ORIGINAL ARTICLE ASIAN JOURNAL OF MEDICAL SCIENCES

Urinary iodine in second trimester of pregnancy: A cross sectional study in tertiary care hospital of Belagavi

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Submission: 17-06-2020 Revision: 23-07-2020 Publication: 01-09-2020

ABSTRACT

Background: Iodine is a nutritionally important trace element and its deficiency is a common health problem affecting a huge population, particularly pregnant women and children. The physiological role of iodine in the human body is synthesis of thyroid hormones. Thyroxine is approximately 60% iodine by weight. If iodine intake falls below approximately 100µg/day, Thyroid Stimulating Hormone (TSH) secretion is augmented, which increases plasma inorganic iodide clearance. **Aims and Objective:** To correlate urinary iodine with serum TSH in the second trimester of pregnant women. **Materials and Methods:** One hundred five subjects were included in the study from tertiary care hospital. A random urine sample was collected. Iodine was estimated by ammonium persulfate method and TSH values were collected from the OBG department of the subjects enrolled. Statistics: Pearson correlation coefficient was done. **Results:** Median UI 138.50 (29.80-350.51) µg/L, median TSH 1.90(0.17-7.46) mIU/L. There was no significant correlation between UI and serum TSH with r = (0.0873, (p = 0.3756). **Conclusion:** Urinary iodine is a marker for population iodine status. A preferable biomarker is necessary to know the iodine status of individual which include not only nutritional biomarker and also required to organise reference range for TSH.

Key words: Urinary Iodine; Pregnancy; ammonium persulfate; TSH

Access this article online

Website: http://nepjol.info/index.php/AJMS

DOI: 10.3126/ajms.v11i5.29439

E-ISSN: 2091-0576

P-ISSN: 2467-9100

INTRODUCTION

Iodine is a nutritionally important trace element and its deficiency is a common health problem affecting a huge population, particularly pregnant women and children.[1,2] The synthesis of thyroid hormones is the physiological role of iodine in the human body. Thyroxine is approximately 60% iodine by weight.[3] If iodine intake falls below approximately 100µg/day, TSH secretion is augmented, which leads to increase in clearance of inorganic iodide. TSH also stimulates the breakdown of Thyroglobulin (Tg) for synthesis and release of T_3 into the blood.[4] There are variations noted in iodine content in drinking water and to some degree in milk in different geographical areas.[5] In mountainous areas soil iodine content is less. Also regions in central part of Asia, Africa and Eastern Europe are found to be insufficient in iodine. People living on the coastal and the island may have an iodine deficiency.[4] As far as India is concerned heavy rainfall/flooding results in mineral depletion and makes the soil iodine deficient.[6]

Dietary iodine deficiency leads to altered synthesis of thyroid hormone and/or thyroid enlargement (goiter).

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Iodine Deficiency Disorders (IDDs) includes endemic goiter, hypothyroidism, cretinism, reduced fertility rate, elevates infant mortality as well as mental retardation.[7] Iodine deficiency is said to result in loss of 13.5 IQ points at the population level.[8] Lower serum T_4 and higher TSH concentration is associated with low urinary iodine at the population level.[9] To trap additional iodine from circulation and thyroid hormone production, body responds in form of increment in size of thyroid gland in persons who are deficient in iodine.[10]

The World Health Organization (WHO) and the International Council for IDD Control recommended markers of nutritional iodine status are urinary iodine concentration (UIC), TSH, thyroglobulin and goiter.[11] Median urinary iodine concentration (UIC) is a key indicator of recent population intake of iodine as recommended by the World Health Organization (WHO).[12] The concentration of urine iodine (UIC) remains the gold standard for monitoring population-level iodine nutrition.[13]

