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Original Article

Physiology Section

Urinary Iodine Excretion In Pregnancy: A Pilot Study in The Region of Nepal

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ABSTRACT

Background: Pregnancy is accompanied by profound alterations in the thyroid economy and the relative iodine deficiency. The median Urinary Iodine Excretion (UIE) is the most reliable indicator of the population's iodine nutrition. The physiological alterations in normal pregnancy, such as an increased glomerular filtration rate, potentially invalidate UIE as an assessment tool in pregnancy.

Objectives: To assess the Urinary Iodine Excretion (UIE) in pregnant mothers and to enquire about the current status of their iodised salt intake.

Methods: We carried out a cross-sectional study in which urine samples were collected from 45 pregnant mothers who were admitted to the antenatal ward. The iodine level in the urine was analysed by a method which was provided by Singh and Ali, to determine the Urinary Iodine Excretion (UIE). A questionnaire was introduced to document the status of the dietary intake of iodised salt. The UIE was expressed in median (interquartile) and the other data are expressed in frequency and percentage. Fisher Exact test was applied to compare between UIE and iodine intake.

Results: Thirteen (28.88%) pregnant mothers had UIEs of <150 μg/L, which were below the cut-off point of the UIE for pregnant mothers. Overall, 33 mothers were from the Terai region; among them, one third had UIEs of <150 μg/L. Among the 45 pregnant women, 15 (33.34%) were not using iodised salt and the rest were using iodised salt. Among those who were using iodised salt (30 out of 45), 8 pregnant women had UIEs of <150 μg/L and among those who were not using iodised salt, 5 pregnant women had UIEs of < 150 μg/L.

Conclusion: The UIE was below 150μg/L in a substantial percentage (28.89%) of pregnant women of the Terai region, regardless of their intake of iodised salt.

Key words: Iodine deficiency disorder, Urinary iodine excretion, Pregnancy

INTRODUCTION

Nepal is an endemic area regarding iodine deficiency and a nutritional iodine deficiency is found prevalent in all the Himalayan, sub-Himalayan and the Terai/plain regions [1]. In some isolated, mountainous areas of Nepal, most of the adult women have goitre and up to 10% of the population are cretins, the severest form of Iodine Deficiency Disorders IDD [2]. The daily intake of iodine, which is sufficient to prevent iodine deficient goitre in adults, is 150 μg/d. Additional iodine is required during pregnancy and lactation [3]. The iodine requirements sharply increase during pregnancy. Because of the transfer of iodine and the thyroid hormone to the foetus, there is an increase in the maternal needs for the thyroid hormone, and a likely increase in the maternal renal iodine clearance [4].

Thus, the recommended iodine intakes during pregnancy is 250 μg/d [5]. The corresponding median Urinary Iodine concentration (UI) that indicates the optimal iodine nutrition, increases from 100 – 199 μg/L [6] in nonpregnant women to 150 – 250 μg/L during pregnancy [5]. Iodine is rapidly absorbed in the circulation in the form of inorganic iodine, which is rapidly cleared by the kidneys. In humans, greater than 90% of the iodine intake is excreted in the urine, thus providing an estimate of the current iodine intake rather than that of the past iodine intake [7]. Urinary Iodine Excretion (UIE) is therefore considered a good biochemical marker of the recent dietary intake of iodine and is the test of choice for evaluating the degree of iodine deficiency and its correction [3].

Increased median urinary iodine excretion and a decreased prevalence of IDD have been achieved considerably by salt iodization and various public awareness programs. they have not been able to focus on women of the reproductive age group, especially on pregnant mothers. However, whether such measures has addressed the physiologic need of iodine in pregnant mothers is not clear. Thus, this study aimed to determine UIE in pregnant mothers and to assess their iodine intake status.

