

To assess the study of dietary habits Iodine intake in school Age children

1 Mrs. Priyanka D. Parikh, 2 Dr. Shreya Nigoskar,

1 Research Scholar, Malwanchal University, Indore (M.P.)

2 Research Supervisor, Malwanchal University, Indore (M.P.)

Abstract - Because iodine deficiency affects 2 billion persons worldwide, its elimination is considered as a global health problem. Inadequate daily intake of iodine can lead to iodine deficiency which can alter physical and mental functions and accelerate cognitive impairment of schoolchildren. Our study aims to determine the iodine status of Indore region, schoolchildren as well as their dietary habits and frequency of consumption of foods that are considered as good sources of dietary iodine, including iodized salt. In an observational study 2100 children (aged 8-12 years) Answers to an adapted food frequency questionnaire and data regarding socio economic status were obtained at the beginning of the survey. Random urine samples were collected in the morning to assess urinary iodine using the Sandell - Kolthoff reaction. Our results showed that iodine deficiency was prevalent in schoolchildren, 82.7% of subjects had an urinary iodine concentration (UIC) $<100\mu\text{g/l}$ and the median of the urinary iodine concentration was found to be $59.6\mu\text{g/l}$. Overall, the study population has limited resources and more than 60% spend less than 110 US \$ for food monthly. Analysis of dietary habits of children relative to consumption of foods rich in iodine showed that 95% of families did not use fortified salt, 30% of schoolchildren did not consume dairy products, 100% did not eat shellfish and 10% did not eat fish. However 59.16% were consuming fish at least once a week.

Key words: Urinary Iodine Concentration, Iodine deficiency, rural region.

Introduction -

The most important result of iodine deficiency are permanent brain damage in the infant and retarded psychomotor development that give rise to development of goiter (enlarged thyroid gland) in the child¹. It was belief that goiter & cretinism was only caused by iodine deficiency, however, it has increasingly clear that iodine deficiency leads to a wide spectrum of disorders which also includes hypothyroidism, brain damage, abortion, mental retardation, still birth and psychomotor defects².

MATERIAL AND METHOD –

This study was conducted at the Department of Biochemistry, Index Medical College, Hospital & Research Centre, Indore region (M.P.) between Feb.2020 – August 2023.

Sample size: - 30 clusters were selected by cluster sampling technique; as per the guidelines from Government of (M.P.)⁷, 70 samples from one cluster has taken, and thus total sample size is 2100.

2.1 Subjects-

This is an observational study that was conducted in February 2020 to August 2023 in Index Medical College, Hospital & Research Centre, Indore region (M.P.). The Indore district has total populations of 3,276,697 (male: 1,699,627 and females: 1,577,070 respectively). The rural population is 848,988 and the urban population is 2427709. Indore district has 10 sub - district (Number of Tehsil/Taluka) and total number of Villages are 629 and 26 towns.

Five from each sex i.e. from boys and girls from every standard, present in classroom on the day of presence were selected at random for examination. So total 70 students

For the presence of iodine status, Urinary iodine is a well-recognized and cost-efficient parameter as the majority of iodine absorbed by the body is excreted in urine^{3,4}, considered as sensitive marker of current intake of iodine & would reflect latest changes in status of iodine^{4,5}. The adoption of IDD highlights that the problem extends far beyond simply goiter & cretinism⁶.

were examined from each school and cluster in selected villages, then thus a total of 2100 students were selected and examined for this study.

At recruitment, a meeting with parents and school's officials was undertaken to explain the purpose of the study and to get the parents' consents. To be included in the study, children had to be aged between 6 and 12 years. Children with severe malnutrition needing nutritional rehabilitation or having chronic or severe illness requiring hospitalization or treatment were **excluded** Criteria from the study. The study was conducted with respect to ethical and legal aspects, and written informed consent was obtained from each parent of recruited children.

