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Original Research Article

Thyroid Status in First Trimester of Pregnancy-A Hospital Based Study

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ABSTRACT

Background: Increased requirement of thyroid hormones is a normal physiological phenomenon during pregnancy to meet the growing maternal metabolic demand and additional requirement of the developing product of conception. Body adapts to this demand by increasing the activity of the thyroid gland.

The present study has been undertaken in the known Sub Himalayan iodine deficient belt of Upper Assam districts of Jorhat, Golaghat and Sibsagar.TT_3, TT_4 and TSH levels evaluated in women in their first trimester of pregnancy compared with a group of similar age and sex matched non pregnant control.

Aim:

1. To evaluate the thyroid status (TT_3, TT4 and TSH levels) in apparently euthyroid women in their first trimester of pregnancy.
2. To analyse the results by comparing with an age/sex matched non pregnant control group.
3. To compare the findings of the study with similar study results carried out elsewhere in the Globe.

Methods: Serum TT_3,TT_4 and TSH levels evaluated in 132 1st trimester pregnant women and 131 non pregnant controls using Access Immunoassay Systems (Beckman Coulter) at the clinical Biochemistry wing of central clinical laboratory of Jorhat Medical College Hospital, Jorhat (Assam) Statistical analysis done using SPSS 16.0 version.

Results: Highly significant increased values were obtained for TT_3 and TT_4 in the study group of pregnant women in 1st trimester when compared with the non pregnant controls.

Conclusion: The study reaffirms the physiological hyperactive state of the thyroid gland in 1st trimester of pregnancy and emphasises for a region/ laboratory based pregnancy specific reference range for thyroid hormones and TSH.

Keywords: Pregnancy, Total triiodothyronine (TT_3), Total Thyroxin (TT_4), Thyroid stimulating hormone (TSH).

INTRODUCTION

Pregnancy is a physiological state associated with significant but reversible changes in thyroid function. [1] Pregnancy demands increased requirement of thyroid hormones. Augmented thyroid activity allows healthy pregnant women to continue an uneventful period of pregnancy culminating with the delivery of a healthy baby. During the first trimester of pregnancy, the fetus is dependent on transplacental passage of maternal thyroxine, as fetal thyroid is not fully functional until about 16 weeks of gestation.

[1] Maternal thyroid hormones play a vital role in early fetal brain development and their deficiency may impair future neuropsychological development of the fetus. [2-4]

Both hypo and hyperthyroidism can occur during pregnancy. Hyperthyroidism in pregnant women has been estimated at 0.2%. [5] Graves disease accounts for 85-90% of all cases. [5,6] Two other pregnancy related conditions associated with hyperthyroidism are hyperemesis gravidarum and trophoblastic disease. Diagnosis of hyperthyroidism which needs to be made on careful clinical observations and well conceived laboratory testing is very important considering that the untreated or poorly treated hyperthyroidism can lead to adverse obstetrical outcomes. These include first trimester spontaneous abortions, high rates of still births and neonatal deaths; two to three fold increase in the frequency of low birth weight infants, preterm delivery, fetal or neonatal hyperthyroidism and intrauterine growth retardation. [5,7]

The incidence of hypothyroidism in pregnant women has been estimated to be 0.3-0.7%. [2] There has been a known association between hypothyroidism and decreased fertility. [8-10] This accounts for the low frequency of its occurrence in pregnant women than the general population (0.6-1.4%). [2]

In pregnancy, the renal clearance of iodide increases substantially because of an increased glomerular filtration rate. [2] The iodide loss lowers the circulating concentration of iodide and produces a compensatory increase in thyroidal iodide clearance. In areas of the World where iodine intake is sufficient, this iodide loss in urine is not clinically important. But in known iodine deficient regions, however, iodine deficiency during pregnancy can lead to hypothyroidism and goitre. This is in fact, a serious public health issue. Untreated Hypothyroidism in pregnancy may cause a significant decrease in the IQ of the children. [11] Apart from this menace, hypothyroidism in pregnancy has also been associated with pregnancy induced hypertension, placenta abruption, post partum haemorrhage and an increase in frequency of low birth weight infants. [5]

The present study is undertaken among apparently healthy euthyroid pregnant women in their first trimester of pregnancy coming to ante-natal outpatient department of Jorhat Medical College Hospital(JMCH).JMCH has a catchment area comprising patients from the upper Assam districts of Joraht, Golaghat and Sibsagar, a known iodine deficient region of the sub Himalayan Iodine deficient Belt. The study aims to evaluate the thyroid status of the pregnant women of this iodine deficient region in their first trimester of pregnancy and statistically analyse the results by comparing with an age/sex matched control group of the same region. The study also compares its findings with studies of similar kind done elsewhere.

MATERIALS AND METHODS

Cases

A total number of 132 women in their first trimester of pregnancy visiting antenatal OPD of Jorhat Medical College Hospital were estimated for total T3, total T4 and TSH. Age of the cases was between 20 years and 40 years.

Selection criteria of cases

The cases were apparently healthy and euthyroid.

Cases did not have any history of taking any drugs apart from pregnancy related supports.

All cases belonged to 1st trimester of pregnancy.

Controls

A total number of 131 non pregnant women between the age of 20 to 40 years visiting Eye, ENT, Orthopaedics and Surgery OPDs of Jorhat Medical College Hospital were included.

Selection criteria

The study subjects were apparently not suffering from thyroid related problems and diabetes mellitus.

Time of study

Between March 2014 and September 2015.

Specimen collection for tests

Collected 2cc of venous blood in sterile empty vial from each of the study subjects maintaining all routine precautions. Allowed the samples to clot and serum was separated.

Then serum was shifted to storage tubes and was tested within four hours of collection at room temperature.

Haemolysed samples were discarded.

