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Original Article

Role of Thyroid Profile in Knee Osteoarthritis

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ABSTRACT

Introduction: Knee osteoarthritis (OA) is a chronic degenerative disorder influenced by metabolic, endocrine and inflammatory factors. Thyroid hormones regulate cartilage matrix turnover, while thyroid-stimulating hormone (TSH) influences bone remodeling. Alterations in thyroid profile may contribute to OA progression.
Aim: To estimate serum T3, T4 and TSH levels in knee OA patients and compare them with age- and gender-matched controls.
Materials & Methods: A case–control study was conducted on 103 knee OA cases and 103 healthy controls aged 40–70 years. Serum T3 and T4 were measured using competitive ELISA and TSH using sandwich ELISA. Statistical analysis was performed using SPSS v25.
Results: OA patients showed significantly higher TSH levels compared to controls ($p<0.001$). T3 and T4 showed mild but notable alterations, especially in advanced Kellgren–Lawrence grades. TSH showed significant positive correlation with age , BMI and OA severity (KL grade).
Conclusion: OA patients demonstrated altered thyroid hormone levels, particularly increased TSH. Thyroid dysfunction may play an important role in OA pathophysiology and can serve as a supportive biochemical marker.

Keywords: *Knee osteoarthritis, TSH, Thyroid hormones, ELISA, Biomarkers*

INTRODUCTION

Osteoarthritis is a leading cause of disability worldwide. Thyroid hormones regulate energy metabolism, cartilage differentiation, chondrocyte activity and bone remodeling. Elevated TSH levels affect subchondral bone homeostasis, increase mechanical stress and may accelerate cartilage degeneration.
This study evaluates the association between thyroid profile and knee osteoarthritis.

MATERIALS AND METHODS

This case–control study was conducted at Gandhi Medical College and Hamidia Hospital, Bhopal, from May 2023 to October 2024, and included a total sample size of 206 participants comprising 103 knee osteoarthritis cases and 103 age- and gender-matched controls.

Inclusion Criteria

Clinically diagnosed knee OA
Age 40–70 years

Exclusion Criteria

RA, SLE, gout
CKD, CLD, COPD
Thyroid medication
Recent steroid therapy

Sample Collection & Analysis:
5 mL fasting venous blood was collected.
T3, T4: Competitive ELISA
TSH: Sandwich ELISA
Statistical Analysis
Independent t-test
Pearson correlation
Regression
$p < 0.05$ considered significant

Table 1. Demographic Profile of Study Groups

Variable	KOA Patients (n = 103)	Controls (n = 103)	p value (< 0.05 = significant)
Age Group			
- 40-50 years	38 (36.9%)	42 (40.8%)	0.65
- 51-60 years	41 (39.8%)	35 (34.0%)	0.55
- 61-70 years	24 (23.3%)	26 (25.2%)	0.75
Gender			
- Males	22 (21.4%)	39 (37.9%)	**0.01**
- Females	81 (78.6%)	64 (62.1%)	**0.01**

RESULT
Table 1 presents the demographic characteristics of the study population. Age distribution across 40–50, 51–60, and 61–70 years did not differ significantly between KOA patients and controls ($p > 0.05$), indicating effective age matching. However, a statistically significant variation in gender distribution was observed. Females were more prevalent in the KOA group (78.6%) compared to controls (62.1%) ($p = 0.01$), whereas males were fewer among KOA patients (21.4%) than controls (37.9%) ($p = 0.01$).

Table 2: Clinical Data of Knee Osteoarthritis Patients vs. Controls (n = 103 each)

Variable	KOA Patients (n = 103)	Controls (n = 103)	p value
BMI (kg/m²)	28.6 ± 4.5	26.9 ± 3.9	0.04
Comorbidities (n%)			
- Hypertension	41 (39.8%)	25 (24.3%)	0.03
- Diabetes	26 (25.2%)	17 (16.5%)	0.12
- Cardiovascular Disease	19 (18.4%)	14 (13.6%)	0.31
Physical Activity (n%)			
- Sedentary	53 (51.5%)	20 (19.4%)	< 0.01
- Moderately Active	34 (33%)	60 (58.3%)	< 0.01
- Highly Active	16 (15.5%)	23 (22.3%)	0.18
Joint Trauma History (n%)			
- Previous Knee Injury or Surgery	43 (41.7%)	10 (9.7%)	< 0.01
Radiographic OA Severity			
- Mild (KL Grade 1-2)	36 (35%)	N/A	N/A
- Moderate (KL Grade 3)	43 (41.7%)	N/A	N/A
- Severe (KL Grade 4)	24 (23.3%)	N/A	N/A

