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Clinical Profile and Blood Pressure Patterns of Patients with Thyroid Dysfunction in Dr. Soetomo General Academic Hospital (2023–2024)

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ABSTRACT

Introduction: Thyroid dysfunction is a common endocrine disorder characterized by abnormalities in thyroid structure or function, leading to disturbances in hormone production. It is the second most prevalent endocrine condition after diabetes mellitus and affects multiple organ systems. Changes in thyroid hormone levels influence metabolic rate, vascular resistance, and cardiac output, making blood pressure an important clinical parameter. Therefore, evaluating clinical characteristics and blood pressure is essential for improving assessment and management. ***Methods:*** This retrospective descriptive study examined 208 adult cases of thyroid dysfunction that met the inclusion and exclusion criteria. Variables assessed included age, gender, anthropometric data, blood pressure, TSH, and FT4 levels. ***Results:*** Of the 208 patients, 79.8% were female, with a mean age of 41.98 years. Hyperthyroidism was more common (69.2%), with overt hyperthyroidism as the most frequent subtype (42.8%). The mean BMI was 25.23 kg/m^2, with most patients classified as normal or overweight. Hypertension was the most prevalent blood pressure category (57.7%), with a higher proportion of hyperthyroid patients affected (60.4% vs. 51.6%). Mean systolic and diastolic blood pressure didn't show any significant difference between thyroid groups. FT4 showed a weak positive correlation with diastolic pressure, while TSH showed no significant correlation. ***Conclusion:*** Thyroid dysfunction in this population predominantly affected women and young to middle-aged adults, with overt hyperthyroidism being the dominant presentation. Hypertension was frequent across thyroid groups, and weak correlations between thyroid levels and blood pressure suggest multifactorial influences. More comprehensive blood pressure monitoring and cardiovascular assessment remain important in patients with thyroid dysfunction.

Keywords: thyroid dysfunction; hyperthyroidism; hypothyroidism; blood pressure; hypertension; body mass index; clinical profile

INTRODUCTION

Thyroid dysfunction is a condition that occurs due to an abnormality in our body that affects the thyroid gland. The abnormality can be in the form of structural abnormalities in the thyroid gland, such as goiter or nodules, or a certain condition that can affect the activity of the gland. The abnormality of the thyroid gland can disrupt the endocrine system, thus affecting various organs throughout the body [1]. Given its broad systemic impact, thyroid dysfunction also represents a significant clinical burden. The thyroid dysfunction case is the second most common endocrine disorder after diabetes mellitus. Thyroid dysfunction can result in an imbalance of the thyroid hormone and affects almost every organ in the body because of its function [2].

Thyroid hormones affect cardiac and vascular cells through both genomic and non-genomic mechanisms. The binding of Thyroid hormone to cellular receptors in cardiomyocytes affects the transcription of structural and regulatory cardiac proteins, leading to increased heart rate and contraction, thus increasing blood pressure. Thyroid hormones also increase the expression of β1-adrenergic receptors, causing inotropic effects.

Non-genomic events within the plasma membrane, cytoplasm, and organelles regulate intracellular functions, including ion channels [3].

Given the growing number of individuals with thyroid dysfunction and the possible impact on their cardiovascular systems, it is necessary to further study the association between blood pressure and thyroid abnormalities in the Indonesian population. This study aims to describe the blood pressure profile of patients with thyroid dysfunction, including both hyperthyroidism and hypothyroidism, in a representative sample of patients treated at Dr. Soetomo General Academic Hospital during 2023–2024.

METHOD

This study is a retrospective descriptive study using electronic medical records of patients diagnosed with hyperthyroidism and hypothyroidism who were treated at the Outpatient Clinic of the Internal Medicine Department. The sample was taken from data collected from January 2023 to December 2024 from the Information and Communication Technology Department at Dr. Soetomo Academic General Hospital.

Variables collected from electronic medical records include initials, gender, age, weight, height, systolic blood pressure, diastolic blood pressure, TSH, and FT4 laboratory test. Inclusion criteria were patients aged 18 years and older who had a confirmed diagnosis of either hyperthyroidism or hypothyroidism. Exclusion criteria included incomplete medical records, the presence of comorbidities known to independently affect blood pressure, and the use of antihypertensive medications. Blood pressure categories were determined based on systolic and diastolic values using the 2024 European Society of Cardiology (ESC) hypertension guideline [4]. Body mass index (BMI) was calculated from height and weight, and BMI classification followed the WHO Asia-Pacific guidelines (2004) [5]. All collected data were analyzed descriptively using SPSS Statistics and presented in tables. This study has been approved for ethical clearance by General Academic Hospital Dr. Soetomo with a letter of approval.

