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A COMPARATIVE STUDY OF TSH AND SERUM CREATININE IN EUTHYROID AND HYPOTHYROID PREGNANT WOMEN ATTENDING AT RAMA MEDICAL COLLEGE HOSPITAL & RESEARCH CENTRE KANPUR

Muskan Gupta[1], Sheila Sharma[2], Harsh Patel[3], Pavan Kumar Sharma[4], Pawan Arun Kulkarni[5*]

PG scholar[1], Department of Biochemistry, Rama Medical College Hospital and ResearchCentre, Kanpur, Uttar Pradesh, India.

Professor[2], Department of Obstetrics and Gynecology, Rama Medical College Hospital andResearch Centre, Kanpur, Uttar Pradesh, India.

Assistant Professor[3], Department of Biochemistry, Government Medical College, Orai,Jalaun, Uttar Pradesh, India.

Associate Professor[4], Department of Biochemistry, Rama Medical College Hospital andResearch Centre, Kanpur, Uttar Pradesh, India.

Professor and Head[5*], Department of Biochemistry, Rama Medical College Hospital andResearch Centre, Kanpur, Uttar Pradesh, India.

Corresponding Author: Dr. Pawan Arun Kulkarni

Email ID: drpawankulkarni20@gmail.com

Abstract

Introduction: Hypothyroidism is a clinical syndrome resulting from a deficiency of thyroid hormones, which in turn results in a generalized slowing down of metabolic processes. It is a common metabolic disorder in general population. Thyroid disease is the second most common endocrine disorder after diabetes in pregnancy. Thyroid disease poses a substantial challenge on the physiology of pregnant women and has significant maternal and fetal implications.

Objectives: This study was designed to estimate the Serum Creatinine level in Euthyroid and Hypothyroid cases in pregnant women and to assess the correlation of serum creatinine with TSH.

Material and methods: A comparative cross-sectional study was conducted in the Department of Biochemistry, Rama Medical college Hospital and Research Centre Kanpur, India. The study involved 60 participants, including 30 recently diagnosed hypothyroid patients with the age ranging 21-40 age (cases) and sex matched euthyroid individuals and 30 healthy controls without any diseases. TSH were quantified using the Cobas e411 electro-chemiluminescence technique. Serum creatinine levels were measured using the Modified Jaffe's method.

Results: In the present study there was significant elevation in serum levels of creatinine and TSH in subclinical and hypothyroidism cases when compared to controls. A total of 60 participants including 30 cases and 30 controls subjects were enrolled, out of which maximum numbers of cases and controls (n=24) was in age group of 25-30 years of age and 30-35 years of age(n=21). Mean serum TSH in cases was observed to be 1.25 ± 0.87, and in

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controls it was 2.35 ± 0.98. There was higher mean serum TSH in controls as compared to cases, and the difference among both the groups was significant and mean serum creatinine of cases was 0.82 ± 0.45, and in controls it was 0.53 ± 0.18, there being less mean serum creatinine in controls as compared to cases and the difference between both the groups being significant. There was a significant positive correlation of 0.006 p value with TSH ans serum creatinine in hypothyroid cases.

Conclusion: Evaluation of Biochemical parameters (creatinine, TSH) in the present study found to be significant markers and their deranged value important in progression, monitoring, and management of hypothyroid pregnant women.

Key words: TSH (thyroid stimulating hormone), Creatinine, Hypothyroidism, Euthyroid, Serum

INTRODUCTION

Hypothyroidism is a clinical syndrome resulting from a deficiency of thyroid hormones, which in turn results in a generalized slowing down of metabolic processes[1]. It is a common metabolic disorder in general population. Thyroid disease is the second most common endocrine disorder after diabetes in pregnancy. Thyroid disease poses a substantial challenge on the physiology of pregnant women and has significant maternal and fetal implications [2].

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Research shows during pregnancy, the size of the thyroid gland increases by 10% in countries with adequate iodine stores and by approximately 20% to 40% in countries with iodine deficiency [3]. During pregnancy, thyroid hormone production increases by around 50% along with a similar increase in total daily iodine requirements.

