conclusion: Salt iodisation at the point of production has proved effective in increasing the consumption of iodised salts in Port Harcourt despite the widespread ignorance of the programme and its importance in controlling IDD. That most of the salts had >30 ppm of iodine portends the danger of toxicity with long-term use. There is need for close monitoring to ensure the safety of the intervention and its sustainability.

Key words: Universal salt iodisation, Iodine deficiency disorders, Ignorance, Community mobilisation

Introduction

Iodine deficiency disorders (IDD) are important public health problems which affected about 1.6 billion people (30% of the world's population) distributed in Africa, South East Asia, Asia and Latin America prior to the Universal Salt Iodisation goal set at the 1990 World Summit for Children. The goal was virtual elimination of iodine deficiency disorders through the iodisation of at least 90% of edible salts by the year 2000. At the end of the decade, when the progress was reviewed, it was noted that about 72% of households in the developing world were using iodised salt compared to less than 20% at the beginning of the decade, and that an estimated 90 million newborns were being protected yearly from significant loss in learning ability due to IDD. The report however noted that there were still 37 countries, excluding Nigeria, where less than half of the households consumed iodised salt.

Iodine deficiency disorders (IDD) present as a spectrum of disorders which are variable and range from slight enlargement of the thyroid gland to the severest form of deficiency-neurological cretinism. The manifestations include goitre, hypothyroidism, cretinism, reproductive failure, increased child mortality and socioeconomic retardation.
Despite the widespread occurrence of IDD, its existence is often not appreciated by those who are in a position to legislate about its control and therefore control programmes are either not initiated or when initiated, are not implemented or sustained. Additionally, the population at risk of the deficiency is often ignorant of the problem, its causes, management and prevention. For these reasons control programmes are not complied as evidenced by the failure of the public to consume iodised salts and in the absence of effective monitoring, the programme dies off.

The 1993 National Micronutrient Survey of Nigerian women of reproductive age and children aged 1-6 years showed a wide variety of IDD ranging from low Thyroxine (T4) (<50 mmol/l) and high Thyroid Stimulating Hormone (TSH) (concentration > 5ig/l) levels (41.1-65.5% and 35.9-61.3% respectively), to goitre. Other studies also confirm a high goitre prevalence ranging from 10 to 89% among Nigerians. After nearly a decade of implementation of the Universal Salt Iodisation programme in Nigeria, the percentage households consuming iodised salt rose to 93-97% in the different zones. However, in spite of this attainment, the 2001-2003 Nigeria Food and Nutrition Consumption Survey showed that 27.5% of under-fives and 30.7% of mothers had varying degrees of iodine deficiency. Additionally, the same survey showed that 29.8% of under-fives and 22.2% of mothers had excess levels of iodine. Nigeria thus has moved from being purely iodine deficient to a transitional phase of a mixed picture of normal, deficient and excess levels of iodine in all zones.

Rivers State, although in Health Zone A and South-South geopolitical zone, has not been previously studied to determine the level of salt iodisation and burden of IDD. Additionally, studies from some countries with successful salt iodisation programme have shown non-sustainability of the achievements. It is therefore not only important to determine the status of IDD and USI in Rivers State at the end of the decade, but also to monitor the sustainability of the achievement. This study was therefore carried out to determine the iodine content of edible salts sold in the markets or consumed in the households in Port Harcourt metropolis.

Materials and Methods

Study site

The study was conducted in Port Harcourt metropolis. Port Harcourt is the capital of Rivers State in the South-South geopolitical zone (Health Zone A) in Nigeria. Port Harcourt metropolis covers Port Harcourt City (PHALGA) and Obio-Akpor (OBALGA) Local Government Areas. It has an international air and sea ports, and a large influx of persons from within and outside Nigeria because of the number of industrial activities related to oil exploration. It is one of the States in the Niger Delta. Sea foods and farm products are the main foods consumed in the city.

The metropolis has a number of large markets such as the Mile 1 Diobu, Mile 3 Diobu, Creek Road, New Layout and Rumuomasi Markets. There are also several small community markets such as those located at the Oil Mill junction, Mile 4, Rumuokoro, Rumuodomanya, Rumuigbo, Afikpo Street and Aluu. The large markets operate daily while the others may operate on certain weekly or other scheduled days, including in the evenings. The wares sold at the smaller markets are farm, fish products or materials produced locally or purchased from the larger markets. Traders at these markets are mainly residents of Rivers and neighbouring States of Abia, Imo, Akwa Ibom and Bayelsa.

