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# The Association of Genetic and Demographic Factors With Hyperthyroid Status at Dr. H. Abdul Moeloek Regional General Hospital, Bandar Lampung

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**Abstract**

**Background:** Hyperthyroidism is an endocrine disorder caused by excessive thyroid hormone production that may lead to severe hypermetabolic complications if left untreated. Genetic predisposition and demographic characteristics are considered important factors associated with hyperthyroidism status**.**
**Aims:** This study aimed to analyze the association between genetic and demographic factors and hyperthyroidism status among patients at Dr. H. Abdul Moeloek Regional General Hospital, Bandar Lampung.
**Methods:** This quantitative study employed a cross-sectional design involving 55 participants recruited through simple random sampling. Information was obtained using a structured data collection form and patients' medical records at the internal medicine outpatient clinic of Dr. H. Abdul Moeloek Regional General Hospital. Variables analyzed included family history, age, sex, ethnicity, education, occupation, and socioeconomic status. Statistical analysis was performed using Fisher's Exact Test and Likelihood Ratio tests with a significance level of $p < 0.05$.
**Results:** The results showed that genetic factors represented by family history were significantly associated with hyperthyroidism among the study participants ($p = 0.003$). Significant associations were also found between hyperthyroidism status and age ($p = 0.002$), sex ($p < 0.001$), and ethnicity ($p < 0.001$). In contrast, education level ($p = 0.167$), occupation ($p = 0.579$), and socioeconomic status ($p = 0.530$) were not significantly associated with hyperthyroidism status. Family genogram findings demonstrated the occurrence of hyperthyroidism across one to three generations, indicating possible hereditary susceptibility.
**Conclusion:** Family history, as an indicator of genetic predisposition, and several demographic factors, particularly age, sex, and ethnicity, were associated with hyperthyroidism status among the study participants. These findings highlight the potential value of assessing family history and demographic characteristics to support early detection and preventive strategies. However, the findings should be interpreted cautiously because of the cross-sectional study design and the small comparison group.

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## INTRODUCTION

Hyperthyroidism is an endocrine disorder characterized by excessive production of hormones produced by the thyroid gland. The thyroid gland is responsible for maintaining metabolic balance, supporting normal growth and body temperature regulation, and controlling numerous physiological functions through the hypothalamic pituitary thyroid (HPT) axis. Excessive secretion of thyroxine (T4) and triiodothyronine (T3) may lead to hypermetabolic conditions that significantly affect patients' overall well-being and elevate the likelihood of severe systemic complications if left untreated (Yahya et al., 2024)**.** Clinically, hyperthyroidism is commonly

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associated with clinical manifestations including unintended weight loss and intolerance to heat, tremors, palpitations, excessive sweating, diarrhea, and muscle weakness. In severe conditions, untreated hyperthyroidism may progress into thyroid storm, a life-threatening complication characterized by tachycardia, fever, gastrointestinal disturbances, and multiorgan dysfunction. Previous studies have reported that thyroid storm is associated with high mortality, particularly among elderly patients (Afifah & Sulisma, 2025).

According to estimates from the World Health Organization (WHO), millions of individuals worldwide are affected by thyroid disorders, with women demonstrating substantially higher prevalence compared with men (Wijaya & Larasati, 2022). In Indonesia, hyperthyroidism is considered one of the most common endocrine disorders after diabetes mellitus. National health data also indicate a continuous increase in healthcare visits related to thyroid diseases over recent years (DJSN & BPJS Kesehatan, 2022). Furthermore, previous reports from RSUD Dr. H. Abdul Moeloek Bandar Lampung documented a considerable number of thyroid disorder cases, emphasizing the importance of identifying factors associated with hyperthyroidism incidence in local populations (Jamal & Maracilu, 2023).

Previous studies have demonstrated that both genetic and demographic factors contribute to the occurrence of hyperthyroidism. Family history has been identified as an important genetic risk factor associated with autoimmune thyroid disorders. Several studies have shown that individuals with a positive family history have a higher risk of developing hyperthyroidism due to hereditary susceptibility involving immune dysregulation and autoimmune responses targeting thyroid tissue (Ferraninda et al., 2023). Genetic susceptibility has also been linked to several genes related to autoimmune thyroid diseases, including genetic factors, such as HLA, CTLA-4, PTPN22, and TSHR (Grixti et al., 2022). Recent studies have also demonstrated that polymorphisms in the thyroid peroxidase (TPO) gene may increase susceptibility to hyperthyroidism by influencing thyroid autoimmunity (AL-Mofarji et al., 2023).