RESULTS

This study identified a total of 3.050 patients diagnosed with thyroid dysfunction (hyperthyroid and hypothyroid) at Dr. Soetomo General Academic Hospital during the period from January 2023 to December 2024. After the initial application of inclusion and exclusion criteria, 670 patients were considered eligible. Following a more detailed manual review in accordance with the exclusion criteria, 208 patients were included in the final analysis.

TABLE 1: Demographic Characteristics of the Study Participants.

Variable	n (%) / Mean ± SD
Gender	
Male	42 (20.2)
Female	166 (79.8)
Age group	
Young Adults	99 (47.6)
Middle-aged Adults	96 (46.2)
Older Adults	13 (6.3)
Age (years)	***41.98 ± 12.95***

Age; Young Adults: 18-40 years; Middle-aged Adults: 41-60 years; Older Adults: >61

The demographic distribution of the thyroid dysfunction patients can be found in Table 1. There were more female patients than male, with female patients consisting of 79.8% of the total participants. The most common age group was young adults (18-40 years old). The mean age of the patients was 41.98 with a standard deviation of 12.95. The youngest patient was 18 years old, while the oldest was 79 years old.

TABLE 2: Thyroid Hormone Levels and Distribution of Thyroid Function Groups in Study Participants.

Variable	n(%)/Mean ± SD
Thyroid Level	
Hyperthyroid	
FT4 (ng/dL)	2.66 ± 1.87
TSH (µIU/mL)	0.03 ± 0.07
Hypothyroid	
FT4 (ng/dL)	0.98 ± 0.32
TSH (µIU/mL)	6.70 ± 3.00
Thyroid Function group	
Subclinical Hyperthyroid	55 (26.4)
Overt Hyperthyroid	89 (42.8)
Subclinical Hypothyroid	47 (22.6)
Overt Hypothyroid	17 (8.2)

Table 2 shows the thyroid hormone levels and thyroid function group of the participants. The hyperthyroid group consisted of 144 patients (69.2%), with a mean FT4 of 2.66 ± 1.87 ng/dL, and suppressed TSH with a mean of 0.03 ± 0.07 µIU/mL. This group consists mostly of Overt Hyperthyroidism (n=89,42.8%) and Subclinical Hyperthyroidism (n=55, 26.4%). Conversely, the hypothyroid group consisted of 64 patients (30.8%), with a mean FT4 of 0.98 ± 0.32 ng/dL, and an elevated TSH with a mean of 6.70 ± 3.00 µIU/mL. The group consists mostly of Subclinical Hypothyroidism (n=47,22.6%) and Overt Hypothyroidism (n=17,8.2%).

TABLE 3: Blood Pressure Profile of the Study Participant.

Variable	n(%)/Mean ± SD
Blood Pressure (mmHg)	
Hyperthyroid	
Systolic (SBP)	128.59 ± 6.80
Diastolic (DBP)	81.13 ± 5.53
Hypothyroid	
Systolic (SBP)	128.86 ± 11.00
Diastolic (DBP)	80.13 ± 8.23
Blood Pressure Category	
Normal	78 (37.5)
Risk	111 (53.4)
Hypertension	19 (9.1)
Overt Hypothyroid	17 (8.2)

Blood Pressure; Normal BP: SBP <120 mmHg and DBP <70 mmHg; Elevated BP: SBP 120–134 mmHg and DBP 70–84 mmHg; Hypertension: SBP ≥135 mmHg and DBP ≥85 mmHg [4].

Table 3 shows the blood pressure profile of the participant. The mean Systolic Blood Pressure (SBP) was nearly identical across both thyroid states: 128.59 ± 6.80 mmHg in the hyperthyroid group and 128.86 ± 11.00 mmHg in the hypothyroid group. Similarly, the mean Diastolic Blood Pressure (DBP) was comparable, measuring 81.13 ± 5.53 mmHg for hyperthyroid and 80.13 ± 8.23 mmHg for hypothyroid groups. When categorized, the majority of the total sample (n=111,53.4%) fell into the Risk category for blood pressure, while some patients were categorized as Normal blood pressure (n=78,37.5%), and only a small proportion were classified as having Hypertension (n=19,9.1%).

