Prevalence of Hyperlipidaemia in Adult Patients with Hypothyroidism: A Systematic Review

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ABSTRACT

Hypothyroidism was reported to raise risk factors for cardiovascular diseases, such as metabolic syndrome, diabetes mellitus, hypertension, and dyslipidemia. The aim of this review is to summarize prior studies that assessed the prevalence of hyperlipidemia in adult patients with hypothyroidism or the prevalence of hypothyroidism in adult patients with hyperlipidemia. An extensive literature search was conducted to identify observational studies with prevalence data on hyperlipidaemia among adult hypothyroid patients. The following databases were searched: PubMed and Scopus until December 11, 2024. The review was based on the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. The total number of studies identified in this review was 13, which were published between 1995 and 2024. The prevalence of hyperlipidemia among adult hypothyroidism patients ranged from 10% to 77%, while the prevalence of hypothyroidism among adult hyperlipidemia patients ranged from 3% to 90.8%. All included studies reported the outcome measure. Identifying confounders criterium was met by two studies (15.4%). The statistical adjustment criterium was met by two studies (15.4%). Funding source was disclosed by seven studies (53.8%). Hyperlipidemia and hypothyroid are prevalent comorbid diseases. Lifestyle modifications are needed as preventive measures to decrease the burden of these two conditions. Educational campaigns to the general public are required to enhance their awareness about modifiable risk factors of these conditions.

Keywords: Adult; Dyslipidemia; Hyperlipidaemia; Hypothyroidism; Thyroid

INTRODUCTION

Thyroid dysfunction is a medical condition involving abnormal thyroid hormone production; hyperthyroidism results from the overproduction of thyroid hormones, and results from a deficiency of thyroid hormone production [1,2]. However, hypothyroidism is more common than hyperthyroidism [3] and includes subclinical hypothyroidism (SCH) and clinical (overt) hypothyroidism as two significant subtypes [4]. Normal thyroxin (T4) levels with raised thyrotropin (TSH) levels describe SCH, while low T4 levels with elevated TSH levels define clinical hypothyroidism [5,6]. Worldwide prevalence for SCH and clinical hypothyroidism among the adult population were 4% to 20% [7,8], and 0.5% to 5% [9], respectively.

Several previous studies have indicated an association between thyroid dysfunction and morbidity [10]. Both SCH and clinical hypothyroidism were reported to raise risk factors for cardiovascular diseases, such as metabolic syndrome, diabetes mellitus, hypertension, and dyslipidemia [11,12]. Dyslipidemia is a chronic metabolic condition defined by declined high-density lipoprotein cholesterol (HDL-C) or elevated triglyceride (TG), low-density lipoprotein cholesterol (LDL-C), and total cholesterol (TC) [13]. The first documented relationship between dyslipidemia and thyroid dysfunction was in 1930. Over time, it was acknowledged that lipid metabolism disturbances can result from hypothyroidism [14]. The thyroid hormone impacts lipid metabolism among patients with thyroid disorders, resulting in diverse alterations in cholesterol, phospholipids, TG, and other lipoproteins [15].

On the other hand, hypothyroidism can result from lipid metabolism abnormalities, as reported by prior research [16-19]. There has been an increasing interest in studying the prevalence of thyroid disorders in recent years [10]. However, no recent review has evaluated the prevalence of hyperlipidemia in adult patients with hypothyroidism or the reverse association. Understanding the disease prevalence is essential for efficacious healthcare planning and resource allocations [20,21]. Therefore, the aim of this review is to summarize prior studies that assessed the prevalence of hyperlipidemia in adult patients with hypothyroidism or the prevalence of hypothyroidism in adult patients with hyperlipidemia.

