



Iodine Deficiency Disorder Control Programme Impact in Pregnant Women and Status of Universal Salt Iodization

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(Received 22 Jan 2011; accepted 17 Jun 2011)

Abstract

Background: Several studies pertaining to current status of Iodine Deficiency Disorder Control Programme in India have revealed goiter prevalence in the range of 1.5- 44.5%, mean urinary iodine excretion level ranging from 92.5-160 mcg/L and iodized salt coverage ranging from 37-62.3%. Most of these studies were based on school children. However, very few studies have focused on pregnant women. This population is very sensitive to marginalized iodine deficiency throughout their gestational period.

Methods: This 40 cluster cross sectional study was done in Raipur district. Iodine content of salt was estimated by using "Rapid Salt Testing Kits" along with observing salt storage practices, at household and in shops. Pregnant women were interviewed by using semi structured comprehensive questionnaire, which was based on knowledge attitude, and practices about salt use pattern and awareness about IDDCP, UIE level were also estimated.

Results: Prevalence of goiter was 0.17%. Many (41.12%) pregnant women had <15ppm iodine content in the salt sample and 51.58% of women had subnormal iodine uptake. Wrong salt storage practice was observed in 36.3% of households.

Conclusions: There were lacunae in Iodine deficiency control program in Chhattisgarh. Implementation and monitoring of program was weak. Thus for monitoring purpose IDD Cell & IDD Laboratory should be established at district level. This will lead to periodic assessment of Iodine Deficiency Disorders, by monitoring of Iodine intake and all other preventive, promotive as well as curative measures in the state.

Keywords: *Iodine Deficiency Disorder Control Program (IDDCP), Monitoring, Evaluation, Goiter, Universal Salt Iodization (USI), Median Urinary Iodine Excretion (MUIE)*

Introduction

India's National Goiter Control Program (1962) was renamed as Iodine Deficiency Disorder Control Program (IDDCP) in 1992 (1). All over the country extensive monitoring system has been established to document changes in the disease burden as well as salt quality and urinary iodine excretion levels in general population. In Chhattisgarh also, Government had introduced the scheme of distributing iodized salt through public distribution system (PDS) ('Chhattisgarh Amrut Namak') to below poverty line population. It was priced at 25 paisa per kg (2).

As per joint recommendation by WHO/UNICEF/ICCIDD, to assess the impact Iodine Deficiency Disorder Control Program (IDDCP), cluster surveys is recommended for iodine status assessment at the community level, carried out in either households or schools. School-age children are surveyed to assess iodine status because of their easy accessibility, and their iodine status represents the iodine status of general population (3). However, in India, national system of monitoring of IDDCP also includes pregnant women (4). Various studies across the country have revealed goiter prevalence in the range of

1.5- 44.5% (5-8) , mean urinary iodine excretion level ranging from 92.5-160 mcg/L (9-11) and universal salt iodization ranging from 37- 62.3% (6, 9, 12). Very few studies have focused on pregnant women. These too do not reflect the true picture, as these were hospital based. Dietary intake of iodine critical during pregnancy, deficiency can result in abortions, stillbirths and the birth of mentally retarded babies.

In 10th Five Year Plan Govt. of India plan to achieve following objectives under the technical guidance of ICCIDD as follows

1. Achieve universal access of iodized salt.
2. Generate district wise data on Iodized salt consumption, and
3. Reduction in the prevalence of Iodine Deficiency Disorders in the country to less than 10% by 2010 (4).

These indicators are summarized in Table-1 (4).

Table 1: Revised Policy Guidelines on National Iodine Deficiency Disorders Control Program

S.No.	Indicators	Goals
1.	Proportion with enlarged thyroid (Goiter) Urinary iodine	<5%
2.	Proportion below 100 µg/L Proportion below 50 µg/L	<50% <20%
3.	Salt iodization Proportion of households using adequately iodized Salt (Universal Salt Iodization).	>90%

Against this background present community based study was conducted in Raipur district of Chhattisgarh with following objectives:-

- 1) To estimate the prevalence of goiter and iodine uptake status among pregnant women of study area.
- 2) To determine the iodine content of edible salt at household and retail shop level in study area.
- 3) To ascertain the awareness and practices of pregnant women about Iodine Deficiency Disorders.

