

Trimester Specific Nutritional Status of Iodine among Euthyroid Pregnant Women

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Abstract

Objective: To evaluate the present nutritional status of iodine among euthyroid pregnant women by measurement of urinary iodine levels.

Material and Methods: 381 pregnant women attending antenatal clinic in the obstetrics and gynaecology department were included in study. Out of 381, 285 euthyroid women were selected as study population. Median urinary iodine levels (MUI) were compared among euthyroid pregnancy women according to trimester of gestation and thyroid peroxidase antibody (TPO Ab) level.

Results: MUI level of euthyroid pregnant women was 119.2 µg/L (IQR=35.8-310.95) with 2.5th and percentile 97.5th being 5.55 µg/L and 1058.68 µg/L respectively. Out of 285 euthyroid women, 153(53.68%) were having MUI level below 150 µg/L. Trimester specific MUI levels decreased from 193.2 µg/L to 111.8 µg/L to 97.65 µg/L as gestational age increased from 1st to 2nd to 3rd trimesters respectively but this decrease with gestational age was not statistically significant. MUI levels of Anti-TPO antibody positive and negative euthyroid women were 153.8 µg/L and 118.4 µg/L respectively without being statistically significant (p=0.98). 138(54.12%) of Anti-TPO antibody negative and 15(50%) of Anti-TPO antibody positive were having MUI level below 150 µg/L.

Conclusions: In the present study, we found that 53.68% of pregnant women were having MUI levels in iodine deficient range as per WHO guidelines.

Keywords: Pregnancy; Euthyroid; Median urinary iodine (MUI)

Introduction

Iodine deficiency is still a significant global public health problem and affects both developed and developing countries. It is estimated that iodine intake is insufficient in about 2 billion people worldwide [1]. Iodine is an essential micronutrient required for thyroid hormone synthesis and its role in fetal and early childhood brain development is emphasized by studies showing iodine deficiency in pregnancy is associated with stunted growth and neuromotor, intellectual, behavioural, and cognitive impairment, as well as, cretinism in severe cases [2-3]. Iodine nutrition in community is assessed by goiter rate, median urinary iodine level, serum TSH and thyroglobulin, although key indicator is median urinary iodine levels among school children [4]. Since majority of dietary iodine (>90%) is excreted in the urine, urinary iodine excretion (UIE) is largely a passive process dependent on glomerular filtration rate (GFR) [5]. The UIE in a non-pregnant individual on a stable diet represents a dynamic equilibrium between dietary intake, thyroidal iodine extraction, the total body thyroid hormone pool, and GFR. The adequacy of iodine nutrition is defined by the following criteria: A median MUI of at least 100 µg/L (with <20% of the population having MUI <50 µg/L) represents adequate population iodine nutrition; a median MUI between 50 µg/L and 99 µg/L represents mild iodine deficiency; and medians of 20-49 µg/L and

<20 µg/L represent moderate and severe iodine deficiency, respectively [4].

During normal pregnancy, GFR increases within the first month following conception, peaking by the end of the first trimester by approximately 40-50% above prepregnant levels [6]. Hence, pregnancy can be expected to result in increased renal iodine loss. Taking these physiological changes into consideration, the WHO and the American Thyroid Association have recommended higher pregnancy-specific urinary iodine ranges as marker of adequacy of iodine nutrition i.e. MUI of <150 µg/L represent insufficient iodine nutrition; MUI of 150-249 µg/L represent adequate iodine nutrition and ≥ 250 represent above requirement [1]. Studies on iodine nutrition in pregnancy, based on median urinary iodine excretion, have been far and few with inter trimester variation, with no study being from Haryana (India). So we conducted this cross sectional study to know the iodine status of pregnant women in Haryana, which is supposed to be an iodine sufficient belt where all households are consuming iodized salt.

Material and Methods

This was a cross-sectional study, conducted at Department of Endocrinology & Medicine Unit VI of PGIMS Rohtak for a period of 1 year after approval from institutional ethical review board. 381 consecutive pregnant women attending antenatal clinic in the obstetrics and gynecology department were included for study. All

women who were carrying a healthy singleton uncomplicated intrauterine pregnancy and consuming iodized salt were recruited. On enrolment of participants, informed consent was obtained from each patient after explaining the purpose of the study. Then detailed history was enquired and participants were subjected to relevant general physical examination which included presence or absence of goiter and general and systemic examinations. Participants having any history of chronic illness, goiter on physical examination, thyroid illness in the past or present, consuming thyroid medications (current and past), consuming iodine containing vitamins and minerals, having family history of thyroid illness, poor obstetrics history included 3 or more abortions were excluded from the study. Blood sample and spot urine samples were collected.