More recent evidence indicates that Graves' disease does not follow a simple Mendelian inheritance pattern but arises from the combined effects of multiple susceptibility loci. In addition to HLA, CTLA-4, PTPN22, and TSHR, variants involving immune-regulatory and thyroid-specific pathways may influence disease susceptibility, age at onset, and clinical expression. Nevertheless, genetic predisposition alone is insufficient to determine disease occurrence because epigenetic regulation, immune imbalance, gut microbiota, and environmental exposures may modify the manifestation of the disease (Zhou et al., 2022; Liao et al., 2022; Grixti et al., 2024).

In addition to genetic predisposition, demographic factors, including age, sex, ethnicity, education, occupation, and socioeconomic status may influence hyperthyroidism status. Women are more susceptible to hyperthyroidism because hormonal factors, particularly estrogen, may affect immune regulation and autoimmune activity (Yahya et al., 2024). Hyperthyroidism is frequently identified among adults and elderly populations due to hormonal and metabolic changes occurring with aging (Anindha et al., 2023). Ethnicity and socioeconomic conditions may also contribute through differences in dietary patterns, environmental exposure, healthcare access, stress levels, and health-seeking behavior (Strikić Đula et al., 2022).

Environmental factors also are key contributors to the onset and progression of thyroid dysfunction. Variations in iodine intake, environmental exposure, nutritional status, smoking habits, and other lifestyle factors may influence thyroid hormone synthesis and regulation, thereby contributing to the occurrence of hyperthyroidism (Babić Leko et al., 2021). These findings indicate that hyperthyroidism is a multifactorial disorder resulting from the interaction between inherited risk factors and environmental triggers.

Although numerous studies have investigated hyperthyroidism, most previous research has focused only on isolated clinical characteristics or specific risk factors such as stress, iodine intake, and smoking behavior. Limited studies have comprehensively examined the simultaneous relationship between genetic and demographic factors associated with hyperthyroidism incidence, particularly within Indonesian hospital settings (Taylor et al., 2018). Most previous studies evaluated either genetic predisposition or demographic characteristics independently. In contrast, the present study integrates both genetic and demographic factors simultaneously to provide a more comprehensive understanding of hyperthyroidism status. Therefore, further investigation

integrating hereditary and demographic perspectives is necessary to strengthen early detection strategies and preventive interventions among high-risk populations.

Although previous studies have identified genetic susceptibility as an important determinant of hyperthyroidism, most investigations have primarily focused on specific genetic mutations or polymorphisms rather than integrating broader patient characteristics (Naghibi et al., 2022). Recent evidence has also emphasized genotype–phenotype correlations in hereditary hyperthyroidism, highlighting the complexity of disease development (Yamichannaiah et al., 2025). Other studies have explored the influence of demographic and lifestyle-related factors on thyroid dysfunction without simultaneously evaluating genetic predisposition (Jangi et al., 2025). In addition, investigations on thyroid dysfunction have reported the contribution of biochemical and demographic determinants but have not comprehensively combined hereditary and demographic factors in a single analytical framework (Balakrishna et al., 2025). Therefore, evidence regarding the simultaneous association between genetic and demographic factors in Indonesian hospital settings remains limited, providing a clear rationale for the present study.

Understanding the relationship between genetic and demographic factors associated with hyperthyroidism is important for identifying vulnerable populations and improving preventive strategies. Considering the increasing number of thyroid disorder cases at RSUD Dr. H. Abdul Moeloek Bandar Lampung, this study aimed to analyze the association between genetic and demographic factors and hyperthyroidism status among patients at the hospital. The findings of this study are expected to contribute to the development of evidence-based screening and prevention programs for hyperthyroidism, particularly among populations with hereditary susceptibility and high-risk demographic characteristics.

## METHOD

This investigation adopted a quantitative observational analytical design based on a cross-sectional framework. Information on genetic factors, demographic characteristics, and hyperthyroidism status was obtained simultaneously, allowing the relationships among these variables to be examined at a single time point. This research took place at Dr. H. Abdul Moeloek Regional General Hospital, Bandar Lampung. The sampling frame consisted of 124 patients identified from hospital medical records based on hyperthyroidism-related diagnosis codes recorded during outpatient visits from January to April 2025. Participant enrollment and data collection were conducted from March to April 2026.

