International Journal of Home Science 2016; 2(3): 417-419

International Journal of Home Science

ISSN: 2395-7476
IJHS 2016; 2(3): 417-419

www.homesciencejournal.com
Received: 09-07-2016
Accepted: 10-08-2016

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Iodine content of salt samples collected from rural households of Gonda and Barabanki districts of Eastern U.P.

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Abstract
Salt is the most popular seasoning and a source of dietary mineral essential for life. Iodine is an essential trace element required for human growth and development and necessary for production of thyroid hormones. In our country the soil is deficient in iodine therefore, its supplements are required. A diet deficient in iodine is associated with a wide spectrum of illness collectively known as iodine deficiency disorders and goiter is major health consequences of iodine deficiency. Two districts of Uttar Pradesh viz. Gonda and Barabanki were selected randomly through stratified random sampling. 100 households were selected from each block and surveyed through questionnaire method about their practices regarding consumption, storage, purchasing and usage of salt. Glass containers were most commonly (31.5%) used for storage of salt in both districts. Salt sample collected from households were found to have 10.6 to 31.7 ppm iodine. The mean iodine content was found to be higher (25.75 ppm) in salt stored in glass containers and least (13.96 ppm) in the salt stored in gunny bags. The mean iodine content was found to be higher in salt samples collected from respondents who were educated up to intermediate level (27.0 ppm). It was found that 68.5% of studied population was consuming iodized salt. A part of iodine was lost due to careless handling, faulty storage and improper usages practices of salt. Thus there is a need to educate people proper methods of salt consumption, storage and usages.

Keywords: Salt, iodine, salt purchase and storage practices

1. Introduction
Iodine is important for normal functioning of thyroid gland. Iodine is a trace mineral present in the body in minute amount. In our country the soil is deficient in iodine, therefore its supplement is required. Our body contains trace amount of iodine, amounting for approximately 0.0004 percent of body weight.

Iodine is essential trace element required for human growth and development, necessary for production of thyroxin, a hormone which regulates a variety of physiological functions and is critical for optimum development of the brain. About 90 percent of daily requirement of iodine is met by well-balanced diet and 10 percent from drinking water.

Iodized salt is considered as the appropriate measure for iodine supplementation. The advantage of supplementing salt with iodine is that, it is used by all sections of the community irrespective of social and economical status. It is consumed as a condiment at roughly the same level throughout the year. Beside iodized salt, oil injections and water iodization are some of the major preventable measure for combating iodine deficiency, but iodized salt is most accepted method in India. According to prevention of food adulteration act, iodized salt should contain at least 30 ppm iodine at wholesale level (Delange and Hetzel, 2006) [2]. Consumption of iodized salt has soared in developing world over the last decade. In the early 1990s only around 20 percent of households consumed adequate iodized salt but today more than two third of households do so (UNICEF, 2008) [5]. The present study was an attempt to explore the practices of purchase and storage practices of salt. The effect of educational status and storage containers on iodine content of salt was also assessed.

2. Materials and Methods

2.1 Sample Selection and data collection

Two districts namely Gonda and Barabanki of eastern U.P. were purposively selected for the study. There are total 14 developmental blocks each in Gonda and Barabanki districts of eastern U.P. Out of these Nawabganj blocks of Gonda district and Dariyabad block of Barabanki district were randomly selected for collection of sample. There are total 62 and 69 villages in the Nawabganj and Dariyabad blocks, respectively. Out of these five village namely Chikya, Turkauli, Maheshpur, Dullapur, Lolpur were selected randomly from Nawabganj block and Aliyabad, Rampur, Raishab, Bilhari, Gazipur and Kusfer from Dariyabad block of Barabanki district were selected. Twenty respondents were randomly selected from each village, hundred households from each block and total 200 households were selected. A self-structured interview schedule was used as a tool for collection of general information such as name, age, educational status, occupation, monthly family income etc. and specific information regarding household practices of consumption, purchase, storage of salt used etc. through interview from respondents.