Estimation for FT3, FT4 TSH, and TPO Ab was done using the electrochemiluminescence (ECL) technique using commercially available kits by Advia Centaur CP analyzer system and immulite 1000. The analytical sensitivities for FT3, FT4, TSH and anti TPO were 0.2 pg/mL, 0.1 ng/dL, 0.010 µIU/mL and 7 IU/mL respectively. Intra-assay coefficients of variation for FT3, FT4, TSH and TPO Ab were 3.8%, 2.20%, 5.2% and 5.6%, respectively. Laboratory reference range for FT3, FT4 and TSH were 2.3-4.2 pg/mL, 0.89-1.76 ng/dL and 0.35-5.5 µIU/L, respectively. Normal range for TPO antibody was <35 IU/mL and value greater than or equal to 35 IU/mL indicate elevated TPO Ab. As per AACE guidelines pregnant women with TSH level ≤ 2.5 µIU/mL in first trimester and TSH level ≤ 3.0 µIU/mL in second and third trimester were classified as having normal thyroid status [7]. Urinary iodine levels were measured by method of Sandell and Kolthoff [8].

According to the aims and objectives of the study, the data was compiled and entered into MS Excel and analysed, using appropriate statistical tests in SPSS (statistical package for social sciences) version 20. For descriptive statistics, frequencies, percentages and median were calculated. To assess difference between categorical variables 'Chi Square Test' was used. Mann Whitney U test was used to compare the median of two separate sets of independent samples. For comparison of means of more than two samples-Kruskal Wallis H test was used. The p-values were two tailed and probability level of significant difference was set at <0.05.

Results

381 consecutive pregnant women attending antenatal clinic (ANC) were screened for their thyroid status and 285(74.8%), 82(21.52%), 11(2.89%) and 3(0.79%) were diagnosed as euthyroid, SCH, overt hypothyroid and hyperthyroid respectively. The 285 euthyroid pregnant women were selected as study population and were studied for Median urinary iodine (MUI) excretion. The mean age of euthyroid pregnant women was 23.47 ± 3.2 year with mean BMI of 22.66 ± 3.96 kg/m². MUI level of euthyroid women was 119.2 µg/L (IQR=35.8-310.95) with 2.5th percentile being 5.55 µg/L and 97.5th percentile being 1058.68 µg/L. Out of 285 euthyroid women, 153(53.68%) euthyroid were having MUI level below 150 µg/L.

Among 285 euthyroid women, 89(31.23%) were from 1st trimester, 98(34.39%) were from 2nd and 3rd trimester each. Mean age of women in 1st, 2nd and 3rd trimester was 23.19 ± 2.88, 23.33 ± 3.29 and 23.88 ± 3.45 year respectively. Trimester specific MUI levels of euthyroid women were 193.25 µg/L, 111.8 µg/L and 97.65 µg/L in 1st, 2nd and 3rd trimester respectively, showing a decreasing trend from 1st to 3rd

trimester. 39(43.82%), 53(54.08%) and 61(62.24%) women of 1st, 2nd and 3rd trimester were having MUI level below 150 µg/L.

When euthyroid women were divided as per Anti-TPO antibody status, 255(89.47%) and 30(10.53%) were found to be Anti-TPO antibody negative and positive respectively. The mean age of Anti-TPO antibody negative and positive women were 23.52 ± 3.2 and 23.1 ± 3.22 year respectively without being statistically significant (p=0.5). MUI levels of Anti-TPO antibody positive and negative euthyroid women were 153.8 µg/L and 118.4 µg/L respectively without being statistically significant (p=0.98). 138(54.12%) of Anti-TPO antibody negative and 15(50%) of Anti-TPO antibody positive were having MUI level below 150 µg/L. Table 1 summarises the frequency distribution of MUI level among euthyroid pregnant women according to trimester of pregnancy and TPO antibody status.

	Median urinary iodine (µg/L)				Total
	<150	150-249	250-499	>500	
All Euthyroid	153 (53.68%)	47 (16.49%)	50 (17.54%)	35 (12.28%)	285
1 st trimester	39 (43.82%)	16 (17.98%)	17 (19.10%)	17 (19.10%)	89
2 nd trimester	53 (54.08%)	19 (19.39%)	17 (17.35%)	9 (9.18%)	98
3 rd trimester	61 (62.24%)	12 (12.24%)	16 (16.33%)	9 (9.18%)	98
TPO negative	138 (54.12%)	47 (16.08%)	43 (16.86%)	33 (12.94%)	255
TPO positive	15 (50%)	6 (20%)	7 (23.33%)	2 (6.67%)	30

Table 1: Comparison of frequency distribution of MUI level among euthyroid pregnant women.

Discussion

Evaluation of thyroid disease in pregnancy is important for gestational maternal health, obstetrical outcome and subsequent mental and physical development of the child. Prevalence of thyroid disorders is more in Asian countries compared to west [9]. Iodine is a micronutrient whose main role is in the synthesis of thyroid hormones and deficiency of which leads to a series of functional and developmental abnormalities grouped under the heading of "Iodine Deficiency Disorders (IDD)". There are very few studies with conflicting results regarding the level of median urinary iodine level during different trimester of pregnancy. Some studies have shown similar values of urinary iodine in both pregnant and non-pregnant women while the others have shown increased excretion of urinary iodine in pregnant women [10-14]. On the contrary, few studies had shown that urinary iodine decreases during gestation [15-16].