Based on the Slovin formula with a 10% margin of error, a sample size of 55 participants was determined. Participants were selected using simple random sampling. Hyperthyroidism status was subsequently verified based on clinical and laboratory examination results and the final diagnosis established by the treating physician. Following verification, 52 participants were classified as hyperthyroid and 3 as non-hyperthyroid. The inclusion criteria were patients aged above 20 years who attended the internal medicine outpatient clinic with suspected hyperthyroidism or thyroid-related symptoms and were willing to participate in the study.

Data were collected using a structured data collection form, interview sheets, and patients' medical records. The structured data collection form was developed by the researchers based on the study variables and relevant literature to record participants' genetic and demographic characteristics, including family history of thyroid disease, age, sex, ethnicity, education level, occupation, and socioeconomic status. Prior to data collection, the content of the instrument was reviewed through expert judgment by the research supervisors to ensure its relevance, clarity, and consistency with the study objectives and variables. Since the instrument served solely as a structured data collection form and was not intended to measure latent constructs, psychometric validity and reliability testing were not applicable. Interview sheets were used to verify participants' answers and to clarify incomplete or inconsistent information obtained from the questionnaires.

Patients' medical records were subsequently reviewed to determine hyperthyroidism status based on physicians' diagnoses supported by clinical manifestations and laboratory examinations, including decreased Thyroid Stimulating Hormone (TSH) levels and elevated free thyroxine (FT4) and/or triiodothyronine (T3) levels according to the hospital's diagnostic criteria.

Information obtained from questionnaires was cross-checked with medical records whenever applicable to improve data accuracy and completeness. Socioeconomic status was classified based on participants' monthly household income and categorized into low (< IDR 2,000,000/month), middle (IDR 2,000,000–5,000,000/month), and high (> IDR 5,000,000/month), adapted from the income classification of Statistics Indonesia (BPS, 2024). The dependent variable in this study was hyperthyroidism status, while the independent variables consisted of genetic and demographic factors, including family history, age, sex, ethnicity, education level, occupation, and socioeconomic status. Hyperthyroidism status and family history were measured using nominal scales, whereas demographic variables were classified according to predefined categories for statistical analysis.

Before participation, each eligible individual received a detailed explanation regarding the purpose of the research, study procedures, expected benefits, and the protection of personal information. Written informed consent was obtained from all participants prior to their involvement in the study. After providing consent, participants completed the questionnaires under the guidance of the researchers. Information related to the clinical diagnosis of hyperthyroidism was subsequently verified using patients' medical records.

The collected data underwent several processing stages, including data checking, coding, data entry, and data cleaning. The checking process was carried out to identify incomplete or inconsistent responses, whereas coding involved converting categorical information into numerical values suitable for statistical analysis. All analyses were performed using IBM SPSS Statistics version 29.

The statistical analysis comprised descriptive and inferential procedures. Descriptive (univariate) analysis was used to summarize participant characteristics and study variables by presenting frequencies and percentages. Inferential (bivariate) analysis evaluated the relationship between the independent variables and hyperthyroidism status using the Chi-square test. If the assumptions required for the Chi-square test were not satisfied, Fisher's Exact Test or the Likelihood Ratio test was employed as an alternative method (Agresti, 2019). Statistical significance was established at a p-value of less than 0.05.

Ethical approval for this research was granted by the Health Research Ethics Committee of Dr. H. Abdul Moeloek Regional General Hospital, Bandar Lampung (Ethical Clearance No. 045/KEPK-RSUDAM/II/2026). Participation was entirely voluntary, and written informed consent was obtained before data collection commenced. Throughout the research process, the privacy, anonymity, and confidentiality of all participants were strictly protected.

## RESULTS AND DISCUSSION

### Results

A total of 55 participants participated in this study. Most participants were classified as hyperthyroid (52 participants, 94.5%), while 3 participants (5.5%) were classified as non-hyperthyroid. The marked imbalance between the two outcome groups, with only three participants in the non-hyperthyroid group, may have reduced statistical power and resulted in less stable estimates of the observed associations. Therefore, the findings should be interpreted with caution, particularly for comparisons involving the non-hyperthyroid group.

Based on genetic characteristics, 36.4% of participants reported having a positive family history of thyroid disorders. Family genogram analysis demonstrated hereditary patterns of thyroid disorders across one to three generations, indicating possible familial clustering of hyperthyroidism. Most participants belonged to adult (18–44 years) and pre-elderly (45–59 years) age groups. Female participants predominated in this study (78.2%), whereas male participants accounted for only 21.8%. More than half of participants were from non-Lampung ethnic groups (52.7%). Most participants had higher educational attainment, were unemployed, and had moderate socioeconomic status.