Material and Methods

This community based cross sectional study was conducted in Raipur district covering both urban and rural areas. Due representation was given to tribal population in rural clusters. Data collection

was done in from 15th December 06 to 15th September 2007. First, a survey team was formed comprising clinician, technician, and interviewers as local health worker (Male/Female) along with health supervisor (Male/female). Training and briefing of survey team was done by investigator, before data collection. Semi structured questionnaire were pretested on pilot basis in the study area to validate interview Performa. It was observed practically little difference would result if the cluster size will increase from 30 (as recommended jointly by WHO/ICCIDD/ UNICEF) to 40 clusters (13). Hence, for better representation of study subjects in study area we opted for 40 cluster sampling method. In Raipur district 32% population resides in urban area and 68% in rural areas (Census 2001) (14). Accordingly, it was decided to take 32% clusters from urban areas and 68% clusters from rural areas. House to house survey was done to collect salt samples for spot assessment of iodization level by “Rapid Salt Testing Kit” (3). Instead of WHO/ICCIDD/ UNICEF joint recommendation 30 study subjects, we have taken 32 study subjects from each cluster to avoid pilferage or loosing samples and data to fulfill prerequisite guideline. In each household, salt storage practices were also observed. Clinical examination of pregnant women was done for screening of goiter by health worker confirmed by clinician. Their urine samples (2-3 ml, in screw tight plastic containers) were collected. Their awareness regarding iodine deficiency disorders were also recorded. In each of the selected cluster, 32 pregnant women were covered. The samples were labeled and transported in suitable media (Thymo1) to the laboratory for detection of ‘Urinary Iodine Excretion’ by “Spectrophotometric- Method” (3). Salt samples were also collected from retail shops (at least 2 from each cluster) for assessment of level of iodization. Here also, the salt storage practices were observed along with collection of necessary information from shopkeepers. Consent was duly taken from respondents. During the study period, the structure of Iodine deficiency disorder control program organization in the state was also observed.

Results

Table-2 shows the profile of the study population. Goiter was detected only in two women (prevalence, 0.17%). One-fourth (25.57%) respondents had history of one or two adverse pregnancy outcomes. Our study reveals that iodine uptake status as reflected by Median Urinary Iodine Excretion (UIE) level among study subject was found unsatisfactory (94 mcg/L), with Urban (90 mcg/L) and Rural (87 mcg/L) (Table 2). About 40% of respondents knew about goiter and out of them only 18.6% were aware that it was because of iodine deficiency in their diet. Many (41.12%) pregnant women had <15 ppm iodine content in their edible salt and 51.58% of study subjects had subnormal iodine uptake as indicated by their UIE level (Table 3). This study emphasize that, history of negative outcome of pregnancy (i.e. Stillbirth and abortion) were observed significantly high (55.14%) in those pregnant women, who had urinary Iodine

Excretion (UIE) level were below acceptable level ($P < 0.05$) (Table 4). 66.26% households were consuming adequately iodized salt whereas wrong storage practice (use of open container) was observed in 36.3% of households (Table 5). Table 6 shows that salt iodine content was found significantly high (68.32%) in samples kept in close container as compare to open container ($P < 0.05$). At the same time we also observed salt iodization level of crystal salt was not satisfactory (<15 ppm) in significant high (52.92%) proportion of household edible salts where as salt iodization was found satisfactory (>15 ppm) in significantly high (68.04%) proportion of powdered salt samples ($P < 0.05$). Half the shopkeepers sold powder and crystal salt and only 27.3% shops followed ideal salt storage practice. Majority (57.6%) of shopkeepers were not aware about iodized salt and most (84.8%) of them were not aware about legislation regarding iodized salt. There was no IDD cell at state level. No IDD labs were there in the state.

