Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 14, Issue 7s (2025)
https://www.jneonatalsurg.com

OPEN ACCESS

Distribution and Determinants of Metabolic Syndrome in Non-Obese Hypothyroid Patients

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Cite this paper as: Dr. Preethi CD, Dr. Prof. Dr. N Anuradha, Dr. Viknesh Prabhu, Dr. Anis Preethi, Dr. Ashwathy, (2025) Distribution and Determinants of Metabolic Syndrome in Non-Obese Hypothyroid Patients. *Journal of Neonatal Surgery*, 14 (7s), 720-725.

ABSTRACT

A number of metabolic and cardiovascular parameters may be profoundly impacted by hypothyroidism, a prevalent endocrine condition. The aim of this study was to determine the prevalence and risk factors of metabolic syndrome in hypothyroidism patients who are not overweight. This research lasted two years in a private medical college, Tamil Nadu between 2022 and 2024. Among 138 hypothyroidism patients the most significant group consisted of individuals from age 41 to 50 (28%). Females constituted majority (57%) of the study population. Hypertension was present in 32% of the patients, while diabetes mellitus was found in 29%. Elevated waist circumference was observed in 38% of the patients. High blood pressure was recorded in 22% of the patients. Regarding HbA1c levels, 55% had levels > 6.5%, indicating poor glycaemic control. While 38% of patients had total cholesterol levels over 200 mg/dL, 55% had triglyceride levels above 150 mg/dL. It was shown that 51% of the patients had low HDL levels (< 40 mg/dL) and 85% had high LDL levels (> 100 mg/dL), respectively. Patients with hypothyroidism are more likely to have metabolic and cardiovascular risk factors, according to this research. The need of doing thorough assessments and managing cardiovascular risk factors in this group is highlighted by these results. Regular monitoring and early intervention can help mitigate long-term risks associated with hypothyroidism.

Keywords: *Hypothyroidism, Metabolic syndrome, Dyslipidaemia, Cardiovascular risk*

1. INTRODUCTION

Central obesity, insulin resistance, hypertension, and dyslipidemia that promotes atherosclerosis are among the metabolic abnormalities that comprise the metabolic dysfunction cluster, which is known as the metabolic syndrome. This condition raises the five times the probability of atherosclerotic cardiovascular diseases such as heart attacks, strokes, peripheral vascular disorders, insulin resistance, and type II diabetes (1,2). Three or more metabolic abnormalities are required for the diagnosis of metabolic syndrome, which includes a male and female waist circumference ≥ 40 and 35 inches, respectively or A blood triglyceride level of 150 mg/dL or above Or low levels of HDL-C were characterized as < 40 mg/dL in men and <50 mg/dL in women or fasting glucose level was 100 mg/dL or above or diastolic blood pressure readings of 85 mm Hg or higher or systolic readings of 130 mm Hg or higher (3).

Hypothyroidism, which is a global health concern with a varying prevalence across different countries. Thyroid hormones influence metabolic syndrome-related variables including HDL-C, triglycerides, blood pressure, and plasma glucose levels; they also regulate glucose, lipid, and energy metabolism. Several scientific reports confirm that hypothyroidism manifesting in conscious states makes traditional cardiovascular risk variables worse (4–6). Scientific studies show that thyroid function maintains intricate ties with metabolic regulation through hypothyroidism because it may affect both lipid control and blood glucose management as well as weight distribution patterns. This distribution patterns together with the risk factors of metabolic syndrome in hypothyroid non-obese patients require comprehensive investigation for effective treatment planning and population risk identification (7).

The objective of this research was to determine the prevalence and risk factors of metabolic syndrome in hypothyroidism patients among non-obese patients. This research examined metabolic syndrome occurrence patterns together with clinical features and biological reasons that affect non-obese hypothyroid patients. This research provides knowledge to healthcare professionals regarding early identification along with prevention and treatment methods of metabolic complications facing non-obese patients with hypothyroidism.

