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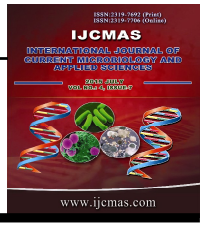

Original Research Article

Status of Consumption of Iodized Salt in Rural Population in District Bareilly, U.P. India

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Keywords

Iodine deficiency disorder, Iodized salt, Households, Spot Testing Kit

A B S T R A C T

The present study was aimed to estimate the consumption of adequate-iodized salt and to assess the utility of the 'spot testing kit' for the quantitative estimation of iodine in salt at the household level. The cross-sectional study was conducted in the field practice area of the Rural Health Training Center under Shri Ram MurtiSmarak-Institute of Medical Sciences (SRMS-IMS), Bareilly. The sample size calculated was 379 for the households. Number of households from each village was selected based on population proportional sampling technique and within each village, households were selected by Simple Random Sampling. 42.0 % of the households were consuming adequately iodized salt, while about 44% of the households were consuming inadequately iodized salt. Nearly 14% of the households were consuming salt with nil iodine. One-fourth of the study population (25.59%) knew about the benefits of using iodized salt. Practice regarding storage of salt was found poor as approx. 2/3rd of the households were storing the salt on the floor and in open containers. More than half of the households were consuming salt with low or no iodine. Regular community-based awareness activities regarding the benefits of iodized salt can be conducted through peripheral health workers.

Introduction

Iodine deficiency disorders in India are mainly due to environmental factors viz. deficiency of iodine in soil which is caused by washing of top soil by rains, glaciers and snows from the mountain regions down the rivers to the sea. Flood water also takes up iodine and multiple cropping practices on the same soil deplete soil iodine. Total quantity present in the body is 15–20 mg mostly in the thyroid gland. Iodine needed in minute quantities daily is 150 µg; it is just as much as is contained on a pin head. Global Iodine Deficiency Disorders Preventive Day is being celebrated on 21st October and the following week till 27th October is observed as Global IDD Week, which emphasizes the daily consumption of Iodized salt.

The govt. of India launched the National Goiter Control Program (NGCP). It aimed at

replacement of ordinary salt by iodized salt, particularly in the goiter endemic regions. The program of universal iodization of edible salt was started from April 1986 in phases with the aim of total salt iodization by 1992. In 1992, the NGCP was renamed as national Iodine Deficiency disorders Control Program.

The magnitude of the problem in India is far greater than what had been estimated in 1960, when it was estimated that about 9 million persons were affected by goiter. Results of sample surveys conducted in 325 districts covering all the states/ UTs have revealed that 263 districts are endemic where the prevalence of IDD (Iodine Deficiency disorders) is more than 10 per cent. It is estimated that >71 million persons are suffering from and other IDD in the country (Ministry of Health and Family Welfare, Annual Report 2009–2010).

Iodine in iodized salt is ascertained by two methods i.e. Spot test in field condition and Iodometry in a laboratory. For the 'spot test for iodine estimation', the most commonly used kit provided by the Government of India for 'on the spot' estimation of iodine is manufactured by a Madras based company (Spot test kit/ MBI kit).

Universal iodization of salt, the mainstay of the intervention, was made compulsory in India in 1998, although it was revoked in 2000 and again reinstated in 2005 (http://pib.nic.in/archieve/lreleng/lyr2000/rmay2000/r11052000.html). Various societal, economic and demographic factors may have differential influences on this practice (Jooste *et al.,* 1995). Identification of such factors that influence the accessibility of iodized salt is, thus, essential as it would allow us to formulate a better prevention policy and intervention measures.

With this background, the study was carried out to: estimate the consumption of adequate-iodized salt and to assess the utility of the 'spot testing kit' for the quantitative estimation of iodine in salt at the household level in the field practice area of the Rural Health Training Center under Shri Ram MurtiSmarak-Institute of Medical Sciences, Bareilly.

Materials and Methods

Study area and study population:

The community-based, cross-sectional study was carried out inthe field practice area of the Rural Health Training Center (RHTC), DhauraTanda under Shri Ram MurtiSmarak-Institute of Medical Sciences (SRMS-IMS), Bareilly. The samples were collected from thehouseholds of the entire area under the Rural Health Training Center having 8706households in 24 villages.

Sample size and sampling technique:

A survey conducted by the Government of India and UNICEF in 2009 reported the national coverage of adequately iodized salt at the household level to be 71.1%. While, in the rural area, it was 66.1% (Krishnan *et al.,* 2010). Considering the prevalence of consumption of adequately iodized salt in the household to be 66.1%, absolute precision of 5%, and a confidence interval of 95%, the sample size calculated was 379 for the households. A population wise list of all the villages was generated and number of households from each village was selected based on population proportional sampling technique and within each village, households were selected by Simple Random Sampling. Salt samples were collected from selected households.