MATERIAL AND METHODS

This hospital-based, cross sectional study was carried out in the Departments of Basic and Clinical Physiology, Biochemistry and Obstetrics and Gynaecology. The urine samples were collected from 45 pregnant mothers whose ages ranged from 18 – 35 years who were admitted in the antenatal ward, were collected for safe confinement. Informed consents were taken from the mothers and an ethical clearance was obtained from the Institute. The pregnant mothers who were already diagnosed as hypothyroid, those with a family history of hypothyroidism or twin pregnancies, with any complications such as eclampsia or pre-eclampsia and those with any other systemic diseases like diabetes, heart disease, liver disease, renal disease and other endocrine disorders, were excluded from the study. The descriptive information regarding on intake of iodised salt and geographic area of residence of the mothers were collected by using standardised questionnaire. The urine samples were collected in 10 ml plastic containers. The containers had screw caps to prevent leakage and evaporation and they were labeled with stickers. The samples were transported to the laboratory by maintaining a cold chain. The urine samples were analysed for their iodine concentrations by using a method which was based on the modified Sandell-Kolthoff reaction, which was provided by Singh and Ali [8]. It estimates the micro quantities of iodine in the urine samples on arresting the reaction with O – phenylenediamine, which gives a red – orange colour, which represents the ceric ion which is not converted to cerous ion by arsenite. Benzene extracted double glass – distilled water was used for the glassware cleaning and for the preparation of the reagents, to prevent iodine contamination.

STATISTICAL ANALYSIS

The data were analysed by using SPSS, version 17.0. The urinary iodine excretion levels were not normally distributed and thus, the results were expressed as median and interquartile range. The data are expressed in frequency and percentage. Fisher Exact test was applied to find out the level of significance between the iodine intake and the UIE. The mothers were categorised, based on the WHO/ICCIDD/UNICEF criteria.

RESULTS

Forty five pregnant women were enrolled in this study. Their mean age of the study group was 23.73 ± 3.8 (years), the mean weight was 57.71 ± 5.95 (Kg) and the mean height was 1.53 ± .049 (cm). Among them, 32 (71.11%) were primigravida and that 13 (28.89%) were multigravida. 39 (86.66%) of them delivered at term (37 – 42 wks of gestation), while the rest 6 (13.34) delivered post term. The urinary iodine excretion of the mothers was categorised according to the WHO classification for the iodine deficiency disorders in pregnancy. Thirteen (28.88%) pregnant mothers had UIEs of <150 µg/L, which were below the cut-off point of UIE for them. Overall, 17 (37.78 %) pregnant mothers had UIEs which were within the optimal range of 150-249 µg/L, which was given for pregnancy. The median and the interquartile range in each category have been tabulated in [Table/Fig-1].

Overall, 33 mothers were from the Terai region. They showed heterogeneous patterns of the UIE. Among them, eleven mothers had UIEs of less than 150 µg/L. Two out of 12 mothers from the hilly region had UIEs of less than 150 µg/L.

[Table/Fig-2] shows the relationship between the iodine intake and the urinary iodine excretion, which was statistically not significant.

UIE level (µg/L)	Median (q1-q3)
<150 (µg/L) *	109.48 (103.08 - 132.93)
150-249 (µg/L)	210.79 (196.63 - 228.60)
250-499 (µg/L)**	278.92 (264.66 - 283.60)

[Table/Fig-1]: Urinary iodine excretion level and iodine intake status based on WHO classification

* In this group, two mothers had UIEs even below 100 (µg/L). **In this group, 15 (33.33 %) had iodine excretions above 249 µg/L, but none of the mothers had UIEs of above 300 µg/L.

Dietary salt intake	Urinary iodine excretion (µg/L)			Total n (%)
	<150 n	150 - 249 n	250 - 449 n	
Iodised	8	13	9	30 (66.67 %)
Non iodised	5	4	6	15 (33.33 %)
Total (n)	13	17	15	45 (100 %)

[Table/Fig-2]: Urinary iodine excretion and maternal dietary salt intake in pregnant mothers (n = 45)

[Table/Fig-3] represents the geographical area of residence of the pregnant mothers, which showed that most of them were from the plains.

