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# CORELATION OF ALLERGIC RHINITIS AND HYPOTHYROIDISM IN PATIENTS IN A RURAL TERTIARY CARE HOSPITAL-A CROSS SECTIONAL STUDY

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**Abstract**

**Introduction:** Allergic rhinitis (AR) and hypothyroidism are common conditions with potential interrelated pathophysiological mechanisms. AR is characterized by mucosal inflammation leading to symptoms such as nasal congestion, sneezing, and rhinorrhea, while hypothyroidism results from reduced thyroid hormone levels affecting various organ systems. The association between AR and hypothyroidism remains unclear, and this study aims to evaluate their correlation in a rural tertiary care hospital.

**Objective:** The study aims to estimate the prevalence of nasal symptomatology in hypothyroid patients and assess the severity of AR in relation to thyroid hormone levels.

**Materials and Methods:** A prospective descriptive cross-sectional study was conducted on 100 hypothyroid patients presenting with AR symptoms at a tertiary care centre. Patients underwent thyroid function tests (TSH, T3, T4) and nasal examinations using the NOSE questionnaire. Data were analyzed using statistical methods, including chi-square and correlation tests, to assess the association between AR severity and thyroid dysfunction.

**Results:** The study found a significant prevalence of nasal symptoms among hypothyroid patients, with sneezing (88%), nasal congestion (84%), and nasal obstruction (85%) being the most common. TSH levels were significantly higher in patients with severe AR ($p = 0.0072$), while T3 and T4 variations were less pronounced. The NOSE scores showed improvement over three months, indicating effective symptom management despite stable thyroid hormone levels. **Conclusion:** There is a significant association between AR severity and hypothyroid status, particularly in relation to TSH levels. Evaluating thyroid function in AR patients may aid in better management and treatment strategies.

**Keywords:** Allergic rhinitis, Hypothyroidism, Thyroid-stimulating hormone, Nasal obstruction, NOSE score, Thyroid function, Nasal symptoms.

## Introduction

Allergic Rhinitis (AR) is a chronic condition of the nasal passages caused by an abnormal immune response to allergens.(1) This reaction is mediated by immunoglobulin E (IgE) and is triggered by common allergens such as pollen, dust mites, animal dander, and mold.(1) The severity of AR can range from mild, which does not interfere with daily activities, to moderate or severe, significantly impacting sleep and productivity [1].

Hypothyroidism is a condition where the thyroid gland produces insufficient levels of thyroid hormones, primarily thyroxine (T4) and triiodothyronine (T3). These hormones play a critical role in regulating metabolism, growth, and numerous physiological processes. The condition can affect individuals across all age groups, but it is more commonly observed in women and older adults. Hypothyroidism may arise from various causes, including autoimmune diseases like Hashimoto's thyroiditis, iodine deficiency, surgical removal of the thyroid gland, or radiation therapy [2].

Allergic Rhinitis (AR) and hypothyroidism are seemingly distinct conditions; however, there is evidence suggesting an underlying connection between the two. Both conditions involve immune dysregulation that may overlap in certain individuals. AR is characterized by a Th2-dominant immune response, which leads to increased production of cytokines such as IL-4, IL-5, and IL-13. This immune activity triggers heightened IgE levels and inflammation, resulting in symptoms like sneezing, nasal congestion, and rhinorrhea [3]. On the other hand, hypothyroidism, particularly in cases caused by autoimmune thyroiditis like Hashimoto's disease, is associated with a Th1-mediated autoimmune response. Despite their differing immune profiles, shared pathways of immune dysfunction may predispose individuals to both AR and hypothyroidism.

This study aims to evaluate the improvement in allergic rhinitis symptoms in hypothyroid patients concerning their thyroid profile. The objectives include determining the prevalence of nasal symptoms in hypothyroid patients and analyzing the correlation between the severity of allergic rhinitis and thyroid hormone levels to understand the potential relationship between thyroid dysfunction and allergic rhinitis severity.

