NATIONAL FOOD AND NUTRITION COMMISSION

IODINE DEFICIENCY SURVEY REPORT

THE STATUS OF IODINE DEFICIENCY AMONG PREGNANT WOMEN IN ZAMBIA, 2012

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National Food and Nutrition Commission Management

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ACRONYMS

CDC	Centre for Disease Control and Prevention
CI	Confidence Interval
EQUIP	Ensuring Quality of Urinary Iodine Procedures
FDCL	Food and Drug Control Laboratory
ICCIDD	International Council for Control of Iodine Deficiency Disorders.
IDD	Iodine Deficiency Disorders
IEC	Information, Education and Communication
MoH	Ministry of Health
MUIC	Median Urinary Iodine Concentration
NFNC	National Food and Nutrition Commission
ppm	Parts per million
SPSS	Statistical Package for the Social Sciences
TFNC	Tanzania Food and Nutrition Centre
TDRC	Tropical Diseases Research Centre
UIE	Urinary Iodine Excretion
USAID	United States Assistance for International Development
USI	Universal Salt Iodization
UNICEF	United Nations Children's Emergency Fund.
WHO	World Health Organization

DISCLAIMER

This study was funded by USAID, through UNICEF and implemented by the National Food and Nutrition Commission, a quasi organisation under the Ministry of Health. However, the views expressed in this report do not necessarily reflect those of the funding agencies.

EXECUTIVE SUMMARY

Introduction

In 2011 Zambia conducted an Iodine Deficiency Disorders (IDD) impact survey as a follow up to the 2002 IDD Impact survey among school children. The 2002 survey findings showed that remarkable progress that had been made in the fight against IDD since 1993, when the Government of Zambia adopted the universal use of iodized salt as the main strategy to eliminate IDD had been maintained.

Between 2002 and 2011 the median urinary iodine concentration (MUIC) in school children remained the same 245 µg/l and the percentage of the surveyed population with urinary iodine excretion (UIE) <100µg/l were 14%. The coverage of adequately iodated salt at household level (within the recommended range of 15-40 ppm of iodine as per the Zambian law) was estimated at 53% a great improvement from the 2002 (30%) results. A proportion of the remaining 47% of the household salt was found to either be under iodated (20%) below 15ppm or over iodated (27%) above 40 ppm.

The sustained progress towards Universal Salt Iodization was attributed more to there being legislation that stipulates that all table salt entering and being distributed in Zambia must be iodated. However lack of sustained political commitment as observed by the absence of a national budget for IDD resulted in a decline in IDD related activities from 2002 onwards. One of the activities most affected was information education and communication under the IDD Programme. The results of the 2002 and 2011 IDD Impact surveys indicated that iodine deficiency was no longer a public health concern. However to confirm this it was felt that an Iodine Deficiency Survey in pregnant women be conducted as pregnant women are not only very vulnerable to iodine deficiency but their requirements are higher than the general population.

Objective

The objective of the survey was to determine iodine status in pregnant women in Zambia and their access to, utilization and coverage of adequately iodized salt by .(1) measuring urinary iodine concentration in the pregnant women, and (2) estimating the coverage of adequately iodated salt in their households.

Methodology

This survey was a cross-sectional national cluster survey in pregnant women aged 15 to 45 years old. A total of 30 health facilities were randomly selected from the 1842 health facilities in

Zambia. The study included a total of 659 urine samples from the pregnant women for determination of iodine urinary concentration and 565 salt samples for determination of iodine content in salt.

Urine samples were analysed using the ammonium persulfate digestion method based on the Sandell-Kolthoff reaction, at the National Resource Laboratory for Iodine located at the Tanzania Food and Nutrition Centre (TFNC). This laboratory is certified as "satisfactory participant" in the programme for ensuring quality of urinary iodine procedures (EQUIP) supported by Centres for Disease Control and Prevention, USA.

Salt samples were analysed using the iodometric titration method at the Food and Drug Control Laboratory (FDCL) in Lusaka. Validation of the results was done on a 10% sub-sample by National Resource Laboratory for Iodine at TFNC.

Results

The MUIC value among pregnant women was estimated at 264µg/L, which was higher than the recommended WHO range (150-249 µg/L) for adequate iodine nutrition. These results indicate that iodine deficiency is not a public health concern among pregnant women in Zambia.

However, only 20.8%% of the women fell within the recommended range (150-249µg/L) while 36.3% were above requirements (250-499 µg/L) and 16.5% had excessive $\geq$500µg/l iodine intake. The situation was similar to that of 2002 and 2011 with high MUIC and high proportion of individuals having iodine intake in excess of the amount required to prevent and control iodine deficiency. It has however been indicated that more than adequate iodine intake in school-age children do not cause thyroid dysfunction in children[1]. Therefore since pregnant women's requirements are even higher; this may not necessarily be problematic. Thyroglobulin Is a Sensitive Measure of Both Deficient and Excess Iodine Intakes in Children and Indicates No Adverse Effects on Thyroid Function in the UIC Range of 100–299 g/L.

[1]Michael B. Zimmermann, Isabelle Aeberli, Maria Andersson, Vincent Assey, Jorge A. Jara Yorg, Pieter Jooste, Tomislav Jukic´, Djoko Kartono, Zvonko Kusic´, Eduardo Pretell, Teofilo O. L. San Luis, Jr., Juliawati Untoro, and Arnold Timmer J Clin Endocrin Metab. First published ahead of print January 23, 2013 as doi:10.1210/jc.2012-3952

The coverage of adequately iodized salt (15-40 ppm as iodine) at household level was estimated at 19.21% which was below the recommended target of more than 90% (WHO/UNICEF/ICCIDD, 2007) which was less than the 53% coverage in 2011. The remaining 80.79% of household salt was either under-iodated with iodine content below 15 ppm (4.59%) or over-iodated with iodine above 40 ppm (76.2%).

The low coverage of adequately iodated salt could be explained by the poor monitoring and the salt producers not being communicated to officially on the 2001 Regulation on iodated salt.

Packaging and labelling of salt was found to be inadequate being a result of most salt that is imported into the country being repackaged into smaller quantities that can be sold also by the vendors.