**Table 1.** Participant Characteristics and Research Variables (n = 55)

| Variables | f | % |
|---|---|---|
| Hyperthyroidism Status | | |
| Non-Hyperthyroid | 3 | 5.5 |
| Hyperthyroid | 52 | 94.5 |
| Genetic Factors | | |
| No family history | 35 | 63.6 |
| Family history present | 20 | 36.4 |
| Genogram History | | |
| 0 history | 35 | 63.6 |
| 1 history | 15 | 27.3 |
| 2 history | 2 | 3.6 |
| 3 history | 3 | 5.5 |
| Age Category | | |
| Adults (18–44 years) | 25 | 45.5 |
| Pre-elderly (45–59 years) | 24 | 43.6 |
| Young elderly (60–69 years) | 4 | 7.3 |
| Middle elderly (70–79 years) | 2 | 3.6 |
| Old elderly (≥80 years) | 0 | 0 |
| Sex | | |
| Male | 12 | 21.8 |
| Female | 43 | 78.2 |
| Ethnicity | | |
| Non-Lampung | 29 | 52.7 |
| Lampung | 26 | 47.3 |
| Education | | |
| Elementary School | 5 | 9.1 |
| Junior High School | 4 | 7.3 |
| Senior High School | 21 | 38.2 |
| Higher Education | 25 | 45.5 |
| Occupation | | |
| Unemployed | 26 | 47.3 |
| Private sector | 19 | 34.5 |
| Civil servant | 5 | 9.1 |
| Others | 5 | 9.1 |
| Socioeconomic Status | | |
| Low (< Rp 2 million) | 17 | 30.9 |
| Middle (Rp 2–5 million) | 28 | 50.9 |
| High (> Rp 5 million) | 10 | 18.2 |

Socioeconomic status was classified based on participants' monthly household income, adapted from the income classification of Statistics Indonesia (BPS, 2024).

The predominance of female participants and productive-age groups suggests that hyperthyroidism is more frequently identified among women and adults. Bivariate analysis demonstrated significant associations between family history (p = 0.003), age (p = 0.002), sex (p < 0.001), and ethnicity (p < 0.001) with hyperthyroidism status. In contrast, education level (p = 0.167), occupation (p = 0.579), and socioeconomic status (p = 0.530) were not significantly associated with hyperthyroidism status.

**Table 2.** Cross-table Relationship between Independent and Dependent Variables*

| Independent Variables | Hyperthyroidism | | | | P value |
|---|---|---|---|---|---|
| | Non-Hyperthyroid | | Hyperthyroid | | |
| | f | % | f | % | |
| **Genetic Factors** | | | | | |
| No family history | 3 | 8.6 | 32 | 91.4 | 0.003 |
| Family history present | 0 | 0.0 | 20 | 100.0 | |

| Independent Variables | Hyperthyroidism | | | | P value |
|---|---|---|---|---|---|
| | Non-Hyperthyroid | | Hyperthyroid | | |
| | f | % | f | % | |
| **Age Category** | | | | | |
| Adults (18–44 years) | 0 | 0.0 | 25 | 100.0 | 0.002 |
| Pre-elderly (45–59 years) | 3 | 12.5 | 21 | 87.5 | |
| Young elderly (60–69 years) | 0 | 0.0 | 4 | 100.0 | |
| Middle elderly (70–79 years) | 0 | 0.0 | 2 | 100.0 | |
| **Sex** | | | | | |
| Male | 1 | 8.3 | 11 | 91.7 | < 0.001 |
| Female | 2 | 4.7 | 41 | 95.3 | |
| **Ethnicity** | | | | | |
| Non-Lampung | 2 | 6.9 | 27 | 93.1 | < 0.001 |
| Lampung | 1 | 3.8 | 25 | 96.2 | |
| **Education** | | | | | |
| Elementary School | 1 | 20.0 | 4 | 80.0 | 0.167 |
| Junior High School | 0 | 0.0 | 4 | 100.0 | |
| Senior High School | 2 | 9.5 | 19 | 90.5 | |
| Higher Education | 0 | 0.0 | 25 | 100.0 | |
| **Occupation** | | | | | |
| Unemployed | 1 | 3.8 | 25 | 96.2 | 0.579 |
| Private sector | 1 | 5.3 | 18 | 94.7 | |
| Civil servant | 0 | 0.0 | 5 | 100.0 | |
| Others | 1 | 20.0 | 4 | 80.0 | |
| **Socioeconomic Status** | | | | | |
| Low (< Rp 2 million) | 1 | 5.9 | 16 | 94.1 | 0.530 |
| Middle (Rp 2–5 million) | 2 | 7.1 | 28 | 92.9 | |
| High (> Rp 5 million) | 0 | 0.0 | 10 | 100.0 | |

* p-values derived from Fisher's exact test or the likelihood ratio test.
** **Significant at $p < 0.05$.