2.2 Collection of salt sample

Respondents were asked to provide two table spoons (20 gm) of the salt from their kitchen from the container in which it was stored. Salt sample were collected in self-sealing polythene bags and coding of samples was done. Spot test and quantitative iodine estimation was done in laboratory of the Department of Food Science and Nutrition, N.D.U.A.T., Faizabad using method of (Belling, 1982) [1] and (Tyabji, 1985) [4].

2.3 Statistical Analysis

The data was analyzed in terms of percentage, mean, chi-square and ANOVA (single factor).

3. Results and Discussion

Table 1: General profile of selected households from selected district of eastern U.P.

Particulars		Districts		Total (%)	x^2 value
		Barabanki (%)	Gonda (%)		
Age of respondent (years)	20-30	17	11	14	9.17
	31-40	38	42	40	
	41-50	25	39	32	
	51-60	20	8	14	
Educational status	Illiterate	40	33	31.5	9.48
	Primary	30	26	28	
	High School	17	23	20	
	Intermediate	8	18	13	
	Graduate	5	-	2.5	
Occupation	Service	15	12	13.5	7.59
	Business	17	28	22.5	
	Agriculture	39	42	40.5	
	Any other	29	18	23.5	
Monthly family income (Rs.)	≥8000	42	61	51.5	17.09
	8001-16000	29	32	30.5	
	16000 and above	29	7	18	
Number of Family members	1-5	42	34	38	*
	5-10	50	53	51.5	
	10-15	8	13	10.5	

Chi square value showed statistically significant difference between the respondents with respect to age, educational status, occupation and monthly family income (Table 1). The majority of respondent's i.e. 38 percent in Barabanki and 42 percent in Gonda district were in the age group a 31 to 40 years. The percentage of illiterate respondents in Barabanki district was 40 while, in Gonda district it was 33.The main occupation of the respondents of both districts was agriculture (40.5%) in their own land and only 13.5% of respondents in both districts were in service. The monthly family income of 42 and 61 percent respondents in Barabanki and Gonda district was less than Rs. 8000.

Table 2: Salt utilization pattern of respondents from selected districts of eastern U.P.

Particulars		Districts		Total (%)	x^2 value
		Barabanki (%)	Gonda (%)		
Quantity of salt used per month	1-2 Kg	55	37	46	7.93
	2-3 Kg	45	57	51	
	<3 kg	-	6	3	
Frequency of purchasing salt	Weekly	9	18	13.5	*
	Monthly	20	14	17.0	
	Any other	71	68	69.5	
Source of water used for cooking	Tap	-	-	-	*
	Hand pump	100	93	96.5	
	Bore well	-	7	3.5	
	Pond	-	-	-	
	River	-	-	-	
	Any other	-	-	-	

The data presented in Table 2 regarding salt utilization pattern shows that in Barabanki district 55 percent respondents were using 1-2 kg salt per month while in Gonda district the majority (57%) of respondents were using 2-3 kg salt per month. Hand pump water was used for cooking food in all the households in Barabanki district as against 93 percent in Gonda district.

Table 3: Iodine content of salt samples collected from rural households

Iodine content (ppm)	Districts		Total (%)	x^2 value
	Barabanki (%)	Gonda (%)		
10 – 14	2	7	4.5	16.47
15 – 20	14	3	8.5	
21 – 25	23	29	26	
26 – 30	31	23	27	
<31	19	15	17	
Nil	11	23	17	

Table – 3 shows the iodine content of salt samples collected from both districts. Eleven percent and 23 percent samples collected from Barabanki and Gonda district were found to have no iodine. The cumulative data of both districts showed that 4.5 percent samples contained iodine but it was less than the recommended level i.e. 15 ppm at household level. Whereas, 8.5 percent salt samples in both the districts had iodine upto the mark i.e. between 15 – 20 ppm and 53 percent samples in the two districts had 21 to 30 ppm iodine. Statistical analysis of the data showed significant difference between the districts with respect to iodine content of salt

samples collected from the households and stored as per their practices.