Pregnancy is a normal physiological phenomenon with many anatomical, physiological and biochemical changes which occurs starting from the conception and extends up to the birth of newborn and subsides after delivery. These changes can be observed by measuring various biochemical parameters like glucose, lipids, electrolytes, urea, creatinine, uric acids, proteins, including different trace elements and vitamins. The result of biochemical tests during pregnancy may therefore differ from the normal reference ranges, so they may be mistakenly interpreted as abnormal. Which may sometime falsely lead to unnecessary and dangerous therapeutic action[4].

Mostly the period of pregnancy is divided into two halves based on the metabolic state and development during pregnancy as first half as an anabolic phase whereby pregnant women accumulates most of the nutrients in regard to future increased demand for the supply to the fetus and health of self. In the second phase known as catalytic phase there is increased catalytic activity aimed at to fulfil the increased demands of the fetus. There is a so many anatomical and physiological changes occur due to increase in vascular and interstitial space in kidney which lead to enlargement of kidney. The most marked structural changes are the dilatation of the calyces, renal pelvis and ureters resulting in hydronephrosis. Which is most commonly founded with variable frequency and peak incidence found at late pregnancy. This changes happen from the effect of progesterone on the tone and force of contraction of the ureter to the compression effect exerted by the weight of the uterus as the pregnancy advances [5].

When there is kidney damage and the kidney are not able to filter waste efficiently, creatinine concentration in serum is maintained by the balance between its generation and excretion by the kidney [6]. Urea is an organic compound and plays a vital role in the nitrogen-containing compound. It is a waste product from dietary protein and is also filtered into urine by the kidney [7,8].

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Urea and creatinine are important parameters in diagnosis, the prognosis of follow up of chronic kidney disease [9]. Uric acid is the end product of purine metabolism is excreted by the kidney and its level is important in the reduced glomerular filtrate rate [10].

Kidney plays an important role in the metabolism of thyroid hormone, chronic kidney disease cause uremia and affects the hypothalamus-pituitary thyroid axis which impairs synthesis and secretion of triiodothyronine (T3) and tetraiodothyronine (T4) [11]. Therefore, the present study was undertaken to determine the creatinine and TSH as it is important in diagnosis, prognosis, and medical management of euthyroid and hypothyroid in pregnant women in the present study which was conducted in Rama Medical College Hospital & Research Centre Kanpur.

MATERIAL AND METHODS

The present study was a cross-sectional study conducted in the Department of Biochemistry, Rama Medical college Hospital and Research Centre Kanpur, India for a period of 12 months. The study involved 60participants, including 30 recently diagnosed hypothyroid patients and 21-40 age and sex matched euthyroid individuals and 30 healthy controls without any diseases.

Inclusion Criteria

- Subjects with detailed history including history of cardiovascular disease, diabetes mellitus, hypertension, and surgery or any drug intake and family history of renal, muscular, liver disorders with no other associated disease such as cancer, tuberculosis
- Male and female group of different age group

Exclusion Criteria

- Any systemic disease such as psychiatric disease, and connective disease
- Subjects on medication such as anticancer, antithyroid drug and steroid drug

Data collection procedure-

Selection of subjects for the study was made based on a detailed history and proper clinical examination such as name, sex, age, address. For the diagnosis of chronic kidney disease,

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clinical history, and physical findings with supportive biochemical evidence were taken as criteria.

Study procedure:

Blood parameters assessed: TSH levels using Cobas e411 (electro-chemiluminescence technique). Serum creatinine levels using Modified Jaffe's method.

Test principles:

TSH estimation (Cobas e411-electro-chemiluminescence): TSH levels were assessed using the Cobas e411 system, which utilises the Electro-chemiluminescence technique. This method involves the use of specific antibodies labeled with a ruthenium complex. For TSH estimation, monoclonal antibodies directed against human TSH are employed, which are labeled with a ruthenium complex. The reaction occurs in multiple steps: first, a sandwich complex is formed with the sample, biotinylated monoclonal TSH-specific antibody, and a monoclonal TSH specific antibody labeled with a ruthenium complex. Then, after adding streptavidin-coated micro-particles, the complex binds to the solid phase via biotin-streptavidin interaction. Finally, chemiluminescent emission, induced by applying a voltage, is measured to determine TSH levels. This method ensures high sensitivity and specificity for thyroid function assessment [12].