**Family Genogram**

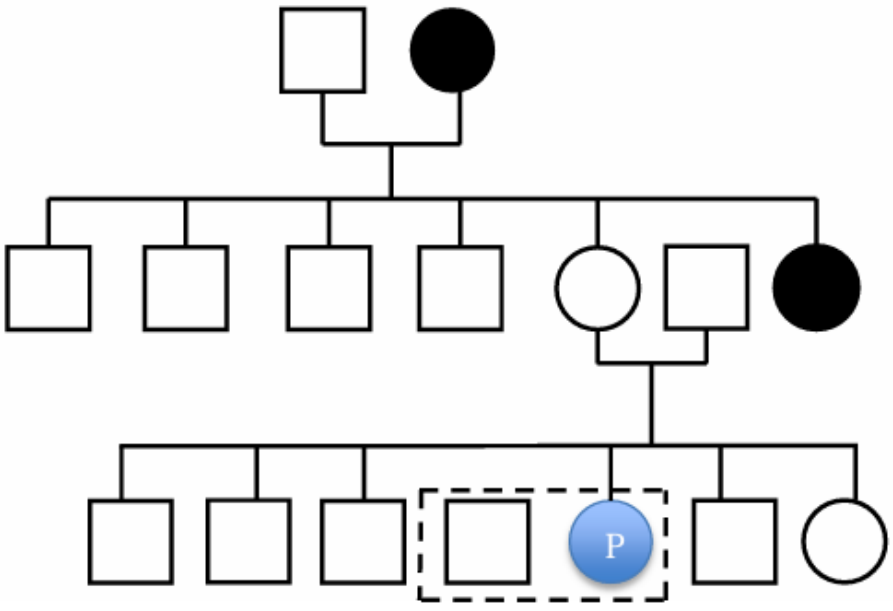


**Figure 1.**Family Genogram with Hyperthyroidism History Across Three Generations

Figure 1 illustrates a family genogram showing hyperthyroidism occurring across three generations. This pattern suggests familial aggregation, which may reflect a possible genetic susceptibility to hyperthyroidism. Although the genogram provides descriptive evidence of disease occurrence within the family, it does not establish a definitive pattern of genetic inheritance. These findings are consistent with previous studies reporting that hereditary factors contribute to the risk of autoimmune thyroid disease (Hu et al., 2021).

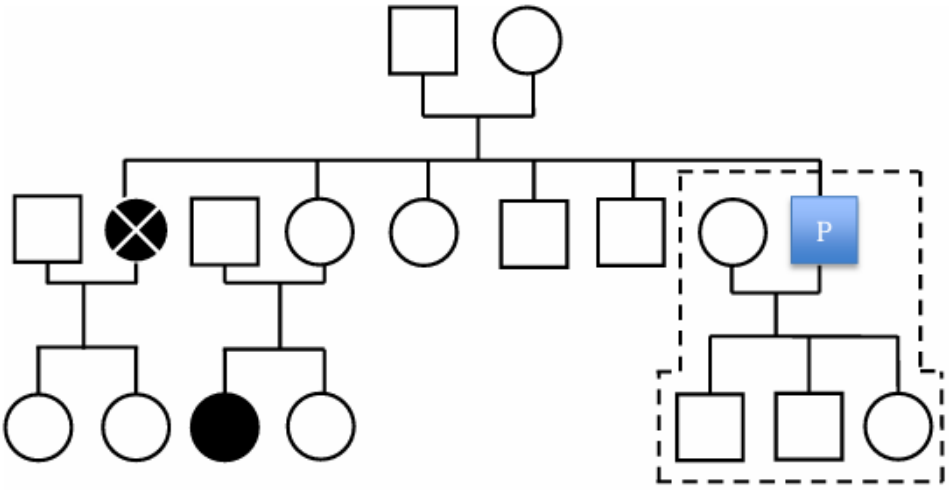


**Figure 2.** Family Genogram with Hyperthyroidism History Across Two Generations

Figure 2 demonstrates hyperthyroidism occurring across two generations. The presence of affected individuals in successive generations suggests familial clustering, although the pattern is insufficient to confirm a specific mode of inheritance (Grixti et al., 2024).