METHODOLOGY

Search Strategy

An extensive literature search was conducted to identify observational studies with prevalence data on hyperlipidaemia among adult hypothyroid patients. The following databases were searched: PubMed and Scopus until December 11, 2024. The search strategy used was ((("Hyperlipidemias"[MeSH] OR hyperlipidaemia OR hyperlipidemia OR dyslipidaemia OR dyslipidemia OR "Cholesterol, LDL"[MeSH] OR elevated cholesterol OR "Triglycerides"[MeSH] OR high triglycerides OR lipid disorder) AND ("Hypothyroidism"[MeSH] OR hypothyroidism OR underactive thyroid OR thyroid insufficiency OR low thyroid function OR "Thyroid Diseases"[MeSH]) AND ("Prevalence"[MeSH] OR prevalence OR incidence OR epidemiology OR frequency OR occurrence) AND ("Adult"[MeSH] OR adults OR "Middle Aged"[MeSH] OR elderly))). The studies were checked for duplicates and irrelevant topics. After reading the full texts, studies that did not meet the inclusion criteria were excluded.

Inclusion and Exclusion Criteria

Relevant studies were identified after assessing the abstract and full-text. The studies included for final analysis had to meet the following inclusion criteria: (1) study subjects were adult patients, at least 18 years of age, with diagnosed hypothyroidism; (2) the original full text was available in English (4) the design was observational studies. The studies would be excluded if included non-relevant study populations: (patients with depression, sub-clinical hypothyroidism, Hashimoto's

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thyroiditis), literature review and meta-analysis, studies that included pediatric population, studies that included cancer patients, studies with no full-text, or did not report the prevalence rate were excluded. Duplicates were removed using the Endnote software, and the review was based on the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines.

The following data were excluded from eligible studies: author(s) names and year of publication, country, study design, study aim, study population, male to female ratio, and prevalence rate of hyperlipidemia in adult patients with hypothyroidism or vice versa.

STATISTICAL ANALYSIS

Descriptive statistics were used to present the findings of this systematic review. Categorical variables were presented as frequencies and percentages. The Modified Newcastle-Ottawa scale was used to assess the quality of included non-randomized controlled studies.

RESULTS

The total number of studies identified in this review was 13, which were published between 1995 and 2024. Figure 1 below presents PRISMA flow diagram that shows the study identification procedure.

Two of the included studies were performed in Saudi Arabia [22,23], 2 in India [24,25], and one study in each following country: Jordan [26], Sri Lanka [27], Philippines [28], Netherlands [29], Algeria [30], Nepal [31], Iran [32], South Africa [33], and Korea [34]. Most of the included studies (69.2%) were cross-sectional studies [22,23,25-27,30-32,34] and predominantly aimed at evaluating hyperlipidemia prevalence among adult hypothyroidism patients or vice versa and/ or its impact. The proportion of females was higher than males in most studies (76.9%). The prevalence of hyperlipidemia among adult hypothyroidism patients ranged from 10% to 77%, while the prevalence of hypothyroidism among adult hyperlipidemia patients ranged from 3% to 90.8% (Table 1).

Quality assessment of included observational studies:

The Modified Newcastle-Ottawa scale was used to assess the quality of the included studies. All included studies reported the outcome measure. Identifying confounders criterium was met by two studies (15.4%). The statistical adjustment criterium was met by two studies (15.4%). Funding source was disclosed by seven studies (53.8%), refer to Table 2.