Serum creatinine estimation (Modified Jaffe's method): Serum creatinine levels were determined using the Modified Jaffe's method. In this enzymatic colorimetric assay, creatinine forms a yelloworange complex with picrate under alkaline conditions. The rate of dye formation is directly proportional to the creatinine concentration in the specimen. This method allows for the assessment of renal function as creatinine is freely filtered by the glomeruli and is not significantly re-absorbed or secreted by the renal tubules under normal conditions. The results are corrected for nonspecific reactions caused by serum/plasma pseudo-creatinine chromogens, ensuring accurate assessment of creatinine levels [13]. These test principles elucidate the biochemical processes underlying the quantification of thyroid hormones and creatinine levels, contributing to the accuracy and reliability of the study's measurements

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Biochemical parameters	Range
Creatinine	0.6-1.5 mg/dl
TSH	0.4- 4.5 micro-IU/ml

Table 1: Normal level of biochemical parameters.

All the above parameters were performed by the commercial kit methods.

Ethical consideration and permission- Written consent was taken from all participants and ethical permission was duly taken from the College Ethical Committee of RMCH&RC.

Statistical analysis- Microsoft Excel worksheets were used and data were analyzed using SPSS version 20.00.

RESULT

In the present study out of 60 participants, including 30 hypothyroid patients and 30 controls, demographic characteristics were recorded. Women were divided in the age group, 20 to 40 years of age group in which maximum numbers of cases and controls (n=24) was in age group of 25-30 years of age. This clearly indicate that young women are more commonly affected. (Table 2 and Graph 1)

Age (years)	Case (n=30)	Control(n=30)	Total
20-25	5	7	12
25-30	11	13	24
30-35	12	9	21
35-40	2	1	3
Total	30	30	60

Table 2: Age wise distribution

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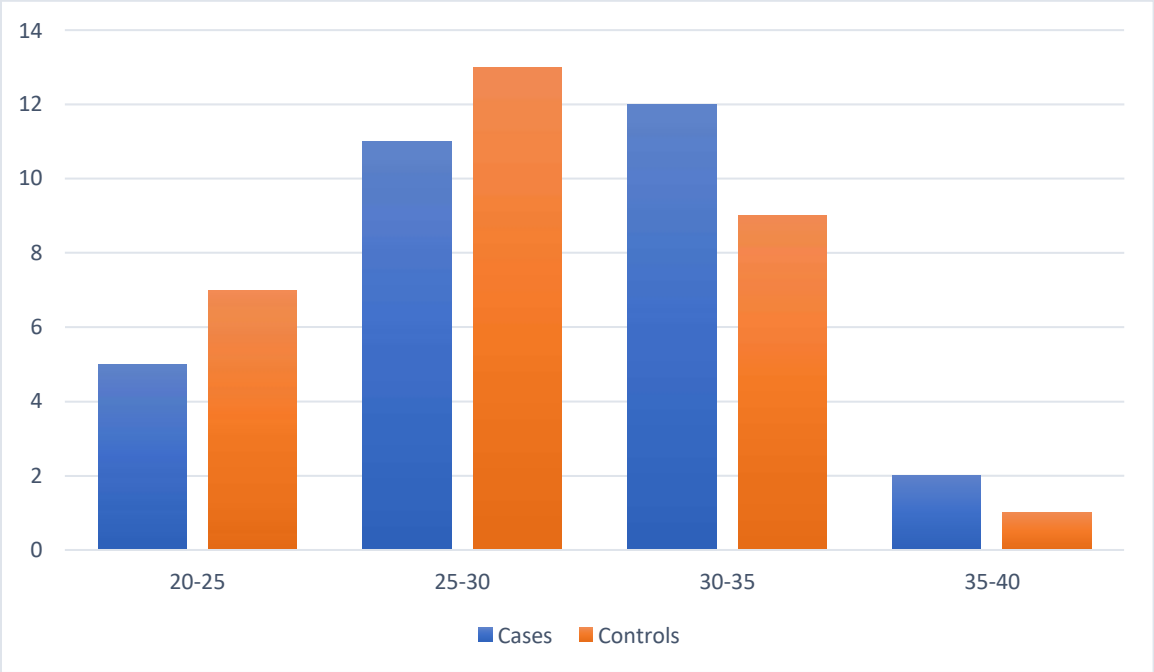
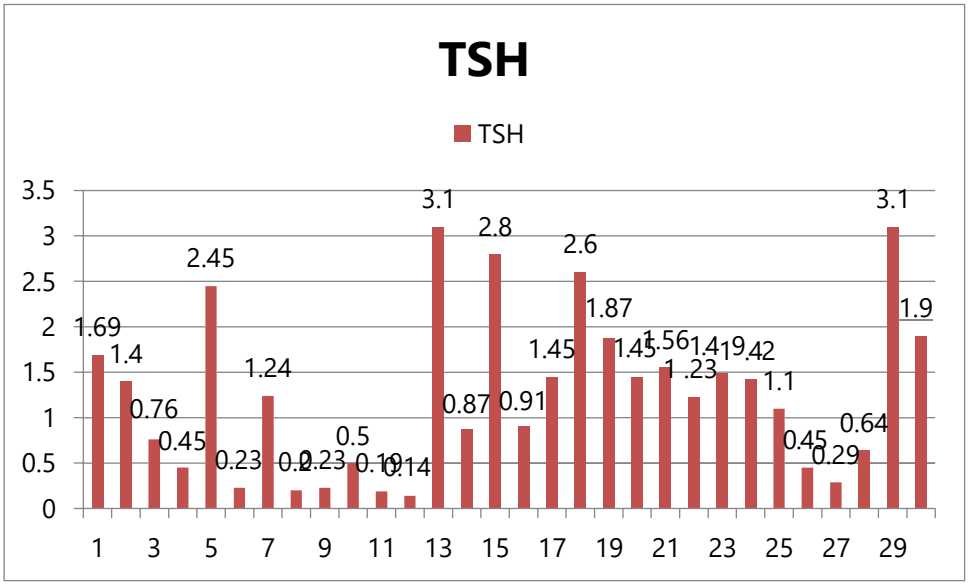