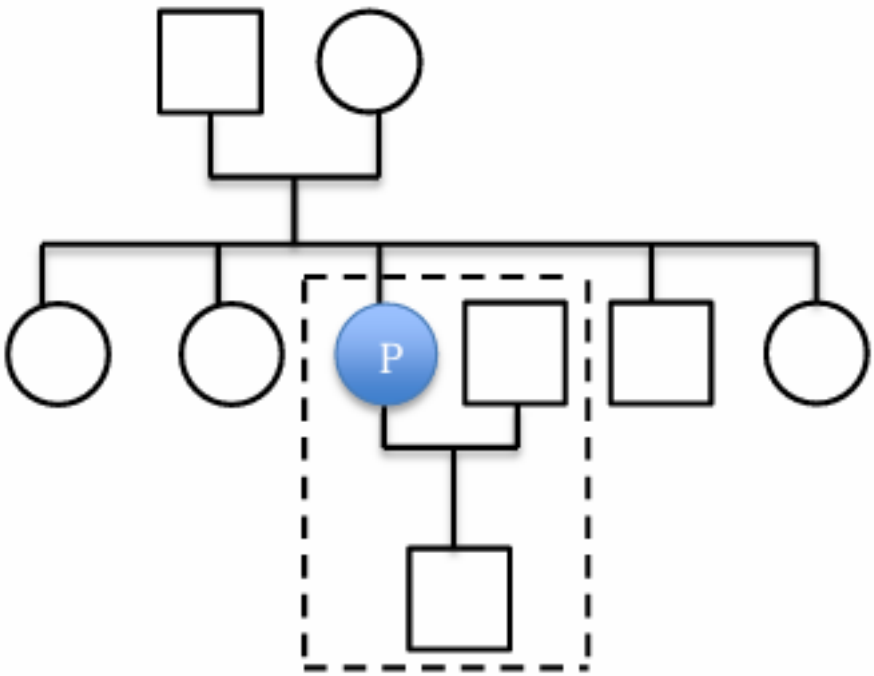


**Figure 3.** Family Genogram with Hyperthyroidism History Across One Generation

Figure 3 illustrates a family genogram showing hyperthyroidism occurring within a single generation of the family. Although the familial pattern is less extensive than those observed in Figures 1 and 2, the presence of affected family members may indicate a possible familial susceptibility to hyperthyroidism. These findings are consistent with previous studies suggesting

that family history is an important risk factor for autoimmune thyroid disease (Gavryutina et al., 2022).

## Discussion

Recent studies have also demonstrated that polymorphisms of thyroid-related genes interact with lifestyle and environmental factors, suggesting that genetic predisposition alone is insufficient to explain the occurrence of thyroid dysfunction (Kim & Park, 2023). Autoimmune activity has also been reported to play an important role in thyroid disorders, supporting the contribution of hereditary susceptibility in disease development (Sharma et al., 2023).

The significant association between family history and hyperthyroidism status suggests that familial susceptibility may contribute to the occurrence of thyroid dysfunction in the study population. This finding is biologically plausible because Graves' disease and other autoimmune thyroid disorders are complex traits involving numerous immune-regulatory and thyroid-specific susceptibility loci, including HLA, CTLA-4, PTPN22, and TSHR. Recent genomic evidence has identified an increasingly broad range of susceptibility loci associated with disease development and clinical expression (Liao et al., 2022; Liu et al., 2023; Grixti et al., 2024).

The genogram findings complement the statistical results by illustrating the presence of thyroid disorders across one to three generations. Similar familial patterns have been reported through whole-exome sequencing and twin-based research, supporting the contribution of inherited susceptibility to autoimmune thyroid disease (Hu et al., 2021; Skov et al., 2021). However, the genograms used in the present study provide descriptive evidence of familial aggregation rather than confirmation of a particular mode of inheritance. Therefore, these findings should not be interpreted as proof of direct genetic transmission. Instead, they may reflect the combined influence of shared genetic susceptibility, environmental exposure, dietary patterns, stress, and other family-level characteristics (Zhou et al., 2022; Gavryutina et al., 2022).

Age was significantly associated with hyperthyroidism status, with most hyperthyroid participants belonging to the adult and pre-elderly groups. Rather than indicating a simple increase in prevalence with advancing age, this distribution suggests that hyperthyroidism in the present clinical population was concentrated mainly within the productive and middle-age periods. Age may influence disease expression through changes in immune regulation, hormonal activity, accumulated environmental exposures, and differences in healthcare utilization. Previous population-based studies have also demonstrated that the distribution of thyroid dysfunction varies across age groups, although the direction and magnitude of the association may differ according to disease etiology, population characteristics, iodine status, and diagnostic criteria (Strikić Đula et al., 2022; Zhang et al., 2023).