Materials and Methods

Salt samples (50 grams of cooking salt) were collected from the selected households by the field workers of the health system working in the study areas in airtight plastic containers, stored in brown paper envelopes and coded accordingly. Household members were also interviewed about storage, source of purchasing the salt and health befits of iodized salts etc.

A pre-tested questionnaire was used for the interview of the head member of the households. The iodine content of the salt samples in parts per million (ppm) was estimated using spot-testing kit.

For further quantitative testing of iodine these samples were transported to the Research laboratory in the Department of Community Medicine, SRMS-IMS for iodometric titration (gold standard method) (ICCIDD, 2007). The test results of titrimetric method were compared with those of the rapid test kit. Adequate iodine content in salt sample was taken when the iodine level was ≥15 ppm.

Statistical analysis

Collected data were entered into Microsoft Excel 2010 and analyzed using IBM SPSS v 20.0.0. The percentages were used to summarize the data and Chi-square test was used as a test of significance. Statistical significance was set at *a P value* less than 0.05.

Ethical issues

All the participants were informed about the purpose of the study and written consent was taken from the participants and confidentiality was maintained with their personal information and their participation before initiation of the study.

Results and Discussion

In the present cross-sectional study, we found that the majority of the population who was Graduate or more was consuming adequately iodized salt and the association between adequately salt consumption and education was found statistically significant. More than half of the households (56.5%) having family size ≤3 were consuming adequately iodized salt (Table 1).

We observed that more than half of the population (55.15%) had heard about iodized salt and 22.43% population had heard about some iodine deficiency disorders. One-fourth of the study population (25.59%) knew about the benefits of using iodized salt. The proportion of knowing the name of any iodized salt brand and knowledge about prohibition of use of non-iodized salt was 11.61% and 5.54% respectively.

The proportion of the population who had heard regarding iodized salt as well as who know the benefits of iodized salts was higher and also were using properly iodized salt. We found this association statistically highly significant (Table 2).

Regarding practices about the use of iodized salt by the study households, it was observed that most of the households were using salt in powder form (72.30%) and most of them (84.70%), they purchased the salt from the shop. More than 2/3rd households (69.39%) had purchased the salt in sealed form. Practice regarding storage of salt was found poor as approx. 2/3rd of the households were storing the salt on the floor and in open containers. The association of consumption of adequately iodized salt with all the practices was found statistically significant (Table 3).

The results obtained by use of the MBI - kit were compared with the results obtained from gold-standard titration method. It was observed that MBI-kit method for quick results in the field was 88% sensitive and 19% specific in detecting iodine content of above 15ppm. It was also observed that the predictive value of rapid test using MBI-kit was 60% for positive results and 54% for negative results (Table 4).

The present study showed that 42.0 % of the households were consuming adequately iodized salt, while about 44% of the households were consuming inadequately iodized salt. Nearly 14% of the households were consuming salt with nil iodine. By Srivastava *et al.* (2012), an iodine content of 0 ppm was found in 13.2% of the household while 21.6% of the households were consuming salt with <15ppm. Remaining 65.2% of the households were consuming iodized salt with iodine content of more than 15ppm (adequately iodized salt). According to the IDD newsletter (2011), Iodized salt consumption at the household level in India in 2009, 71.1 percent of the households were using cooking salt which was iodized at the recommended level of 15 ppm or more. Only 9.3 percent of the households used salt that was not iodized at all and 19.3 percent used salt that was iodized inadequately (<15 ppm) (IDD newsletter, 2011). Another national level survey in 2005-06 (NFHS III) reported the coverage of adequately iodized salt to be 41.2% in rural India (IIPS, 2007).

Table.1 Socio-demographic profile of the study subjects and consumption of iodized salt

		>15	<15	Uniodized	Total	Chi Square	p Value
Total		**159**	**166**	**54**	**379**		
Education	Graduate and above	37	23	6	66	10.525	0.0324
	Upto 12th standard	41	54	11	106		
	Illiterate	81	89	37	207		
Religion	Hindu	76	75	30	181	1.758	0.4152
	Muslim	83	91	24	198		
Caste	General	38	31	13	82	4.041	0.4005
	OBC	99	107	37	243		
	SC/ST	22	28	4	54		
Family Size	≤ 3	13	6	4	23	3.598	0.7309
	4 - 5	40	46	16	102		
	6 - 7	48	51	16	115		
	8+	58	63	18	139		
Socioeconomic Status (Modified B G Prasad; Nov'14)	I	24	13	6	43	6.93	0.5442
	II	42	36	13	91		
	III	59	69	22	150		
	IV	22	31	9	62		
	V	12	17	4	33		