Preparation for the survey

The researchers were members of the Baby Friendly Hospital Initiative Committee of the University of Port Harcourt Teaching Hospital. The Committee was allocated the MBI test kits for determining the salt iodine level in Port Harcourt by the United Nations Children's Fund (UNICEF) Zone A Field Office. With the permission of the Committee the researchers embarked on the survey. Questionnaires were developed and pilot tested to determine their suitability for data collection. The questionnaire obtained data on the knowledge of
Salt iodisation and iodine deficiency disorders and the brands of salts sold or consumed in the households. Ten years 5 and 6 medical students of the University of Port Harcourt and four paediatric resident doctors of the University of Port Harcourt Teaching Hospital were recruited and trained for data collection. They were distributed to the different markets and sections of Port Harcourt. The data collection process was monitored by the researchers who also took part in the data collection process. All completed questionnaires were vetted by the researchers.

**Iodine testing method**

The iodine testing kit-MBI KITS (85 G.N. Chetty Road, III Floor, T. Nagar, Chennai-600 017, India) Stock No.05-860-00 was used. The instructions for the testing were written in English and in three other languages. The procedure for testing is as follows:

1. Take a few drops of iodated salt to be checked and spread it flat
2. Open the seal of the ampule (white cap) by making a pinhole
3. Discharge a drop of the test solution on the surface of the salt by pressing the ampule
4. The salt will turn light blue to dark violet on the iodine content of the salt
5. Use the colour chart instantly to compare and determine the iodine range in the iodated salt.

The levels of the iodine were - no colour change (No iodine), very light blue (7 parts iodine per million), light violet (15 parts per million), dark violet (30ppm). Salts that contain at least 15 parts per million of iodine were considered to be adequately iodised. The manufacturers recommended that in the absence of any colour indication, a recheck solution should be used along with the test solution for final determination of iodine content. The recheck solution was not provided along with the test kits. Uniodised salts were also confirmed to be so by their manufacturer’s labels and therefore did not need further testing.

**Sample size**

For the market survey all traders that sold edible salts in the main markets and gave their consents for the survey were studied.

For the household survey the sample size was calculated using the formula:

\[ n = \frac{p(1-p)Z_a^2}{d^2} \]

Where:

- \( n \) = desired sample size
- \( \alpha \) = 1-confidence level viz 2.5% (0.025) chosen for this study
- \( P \) = present prevalence of salt iodisation for Nigeria = 90% (0.09)
- \( d \) = distance or tolerance (how close to the proportion of interest the estimate is desired to be viz the standard error) = 0.025

\( Z_a \) (for a one sided test) = 1.96.

The minimum sample size obtained was 553.

**Market survey**

Eight markets, comprising all the major markets and three randomly selected smaller markets were surveyed. A pre-tested questionnaire which explored the knowledge of the traders on salt iodisation and Iodine Deficiency Disorders was to be administered to each trader who sold an edible salt and gave consent for the study. If the trader opted not to complete the questionnaire, he/she was asked to provide samples of all salts displayed for sale for testing for the iodine level using the MBI test kit. The testing was done in the presence of the trader and the result and its interpretation provided. For each stall, the following data were collected: the shed’s number, the name of the respondent and the brand(s) of the salt on sale. If a trader could not provide a free salt sample for testing, the researchers paid for some quantity and performed the test on the sample as before.

**Household survey**

Port Harcourt was zoned into different areas as shown in the results based on the convenience of the research team. Interviewers were assigned to different areas to complete the household questionnaires and test all available edible salts for
iodine content after obtaining informed consent. If the respondent objected to completing the questionnaire, a request was made for samples of all edible salts in the household to be provided for testing, after explaining the procedure. The testing was carried out in the presence of the respondent and the results interpreted.

