

## FREQUENCY OF SUBCLINICAL HYPO AND HYPERTHYROIDISM IN PATIENTS PRESENTING WITH CONGESTIVE HEART FAILURE

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**Abstract:** Congestive heart failure is among the most common presentations in Cardiology inpatient and outpatient departments. It is associated with several long- and short-term complications and among these patients hypo and hyperthyroidism is found frequently. This study aims to determine the frequency of subclinical hypo or hyperthyroidism in cases with congestive heart failure. This cross-sectional study was conducted at the Rehmatul-Lil-Alameen institute of cardiology, PESSI, from 23-08-2020 to 22-02-2021. This study included cases of both genders aged 30-70 years suffering from congestive heart failure. Hypothyroidism was labeled when the TSH level was between 4.6 to 10 mIU/L, and hyperthyroidism was labeled when the TSH level was between 0.01 to 0.02 mIU/L. In this study, there were 91 cases of congestive HF. There were 61 (67.03%) males and 30 (32.97%) females. The mean age of the subjects was 25.53±9.23 years, and the mean weight was 75.71±15.18 kg. There were 20 (21.98%) cases with a history of DM. Hypothyroidism was observed in 19 (20.88%) of the cases, and hyperthyroidism in 08 (8.79%) of the cases. There was no significant difference in gender, age, BMI, duration of HF, and DM with hypo and hyperthyroidism. We can conclude from the study results that hypo and hyperthyroidism are common in cases with congestive heart failure, though hypothyroidism cases were found to be double than the hyperthyroidism.

**Keywords:** Congestive heart failure, thyroid gland, thyroid stimulating hormone, body mass index, diabetes Mellitus

### Introduction

Congestive heart failure (CHF) is a clinical syndrome when the heart cannot pump enough blood to meet the body's metabolic demands (Altamish et al., 2020). On the other hand, thyroid dysfunction is a condition in which the thyroid gland does not produce enough or produces too much thyroid hormone, leading to either hypothyroidism or hyperthyroidism, respectively. These two conditions are often interrelated, and thyroid dysfunction can significantly impact the development and progression of CHF (Piantanida et al., 2020).

Research has shown that thyroid dysfunction can contribute to the development of CHF and worsen the prognosis of existing CHF. Hypothyroidism, in particular, has been associated with an increased risk of CHF, while hyperthyroidism can lead to increased heart rate, cardiac output, and arrhythmias, all of which can exacerbate CHF symptoms (Lisco et al., 2020).

The incidence of CHF and thyroid dysfunction varies worldwide, with some countries reporting higher rates of these conditions than others. In Pakistan, CHF is a

significant public health issue, with a prevalence of 2.7% in the general population (Yezli et al., 2021). Thyroid dysfunction is also relatively common in Pakistan, affecting approximately 10% of the population (Naeem et al., 2022).

Understanding the frequency of thyroid dysfunction in CHF patients can provide important insights into the underlying mechanisms of CHF and inform treatment strategies. For example, identifying and treating thyroid dysfunction in CHF patients may improve cardiac function and overall prognosis. Therefore, exploring the relationship between CHF and thyroid dysfunction is crucial for optimizing patient care and improving outcomes. This study aims to determine the frequency of subclinical hypo or hyperthyroidism in cases with congestive heart failure.

### Methodology

The current Cross-sectional study was conducted at the Rehmatul-Lil-Alameen institute of cardiology,

PESSI, from 23-08-2020 to 22-02-2021. The sample size was calculated as 91 by keeping the confidence interval equal to 95%, the margin of error equal to 8%, and the anticipated prevalence of subclinical hypothyroidism as 18.5% (Tittl et al., 2021).

A nonprobability consecutive sampling technique was used to collect data. Both genders, Aged 30-70 years, had congestive heart failure (as per operational definition) were included in the study. The cases with signs and symptoms of hypo or hyperthyroidism (as per medical record), documented cases with a history of chronic liver (ALT/AST > 40 IU/L, renal (Cr >3 mg/dl) or cardiac disease (assessed by history and medical record) were excluded from the study.