Graph 1. Showing Age wise distribution of case and controls.

Graph 2 and Graph 3 shows TSH and serum creatinine levels distribution in different groups of 30 cases.



Graph 2: Showing frequency distribution of Serum TSH levels among Cases

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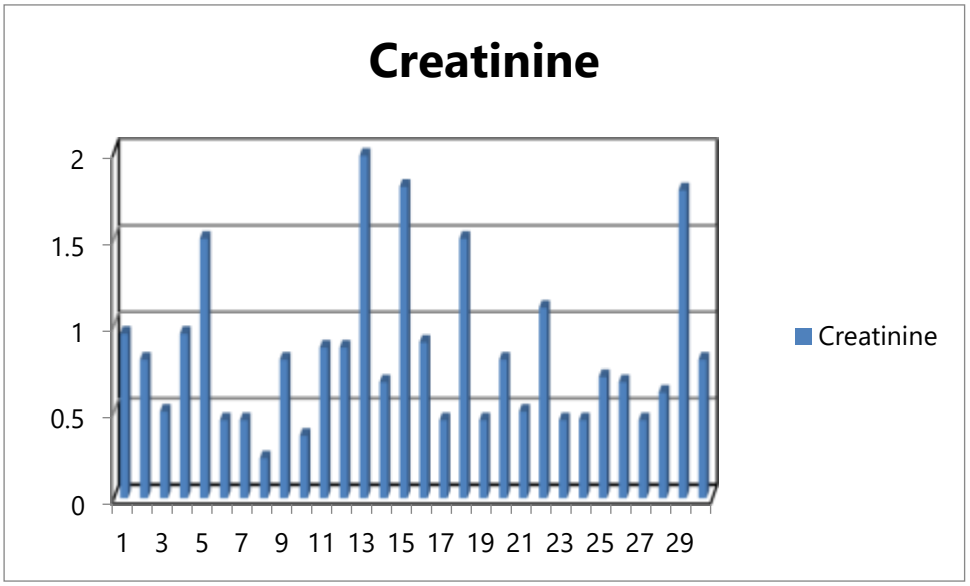

Graph 3: Showing frequency distribution of Serum Creatinine levels among cases

Mean serum creatinine of cases was 0.82 ± 0.45, and in controls it was 0.53 ± 0.18, there being less mean serum creatinine in controls as compared to cases and the difference between both the groups being significant. Mean serum TSH in cases was 1. 25 ± 0.87, and in controls it was observed to be 2.35 ± 0.98. There was higher mean serum TSH in controls as compared to cases, and the difference among both the groups was statiscally significant. (Table no. 3)

Parameters	Case (n=30)	Control(n=30)	P value
TSH (micro-IU/ml)	1.25 ± 0.87	2.35 ± 0.98	0.006
Serum creatinine (mg/dl)	0.82 ± 0.45	0.53 ± 0.18	