Iodine requirement increases during pregnancy.[14] Pregnant women are prone to iodine deficiency mostly in first trimester.[3] Production of maternal T_4 with euthyroid levels of 25 to 50% is provided by the increase consumption of iodine. In pregnancy, there are 3 thyroid stimulators namely, pituitary thyroid stimulating hormone (TSH), the human chorionic gonadotropin (hCG) and the chorionic TSH (hCT).[15] IDDs are the major health problem affecting 1/3rd of the population.[16] As per the statistics of 1990, the proportion of population who were at risk of iodine deficiency was 28.9%, goiter 12%, 11.2 million individuals were diagnosed with cretinism and 43 million individual had some degree of mental retardation.[17]Around 29.8% of South Asian countries are estimated to have insufficient iodine intakes.[18] Around 71 million are affected due to dietary iodine insufficiency in India.[7] A notable iodine insufficiency was disclosed in a review done in Indian studies that advised timely examination of UIC during pregnancy is an essential part of National IDD programme. It also provided the spotlight of requirement of prototypical surveys at national levels. Two cross-sectional studies from Rajasthan, revealed median UIC was 127μg/L and 118μg/L in pregnant women of >28 weeks of gestation which indicates deficiency.[6] Another study conducted in New Delhi[19] and Haryana[20] showed median urinary iodine 150μg/L indicating dietary sufficiency. The study in Dhaka[21] showed that maternal urinary iodine is negatively correlated with their serum TSH. Similarly other study in Thailand[22] showed there was no co-relation between maternal urinary iodine and TSH. It is found that the iodination of salt that is undertaken by Indian Government is unable to meet requirement in pregnant and lactating mothers as compared to general population.[12] The present study was done to see the association between UI with serum TSH in pregnant women. Serum iodine level is not reliable marker to know the iodine status on the other hand UI concentration indicates current iodine level in the population.

The aim of this study is to correlate urinary iodine with serum TSH in second trimester pregnant women.

MATERIALS AND METHODS

A Cross sectional study conducted in J.N Medical College, Belagavi, Karnataka, India, in 2019. One hundred five second trimester pregnant women were enrolled for the study. Those pregnant women attending in OPD of OBG department in KLE Society's Dr. Prabhakar Kore Charitable Hospital and Medical Research Centre, Belagavi. All the participants gave written informed consent for the study.

Ethical approval

The study was approved by the Institutional Ethics Committee of Jawaharlal Nehru Medical College, KLE Academy Higher Education and Research, Karnataka, India. Second trimester pregnant women with both primigravida and multigravida status were included. Multiple pregnancies, clinical diagnosed hypothyroidism and hyperthyroidism, thyrotoxicosis or previous history of thyroid disease, acute or chronic infection, history of ingestion of certain drugs (steroids, iodine containing dyes) and renal disease were excluded. Random urine was collected in a dry, clean and fresh glass container free from any chemical contamination and stored at -20°C which was proceed within 24hrs for estimation of urinary iodine. Urinary iodine was estimated by ammonium persulfate method[23] and TSH values were obtained from OBG department of the subjects.

Inclusion criteria

Second trimester pregnant women, Gravida status both Primigravida and multigravida.

Exclusion criteria

Multiple pregnancies, clinical diagnosed hypothyroidism and hyperthyroidism, thyrotoxicosis or previous history of thyroid disease, acute or chronic infection, history of ingestion of certain drugs (steroids, iodine containing dyes) and renal disease.

The data obtained was analyzed statically by computing median (Range). Linear regression analysis was used to access the significance of correlation and calculate the p-value. The results were considered statistical significant $p \leq 0.05$. The obtained data in the study was tabulated using Microsoft Excel. A statistical analysis was done

using Statistical Package for Social Sciences, version 20.0 software (IBM-SPSS).

RESULTS

A cross sectional study was done to study the urinary iodine level in pregnant women. Urinary iodine was estimated in 2nd trimester pregnant women & correlated its value with serum TSH. Correlation between urinary iodine and TSH scores in the study by Karl Pearson's correlation coefficient and comparison of groups of urinary iodine (<150 and ≥150) with TSH scores by independent t test by using the SPSS.

In Table 1, the subject were divided into age wise distribution where 20-24yrs were highest (n=63) and least in 30 or above (n=8) and age mean ± SD was 24.34± 3.51. The median UI was 138.50 with range (29.80-350.51) µg/L and TSH was 1.90 with range (0.17-7.46) mIU/L. 60% subjects were <150 UI with mean TSH 2.04 and 40% had ≥150 µg/L UI with mean TSH 2.13. There was no significant correlation between UI and serum TSH(r=0.0873, p=0.3756).

In Table 2, There was no significant correlation between urinary iodine and serum TSH value with (r-value= 0.0873), (p-value=0.3756).

