Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 14,issue.33s (2025)
https://www.jneonatalsurg.com

OPEN ACCESS

Exploring The Role Of Thyroid Hormone Levels In Gallstones In Jordan: A Reasearch Study

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.Cite this paper as Anas As'ad M.D., Samer A Al-Shbailat M.D, Eyad Alqarqaz M.D., Tareq Alwreikat M.D, , Mohammad Alananzh (2025) Exploring The Role Of Thyroid Hormone Levels In Gallstones In Jordan: A Reasearch Study.. .Journal of Neonatal Surgery, 14, (33s), 25-30

ABSTRACT

Background: Cholesterol, bilirubin, or a mixture of both gallstones are hardened deposits that develop in the gallbladder and bile ducts. When there is excessive cholesterol, bile salts, and bilirubin among other substances present in bile, it can result into the formation of gallstones. Gallstones are well known to be one of the most common reasons for hospital admissions, which strikes suspicion towards thyroid imbalance of some sort. The reason this seems logical is that Hypothyroidism affects so many people across the globe coupled with its impact on hepatic lipid homeostasis as well as biliary secretion and gallbladder motility all some of the things thought to contribute into cholesterol gallstone disease.

Aim;To investigate between the association between thyroid hormone levels and the risk of Gallstones in Jordan.

Materials and Methods: The purpose of this cross-sectional study is to investigate the relationship between thyroid hormone levels and gallstone development. From July 2023 to March 2025, information was gathered from Al Salt Hospital . Adults who presently have or previously had gallstone disease diagnosed by ultrasound, with or without thyroid disease confirmed or ruled out by obtaining TSH and T4 levels, were chosen using a non-probability sampling technique. Our final sample was 904. All of the data that was gathered and examined using statistical analysis.

1. INTRODUCTION

As one of the most popular gastrointestinal diseases, gallstone disease is defined as hard pieces that formulate in different parts of the biliary tract or in the gallbladder itself.[1] This disease is mainly caused by cholesterol and bilirubin extraordinary levels, >20% of individuals who have gallstones will experience various symptoms throughout their lives. Furthermore, gallstones formation is affected by various risk factors like; age, obesity, and female sex (Worthington, 2023). The percentage of gallstones spread over the general population lies between 10%-15%. For more details, cholesterol gallstones represent the most percentage (90%) in Western countries and around 77% in China (Wang et al., 2016). Over a group of 668 cholecystectomy undergone female patients, about 2.4% are classified as treated hypothyroidism (Völzke et al., 2005).

Over the past years, several explanations have been established to find the relationship between thyroid disorders and gallstones formulation. To explore the connection between thyroid function and gallstone disease, studies are carried out over a sequence of patients who are with potential for assortment bias that could have shown incorrect positive results. Generally, the structure of bile changes with thyroid failure and lipid metabolism turbulences. In particular, low thyroid hormone levels are related to hypercholesterolemia, resulting in high concentrations of total and low-density lipoprotein (LDL) cholesterols. Conversely, higher thyroid hormone levels May lead to a reduction in total cholesterol, as well as LDL and HDL cholesterol. This is possible because of a built-in mechanism that helps get rid of cholesterol, which helps remove cholesterol from the body[2].Previously conducted studies have concluded that the paucity of thyroid hormone can impair the ideal relaxation of the sphincter of Oddi[3] .

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However, some works have shown that there is no direct impact of thyroid disease on the expression of gallstones [4]. In addition, most of the preceding researches have focused on the relationship between hypothyroidism and gallstones. Nevertheless, few studies included the effect of decreased levels of thyroid hormone on gallstone production. In this work, we aim to further discover the consequence of hypothyroidism on gallstone motivation. Information on patients from the middle areas of Jordan will be gathered and utilized to estimate the results.

2. OBJECTIVES

- To determine the correlation between thyroid hormone levels and the occurrence of gallstones.
- To investigate factors (age, gender, BMI) particular role in the relationship between abnormal thyroid hormone levels and gallbladder stones.

3. LITERATURE REVIEW

The potential precursors to gallstone development have been comprehensively researched.

Several factors contribute to the formation of gallstones, including advanced age, female sex, obesity, metabolic syndrome, and chronic liver disease. These factors can influence bile composition, gallbladder motility, and cholesterol metabolism, increasing the risk of gallstone formation [5]. Interestingly, not only obesity but also rapid weight loss can precipitate cholelithiasis [6] .

In studies comparing the different factors that contribute to gallstones formation involving individuals considered free of thyroid disease, TSH levels were observed to elevate with advancing age [7]. Another study has shown that in all age groups, females showed higher TSH levels compared to males [8], Serum TSH levels were compared and were elevated in the obese individuals compared to the lean individuals [9].