Table 3. Comparison of level of TSH and creatinine

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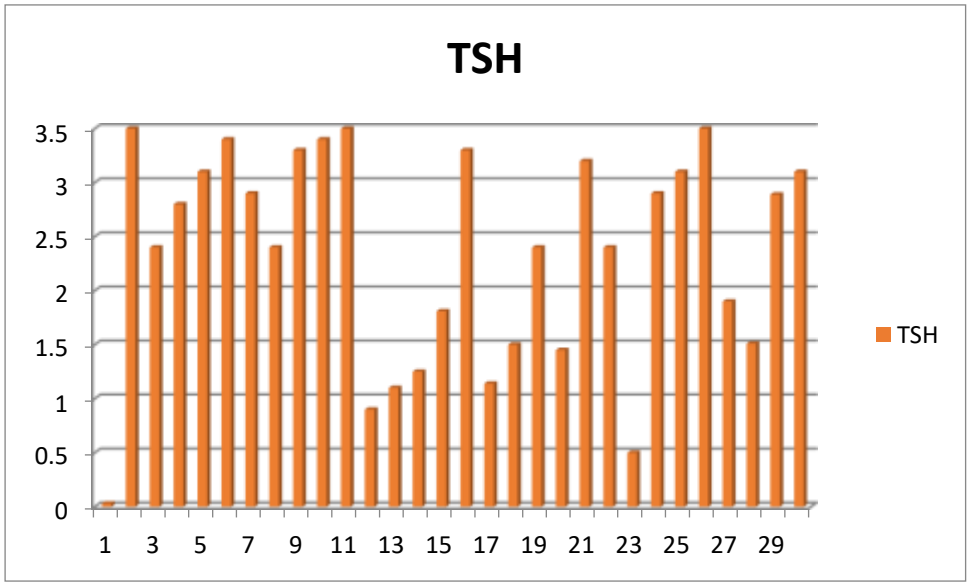
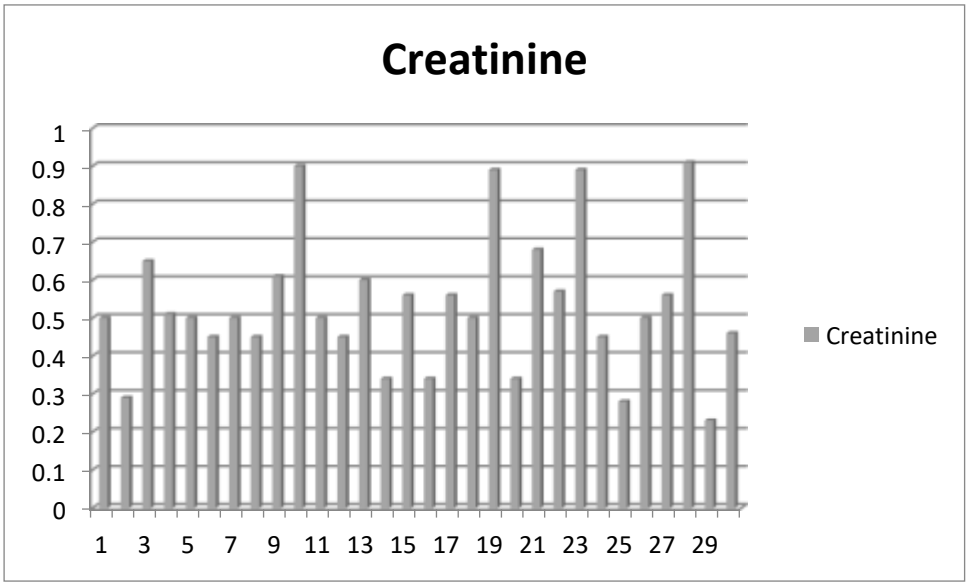


Graph 4: Bar Chart showing frequency distribution of Serum TSH levels among Control group



Graph 4: Bar Chart showing frequency distribution of Serum Creatinine levels among Control group

In the present study the statistically significant was observed with Chi ^{2} : 3.33, P-value: 0.006