## Methodology

This study is a prospective, descriptive, cross-sectional study conducted at the Department of ENT, Adichunchanagiri Hospital and Research Centre, BG Nagara, Mandya District. The study spans 18 months (July 2023 - January 2025) and aims to analyze the correlation between allergic rhinitis and hypothyroidism in patients attending the ENT outpatient department (OPD).

The study includes patients aged 15-50 years diagnosed with hypothyroidism presenting with symptoms of allergic rhinitis. The participants were recruited from the ENT OPD and were assessed for nasal symptoms and thyroid function. Patients with psychiatric illness, known cases of respiratory conditions such as bronchial asthma, hyperthyroidism, recent upper respiratory tract infections, pregnant women, and those under 18 years were excluded.

The study included patients with a history of Psychiatric illness, known case of Respiratory conditions like Bronchial asthma , Hyperthyroid patients , Recent upper respiratory tract infection and age less than 18 years , Pregnant women

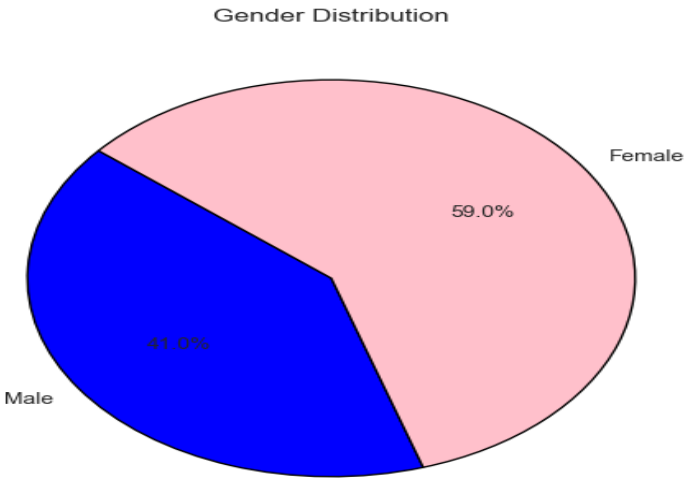
**Statistical Analysis**

Data were entered into Microsoft Excel and analyzed using SPSS software. Categorical variables were expressed as frequencies and percentages, while continuous variables were presented as mean ± standard deviation (SD). The chi-square test was used to determine the significance of categorical variables, while the Kruskal-Wallis test was applied for assessing differences in thyroid parameters among different severities of allergic rhinitis. A p-value of <0.05 was considered statistically significant.

**Results**

**Table 1: Demographic Characteristics of Study Participants**

| | | Count(percentage) |
|---|---|---|
| **Gender** | **Male** | 41(41%) |
| | **Female** | 59(59%) |
| | **Total** | 100(100%) |