Table 2: Profile of pregnant women under study

	Area			Total (n=1177) n (%)
	Urban (n=340) n (%)	Rural (n= 581) n (%)	Tribal (n= 256) n (%)	
Age group				
<20 Yrs	99(29)	169(29.08)	74(28.9)	342(29.05)
21-30 Yrs	233(68.52)	399(64.67)	166(64.84)	798(67.80)
>30 Yrs	8(2.35)	13(2.24)	16(6.54)	37(3.15)
Literacy status				
Illiterate	78(22.94)	165(28.39)	108(42.18)	351(29.82)
Up to primary	89(26.18)	194(33.39)	92(35.93)	375(31.86)
> 8 th	173(50.88)	222(38.2)	56(21.87)	451(38.32)
Caste				
General	99(29.11)	138(23.75)	43(16.8)	280(23.8)
Schedule Tribe	47(13.82)	54(9.3)	130(50.8)	231(19.62)
Schedule Caste	172(50.58)	373(64.2)	81(31.64)	626(53.18)
Other Backward class	22(6.48)	16(2.75)	2(0.8)	40(3.4)
Type of family				
Nuclear	125(36.76)	158(27.19)	79(30.86)	362(30.75)
Dietary habit				
Vegetarian	275(8.08)	441(75.9)	16(6.25)	732(62.19)
Parity				
Primi	119(35)	178(30.64)	98(38.21)	395(33.55)
2nd Gravida	99(29.11)	172(29.6)	76(29.68)	347(29.48)
Parity 3 or More	122(35.88)	231(39.76)	82(32.06)	435(36.97)
Phase of pregnancy				
1st Trimester	61(17.94)	99(17.0)	46(17.96)	206(17.5)

Table 2: Countinued...

2nd Trimester	128(37.64)	286(49.22)	118(46.1)	532(45.2)
3rd Trimester	151(44.42)	196(33.78)	92(35.94)	439(37.3)
History of negative outcome in previous pregnancies				
History of negative outcome in previous pregnancies	86(22.64)	141(16.86)	74(25.9)	301(25.57)
Source of getting salt by respondents				
Public Distribution System	91(26.76)	201(34.66)	173(67.56)	465(39.5)
Retail Shops	226(66.47)	339(58.34)	69(26.95)	634(53.86)
Anganwadi Centers	23(6.76)	41(7.0)	14(5.46)	78(6.64)
Median Urinary Iodine excretion status (MUIE) of respondent				
	90mcg/L	87mcg/L	116mcg/L	94mcg/L

Table 3: Association of urinary iodine Excretion with Salt iodine content consumed by pregnant women

Area	Salt iodine content	Urinary Iodine Excretion level within acceptable limits		
		NO n. (%)	YES n. (%)	Total n. (%)
Urban	< 15 PPM	70(53.84)	60(46.16)	130(100)
	>15 PPM	127(60.48)	83(39.52)	210(100)
	Total	197(57.94)	143(42.06)	340(100)
				$\chi^2 = 3.4, df = 2, P = 0.2$
Rural	< 15 PPM	148(62.24)	89(37.76)	237(100)
	>15 PPM	174(50.6)	170(49.4)	344(100)
	Total	322(55.52)	259(44.58)	581(100)
				$\chi^2 = 8.066, df = 2, P = 0.018$
Tribal	< 15 PPM	85(73.27)	29(26.73)	116(100)
	>15 PPM	24(17.15)	107(81.9)	140(100)
	Total	109(42.58)	136(57.42)	256(100)
				$\chi^2 = 81.79, df = 2, P = 0.0002$

Table 4: Association of Urinary Iodine Excretion level with history of still birth and abortion in pregnant women

History of stillbirth and abortion	Urinary Iodine Excretion level within acceptable limits			Statistical interpretation
	NO n. (%)	YES n. (%)	Total (%)	
No	452(51.20)	424(48.39)	876(100)	$\chi^2 = 10.233, df = 2, P = 0.006$
Yes	166(55.14)	135(44.84)	301(100)	
Total	618(52.5)	516(47.50)	1177(100)	

