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**Correlation between TSH level with each of
Cholesterol and Triglycerides in Mild Subclinical
Hypothyroidism**

Graduate Project

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Correlation between TSH level with each of Cholesterol and Triglycerides in Mild Subclinical Hypothyroidism

Abstract

Mild subclinical hypothyroidism (MSCH) means the TSH level is higher than normal range and below 10 mIU/L with normal T3, T4. Only severe subclinical hypothyroidism with TSH above 10 mIU/L is considered a risk factor of hyperlipidemia and cardiovascular disease. Based on this aspect the aim of this study to showing the effect of dyslipidemia on MSCH. **The aim of this study** is showing the relationship between TSH level with each of cholesterol and triglycerides in mild subclinical hypothyroidism (MSCH) with TSH below 10 mIU/L. **Methodology** the data have been collected from several private laboratories in Erbil city, including King, Millet, Razi and Med line laboratories with several devices such as Vitik, Cobas 6000, Cobas e 411 and Cobas c 111. 17 male patients with (20-85 ages) and 26 female patients with (9-66 ages) with mild subclinical hypothyroidism (MSHT group). The data includes thyroid function tests (TSH, T3, T4,) and lipid tests such as Triglyceride and Cholesterol. **Results** in this study showing that there is a moderate significant positive correlation between TSH and each of Cholesterol and TG in female patients ($r=0.4145$, P value= 0.0352 and $r=0.5338$, P value= 0.0060) respectively. While for male patients there were negatively weak non-significant correlation between TSH and each of Cholesterol and TG ($r=-0.1217$, P value= 0.6417 and $r=-0.3407$, P value= 0.1808) respectively. **Conclusions**, according to our results and previous studies even in MSCH elevating TSH may lead to increase in level of both serum cholesterol and TG. In this way dyslipidemia may serve as indicator for MSCH.

Keywords: dyslipidemia and MSCH

CHAPTER ONE

Introduction

Thyroid-stimulating hormone (TSH) is secreted by the pituitary gland, which regulates the proliferation of thyroid cells, thyroid blood supply, and synthesis and secretion of thyroid hormones. These processes maintain normal thyroid function. TSH is the most sensitive indicator of thyroid function. Thyroid hormones regulate metabolic process crucial for the normal development and growth, as well as metabolic regulation. Thyroid hormones have direct and indirect actions on the regulation of lipid production, disposal and efflux (Liu and Brent, 2010;Webb, 2010). The thyroid function is closely related to the metabolism of blood lipids, the change in blood lipids in hypothyroidism and hyperthyroidism is usually the opposite. Some studies revealed that hypothyroidism might lead to hyperlipidemia, while hyperthyroidism leads to a decrease in blood lipids (Abdel-Gayoum, 2014).

Asymptomatic patients with raised TSH and normal FT4 concentration are known as subclinical hypothyroid. SCH is mild thyroid disorder if left untreated leads to overt hypothyroidism in many cases. Patients of SCH are mostly asymptomatic or have minimal symptoms. Thus, SCH is solely a laboratory diagnosis (Surks *et al.*, 2004). The incidence of SCH is more common in women than men, almost twice (Canaris *et al.*, 2000). Worldwide prevalence of SCH is found to be 7.5- 8.5% in women and 2.8-4.4% in men (Biondi and Cooper, 2008).

Mild subclinical hypothyroidism (MSCH) means the TSH level is higher than normal range and below 10 mIU/L with normal T3, T4. Only severe subclinical hypothyroidism with TSH above 10 mIU/L is considered a risk factor of

hyperlipidemia and cardiovascular disease (Treister-Goltzman *et al.*, 2021). Based on this aspect the aim of this study to showing the effect of dyslipidemia on MSCH.

Aim of study

The aim of this study is showing the relationship between TSH level with each of cholesterol and triglycerides in mild subclinical hypothyroidism (MSCH) with TSH below 10 mIU/L.

CHAPTER TWO

Methodology

Sample collection

The data have been collected from several private laboratories in Erbil city, including King, Millet, Razi and Med line laboratories with several devices such as Vitik, Cobas 6000, Cobas e 411 and Cobas c 111. 17 male patients with (20-85 ages) and 26 female patients with (9-66 ages) with mild subclinical hypothyroidism (MSHT group). The data includes thyroid function tests (TSH, T3, T4,) and lipid tests such as Triglyceride and Cholesterol.

Statistical analysis

Person correlation analysis was performed for each group of males and females between TSH and each of Triglyceride and Cholesterol. Using Graphpad prism 8 software. *P* value >0.005 considered as significant.

CHAPTER THREE

Results

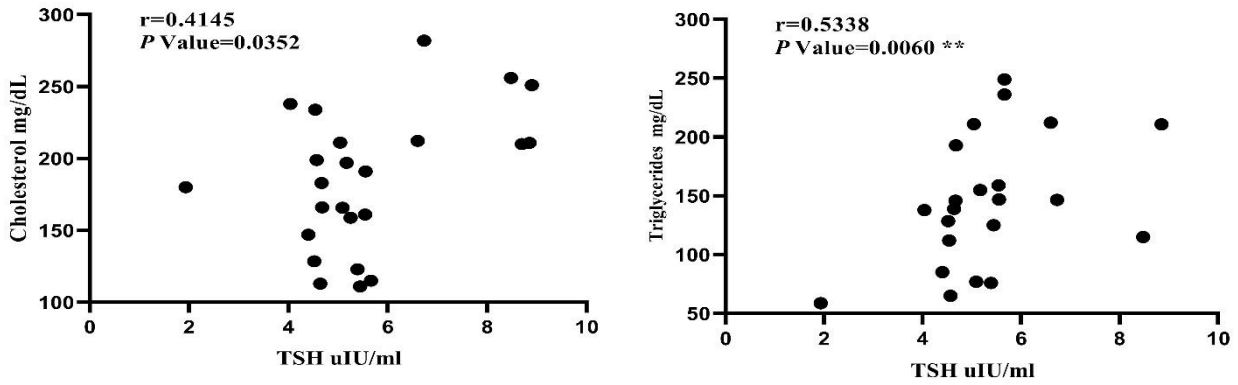


Figure 3.1: Person correlation analysis between TSH with each of Cholesterol and Triglycerides in females with mild subclinical hypothyroidism. P value >0.05 considered as significant.