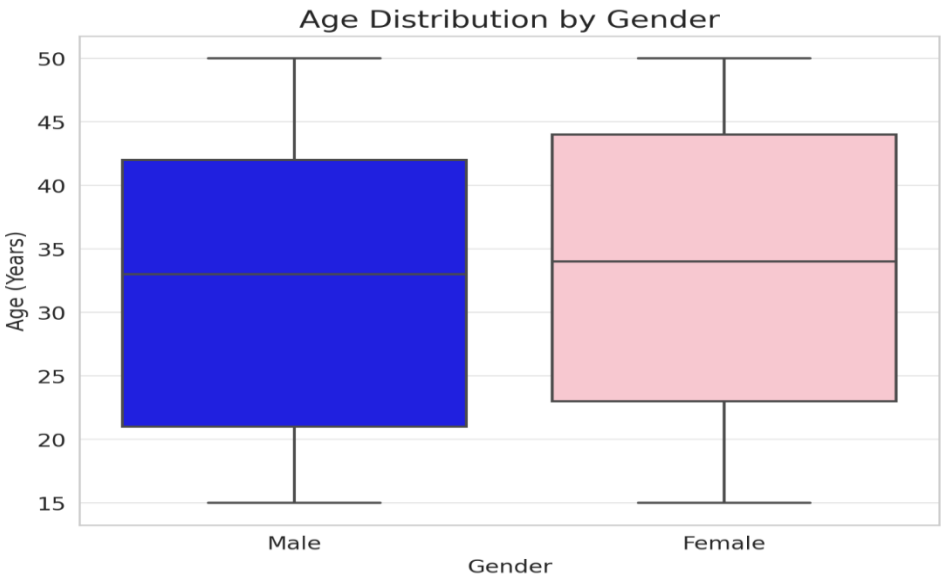

**Graph 1: Gender Distribution among Study Participants**

**Interpretation:**

The study included 100 hypothyroid patients, with 41% males and 59% females. The mean age was 32.67 ± 11.35 years, with a median of 33.5 years (range 15-50 years). The Independent t-test showed no statistically significant difference in age between males (33.05 ± 11.58 years) and females (32.41 ± 11.27 years) (t = 0.2756, p = 0.7835), indicating a similar age distribution across genders. The pie chart visually represents the gender proportion, showing a higher prevalence of females (59%) compared to males (41%) in the study cohort.

**Table 2: Age Distribution by Gender**

| | | Age Mean +- SD Median Range | Independent t-test | P-value |
|---|---|---|---|---|
| **Gender** | **Male** | 33.05 ± 11.58<br>34<br>15-50 | 0.2756 | 0.7835 |
| | **Female** | 32.41 ± 11.27<br>33<br>15-50 | | |
| | **Total** | 32.67 ± 11.35<br>33.5<br>15-50 | | |



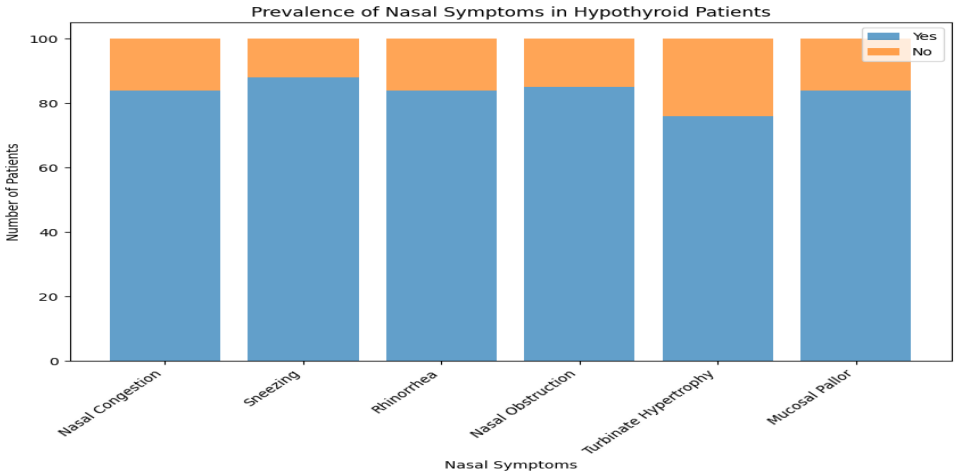

**Graph 2: Age Distribution among Study Participants**

**Interpretation:**

The mean age for males was 33.05 ± 11.58 years, while for females, it was 32.41 ± 11.27 years. The median age was 34 years for males and 33 years for females, with both groups ranging from 15 to 50 years. The Independent t-test yielded t = 0.2756 and p = 0.7835, indicating that the difference in age distribution between males and females was not statistically significant. The box plot visually represents this similarity in age distribution among genders.

