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Association of Fatty Liver and Hypothyroidism

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Abstract: ***Aim:*** *The aim of this study was to evaluate the association of thyroid dysfunction on the development of fatty liver.* ***Objective:*** *The main objective of this study is to determine the relationship of abnormal liver function, fatty liver among subclinical and overt hypothyroid patients.* ***Background:*** *Thyroid hormones are totally involved in the regulation of body weight, lipid metabolism, and insulin resistance. The liver plays a crucial role in the metabolism of cholesterol and triglycerides; thyroid hormones interact on hepatic lipid homeostasis. Therefore it is anticipated that thyroid hormones may have a role in the pathogenesis of non alcoholic fatty liver disease (NAFLD). Hypothyroidism confers an increased risk of non-alcoholic fatty liver disease (NAFLD).* ***Reason:*** *Non-alcoholic fatty liver disease (NAFLD) represents one of the most common chronic disorders of the liver. Various literatures provide evidence that hypothyroidism is reported to contribute to the development of fatty liver. Thus this study is done to confirm those findings and for early diagnosis and prevent complications.*

Keywords: NAFLD, hypothyroid, insulin, hormones, metabolism

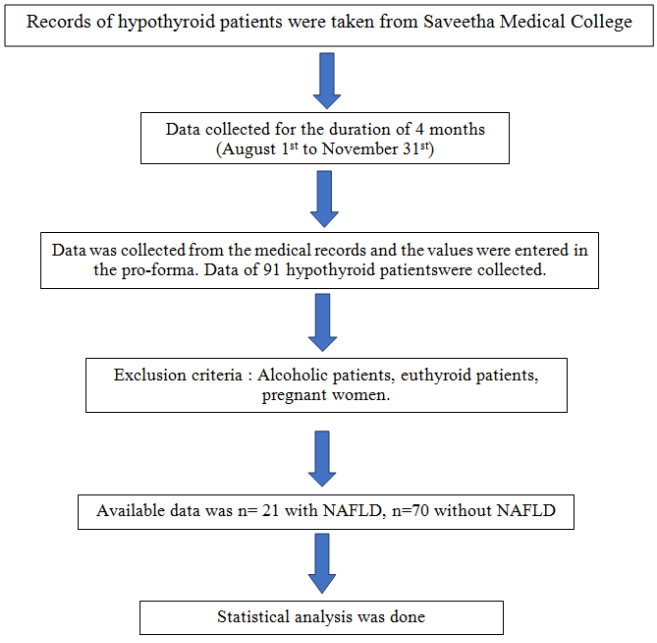
1. Introduction

Non-alcoholic fatty liver disease (NAFLD) is increasingly recognised as one of the cause of chronic liver disease and is also considered as the commonest cause of abnormal liver function tests.[(1)]NAFLD represents one of the most common chronic disorders of the liver in the Western industrialised nations.[(2-5)] It is a pathological spectrum of liver disorders ranging from simple steatosis to non alcoholic steatohepatitis with inflammations, which can also progress to cirrhosis which can also predispose to hepatocellular carcinoma.[(6, 7)] It is characterised by excess hepatic accumulation with triglycerides and free fatty acids in the liver. The incidence of NAFLD is found to be increasing rapidly. The risk factors that can contribute to this condition include obesity, type 2 diabetes and any other metabolic risk factors. Although obesity is the commonest and primary metabolic cause, non-alcoholic fatty liver disease may arise secondary to several other endocrine disorders, including thyroid dysfunction, growth hormone deficiency, adrenal insufficiency, and polycystic ovary syndrome.[(8)]

Endocrine hormones are generally involved in cell metabolism, regulation of energy expenditure and fat distribution in the human body and thereby play an important role in the development of metabolic abnormalities. The thyroid gland is significantly involved in energy homeostasis, lipid and carbohydrate metabolism, regulation of body weight and adipogenesis[(9, 10)]. In a clinical setting, hypothyroidism has been associated with metabolic syndrome, cardiovascular mortality and disturbance of lipid metabolism [(11, 12)]. In recent years, growing body of evidence has led to speculation on the association between NAFLD/NASH and thyroid dysfunction. Disturbances in thyroid hormone concentrations may promotehyperlipidemia and obesity, thus contributing to NAFLD [(13, 14)]. Importantly, thyroid hormones interact on hepatic lipid homeostasis through multiple pathways, including stimulation of free fatty acid delivery to the liver for re-esterification to triglycerides, and increasing fatty acid β-oxidation, thereby affecting hepatic fat accumulation. Early identification of at-risk patients is important since treatment of the hypothyroidism may reduce the risk of NAFLD and potential complications. [(15)]

Several clinical studies have investigated the role of hypothyroidism as a predictor for NAFLD in cross-sectional analyses but the results have been contradictory. Thus this is a retrospective study, which was done with the available data from Saveetha Medical College to determine the relationship of abnormal liver function, fatty liver among subclinical and overt hypothyroid patients.