TABLE 4: Body Mass Index Profile of the Study Participant.

Variable	n(%)/Mean ± SD
BMI (kg/m^2)	**25.23 ± 3.81**
Hyperthyroid	
BMI (kg/m^2)	23.65 ± 2.95
Hypothyroid	
BMI (kg/m^2)	28.79 ± 3.04
BMI Group (Asia classification, WHO 2004)	
Underweight (<18.5)	2 (1.0)
Normal (18.5–22.9)	64 (30.8)
Overweight (23–24.9)	60 (28.8)
Obese I (25–29.9)	53 (25.5)
Obese II (≥30)	29 (13.9)

BMI: Body Mass Index; Underweight: < 18.5 kg/m^2; Normal: 18.5 –22.9 kg/m^2; Overweight: 23–24.9 kg/m^2; Obese 1: 25–29.9 kg/m^2, Obese II: ≥30 kg/m^2.

Table 4 shows the body mass index (BMI) profile of the participant, calculated using the WHO 2004 Asia BMI classification. The Total mean BMI of the participants was 25.23 ± 3.81 kg/m^2, consisting of hyperthyroid patient's BMI (23.65 ± 2.95 kg/m^2) and hypothyroid patient's BMI (28.79 ± 3.04kg/m^2). When categorized as a group, most of the patients fall into the Normal Group (n=64, 30.8%) and Overweight Group (n=60, 28.8%). The rest was distributed across Obese I (n=53, 25.5%), Obese II (n=29, 13.9%), and Underweight (n=2, 1.0%).

TABLE 5: Comparison of Mean Systolic and Diastolic Blood Pressure Between Hyperthyroid and Hypothyroid Patients.

	Systolic BP (mmHg)	Diastolic BP (mmHg)
Hyperthyroid (mean ± SD)	128.59 ± 6.80	81.14 ± 5.53
Hypothyroid (mean ± SD)	128.86±11.01	80.14 ± 8.23
P-value	0.830	0.306

Table 5 shows the comparison of mean systolic and diastolic blood pressure between hyperthyroid and hypothyroid patients. The mean systolic blood pressure in the hyperthyroid group was 128.59 ± 6.80 mmHg, while the hypothyroid group had a mean of 128.86 ± 11.01 mmHg, showing no significant difference in the systolic blood pressure (p = 0.830). Similarly, the mean diastolic blood pressure was 81.14 ± 5.53 mmHg in hyperthyroid patients and 80.14 ± 8.23 mmHg in hypothyroid patients, which also shows no significant difference (p = 0.306).

TABLE 6: Distribution of Blood Pressure Categories by Thyroid Status.

BP Category	Hyperthyroid (n = 144)	Hypothyroid (n = 26)	*P* value
Normal	47 (32.6%)	31 (65.4%)	<0.001
Risk	89 (61.8%)	22 (30.8%)	
Hypertension	8 (5.6%)	11 (3.8%)	
Total	144	64	

Table 6 shows the distribution of blood pressure categories according to thyroid status. Among hyperthyroid patients, most fell into the "Risk" category (n = 89, 61.8%), followed by the Normal category (n = 47, 32.6%) and Hypertension (n = 8, 5.6%). In contrast, hypothyroid patients were predominantly in the Normal category (n = 31, 65.4%), with fewer classified as At Risk (n = 22, 30.8%) and Hypertension (n = 11, 3.8%). A significant association was observed between thyroid status and blood pressure category (p < 0.001).

TABLE 7: Correlation Analysis of Thyroid Hormone Levels and Blood Pressure Readings.