**Table 3: Prevalence of Nasal Symptoms in Hypothyroid Patients**

| | | Yes | No | Total | Chi square test | P value |
|---|---|---|---|---|---|---|
| Nasal Symptoms | Nasal Congestion | 84(84%) | 16(16%) | 100(100%) | 46.24 | 0.000 |
| | Sneezing | 88(88%) | 12(12%) | 100(100%) | 57.76 | 0.000 |
| | Rhinorrhea | 84(84%) | 16(16%) | 100(100%) | 46.24 | 0.000 |
| | Nasal Obstruction | 85(85%) | 15(15%) | 100(100%) | 49 | 0.000 |
| | Turbinate Hypertrophy | 76(76%) | 24(24%) | 100(100%) | 27.04 | 0.000 |
| | Mucosal Pallor | 84(84%) | 16(16%) | 100(100%) | 46.24 | 0.000 |




**Graph 3: Prevalence of Nasal Symptoms in Hypothyroid Patients**

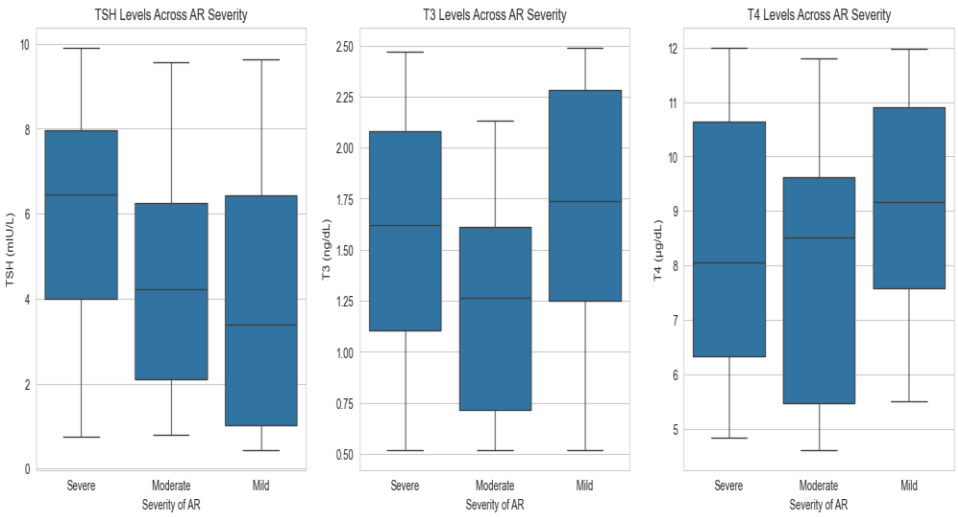
**Interprtation:**

The prevalence analysis of nasal symptoms in hypothyroid patients (n=100) revealed a high occurrence of nasal congestion (84%), sneezing (88%), rhinorrhea (84%), nasal obstruction (85%), turbinate hypertrophy (76%), and mucosal pallor (84%). The Chi-Square test confirmed statistical significance for all symptoms, with Nasal Congestion ($\chi^2 = 46.24$, $p < 0.0001$), Sneezing ($\chi^2 = 57.76$, $p < 0.0001$), Rhinorrhea ($\chi^2 = 46.24$, $p < 0.0001$), Nasal Obstruction ($\chi^2 = 49.00$, $p < 0.0001$), and Turbinate Hypertrophy ($\chi^2 = 27.04$, $p < 0.0001$), indicating a strong association between hypothyroidism and nasal symptomatology. The highly significant p-values (all < 0.05) confirm that these symptoms are not due to chance but likely influenced by underlying hypothyroidism. The bar chart visually supports this finding, showing sneezing as the most prevalent symptom (88%), followed closely by nasal obstruction and congestion. These results emphasize the importance of assessing nasal symptoms in hypothyroid patients for better diagnosis and management.