Present study found MUI level of 119.2 µg/L among euthyroid pregnant women with 53.68% having MUI <150 µg/L indicating iodine deficiency among them. Similar deficiency was found by Ategbro, et al. [17] in Rajasthan where 56% out of 360 pregnant women were having MUI level below 150 µg/L and Majumder, et al. [18] in Kolkata with 88(37%) out of 237 pregnant women were having iodine deficiency. Although Grewal, et al. [19] conducted a study in Delhi and found that only 3(2%) out of 150 pregnant women were having urinary iodine levels <150 µg/L with median value of 304 µg/L. Another study conducted by Ainy, et al. [20] from Delhi found MUI concentration of 178.2 µg/L, 182.8 µg/L, and 167.5 µg/L during the first, second, and third trimesters respectively. All levels fell within the range (150-250

µg/L) recommended by WHO/UNICEF/ICCIDD, 2007 for pregnant women. Urinary iodine levels of pregnant women were higher than those of non-pregnant women (143.8 µg/L). The higher MUI in pregnant as well as nonpregnant in above studies from Delhi could be due small sample size, selectivity of study population, and failure to exclude women consuming vitamins and mineral which are important sources of nonsalt iodine intake.

Various physiological changes associated with increased iodine requirement as pregnancy advances include increase in renal blood flow and GFR results in increased urinary iodine excretion, increased maternal thyroid hormone synthesis to maintain euthyroidism and transplacental transfer of iodine to the fetus for fetal thyroid hormone synthesis. There are very few studies across the world studying and reporting trimester specific median urinary excretion. In present study median urinary iodine levels of euthyroid pregnant women in 1st, 2nd and 3rd trimester were found to be 193.2 µg/L, 111.8 µg/L and 97.65 µg/L respectively. Decrease was 42.13% from 1st to 2nd trimester and additional 7.32% from 2nd to 3rd trimester (p=0.69) which was not statistically significant. Brander, et al. [21] from Switzerland showed decrease in UIC from 267 µg/L, 206 µg/L to 172 µg/L from 1st, 2nd to 3rd trimester respectively. Ainy et al. involving 298 Tehranian pregnant women found decreasing MUI from 1st (193) to 2nd (159) to 3rd (141) trimester [22]. The increased thyroidal iodide clearance and shift to fetal-placental unit as pregnancy advances may explain the observation of progressive MUI decrease during gestation. However, other studies shows increased urinary iodine excretion as pregnancy advances. A study done in United Kingdom by Bath, et al. [23] found median Urinary iodine level (mcg/l) of 42, 52 and 69.4 in 1st, 2nd and 3rd trimesters respectively. Chakraborty, et al. [24] found median urinary iodine level of 137.5, 135 and 160 µg/L in 1st, 2nd and 3rd trimesters respectively, while study conducted by Grewal, et al. [19], involving 50 women from each trimester of pregnancy found median urinary iodine levels in 1st, 2nd and 3rd trimester as 285, 318 and 304 µg/L, respectively. Various likely reasons cited for these differences in median urinary iodine excretion as pregnancy advances includes increased utilization of iodine to meet the high demands for thyroid hormone production during first trimester at least partly because of stimulation of thyroid gland by human chorionic gonadotropin reducing the proportion excreted into the urine and increase in dietary iodine intake, particularly from dairy products and non-dietary iodine intake inform of vitamin and minerals as pregnancy progresses which would had resulted in increased iodine excretion with advancing gestation. In the present study we have studies women who were not consuming vitamins and minerals containing iodine and found that median urinary iodine decreases as pregnancy advances.

No study in past have studied and compared the median urinary iodine level among TPO antibody positive and negative euthyroid pregnant women. In present study we found that although anti-TPO positive euthyroid women had higher median urinary iodine (153.8 µg/L) compared to TPO negative women (118.4 µg/L) although this difference was statistically insignificant (p=0.98). Studies from China and Japan had shown the higher incidence of thyroiditis among subjects taking more than adequate iodine intake [25,26]. Various mechanisms assumed for the development of iodine-induced autoimmune thyroiditis include increased the immunogenicity of thyroglobulin (Tg) in presence of high iodine intake, thereby precipitating an autoimmune process at both the T-and B-cell level, direct toxic effect of iodine on thyroid cells and lastly direct stimulation of immune and immunity-related cells by iodine.

To conclude with in post iodization era although Haryana is considered to be an iodine sufficient state with almost 100% of houses consuming iodised salt, in the present study, we found that 53.68% of pregnant women were having median urinary iodine levels in iodine deficient range as per WHO guidelines. Some of the short comings of present study include small sample size (although absolute no of participant was greater than other available studies), non-estimation of salt iodine content and no collection of information about salt storage. So there is need to estimate urinary iodine from a larger sample of pregnant women across different districts of not only Haryana but even other parts of country which are supposed to be iodine sufficient as Haryana to find out real current status of iodination in our population.

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