Table 5: Results of household survey about salt use pattern and iodine content

Salt use pattern and iodine content	Area			
	Urban (n=1168)	Rural (n= 2143)	Tribal (n= 1171)	Total (n=4482)
Salt iodine content ($\chi^2 32.51, df 2, P < 0.05$)				
< 15 PPM	353(30.22)	686(32.0)	473(40.40)	1512(33.75)
> 15 PPM	815(69.78)	1457(68.0)	698(59.60)	2970(66.26)
Total	1168(100)	2143(100)	1171(100)	4482(100)
Type of salt ($\chi^2 8.822, df 2, P < 0.05$)				
Crystal Salt	102(8.74)	156(7.28)	120(11.2)	378(8.44)
Powder Salt	1066(91.26)	1987(92.72)	1051(88.8)	4104(91.56)
Total	1168(100)	2143(100)	1071(100)	4482(100)
Salt storage practices ($\chi^2 140.15 df 2, P < 0.05$)				
Open Container	257(22.0)	891(21.58)	480(41.0)	1628(36.32)
Close Container	911(78.0)	1252(78.42)	691(59.0)	2854(63.67)
Total	1168(100)	2143(100)	1171(100)	4482(100)

Table 6: Association between salt iodine content with storage practices and type of salt at households

Type of container	Salt iodine content		Total	Statistical interpretation
	< 15 PPM	> 15 PPM		
Open container	608(37.2)	1020(62.7)	1628(100)	$(\chi^2 14.91 \text{ df } 2, P<0.05)$
Close container	904(31.67)	1950(68.32)	2854(100)	
Total	1512(33.73)	2970(66.27)	4482(100)	
Type of salt	< 15 PPM	> 15 PPM	Total	Statistical interpretation
Crystal Salt	200(52.92)	178(47.08)	378(100)	$(\chi^2 67 \text{ df } 2, P<0.05)$
Powder Salt	1312(31.96)	2792(68.04)	4104(100)	
Total	1512(33.73)	2970(66.27)	4482(100)	

Discussion

Adequacy of National Iodine Deficiency Disorder Control Programme (NIDDCP) is reflected by achieving goal of universal salt iodization as iodized salt coverage should be >90%, our study area fail to meet these standards; hence the goal of universal salt iodization was not achieved in Raipur district of Chhattisgarh. Only 66.26% households were consuming adequately iodized salt as against the goal of >90% decided by National Iodine Deficiency Disorder Control Programme (NIDDCP). In a similar study in Assam, Patowary et al. reported 53.05% households were consuming adequately iodated salt (15). Unlike our study, which reported a range of 40-52% various hospital based studies reported that 22-30% women had subnormal iodine uptake (11, 16, 17). A higher (18.5%) prevalence of goiter in pregnant women was reported Yadav et al. (18) probably because it was a hospital based study.

Our study also revealed that soft component of the program i.e. health education of the masses was found to be unsatisfactory as only 39.6% of respondents were aware about goiter as a problem. Out of all respondents only 18.6% were aware that goiter is because of iodine deficiency in the diet. Such ignorance was quite high in women of Ethiopia (more than 90%). This indicates that in other countries also public participation in the program implemented by government is inadequate (19-22).

In all the areas, plastic container was more popular for storage of edible salt. Open container

may lead to loss of iodine from edible salt. This harmful practice was observed in 36.33% of households. In retail shops of study area 50% of shopkeepers sold both powder and crystal salt. It is a matter of concern that more than 8% of people consumed crystal salt despite government ban on sale of non-iodized salt. Iodine content of crystal salt is poorer and unpredictable. Our analysis revealed that iodine content of crystal salt was significantly lower than powdered salt. Sankar et al (19) reported even a higher (28%) use rate of crystal salt in Bihar.

As per the standard guidelines jute coated with plastic inside is ideal for storage of larger quantity of salt for long duration as done in retail shops. In the present study, it was observed that only 27.3% shops followed ideal storage practice. Besides this, the retail shops were still the main source of getting edible salt despite government's effort to supply edible iodized salt by public distribution system, which focused only on BPL families.