**Table 4: Thyroid Function Variation by Severity of Allergic Rhinitis**

| | Severity of AR | | | Test Kruskal Wallis Test | P-value |
|---|---|---|---|---|---|
| | Mild Mean+-SD Median Range | Moderate Mean+-SD Median Range | Severe Mean+-SD Median Range | | |
| **TSH (mIU/L)** | 3.99 ± 3.0<br>3.390<br>0.44 - 9.64 | 4.36 ± 2.46<br>4.220<br>0.8 - 9.56 | 5.88 ± 2.69<br>6.460<br>0.74 - 9.91 | 9.8437 | 0.0072 |
| **T3 (ng/dL)** | 1.65 ± 0.65<br>1.740<br>0.52 - 2.49 | 1.25 ± 0.53<br>1.265<br>0.52 - 2.13 | 1.59 ± 0.62<br>1.620<br>0.52 - 2.47 | 6.262 | 0.0436 |
| **T4 (µg/dL)** | 9.15 ± 1.97<br>9.170<br>5.51 - 11.97 | 8.02 ± 2.4<br>8.510<br>4.61 - 11.81 | 8.41 ± 2.29<br>8.050<br>4.84 - 12.0 | 3.6172 | 0.1638 |

| Thyroid Parameter | Spearman Correlation | p-value |
|---|---|---|
| TSH (mIU/L) | 0.310 | 0.002 |
| T3 (ng/dL) | -0.011 | 0.913 |
| T4 (µg/dL) | -0.117 | 0.248 |

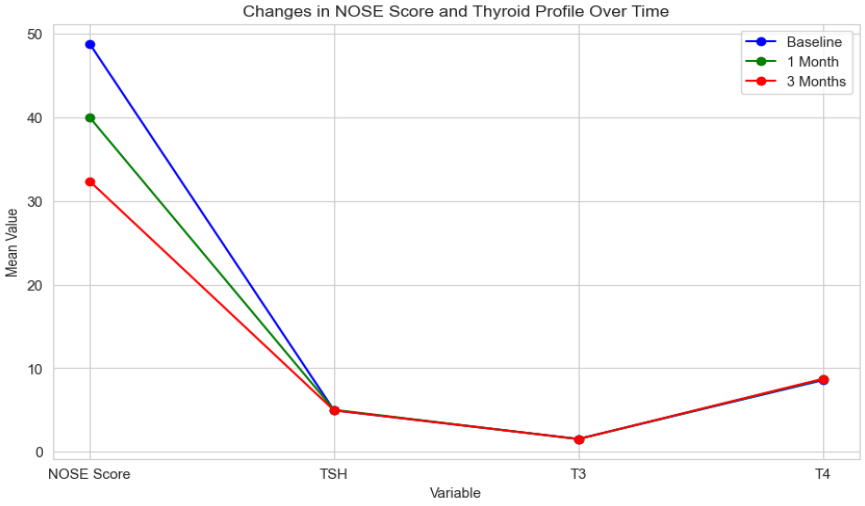



**Graph 4: Box plot for Thyroid Parameters by AR Severity**

**Interpretation:**
The study investigated the relationship between thyroid function (TSH, T3, T4) and the severity of allergic rhinitis (AR). The Kruskal-Wallis test revealed significant differences in TSH levels across mild, moderate, and severe AR categories ($p = 0.0072$), indicating higher TSH levels with increasing AR severity. For T3 levels, there was a marginal significance ($p = 0.0436$), suggesting a potential variation of T3 across severity levels, while T4 levels showed no significant variation ($p = 0.1638$). The Spearman correlation analysis further supported these findings, showing a moderate correlation between TSH levels and AR severity ($\rho = 0.310$, $p = 0.002$), with no significant correlation for T3 and T4. These results suggest that TSH may be more sensitive to changes in AR severity, providing insights into the complex interactions between thyroid function and nasal inflammation.