Knowledge amongst the women on iodine was low (45.95%), so was the knowledge on the health problems related to iodine deficiency. Awareness of the existence iodated salt was also low (44%) and the main source of information were the health workers.

Conclusions.

The survey has shown that iodine deficiency is not a public health concern among pregnant women in Zambia and therefore confirming that it is not a public health concern in the country as a whole.

However, the high iodine intake being observed points to poor adherence to the salt Regulation by the salt producers and calls for an effective monitoring system especially at the ports of entry.

Improving coverage of adequately iodated salt is still a challenge but once addressed it would answer to the two concerns for those whose iodine intake is insufficient and for those whose iodine intake is excessive

Recommendations

Elimination of Iodine Deficiency Disorders in Zambia can be sustained by:

Regulatory Monitoring and Law Enforcement

An effective salt monitoring system focusing on the ports of entry must be put in place. Further, major salt producers in Botswana and Namibia must be communicated to officially about the Zambian salt Regulations revised in 2001.

Salt legislation

The proposed review of the current legislation on salt iodation should be conducted so as to deal with the gaps that were identified in the current Regulations

Communication

A comprehensive communication strategy should be developed and implemented to create and maintain the demand for iodated salt in the general public and increase awareness and knowledge on iodine and health problems related to its deficiency.

Program Monitoring

The National IDD survey must be carried out every five years to assess progress towards sustained elimination of iodine deficiency.

1. INTRODUCTION

Iodine deficiency is considered as the single most important preventable cause of brain damage; yet it is one of the easiest and cheapest disorders to prevent (WHO, 2007). The effects of iodine deficiency on brain development contribute to decreased prospects and continued underdevelopment for a significant proportion of the humanity. Mental deficiency affects child learning capacity, women's health, the quality of life of communities, and economic productivity. In pregnant women iodine deficiency can cause still births, abortions and increased perinatal mortality and in new born it causes deaf mutism and endemic cretinism (UNICEF, 2007).

In recognition of the importance of iodine deficiency on brain development, the World Health Assembly adopted in 1991 the goal of the virtual elimination of Iodine Deficiency Disorders (IDD) by the year 2000. The commitment to this goal was reaffirmed by the International Conference on Nutrition in 1992. Further in 1993, WHO and UNICEF recommended universal salt iodization (USI) as the main strategy to achieve elimination of IDD.

Zambia has made remarkable progress in the fight against IDD since 1993, when the Government adopted the universal use of iodized salt as the main strategy to eliminate iodine deficiency. Between 1993 and 2002 the median urinary iodine excretion (UIE) in school children increased dramatically from 49 to 245 µg/l (NFNC, 2003). A similar median **UIE value (245** µg/L) **was found among school children in the 2011 survey indicating that** iodine deficiency was not any longer a problem of public health significance in Zambia (NFNC, 2012).

However, the coverage of adequately iodized salt (15-40 ppm as iodine) at household level was found to be at 53% which was below the recommended target of more than 90% (WHO/UNICEF/ICCIDD, 2007). The remaining 47% of household salt was either under-iodated with **iodine content below 15 ppm (20%) or over-iodated with iodine content above the upper limit of 40 ppm (27%).** The low coverage of adequately iodated salt was explained by the low availability of adequately iodated salt with only 48% of the traders selling salt with adequate level of iodine of 15-40 ppm as per the Zambian legislation. The issue of under- and over-iodization was attributed to the lack of an adequate functional salt monitoring system at all level (points of entry, wholesalers, and retailers) and hence inadequate law enforcement. This was further compounded by a lack of communication to the main salt producers and traders on the revised

2001 salt legislation shifting from three levels of iodization to a single level (MoH/NFNC Technical visit to salt factories, 2012).

Even though Zambia has made such impressive strides in the prevention and or control of iodine deficiency, pregnant and lactating women are of particular concern. Marginal iodine deficiency can occur especially in situations where the salt monitoring system is dysfunctional. Pregnant women have higher iodine requirements and it is essential to ensure optimal iodine nutrition in this population group to protect the foetus from adverse effects of iodine deficiency especially on brain development. Further school children, the usual indicator group of a population's iodine status, are not necessarily the most appropriate group to reflect iodine status in pregnant women. Thus a similar study looking at the adequacy of iodine intake in pregnant women was required to confirm whether IDD had been eliminated in all segments of the Zambian population.

2. OBJECTIVES

The main objective of the survey was to assess the iodine nutrition status of pregnant women and their access to and use of adequately iodated salt.

Specific objectives included:

- Estimate the Median Urinary Iodine Concentration in pregnant women;
- Estimate the proportion of pregnant women using adequately iodized salt;
- Assess awareness of pregnant women on iodine deficiency, the existence and benefits of iodized salt.

3. METHODOLOGY

3.1. Survey Design

This was a cross sectional national survey using a two stage cluster survey design. Considering that household-based surveys are too costly and the proportion of pregnant women in the general population is low, the proposed survey was undertaken in health facilities where pregnant women report for ante-natal care (ANC) visits. In Zambia it is estimated that 97% of the women had at least one ANC visit during their pregnancy with 60% having four visits (DHS, 2007). This approach was considered to be able to provide a reasonably representative sample of pregnant women and reliable estimates. Thus the first stage was the selection of 30 clusters (health facilities) and the second stage was the selection of the eligible pregnant women.

3.2. Geographic Coverage

The geographic coverage of the survey was nation-wide. The sampling frame included the 10 provinces and 87 districts.

3.3. Target Groups

The target group was pregnant women aged 15 -49 years of age of any gestational period.

3.4. Sample Size

The required sample size was calculated according to the formula below using the expected prevalence of the variable under study (iodine deficiency), the desired precision of the estimate and the expected design effect.

$$\frac{n = k * t^2 * (1-p) * p}{\varepsilon^2}$$

p = expected prevalence, t = relative error (=1.96 for 95% CI), k = design effect, and ε = precision

Considering that there is no data on IDD in pregnant women in Zambia in terms of prevalence of goitre or median urinary iodine concentration, the coverage of adequately iodized salt at household level estimated at 53% in 2011 was used as a proxy (NFNC, National IDD survey, 2012).

