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Original Article

IODINE STATUS OF SCHOOL AGE CHILDREN IN THE TWO HILLY DISTRICTS DHANKUTA AND TEHRATHUM OF EASTERN NEPAL

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ABSTRACT

Background: Iodine deficiency remains a significant health problem in developing countries, including Nepal. Objective: This study was conducted to assess the iodine status of school children in two districts Dhankuta and Tehrathum of Eastern Nepal by estimating median urinary iodine concentration (UIC) as a population parameter. Materials and Methods: This cross-sectional study was conducted from August 2010 to July 2011 in school children (6-12 years of age) of two hilly districts of Eastern Nepal, Dhankuta and Tehrathum. A total of 154 school age children from the two districts were chosen for the study after obtaining written consent from their guardians and school authority. UIC was estimated in these school children by ammonium persulphate digestion microplate method. Results: Among the school age children selected for the study median inter-quartile range (IQR) of urinary iodine in Dhankuta (n=63) and Tehrathum (n=91) districts were 214.04 (126.44; 323.0) µg/L and 252.34 (161.81; 301.63) µg/L. No significant differences were observed between the median UIC of these two districts (p=0.235). Among the school children in Dhankuta districts 2(3.2%) were severely deficient, 4(6.3%) were moderately deficient and 6(9.5%) were mildly deficient in iodine. In Tehrathum district 2(2.2%) were moderately iodine deficient and 5(5.5%) were mildly iodine deficient. Conclusion: The present study showed improved iodine status with optimal levels of median urinary iodine concentration in the two districts, Dhankuta and Tehrathum of Eastern Nepal. Regular monitoring of population median urinary iodine concentration is recommended for sustainable optimal iodine nutrition.

INTRODUCTION

Iodine deficiency is a significant health problem in developing countries, including Nepal.[1, 2] Iodine deficiency causes goiter, cretinism, and hypothyroidism, and is the major cause of preventable mental retardation in children. [3, 4] Three National surveys have been conducted in 1998, 2005 and 2007, which have shown median urinary iodine concentration (UIC) 143.8 µg/L, 188.0 µg/L and 202.8 µg/L respectively. [2, 5, 6] Populations having inadequate iodine status (UIC<100µg/L) were 35.1% in 1998, 27.4% in 2005 and 19.4% in 2007. Households consuming adequately iodized salt (at

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least 15 ppm at the household level) were 55.2% in 1998 and 77.0% in 2007.[7] Universal salt iodization, implemented since 1993 in Nepal is regarded as the best strategy to control iodine deficiency disorders (IDD).[2] Iodized salt is the major dietary source of iodine to combat iodine deficiency in Nepal. Median UIC is used as a population marker of iodine deficiency followed by thyroglobulin, thyroid stimulating hormones (TSH in infants), salt iodine content in households and thyroid ultrasonography. Elimination of these deficiency states should be a target to minimize the risk of IDD. National surveys have shown deficiency of iodine in these regions in previous studies. The present study will show current status of iodine deficiency by estimating median UIC as a population marker of iodine deficiency in the two hilly districts Tehrathum and Dhankuta of Eastern Nepal and help the policy makers to aid the strategy to eliminate iodine deficiency from these regions. This main objective of the study was to assess the iodine status of school children in two districts Dhankuta and Tehrathum of Eastern Nepal by estimating median UIC as a population parameter in the school children.

MATERIALS AND METHODS

This cross-sectional study was conducted from August 2010 to July 2011 in Department of Biochemistry, B.P. Koirala Institute of Health Sciences, Dharan, Nepal. School children of two hilly districts of Eastern Nepal, Dhankuta and Tehrathum were chosen as sampling units. A total of 154 school age children from the two districts were chosen for the study after obtaining written consent from their guardians and school authority. Urinary iodine concentration (UIC) was estimated in these school children. Spot urine samples (5-10 ml) were collected in screw cupped plastic vials and transferred to the laboratory maintaining cold chain, in an ice cool bag, and were stored in refrigerator at 2-8 °C until analysis. UIC was estimated by Ammonium Persulphate Digestion Microplate (APDM) method.[8] Iodine status of the school children was defined as per the WHO/ICCIDD/ UNICEF criteria as: severe deficiency (<20 µg/L), moderate deficiency (20-49 µg/L), mild deficiency (50-99 µg/L), adequate (100-199 µg/L), more than adequate (200-299 µg/L) and excessive (>300 µg/L). Two levels of urinary iodine controls L_1 and L_2 (Seronorm, Norway) were analyzed to obtain intra-assay coefficient of variations (CVs) (L_1 = 7.4%, L_2 = 3.3%) and inter assay CVs (L_1=23.5%, L_2=11.26%) respectively. Ethical clearance was obtained as per the guidelines of Institutional Ethical Review Board (IERB) of B. P. Koirala Institute of Health Sciences, Dharan, Nepal.