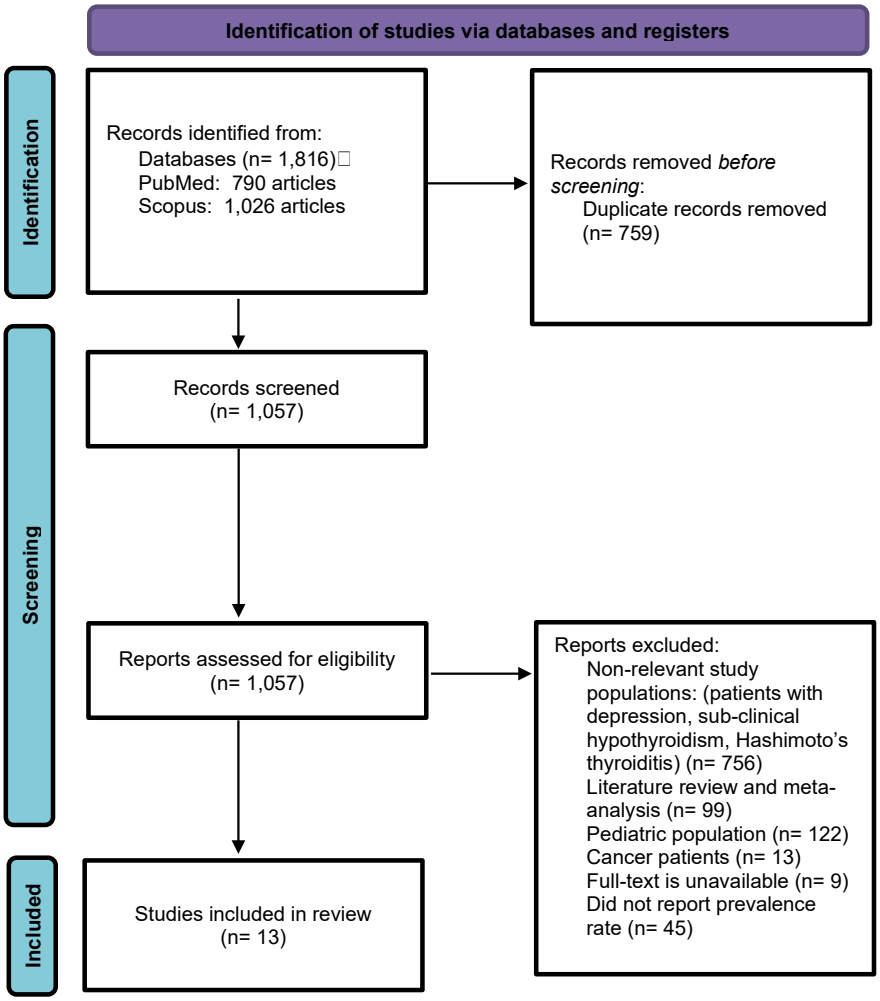

Figure 1. PRISMA flow diagram

Table 1. Characteristics of included studies

Author(s) names (year)	Country	Study design	Study aim	Study population	Male to female ratio (patients)	Prevalence rate of hyperlipidaemia in adult patients with hypothyroidism or vice versa
Ahmed et al., (2022) [22]	Saudi Arabia	A cross-sectional study	To access the prevalence of MetS profiles among the public based on obesity, age, and sex as CVD risk factors.	648 participants, gender was recorded for 440 of the participants.	9:13	Hypothyroidism: 90.8%
Al-Odat et al., (2024) [26]	Jordan	A cross-sectional study	To evaluate thyroid dysfunction prevalence and its impacts on lipid profiles.	228 subjects Patients with thyroid dysfunction: 178 Healthy individuals: 50	Patients with thyroid dysfunction: 9:17	Hypercholesterolemia: 48.4% Hypertriglyceridemia: 32.3%
Aldhafiri et al., (2021) [23]	Saudi Arabia	A cross-sectional study	To evaluate thyroid functions in males with MetS.	200 males MetS group: 100 Control group: 100	N/A	In MetS patients SCH: 16% Overt hypothyroidism: 4%
Bardara et al., 2020 [27]	Sri Lanka	A cross-sectional study	To access the SCH and hypothyroidism prevalence and its influence on lipid and other parameters in patients awaiting CABG.	102 patients	67:35	In SCH patients: Dyslipidemia: 75%
Chiu et al., (2023) [28]	Philippines	A retrospective study	To assess MetS prevalence among adult hypothyroidism patients.	105 patients with hypothyroidism	37:68	MetS: 36.2%
Diekman et al., (1995) [29]	Netherlands	A retrospective follow-up study	To investigate hypothyroidism prevalence in patients referred for dyslipidemia and the changes in lipid profiles on euthyroid state restoration.	1509 patients	800:709	Hypothyroidism: 4.2%
Hamlaoui et al., (2018) [30]	Algeria	A prospective cross-sectional study	To assess MetS prevalence in various thyroid status patients.	86 patients Euthyroid: 35 Hypothyroid: 39 Hyperthyroid: 12	Hypothyroid: 2:37	Among hypothyroid patients MetS: 64.1% Low HDL-C: 69.2%
Jaseem et al., (2021) [24]	India	A retrospective hospital-based study	To evaluate MetS patient's demographic profile.	650 patients MetS: 153 MetS with Hypothyroid: 24	MetS with Hypothyroid 5:19	Hypothyroid among MetS patients: 27%
Khatri et al., (2021) [31]	Nepal	A descriptive cross-sectional study	To determine the prevalence of lipid abnormalities in newly diagnosed cases of primary hypothyroidism.	71 patients	19:52	Abnormal lipid profiles: 69.0%
Khazan et al., (2014) [32]	Iran	A cross-sectional study	To evaluate the correlation between dyslipidemia and hypothyroidism.	4,794 subjects 2,315 subjects with dyslipidemia 2,445 subjects without dyslipidemia	Subjects with dyslipidemia 694:1621	In subjects with dyslipidemia: Subclinical hypothyroidism: 7% and clinical hypothyroidism: 3%
Mansfield, Bhana and Raal, (2022) [33]	South Africa	A retrospective case-control study	To express and compare the dyslipidemia prevalence between hypothyroid ethnically various patients and euthyroid controls.	618 patients Hypothyroidism: 206 Euthyroid controls: 412	Patients with hypothyroidism 13:90	In hypothyroidism patients: Dyslipidemia: 70.6% Hypercholesterolemia: 32% Hypertriglyceridemia: 10% Raised TG and TC: 20%