**Table 5: Changes in NOSE Score and Thyroid Profile over Time**

| Variable | Baseline (Mean ± SD) Median Range | 1 Month (Mean ± SD) Median Range | 3 Months (Mean ± SD) Median Range | Friedman Test | p-value |
|---|---|---|---|---|---|
| NOSE | 48.81 ± 30.21 47.5 (0.0 - 100.0) | 40.0 ± 29.36, 38.0 (0.0 - 95.0) | 32.37 ± 27.98, 29.0 (0.0 - 87.0) | 190.976 | 0.00000 |
| TSH | 4.96 ± 2.85 5.12 (0.44 - 9.91) | 5.03 ± 3.09, 5.01 (-1.42 - 11.6) | 4.96 ± 3.16, 5.18 (-2.65 - 11.17) | 0.757 | 0.68492 |
| T3 | 1.54 ± 0.62 1.56 (0.52 - 2.49) | 1.52 ± 0.63, 1.53 (0.26 - 2.6) | 1.52 ± 0.65, 1.5 (0.16 - 2.64) | 1.103 | 0.57601 |
| T4 | 8.56 ± 2.24 8.66 (4.61 - 12.0) | 8.66 ± 2.44 8.6 (3.78 - 12.94) | 8.73 ± 2.47 8.95 (3.7 - 13.28) | 4.340 | 0.11418 |




**Graph 5: Time-Based Changes in NOSE Score and Thyroid Function**

**Interpretation:**
The longitudinal analysis using the Friedman test demonstrated a significant decrease in NOSE scores over time among hypothyroid patients, from an initial mean of 48.81 ± 30.21 to 32.37 ± 27.98 over three months ($p < 0.00001$), indicating effective symptom management. Conversely, the thyroid

function parameters (TSH, T3, T4) did not show significant changes over the same period, with p-values well above the significance level ($p > 0.05$ for all). This indicates that while AR symptoms significantly improved, the thyroid status remained relatively stable, underscoring the possible independence of symptomatic improvement from underlying thyroid hormonal changes in the short term.

**Discussion**

Allergic rhinitis (AR) and hypothyroidism are two common conditions that significantly impact the health and quality of life of individuals worldwide. Allergic rhinitis is characterized by an inflammatory response in the nasal mucosa triggered by allergens, such as pollen, dust mites, or animal dander [4]. It is commonly associated with symptoms such as sneezing, nasal congestion, runny nose, and itchy eyes [5]. Hypothyroidism, on the other hand, is a condition where the thyroid gland produces insufficient thyroid hormones, leading to a range of symptoms including fatigue, weight gain, cold intolerance, constipation, and dry skin [1]. Both conditions are highly prevalent in the general population, with allergic rhinitis affecting a significant proportion of individuals across various age groups, and hypothyroidism being more common in women and the elderly [6].

Despite the individual nature of these conditions, emerging evidence suggests that there might be an overlap between allergic rhinitis and hypothyroidism, with various studies hinting at possible associations between autoimmune processes, thyroid dysfunction, and allergic diseases. Autoimmunity is a key factor in the development of both conditions [7]. Allergic rhinitis is known to have an immunological basis, driven by a hypersensitivity response to environmental allergens, often involving IgE-mediated mechanisms [8]. Hypothyroidism, particularly Hashimoto’s thyroiditis, is an autoimmune disease where the body's immune system attacks the thyroid gland, leading to its dysfunction. It is conceivable that there could be a relationship between these two conditions, potentially due to shared immunological pathways or endocrine disruptions [9].

The interaction between the immune system and the thyroid axis plays a crucial role in both diseases. In hypothyroidism, there is a decrease in the secretion of thyroid hormones, which affects multiple organ systems and may alter immune responses [10]. Thyroid hormones are known to regulate immune cell function and inflammatory pathways, and disturbances in their levels might influence the severity or expression of allergic diseases like rhinitis. Furthermore, certain studies suggest that patients with hypothyroidism might be more susceptible to allergic diseases due to alterations in the immune response, potentially leading to an increased prevalence of allergic rhinitis in this population [11].

