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IODOMETRIC TITRATION OF EDIBLE SALT SAMPLES TO ASSESS THE AVAILABILITY OF IODINE IN TAMIL NADU FROM 2017-2022

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Abstract

BACKGROUND: Globally Iodine deficiency disorders (IDDs) is one of the important public health problem.Iodine deficiency disorders leads to various diseases including cretinism,goitre,hypothyroidism,mental retardation,loss of hearing,intellectual disabilities,abortion ,still birth .Iodine deficiency is the one of the preventable public health problems. Due to the implement of IDD control programme in India ,94% of people taking iodised salt.IDD Monitoring Laboratories in States are useful in measuring amount of iodine in production and consumer level.

OBJECTIVE : To test the availability of iodine in edible salt at households and retailers both in rural and urban areas from Jan 2017- June 2022 by iodometric titration method.

METHODS : Iodine Content of edible salt sample was estimated by a process called Iodometric Titration which involve the titration of iodine liberated by addition of sulphuric acid (H2So4) from a solution of iodated salt. Iodine liberated is then titrated with Sodium Thiosulphate .

RESULTS : A total of 31805 edible salt samples were tested at State IDD Monitoring laboratory from Jan 2017 to June 2022 and overall, 75% of the salt samples tested were found to have >15PPM iodine. There has been a consistent increase in iodine adequacy from 66% in 2017 to 83% in 2022.

CONCLUSION : NFHS 2019-21 survey conducted among the households in which salt was tested, 92% in Tamil Nadu had iodized salt against the national average of 94% suggesting the importance of State IDD Monitoring Laboratory to provide scientific evidence to ensure availability of iodized salt in the community.

KEYWORDS : Iodine Deficiency Disorder, Iodized Salt, IDD Monitoring Lab.

INTRODUCTION

Iodine is a element required for human body for normal mental and physical development. It is the one of the important element for thyroid hormone synthesis. [1] Iodine deficiency disorders leads to various diseases including cretinism, goitre, hypothyroidism,mental retardation, loss of hearing, intellectual disabilities, abortion, still birth. Iodine deficiency is the one of the preventable public health problems.[2] Iodine deficiency was thought to associated only with goitre and cretinism.[3] But now a days due to advancement in Biomedicalresearch has shown that iodine deficiency has a significantly associated with many disease and also independent risk factor for certain disease affecting peoples in all age group from fetus to adults.[4-6]

The iodine deficiency in pregnancy is a preventable conditions and prevention of iodine deficiency in pregnant mothers prevent neurodevelopmental disorder in new born . The children born in iodine-deficient regions have intelligence quotient (IQ) 13.5 points lesser than children born in iodine sufficient regions. IDD with its direct association with brain development, cognition development. Globally, 1.8 billion people are at risk of developing iodine deficiency due to insufficient iodine intake in diet. The Indian population is more prone for IDDs due to insufficient amount of iodine in the soil.[7]

Globally,Universal Salt Iodization (USI) is the one of the key strategy for control of IDD. In 1994, It was introduced by the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) Joint Committee .It is a safe, cost-effective and sustainable strategy to ensure sufficient intake of iodine by all individuals.[8] Salt iodization, which costs less than ₹0.2 per person per year [9] and has been rated as one of the most cost-effective development interventions (ratio of 1:81) by Copenhagen Consensus Statement 2008 [10] and subsequently again in 2012.[11]

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In India IDDs has declined due successful adoption and scaling up of USI in the country. IDD control programme in India has been a public health success story.India has achieved >90 per cent household level coverage of adequately iodized salt of USI as per NFHS 2019-21.[12]

OBJECTIVES

- To establish the State IDD Monitoring Laboratory at State Public Health Laboratory (SPHL), Directorate of Public Health and Preventive Medicine.
- To train the field staff for collection of edible salt samples collected from households and retailers, both rural and urban areas and shipment to State IDD Monitoring Laboratory @ SPHL, Chennai.
- To test the availability of iodine in edible salt by iodometric titration method from 2017-2022.
- To initiate appropriate preventive and corrective measures to ensure consumption of 100% iodized salt in households.

METHODS

SAMPLING PROCEDURE :

- 50 salt samples were collected per District for a 3 months cycle.
- Out of 50 samples, 25 samples from rural households, 15 samples from urban households, 7 samples from rural retailers and 3 samples from urban retailers were collected with Proper label (Fig-1).
- The amount of an iodated salt samples should be about 100 gms for loose iodated salt kept in polythene pouch and a whole packet for packed iodated salt.
- These samples were sent to State IDD Monitoring Laboratory for testing by iodometric titration method (Based on IS: 7224 – 1985).
- A compiled report (Monthly Report) of Iodated salt analysis have been furnished to State and District Programme officers every month for necessary corrective measures.