Another matter of concern was that even in powdered salt iodine content was below acceptable limit in 32% household salt samples. This may be due to faulty storage practices at shopkeeper level or at the household level. Both these lacunae were observed in our evaluation. This also reflects the weak monitoring of the program. This situation is responsible for consumption of low or nil iodine containing salt by pregnant women. This in turn results in adverse obstetric outcome as reflected in our results also i.e. significant association of history of stillbirth and abortion in previous pregnancies with low

UIE levels, Significantly more (55.14%) pregnant women who gave such history had UIE level below acceptable limits in comparison to those with no such history ($P < 0.05$). Similar findings were reported from Ethiopian (16.7%) and Australian (50%) studies (23, 24).

Ideally, as per the Iodine Deficiency Disorder Control Programme provisions the Indian citizens should consume salt with adequate iodine content. But this was not witnessed in our study in Chhattisgarh, as gaps at various levels were observed. In fact, as per the law, non-iodized salt should not be available to general public. We found that single salt supply system which is essential to ensure universal iodization did not operate in Chhattisgarh. Crystal salt was accessible and was being used by the study population. The powdered salt should be dispensed in all retail shops. Salt should be stored properly at shopkeeper and household level. Awareness as well as proper salt storage practice was lacking equally among shopkeepers and consumers. Tribal population was more disadvantaged in this context as significantly more of them had < 15 PPM iodine content in their salt. Possibly this was due to the fact that more of them used crystal salt (11.2%) and used open container (41%) for salt storage as compared to their rural and urban counterparts.

For effective implementation of National Iodine Deficiency Disorder Control Programme, the Union Government had decided to establish IDD control cells in all the states during 7th Five Year Plan (4). But as of 2006 out of 28 states 10 had no IDD labs and 2 had no IDD cells. The weak monitoring and implementation of Iodine Deficiency Disorder Control Programme in Chhattisgarh can be explained by the fact that, requisite mechanisms have not been established yet e.g. IDD cell and IDD lab.

Our study highlights many lacunae in context with implementation of Iodine Deficiency Disorder Control Programme in Raipur district of Chhattisgarh. Iodine uptake status of majority of pregnant women was not satisfactory. This indicates the study area might be at high risk of be-

coming endemic zone for Iodine Deficiency Disorders. Universal salt (USI) iodization was not up to the mark in the state, whether the scenario is similar in other districts or even worse, needs further exploration. For better monitoring of level of Iodization of edible salt at the consumer level, "Rapid salt testing kits", be made available at village level. The target study group was ignorant about the existence and benefits of iodized Salt. It seems that the felt need of using iodized salt was not translated into community demand. The ongoing IEC activities linked with a BCC effort needs to be augmented in order to generate a strong community demand for iodized salt in the tribal dominated state of Chhattisgarh. The present study was confined to pregnant women, highlights the need to assess endemicity, especially in other vulnerable group (i.e. School-aged children). Further by establishing IDD Cell & district-level IDD Laboratories to monitor the iodine intake of the vulnerable groups. The establishment of IDD cell will ensure the periodic assessment of Iodine Deficiency Disorders along with other preventive, promotive and curative measures in developing nations like India.

Recommendations

We are now living in 21st century. Such reports of defaults in Iodine Deficiency Disorder Control Programme have been reported regularly in various studies conducted over last 2 decades, Rather it has become, more or less an accepted thing. We can no longer afford to be lax about enforcement of laws pertaining to iodized salt. Sale of non-iodized salt should be penalized. Fine should be imposed on shopkeepers who sell non-iodized salt. Similarly, both shopkeepers as well as consumer need to be educated about Iodine Deficiency Disorder Control Programme. Therefore, we strongly recommend for establishment of IDD cell and lab in the state to ensure effective monitoring the program with special emphasis on proper salt storage practices (both at shop and household level) and on ensuring adequate iodine content in the salt.

Ethical Considerations

Ethical issues including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc. have been completely observed by the authors.

Acknowledgements

Special thanks to UNICEF Chhattisgarh, who supported us, by providing 'Rapid Salt Testing kit' free of cost for this study. The authors declare that there is no conflict of interests.

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