In rural areas, where access to healthcare may be limited, there is a need for better understanding of how these two conditions interact and affect patients [12]. A cross-sectional study in a rural tertiary care hospital can provide valuable insights into the correlation between allergic rhinitis and hypothyroidism, especially in terms of their combined impact on patient morbidity. In rural settings, where conditions like hypothyroidism may often go undiagnosed or untreated, it is important to explore whether there is a higher prevalence of allergic rhinitis among hypothyroid patients, and vice versa [13].

This study aims to investigate the potential correlation between allergic rhinitis and hypothyroidism in patients at a rural tertiary care hospital, examining factors such as demographics, comorbidities, and clinical outcomes [14]. By understanding this relationship, healthcare providers can enhance diagnosis, treatment, and management strategies for these two common conditions, especially in underserved rural populations [7]. The findings from this study could contribute to broader healthcare strategies aimed at improving patient outcomes and reducing the burden of both allergic rhinitis and hypothyroidism in rural settings [15].

The study included 100 participants, with 41 males (41%) and 59 females (59%). The gender distribution indicates a higher proportion of females in the study population compared to males. This demographic breakdown provides a representation of the population under investigation, where female participants slightly outnumbered male participants. The sample size of 100 is sufficient for examining the correlation between allergic rhinitis and hypothyroidism, ensuring that the results are generalizable to the studied group. This gender-based distribution aligns with the general observation that certain conditions, like hypothyroidism, are more common in females, which may also impact the occurrence of allergic rhinitis in this population. The findings will help in understanding how gender influences the correlation between these two conditions.

In our study, the gender distribution showed 41% male and 59% female participants, with a slightly higher proportion of females, aligning with general trends in hypothyroidism prevalence. Female predominance in thyroid dysfunction has been widely reported, as hypothyroidism, particularly autoimmune forms like Hashimoto's thyroiditis, is more common in women by **Degirmenci PB et.al; 2015**. A study by **Fawzan AE et.al; 2022** also highlighted the higher prevalence of hypothyroidism in females and suggested that gender could play a crucial role in the relationship between allergic rhinitis and thyroid dysfunction. The gender-based findings from our study provide valuable insight into how gender may affect the association between these two conditions, particularly in a rural setting [5][6].

In our study, the mean age of participants was 32.67 ± 11.35 years, with no significant age difference between males (33.05 ± 11.58 years) and females (32.41 ± 11.27 years), as confirmed by the independent t-test ($p = 0.7835$). This age distribution reflects a relatively young population, consistent with the general age range for the onset of both allergic rhinitis and hypothyroidism. Similar findings were reported by **Lokaj-Berisha V et.al; 2025**, who observed a predominant age group of 30-40 years in patients with both allergic rhinitis and hypothyroidism. Another study by **Kulekci-Ozturk S et.al; 2021** found that although allergic rhinitis and hypothyroidism can affect a wide range of ages, young adults are more frequently affected, likely due to the early onset of thyroid dysfunction and allergic sensitivities. Our study aligns with these findings, reinforcing the association between these conditions in a younger population [16][17].

In our study, we observed a high prevalence of nasal symptoms in hypothyroid patients, with symptoms like nasal congestion (84%), sneezing (88%), rhinorrhea (84%), and nasal obstruction (85%) being significantly more common. This finding is consistent with studies highlighting the overlap between hypothyroidism and allergic rhinitis. A study by **Ghaffari J et.al; 2017** demonstrated a higher prevalence of nasal symptoms, including congestion and sneezing, in hypothyroid patients, suggesting that thyroid dysfunction may exacerbate or predispose individuals to allergic rhinitis. Another study by **Allam MM et.al; 2024** found a significant association between hypothyroidism and nasal symptoms, particularly rhinorrhea and nasal obstruction, suggesting that thyroid hormones may influence nasal mucosal responses and inflammation. Our study reinforces these findings and emphasizes the importance of considering thyroid function in the management of patients with nasal symptoms [18][19].