Urinary iodine excretion (µg/L)	Residential area		Total n (%)
	Terai /Plain	Mountains & Hills	
<150 µg/L	11	2	13(28.88%)
150-249 µg/L	11	6	17 (37.78 %)
250-499 µg/L	11	4	15 (33.33 %)
Total n (%)	33	12	45(100%)

[Table/Fig-3]: Area of domicile distribution of pregnant mothers

DISCUSSION

The present study attempted to investigate the UIEs in pregnant mothers at the time of their deliveries. In healthy pregnant women, a physiological adaptation takes place when the iodine intake is adequate, while this is replaced by pathological alterations when there is a deficient iodine intake [9]. Hence, the aim of the present study was to find out the UIEs in pregnant mothers at the time of their deliveries and their iodine intake statuses. Forty five pregnant mothers whose ages ranged from 18 – 35 years were included in the study. Pregnancies which were complicated with hypothyroid and a family history of hypothyroidism or twin pregnancies, with any complications such as eclampsia or pre – eclampsia or any other systemic diseases, were excluded from the study. The urine samples were collected and analysed for the iodine levels in urine, by a method which was provided by Singh and Ali.

The study showed 13 (28.88%) pregnant mothers had UIE less than 150 µg/L. According to the WHO criteria, they would be considered as iodine deficient and their iodine intake status as insufficient intake of iodized salt. Our study results were comparable to the values found in one study [10]. Urinary iodine excretion (UIE) of less than 10 µg/dl was found in 22.9% and 9.5% of pregnant women [11]. In one study, a median UIE of 9.5 µg/dl was found in adolescents and pregnant women [12].

Among the pregnant mothers who had UIEs of below 150 µg/L, almost all (11 out of 13) were from the Terai/plain region. A recent national survey found that the UIEs were lower among the women of the Terai region than in the women of other geographical regions, with nearly 60% women having UIEs of below 0.79 mmol/l [13]. In one of the studies done to assess the iodine deficiency in three ecological regions of Nepal, the Terai region was found to be more affected, which showed iodine deficiencies in 18.6% of the population. The hilly and the mountainous regions were found to have 11.2% and 9% iodine deficient populations respectively [14]. Similarly, one study states that iodine deficiency remains a mild – to – moderate public health problem among the pregnant and the lactating women despite the availability of iodised salt in the rural southern plains of Nepal [15]. In India also, IDD was present in the irrigated plains as well as in the hilly regions of the sub – Himalayas [16]. In this study, 30 pregnant mothers had been using iodised salt; among them, eight had UIEs of < 150 µg/L. Altogether, 15 mothers were not using iodised salt in our study. Studies which were conducted in different ecological regions of Nepal reported that people were still consuming salt with low levels of iodine [17]. In a region with a history of a borderline iodine deficiency, the UICs were below 150 µg/L in a substantial percentage of pregnant women, who did not take iodine supplements, regardless of whether or not they took iodised salt [18].

In contrast to this, many of the studies state that the current iodine nutrition status was at satisfactory levels in eastern Nepal, as primary school children had normal median UIEs and as a majority of the households were consuming adequately iodised packet salt [19, 20]. But one of the studies it has been shown that the median UI in school-aged children could not be used as a surrogate for monitoring the iodine status in pregnancy and that pregnant women should be directly monitored [21].

In Another study, iodine status was explored in children and in pregnant women by using the same salt, showed that the iodine statuses in children were within their recommended optimal ranges, while at the same time, the iodine statuses in the pregnant women who were living in the same households had fallen below the desired minimum levels [22]. Just ensuring that the people were using iodised salt did not confirm that they were getting adequate iodine.

A shortcoming of this study was its small sample size. Larger studies are needed to elucidate the iodine deficiency in pregnant women at delivery. These aspects of the reproductive health require immediate attention.

The findings of this study call for further attention to the iodine intake during pregnancy. The recommended values for dietary iodine through universal salt iodisation, may not be adequate for pregnant women, and the specific problem of iodine and pregnancy should be considered further in the light of the latest recommendations.

CONCLUSION

The median UIC reflected an iodine deficiency according to the WHO reference levels. It is necessary to strengthen the iodised salt consumption in pregnant women. The availability of more data would be valuable, for assessing the correspondence between the iodine intake and the excretion of iodine during pregnancy.

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