Research has demonstrated the essential role of thyroid hormones (TH) in regulating various aspects of gallbladder function, including bile composition, biliary secretion, gallbladder motility, and sphincter of Oddi relaxation. These regulatory effects of TH on gallbladder function may contribute to the development of gallbladder stones (GSD) in individuals with thyroid disorders [10]

A correlation between thyroid dysfunction and GSD has been explored in several human studies but with inconsistent results [11] [12] [13]. While some studies have identified a potential link between hypothyroidism and GSD [14] [15], others have not found a clear connection between general thyroid issues and GSD [16] [17]. Some people have reported their gallstones disappearing after their thyroid levels returned to normal [18]. However, Those studies are limited.

Current research on the association between subtle variations in thyroid hormone levels and gusto formation is limited. It remains unclear whether these minor differences in thyroid hormone levels among euthyroid individuals contribute to gallstone development.

By unraveling this relationship, we can gain valuable insights into gallstone development and develop strategies to stop them from forming.

Our cross sectional study conducted in the mid region of Jordan will provide evidence supporting a positive association between changes and thyroid hormone levels and goldstone disease. Further research is needed to clarify this association.

4. RESEARCH DESIGN AND METHODS

Study Design

This cross-sectional study aims to investigate the correlation between thyroid hormone levels and the development of gallstones.

Study Setting

The study was conducted at Al Salt Hospital, and King Hussein medical center from July 2023 until March 2025.

Sampling

A minimum sample size was calculated using a priori power analysis desired power level of 0.80, and an alpha level of 0.05. The minimum required sample size was 896. The sample size is 904, convenient non-probability sampling technique was used to select adults who have a history of gallstone disease diagnosed by ultrasound upon their presentation to the clinic, with or without thyroid disease.

Data Collection Method

Direct personal inquiry was employed; the treating surgeon ordered TSH and T4 to diagnose or rule out thyroid disease; and all information, including age, gender, and BMI, was considered when matching individuals.

Data Management and Analysis

All data was analyzed using SPSS version 28. Descriptive statistics, such as means and standard deviations (SD) for continuous variables, and percentages for categorical variables. P values < 0.05 were considered to be significant. For qualitative variables, chi-square test was performed. Unpaired t-tests for quantitative variables. The link between the presence of gallstones and risk factors was assessed through bivariate correlation coefficient analysis.

Ethical Considerations

The approval of the institutional review board at Al-Balqa University was secured. The data collected was used solely for scientific research purposes, and all personal information was kept anonymous and confidential. No names were mentioned, shared, or discussed.

Inclusion and Exclusion Criteria

This study included all adults who have a history of active gallstone disease admitted to and OPD of Al Salt Hospital, and King Hussein medical center. Patients who fit these categories were excluded:

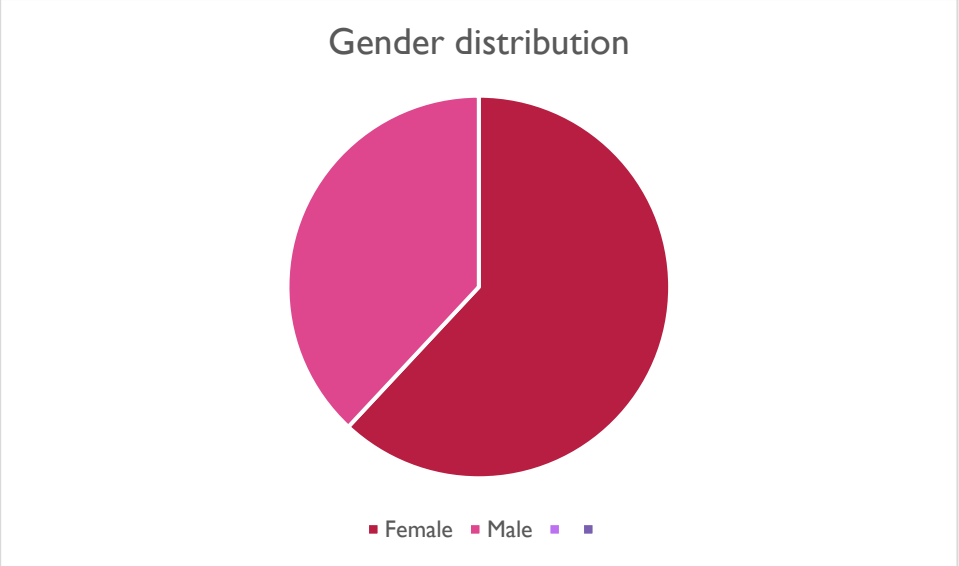
- Pregnancy
- Patients on drugs causing hypothyroidism
- Patients on drugs causing gallstones

5. RESULTS

The study includes 904 participants who were in 19-72 years age group with a median age of 47 years. [Table 1]

Age (years)	Frequency N	Percentage %
19–24	48	5.31%
25–34	106	11.73%
35–44	198	21.90%
45–54	270	29.87%
55–72	282	31.19%
Total	**904**	**100%**

Among the patients tested, 62 % were female (560), while 38% (344) were male. The female-to-male ratio was approximately 1.6 :1. [Chart 1]



In terms of BMI categories, 42% of participants were classified as normal weight, while a larger proportion falls into the overweight (30%) and obese (28%) categories. [Table 2]

BMI Category	BMI Range	Frequency N	Percentage %
Normal weight	18.5–24.9	380	42%
Overweight	25.0–29.9	271	30%
Obese	≥30.0	253	28%
Total	—	**904**	**100%**

The distribution of TSH levels among the study participants was categorized into three groups: euthyroidism (0.4–4.0 mIU/L), hyperthyroidism (<0.4 mIU/L), and hypothyroidism (>4.0 mIU/L).