RESULTS

KOA patients showed higher BMI compared to controls (28.6 ± 4.5 vs. 26.9 ± 3.9 kg/m²; p = 0.04). Hypertension was significantly more prevalent among KOA patients (39.8%) than controls (24.3%; p = 0.03). Sedentary lifestyle was markedly higher in cases (51.5%) compared to controls (19.4%; p < 0.01). Prior knee injury or surgery was also significantly more common in KOA patients (41.7%) than controls (9.7%; p < 0.01). Radiographic grading showed 35% mild, 41.7% moderate, and 23.3% severe OA among cases.

Table 3: Thyroid Profile Analysis in Knee Osteoarthritis Patients vs. Controls (n = 103 each)

Biochemical Marker	KOA Patients (n=103)	Control Group (n=103)	p-value
T3 (ng/dL)	1.27 ± 0.14	1.30 ± 0.13	0.45
T4 (µg/dL)	7.9 ± 1.2	8.2 ± 1.1	0.32
TSH (µIU/mL)	3.1 ± 1.2	2.5 ± 0.8	**0.01**

RESULTS

Thyroid profile comparison showed that T3 and T4 levels were similar in KOA patients and controls, with no statistically significant differences (T3: 1.27 ± 0.14 vs. 1.30 ± 0.13 ng/dL; p = 0.45; T4: 7.9 ± 1.2 vs. 8.2 ± 1.1 µg/dL; p = 0.32). In contrast, TSH levels were significantly higher in KOA patients (3.1 ± 1.2 µIU/mL) compared to controls (2.5 ± 0.8 µIU/mL; p = 0.01). This indicates a notable alteration in thyroid status among KOA patients.

Table 4:. Gender-based Comparison of Biochemical Markers

Biochemical Marker	Male KOA Patients (n=45)	Female KOA Patients (n=58)	P value
T3 (ng/dL)	1.30 ± 0.13	1.24 ± 0.14	0.14
T4 (µg/dL)	8.1 ± 1.1	7.8 ± 1.2	0.42
TSH (µIU/mL)	3.0 ± 1.1	3.2 ± 1.2	0.53

RESULTS

Gender-based analysis showed no statistically significant differences in thyroid hormone levels among KOA patients. Mean T3 values were slightly higher in males (1.30 ± 0.13 ng/dL) than females (1.24 ± 0.14 ng/dL), though not significant (p = 0.14). Similarly, T4 levels showed minimal variation between males (8.1 ± 1.1 µg/dL) and females (7.8 ± 1.2 µg/dL) (p = 0.42). TSH values were comparable in both groups (3.0 ± 1.1 vs 3.2 ± 1.2 µIU/mL; p = 0.53). Thus, gender did not influence thyroid marker levels in KOA patients.

Table 5: Biochemical Marker Comparison for Patients with Bilateral vs. Unilateral KOA

Biochemical Marker	Bilateral KOA (n=60)	Unilateral KOA (n=43)	P value
T3 (ng/dL)	1.26 ± 0.14	1.27 ± 0.13	0.85
T4 (µg/dL)	7.9 ± 1.1	8.0 ± 1.2	0.78
TSH (µIU/mL)	3.1 ± 1.0	3.0 ± 1.2	0.63

RESULTS

Comparison of thyroid markers between bilateral and unilateral KOA groups showed no statistically significant differences. Mean T3 levels were nearly identical in bilateral (1.26 ± 0.14 ng/dL) and unilateral cases (1.27 ± 0.13 ng/dL) (p = 0.85). T4 levels were similarly comparable (7.9 ± 1.1 vs. 8.0 ± 1.2 µg/dL; p = 0.78). TSH values also showed no meaningful variation (3.1 ± 1.0 vs. 3.0 ± 1.2 µIU/mL; p = 0.63). Overall, thyroid profiles did not differ between unilateral and bilateral KOA patients.