Oh et al., (2018) [34]	Korea	A cross-sectional survey	To examine the correlation between lipid profiles and categorical thyroid dysfunction based on sex and age.	4,640 participants	571:589	Hypothyroidism among participants with dyslipidemia: TC ≥ 200 mg/dL: 5.6% LDLC ≥ 130 mg/dL: 5.1%
Wasalwar and Wasnik, (2020) [25]	India	A cross-sectional study	To assess MetS prevalence in patients with hypothyroidism.	100 patients	8:17	MetS: 84% Elevated TG: 77% Low HDL-C: 76%

MetS, = metabolic syndrome; CVD, cardiovascular disease; SCH, subclinical hypothyroidism; CABG, coronary artery bypass graft surgery; HDL-C, = high-density lipoprotein cholesterol; TG, triglycerides; TC, total cholesterol; LDLC, low-density lipoprotein cholesterol.

Table 2. Modified Newcastle-Ottawa scale for appraisal of the studies

Study	Study groups	Attrition	Exposure measure	Outcome measure	Investigators blinded	Confounders identified	Statistical adjustment	Funding source
Ahmed et al., (2022) [22]	N/A	NR	N/A	Y	N/A	N	Y	Y
Al-Odat et al., (2024) [26]	N/A	NR	N/A	Y	N/A	N	N	Y
Aldhafiri et al., (2021) [23]	N/A	NR	N/A	Y	N/A	N	N	Y
Bardara et al., 2020 [27]	N/A	NR	N/A	Y	N/A	N	N	Y
Chiu et al., (2023) [28]	N/A	NR	N/A	Y	N/A	N	N	Y
Diekman et al., (1995) [29]	N/A	NR	N/A	Y	N/A	N	N	Y
Hamlaoui et al., (2018) [30]	N/A	NR	N/A	Y	N/A	N	N	Y
Jaseem et al., (2021) [24]	N/A	NR	N/A	Y	N/A	N	N	N
Khatri et al., (2021) [31]	N/A	NR	N/A	Y	N/A	N	N	N
Khazan et al., (2014) [32]	N/A	NR	N/A	Y	N/A	N	Y	N
Mansfield, Bhana and Raal, (2022) [33]	N/A	NR	N/A	Y	N/A	Y	N	N
Oh et al., (2018) [34]	N/A	NR	N/A	Y	N/A	Y	N	N
Wasalwar and Wasnik, (2020) [25]	N/A	NR	N/A	Y	N/A	N	N	N