2.2 Study design

At recruitment, data regarding socio economic status and a qualitative food frequency questionnaire were administered to each child. Random urine samples were collected in the morning to assess urinary iodine using the Sandell-Kolthoff reaction.

Method for measuring urinary iodine using ammonium persulfate.

2.3 Socio-economic status assessment

Data regarding socio-economic status were collected at the beginning of the study from parents in all subjects groups, using questionnaires including level of parental education and monthly food expenditure.

2.4 Dietary assessment

Dietary patterns of the study subjects and the frequency of consumption of certain food were assessed via the Food Frequency Questionnaire method which was completed by the participants in the presence and assistance of a trained dietitian. The Food Frequency Questionnaire designed to assess frequency of consumption, over the previous one month, of foods or food groups that are good sources of dietary iodine, including iodized salt. The three main components of the Food Frequency Questionnaire are the list of foods.

and the estimation of portion size consumed either in household measures or grams

2.5 Urine sampling

Random urine samples were collected in the morning, between 10 a.m. and 11 a.m. to assess urinary iodine (WHO/UNICEF/ICCIDD 2007). These samples were aseptically collected in 40 ml capped polypropylene tubes, aliquoted in 4 ml cryovial tubes and stored at -20°C until analysis. Urinary iodine was determined spectrophotometrically using the Sandell-Kolthoff reaction (Dunn JT et al, 1993). According to the level of iodine in urine, the iodine deficiency is classified into three classes; normal iodine status: $>100\mu\text{g/L}$; mild iodine deficiency: $50\text{--}99\mu\text{g/L}$; moderate iodine deficiency: $20\text{--}49\mu\text{g/L}$ and severe iodine deficiency: $<20\mu\text{g/L}$ (De Benoist B et al, 2003).

2.6 Statistical analyses

All statistical analyses were performed using Statistical Package for the Social Sciences (SPSS, version 20.0). The distribution normality of quantitative variable was tested by Kolmogorov –Smirnov test. The variables non-normally distributed were presented as median (interquartile range). Nominal variables are presented as frequency and Chi-square test was used to test independence between them, in the case of cells with a theoretical frequency $n < 5$, we take the p-value of Fisher. Two-sided p-values <0.05 were considered significant.

Result -

Table 1- Taluka specific assessment of iodine in salt samples by spot kit at retail trader levels in rural area of Indore district.

Tehsil/ Taluka	No .of Salt Samples tested	Urinary Iodine excretion(UIE)			
		0 ppm	<15ppm	>15ppm	% of Salt Samples Adequately Iodized
Juni Indore	210	0	5	205	97.61
Kanadia	210	0	17	193	91.9
BicholiHapsi	210	0	12	198	94.28
Malharganj	210	0	24	186	88.57
Khudel	210	0	7	203	96.66
Rau	210	0	16	194	92.38
Dr. Ambedkar Nagar (Mhow)	210	0	14	196	93.33
Sanwer	210	0	42	168	80
Depalpur	210	0	30	180	85.71
Hatod	210	0	8	202	96.19
Total	2100	0	175	1925	
			8.33%	91.66%	

Table-2 : Iodine content in salt sample in Indore district (n- 2100).

Iodine content in salt sample in Indore district		
Iodine content (ppm)	Number	%
NIL	0	0
<15	175	8.33
>15	1925	91.66
Total	2100	100

Table 3:- Age and Grade Specific Prevalence of Goitre in Indore District.

Age	Grade 0	Grade 1	Grade 2	Total (1+2)	Total children examined	Prevalence rate (%)
6	0	0	0	0	172	0
7	0	1	0	1	302	0.33
8	0	2	0	2	294	0.68
9	0	1	1	2	305	0.65
10	0	1	1	2	309	0.64
11	0	2	2	4	408	0.98
12	0	2	0	2	310	0.64
Total	0	9	4	13	2100	0.61

Table 4 :- Sex and Grade specific prevalence of Goitre in Indore District.