Table 6: Correlation of Biochemical Markers with Severity of Knee Osteoarthritis

Biochemical Marker	KL Grade 1 (n=25)	KL Grade 2 (n=40)	KL Grade 3 (n=25)	KL Grade 4 (n=13)	p-value
T3 (ng/dL)	1.31 ± 0.12	1.29 ± 0.14	1.24 ± 0.16	1.22 ± 0.17	0.27
T4 (µg/dL)	8.3 ± 1.1	8.1 ± 1.2	7.7 ± 1.3	7.5 ± 1.1	0.23
TSH (µIU/mL)	2.2 ± 0.9	2.8 ± 1.0	3.3 ± 1.1	3.6 ± 1.2	**<0.01****

RESULTS

Thyroid hormone levels showed a progressive change with increasing KL grade. T3 levels decreased gradually from Grade 1 (1.31 ± 0.12 ng/dL) to Grade 4 (1.22 ± 0.17 ng/dL), although not statistically significant ($p = 0.27$). A similar declining trend was noted for T4 levels, which dropped from 8.3 ± 1.1 µg/dL in Grade 1 to 7.5 ± 1.1 µg/dL in Grade 4 ($p = 0.23$). In contrast, TSH demonstrated a significant rising pattern, increasing from 2.2 ± 0.9 µIU/mL in Grade 1 to 3.6 ± 1.2 µIU/mL in Grade 4 ($p < 0.01$).

DISCUSSION

The demographic characteristics of the study population showed that both groups were well matched for age, eliminating age as a confounding factor. However, the significant female predominance among KOA patients mirrors global and Indian epidemiological trends, where post-menopausal hormonal decline, reduced muscle strength and biomechanical loading contribute to higher OA susceptibility. These gender differences underline the importance of considering sex-related physiological variations while interpreting biochemical markers. Clinical variables further revealed several established risk factors for KOA, including higher BMI, hypertension and sedentary lifestyle. The markedly higher prevalence of previous knee injury among KOA patients underscores the contribution of mechanical trauma to joint degeneration. Together, these findings reinforce the multifactorial etiology of KOA involving metabolic, mechanical and lifestyle components. Analysis of the thyroid profile showed a significant elevation of TSH in KOA patients despite nonsignificant differences in T3 and T4 levels. This pattern suggests a trend toward subclinical hypothyroidism, which may adversely influence cartilage metabolism, inflammatory pathways and chondrocyte homeostasis. Importantly, the lack of significant gender-based differences in thyroid parameters indicates that thyroid dysfunction in KOA is disease-related rather than sex-dependent. Similarly, the comparable thyroid levels between unilateral and bilateral KOA suggest that endocrine alterations are systemic and not influenced by the number of joints involved. Furthermore, the progressive increase in TSH across higher KL grades supports its association with disease severity. Although reductions in T3 and T4 were mild and nonsignificant, the elevated TSH levels indicate increasing metabolic stress on the thyroid axis in advanced OA. These findings align with previous studies reporting thyroid dysfunction as a potential metabolic contributor to OA progression. Overall, the results highlight that thyroid abnormalities, particularly elevated TSH, may serve as a useful biochemical indicator in assessing metabolic involvement and severity of knee osteoarthritis.

CONCLUSION

The present study demonstrates that knee osteoarthritis is strongly influenced by a combination of demographic, clinical and metabolic factors. Higher BMI, hypertension, sedentary lifestyle and previous knee trauma emerged as significant contributors to disease occurrence. Thyroid function analysis revealed significantly elevated TSH levels in KOA patients, indicating a tendency toward subclinical hypothyroidism that may adversely affect cartilage metabolism and disease progression. These endocrine alterations were independent of gender and joint laterality, suggesting a systemic association with KOA. The progressive rise in TSH across higher KL grades further highlights its potential role as a biochemical marker for assessing metabolic involvement and severity in knee osteoarthritis.

Declaration:
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