Table 4: Effect of educational status on salt consumption pattern of selected households

Educational status of respondents	No.	Mean of iodine content of salt ppm	x^2value
Illiterate	73	21.82	8.80
Primary	56	24.23	
High school	40	23.99	
Intermediate	26	27.00	
Graduate	5	20.54	

Table- 4 shows that educational status of respondents significantly affected the iodine content of salt samples. The iodine content in salt sample was highest i.e. 27 ppm in samples collected from respondents who were intermediate. It was followed by primary (24.23 ppm), high school (23.99ppm) and illiterate (21.23 ppm). The number of respondents who were educated up to graduation was only five. The education plays a vital role in improving our knowledge thus educational status of mother/ female/house wife might affect salt purchase, storage and consumption practices.

Table 5: Effect of income on salt consumption pattern of selected households

Monthly family income (Rs)	No.	Mean of iodine content of salt ppm	F value
≥8000	103	19.28	52.22
8001-16000	61	26.13	
16001 to above	36	25.54	

Table -5 shows that economic condition has significant effect on iodine content of salt used. There was significant difference in mean iodine values of salt collected from different income groups. The mean iodine content of salts sample was found to be maximum in (26.13 ppm) in families having monthly income between Rs. 8001 – 1600 followed by families having Rs. 1600 and above (25.54 ppm). Least iodine value was observed in families having income below Rs. 8000 per month. The exposure of respondents from high income group might have affected their salt purchase, storage and handling practices. A similar study from Ludhiana by Singh *et al*, 1996 also revealed that the level of iodine in diet was higher in high income group population.

Table 6: Effect of storage containers on iodine content of salt samples collected from selected households

Storage container	No.	Mean of iodine content of salt ppm	F value
Metal container	59	24.70	15.99
Airtight plastic container	34	24.89	
Original packet	12	18.33	
Gunny bag	6	13.96	
Polyethylene bag	16	20.03	
Earthen pot	10	15.24	
Small glass container	63	25.75	

Table – 6 shows that the type of containers used for storage of salt also affected the iodine content. The iodine content of salt stored in small glass container was the maximum i.e. 25.75 ppm, followed by air tight plastic container (24.89 ppm), metal container (24.70 ppm), polythene bags (20.03 ppm), original container (18.33 ppm), earthen were (15.24 ppm) and gunny bags (13.96 ppm), respectively. A study in Assam reported that 80.89 percent and 12.15 percent of the respondents were using plastic or glass jars, respectively and 3.41 percent used earthen pots (Potowary *et al*, 1995) [3].

4. Conclusion

The majority of respondents in both the districts were in the age group of 31-40 years and average 36.5 percent respondents were found to be illiterate and majority (40.5%) respondents were engaged in farming on their own land. Monthly 1-2 kg of salt was used by 55 percent respondents in Barabanki district while, in Gonda district majority (57%) families used 2-3 kg salt per month. No definite trend in the buying behavior of salt of the families was observed. Hand pump water was exclusively used for cooking purpose in Barabanki and only seven percent people in Gonda district were using bore well water. Glass containers were most popular (31.5%) for salt storage followed by metal containers (29.5%), air tight plastic container (17%), earthen pot (81%), original packet (67%), poly ethylene bags (55%) and gunny bags (3%), respectively. Chi square value for iodine content of collected samples shows significant variation and 17% samples did not contain any iodine and 4.5% samples had iodine but it was less than 15 ppm,. Maximum (27 ppm) iodine was found in salt samples collected from respondents who were educated upto intermediate followed by those who were educated upto high school and least iodine value were observed in family below income Rs. 8000/- per month. To conclude people are consuming iodized salt but a part of iodine is lost due to improper storage or handling therefore efforts showed be taken to educate people to improve purchasing storage and consumption pattern of salt.

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