After the approval of the hospital's local ethical review committee, the cases were selected according to the inclusion criteria and ensured to keep the record's confidentiality. After consent, detailed clinical and demographic data were collected in the form of gender (male/female), age (years), weight (in kg by electronic weighing machine), duration of congestive heart failure, and DM (yes/no) and recorded on a specially designed proforma. Then 5 ml of venous blood was drawn and checked at the same institute for thyroid function tests and was labeled as hyperthyroidism per operational definitions. The results were noted and recorded on the same proforma.

The data were analyzed by using SPSS version 21. Quantitative variables were presented as mean ± SD (Standard Deviation) for quantitative variables like age, weight, and duration of congestive heart failure. Frequency & percentages were calculated for qualitative data like gender, DM, and outcome variables, i.e., hypo or hyperthyroidism. Effect modifiers were controlled through stratification of gender, age, BMI, duration of congestive failure, and DM (BSR > 200 mg/dl) to see the effect of 55 on the outcome variable. Post-stratification chi-square test was applied. P-value ≤ 0.05 was taken as significant.

**Results**

In this study, there were 91 cases of congestive HF. There were 61 (67.03%) males and 30 (32.97%) females (figure 01). The mean age of the subjects was 51.53±9.23 years, the mean weight was 75.71±15.18 kg, and the mean duration of HF (table 1). There were 20 (21.98%) cases with a history of DM. Hypothyroidism was observed in 19 (20.88%) of the cases and hyperthyroidism in 08 (8.79%) of the cases, as in figure 2. Hypothyroidism was seen in 11 (22.95%) males vs. 8 (26.67%) females with p= 0.41). There was no significant difference in age, BMI, and duration of HF with p= 0.14, 0.25, and 0.39, respectively. It was observed in 3 (15%) cases

with DM compared to 16 (22.53%) nondiabetics with p= 0.55, as in table 2.

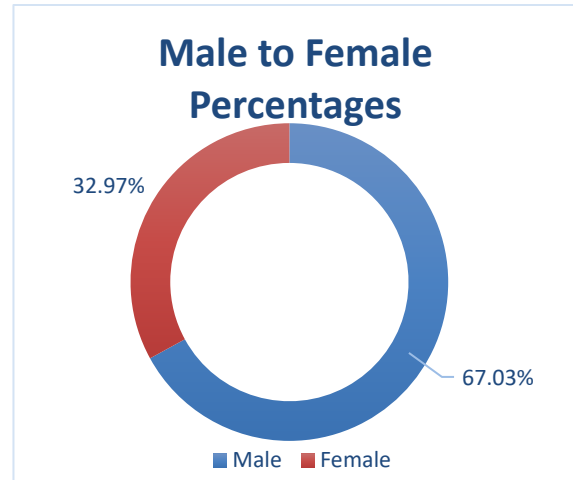


Figure 1:

Table 1 Demographics of the study population:

Variable	Mean	Std. Deviation	Minimum	Maximum
Age (years)	51.53	9.23	30	70
WEIGHT (KG)	75.71	15.18	57	115
Duration of HF (months)	17.34	9.67	1	48