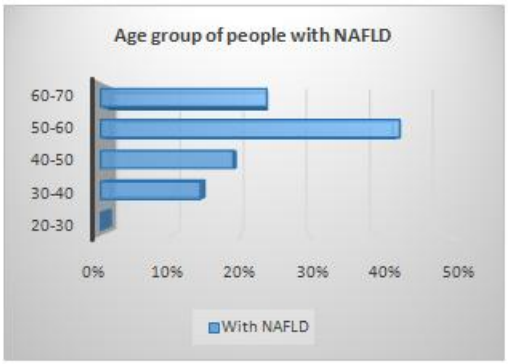
2. Materials and Methods

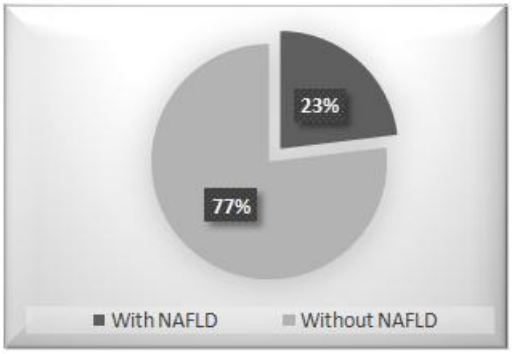


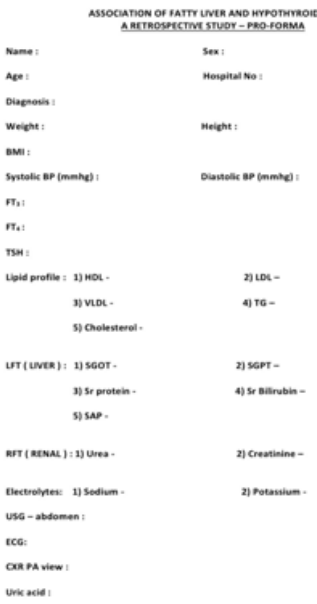
3. Results

The results were collected from the pro-forma and were collected. The results were tabulated with parameters such as age, blood pressure, thyroid function test, liver function test, renal function test by comparing both patients with and without non alcoholic fatty liver disease.

Parameters	With NAFLD (n=21)	Without NAFLD (n=70)
Age	53.8 ± 6.3	40.171 ± 11.25
Systolic BP	110 ± 8.3	120 ± 13.9
Diastolic BP	80 ± 7.07	80 ± 9.32
FT3	4.7 ± 0.91	3.33 ± 4.02
FT4	1.6 ± 1.22	1.59 ± 1.26
TSH	15.31 ± 4.79	12.13 ± 7.07
SGOT	39.8 ± 28.06	22 ± 10.305
SGPT	29.914 ± 12.807	25 ± 8.24
Sr. Protein	7.11 ± 0.76	6.72 ± 0.66
Sr. Bilirubin	1.04 ± 0.83	0.932 ± 0.47
SAP	101.6 ± 43.41	109.4 ± 23.7
Urea	23.24 ± 14.34	17.99 ± 2.63
Creatinine	0.82 ± 0.208	0.78 ± 0.14
Sodium	129.8 ± 13.2	117.5 ± 40.87
Potassium	4.134 ± 1.52	3.88 ± 0.621

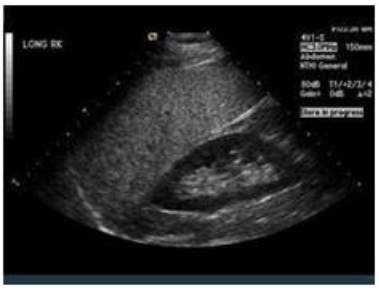






ASSOCIATION OF FATTY LIVER AND HYPOTHYROIDISM
A RETROSPECTIVE STUDY – PRO-FORMA

Name : Sex :
Age : Hospital No :
Diagnosis :
Weight : Height :
BMI :
Systolic BP (mmhg) : Diastolic BP (mmhg) :
FT_3 :
FT_4 :
TSH :
Lipid profile : 1) HDL - 2) LDL –
3) VLDL - 4) TG –
5) Cholesterol -
LFT (LIVER) : 1) SGOT - 2) SGPT –
3) Sr protein - 4) Sr Bilirubin –
5) SAP -
RFT (RENAL) : 1) Urea - 2) Creatinine –
Electrolytes: 1) Sodium - 2) Potassium -
USG – abdomen :
ECG:
CXR PA view :
Uric acid :



4. Thyroid Levels – Normal and Hypothyroidism

Thyroid stimulating hormone: TSH levels are determined by ranges (all figures in mU/L—milliunits per liter). Below are the ranges, according to the American Thyroid Association. However, these numbers are not set in stone. Normal ranges can vary by individual, and they can even change over the course of a day. Also, ranges can vary slightly from lab to lab. Hypothyroidism is separated into either overt or subclinical disease. That diagnosis is determined on the basis of the TSH laboratory blood tests. The normal range of TSH concentration falls between 0.45 - 4.5 mU/L.