Variable Pair	Correlation Coefficient	*P*-value	Interpretation
TSH vs SBP	0.049	0.482	No significant correlation
TSH vs DBP	0.021	0.769	No significant correlation
FT4 vs SBP	0.100	0.150	No significant correlation
FT4 vs DBP	0.268	<0.001	Weak, significant correlation
TSH vs FT4	–0.418	<0.001	Strong, significant correlation

Table 7 summarizes the correlation analysis between thyroid hormone levels (TSH and FT4) and blood pressure measurements (systolic and diastolic) in this study. TSH showed no significant correlation with either systolic ($r = 0.049$, $p = 0.482$) or diastolic blood pressure ($r = 0.021$, $p = 0.769$). FT4 also showed no significant correlation with systolic pressure ($r = 0.100$, $p = 0.150$), but demonstrated a weak yet significant positive correlation with diastolic pressure ($r = 0.268$, $p < 0.001$). Lastly, TSH and FT4 showed a strong and significant inverse correlation ($r = –0.418$, $p < 0.001$), consistent with the physiological feedback mechanisms

DISCUSSION

The demographic distribution in this study was predominantly female, accounting for 79.8% of participants, with a female-to-male ratio of 3.9:1. These findings are consistent with a study conducted in Bangladesh, which also reported a predominance of female patients at 69.7% and a female-to-male ratio of 2.3:1 [6].

The higher prevalence of thyroid dysfunction in women compared to men is thought to result from a multifactorial interplay of hormonal, autoimmune, environmental, and genetic influences. Estrogen enhances immune responsiveness, leading to a more reactive immune system in women. This increased immune activity increases the likelihood of autoimmune processes targeting the thyroid tissue, thus contributing to the greater susceptibility of women to thyroid disorders [7].

Additionally, conditions that are unique to women, such as pregnancy and the postpartum phase, are linked with hormonal changes that can trigger thyroid dysfunction, especially in postpartum if the immune homeostasis is not achieved properly. Hormonal fluctuations during menopause have also been suggested to increase the susceptibility towards thyroid disorders among women [8,9].

The age range of patients involved in this study was between 18 and 79 years of age. The age distribution showed that most participants were young adults (18–40 years of age), with a total of 99 people (47.6%). The average age of patients when they were first diagnosed was 41.98 years, indicating that the majority of cases were identified in middle-aged adults. These results are consistent with a recent study conducted at Karachi in 2024, which suggests that the most cases were identified in the age group between 30 and 50 years of age, accounting for 47.3% of the total subjects, with a mean patient age of 37.9 years [10].

In terms of thyroid function categories, overt hyperthyroidism was the most frequently observed condition, accounting for 42.8% of all cases, followed by subclinical hyperthyroidism at 26.4%. Subclinical hypothyroidism represented 22.6%, while overt hypothyroidism was the least common at 8.2%. Laboratory findings showed that patients with hyperthyroidism exhibited increased free T4 levels (2.66 ± 1.87 ng/dL) and a suppressed TSH (0.03 ± 0.07 µIU/mL), consistent with increased thyroid hormone production. Conversely, hypothyroid patients exhibited decreased free T4 levels (0.98 ± 0.32 ng/dL), accompanied by an elevated TSH (6.70 ± 3.00 µIU/mL), reflecting impaired thyroid hormone production. Subclinical forms of both conditions showed TSH abnormalities with free T4 values that remained within normal limits.

These results are supported by recent studies published in 2023, which reported that the prevalence estimates of overt hyperthyroidism range from 0.2-1.4% of the people worldwide, and Subclinical hyperthyroidism accounts for 0.7-1.4% of people worldwide. Furthermore, a previous study by Wiersinga reported that subclinical hypothyroidism occurs in approximately 6% of the general population. While overt hypothyroidism approximately 1%. Together, these data reinforce the distribution observed in this study and support the predominance of hyperthyroid categories within the patient population [11,12].

The evaluation of body mass index (BMI) in this study showed that the overall mean BMI of participants was 25.23 ± 3.81 kg/m^2, placing the study population within the overweight category based on the WHO Asia classification. When categorized by thyroid status, patients with hyperthyroidism had a lower mean BMI (23.65 ± 2.95 kg/m^2), consistent with the hypermetabolic state typically associated with excessive thyroid hormone levels. In contrast, patients with hypothyroidism showed a higher mean BMI (28.79 ± 3.04 kg/m^2), reflecting the reduced metabolic rate and tendency toward weight gain commonly seen in thyroid hormone deficiency. When classified by BMI categories, most patients fell into the normal (30.8%) and overweight (28.8%) groups, while a substantial proportion were classified as obese (Obese I: 25.5%; Obese II: 13.9%).