Based on an expected prevalence of 53%, a desired precision of 5%, and an expected design effect of 2, the required sample size was about 510 pregnant women or 17 women per cluster/health facility.

3.5. Selection of Target Groups

3.5.1. Selection of clusters (health facilities)

Out of a total of 1882 health facilities listed by the Ministry of Health, 1842 health facilities were identified as offering antenatal care. Since the total population catchment for each health facility was not readily available, the simple systematic selection method was used to randomly select 30 clusters/health facilities out of the 1842 health facilities (Appendix 1).

The interval (k) for selecting health facilities was calculated as total number of health facilities offering antenatal services in the country divided by the number of clusters = 1,842/30 = 61.4 which is roughly 61. This was followed by the selection of a random number using a table of random numbers. The random number selected was 16 as the first health facility after ruling off

the Random Tables into columns of two digits (2nd Column 1st row [Appendix 2]). Therefore the first health facility to be included in the survey was the 16th health facility on the list. The 2nd to be included was the 77th on the list (16+61) and subsequent health facilities were selected by adding the sampling interval to the previous health facility number until 30 health facilities had been chosen.

3.5.2. Selection of Pregnant Women

The health facility staff mobilised the pregnant women after the sensitisation meetings and selected the eligible pregnant women on a voluntary basis to participate in the survey. Mobilisation and selection was generally done either a day or days before data collection except in few cases where it was done on the day of data collection when the latter coincided with the first visit or follow up visit dates. Though the target sample size per health facility was 17, more than 20 pregnant women were recruited in most facilities.

3.6. Indicator of iodine deficiency

Urinary iodine is a good indicator of very recent dietary iodine intake as most iodine absorbed in the body eventually appears in the urine. Even though urinary iodine excretion can vary from day to day and even within a given day in individuals, this variation tends to even out among populations. Provided a sufficient number of specimens are collected, casual urine specimens are considered to provide an adequate assessment of a population's iodine nutrition (WHO/UNICEF/ICCIDD, 2007).

The median value for the sampled population is the most commonly assessed indicator, as urinary iodine values are usually not normally distributed. In pregnant women median urinary iodine concentrations of between 150 µg/l and 249 µg/l define a population which has no iodine deficiency (WHO/UNICEF/ICCIDD, 2007). The epidemiological criteria for assessing iodine nutrition based on median urinary iodine concentrations in pregnant women are presented in Table 1.

Table 1: Classification of iodine nutrition in pregnant women (WHO/UNICEF/ICCIDD, 2007)

Median urinary iodine (µg/L)	Iodine intake	Iodine status
< 150	Insufficient	Iodine deficiency
150-249	Adequate	Adequate iodine nutrition
250-499	Above requirements	May pose a slight risk of more than adequate intake in the population
>= 500	Excessive	Risk of adverse health consequences (iodine-induced hyperthyroidism and autoimmune thyroid diseases)*

***** *The upper limit of the recommended range reflects concern about the risk of hyperthyroidism when high levels of iodine are introduced in a previously endemic population.*

3.7. Data Collection

3.7.1. Collection of Urine Samples

Each selected pregnant woman was requested to submit a urine specimen in a 15 ml sterile, iodine-free plastic universal urine container. From each urine specimen, two aliquots of 5 ml were transferred into two iodine-free plastic cryo-vials using a sterile disposable pipette. The vials were closed with tight fitting screw tops. Using a permanent marker, each tube was labelled with a code to capture the following information: the pregnant woman's ID number and district codes. The labelled vials were packed in two sets of cryo-boxes (racks) and stored in a cooler box at ambient temperature. The vials were then stored in a refrigerator at 4°C at NFNC Offices in Lusaka until one set was sent for analysis to the Iodine Laboratory of the Tanzania Food and Nutrition Centre in Dar es Salaam while the other set remained as a backup.

3.7.2. Collection of Salt Samples

Each pregnant woman was requested to bring a salt sample of a minimum weight of 55g. The salt samples were collected in iodine free black polythene bags. A permanent marker was used to label the stickers that were stuck on each bag, carrying the following information: the pregnant woman's ID number and the district codes. The salt samples were then kept in clean iodine free polypropylene sacks at the NFNC offices until their transportation to the Food and Drug Control Laboratory in Lusaka for analysis.

3.7.3. Collection of Information on Knowledge on IDD and Iodized Salt

Semi-structured questionnaires were administered to the pregnant women, to assess knowledge on iodine deficiency and iodised salt **(Appendix 3).**

3.8. Analysis of Urine and Salt Samples

3.8.1. Iodine urinary concentration

Urinary iodine was determined by the Sandell-Kolthoff reaction - reduction of ceric ammonium sulphate (yellow) to the cerous form (colourless). Urine was digested with ammonium persulfate with iodide as the catalyst in the reduction of ceric ammonium sulphate. The rate at which the yellow colour decreased was measured by a spectrophotometer and then plotted against a standard curve constructed with known amounts of iodine (WHO/UNICEF/ICCD IDD, 2007).

The urine specimens were analysed at the Tanzania Food and Nutrition Centre (TFNC) in Dar es Salaam, Tanzania. The TFNC is certified as a "satisfactory participant" in the programme for ensuring quality of urinary iodine procedures (EQUIP). EQUIP is s programme run by the Centre for Disease Control and Prevention (CDC), Atlanta, Georgia, USA. During the analysis, both externally and internally checked quality control (QC) materials were used covering low, medium, and high iodine concentration runs within and between assays.

Validation of the results was also done on 6.5% of the total samples, randomly sampled and assessed for reproducibility by different hands. Statistical calculations (Pearson correlation = 0.98) showed that there was no significant difference of sample results obtained in run 1 and 2.

3.8.2. Salt iodine determination

Iodine levels in salt were determined using the reference and most commonly used quantitative method – titration. Iodine is liberated from salt and the free iodine titrated with sodium thiosulfate using starch as an external indicator to produce blue colour. Free iodine is consumed by thiosulfate and the amount used is proportional to the amount of free iodine (WHO/UNICEF/ICCIDD, 2007).

Salt samples were analysed at the Food and Drugs Control Laboratory (FDCL) in Lusaka. About 10% of the salt samples were randomly selected and sent to the Tanzanian Food and Nutrition Centre in Dar es Salaam for external verification of results.

