



# PREVALENCE OF GOITER AND THE STATUS OF IODIZED SALT AMONG THE PRIMARY SCHOOL CHILDREN OF A RURAL DISTRICT IN CENTRAL INDIA

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## ABSTRACT

**Introduction:** Iodine deficiency disorders are one of the most common public health problems throughout India. The long term goal of salt iodization is elimination of iodine deficiency and reduction of goiter rate in school aged children. Objective of the study was to find out the prevalence of goiter in primary school children.

**Methods:** In a cross sectional study, a total of forty-seven villages (about 5%) having primary schools, were selected by systematic random sampling method to study the prevalence of goiter and the status of iodized salt at consumer and distribution level.

**Results:** The overall prevalence of goiter in the primary schools children is estimated about 21.23%. Thus it falls under moderate IDD. In the study maximum 311 (53.25%) salt samples have shown 15 ppm iodine.

**Conclusion:** Goiter prevalence is still a public health problem in study area even after the introduction of iodized salt.

**Key words:** Iodine deficiency disorder, prevalence of goiter, iodized salt

## INTRODUCTION

Iodine is an essential dietary nutrient that helps the body to produce thyroxin hormone that regulates normal growth and development. Globally about 266 million school aged children worldwide have insufficient iodine intake.<sup>1</sup>

The present study was conducted with the objective to assess the prevalence of goiter in primary school children and to estimate the iodine content of salt consumed by the population in the district. In the study as per recommendation of WHO/UNICEF/ICCIDD, the school children in

the age group 6-12 yrs from both sexes were selected, because of their high vulnerability to goiter, common manifestation of IDD, easy accessibility and because they are representative of their age group in the community.<sup>2</sup>

The prevalence of goitre indicates past iodine nutriture and the goiter prevalence survey is used as diagnostic tool for identifying areas of IDD. The knowledge gap regarding the burden of disease still exists in context of Madhya Pradesh. Estimation of burden may facilitate the planning and implementation of control strategies. It has been recommended that if more than

5% school age children are suffering from goiter, the area should be classified as endemic to iodine deficiency.<sup>3</sup>

Iodine deficiency is the primary cause for the persistence of iodine deficiency disorders during post salt iodization period in the studied region. Estimation of iodine contents in selected salt samples in a community may be visualized as a surrogate measure for iodine fortification. It is a well known fact that due to paucity of iodine intake from natural sources the best possible option is salt fortification. However fortification of salt is being determined by several factors like storage conditions, humidity and auto disintegration of iodine. Hence, in the post fortification it is equally important to check the adequacy of salt fortification at distribution level and further at consumers in order to avert a false sense of security. Salt fortification is a powerful public health intervention at the community level to address iodine deficiency. However, if the optimization and extent of truth is not explored for this deemed solution the intervention remains unutterable only & feedback loop (which is of paramount importance for any public health intervention) is not completed.

**METHODS**

The present study was conducted to find out the prevalence of goiter and the status of iodized salt in a District of Madhya Pradesh. The target population was the children below 15 years of age of the identified villages. Total forty-seven villages (about 5%) having primary schools were selected through systematic random sampling method, including Block headquarters of the District.

As there is no specific information on prevalence of goiter in the study area, the sample size has been calculated assuming goiter prevalence of 20%. This study uses stringent criteria of allowable error (2.5% around the estimate), the calculated sample size was 1013 for the simple random sampling. A design effect of 3.4 was calculated for the systematic random sampling after

calculating inter cluster variability 0.2 this lead to sample size 3442 (1013X3.4) for the systematic random sampling. In the District total 3551 school children, who were present on the day of examination, were examined for the presence of goiter.

The criteria to identify the Goiter were adopted from WHO/ UNICEF/ ICCIDD.<sup>4</sup> Goitre is a reflection of chronic iodine deficiency and can be used as a baseline assessment of a region’s iodine status and as a sensitive long-term indicator for the success of an iodine programme.<sup>5</sup> The thyroid palpation to grade goiter is subjective and its sensitivity and specificity are low<sup>6</sup> but the measurement of thyroid on the basis of size has been adapted in most studies due to examination of large number of children in rural areas. The child was examined by the examiner in a sitting position, with the neck in a normal position. The following classification was used for goiter: (a) grade 0 – not visible, not palpable, (b) grade 1 – palpable, but not visible, and (c) grade 2 – palpable and visible, as per the WHO / UNICEF / ICCIDD guidelines.<sup>7</sup>