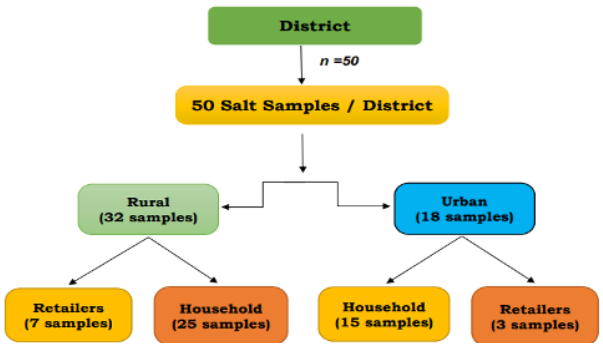

Figure 1 : Sampling procedure

RESULTS

A total of 31805 salt samples were received from the districts from Jan 2017 to June 2022 were tested for the Iodine content by Iodometric Titration Method at State IDD Monitoring Laboratory. Overall, 75% of salt samples were found to have >15PPM iodine.

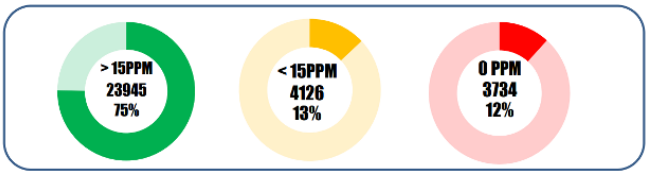

Figure 2 : Iodine content in salt samples

There has been a consistent increase in iodine adequacy from 66% in 2017 to 83% in 2022(Table-1).

Table 1 : Overall analysis of Iodine in salt sample

Over all Analysis - 2017 - 2022							
Year wise	> 15PPM	%	< 15PPM	%	0 PPM	%	Total Salt Samples
2017	3120	66%	753	16%	820	17%	4693
2018	10708	73%	1972	13%	1968	13%	14648
2019	4054	76%	621	12%	642	12%	5317
2020	1453	81%	133	7%	197	11%	1783
2021	2968	88%	330	10%	92	3%	3390
Jan 2022 - June 2022	1642	83%	317	16%	15	1%	1974
Total	23945	75%	4126	13%	3734	12%	31805

District wise analysis indicate few districts viz., Virudhunagar, Villupuram, Theni, Krishnagiri, Madurai and Ramanathapuram has less than 70% of the salt samples having >15PPM of iodine (Table-2).

Table 2 : District wise analysis of Iodine in salt sample

District wise Analysis of Iodine in Salt Sample, during (Jan 2017- June 2022)

S.No	Districts	> 15PPM %	< 15PPM %	0 PPM %
1	Chengalpattu	100%	0%	0%
2	Ranipet	90%	10%	0%
3	Salem	90%	8%	3%
4	The Nilgiris	89%	10%	1%
5	Tenkasi	86%	14%	0%
6	Kanchipuram	85%	6%	9%
7	Nagapattinam	84%	10%	6%
8	Ariyalur	83%	8%	9%
9	Namakkal	83%	12%	5%
10	Kaniyakumari	81%	10%	9%
11	Coimbatore	79%	10%	11%
12	Karur	79%	11%	10%
13	Tiruppur	78%	13%	9%
14	Trichy	76%	12%	11%
15	Tiruvarur	76%	14%	10%
16	Sivaganga	76%	12%	11%
17	Tiruvannamalai	76%	12%	12%
18	Thiruvallur	75%	10%	15%
19	Tuticorin	75%	17%	9%
20	Dharmapuri	74%	13%	13%
21	Tiruppathur	74%	11%	15%
22	Erode	74%	16%	10%
	Tamil Nadu	75%	13%	12%

S.No	Districts	> 15PPM %	< 15PPM %	0 PPM %
23	Cuddalore	73%	13%	14%
24	Vellore	72%	11%	17%
25	Tirunelveli	71%	12%	17%
26	Dindigul	71%	17%	13%
27	Pudukottai	70%	14%	16%
28	Perambalur	70%	23%	7%
29	Thanjavur	70%	16%	15%
30	Ramanathapuram	69%	14%	17%
31	Madurai	67%	15%	18%
32	Krishnagiri	67%	13%	20%
33	Theni	66%	10%	25%
34	Villupuram	65%	15%	20%
35	Chennai	62%	23%	15%
36	Virudhunagar	59%	17%	23%

DISCUSSION

In order to eliminate IDD in the country, there is a need to invigorate the efforts at national and State level from production to consumer level. There is a need to reposition the NIDDCP by linking elimination of IDD to HRD of the country. The Country should follow social process model based on four main components.The four main components are Demand for Iodized Salt (Pull), Supply of Iodized Salt

(Push), Regular Reliable Representative State Level Scientific Data and Data for Decision Makers and Sustained Political Commitment .