3.9. The Survey Team

The survey technical team comprised the Principal Investigator, three Nutritionists from NFNC and one Nutritionist from UNICEF and were in charge of the survey planning, preparation, coordination and supervision.

Five field teams were involved in data collection and each individual team consisted of the following members:

- A nutritionist from NFNC
- A laboratory technologist from TDRC or FDCL
- Staff from the selected health facility
- An Environment Health Officer from the district community medical office

The teams from national level were trained in sample and data collection at a workshop held in Chilanga in July 2013 while the team members recruited at district level were trained with the selected health facility staff in the same tasks within their respective districts.

3.10. Data Analysis

The results from salt titration and urinary iodine determination were entered in Microsoft Excel and then were exported into SPSS while data from the questionnaires were entered in Stata. Descriptive statistics were generated using frequency tables. In addition, the chi-square test, normality test, correlation and regression were also carried out on the urinary and salt iodine data.

3.11. Survey period

The field work was carried out from 10th July 2013 to 2nd August 2013. The salt analysis was carried out at FDCL from mid-August to 20th November 2013 while the urine specimens were analysed at TFNC Laboratory from 4th to 17th November 2013.

3.12. Ethical Considerations

Ethical clearance was obtained from the TDRC Ethics Review Committee and permission to carry out the survey given by the offices of the Permanent Secretaries in the Ministries of Health and Community Development Mother and Child Health before commencement of the survey. Before collection of urine samples consent was obtained from the participating pregnant women. The letter of final Ethical Clearance and the Consent forms used in the survey are attached (Appendices 4). All the pregnant women that participated in the survey were given 1 kg of iodated salt each to contribute to increased awareness and access to iodated salt at household level.

4. SURVEY RESULTS

4.1. Sample sizes

The actual numbers of urine specimens and salt samples collected, and questionnaires administered as well as the respondent rates are presented in the table below

Table 2. Number of questionnaires, urine and salt samples

Parameter	Targeted	Collected	Response Rate (%)
Urine specimens	510	659	129%
Salt Samples	510	565	110%
Questionnaires	510	656	

4.2. Survey Demographics

The mean age of the pregnant women was 25.1 ± 6.7 years with the minimum being 15 years and maximum being 45 years.

Variable	Freq.	Min	Max	Mean	Std. Dev.
Age	654	15	45	25.11162	6.709557

About a quarter (25.2 %) of the respondents were from urban areas while the rest (74.7 %) were from rural areas.

Table 3: Residence of respondents

Residence	Freq.	Percent
Urban	165	25.23
Rural	489	74.77
Total	654	100.00

About half (54.0%) of the pregnant women that participated in the survey had attained primary education with 33.4% having attained secondary education and the remaining 2.0% having attained tertiary education.

Table 4: Level of education of respondents

Education level of the woman	No.	Percent
None	69	10.55
Primary	354	54.13
Secondary	218	33.33
Tertiary	13	1.99
Total	654	100.00

More than half of the respondents (53.5%) were not in employment, with 40.7% in informal employment and only 5.8% in formal employment as shown in Table 5 below.

Table 5: Occupation of respondents

Occupation of the woman	No.	Percent
None	351	53.59
Formal employment	38	5.80
Informal employment	266	40.61
Total	655	100.00

4.3. Urinary Iodine Concentrations

Normality of the results of the urinary iodine concentration was tested using Kolmogorov-Smirnov Test. The distribution results show a Kurtosis value of 6.6 and skewness of 2.1. This Positive kurtosis indicates that the Urinary iodine concentration observations cluster more and have longer tails than those in the normal distribution. However, since the skewness value is not more than twice the standard error, the distribution of the urinary concentrations of the study population was treated as a normal distribution even though it was above zero. The descriptive statistics of the urinary iodine concentrations in the pregnant women are summarized in **Table 6**.

Table 6: Urine Iodine Concentration (UIC) descriptive statistics

Statistics	Value
N	659
Mean	323.1
Standard Error	10.1
Median	264.2
Mode	456.4
Standard Deviation	258.5
Kurtosis	6.6
Skewness	2.1
Range	1946.7
Minimum	3.3
Maximum	1950
95% Confidence Interval	+/- 19.8

The median urinary iodine concentration was 264µg/L with UIC values ranging from 3.3µg/L to 1950µg/L. The proportion of pregnant women in each category of iodine status is presented in **Table 7.**

Table 7: Proportion of pregnant women in each urine iodine category

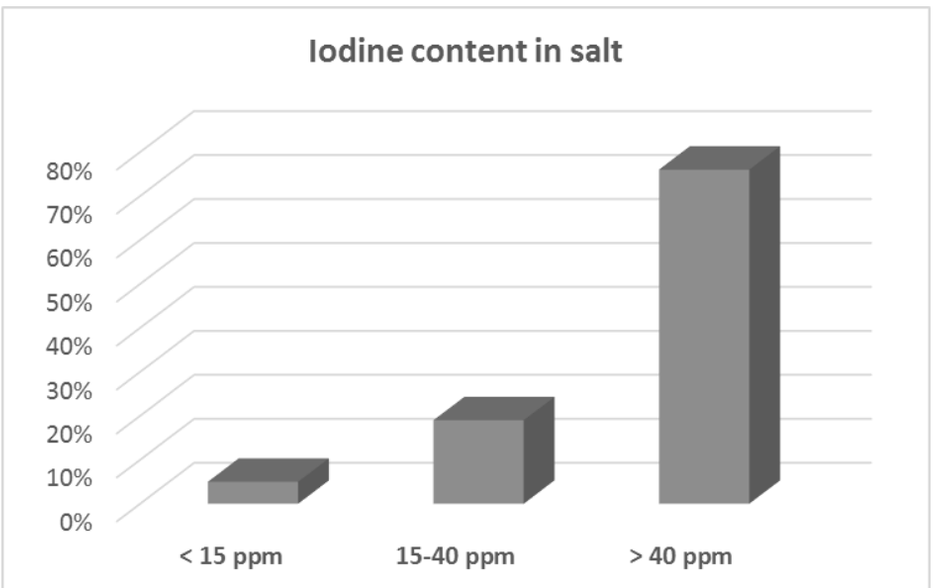
Iodine intake status	UIC (µg/L)	n	%
Insufficient	= 150	174	26.4%
Adequate	150-249	137	20.8%
More than Adequate	250 - 499	239	36.3%
Excessive	= 500	109	16.5%
Total		649	100.00

The proportion of pregnant women with urinary iodine concentration below 150µg/l was 26.4%. Only 20.8% had adequate iodine intake while 36.3% had more than adequate iodine intake and 16.5% had excessive iodine intake.