In the present study total 574 salt samples were tested for their iodine content at the spot by iodine testing kits. As per protocol out of total 584 samples, 470 (80.48%) salt samples were collected and tested at village level (10 samples tested from houses per village unit) and 114 (19.52%) salt samples were collected and tested (2 samples from shops at every village and 4 samples from shops at each block headquarter) at distribution/ shop level.<sup>8</sup>

**RESULTS**

In the present study the proportion of goiter was found higher in males 57.03% compared to female 42.97%. It has been observed that more number of male children 270 (35.80%) had goiter of grade I followed by 160 (21.22%) had Goiter of grade II, while in female children, 219 (29.05%) showed grade I Goiter and 105 (13.93%) were having grade II Goiter.

**Table 1: Prevalence (proportion) of goiter cases distributed as per age and sex**

Age Groups (in Years)	Male			Female			Total Goiter proportion for the age group (%)
	No.	Grade I (%)	Grade II (%)	No.	Grade I (%)	Grade II (%)	
3-5	304	11 (3.62)	0 (0.00)	239	15 (6.28)	10 (4.18)	36 (6.63)
6-8	491	109 (22.20)	59 (12.02)	439	89 (20.27)	44 (10.02)	301 (32.37)
9-11	599	92 (15.36)	67 (11.19)	631	76 (12.04)	33 (5.23)	268 (21.79)
12 & above	453	58 (12.80)	34 (7.51)	395	39 (9.87)	18 (4.56)	149 (17.57)
<b>Goiter prevalence</b>							<b>754 (21.23)</b>

**Table 2: Salt samples (at distribution and consumer level) grouped according to Iodine content**

	Number of salt sample tested	Absence of Iodine (%)	15 ppm Iodine	30 ppm Iodine	7 ppm Iodine
<b>Distribution Level (Shops)</b>	114 (19.52%)	15 (13.16)	48 (48.49)	37 (37.37)	14 (14.14)
<b>Consumer Level (House hold)</b>	470 (80.48%)	37 (7.87)	263 (55.96)	103 (21.91)	67 (14.26)
<b>Total</b>	584	52 (8.90)	311 (53.25)	140 (23.97)	81 (13.87)

In the study, maximum were male children 109 (14.46%), who had grade I Goiter in the age group of 6 – 8 years. The overall prevalence of goiter in the primary schools children of the study area is estimated about 21.23%. Thus it falls under moderate IDD.

In the present study a total of 584 salt samples were tested for their Iodine content at distribution level and at the consumer level by salt testing kits. Out of total 584 samples, 114 (19.52%), salt samples were tested at distribution level (Shops) and 470 (80.48%) samples were tested at consumer level (houses).

It has been observed that out of total 114 salt samples tested at distribution level, 15 (13.16%) samples were showing absence of Iodine and out of these 15 samples, maximum 6 (40.00%) were found in Sehore Block followed by 3 (20.00%) in Astha, and Budni each, 2 (13.33%) in Ichawar each and 1 (6.67%) in Nasrullaganj Block.

Out of remaining 99 (86.84%) salt samples showed presence of iodine, maximum 48 (48.49%) samples at distribution level were containing 15 ppm Iodine, followed by 37 (37.37%) samples containing 30 ppm Iodine and 14 (14.14%) were containing 7 ppm of Iodine. It has also been observed that the shopkeepers were sailing salts in the packets resembling branded salt company's salt packets but under the brand name of Tara, Taza, Anna, Amma, Teta and Taru printed as Iodized salt on them. In some such type of packets there was no iodine present on testing and some of them showed Iodine with 7 ppm or 15 ppm. The actual cost of these duplicate packets was quite less but the shopkeepers were sailing these packets at the same cost as Tata Iodized salt.

The measure to reduce the iodine deficiency disorders has been taken by fortification of salt with iodine which is a low cost procedure. In present study, it has been observed that out of total 470 salt samples collected at consumer level, the Iodine was not present in 37 (7.87%) salt samples and 263 (55.96%) salt samples were containing 15 ppm of Iodine. In the study only 103 (21.91%) salt samples were containing 30 ppm and 67

(14.26%) samples were containing 7 ppm of Iodine. In the present study larger children population was found using the iodized salt containing 15 ppm iodine.

