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Original Research :

Goiter in Pre-pubertal Children despite Urinary Iodine Sufficiency

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Abstract:

Background: High prevalence of goiter is regarded a public health problem due to iodine deficiency disorder (IDD). Goiter in spite of urinary iodine sufficiency is also being reported. Even though. Universal iodization of salt (UIS) is mandatory in our country; sale of non iodized salt is still prevailing. **Objective:** To estimate the presence of goiter, mean urinary iodine excretion (UIE) level among prepubertal school children and also adequacy of salt iodization. **Methods:** 400 prepubertal school children were screened for goiter, UIE was estimated on every 10th child and 30 salt samples were tested for optimum iodization. **Results:** There was a high incidence of goiter in 112 (28%); Grade 1 Goiter-14.75% and Grade 2-13.25%. Mean UIE was 115 ug/L with no samples having <100 ug/L indicating current iodine sufficiency. Among the 30 salt samples tested, 26 (86 %) were optimally iodized, 2 (7%) were suboptimally iodized and 2 (7%) were found to have no trace of iodine, even though all were labelled as iodized salt. **Conclusion:** Goiter is a public health problem in the study area, but current iodine sufficiency is noted as per UIE. This paradox can be explained by the transition phase during shift from iodine deficiency to iodine sufficiency or may be the result of other confounders. Goiter due to previous iodine deficiency may take several years to resolve. Inadequately iodized salt is still being marketed, getting transported by roadways. **Recommendation:** There is a need for reappraisal of goiter, UIE and adequacy of salt iodization. Further research on other causes of goiter like consumption of goitrogens and reduced response of iodine due to opposing action by excess fluorine and cobalt and associated iron deficiency is recommended.

Key Words:

Goiter, Iodine deficiency disorder (IDD), Iodine sufficiency, Universal iodization of salt (UIS), Salt testing kits

Introduction :

Goiter and iodine deficiency disorder (IDD) are major public health problems with various deleterious effects on growth, development and quality of survival. Globally iodine deficiency disorder (IDD) continues to affect 29% with 1.5 billion people at risk across the globe and 167 million people in India at risk[1,2]. Iodine deficiency causes its impact right from conception to adulthood. The spectrum of manifestations varies from abortion, stillbirth, mental retardation, deaf-mutism, squint, goiter, stunting of growth, to neuro-developmental issues. Currently, iodine deficiency is the single most important preventable cause of brain damage and mental retardation[3]. In 2012, the global prevalence of IDD was reported as 29.8.5% among school age children with a reduction by 7% compared to 2003[4]. As per the report of 2013, India has protected 51.2% of the population from Iodine deficiency[5]. Universal iodization of salt (UIS) is mandatory in our country. Still, high prevalence of goiter and sale of substandard salt brands are noted in the country. It is also noted that other confounders may be there for the high prevalence

of goiter, even after iodine supplementation. Hence, a study was planned to estimate the presence of goiter, mean urinary iodine excretion (UIE) level among prepubertal school children and also adequacy of salt iodization in a hilly suburb of Thiruvananthapuram District, Kerala, South India.

Methods

This cross-sectional study was conducted among 400 prepubertal children in the age group of 5-10 years from three Government schools in Kunnathukal Panchayat area with technical assistance from IDD Control Cell, Kerala State. Institutional Ethics Committee clearance and informed written consent were obtained from the Heads of the Institution of each school and the parents of the children. A pre-tested structured proforma was developed to record the relevant details.

The presence of goiter was assessed by a single investigator ensuring intra-observer reliability as per the National IDD Control Program (NIDDCP) Guidelines and the WHO grading system as; Grade 0- not visible and not palpable, Grade 1- palpable, but not visible and Grade 3- visible and palpable. Urine samples were collected in screw capped plastic bottles with a few drops of toluene to prevent bacterial growth and bad odour, from every 10th child enrolled (n=40). Ammonium per sulfate titration method was used to estimate the iodine excretion level.30 salt samples were tested for iodization status from the school mid-day meal program and also from the households of the enrolled children using the Iodine spot testing kit supplied by UNICEF. Salt samples were rated as optimally iodized, suboptimally iodized or non iodized.

Results :

Among the total number of 400 children enrolled, a high prevalence of goiter was recorded in 112 (28%) with a male to female ratio of 1.6:1 (67: 45); Grade 1 Goiter was noted in 59 (14.75%) and Grade 2 in 53 (13.25%). Table I depicts the distribution of children. Among the 40 urine samples tested from every 10th child, mean urine iodine estimation (UIE) was 115 ug/L with no samples having <100 ug/L indicating current iodine sufficiency. Among the 30 salt samples tested, 26 (86 %) were optimally iodized, 2 (7%) were suboptimally iodized and 2 (7%) were found to have no trace of iodine, even though all were labelled as iodized salt.