4.4. Coverage of Adequately Iodated Salt

76 out of the 565 samples of salt collected were not analysed because the amounts were not sufficient for the purpose of titration.

The coverage of adequately iodated salt (15-40 ppm iodine) at household level was 19.21%The iodine content was less than 15 ppm in 4.59% of the salt samples and above 40 ppm in 76.2% of the salt samples.



4.5. Correlation between UIC among Pregnant women and Salt Iodine Content

A non significant (P=0.767) positive correlation coefficient (r=0.014) between Urinary Iodine Content and salt iodine content was observed. Several explanations could be made on this; the salt samples submitted may not necessarily be the sample used at home.

4.6. Knowledge Attitude and Practices

4.6.1. Knowledge on Iodine Deficiency

Less than half (45.95%) of the respondents had heard while 54.05% indicated had not heard about iodine in the diet. The major source of information on iodine in the diet were Health Worker (60.13%) of these cited the as the source of information. Some reported to have received information from the Neighbourhood Health Committee (9.3%) and neighbours (10.96%)

A slightly higher proportion (15.1%) of women cited goitre as resulting from lack of iodine in the diet compared to those that did not know (13.9%) of any disease resulting from iodine deficiency. A few (10.7%) knew that mental retardation was a result of iodine deficiency, followed by those who cited still births (3.2%). Even though a large proportion (68.24%) indicated that they had seen people with goitre, they also said it was rare.

Table 8: Knowledge on diseases resulting from lack of iodine in the diet

Disorders due to iodine deficiency	No.	Percent
Goitre	99	33.22 (15.18)
Mental retardation	70	23.49 (10.74)
Still births	21	7.05 (3.22)
Don't know	91	30.54 (13.96)
other	17	5.70 (2.60)
All	298	100.00

4.6.2. Knowledge and Practices on iodated salt

Less than half (40.4%) had heard about iodated salt and the rest (59.4%) had not. The source of information by those that heard about iodated salt was the health worker at 54.34%, followed by NHC and neighbours (12.83% each). Further results showed that out of the respondents that had heard about iodated salt about half (49.43%) of them understood the meaning of iodated salt while 38.49% did not understand.

Seen 'Iodated Salt' on Salt being sold

On whether respondents had seen iodated salt on salt displayed for sale, results showed that only 29.92% (n = 196) agreed that they had seen this while the 70% (n = 459) indicated they had not.

Storage of Salt

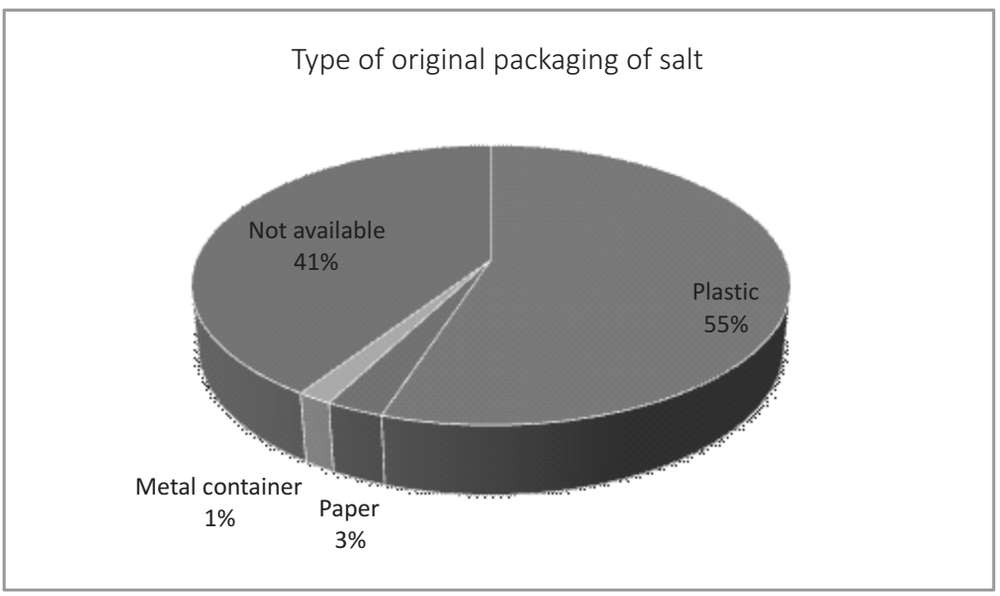
Most of the pregnant women (74.81%) indicated that they store the salt in containers with lids.

Table 9: Storage of salt in households

Type of storage	No.	Percent
Open package	50	7.63
Container without lid	85	12.98
Container with lid	490	74.81
Other	30	4.58
Total	655	100.00

Concerning time when salt is added to food, almost similar proportions of the respondents indicated that they add salt prior to cooking (43.82%), and after cooking (47.33%), while the remaining 8.85% stated they add salt during cooking.

Most of the pregnant women (98.17%) had used salt in the past 24 hours and half (50.7%) of them brought coarse salt and the other half (49.30%) fine salt. In terms of packaging slightly above half (54.96%) indicated that the original packaging was plastic, while 40.78%stated did not have the original packaging.



5. DISCUSSION

The Median Urinary Iodine Concentration was found to be 264µg/l among pregnant women. This is above the range 150-249µg/l which according to WHO indicates adequate iodine nutrition. These results indicate that iodine deficiency is not a public health concern among the pregnant women. However, a sizable l proportion of pregnant women (26.4%) had insufficient iodine status and 52.8% had an iodine intake exceeding 250µg/l.