2. METHODS AND MATERIALS:

Between 2022 and 2024, 138 non-obese hypothyroid patients who visited the general medicine outpatient department were included in this hospital-based cross-sectional study. The inclusion criteria were as follows: Clinically diagnosed and laboratory-confirmed hypothyroidism; Non-obese patients with a Body Mass Index (BMI) of less than 24.9; Thyroid-stimulating hormone (TSH) levels greater than 4.50 mIU/L; The free T4 levels were less than 1.8 ng/dL; Free T3 levels of less than 1.4 ng/dL. Patients whore were fulfilled the inclusion criteria, a detailed Medical histories about diabetes, hypertension, triglycerides, past test results were collected. Waist circumference? After a thorough explanation of the study, written informed consent was acquired. The questionnaires were filled by the researcher by interview method. Ethics approval was obtained from the institutional ethics committee.

3. STAT ANALYSIS

RESULTS:

The distribution of patients in this research by age group showed that the largest percentage of patients fell within the 41-50 age ranges, accounting for 28% (39 patients) and those aged 51-60 years made up the smallest group at 23% (32 patients). In this study, the proportion of females was higher, with 79 patients (57%) compared to 59 males (43%).

Based on their prior medical history, 44 patients (32%) were diagnosed with hypertension, although 94 patients (68%) did not have hypertension, and 98 patients (71%) did not have diabetes, but 40 patients (29%) had.

According to measurements of waist circumference, 53 patients (38%) had a high waist circumference, whereas 85 patients (62%) had a normal one. When the blood pressure of the non-obese patients was taken, it was found that 31 patients (22%) had high blood pressure and 107 patients (78%) had normal blood pressure. 17 patients (12%) had HbA1c levels below 5.7%, 45 patients (33%) had levels between 5.7 and 6.4%, and the majority of patients (76 patients, 55%) had levels above 6.5%, according to the patients' HbA1c values.

Among study participants, 86 patients (62%) had total cholesterol levels below 200 mg/dL, whereas 52 patients (38%) had levels above 200 mg/dL. Additionally, 62 patients (45%) had normal triglyceride levels, while 76 patients (55%), had elevated triglyceride levels.

Of the individuals with high-density lipoprotein levels, 70 (51%) had HDL levels below 40 mg/dL, 60 (43%) had HDL values between 41 and 60 mg/dL, and eight (6%) had levels over 60 mg/dL. According to very low-density lipoprotein levels, 27 patients (20%) had values above 30 mg/dL, while 111 patients (80%) had levels below that threshold. Twenty-one patients (15%) had low-density lipoprotein values below 100 mg/dL, while the vast majority of patients (117 patients, 85%) had levels over 100 mg/dL.

TABLE 1: DISTRIBUTION OF DEMOGRAPHIC AND RISK FACTORS DETAILS:

CHARACTERS	**N**	**PERCENTAGE**
AGE (YRS)		
<30	34	25%
31-40	33	24%
41-50	39	28%
51-60	32	23%
GENDER		
FEMALE	79	57%
MALE	59	43%
H/O HYPERTENSION		
No	94	68%
Yes	44	32%

H/O DIABETES		
No	98	71%
Yes	40	29%
WC MEASUREMENT		
Normal	85	62%
High	53	38%
BLOOD PRESSURE MEASUREMENT		
Normal	107	78%
High	31	22%
HbA1C LEVEL		
<5.7	17	12%
5.7-6.4	45	33%
>6.5	76	55%
TOTAL CHOLESTEROL LEVEL (mg/dl)		
<200	86	62%
>200	52	38%
TG LEVEL (mg/dl)		
<150	62	45%
>150	76	55%
HDL LEVEL (mg/dl)		
<40	70	51%
41-60	60	43%
>60	8	6%
VLDL LEVEL (mg/dl)		
<30	111	80%
>30	27	20%
LDL LEVEL (mg/dl)		
<100	21	15%
>100	117	85%

4. DISCUSSION

A person's thyroid hormones play an essential role in controlling their hunger, metabolic rate, cholesterol and glucose levels, and the production of fat cells (7). Hypothyroidism results from the insufficient production of thyroid hormones, leading to

a decrease in metabolic rate, fatigue, weight gain, cold intolerance, and other symptoms associated with decreased cellular metabolism. The goal of treating this condition is to normalize metabolic function (8).