STATISTICAL ANALYSIS

Data were entered in MS Excel 2007 and Statistical Package for Social Sciences (SPSS) version 16.0 (SPSS Inc., USA) was used to calculate descriptive and inferential statistics. A Chi Square test was applied to compare the association of qualitative non-parametric data and Man Whitney U test was applied for the non-parametric numerical data considering p value of less than 0.05 was statistically significant at 5% level of significance.

RESULTS

Among the school age children selected for the study (n=154) median inter-quartile range (IQR) of urinary iodine in Dhankuta (n=63) and Tehrathum (n=91) districts were 214.04 (126.44; 323.0) µg/L and 252.34 (161.81; 301.63) µg/L. No significant differences were observed between the median UIC of these two districts (p=0.235) (Table 1). Median IQR UIC of the male (n=86) and female (n=68) school children were 232.08 (159.58; 301.76) µg/L and 225.45 (127.12; 335.01) µg/L respectively. No significant differences were observed between the male and female populations of school children (p=0.681) (Table 2). Among the school children in Dhankuta districts 2(3.2%) were severely deficient, 4(6.3%) were moderately deficient and 6(9.5%) were mildly deficient. In Tehrathum district 2(2.2%) were moderately deficient and 5(5.5%) were mildly deficient. There were no significant differences observed between the iodine statuses of the two districts (p=0.161).

Table 1: Median UIE in phase out study in two districts

Variables	Categories	Median IQR UIC (µg/L)	P value
Districts	Dhankuta (n=63)	214.04 (126.44; 323.00)	0.236
	Tehrathum (n=91)	252.34 (161.81; 301.63)	
	Total	229.85 (149.57; 308.97)	
Gender	Male (n=86)	232.08 (159.58; 301.76)	0.681
	Female (n=68)	225.45 (127.12; 335.01)	
	Total (n=154)	229.85 (149.57; 308.97)	

Man Whitney U test was applied to compare the median UIC among the two districts at 5% level of significance

Table 3: Iodine status of school children in the two districts

Districts	Iodine status						P value
	Severe	Moderate	Mild	Adequate	More than adequate	Excessive	
Dhankuta(n=63)	2(3.2%)	4(6.3%)	6(9.5%)	17(27.0%)	15(23.8%)	19(30.2%)	0.161
Tehrathum(n=91)	-	2(2.2%)	5(5.5%)	23(25.3%)	35(38.5%)	26(28.6%)	
Total(n=154)	2(1.3%)	6(3.9%)	11(7.1%)	40(26.0%)	50(32.5%)	45(29.2%)	

Chi square test was used to compare the iodine status among the two districts at 5 % level of significance.

DISCUSSION

The present study showed adequate iodine status with median UIC at optimum levels in Dhankuta and Tehrathum districts of Eastern Nepal. Median UIC of Tehrathum district was more than Dhankuta, however not significantly different, representing adequate iodine status in both districts of Eastern Nepal. Proportions of iodine deficient school children were more in Dhankuta as compared to Tehrathum, and no significant difference was observed among the iodine status of the two districts, and the median UIC between the male and female subjects of the two districts. This can be imparted to the fact that both Dhankuta and Tehrathum districts are hilly districts of Eastern Nepal, having similar level of awareness towards consumption of iodized salt for the prevention of IDDs.

In our previous studies median UIC of Dhankuta and Tehrathum were 180.3µg/L (Gelal et al, 2011) and 333 µg/L (Shakya et al, 2011) respectively.[7, 9] Percentage of iodized salt consumption in these two districts were 63.1% in Tehrathum and 83.3% in Dhankuta in the two different studies conducted by Gelal et al, 2011 and Shakya et al, 2011.[9, 10] Our study has shown increased median UIC to 214.0 ìg/L in Dhankuta and slightly decreased median UIC of Tehrathum to 252.3 ìg/L as compared to previous studies.

Our study included only urine sample for the study of iodine status of the school children. Household salt iodine content of these school children could be estimated, including thyroid hormone status to give more clear evidence about the iodine nutrition of school children in these districts. Also, the number of school children enrolled for the study was few so it would not proportionately reflect the iodine status of the whole population.

CONCLUSION

The present study showed improved iodine status with optimal level of median urinary iodine concentration in the two districts, Dhankuta and Tehrathum of Eastern Nepal. Our study recommends that it is essential to regularly monitor the urinary iodine levels in population for the sustainable elimination of iodine deficiency in these regions.

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Conflict of interest:
None

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