Table I.: Distribution of children with Incidence of Goiter.

Grade of Goiter	Sex	GHW LPS Kunnathukal		Govt. HSS Anavoor		Govt. UPS Kunnathukal		Total Goiter (%)		Goiter Number (Percentage)
		Total	Goiter	Total	Goiter	Total	Goiter			
Grade 1	M	51	7	80	13	84	15	215	35	
								(16.3%)		59 (14.75%)
	F	42	3	75	13	68	8	185	24	
								(13%)		
Grade 2	M	51	5	80	15	84	12	215	32	
								(14.9%)		53 (13.25%)
	F	42	7	75	06	68	8	185	21	
								(11.4%)		
Total		93	22	155	59	152	47	400	112	
								(28%)		112 (28%)

Discussion :

The National Iodine Deficiency Disorder Control Program (NIDDCP) has defined the criteria for classifying IDD as a significant public health problem based on prevalence of goiter among prepubertal children; 5-20% mild, 20-30% moderate and > 30% severe[1]. UIE > 100 ug/L indicates iodine sufficiency, < 20 ug/L is regarded as severe deficiency, 20-49 as moderate and 50-99 as mild deficiency[1]. Goiter rate of 28% noted in the present study indicated that it as a moderate public health problem in the study area. It has been reported that out of the 282 districts surveyed in India, IDD was a major public health problem in 242 (2).

Contrary to the expectation; in spite of being a coastal belt with people consuming abundant fish have iodine sufficiency, the goiter prevalence in Kerala State was reported to be ranging from 9.3 to 44.5%. Among the 14 districts of Kerala, the majority, 12 were found to be endemic for IDD by the NIDCCP goiter survey[1,6]. The high incidence of goiter in the study area is in accordance with this finding. Goiter is said to indicate previous iodine deficiency.

Current iodine sufficiency is assessed by UIE. The mean UIE,115 ug/L noted in the study is indicative of current Iodine sufficiency among the subjects. Based on mean UIE, only 3 hilly districts in Kerala namely Kasaragod, Idukki and Kottayam were reported to be having continued iodine deficiency[6,7].

This paradox of high goiter incidence with normal UIE as in this study has been observed from some other regions in India as well[8,9]. This paradox can be explained by the transition phase during the shift from iodine deficiency to iodine sufficiency. It is expected that as optimum iodization continues, goiter prevalence due to iodine deficiency will come down. Even after successful implementation of universal salt iodization (USI), goiter may take up to 4 years to regress[10]. The thyroid size reflects previous iodine nutrition and it takes years to shrink after attaining iodine sufficiency.

Currently, it is proposed that, goiter should no longer be a criterion for assessing the burden of disease, which was of value prior to the iodization era. Therefore, the effect of USI program should be based on normalization of UIE on resurveys in areas with previous endemicity. The presence of goiter and the normalization of UIE in the present study subjects indicate the need for continuing the USI program and not the contrary.

Even though, India has a policy for USI, being implemented in a phased manner from 1986 and a ban in the sale of non iodized salt, practically sale of non-iodized salt has not been eliminated. Iodine content of salt >30 ppm at production level and >15 ppm at retail/beneficiary level is considered optimum. The extent of iodization can be estimated and categorized as optimally iodized, suboptimally iodized or non iodized based on the Salt testing Kit supplied by UNICEF and available with the IDD Control Cell.

As per the National Family Health Survey (NFHS) 2 data (1998-99), in India, 28% salt was found to be non-iodized and 22 % inadequately iodized and in Kerala, 17% were non-iodized and 9% inadequately iodized[11]. In the present study, 7% of the salt samples were suboptimally iodized and 7% were non- iodized, but all were sold with a label stating iodized salt.

These substandard samples were local brands manufactured locally in the nearby coastal belt and transported by roadways to Kerala. All salt transports by the railways is currently subjected to quality control by the Salt Commissioner of the Government. In the setting of UIS and the ban in the sale of non-iodized salt, this observation of substandard brands being still sold with wrong label is of great public health importance. Consumers are often unaware of this because these brands are sold with the 'rising sun logo' of iodized salt. Constant vigil against this practice is needed and operational research on ensuring quality in salt moving by road transport as in case of rail should be

undertaken.

In view of the high incidence of goiter with normal urinary iodine level in this study, further research on other causes of goiter like consumption of goitrogens and reduced response of iodine due opposing action by excess fluorine and cobalt and due to associated iron deficiency[12], is recommended.

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Conflict of Interest: Nil

What this study adds

High Goiter incidence indicating previous iodine deficiency can coexist with normal Urine iodine excretion suggesting current iodine sufficiency. The role of confounders is to be explored in this context. Non iodized and suboptimally iodized salt are being marketed in spite of the efforts for universal salt iodization.

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