Similar findings have been reported in other populations, where thyroid dysfunction varied according to age and was associated with different clinical characteristics across age groups (Yang & Cao, 2022). Thyroid dysfunction has also been associated with long-term neurological outcomes, indicating that age-related thyroid abnormalities may contribute to cognitive decline among older individuals (Sheng et al., 2024). Previous neuroimaging studies have further demonstrated that thyroid status may influence structural brain changes, emphasizing the importance of maintaining normal thyroid function throughout adulthood.

Sex was significantly associated with hyperthyroidism status, and women constituted the majority of participants. This finding is consistent with the well-established female predominance of autoimmune thyroid disease. The difference is unlikely to be explained by a single hormonal mechanism; rather, it may result from interactions among sex hormones, X-chromosome-related immune regulation, genetic susceptibility, epigenetic modifications, and sex-specific immune responses. Recent epigenetic and genetic investigations have further demonstrated that the biological expression of autoimmune thyroid disease may differ between women and men (Lafontaine et al., 2024; Grixti et al., 2024). Hospital-based studies consistently reported that women constitute the majority of patients diagnosed with hyperthyroidism, reflecting the influence of hormonal and immunological mechanisms on disease occurrence (Mekki et al., 2022).

Ethnicity was also significantly associated with hyperthyroidism status in the present analysis. Nevertheless, ethnicity should not be interpreted as a direct biological cause of

hyperthyroidism. It may represent a combination of genetic ancestry, dietary iodine exposure, environmental conditions, cultural practices, socioeconomic circumstances, healthcare access, and health-seeking behavior. Population studies have shown that the prevalence and detection of thyroid dysfunction can differ according to racial and ethnic background; however, these differences may also reflect variations in population composition, diagnostic thresholds, and access to healthcare (Zhang et al., 2023). Therefore, the association found in this study should be considered exploratory and requires confirmation in a larger sample with more detailed measurement of dietary, environmental, and healthcare-related variables. Environmental and nutritional factors, including vitamin D status, have also been associated with thyroid dysfunction and may contribute to differences in disease manifestation among populations (Sahi et al., 2025).

Education, occupation, and socioeconomic status were not significantly associated with hyperthyroidism status. This finding does not necessarily indicate that these factors have no relevance to thyroid health. Although they may not directly determine the occurrence of hyperthyroidism, they may still exert an indirect influence through nutritional status, iodine exposure, health literacy, access to healthcare services, and health-seeking behavior. Previous studies have shown that the distribution and detection of thyroid and autoimmune disorders may vary according to environmental exposure, iodine status, healthcare conditions, and socioeconomic characteristics (Taylor et al., 2018; Conrad et al., 2023). In addition, the limited number of participants in the non-hyperthyroid group may have reduced the ability of the statistical analysis to detect significant differences. Therefore, these findings should be interpreted cautiously.

Previous studies have shown that patient characteristics and comorbid conditions may influence the prevalence and clinical outcomes of thyroid disorders, although these factors do not always demonstrate a direct statistical association with disease occurrence (Suarez-Zdunek et al., 2024). Hyperthyroidism has also been associated with several chronic diseases, highlighting the importance of comprehensive clinical evaluation among affected patients (Leung et al., 2024). In addition, hyperthyroidism may increase the risk of adverse clinical outcomes, including cardiovascular complications and mortality, emphasizing the importance of early diagnosis and appropriate management (Alluri et al., 2025). Hematological abnormalities have also been reported among patients with thyroid dysfunction, suggesting that comprehensive clinical assessment is important during patient management (Mandefro et al., 2026). Appropriate treatment and long-term follow-up remain essential to improve hormonal control and reduce disease-related complications in patients with hyperthyroidism (Hussain et al., 2026).

Overall, the present findings emphasize that hyperthyroidism is a multifactorial disorder influenced by complex interactions among genetic susceptibility, demographic characteristics, environmental factors, and clinical conditions. These results highlight the importance of comprehensive risk assessment and early screening strategies to support timely diagnosis, appropriate management, and improved clinical outcomes among individuals at high risk of hyperthyroidism.