In Table 3, Out of 105, 63 were found to be <150 and ≥150 were 42 in which mean were 2.04 and 2.13 respectively with P-value 0.6817

Table 1: Summary of urinary iodine and TSH scores in the study

Summary	Urinary iodine (µg/L)	TSH (mIU/L)
Minimum	29.80	0.17
Maximum	350.51	7.46
Mean	146.56	2.08
Median	138.50	1.90
SD	59.55	1.14
SE	5.81	0.11

Table 2: Correlation between urinary iodine and TSH scores in the study by Karl Pearson's correlation coefficient

Variables	Correlation between Urinary iodine with		
	r-value	t-value	p-value
TSH scores	0.0873	0.8899	0.3756

Table 3: Comparison of groups of urinary iodine (<150 and ≥150) with TSH scores by independent t test

Urinary iodine	N	Mean	SD	t-value	P-value
<150	63	2.04	1.21	-0.4113	0.6817
≥150	42	2.13	1.03		

DISCUSSION

During pregnancy metabolic demands result in changes in the biochemical parameters of thyroid function. There is an increase demand of thyroid hormone. The main changes' occurring is decrease in free hormone concentrations and slight rise in basal thyroid stimulating hormone (TSH). Iodine is required for thyroid hormone synthesis, its deficiency affect thyroxine synthesis, which presents with a spectrum of findings known as IDDs, which in a pregnant women may present with endemic goiters, abortion, stillbirth, cretinism, severe mental retardation, growth retardation and prematurity.[7]

The present study was done to see for association between UI with serum TSH in pregnant women. Serum iodine level is not reliable marker to know the iodine status on the other hand Urinary Iodine (UI) concentration indicates current iodine nutrition across the populations.

105 pregnant women second trimester were included. Urinary Iodine and serum TSH were assessed. Median UI 138.50 (29.80-350.51)µg/L, Median TSH 1.90mcIU/ml (0.17-7.46). There was no correlation between Urinary Iodine and serum TSH (r = 0.0873, p = 0.3756). Our study is in accordance to study done by A Amouzegaretl al [24] which showed no association between urinary iodine and serum TSH level. Similarly, another study done by elsewhere[9] and Indranil Chakraborty et.al[16] in pregnant women showed there was no association between UI and TSH concentration which supports accordance to our study.

A study done by PR Saha et al.[1] in healthy pregnant found a significant negative correlation between UI and serum TSH (p<0.01) and Caron P et al.[25] had significant negative correlation between UI and serum TSH in pregnant women. Rostami et al. revealed that overall median UIE in pregnant residents of Urmia, in I.R. Iran, was 93.7 µg/l; that was 73.5 µg/l in first and 114µg/l.[26] Fuse et al. who found no correlation between UIE and thyroid function parameters in Japanese pregnant women, in an iodine sufficient area.[27] According to WHO[12] UI <150 µg/L in a random sample in pregnant women in a population indicates iodine deficiency.The NHANES survey showed 35.5% of pregnant women suffer from mild iodine deficiency with urinary iodine levels below 100 µg/l.[28]

Utility of urinary iodine can be further improved, so that it can be used for an individual, there are studies which have

shown use of 10 consecutive urine samples or 24 hrs[29] urine sample iodine measured by a specific method can be used to know individuals iodine status. And this individual iodine status can be used as nutritional biomarkers and is useful for establishing the reference range of TSH.

CONCLUSION

In the present study we could not establish an association between TSH and urinary iodine. Urinary iodine is a marker for population iodine status. A better biomarker is needed to know the iodine status of individual iodine which is not just a nutritional biomarker. It is also need to establish reference range for TSH.

ACKNOWLEDGEMENTS

The authors are deeply indebted to all the participants of the study.

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BB-Conceptualized study and design of the study, collected data, analysed and interpreted, reviewed the literature, manuscript preparation andcritical revision of the manuscript; **AP-**Conceptualized study, literature search, statistically analysed and interpreted, prepared first draft of manuscript and critical revision of the manuscript; **SM-**Concept, and review of literature and helped in preparing first draft ofmanuscript; **LS-**Literature search, statistically, prepared first draft of manuscript, critical revision of the manuscript and Collected data; **KP-**Conceptualized study, statistically analysed and interpreted, prepared first draft of manuscript.

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Source of support: None, **Conflicts of Interest:** None