Sex	Grade 0	Grade 1	Grade 2	Total (1+2)	Total children examined	Prevalence rate (%)
Female	0	6	2	8	1050	0.76
Male	0	3	2	5	1050	0.47
Total	0	9	4	13	2100	0.61

Table 5- : Goitre prevalence rate in various Tehsil /Talukas of Indore District.

Tehsil/Taluka	Children examined	Goiter Cases	Prevalence Rates(%)
Juni Indore	210	0	0
Kanadia	210	0	0
BicholiHapsi	210	2	0.95
Malharganj	210	0	0
Khudel	210	0	0
Rau	210	2	0.95
Dr. Ambedkar Nagar (Mhow)	210	2	0.95
Sanwer	210	5	2.38
Depalpur	210	1	0.47
Hatod	210	1	0.47
Total	2100	13	0.61

Table 6 :- Summary of children BMI-for- AGE.

Summary of Children BMI-for AGE.				
	Boys	Girls	Total	%
Number of children assessed	1050	1050	2100	
Underweight (<5th percentile)	22(2.09%)	19(1.80%)	41	1.95%
Normal BMI (5th - 85 th percentile)	1021(97.23%)	1025(97.61%)	2046	97.42%
Overweight (85th to 95 th percentile)	6(0.57%)	5(0.47%)	11	0.52%
Obese (> 95th percentile)	1(0.09%)	1(0.09%)	2	0.09%

Discussion -

This discusses a number of issues faced when analyzing iodine nutrition within young group of study. Because 90% of iodine in the body is excreted through urine, urinary iodine level is used as a reliable indicator for the assessment of iodine deficiency disorders. It is a more sensitive indicator to recent changes in iodine intake and a median of urinary iodine concentration of 100µg/L indicates that there is no iodine deficiency in the population (WHO / UNICEF / ICCIDD, 2007)⁸. The results of this study show that the median urinary iodine concentration of schoolchildren living in rural mountainous area of Indore region is inadequate 59.6 µg/dL (Normal= 135.2 µg/L; abnormal= 52.7µg/L) and compatible with a mild iodine deficiency profile.

Although little is known about the consequences of mild iodine deficiency in childhood as most researches focused on the effects of moderate and severe iodine deficiency, yet the correction of mild iodine deficiency in children can improve their ability to learn (Gordon R et al,2009)⁹. Furthermore, WHO / ICCIDD / UNICEF state that no more than 20% of the population should have urinary iodine concentrations less than 50µg/L (WHO UNICEF & ICCIDD, 1994)¹⁰.

In the present study, over 30% of the children had levels below this figure. A study conducted in Sydney, Australia also found mild iodine deficiency as determined by casual urine samples in school-aged children (Li M et al, 2001)¹¹.

Conclusion

In conclusion, our study demonstrates that the population of rural & urban region of Indore region (M.P.)

1. 91.66% of salt samples had iodine levels > 15 ppm and the iodine content in salt samples < 15 ppm was 8.33% indicating the salt samples at household contain sufficient levels of iodine as per criteria.

2. 0.61% goitre cases have been reported i.e. 13 out of 2100 samples. 9 cases were from grade-1 and 4 cases were from grade-2. Maximum prevalence rate was observed in the age group of 11 year children i.e. 0.98% in which two cases was from grade-1 and two cases were from grade-2. 0.76% prevalence rate was observed in female children and 0.47% prevalence rate was observed in male children out of total sample.

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3. Median iodine content in drinking water samples were found 75.06 µg/L which in the range of 72-80 µg/L and the mean iodine content in water sample was found 76.54± 4.83 µg/L which was found above the relative deficient region.

4. In the present study. 1.95% children were observed underweight, 97.42% were healthy weight, 0.61% were under overweight and 0.09% was observed under obesity. Kanadia tehsil/taluka region had maximum underweight condition i.e. 5.2% compare to other talukas and Juni Indore tehsil/taluka had maximum overweight condition i.e. 3.3% compare to other talukas.

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