Estimation

It was carried out in Access Immuno Assay Systems (Beckman Coulter) at the clinical Biochemistry wing of Central Clinical Laboratory, Jorhat Medical College Hospital.

Assays

The Access Total T3 and total T4 assays are competitive binding immunoenzymatic assay.

The Access TSH assay is a two site immunoenzymatic ("Sandwich") assay.

Calibration

Regular calibrations were done as per following schedule-

T3: every 14 days

T4: every 21 days

TSH: every 28 days

Quality control

QC material simulates the characteristics of patient samples are commercially available and supplied by the manufacturers- Beckman Coulter, were used.

Quality control materials were run in every 24 hours time for authenticity of the reports.

These QC materials cover at least two levels of the analyte. The test results were accepted only when quality control results were found to be within acceptable ranges.

Results

Results of the tests were determined automatically by the system's software. The amount of analyte in the sample was determined from the measured light production by means of calibration data.

Statistical analysis

Statistical analysis of the data were done using SPSS 16.0 version according to the following sequence:

1. Mean and Standard deviation were calculated
2. Normality of the data were examined
3. Homogeneity of variances between control and test groups for TT_3, TT_4 and TSH levels performed.
4. Finally two tailed independent t test was undertaken

RESULTS

Table I: Seum TT_3, TT_4 and TSH levels

Source of variation (subject)	No.	Total T4 (ngm/ml)		Total T3 (µgm/dl)		TSH (µIU/ml)	
		Mean±SD	P value	Mean±SD	P value	Mean±SD	P value
Pregnant(cases)	132	11.4986± 2.62082	0.000	1.5013± 0.28341	0.000	2.2034± 1.03245	0.112
Non pregnant (control)	131	8.5422± 2.01670		1.0957± 0.27668		2.4847± 1.74394	

Table I shows the detailed statistical analysis for TT_4, TT_3 and TSH level in and between cases (pregnant) and controls. This includes total numbers, means ± standard deviation and the sig 2-tailed (P value) results.

Total T_4 levels were found to be 11.4986±2.62082 (ngm/ml) in pregnant women (cases) and 8.5422±2.10670 (ngm/ml) in the non pregnant women (control). On examination by two tailed independent t test higher levels in pregnant women were found to be statistically highly

significant (P<0.001) with 95% confidence interval when compared with controls (non pregnant).

Total T3 levels were found to be 1.5013± 0.28341(µgm/dl) in pregnant women (cases) and 1.0957± 0.27668(µgm/dl) in the non pregnant control group. On examination by two tailed independent t test, higher levels in pregnant women for TT_3 levels were found to be statistically highly significant(P<0.001) with a confidence interval of 95% when compared with controls(non pregnant)

Total TSH levels were found to be 2.2034±1.03245 (µIU/ml) in pregnant women (cases) and 2.4847±1.74394 (µIU/ml) in non pregnant women (controls). On statistical analysis, the findings revealed not to be statistically significant (P>0.05). The results being almost same in both groups.

DISCUSSION

The study was planned to evaluate, analyse and document the pregnancy induced changes of thyroid status in the first trimester with respect to non pregnant women. The study was carried out in the known sub Himalayan iodine deficient belt of upper Assam districts of Jorhat, Golaghat and Sibsagar.

The present study found highly significant increased values for Total T_4 and total T_3 levels in the first trimester of pregnancy when compared with the control group of non pregnant women with confidence interval of 95%. Similar significantly higher results were also reported by Mujawar et al, [12] Wohll K N et al, [13] and Jugare S et al, [14] Manjunatha S et al, [15] and Kumar et al, [16] also reported higher values for TT_3 and TT_4 in pregnancy. Although the increases were not statistically significant in 1st trimester when compared with non pregnant.

Plasma concentrations of Total T_4 and Total T_3 are increased in pregnancy, often outside the health related reference interval. TT_3 and TT_4 concentrations increase sharply in early pregnancy and plateau early in second trimester at concentrations 30-100% greater than pre pregnancy values. [17,18] This increase is attributed to mainly three reasons. Firstly, it is the estrogen induced increase in concentration and socialisation of plasma thyroxine binding globulin (TBG). [2,17,18]

Secondly, production of type III deiodinase by the placenta [2,19 20] and thirdly due to the mild thyrotropic activity of human chorionic gonadotropin (HCG). [21-24]

The mean TSH level in the study was found to be lower among the first trimester pregnant when compared with the control non pregnant. But the suppression was not statistically significant. Similar non significant reduced values were also reported by Jugare S et al, [14] Mujawar et al [12] and Zarghami et al. [1] this observation, i.e. the reduced TSH value in pregnancy is due to feedback inhibition of TSH secretion by increased thyroxine levels. TSH excretion is also increased in pregnancy. [25] The present study found TSH values to be 2.2034±1.03245 in 1st trimester of pregnancy and 2.4847±1.74394 among the non pregnant control group of women. Both these values are towards the upper limit or about to cross the upper limit of euthyroid TSH levels.

Many authors had suggested upper limit of TSH level to be 2µIU/ml in pregnancy [25-27] and others had even slightly extended the upper limit of TSH to <2.5µIU/ml. [25,28] Non pregnant TSH levels are unreliable in pregnancy [25] and also there has not been a consensus on a fixed maximum permissible limit for TSH levels for safe pregnancy considering the widespread demographic and geographical variation around the globe.

Moreover, the physiological adjustment in stimulation, activity and regulation of the thyroid demands the need for a separate extended study to correlate increased thyroxin levels and the proportionate suppression of TSH levels in pregnancy.

CONCLUSION

The study reaffirms the physiological increased activity of the thyroid gland in pregnancy. It also stresses the need for pregnancy specific separate region/ laboratory based reference values of TT_3, TT_4 and TSH.

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