- Patients with mildly underactive (subclinical) thyroid have TSH levels of 4.5 - 10mU/L.
- Patients with levels greater than 10mU/L are considered to have overt hypothyroidism and should be treated with medication.

The finding of an elevated TSH and low FT4 indicates primary hypothyroidism due to disease in the thyroid gland. A low TSH and low FT4 indicate hypothyroidism due to a problem involving the pituitary gland.

The datas were recorded for 91 hypothyroid patients. All the patients were above 20 years of age group. Among them 21patients were found to have Non alcoholic fatty liver disease. The age group of patients with NAFLD ranges from 47-59 years approximately. The systolic and diastolic blood pressures for patients with NAFLD were found to increased with a variation110 ± 8.3 and 80 ± 7.07 respectively. The FT3 and FT4 levels were found to be varying slightly 4.7 ± 0.91 and 1.6 ± 1.22 respectively in patients with NAFLD. The TSH levels will always be above 10mU/Lin hypothyroidism patients while it was found to rapidly raise with slight variations in the values 15.31 ± 4.79.Other than the thyroid hormones, SGOT, SGPT, Serum protein, serum bilirubin, urea, creatinine,

sodium, potassium levels were found to raised comparatively for patients with NALFD. The abdominal ultrasonographies were performed in all the subjects with NAFLD. Fatty liver was diagnosed based on standard criteria, including hepatorenal echo contrast, liver brightness, deep attenuation, and vascular blurring, using a 3.5 MHz probe.

5. Discussion

NAFLD is a burgeoning health problem and is currently recognised as the most common metabolic liver disease. Insulin resistance and obesity contribute to the development of NAFLD, which has become the most prevalent liver disease worldwide, affecting one-third of the global adult population.[16] NAFLD can lead to NASH and/or hepatocellular cancer[17]. It has been suggested that a relationship exists between NAFLD and thyroid dysfunction [18]. Despite the precise physiological mechanism underlying the development of NAFLD, the relationship between NAFLD, hypothyroidism and metabolic syndrome remains unclear. Because of the importance of thyroid hormones in lipid metabolism [19], hypothyroidism may result in hyperlipidemia, thereby initiating the development of NAFLD.

Several studies have indicated that hypothyroidism is a risk factor for NAFLD and can result inmetabolic syndrome [20, 21]. FT3/FT4ratio can be considered an indicator of peripheral deiodinase activity. Bilgin and Pirgon[22] suggested that augmented conversion from FT4 to FT3 due to increased deiodinase activity is a compensatory mechanism for fat accumulation to improve energy expenditure. FT3/FT4 ratio positively correlates with HOMA-IR in patients with NAFLD. Moreover, positive associations have been reported between FT3/FT4 ratio and both waist circumference and BMI in patients with obesity [23, 24]

Because thyroid dysfunction, especially the hypothyroid metabolic state, affects the overall metabolism and maycontribute to the development of hepatic steatosis and more serious forms of NAFLD, future interventional studies, similar to that of Ineck et al. should focus on treatment of thyroid dysfunction. [25]The present study has some limitations. Because of the choice of study design, it was possible to investigate associations but not causalities. While liver biopsy represents the gold standard for diagnosis of NAFLD, the diagnosis of hepatic steatosis in our study was made using ultrasonography. Also, because serum insulin levels were not determined in fasting subjects and thus could not be used, insulin resistance was not assessed in this study as a possible factor impacting the association between thyroid dysfunction and NAFLD. Yet with this study it is indicated that development of NAFLD is associated with the mechanism of hypothyroidism.

6. Conclusion

In summary, the results of the present retrospective study agree in many points with the findings of numerous other publications and confirm a correlation between thyroid hormone levels and hepatic steatosis in a study collective representative of the general population. The prevalence of hepatic steatosis rises significantly with reductions in FT4, and a rapid increase in TSH concentrations. Amost 23% of hypothyroid patients were found to have NAFLD in their later stage. Thus it is understood long term hypothyroidism can be one of the important cause or the development of NAFLD and further studies are needed to clarify the exact role of thyroid hormones and its association in the development and progression of NAFLD.

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