Results

Market survey

Eight markets were surveyed and three hundred and thirty six salt samples tested. All the traders except those at Oil Mill and Rumuomasi markets provided the samples free, for testing. All the samples except one, obtained in the markets, contained iodine at a level above 30 parts per million. The uniodised salt was an imported table salt produced by Best Way C&C Ltd, London (NW 107 B W), sold at a supermarket within the market. The label on the salt indicated it had no iodine thus confirming the test result. The main brands of salts sold were Union Dicon (70. 54%) and Cassava (11.90%). The bags in which these salts were packaged from the manufacturers indicated that they were iodised. The Cassava brands also indicated its content of iodine (Nezo Pure Refined

Salt, made by Ritz Mong Ltd, Lagos, Nigeria) as iodine 50mg/kg in the form of potassium iodate. The traders who owned 57(16.96%) of the salt samples neither had the bags from where the samples were poured nor knew names of the brands of these salts (Table 1). The Cassava brand of salt was at least 1.5 times more expensive than Union Dicon Salt and the latter was preferred because of this price difference, despite the fact that the former was more refined.

The questionnaire on salt iodisation was completed for only 27 traders because the others consented only to having their salt samples tested but opted not to respond to the questions. Of these 27 traders, 25(92.6%) had seen persons with a swelling in front of the neck whose description fitted that of goitre. All 27 (100%) neither knew the cause(s) of goitre nor its treatment and prevention. They also had neither heard of salt iodisation programme nor iodine deficiency disorders.

Household survey

The residents declined to respond to questions on the questionnaire but provided salt samples for testing. Two thousand, one hundred and eighty one households provided 2182 samples. Table 2 summarises the results of the testing and the brands of salts. Two thousand, one hundred and sixty three

<table>
<thead>
<tr>
<th>S. no</th>
<th>Name of market</th>
<th>No. of samples tested</th>
<th>Result of tests (iodine level: parts per million)</th>
<th>Brands of salt tested</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>1</td>
<td>New Layout</td>
<td>46</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>Creek Road</td>
<td>67</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>Mile 1 Market</td>
<td>63</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>Afikpo Street Market</td>
<td>19</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>Mile 3 Market</td>
<td>75</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>Boundary Market Aluu</td>
<td>9</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>Oil Mill Market</td>
<td>19</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>Rumuomasi Market</td>
<td>38</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>336</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>(%)</td>
<td></td>
<td></td>
<td>(0.3)</td>
<td></td>
</tr>
</tbody>
</table>

* An imported table salt produced by Best Way C&C Ltd, London (NW 107 B W), sold at a supermarket within Creek Road Market
Table 4. The summary of the levels of iodine in the Salts tested from households and markets

<table>
<thead>
<tr>
<th>Serial no.</th>
<th>Name of area</th>
<th>No of streets surveyed</th>
<th>No of samples tested</th>
<th>Result of tests (Iodine level: parts/million)</th>
<th>Brands of salt tested</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>1</td>
<td>Old GRA</td>
<td>1</td>
<td>11</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>Ogbunabali</td>
<td>6</td>
<td>272</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>D/Lane</td>
<td>3</td>
<td>171</td>
<td>6</td>
<td>165</td>
</tr>
<tr>
<td>4</td>
<td>Elekaha</td>
<td>15</td>
<td>358</td>
<td>6</td>
<td>352</td>
</tr>
<tr>
<td>5</td>
<td>Rumuomasi</td>
<td>12</td>
<td>302</td>
<td>302</td>
<td>34</td>
</tr>
<tr>
<td>6</td>
<td>Rumueme</td>
<td>8</td>
<td>211</td>
<td>211</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Mile 1</td>
<td>5</td>
<td>194</td>
<td>194</td>
<td>10</td>
</tr>
<tr>
<td>8</td>
<td>Mile 2</td>
<td>3</td>
<td>73</td>
<td>73</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Mile 3</td>
<td>7</td>
<td>217</td>
<td>217</td>
<td>124</td>
</tr>
<tr>
<td>10</td>
<td>Mile 4</td>
<td>2</td>
<td>55</td>
<td>55</td>
<td>33</td>
</tr>
<tr>
<td>11</td>
<td>Rumuokwuta</td>
<td>5</td>
<td>153</td>
<td>153</td>
<td>131</td>
</tr>
<tr>
<td>12</td>
<td>Main Town / 2 water front settlements</td>
<td>8</td>
<td>165</td>
<td>165</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total (Percent)</th>
<th>75</th>
<th>1 village</th>
<th>2182</th>
<th>1</th>
<th>1</th>
<th>17</th>
<th>2163</th>
<th>57</th>
<th>42(1.92)</th>
<th>1583 (72.55)</th>
</tr>
</thead>
</table>