A similar pattern is observed in a recent study in Tehran, where hypothyroid patients generally exhibit higher BMI values, frequently falling into the overweight or obese categories, while those with hyperthyroidism tend to have lower BMI due to increased metabolic rate. However, BMI in hyperthyroid subjects can vary depending on patient diet and nutritional status, as reported in multiple clinical and epidemiologic investigations [13].

In comparing blood pressure between hyperthyroid and hypothyroid patients, the mean systolic and diastolic values showed no statistically significant differences between the two groups. Hyperthyroid patients demonstrated a mean systolic blood pressure of 128.59 ± 6.80 mmHg, which was nearly identical to that of hypothyroid patients (128.86 ± 11.01 mmHg; $p = 0.830$). Similarly, the diastolic blood pressure of hyperthyroid patients (81.14 ± 5.53 mmHg) was comparable to that of hypothyroid patients (80.14 ± 8.23 mmHg; $p = 0.306$). Despite these similar mean values, the distribution of blood pressure categories showed a different pattern. A higher proportion of hyperthyroid patients fell into the hypertension category (60.4%) compared to hypothyroid patients (51.6%), while elevated-risk blood pressure was more common in the hypothyroid group (42.2% vs. 31.9%). Normal blood pressure was observed in only a small fraction of both groups. These findings suggest that although the average systolic and diastolic values appear similar, differences in the distribution of blood pressure categories indicate a higher tendency for hyperthyroid patients to present with hypertension, whereas hypothyroid patients more frequently fall into the elevated-risk range.

This finding is consistent with a recent study by Soetedjo et al. (2024), which reported that both hyperthyroidism and hypothyroidism are associated with increased blood pressure, although through different physiological pathways. Hyperthyroidism typically increases systolic pressure due to enhanced cardiac output and reduced systemic vascular resistance, whereas hypothyroidism tends to elevate diastolic pressure through increased vascular resistance and reduced cardiac output. Despite these differing mechanisms, several studies have shown that the overall blood pressure values observed in clinical settings may appear similar between the two groups [14]. Nonetheless, this similarity is likely influenced by additional factors such as age, body mass index, dietary habits, and lifestyle, which can modify the direct effects of thyroid hormone changes on systemic blood pressure, thus resulting in no significant difference between hyperthyroid and hypothyroid patients.

Correlation analysis between thyroid parameters and blood pressure further supported these findings. TSH showed no significant correlation with either systolic pressure ($r = 0.049$; $p = 0.482$) or diastolic pressure ($r = 0.021$; $p = 0.769$), indicating that TSH levels alone did not influence blood pressure variations in this population. Similarly, free T4 showed no meaningful correlation with systolic pressure ($r = 0.100$; $p = 0.150$). However, a weak but statistically significant correlation was observed between free T4 and diastolic pressure ($r = 0.268$; $p < 0.001$), suggesting that higher thyroid hormone levels may contribute slightly to diastolic elevation, although the effect is modest. As expected, TSH and free T4 demonstrated a strong negative correlation ($r = -0.418$; $p < 0.001$), reflecting the typical physiological feedback pattern. Recent studies by Amouzegar et al. (2015) reported that TSH levels within the reference range were not associated with systolic or diastolic blood pressure, while free T4 showed a positive association with blood pressure parameters. However, the findings regarding free T4 differ slightly from the results reported by Amouzegar et al. (2015), who observed a positive association between FT4 and both systolic and diastolic blood pressure in a large euthyroid population. In contrast, the present study identified a significant relationship only with diastolic pressure, and the strength of this correlation remained weak. This discrepancy may be attributed to several factors, including differences in population characteristics and disease status [15].

CONCLUSION

This study shows that thyroid dysfunction in this population predominantly affects women and young to middle-aged adults, with overt hyperthyroidism being the most common presentation. BMI patterns reflected expected metabolic effects, with lower values in hyperthyroidism and higher values in hypothyroidism. A higher proportion of hyperthyroid patients presented with hypertension, while hypothyroid patients more frequently showed elevated-risk blood pressure. However, correlations between thyroid hormone levels and blood pressure were weak. This pattern may also be influenced by factors such as sample BMI distribution, lifestyle, or the cross-sectional design of the study. These findings indicate that blood pressure alterations in thyroid dysfunction are likely multifactorial.

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CONFLICT OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relation that could be construed as a potential conflict of interest.

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