DISCUSSION

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Hypothyroidism is a clinical syndrome resulting from deficiency of thyroid hormones, leading to generalized slowing of all metabolic process. The prevalence of hypothyroidism varies in different regions of the world and is more prevalent in females [12-14]. Thyroid dysfunction causes significant changes in kidney function and the most common kidney derangements associated with hypothyroidism is elevation of serum creatinine levels, reduction in glomerular filtration rate and renal plasma flow. Primary subclinical hypothyroidism is associated with a reversible elevation of serum creatinine in both adults and children [15]. Hypothyroidism is one of the most common endocrine disorders in India. It affects 2-15% of population worldwide and women are more commonly affected compared to men. Most common cause is iodine deficiency and another cause is autoimmune thyroid disease characterized by elevated anti-Thyroid Peroxidase antibody. [16]

Association between age group in cases and control patients: In the present study, 60 participants, including 30 casesand 30 controls subjects were enrolled, out of which maximum numbers of cases and controls (n=24) were recorded in the age group of 25-30 years of age and 30-35 years of age (n=21). This finding was similar to many other studies by Lise Husted et al (2023) [17], Mahantesh BB et al(2015) [18] , Swati Srivastava et al (2018) [19] in which the maximum age group was observed between 25-35 years of age .

Serum TSH: In our study, mean serum TSH in cases was 1.25± 0.87, and in controls it was 2.35 ± 0.98. There was higher mean serum TSH in controls as compared to cases, and the difference among both the groups was significant. This finding in accordance with other study by Swati Srivastava et al (2018) [19] in which mean serum TSH in cases was 1.8120 ± 1.0844, and in controls, it was 2.5233 ± 0.7447. There was other study by Mahantesh BB et al (2015) which was in support to the present study [18].

Serum creatinine: In our study**,** mean serum creatinine of cases was 0.82 ± 0.45, and in controls it was 0.53 ± 0.18, there being less mean serum creatinine in controls as compared to cases and the difference between both the groups being significant. This finding in accordance with other study by Shilpa M et al (2021) [20] in which serum creatinine between cases and controls was 1.29 ± 0.65 and 0.81 ±0.32 respectively. Similar study by Mahantesh BB et al (2015) [18] was observed in which the levels of serum creatinine in subclinical hypothyroid cases (0.95 ± 0.21) were higher compared to euthyroid subjects (0.66 ± 0.11). and similar finding by Dilipkumar M Kava (2019)[21] was recorded in which the level of creatinine was 0.65 ± 0.13 in pregnant women.

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Thyroid dysfunction is the most common endocrinological disorder in pregnancy, only second to diabetes. In recent times, it is also the most sought-after area of research in clinical endocrinology.[1] Assessment of thyroid function is pertinent during pregnancy because of its proven influence on feto-maternal outcomes. As soon as pregnancy is established, thyroid physiology starts altering, which continues throughout the gestation, but is reversible postpartum. Thus, thyroid disorders during pregnancy predispose to increased feto-maternal and neonatal morbidity and mortality. This makes it imperative to identify women at risk by early screening and initiation of timely treatment.

To the best of our knowledge, this study was the first to investigate the link between creatinine and TSH in pregnant women with hypothyroidism residing in a rural region of northern India. Additionally, this study assessed both TSH & creatinine simultaneously. However, there are certain limitations to consider, the findings of our study are solely based on data obtained from a single institution. Therefore, further studies are necessary to confirm our results before generalizing them to the wider population of pregnant women with hypothyroidism. Moreover, since our study's design was a case-control one, we can only establish a comparison between TSH and creatinine in pregnant women with hypothyroidism, and not causation.

Conclusion

Thyroid disease in pregnancy can lead to serious maternal and fetal implications if not adequately diagnosed and treated. It is vital to follow an interprofessional approach when treating pregnant women with thyroid disease. It should be managed by a team of healthcare professionals including an endocrinologist, obstetrician, primary medical doctor, nurse practitioner, and pharmacist. Serum creatinine level is significantly higher in subclinical hypothyroid patients. So, hypothyroidism should be taken into account in patients presenting with elevated serum creatinine levels. The study has certain drawbacks, including a small sample size and a brief time frame, which could affect the generalisability of the results. Regular monitoring of these parameters is crucial for individuals with hypothyroidism.

Declarations:

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Conflicts of interest: There is no any conflict of interest associated with this study

Consent to participate: We have consent to participate.

Consent for publication: We have consent for the publication of this paper.

Authors' contributions: All the authors equally contributed the work.

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