756 of these patients (83.7%) had TSH levels within the normal range. 26 Patients (2.8%) Exhibited TSH levels below the normal threshold, While 122 patients (13.5%) had TSH levels above the normal range. These differences confirm a clinically significant pattern especially for hypothyroidism. ($P < 0.001$). [Table 3]

TSH Category	TSH Range	Frequency N	Percentage %
Euthyroidism	0.4–4.0 mIU/L	756	83.7%
Hypothyroidism	>4.0 mIU/L	122	13.5%
Hyperthyroidism	<0.4 mIU/L	26	2.8%

When comparing thyroid hormone levels between females (N= 560) and males (N=344), the median TSH levels were 2.3 Miu/L in females and 2.1 mIU/L in males, With no statistically significant difference (P=0.98) . Similarly median TSH levels were 3.8 ng/dL in females and 2.04 ng/dLin males, showing strong significant difference. ($P < 0.001$). [Table 4]

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Gender	Total N	Hypothyroidism N	Hypothyroidism %
Male	344	21	6%
Female	560	106	19%

When assessing thyroid hormone levels across BMI categories, The median tsh levels were 2.2 MIU LA normal weight individuals 2.0 MIU\ L in overweight individuals and 2.4 mu \ L in obese individual with no statistically significant difference (P = 0.74).

6. DISCUSSION:

This cross-sectional study examined the distribution of thyroid-stimulating hormone (TSH) levels and their association with gender and body mass index (BMI) among 904 adult participants aged 19–72 years, with a median age of 47 years. The study population demonstrated a notable gender imbalance, with a female predominance (62%), resulting in a female-to-male ratio of approximately 1.6 :1. This gender distribution reflects broader epidemiological patterns, as thyroid disorders are more frequently observed in females.

In terms of BMI, the majority of participants were either overweight (30%) or obese (28%), while only (42%) had a normal weight. This pattern suggests a high burden of weight-related health risks in the studied population, which is relevant given the known associations between obesity and thyroid function, particularly subclinical hypothyroidism.

Regarding thyroid function, the distribution of TSH levels showed that **83.7% of participants had euthyroid levels,** while **13.5% were hypothyroid,** and **2.8% were hyperthyroid.** The proportion of hypothyroid individuals exceeds typical global prevalence estimates (which range from 4–10%), suggesting a potentially higher burden of thyroid dysfunction in this cohort. The difference in TSH distribution was statistically significant ($P < 0.001$), indicating a clinically relevant deviation from expected norms, particularly in the hypothyroid subgroup.

Gender-based analysis further supported this finding. Although the **median TSH levels were similar between females and males** (2.3 mIU/L vs. 2.1 mIU/L, P = 0.98), the **prevalence of hypothyroidism was significantly higher in females (19%) compared to males (6%),** with a **highly significant Chi-square p-value of 1.23×10^{-7}.** This aligns with existing literature attributing increased risk of thyroid disorders in females to autoimmune etiologies such as Hashimoto's thyroiditis. Interestingly, the free T3/T4 levels (represented here as TSH-related hormone levels) also showed a statistically significant difference ($P < 0.001$), suggesting gender-specific patterns in thyroid hormone regulation or metabolism.

In contrast, analysis across BMI categories revealed **no significant association between BMI and TSH levels** (P = 0.74), although the median TSH appeared slightly higher in the obese group (2.4 mIU/L) compared to normal (2.2 mIU/L) and overweight (2.0 mIU/L) participants. While this trend is consistent with some prior studies suggesting a link between elevated BMI and TSH, the lack of statistical significance in this sample suggests that BMI may not independently influence thyroid function in a clinically meaningful way within this population.

7. CONCLUSION:

This study shows that thyroid malfunction especially hypothyroidism is very common in adult population that is predominantly female. While the majority of patients maintained their thyroid status 13.5% had increased TSH levels which may indicate hypothyroidism. This condition was more common in females than in males ($P < 0.001$). Gallbladder stones and thyroid hormone levels did not significantly correlate with BMI, despite the high prevalence of overweight and obesity. These results emphasized the significance of routine thyroid function testing, particularly for women and other populations at risk for endocrine abnormalities linked to obesity. Improving long-term health outcomes can be greatly aided by the early detection and the treatment of thyroid disorders,

Early Identification and management of thyroid disorders can play a critical role in improving long-term health outcomes.

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