The excessive iodine intake in more than 50% of the pregnant women is a trend that has been observed in the general population since the 2002 IDD Impact Survey including the 2011 IDD Impact Survey among school children.
According to Zimmermann et al (2013) most healthy adults are remarkably tolerant to iodine intake up to 1mg/d in areas of iodine sufficiency. Zimmermann et al (2013) also indicated that urinary iodine concentration of 200–299µg/L even though presently categorised as above iodine intake requirements in school-age children do not cause thyroid dysfunction in children. The Recommended Daily Allowance for iodine for pregnant women and lactating women is 220ug/day and 290ug/day while adolescents and teenage girls (14-18 years) require about 150ug/day.

The coverage of adequately iodated salt (15 – 40ppm iodine) was estimated at less than a fifth (19.21%) with more than three quarters (76.2%) of the salt samples containing iodine above recommended level. The coverage of 19.21% observed is less than what was observed in 2011, this is less than the 53% observed in 2011 and far less than the WHO recommended target of above 90% of households.

The revelation by this study on under and over iodated salt is similar to findings of the 2002 IDD Impact Survey. In this study only 4.59% were under iodated and 76.2% were over iodated, compared to 2002 where 6.5% of the salt samples were under iodated and 64% were over iodated. However this result is very different to what was observed 2011 where 20% were under iodated and 27% were over iodated. This shows that iodation levels of the salt are still an issue which has to be pursued with the salt producers. Zambia relies on imported salt for domestic use and this therefore also points to poor monitoring.

Most of the salt was packaged in plastic 54.96% of which 83.43% of the packages were not labelled. Inadequate packaging and labelling of iodated salt is another issue which was identified in 2011. The inadequate labelling and packaging is a result of most of salt imported into Zambia in

bulk being repackaged into small and even smaller quantities for sale by retailers and vendors respectively. This poses challenge to consumers because they may not be able to know whether the salt is actually iodated or not. Routine inspection using rapid testing kit is necessary ensure unsuspecting consumers have access to iodated salt at all time.

Knowledge on iodine in the diet was relatively low with less than half (45.95%) of the respondents having heard about it. Knowledge on health problems related to iodine deficiency was also found to be low where slightly above a third (33.2%) of the respondents cited goitre as resulting from the lack of iodine in the diet. Mental retardation (23.49%) and still births (7.05%) were also cited as resulting from iodine deficiency. This may imply inadequate sensitization on importance of iodine to health well-being, as such the need to utilise strengthen information dissemination by making full use of other channels beyond Health workers who were the cited as main source of IDD information. For example primary schools could be one potential channel as well as churches and traditional leaders.

Knowledge on iodated salt was also low with less than half (40.46%) of the pregnant women having heard about it, of which more than half of them (54.34%) had heard from a health worker. The other sources were the neighbourhood health committee (12.83%) and the neighbours (12.83%) with the remaining women (20%) having heard from other sources. Only about a third (29.92%) of all the participating pregnant women had seen iodated salt on the market and about 70% of these indicated that they buy iodated salt.

Almost three quarters of the pregnant women (74.81%) indicated that they usually stored the salt in containers with lids, 12.98% indicating that they stored in containers without lids and while 7.63% indicated that they stored in open packages. This is best practice so far exhibited by the women where most of them store their salt in containers with lids. This can be explained by the fact properly stored salt does not cake easily.

Regarding adding salt to food, 43.82% of the women indicated that they added salt prior to cooking and 47.33% indicated that they added salt after cooking with the rest (8.85%) added during cooking. Nutrition education to women and their families should emphasise that iodine is lost in the presence of excessive heat and humidity.

Almost all the women (98.17%) had used salt in the past 24 hours and almost half (49.3%) of the salt samples that were collected were fine salt and the other half (50.7%) coarse salt.

6. CONCLUSION

The Median Urinary Iodine of 264µg/l confirms that iodine deficiency is not a public health concern among pregnant women in Zambia. Hence, iodine deficiency is not a public health in Zambia.

However, the high iodine intake being observed points to poor adherence to the salt Regulation by the salt producers and calls for an effective monitoring system especially at the ports of entry. Improving coverage of adequately iodated salt is still a challenge but once addressed it would answer to the two concerns for those whose iodine intake is insufficient and for those whose iodine intake is excessive.

7. RECOMMENDATIONS

Elimination of Iodine Deficiency Disorders in Zambia can be sustained by:

6.1 **Regulatory Monitoring and Law Enforcement:** An effective salt monitoring system focusing on the ports of entry must be put in place. Further, major salt producers in Botswana and Namibia must be communicated to officially about the Zambian salt Regulations revised in 2001.

6.2 Salt legislation: The proposed review of the current legislation on salt iodation should be conducted so as to deal with the gaps that were identified in the current Regulations

6.3 Communication:

Implementation of the communication component of the IDD strategic plan 2012 to 2016 should accelerated to widely increase coverage so as to create and maintain the demand for iodated salt in the general public as well as increase awareness and knowledge on iodine and health problems related to its deficiency.

6.4 Program Monitoring:

The National IDD survey must be carried out every five years to assess progress towards sustained elimination of iodine deficiency.

8. APPENDICES

Appendix 1: Health Facilities Actually Visited during Data Collection

	Province	District	Health Facility
1.	Central	Chibombo	Malambanyama
2.	Central	Mkushi	Luanshimba
3.	Central	Serenje	Kabamba.
4.	Copperbelt	Kalulushi	Lukoshi RHC
5.	Copperbelt	Luanshya	Section 9 Clinic
6.	Copperbelt	Mufulira	Miles HP
7.	Copperbelt	Ndola	Sathya Sai Clinic
8.	Eastern	Chipata	Chiwoko
9.	Eastern	Katete	Kamphambe
10.	Eastern	Mambwe	Nyakatokoli
11.	Luapula	Chienge	Kabole
12.	Luapula	Mansa	Paul Mambilima
13.	Luapula	Samfya	Kasaba HAHC
14.	Lusaka	Chongwe	Chalimbana
15.	Lusaka	Lusaka	Chipata
16.	Lusaka	Lusaka	Kanyama Clinic
17.	Lusaka	Lusaka	Mtendere
18.	Northern	Chinsali	Nkula
19.	Northern	Kasama	Mwamba
20.	Northern	Mpika	Mapuma
21.	Northern	Nakonde	Chilolwa
22.	North -Western	Mufumbwe	Kalengwa
23.	North -Western	Solwezi	Kazomba
24.	Southern	Choma	Jembo
25.	Southern	Kalomo	Habulile
26.	Southern	Livingstone	Police
27.	Southern	Monze	Chisekesi
28.	Southern	Sinazongwe	Sikaneka
29.	Western	Lukulu	Kakulunda
30.	Western	Senanga	Sikumbi