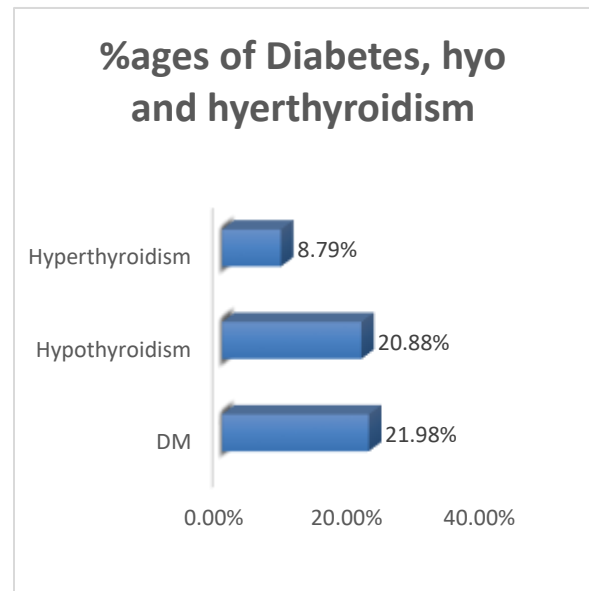


Figure 2:

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**Table 2: Association of hypothyroidism with different factors:**

Factors	Construct	HYPOTHYROIDISM		Total	P-value
		Yes	No		
Gender	Male	11 (22.95%)	50 (77.05%)	61 (100%)	<b>0.41</b>
	Female	08 (26.67%)	22 (73.33%)	30 (100%)	
Age (years)	30-49	2 (8.69%)	21 (91.31%)	23 (100%)	<b>0.14</b>
	50-70	17 (25%)	51 (75%)	68 (100%)	
BMI	Up to 25	3 (11.53%)	23 (88.47%)	26 (100%)	<b>0.25</b>
	>25	16 (24.61%)	49 (75.39%)	65 (100%)	
Duration of HF	Up to 6 months	7 (28%)	18 (72%)	25 (100%)	<b>0.39</b>
	>6 months	12 (18.18%)	54 (81.82%)	66 (100%)	
DM	Yes	3 (15%)	17 (85%)	20 (100%)	<b>0.55</b>
	No	16 (22.53%)	55 (77.47%)	71 (100%)	

Hyperthyroidism was found in 04 (6.55%) males vs. 04 (13.33%) females with  $p= 0.43$  (table 13). It was seen in all cases with the age group 50-70 years compared to none in age 30-49 years with  $p= 0.19$  as

in table 14. There was no significant association between BMI, duration of HF, and DM with hyperthyroidism, as in Table 3.

**Table 3: Association of hyperthyroidism with different factors:**

Factors	Construct	HYPERTHYROIDISM		Total	P-value
		Yes	No		
Gender	Male	04 (6.55%)	57 (93.45%)	61 (100%)	<b>0.43</b>
	Female	04 (13.33%)	26 (86.67%)	30 (100%)	
Age (years)	30-49	0 (0%)	23 (100%)	23 (100%)	<b>0.19</b>
	50-70	08 (11.76%)	60 (88.24%)	68 (100%)	
BMI	Up to 25	1 (3.84%)	25 (96.16%)	26 (100%)	<b>0.43</b>
	>25	7 (10.77%)	58 (89.23%)	65 (100%)	
Duration of HF	Up to 6 months	3 (12%)	22 (88%)	25 (100%)	<b>0.68</b>
	>6 months	5 (7.57%)	61 (82.43%)	66 (100%)	
DM	Yes	1 (5%)	19 (85%)	20 (100%)	<b>0.86</b>
	No	7 (9.95%)	64 (90.05%)	71 (100%)	

**Discussion**

Subclinical thyroid disease is a common clinical problem. Many controversies exist regarding subclinical thyroid disease screening, evaluation, and management. Subclinical hypothyroidism is defined as thyrotropin level above the upper limit of normal and free thyroxine & triiodothyronine level within normal limits. The prevalence of subclinical hypothyroidism is about 4 to 8.5% and may be as high as 20% in females aged more than 60 years. Subclinical hyperthyroidism is defined as low or undetectable thyrotropin levels with normal thyroxine and triiodothyronine levels. Subclinical hyperthyroidism has a prevalence of about 2% (Kim et al., 2019; Kim and Park, 2014; Selmer et al., 2014). The cardiovascular system is one of the main body systems affected by changes in thyroid hormone levels, which directly and indirectly affect its function. Subclinical hyperthyroidism is associated with a five times high risk for atrial fibrillation.