The rapid increase of sedentary activities combined with excessive calorie consumption resulted in higher metabolic syndrome rates that appeared throughout the last few decades. The development of metabolic syndrome strongly depends on genetic factors while environmental elements also contribute significantly. The implementation of intervention measures provides promise to stop and revert the advancement of metabolic syndrome (1–3,9)

The higher prevalence of hypothyroidism in our study was between in the 41-50 age group affecting middle-aged individuals and this could be related to the natural progression of thyroid dysfunction, which tends to increase with age. The gender distribution revealed a higher proportion of females (57%) than males (43%). This aligns with the existing literature, indicating that hypothyroidism is more common in women, likely due to autoimmune factors that are more prevalent in females. Similar demographic results were observed in Mehran et al. (10) research where the MetS group exhibited a significantly higher mean age (48.8 ± 12.9 years) than the non-MetS group (36.3 ± 13.1 years, $p < 0.001$) and majority of them were females.

Regarding hypertension in this current research, 32% were hypertensive. The association between hypothyroidism and hypertension is well-documented, as thyroid hormone imbalances can lead to alterations in cardiovascular function and blood pressure regulation (11,12).

Blood pressure readings in our study showed that 22% of the patients had high blood pressure, whereas 78% had normal blood pressure. This finding underscores the cardiovascular risk associated with hypothyroidism, as thyroid hormone deficiency can affect vascular resistance and heart function. The changes in BP were significantly associated with those reported by Cornier et al., (13). Thyroid hormones (THs) have significant inotropic and chronotropic effects on the heart, causing vasodilation in the systemic circulation and reducing systemic vascular resistance (14,15).

The prevalence of diabetes mellitus showed that 29% of the patients had diabetes. Regular monitoring and control of blood glucose levels in individuals with hypothyroidism is necessary since diabetes is present in about one-third of the patients (11). Hypermature atherosclerosis and premature cardiovascular disease along with early type II diabetes mellitus develop because of the metabolic syndrome (16).

Similarly in Langen et al research, most individuals with subclinical hypothyroidism had hypertension but no correlation has been reported with DM in such patients. Park SB also reported similar findings where HTN and DM were present in patients with MetS (17).

As in current research, HbA1c levels revealed that 55% of the patients had levels greater than 6.5%, indicating poor glycaemic control, 33% had levels between 5.7 and 6.4%, and 12% had levels less than 5.7%. The high percentage of patients with elevated HbA1c levels highlights a link between hypothyroidism and impaired glucose metabolism. Greater frequency of changed HbA1c levels noted in individuals with hypothyroidism compared to those without the condition, but did not find a significant association between HbA1c levels and hypothyroidism in Sherwani research (18). Ogbonna et al., who reported a higher incidence of elevated HbA1c levels (19).

People suffering from hypothyroidism experience problems with their insulin sensitivity along with their glucose metabolic functions. The reduction of thyroid hormone levels causes peripheral tissues to absorb less glucose along with impaired insulin production from pancreatic β-cells. The condition causes blood glucose levels to rise and triggers compensatory hyperinsulinaemia which stands as the basic elements of insulin obstruction that is a critical component of metabolic condition (20).

Sixty-two percent of the patients had a normal waist circumference, whereas 38% had a high waist circumference. It is important to effectively control weight in this group since a large waist circumference, which is a sign of central obesity, increases the risk of metabolic syndrome. Scientific studies found that the little increase in serum TSH is more of a side effect than a main cause of obesity, as a 1 mIU/L rise in TSH was linked to a 0.6 kg increase in BW for women and a 0.7 kg gain for males (21).

Obesity tends to manifest as a wide-spread medical condition in metabolic syndrome yet it appears in people with hypothyroidism primarily due to diminished thyroid hormone action on metabolism and metabolic efficiency. The deficit of thyroid hormones modifies both lipid tissue locations and overall functionality to promote the development of deep internal abdominal fat deposits. Excess visceral fat creates powerful associations with insulin resistance alongside systemic inflammation which advances the metabolic issues prevalent in hypothyroidism and metabolic syndrome. The increased size of adipose tissue triggers the release of pro-inflammatory cytokines including tumour necrosis factor, leptin, adiponectin, plasminogen activator inhibitor, and resistin that damage insulin function causing metabolic problems (22).

Of the patients surveyed in our research, 38% had total cholesterol levels higher than 200 mg/dL. 55 percent had triglyceride levels higher than 150 mg/dL. The results showed that over half of the patients had low levels of high-density lipoprotein (HDL) as just 6% of people had HDL values over 60 mg/dL and more than half of the people had abnormal LDL values. An

increased risk of cardiovascular illnesses is linked to dyslipidaemia, namely high total cholesterol levels, which may be seen in hypothyroidism. Hypothyroidism is characterized by an enhanced total dyslipidaemia profile (23).