Appendix 2: Table of Random Numbers

TABLE 1- RANDOM DIGITS

11164 36318 75061 37674 26320 75100 10431 20418 19228 91792 21215 91791 76831 58678 87054 31687 93205
43685 19732 08468 10438 44482 66558 37649 08882 90870 12462 41810 01806 02977 36792 26236 33266
66583 60881 97395 20461 36742 02852 50564 73944 04773 12032 51414 82384 38370 00249 80709 72605
67497 49563 12872 14063 93104 78483 72717 68714 18048 25005 04151 64208 48237 41701 73117 33242
42314 83049 21933 92813 04763 51486 72875 38605 29341 80749 80151 33835 52602 79147 08868 99756
26360 64516 17971 48478 09610 04638 17141 09227 10606 71325 55217 13015 72907 00431 45117 33827
92873 02953 85474 65285 97198 12138 53010 94601 15838 16805 61004 43516 17020 17264 57327 38224
29301 31381 38109 34976 65692 98566 29550 95639 99754 31199 92558 68368 04985 51092 37780 40261
14479 61555 76404 86210 11808 12841 45147 97438 60022 12645 62000 78137 98768 04689 87130 79225
08153 84967 64539 79493 74917 62490 99215 84987 28759 19177 14733 24550 28067 68894 38490 24216
63444 21283 07044 92729 37284 13211 37485 10415 36457 16975 95428 33226 55903 31605 43817 22250
03918 46999 98501 59138 39542 71168 57609 91510 77904 74244 50940 31553 62562 29478 59652 50414
31966 87912 87154 12944 49862 96566 48825 96155 95009 27429 72918 08457 78134 48407 26061 58754
05326 29621 66583 62966 12468 20245 14015 04014 35713 03980 03024 12639 75291 71020 17265 41598
64074 64629 63293 53307 48766 14544 37134 54714 02401 63228 26831 19386 15457 17999 18306 83403
88827 09834 11333 68431 31706 26652 04711 34593 22561 67642 05204 30697 44806 96989 68403 85621
45556 35434 09532 64041 99011 14610 40273 09482 62864 01573 82274 81446 32477 17048 94523 97444
59904 16936 39384 97551 09620 63932 03091 93039 89416 52795 10631 09728 68202 20963 02477 55494
39563 82244 34392 96607 '17220 51984 10753 76272 50985 97593 34320 96990 55244 70693 25255 40029
23289 48819 07159 60172 81697 09119 74803 97303 88701 51380 73143 98251 78635 27556 20712 57666
41204 47589 78364 38266 94393 70713 53388 79865 92069 46492 61594 26729 58272 81754 14648 77210
12923 53712 87771 08433 19172 08320 20839 13715 10597 17234 39355 74816 03363 10011 75004 86054 41190
10061 19660 03500 68412 57812 57929 92420 65431 16530 05547 10683 88102 30176 84750 10115 69220
35542 55865 07304 47010 43233 57022 52161 82976 47981 46588 86595 26247 18552 29491 33712 32285
64844 69395 41387 87195 72115 34985 58036 99137 47482 06204 24138 24272 16196 04393 07428 58863
96023 88936 51343 70958 96768 74317 27176 29600 35379 27922 28906 55013 26937 48174 04197 36074
65315 12537 10982 22807 10920 26299 23593 64629 57801 10437 43965 15344 90127 33341 77806 12446
15444 49244 47277 11346 15884 28131 63002 12990 23510 68774 48983 20481 59815 67248 17076 78910
40779 86382 48454 65269 91239 45989 45389 54847 77919 41105 43216 12608 18167 84631 94058 82458
15139 76856 86019 47928 96167 64375 74108 93643 09204 98855 59051 56492 11933 64958 70975 62693
35684 72607 23026 37004 32989 24843 01128 74658 85812 61875 23570 75754 29090 40264 80399 47254
40135 69916

Appendix 3: Household Questionnaire

QUESTIONNAIRE ON KNOWLEDGE, ATTITUDE AND PRACTICES ON IODINE DEFICIENCY AND IODATED SALT

A. IDENTIFICATION PARTICULAR

1. Province	
2. District	
3. Name of Health Facility	
4. Identification Number of Pregnant Woman	[_____][_____]
5. Date of Visit (DD / MM /YYYY)	[____][____]/[____][_____]/[____][____]
6. Name of Enumerator	
7. Consent Obtained: 1= Yes: 2 = No	[_____]

B. DEMOGRAPHIC INFORMATION

8. Area of residence: [_____]

1. Urban 2. Rural

9a. Age in years [_____]

9b. Gestational age if known [_____]

10. Education level: [_____]

1. None
2. Primary
3. Secondary
4. Tertiary

11. Occupation: [_____]

1. None
2. Formal employment
3. Informal employment

C. KAP ON IODINE DEFICIENCY

12. Have you ever heard of iodine in the diet? [_____]

1. Yes 2. No >>>>>>>14

12a. If yes, where did you hear it from? [_____]

1. Health worker

2. Neighbourhood Health Committee

3. Neighbours/Friends

4. Others (specify) _____

13. Can you list any disease resulting from lack of iodine in the diet? [_____]

1. Goitre

2. Mental retardation

3. Still birth

4. Don't know

5. Others (Specify) _____

14. Have you ever seen people with swellings in the neck in your community? [_____]

1. Yes and are common

2. Yes but rare

3. No >>>>>>>18

15. What do you call it? _____

16. What are the causes of this swelling? _____

17. How do you treat the swellings? [_____]

1. Health centre

2. Traditional medicine

3. Don't know

4. Others (specify) _____

D. KAP ON IODATED SALT

18. Have you heard of iodated saltfi [_____]

1. Yes 2. No **>>>>>>>19**

18a. If yes, where did you hear of it fromfi [_____]