**Implications**

The results of this research have practical, clinical, and public health implications for the early detection and management of hyperthyroidism. From a practical perspective, identifying individuals with a positive family history and high-risk demographic characteristics, particularly women and adults, may assist healthcare providers in recognizing populations that require closer monitoring for thyroid disorders. For example, family history screening can be incorporated into routine assessments at community health centers (Puskesmas) to identify individuals who may require further thyroid evaluation. Clinically, incorporating family history assessment into routine patient evaluation may facilitate earlier diagnosis and timely management of hyperthyroidism before serious complications occur. The use of simple family history tools or genograms may also be integrated into chronic disease care to help healthcare providers identify patterns of thyroid disorders within families. From a public health perspective, the findings support the implementation of health education programs, particularly for women of reproductive age and other high-risk groups, focusing on hereditary susceptibility, early symptoms, and the importance of seeking medical evaluation. These strategies may contribute to earlier detection, appropriate monitoring, and improved management of hyperthyroidism at the community level.

**Research Contribution**

The present study contributes to the existing body of knowledge by simultaneously examining genetic and demographic factors associated with hyperthyroidism within a single analytical framework. This integrated approach represents an important contribution because previous studies have often focused primarily on clinical manifestations or individual risk factors rather than examining familial and demographic characteristics together. In addition, the use of family genograms as supporting data provides a visual representation of the distribution of hyperthyroidism across generations and offers additional descriptive evidence of potential familial patterns. The study also provides empirical evidence from a hospital-based population in Indonesia, a setting that remains relatively underrepresented in research on familial and demographic factors associated with hyperthyroidism. By combining genetic and demographic factor analyses, supported by family genogram information, this study provides a more comprehensive perspective on populations potentially at increased risk of hyperthyroidism. The findings may serve as baseline evidence for future epidemiological research and support the development of evidence-informed screening and early detection strategies for individuals with increased risk of thyroid disorders.

**Limitations**

Several limitations should be acknowledged when interpreting the findings of this research. The use of a cross-sectional approach does not allow conclusions regarding cause-and-effect relationships between demographic or genetic characteristics and hyperthyroidism. Furthermore, because the study was carried out at a single hospital and involved a relatively limited number of participants, the applicability of the results to other populations or healthcare settings may be restricted. In addition, the unequal distribution between hyperthyroid and non-hyperthyroid participants may have affected the statistical power of the analysis. Furthermore, several potential confounding variables, such as iodine intake, stress level, smoking behavior, and environmental exposure were not evaluated in this study.

**Suggestions**

Future studies are recommended to involve larger and more representative samples from multiple healthcare centers to improve the generalizability of the findings. Further research should also include additional variables that may influence hyperthyroidism, such as iodine intake, smoking behavior, stress levels, environmental exposure, and genetic biomarkers. For healthcare practitioners, routine assessment of family history and demographic risk factors is recommended as part of early screening for hyperthyroidism, particularly among women and individuals with a positive family history. Public health authorities are encouraged to strengthen educational programs promoting awareness of hereditary risk factors and the importance of early medical evaluation for thyroid-related symptoms.

## CONCLUSION

Based on the findings and discussion of this study regarding the relationship between genetic and demographic factors and hyperthyroidism status at RSUD Dr. H. Abdul Moeloek in 2026, it can be concluded that genetic factors and several demographic characteristics are significantly associated with hyperthyroidism status. Family history as a representation of genetic predisposition was significantly associated with hyperthyroidism status, indicating an association between hereditary factors and susceptibility to thyroid dysfunction. In addition, demographic variables including age, sex, and ethnicity were significantly related to hyperthyroidism status, whereas education level, occupation, and socioeconomic status did not demonstrate significant associations. These findings may support the development of community-based screening programs, health promotion strategies, and early preventive interventions for populations at high risk of hyperthyroidism, particularly individuals with a positive family history and vulnerable demographic characteristics.

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## AUTHOR CONTRIBUTION STATEMENT

PAZ, MK, and GP developed the study concept and research design. PAZ was responsible for data collection and statistical analysis. MK and GP provided supervision throughout the study and critically revised the manuscript. NS reviewed the manuscript and offered valuable intellectual contributions. All authors participated in drafting and revising the manuscript and approved the final version for publication.

## AI DISCLOSURE STATEMENT

The authors declare that artificial intelligence (AI) tools were used solely to assist with language editing, grammar correction, and improvement of writing clarity. AI was not used for data collection, statistical analysis, interpretation of the results, or formulation of the research findings. All AI-assisted content was critically reviewed and verified by the authors, who take full responsibility for the content, accuracy, and integrity of this publication.

## CONFLICTS OF INTEREST

The authors state that they have no competing financial, institutional, or personal interests that may have affected any stage of this research, including its implementation, data analysis, manuscript writing, and publication.

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