In our study, thyroid function varied across different severities of allergic rhinitis (AR), with TSH levels significantly increasing as the severity of AR rose. The mean TSH level in severe AR was 5.88 ± 2.69 mIU/L, which was significantly higher than in mild (3.99 ± 3.0 mIU/L) and moderate (4.36 ± 2.46 mIU/L) AR groups ($p = 0.0072$). Similarly, T3 levels showed significant variation, with lower T3 levels observed in moderate AR (1.25 ± 0.53 ng/dL) compared to mild (1.65 ± 0.65 ng/dL) and severe AR (1.59 ± 0.62 ng/dL) groups ($p = 0.0436$). T4 levels, however, did not show a significant difference across AR severities ($p = 0.1638$). These findings align with those of previous studies, such as by **Abd El-Aziz MF et.al; 2010**, which reported an association between thyroid dysfunction and

AR severity, with higher thyroid-stimulating hormone levels linked to more severe allergic symptoms. Similarly,**Gürlek F et.al; 2017** observed that hypothyroid patients with AR exhibited altered thyroid function compared to non-allergic individuals [20][21].

In our study, changes in the NOSE (Nasal Obstruction Symptom Evaluation) score over time were significant, with a marked reduction in symptoms from baseline (48.81 ± 30.21) to 3 months (32.37 ± 27.98), indicating improvement in allergic rhinitis symptoms over time ($p = 0.00000$). However, thyroid function parameters, including TSH, T3, and T4, showed no significant changes over the 3-month period ($p > 0.05$ for all), suggesting stable thyroid function despite changes in nasal symptoms. These findings are consistent with studies like those by **Hidaka Y et.al;** and **Tu J, et.al; 2024** which highlighted that thyroid dysfunction in allergic rhinitis patients remains relatively stable over time, with symptom improvement in allergic rhinitis not correlating directly with thyroid function. Our results also suggest that the management of allergic rhinitis symptoms may not significantly alter thyroid function over time [22] [11].

## Limitations

The study was conducted at a single tertiary care hospital, limiting the generalizability of the findings.The study assessed changes in nasal symptoms and thyroid function over a three-month period. A longer follow-up could provide a more comprehensive understanding of the relationship. The NOSE questionnaire is a subjective assessment tool, which may introduce response bias. The absence of a non-hypothyroid control group limits comparative analysis. Other potential contributing factors, such as environmental allergens and autoimmune conditions, were not explored in detail.

## Recommendations

1. **Routine Thyroid Screening in AR Patients:** Given the strong correlation between AR severity and hypothyroidism, screening for thyroid dysfunction in AR patients should be considered, especially in those with persistent symptoms.
2. **Multicenter Studies:** Future research should involve a larger and more diverse population to validate findings across different demographic groups.
3. **Longitudinal Studies:** Extended follow-up periods should be implemented to observe long-term changes in thyroid function and AR severity.
4. **Comprehensive Treatment Approaches:** Treatment protocols should integrate both symptomatic relief strategies and hormonal management for optimal patient outcomes.
5. **Investigation of Additional Biomarkers:** Further research should explore inflammatory markers and immune responses to understand the underlying mechanisms linking AR and hypothyroidism.

## Conclusion

The findings of this study establish a significant association between allergic rhinitis and hypothyroidism. Higher TSH levels were found to correlate with increased severity of AR symptoms, emphasizing the potential role of thyroid dysfunction in nasal inflammation. The improvement in nasal symptoms over time, despite stable thyroid hormone levels, suggests that symptomatic treatment may be effective regardless of underlying thyroid status. In conclusion, this study provides strong evidence that hypothyroidism plays a role in allergic rhinitis severity. Understanding this association can enhance diagnostic and therapeutic approaches, leading to improved patient care in clinical settings.

**Conflict of interest:** The authors declare no conflict of interest whatsoever.

**Ethical statement:** Before starting the study ethical clearance was taken from the institutional ethical committee.

**Consent for publication:** Informed consent was taken by the patient's relatives before the tracheostomy and by the patient to enroll in the study.

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