Table.2 Knowledge regarding iodized salts in the study population

Knowledge	Iodine cons. By iodometry in PPM						Total		X^2	P-value
	> 15		<15		0					
	No.	%	No.	%	No.	%	No.	%		
Heard About Iodized Salt	104	49.76	76	36.36	29	13.88	209	55.15	12.699	0.00175
Heard About any Iodine Deficiency Disorders	29	34.12	41	48.24	15	17.65	85	22.43	2.984	0.22492
Know the benefits of Iodized Salt	57	58.76	25	25.77	15	15.46	97	25.59	18.588	0.00009
Know the name of any Iodine Deficiency disorders	21	32.81	29	45.31	14	21.88	64	16.89	4.717	0.09456
Know any Brand of Iodized Salt	18	40.91	19	43.18	7	15.91	44	11.61	0.114	0.94459
Know that Non Iodized Salt is Prohibited	9	42.86	9	42.86	3	14.29	21	5.54	0.009	0.99551

Table.3 Practices regarding iodized salt in the study population

Practice		>15		<15		0		Total		X^2	P-value
		No.	%	No.	%	No	%	No.	%		
Type of Salt Used	Powder	122	44.53	108	39.42	44	16.06	274	72.30	8.174	0.01679
	Crystal	37	35.24	58	55.24	10	9.52	105	27.70		
Salt purchasing source	Shop	146	45.48	128	39.88	47	14.64	321	84.70	13.834	0.00099
	Vendor	13	22.41	38	65.52	7	12.07	58	15.30		
Salt purchased form	Sealed	119	45.25	103	39.16	41	15.59	263	69.39	7.525	0.02323
	Open	40	34.48	63	54.31	13	11.21	116	30.61		
Salt storage	Cupboard	73	53.68	52	38.24	11	8.09	136	35.88	14.098	0.00087
	Floor	86	35.39	114	46.91	43	17.70	243	64.12		
Salt container	Closed airtight	78	56.12	47	33.81	14	10.07	139	36.68	18.18	0.00022
	Open	81	33.75	119	49.58	40	16.67	240	63.32		

Table.4 Results obtained by both methods

Spot testing kit (MBI-kit)		Iodometry (iodine cons. in PPM)		Total
		<15	>15	
Results (iodine cons. in PPM)	<15	194	129	323
	>15	26	30	56
Total		220	159	379

Sensitivity = (194/220) x 100 = 88.18%
Specificity = (30/159) x 100 = 18.87%
PPV = (194/323) x 100 = 60.06%
NPV = (30/56) x 100 = 53.57%

Fig.1 Map of study area of 24 villages under RHTC

We observed that approximately half of the population (55.15%) had heard about iodized salt and approx. A quarter of the population (22.43%) had heard about some iodine deficiency disorder. One-fifth of the study population (25.59%) knew about the benefits of using iodized salt. Amongst the households having expected right practices, the proportion of correct practices were higher amongst those consuming aptly iodized salt having iodine in the concentration of more than 15ppm at the

consumer end and the proportion reduced as the iodine content of salt fell to below 15 ppm and lesser for non-iodized salt.According to Tapas *et al.* (2010), the consumption of iodized salt was higher among those who were aware of any IDD (PR: 1.2, 95% CI 1.1-1.3) and iodized salt (PR: 1.2, 95% CI 1.1-1.4) and its benefits (PR: 1.2, 95% CI 1.1-1.3).

The study observed that the MBI-kit (Spot Testing Kit) method for quick results in the field was 88.18% sensitive and 18.87% specific in detecting iodine content of above 15ppm. It was also observed that the predictive value of rapid test using MBI-kit was 60.06% for positive results and 53.57% for negative results. According to Umesh Kapil *et al.* (1996), the sensitivity and specificity of STK was 96.5% and 25% respectively. In their study, they also observed the Positive Predictive Value and Negative Predictive Value of the kit and that were 90% and 48% respectively.

Conclusion

The present study identified that more than half of the households were consuming salt with low or no iodine. Our study also revealed that for quantitative estimation, STK had a high sensitivity but low specificity. The STK can be utilized as a quantitative method for assessment of iodine content of salt only for the purpose of monitoring the quality of salt available to the community. For monitoring the quality of iodized salt in the community it is necessary to analyze a large number of salt samples to visualize the trend. Regular community-based awareness activities regarding the benefits of iodized salt can be conducted through Anganwadi workers (community-based front line voluntary workers), auxiliary nurse midwives, nongovernment organizations, self-help groups and schools. The findings of our study will help the policy makers to modify the existing programs/ services that is running more than two decades in order to curb down the problem related to consumption of iodized salt in the community.

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