Even though, 92% of iodized salt consumption among households in Tamil Nadu (Based on NFHS-5 survey findings), still there are few districts in Tamil Nadu with less than 70% salt samples found to have >15PPM of the required iodine content needs to be addressed.

There is a need for renewed focus and vigour to achieve USI in the country by developing strategy to target and engage small-scale producer/difficult to reach areas/marginalized population and strengthen monitoring of iodine content of salt from production to consumer level. There is also a need to establish national and State level coalitions for sustained optimal iodine intake comprising key stakeholders which include government policymakers, salt industry representatives, civil society, consumer organizations and national and international development agencies working for IDD elimination in India.

CONCLUSION

The elimination of IDD is eminently possible. We are at a turning point in our battle against the ancient and pervasive scourge of iodine deficiency. IDD control programme is one of the success public health programme. The result from State IDD Laboratories providing the evidence-based report for 100% elimination. The current 94% household level coverage of iodized salt in India, of which 78% is using adequately iodized salt.It is a huge achievement.In future with accelerated and coordinated efforts it would be possible to achieve the IDD control in our country.

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REFERENCES

1. ICCIDD, UNICEF, WHO. Assessment of iodine deficiency disorders and monitoring their elimination: A guide for programme managers. 3rd ed. Geneva: World Health Organization; 2007.

2. Hetzel B. International Council for the Control of Iodine Deficiency Disorders. Towards the global elimination of brain damage due to iodine deficiency: A global program for human development with a model applicable to a variety of health, social and environmental problems. New Delhi: Oxford University Press; 2004.

3. Ramalingaswami V. The problem of goitre prevention in India. Bull World Health Organ 1953; 9: 275-81.

4. Mehta M, Pandav CS, Kochupillai N. Intellectual assessment of school children from severely iodine deficient villages. Indian Pediatr 1987; 24 : 467-73.

5. Upadhyay SK, Agarwal KN, Rani A, Cherian S, Tripathi AM, Agarwal DK. Developmental lag in preschool children of goitrous mothers. Indian Pediatr 1983; 20 : 259-63.

6. Kochupillai N, Pandav CS, Godbole MM, Mehta M, Ahuja MM. Iodine deficiency and neonatal hypothyroidism. Bull World Health Organ 1986; 64 : 547-51

7. Pandav CS, Yadav K, Srivastava R, Pandav R, Karmarkar MG. Iodine deficiency disorders (IDD) control in India. Indian J Med Res 2013; 138 : 418-33

8. Bath SC, Steer CD, Golding J, Emmett P, Rayman MP. Effect of inadequate iodine status in UK pregnant women on cognitive outcomes in their children: Results from the Avon Longitudinal Study of Parents and Children (ALSPAC). Lancet 2013; 382 : 331-7

9. Pandav CS, Yadav K, Ansari MA, Sundaresan S, Karmarkar MG. Salt for Freedom and Iodized Salt for Freedom from Preventable Brain Damage. 7th ed. New Delhi: Indian Coalition for Control of Iodine deficiency Disorders (ICCIDD); 2012

10. Horton S, Alderman H, Rivera JA. The challenge of hunger and malnutrition. Copenhagen Consensus. 2008. Available from: https://www.copenhagenconsensus.com/sites/default/files/CP_Malnutrition_and_Hunger_-_Horton.pdf, accessed

on November 7, 2018.

11. Hoddinott J, Rosegrant M, Torero M. Challenge paper: Hunger and malnutrition. Copenhagen consensus centre. Coenhagen; 2012. Available from: https://www.copenhagenconsensus. com/sites/default/files/hungerandmalnutrition.pdf, accessed on November 7, 2018

12. National Family Health Survey (NFHS-5), 2019-21 – India Report by International Institute for Population Studies, Mumbai-88, Ministry of Health and Family Welfare, Govt.of India.March 2022; 381,412,413.

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