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Iodine Content Of Salt And Drinking Water In Murshidabad District Of West Bengal, India

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Abstract

Iodine is a trace element found in water, plants and soils. Man needs iodine to make thyroid hormone for normal development and functions of the body. In iodine deficient environment, the people do not have enough iodine for the thyroid hormone synthesis and the deficiency of iodine causes several important health consequences collectively called Iodine Deficiency Disorders (IDD). Prevalence of goiter has been reported from Murshidabad district in West Bengal. Present study was undertaken to evaluate the iodine content of edible salt consumed by the people of Murshidabad district along with the measurement of bioavailability of iodine through drinking water. Results showed that 72.4% of the families were consuming iodide salt below the recommended level of 15 ppm. Iodine content in the drinking water indicates that the region is environmentally iodine sufficient or the soil rich in iodine.

Introduction

Trace element iodine is essential for thyroid hormone synthesis. Thyroid hormones help normal development and function of the brain, and maintain body heat and energy. Lack of iodine in the diet leads to visible and invisible spectrum of health consequences known as iodine deficiency disorders (IDD). The sources of dietary iodine are water, food and iodized salt available in the region. Iodine content in the crop is dependent on iodine content of the soil. An indication in the iodine content of the soil can be given by the local drinking water concentration (Hetzel 1989). The dietary source of iodine is not sufficient to fulfill the demand of thyroid gland. Considerable progress has been made in the implementation of the universal salt iodization programme in the countries affected by IDD. Keeping in view of the daily intake of common salt of 10 g by the population in different parts of the country, it is mandatory under National Iodine Deficiency Disorders Control Programme (NIDDCP) that a minimum of 15 ppm of iodine should be present

per gram of edible salt at the beneficiary level to ensure at least 150 µg of dietary intake of iodine per day through the salt. As there is considerable loss of iodine during transportation and storage, hence under NIDDCP it is mandatory that a minimum of 30 ppm should be present in edible salt at the manufacturer's level (Pandav and Anand, 1995). Prevalence of goiter i.e., enlargement of thyroid gland has already been reported in Murshidabad district (Tripathy et al 2013, Tripathy 2013, Tripathy 2015). Reports on the bioavailability of iodine and iodine content of edible salts in this newly found goiter endemic region of Murshidabad district is not available. Therefore the present work was undertaken to observe the distribution of iodine through iodized salt and bioavailability of iodine in a randomly selected area from IDD affected region of West Bengal.

Materials and Methods

Selection of study area

Murshidabad is one of the important and historical districts in West Bengal. There are 26 C D Blocks under 5 sub-divisions in Murshidabad district. Despite the progress of West Bengal in every way there is no significant change observed in Murshidabad district. Poverty and illiteracy are very common. Most of the people are engaged in agricultural activities.

Collection of salt samples

It has been recommended that iodine content of at least 35 salt samples collected at random from a locality represent the valid estimate about the iodine content of the salt of the locality (IDD Newsletter 1994). To get the proper information in each study area, the students of the studied school from each block were instructed in course of survey to carry with them edible salt from their households. At random 35 salt samples were collected from each area in the marked plastic container and brought to the laboratory and kept at room temperature. Subsequently iodine content of the collected salt samples was measured within a week following the iodometric titration method endorsed by WHO (UNICEF/ICCIDD/PAMM/WHO, 1995)

Iodine in drinking water

In each selected area of the respective block, at least four drinking water samples of about 100 ml were collected at random from the available sources i.e., shallow or deep tube wells in wide mouth screw capped plastic bottles for the determination of iodine. The collected water samples were brought to the laboratory and kept at 4° C until analysis. On the day of analysis, the samples were brought to room temperature and the collected samples were measured by its catalytic action on the reduction of ceric ion (Ce^{+4}) to cerous ion (Ce^{+3}) following the method of Karmarkar et al (1986) and the iodine status of the area was expressed following the recommendation of Zeltser et al (1992).

Results and Discussion

The advantage of supplementing with iodized salt is that it is used by all sections of a community irrespective of social and economic status. There are two forms of iodine, which can be used to iodised salt: "iodide" and "iodate" usually as the potassium salt. Iodate is less soluble and more stable than iodide and is therefore preferred for tropical moist conditions. Both are generally referred to as "iodized" salt. Recognizing the importance of elimination of IDD as a health and developmental goal, the government of India launched the National Goitre Control Programme (NGCP) in 1962 and the same was renamed as National Iodine Deficiency Disorders Control Programme (NIDDCP) in 1992. Government of India adopted the policy of universal salt iodization (USI) in 1984 under which the entire population of the country is to receive edible salt with a minimum of 30 ppm of iodine at the manufacturer's level and 15 ppm at the consumer's level. To bring uniformity in implementation and to ensure the further success of universal salt iodization in all states, the Government of India in 1998 implemented a central legislation-banning sale of non iodized salt for edible purposes in the entire community. However in the year 2000, due to political compulsions, the Government of India withdraw this central legislation (Kapil 2005). But on 27th May 2005 Government of India re imposed the ban on the sale of noniodized salt for human consumption in the entire community (Pandav 2005).