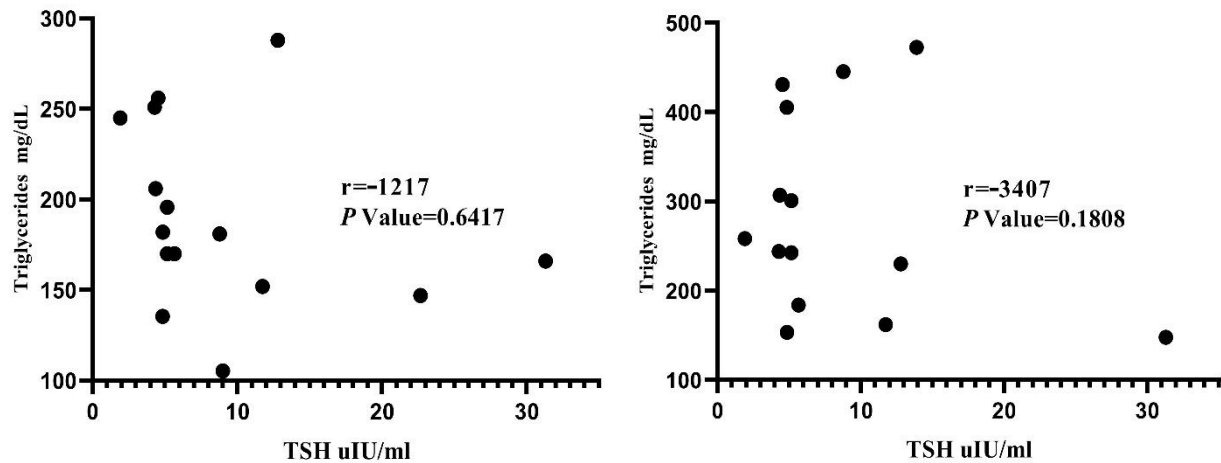


Figure 3.2: Person correlation analysis between TSH with each of Cholesterol and Triglycerides in males with mild subclinical hypothyroidism. P value >0.05 considered as significant.

Our results in this study showing that there is a moderate significant positive correlation between TSH and each of Cholesterol and TG in female patients ($r=0.4145$, P value= 0.0352 and $r=0.5338$, P value= 0.0060) respectively, figure 3.1. While for male patients there were negatively weak non-significant correlation between TSH and each of Cholesterol and TG ($r=-1217$, P value= 0.6417 and $r=-3407$, P value= 0.1808) respectively, figure 3.2.

Discussion

Hypercholesterolemia is the most common lipoprotein change in hypothyroidism., Thyroid hormones have multiple effects on lipid metabolism including synthesis, mobilization, and degradation (Pearce, 2004).Thyroid hormones also increase cholesterol cellular uptake by increasing the expression of the regulatory sterol element binding protein-2 (SREBP-2) with the decrease of thyroid hormone levels, sterol regulatory element-binding protein 2 (SREBP-2)

levels decline followed closely by a drop in LDL receptor mRNA, which caused a decrease in high affinity LDL cholesterol uptake in the liver leading to hypercholesterolemia (Shin and Osborne, 2003; Duntas and Brenta, 2018). These results suggested that hypercholesterolemia in hypothyroidism may be due to the decrease of LDL receptor activity. With 3-hydroxy-3-methylglutaryl-coenzyme (HMG-CoA) as a rate-limiting enzyme of cholesterol synthesis, TSH could reduce the phosphorylation of HMG-CoA via AMP-activated protein kinase (AMPK) in the liver, leading to increased HMG-CoA reductase activity, which increases cholesterol levels in the liver (Zhang *et al.*, 2015), thyroid hormones can stimulate 3-hydroxy-3-methylglutarylcoenzyme A reductase, which is responsible for the key step in cholesterol biosynthesis (Rizos *et al.*, 2011). TSH can also directly upregulate the expression of 3-hydroxy-3-methylglutaryl-coenzyme A reductase (HMGCR) in the liver, thus increasing the cholesterol content in liver and serum of rats after thyroidectomy (Tian *et al.*, 2010). From the above, evidence assume that THs levels, even if they are within normal reference ranges, may be early predictors for the development of dyslipidemia (Gu *et al.*, 2020).

In patients with normal thyroid function and newly diagnosed asymptomatic coronary heart disease, the increased TSH level may have adverse effects on blood lipids and may also be a risk factor for hypercholesterolemia and hypertriglyceridemia (Wanjia *et al.*, 2012).

High TSH level induces the hepatic expression of hydroxy methyl glutaryl coenzyme A reductase, which results in increased cholesterol synthesis (Choi and

Choi, 2000) and Plasma triglycerides are increased because of an enhanced esterification of fatty acids at hepatic level (Pucci *et al.*, 2000)

Conclusions

According to our results and previous studies even in MSCH elevating TSH may lead to increase in level of both serum cholesterol and TG. In this way dyslipidemia may serve as indicator for MSCH.

Recommendations

More studies required with taking more data for both males and females, measuring other lipid parameters.

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