1. Health worker

2. Neighbourhood Health Committee
3. Neighbours/Friends
4. Others (specify) _____

18b. If yes, what do you understand by iodated saltfi [_____]

1. Salt in which in iodine is added
2. Don't know
3. Other (specify) _____

19. Have you ever seen iodated salt on salefi [_____]

1. Yes 2. No **>>>>>>>21**

19a. If yes wherefi_____

20. Do you buy iodated saltfi [_____]

1. Yes 2. No

20a. If yes whyfi _____

20b. If no whyfi _____

21. How much salt do you buy at a timefi_____

22. How often do you buy saltfi_____

23. Where do you buy salt fromfi_____

24. Is there anything written on the salt packaging you buyfi [_____]

1. Yes 2. No

25. How do you usually store saltfi [_____]

1. In open packing
2. In a container without a lid
3. In a container with a lid closed
4. Other (specify) _____

26. When do you add salt to your foodfi [_____]

1. Add prior to cooking
2. Add after cooking
3. Add during cooking

E. SALT SAMPLE

27. Have you used salt in the past 24 hoursfi [_____]

1. Yes 2. No

28. Have you brought a sample of saltfi [_____]

1. Yes 2. No

28a. What type of salt is itfi**Observe** [_____]

1. Fine salt 2. Coarse salt

28b. If available, record the type of original packaging [_____]

1. Plastic
2. Paper
3. Metal Container
4. Not available **Ask for the salt sample if available**

28c. If available record the brand _____

28d. Is the salt labelled iodatedfi [_____]

1. Yes 2. No

Please Enumerator, ask for a salt sample, if available

Any comments:

_____

The End

Thank You For Your Participation

Appendix 4: Ethical Clearance

TROPICAL DISEASES RESEARCH CENTRE
Tel/Fax +260212615444
tdrc-ethics@tdrc.org.zm
P O Box 71769
NDOLA, ZAMBIA

TDRC ETHICS REVIEW COMMITTEE
IRB REGISTRATION NUMBER: 00002911
FWA NUMBER: 00003729

30th July, 2013

The Principal Investigator

LUSAKA

Dear Mrs. Kabaghe

RE: APPROVAL OF PROTOCOL

Reference is made to your protocol entitled **"Iodine deficiency survey in pregnant women in Zambia."**

On behalf of the Chairman of the TDRC Ethics Review Committee, I am pleased to inform you that your protocol was reviewed and approved at the meeting held at TDRC on 27th July, 2013.

Your study number is **TDRC/ERC/3007/48/13**

For any amendments to the protocol or informed consent forms during the execution of the study, you should seek approval from the TDRC Ethics Review Committee.

You are required to submit at least two (2) progress reports annually. A final report to the Ethics Review Committee should also be submitted at the end of the study.

This approval is valid until 26th July, 2014.

The Committee wishes you and your team success in the execution of the study.

Yours sincerely
TROPICAL DISEASES RESEARCH CENTRE

Eric M. Njunju, Bsc, Msc
SECRETARY-TDRC ETHICS REVIEW COMMITTEE

cc: Secretary-STC

TROPICAL DISEASE RESEARCH CENTRE
ETHICS REVIEW COMMITTEE
30 JUL 2013
P.O.BOX 71769
NDOLA, ZAMBIA

Appendix 5: Informed Consent Form

Informed Consent Form

Title of Project: Iodine Deficiency Survey in Pregnant Women in Zambia
Investigators: Ms Gladys Kabaghe
Study Sponsors: USAID and UNICEF
Participants: Pregnant women (15-49 years)

Part I: Information Sheet

Purpose

The National Food and Nutrition Commission is conducting a study to determine the number of pregnant women suffering from iodine deficiency, the number of pregnant women accessing salt that is fortified with iodine and the amount of iodine in the fortified salt. Iodine Deficiency in pregnancy affects both the mother and the foetus; however adverse effects are much more serious on the foetus especially on brain development, which can result in permanent mental retardation and poor learning capacity in children. To combat iodine deficiency in Zambia, a law was put in place for edible salt to be fortified with iodine and this has been going on for a number of years. The purpose of the study is to find out whether the salt iodisation programme is successful in combating iodine deficiency in pregnancy by meeting the iodine needs of the pregnant women.

Procedure

If you agree to participate in the study, you will be asked to provide a sample of about 10 – 20 ml of urine at your health facility. The urine will be tested for iodine at a laboratory. We will also request that you come to the health facility with a salt sample from your home for testing for presence of iodine.

Risks

There is no risk associated to this study.

Benefits

The benefits of participating are that the information that will be generated from this study will be used to assess the magnitude of iodine deficiency in pregnant women thus assist in planning for improvements of the program if there will be need and preventing irreversible brain damages in children.

Confidentiality

Information on identity of the study participants will be kept confidential.

Right to refuse or withdraw

Your decision whether or not to participate in this study will not negatively affect you in any way. If you agree to participate in this study, you are free to withdraw at any time for any reason.

Costs/Compensation

You will not be charged for your participation in the study. All costs associated with the study will be paid by the sponsor. You will not receive any payment to take part in the study.

Complaints

Should you wish to raise any ethical issues you may be concerned about please contact the chairman of the TDRC Ethics Committee Dr T G Ngulube at Box 320168, Lusaka, phone 0955914844.

Part II: Certificate of Consent

I have been asked to give consent for me to participate in the study entitled "Iodine Deficiency Survey in Pregnant Women in Zambia" which will involve for me to give a urine sample. I have read/or it has been read to me and understood the forgoing information. I have had the opportunity to ask questions and I was given satisfactory answers to my questions.

Name of participant _____

Signature of participant _____

Signature of presenter_____

Date _____

I have witnessed the accurate reading of the consent to the participant and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Signature of witness _____

Thumbprint

For further information Contact;
National Food and Nutrition Commission
P.O. Box 32669 Lusaka.
Tel: 211-227803
Fax: 211 221426
Website: www.nfnc.org.zm