DISCUSSION

The current review found that in most included studies (76.9%), the proportion of females was higher than that of males. This finding aligns with a previous retrospective cohort study that included 8,795 newly diagnosed hyperlipidemic patients, which aimed to document the prevalence of thyroid function testing among them, in which 55% of those patients were women [35]. These findings could be attributed to the fact that thyroid dysfunction, particularly hypothyroidism, is more prevalent among females than males due to differences in immune function between the sexes [36]. Besides, the prevalence of hypothyroidism increases among females based on concurrent autoimmune conditions and age [7]. Previous studies also have found that women are about 3 to 5 times more likely to receive thyroid disorder treatment than men [37,38]. Moreover, the leading reason for hypothyroidism in developed countries is Hashimoto thyroiditis (an autoimmune disease) [39], which is more prevalent among females by at least 10-fold [40].

Hypothyroidism can result in dyslipidemia through many mechanisms, including diminished activity for LDL receptors [41-43], impaired functions of HDL [4], and increased HMG-CoA reductase expression in the liver, consequently raising cholesterol synthesis activity [44]. One significant finding from this review is that the prevalence of hyperlipidemia among adult hypothyroidism patients ranged from 10% to 77%. This wide range could be due to disparities in study populations, diagnostic thresholds, participants' age, iodine sufficiency, geographical variations [45], hypothyroidism subtypes, and hypothyroidism severity [7]. Hypothyroidism was reported to be more common among advanced-aged persons, non-Hispanic females, whites, and individuals with a family history of thyroid dysfunction [46,47]. Also, another prior study documented thyroid dysfunction, including hypothyroidism, more prevalent among patients with hypertension and diabetes mellitus, postmenopausal individuals, and those of reproductive age [10]. Dyslipidemia among middle-aged hypothyroidism patients could arise from physical inactivity and unhealthy eating habits because of rapid urbanization in some nations [48]. Therefore, routine health screening [10] for those high-risk populations can reduce premature death and associated comorbidities [49]. Engaging in physical exercise is also recommended for those patients [49].

Dyslipidemia prevalence and pattern among hypothyroidism patients vary across research; HDL-C may be low, normal, or high [50-52], and TG may increase [52-54], with prevailing increased LDL-C and TC [52,54]. Besides, an earlier study has declared that LDL-C, TG, and TC levels were significantly higher among overt hypothyroidism patients than SCH patients [55]. Thus, prior research demonstrated that the prevalence of hyperlipidemia in patients with clinical hypothyroidism exceeds 90% [52], with serum levels for LDL-C and TC raised by about 30% among these patients [56]. On the other hand, some studies suggest mild serum lipoprotein abnormalities among patients with SCH [57,58], and others revealed either absences associated with lipoprotein abnormalities [59] or no significant change in serum lipoproteins [60-63].

Another finding is that the prevalence of hypothyroidism among adult patients with hyperlipidemia ranged from 3% to 90.8%. These variations in prevalence rates could be attributed to demographic and geographical variations. A previous prospective study found more significant increases in the prevalence of hypothyroidism in hyperlipidemic patients with serum cholesterol exceeding 7.7 mmol/L, particularly among females aged > 50 years [64]. It is well-established that dyslipidemia is associated with hypothyroidism [65]. This could be attributed to the strong positive association between serum LDL-C and TC levels and serum TSH in males and females [66]. Up to 2011, research reported that the prevalence of hypothyroidism among hyperlipidemic patients ranged from 1.4% to 13.3% [7,29,67-72]. This implies an increase in the prevalence of hypothyroidism among hyperlipidemic patients after 2011, as reported in this review. Many of hyperlipidemic patients with hypothyroidism are asymptomatic [69]. Therefore, screening for hypothyroidism by measuring TSH levels is essential among hyperlipidemic patients [64]. For newly diagnosed hyperlipidemic patients, guidelines recommend screening for hypothyroidism before initiating treatment with a lipid-lowering agent [73-76].

CONCLUSION

Hyperlipidemia and hypothyroid are prevalent comorbid diseases. Lifestyle modifications are needed as preventive measures to decrease the burden of these two conditions. Educational campaigns to the general public are required to enhance their awareness about modifiable risk factors of these conditions.

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Competing Interest: None

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