In the present study, the iodine content of the salt samples was categorized into four groups i.e., number of samples without iodine, number of samples below 15 ppm, in between 15-30 ppm and above 30 ppm. However, no sample was found without iodine. The overall results showed that 72.4% of the families were consuming iodide salt below the recommended level of 15 ppm or Indian recommended value at consumption point (Pandav and Anand, 1995)) and rest of the population was thus consuming iodine at adequate level through salt (Table 1).

Iodine deficiency in a region is characterized by iodine poor soil, less iodine in foods (animal or vegetable origin) and in drinking water, resulting in iodine deprivation of living organism. The major consequences of iodine deficiency are goiter (enlagement of thyroid gland than normal), still birth and miscarriages, mental defects, deaf- mutism, weakness and paralysis of muscles as well as lesser degree of physical and mental function (Hetzel 1987). Zeltser et al (1992) have categorized the iodine deficient zones- as the severe deficient zone having iodine less than 4 µg/L of water; moderate deficient zone with iodine level 4-10 µg/L of water and the relative deficient zone having iodine level 20 µg/L of water. According to these criteria, the iodine content in the drinking water indicates that the region is environmentally iodine sufficient or the soil rich in iodine.

Table 1: Iodine content of salts and drinking water in different study areas of Murshidabad district

Sl.No	Study areas (C.D.Blocks)	Iodine content in Salts (ppm)			Iodine in Drinking water (µg/L), Mean ± SD
		<15	15-30	>30	
1	Berhampore	20 (57.1)	05 (14.3)	10 (28.6)	75.2 ± 14.1
2	Beldanga-I	28 (80.0)	02 (5.7)	05 (14.3)	33.4 ± 4.5
3	Beldanga-II	26 (74.3)	00 (0.0)	09 (25.7)	44.6 ± 5.4
4	Hariharpara	23 (65.7)	04 (11.4)	08 (22.9)	60.9 ± 6.2
5	Nawda	28 (80.0)	02 (5.7)	05 (14.3)	25.2 ± 1.9
6	Raghunathganj-I	27 (77.1)	02 (5.7)	06 (17.1)	32.9 ± 5.9
7	Raghunathganj-II	25 (71.4)	00 (0.0)	10 (28.6)	49.5 ± 4.3
8	Kandi	21 (60.0)	04 (11.4)	10 (28.6)	52.8 ± 4.2
9	Murshidabad-Jiaganj	18 (51.4)	05 (14.3)	12 (34.3)	69.8 ± 7.3
10	Domkol	25 (71.4)	01 (2.9)	09 (25.7)	42.3 ± 3.3
11	Jalangi	29 (82.8)	00 (0.0)	06 (17.1)	23.6 ± 3.4
12	Raninagar-I	26 (74.3)	03 (8.6)	06 (17.1)	40.9 ± 2.6
13	Raninagar-II	25 (71.4)	02 (5.7)	08 (22.9)	35.6 ± 2.2
14	Lalgola	31 (88.6)	01 (2.9)	03 (8.6)	55.4 ± 2.9
15	Bhagwangola-I	30 (85.7)	00 (0.0)	05 (14.3)	68.2 ± 6.8
16	Bhagwangola-II	29 (82.8)	01 (2.9)	05 (14.3)	73.5 ± 10.1
17	Nabagram	22 (62.8)	04 (11.4)	09 (25.7)	40.1 ± 2.6
18	Farakka	20 (57.1)	05 (14.3)	10 (28.6)	43.2 ± 2.8
19	Samserganj	26 (74.3)	02 (5.7)	07 (20.0)	35.6 ± 3.6
20	Suti-I	26 (74.3)	03 (8.6)	06 (17.1)	33.9 ± 3.1
21	Suti-II	28 (80.0)	02 (5.7)	05 (14.3)	50.5 ± 4.2
22	Sagardighi	25 (71.4)	02 (5.7)	08 (22.9)	35.2 ± 5.3
23	Khargram	24 (68.6)	03 (8.6)	08 (22.9)	36.2 ± 3.3
24	Burwan	29 (82.8)	00 (0.0)	06 (17.1)	43.3 ± 2.9
25	Bharatpur-I	26 (74.3)	04 (11.4)	05 (14.3)	48.1 ± 3.8
26	Bharatpur-II	22 (62.8)	07 (20.0)	06 (17.1)	71.9 ± 9.8
Total		659 (72.4)	64 (7.0)	187 (20.6)	45.6 ± 31.2

Total salt samples analyzed: 910; No. of salt samples from each area: 35
Total drinking water samples: 104; Water samples collected from each area: 4
(Parentheses indicate percentage)

Conclusion

WHO/UNICEF/ICCIDD recommends 90% of the households should get iodized salt at the recommended level of 15 ppm. In spite of the universal salt iodization programme, only about

30% of the salt samples contained iodine at adequate level and the rest of the salt sample contained iodine below the recommended level of 15 ppm. Thus iodine intake through salt is found unsatisfactory in the studied region. However, iodine content in drinking water shows that the entire Murshidabad district is environmentally iodine sufficient region.

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