## DISCUSSION

**Prevalence of goiter:** In the studied district, the total goiter prevalence rate was found to be 21.23% with grade 1 - 13.77% and grade 2 - 7.46%, indicating that IDD was a moderate public health problem in the study area. Surveys conducted by the Central and State Health Directorate, ICMR have clearly demonstrated that IDD is a public health problem in all states and union territories in India. Off the 325 districts surveyed in India so far, 263 districts are IDD endemic, i.e. the prevalence of IDD above 10 percent in the population.<sup>9</sup>

The Prevalence in the current study was in agreement with the studies done at South Africa (25.5%)<sup>10</sup>, Southern Blue Nile area of Sudan (22.3%)<sup>11</sup>, Panchmahal district in Gujarat, India (20.5%)<sup>12</sup>, Jodhpur district of Rajasthan (11.4%)<sup>13</sup>, but the prevalence in our study was found lower than a study done on schoolchildren in Islamabad which was 71.6%.<sup>14</sup> The Prevalence was also lower than the cross-sectional study done among ten villages from four administrative regions of Ethiopia with a gross prevalence of goiter among school children of 53.3%.<sup>15</sup> The moderate prevalence rate in the present study is probably due to the availability of iodized salt, but the consumption remains low. The available salt with variety brands had variable iodine concentration in them.

The similar study was conducted in one of the district of Gujarat, reported 20.5% total goiter prevalence.<sup>16</sup> In another study at coastal area of Karnataka in Udupi district among 8-10 years age group showed a prevalence of 30%.<sup>17</sup> Chandra et al. showed a prevalence of 38.8% in Kolkata.<sup>18</sup>

An international study from Indonesia reported 35% goiter prevalence among school children.<sup>19</sup> Similar prevalence was observed in another

study by Patowari et al. during 1998 assessed the prevalence of goiter in Kamalpur district of Gauhati and found that the highest prevalence of goiter was 37.3% in the age group of 13-18 years.<sup>20</sup> Another study conducted in Yaman, showed 16.8% goiter prevalence in school children, indicating that IDD is reflected as public health problem in many countries.<sup>21</sup>

The factors likely to be responsible for higher Goiter prevalence might be due to significantly low soil iodine concentration, low food iodine concentration and lesser consumption of protein and calories in children of schools with higher goiter prevalence. The higher goiter rate despite of sufficient iodine in household samples may be due to the fact that in children iodine deficiency is reflected by goiter rate but the size of the thyroid changes inversely in response to alteration in iodine intake and a significant period is required before the goiter rate normalize after iodine repletion. The duration of this leg period may last from months to years. The goiter rate during the leg period is a poor indicator of effect of iodine because it reflects the history of iodine intake but not its present iodine status. In general the goiter rate is an important long term indicator of success of iodine deficiency disorder control programme because goiter represents the mal adaptation of thyroid to iodine deficiency.<sup>22</sup>

**Iodine concentration of salt:** It has been recommended by WHO/UNICEF/ICCIDD that 90% of the household should get iodized salt at the level of 15 ppm.<sup>23</sup> The present study showed that 78.09% of the salt samples at consumer level were with inadequate iodine (<15 ppm), and of them 7.87% salt samples were without iodine and only 21.6% consuming salt with recommended level of iodine. The almost similar results were observed by Chandra et al. in their study.<sup>24</sup> All these results suggest that there is need to strengthen the system of monitoring the quality of salt to ensure the availability of 15 ppm of iodine at the consumption point or household level.

According to the report of Joint WHO/ UNICEF /ICCIDD, It has been recommended that if more than 5% school age children (6-12 yrs) are suffering from goiter, the area should be classified as endemic to iodine deficiency.<sup>25</sup> In NFHS-3, it showed that 51% population of the country was using adequate iodized salt (>15ppm) and 24% were using non iodized salt.

## CONCLUSION

In post fortification era and despite the several attempts instigated by Governmental agency, the findings revealed by the study are indeed alarming. This is circuitously an indication to add surveillance and quality assurance in the programme. This study also generates evidences in terms of sub-optimum fortification of iodine at distribution and consumer level in some brands (closely resembling to popular brands). In addition to above a further study may be planned at this juncture with the motto to describe the relation of goiter type (nutritional, autoimmune etc.) to extent of salt fortification. This may reveal whether the problem is associated with inadequacy of salt fortification only or factors like autoimmunity are now playing a crucial role in present fortification era.

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