Similar to our findings, in Haghi et al., who studied the link between lipid levels and subclinical hypothyroidism (SCH), SCH patients, regardless of age or gender, had significantly higher levels of low-density lipoprotein (LDL) and lower levels of high-density lipoprotein (HDL) compared to normal patients ($p < 0.001$). No statistically significant variations were seen in the levels of total cholesterol (TC), very low-density lipoprotein (VLDL), or triglycerides (TG) ($p > 0.05$) (24).

The cardiovascular risks linked with metabolic syndrome (MetS) were examined in a systematic evaluation of 87 trials showed that MetS is strongly associated with an increased risk of CVD, CVD mortality, all-cause mortality, myocardial infarction, stroke, and other cardiovascular diseases. The relative risks for these outcomes were 2.35 (95% CI: 2.02 to 2.73) and 2.40 (95% CI: 1.87 to 3.08), 1.58 (95% CI: 1.39 to 1.78), 1.99 (95% CI: 1.61 to 2.46), and 2.27 (95% CI: 1.80 to 2.85), respectively. Based on these results, it seems that MetS increases the risk of cardiovascular disease even in those who do not have diabetes. The overall risk of death from any cause was 1.5 times higher in those with metabolic syndrome, and the risk of death from cardiovascular disease was 2 times higher (23).

The metabolic processes of lipids depend heavily on thyroid hormones because these hormones control synthesis and movement and catabolic activities of lipids. Among hypothyroidism patients, dyslipidemia develops as a common condition which elevates total cholesterol together with LDL-C and triglycerides yet decreases HDL-C. The atherogenic characteristics of metabolic syndromes develop because of defective lipid metabolism (16).

5. CONCLUSION

This study found that people with hypothyroidism are more likely to have metabolic and cardiovascular risk factors. Thyroid dysfunction and metabolic syndrome are closely related, as seen by the high proportion of patients with higher LDL cholesterol, triglycerides, and HbA1c values. This study imply that a comprehensive approach to patient management is essential for patients with hypothyroidism. In order to enhance their overall health outcomes, early intervention techniques such as lifestyle changes and proper medication may be able to reduce the long-term hazards associated with metabolic abnormalities.

REFERENCES

[1] Saklayen MG. The Global Epidemic of the Metabolic Syndrome. Curr Hypertens Rep. 2018;20(2):12.

[2] Alberti KG, Eckel RH, Grundy SM, Zimmet PZ, Cleeman JI, Donato KA, Fruchart JC, James WP, Loria CM, Smith SC., International Diabetes Federation Task Force on Epidemiology and Prevention. National Heart, Lung, and Blood Institute. American Heart Association (AHA). World Heart Federation. International Atherosclerosis Society. International Association for the Study of Obesity. Harmonising the metabolic syndrome: A joint interim statement of the International Diabetes Federation Task Force on Epidemiology and Prevention; National Heart, Lung, and Blood Institute; American Heart Association; World Heart Federation; International Atherosclerosis Society; and International Association for the Study of Obesity. Circulation. 2009 Oct 20;120(16):1640-5.

[3] Samson SL, Garber AJ. Metabolic syndrome. Endocrinol Metab Clin North Am. 2014 Mar;43(1):1-23.

[4] Strachan MWJ and Walker BR. Endocrine diseases in NA Boon, NR Colledge and BR Walker(eds), Davidson's Principle and practice of Medicine, 20th ed, Churchill Livingstone, New York, 2006: 739-804.

[5] Grundy SM, Brewer B, Cleeman JI, Smith SC, Lenfant C. 'Definition of Metabolic syndrome', Proceedings of the National Heart, Lung and Blood Institute/American Heart Association Conference on Scientific Issues related to Definition. Circulation 2004; 109: 433-38.

[6] Dhanraj E, Bhansali A, Jaggi S, Dutta P, Jain S, Tiwari P. Prevalence and predictors of metabolic syndrome in non-obese Asian Indians with newly detected type 2 diabetes mellitus. J Ind Med Assoc 2008; 106: 366-72.

[7] Deshmukh V, Farishta F, Bhole M. Thyroid Dysfunction in Patients with Metabolic Syndrome: A Cross-Sectional, Epidemiological, Pan-India Study. International Journal of Endocrinology. 2018;2018(1):2930251.