Although not recommended routinely, screening for subclinical thyroid disease is strongly advocated in high-risk groups, as it has a risk of progression to overt thyroid disease, especially in subclinical hypothyroidism. Subclinical hyperthyroidism has a particular effect on the heart and may be associated with cardiac dysfunction and atrial fibrillation (Ye et al., 2014)

Subclinical hypothyroidism affects the heart by disturbing both the systolic and diastolic function of the heart, resulting in heart failure, which is the structural or functional inability of the heart to maintain adequate output as per the demands of the body. Heart failure has a mortality of 10% per year. Heart failure imparts morbidity in the form of recurrent admissions for worsening shortness of breath, and with the passage of time, morbidity and healthcare costs related to heart failure are rising (Din et al., 2022; Kuchulakanti et al., 2019).

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Out of the 91 cases studied, suffering from congestive heart failure, hypothyroidism was observed in 19 (20.88%) of the cases and hyperthyroidism in 08 (8.79%) of the cases. These results were comparable with the variable findings of the previous studies where more or fewer the same percentages were observed with altered thyroid function.

According to a study by Asif Ullah, subclinical hypo and hyperthyroidism were seen in 2.12% of cases, and hypothyroidism in 3.98% of cases (Din et al., 2022). Though the prevalence was lower than the results of the present study, one thing was common: hypothyroidism was commoner and seen in almost double the cases of hyperthyroidism, which was also seen in the present study.

The results from another study revealed that subclinical hypothyroidism in cases of congestive heart failure was seen in 18.5% of the cases, which was almost identical to the results of the present study showing in 20.88% of the cases (Kuchulakanti et al., 2019).

Hypothyroidism was seen in 11 (22.95%) males vs. 8 (26.67%) females with  $p= 0.41$ , while hyperthyroidism was found in 04 (6.55%) males vs. 04 (13.33%) females with  $p= 0.43$  with female predominance, though this difference was not statistically significant. Similar findings were observed in the study by Akhter et al., where the frequency of subclinical hypothyroidism was 5.4%, while subclinical hyperthyroidism was 5.8%. Moreover, as far as gender distribution of the disease was concerned, both forms of subclinical thyroid dysfunction appeared to be more in females than males. The reason for this is not known (Akhtar et al., 2001).

In the present study, there was no association of thyroid dysfunction with age, duration of heart failure, BMI, and DM. The data regarding the association of such confounders was lacking, but none found a significant association with any of the variables studied before. Furthermore, Subclinical hypothyroidism has been reported to be in the range of 3.3% to 16.4 % in these studies (Åsvold et al., 2008; Boekholdt et al., 2010; Vanderpump et al., 1996).

Hyperthyroidism was seen in all cases in the age group 50-70 years compared to none in age 30-49 years with  $p= 0.19$ . There was no such cut-off value used in previous studies. However, the data from the study done by Asif Ullah revealed that out of 30 subclinical hypothyroid patients, 20 (66.7%) patients were <60 years of age, while 13/16 (81.25%) subclinical hyperthyroid patients were <60 years of age, and these were almost similar to the group in the present study comprising 50-70 years where all of the cases were found and none in the age group of 30 to 49 years suffered from this (Din et al., 2022).

There were a few limitations of this study, as this study assessed the cases only in sub-clinical form, and none was assessed as overt cases of thyroid dysfunction with clinical signs, which could have also raised the number.

However, there were many strengthening points as well, as this study highlighted a very important but underrated entity, which can reduce further morbidity in such cases by treating.

## Conclusion

We can conclude from the study results that hypo and hyperthyroidism are common in cases with congestive heart failure, though hypothyroidism cases were found to be double than the hyperthyroidism.

## Conflict of interest

The authors declared an absence of conflict of interest.

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