Table 2. Results of the household survey in Port Harcourt metropolis

Table 3. A Summary of the brands of Salt tested from the Markets and households

Table 4. The summary of the levels Iodine in the Salts tested from households and markets

Although there was a statistically significant difference ($\chi^2 = 411.8745$, df: 2, $p=0.0000$) in the
knowledge of the brands of salts sold and those consumed, there was no statistically significant difference in the iodine contents of the samples tested in the markets and households \((\chi^2=0.02902\) with Yates correction, \(p=0.86249\)) (Tables 3 and 4). Overall, 335(99.5\%) salt samples sold in the markets and 2163(99.13\%) of those consumed in households contained > 30 ppm of iodine.

**Discussion**

From the responses of the participants in this study it may be assumed that IDD, exemplified by goitre, is a recognisable public health problem. Despite its possible appreciation as a public health problem, its aetiology and modes of prevention remain largely unknown by the public, in spite of the implementation of the salt iodisation programme for several years. This suggests that although salt iodisation programme has been implemented and sustained in this State and country, the public remains largely ignorant of its value. This implies that over time, this achievement may not be sustained especially if there is a differential in the prices of iodised/uniodised salts and uniodised salts are imported from countries where IDD is not of public health significance. Concerted efforts at public mobilisation such as those currently being employed by the National Agency for Food and Drug Administration and Control (NAFDAC) are required to sustain the control efforts.

It is commendable that Health Zone A, which once had the highest prevalence of iodine deficiency, has, in about 10 years, transited to have a 28.1\% prevalence of under-fives with excess iodine level. This transition requires close monitoring to ensure there is no complete change from the present mixed state of deficiency, adequacy and excess to one of iodine toxicity. It is important that the level of iodine in the different foods and the quantities consumed are closely monitored to ensure that a careful balance is maintained. This is particularly important since as part of the Universal Salt Iodisation programme, it is expected that communities are monitored for the prevalence of goitre and level of salt iodisation as is being done in UNICEF focal LGAs, three of which are in Rivers State. At the national level, the Federal Ministry of Health’s Nutrition Information and Surveillance System developed to collect nutrition-related data, including those on Iodine and IDD, has remained largely underutilised. However, in view of the present high proportion of women and children with excess blood iodine levels it may be necessary to review the supplementation programme with a view to reducing the iodine content of edible salts from over 30 to 15ppm.

The Salt iodisation programme remains very essential in our country for obvious reasons. Thus, in spite of the attainment of an iodisation level of at least 93\% in different zones and about 40.5\% women and 46.5\% children had more than adequate levels of iodine, there were 30.7\% women and 27.5\% children with iodine deficiency. It is therefore important that while instituting close monitoring of the edible salts to ensure that they are adequately iodised, measures of ensuring safety in terms of the level of iodine consumed to prevent toxicity, should be instituted.

**Conclusion**

In Port Harcourt, as in many other parts of Nigeria, IDD is a preventable public health problem concerning which there is widespread ignorance of its disease burden, causes and prevention. Salt iodisation at point of production, however, appears to be the most cost effective method of controlling IDD in our setting. This study noted that the prices of edible salt brands determined their affordability and use. This highlights the need to keep the prices of iodised salts affordable. There is also need to continue to augment the salt iodisation programme with public enlightenment about its value in order to sustain the intervention and its impact. Supervision and monitoring of the companies and the public to ensure continued compliance with the legislation on salt iodisation are essential. It is also important to monitor the impact of the programme on IDD and evidences of its toxicity in order to maintain a balanced state. The use of iodised salt promises to be a sustainable method of addressing the wide scale problem of IDD and therefore should continue to be promoted in the country.
Acknowledgments

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References

9 Hetzel SB. The Prevention and Control of Iodine Deficiency Disorders. ACC/SCN. 1993(Reprint).
14 ACC/SCN (United Nation's Administrative Committee on Coordination- Sub-Committee on Nutrition). Iodine Deficiency Disorders. SCN News 1999;18:8
20 National Planning Commission (Federal Government of Nigeria) and UNICEF. Annex