[8] Mullur R, Liu YY, Brent GA. Thyroid hormone regulation of metabolism. Physiol Rev. 2014 Apr;94(2):355-82. doi: 10.1152/physrev.00030.2013. PMID: 24692351; PMCID: PMC4044302.

[9] Pucci G, Alcidi R, Tap L, Battista F, Mattace-Raso F, Schillaci G. Sex- and gender-related prevalence, cardiovascular risk and therapeutic approach in metabolic syndrome: A review of the literature. Pharmacological Research. 2017 Jun 1;120:34–42.

[10] Mehran L, Amouzegar A, Rahimabad PK, Tohidi M, Tahmasebinejad Z, Azizi F. Thyroid Function and

Metabolic Syndrome: A Population-Based Thyroid Study. Horm Metab Res. 2017 Mar;49(3):192-200.

[11] Hage M, Zantout MS, Azar ST. Thyroid Disorders and Diabetes Mellitus. J Thyroid Res. 2011 Jul 12;2011:439463.

[12] Brenta G, Danzi S, Klein I. Potential therapeutic applications of thyroid hormone analogs. Nat Clin Pract Endocrinol Metab. 2007 Sep;3(9):632–40.

[13] Cornier MA, Dabelea D, Hernandez TL, Lindstrom RC, Steig AJ, Stob NR, et al. The Metabolic Syndrome. Endocr Rev. 2008 Dec;29(7):777–822.

[14] Pazos-Moura CC, Moura EG, Breitenbach MM, et al. Nailfold capillaroscopy in hypothyroidism and hyperthyroidism: blood flow velocity during rest and postocclusive reactive hyperemia. Angiology 1998; 49: 471–476.

[15] Lekakis J, Papamichael C, Alevizaki M, et al. Flow-mediated, endothelium-dependent vasodilation is impaired in subjects with hypothyroidism, borderline hypothyroidism, and high-normal serum thyrotropin (TSH) values. Thyroid 1997; 7: 411–414

[16] Saltiel AR, Olefsky JM. Inflammatory mechanisms linking obesity and metabolic disease. J Clin Invest. 2017 Jan 03;127(1):1-4.

[17] Langén VL, Niiranen TJ, Puukka P, et al. Association of thyroid-stimulating hormone with lipid concentrations: an 11-year longitudinal study. Clin Endocrinol (Oxf) 2017; 86: 120–127.

[18] Sherwani SI, Khan HA, Ekhzaimy A, Masood A, Sakharkar MK. Significance of HbA1c Test in Diagnosis and Prognosis of Diabetic Patients. Biomark Insights. 2016 Jul 3;11:95–104.

[19] Ogbonna S, Ezeani I, Okafor C, Chinenye S. Association between glycemic status and thyroid dysfunction in patients with type 2 diabetes mellitus. Diabetes Metab Syndr Obes. 2019 Jul 12;12:1113–22.

[20] Biondi B., Kahaly G.J., Robertson R.P. Thyroid Dysfunction and Diabetes Mellitus: Two Closely Associated Disorders. Endocr. Rev. 2019;40:789–824.

[21] Bjergved L, Jørgensen T, Perrild H, Laurberg P, Krejbjerg A, Ovesen L, et al. Thyroid Function and Body Weight: A Community-Based Longitudinal Study. PLoS One. 2014 Apr 11;9(4):e93515.

[22] Song R hua, Wang B, Yao Q ming, Li Q, Jia X, Zhang J an. The Impact of Obesity on Thyroid Autoimmunity and Dysfunction: A Systematic Review and Meta-Analysis. Front Immunol. 2019 Oct 1;10:2349.

[23] Mottillo, S.; Filion, K.B.; Genest, J.; Joseph, L.; Pilote, L.; Poirier, P.; Rinfret, S.; Schiffrin, E.L.; Eisenberg, M.J. The metabolic syndrome and cardiovascular risk a systematic review and meta-analysis. J. Am. Coll. Cardiol. 2010, 56, 1113–1132.

[24] Rastgooye Haghi A, Solhjoo M, Tavakoli MH. Correlation Between Subclinical Hypothyroidism and Dyslipidemia. Iran J Pathol. 2017;12(2):106–11.