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Subclinical Hypothyroidism: Biochemical and Molecular Cardiovascular Disease Risks

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Abstract:
This research aims to find biochemical and molecular indicators of subclinical hypothyroidism that may be used to diagnose cardiovascular disease at an early stage. To determine which biochemical and molecular indicators are most useful for the early diagnosis of cardiovascular disease in people with subclinical hypothyroidism, a case-control research design was used in the current investigation. Results suggest that the mean CBMN frequency was higher in men than in women, and that the mean MN frequency was higher in those with lower HDL-C.

1. Introduction:

Subclinical hypothyroidism, also known as SCH, is a condition that is distinguished by increased amounts of thyroid-stimulating hormone (TSH) but normal levels of thyroid hormone. It is estimated that between 4% and 20% of adults are affected, with a greater frequency seen in those over the age of 65 and in females. SCH has been linked to an increased risk of cardiovascular disease (CVD) as well as death [1], despite the fact that it often does not manifest any symptoms.

There is a lack of complete comprehension about the processes that underlie the link between SCH and CVD. However, the findings of a number of researches point to the possibility that SCH may raise the risk of CVD by contributing to the development of atherosclerosis, elevating blood pressure, and reducing endothelial function. In addition, it has been shown that SCH is connected to established risk factors for cardiovascular disease (CVD), such as dyslipidemia, insulin resistance, and obesity [2].

The elevated risk of cardiovascular disease (CVD) that is related with SCH may be caused by biochemical and molecular processes. For instance, it has been shown that SCH raises blood levels of low-density lipoprotein cholesterol (LDL-C), which is a significant factor in the progression of atherosclerosis. In addition, SCH has the potential to inhibit the generation of nitric oxide as well as its function, which is a molecule that controls the tone of the blood vessels and the function of the endothelium [3].

According to the findings of several molecular investigations, SCH could be able to change the expression of genes that are involved in lipid metabolism, inflammation, and oxidative stress [4]. For example, it has been shown that SCH may upregulate the production of pro-inflammatory cytokines and induce oxidative stress, both of which may contribute to the development of atherosclerosis and cardiovascular disease [5].

SCH is a very common disorder that has been linked to an elevated risk of cardiovascular disease (CVD). The processes [6] that are responsible for this connection are complicated. They include biochemical and molecular pathways that may cause atherosclerosis, decrease endothelial function, and affect the expression of genes that are involved in lipid metabolism, inflammation, and oxidative stress. Additional study is required to completely understand the processes that are responsible for the elevated risk

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of CVD that is associated with SCH and to create effective ways to prevent and cure CVD in persons who have SCH [7, 8].

Subclinical hypothyroidism

Subclinical hypothyroidism, also known as SCH, is a disease in which the thyroid gland produces an inadequate quantity of thyroid hormone; nevertheless, the patient does not display any overt symptoms of hypothyroidism. Subclinical hypothyroidism may be treated by increasing the patient's dosage of thyroid hormone. While the levels of thyroid hormones (T3 and T4) are within the normal range in patients with SCH, the levels of thyroid-stimulating hormone (TSH) in the blood are high in this condition. When TSH levels stay continuously high (>4.0 mIU/L) for a period of many months, while T4 levels remain within the reference range, a diagnosis of SCH is made.

Although the incidence of SCH varies widely based on factors such as age, gender, and geography, it is believed that anywhere from 4% to 20% of adults are affected by the condition. Women, those of advanced age, and those with a family history of autoimmune illnesses or thyroid disease are more likely to be diagnosed with SCH.

SCH is often asymptomatic and may not need treatment right away because of this. Nevertheless, research has revealed that SCH may be related with an elevated risk of cardiovascular disease (CVD), especially in those whose TSH levels are >10 mIU/L. The processes that underlie this relationship are complicated. They include biochemical and molecular pathways that may increase atherosclerosis, decrease endothelial function, and affect the expression of genes involved in lipid metabolism, inflammation, and oxidative stress. These effects may have a negative impact on cardiovascular health [3].

The most effective way to control SCH is still a contentious topic. It is possible that L-T4 medication will reduce the risk of cardiovascular disease in people who have SCH; nevertheless, the potential hazards and benefits of treatment should be carefully examined in each individual patient before beginning treatment. It is also suggested that patients who have SCH have their thyroid function and cardiovascular risk factors monitored on a regular basis [5].

Review of Literature

In a randomised, crossover experiment conducted in 2007, Razvi S, et al. evaluated the effects of levothyroxine (L-T4) medication on cardiovascular risk factors, endothelial function, and quality of life in people who had SCH. L-T4 therapy resulted in substantial improvements in LDL-C, endothelial function, and quality of life compared to placebo treatment, indicating that L-T4 may have favourable effects on CVD risks in persons who have SCH [9]. The research indicated that L-T4 treatment resulted in considerable improvements in endothelial function.

In their research on older persons, Gussekloo et al. (2004) investigated whether or not there was a correlation between the presence or absence of thyroid disease and disability, cognitive function, and survival. According to the findings of the research, SCH was related with an increased risk of death, as well as an increased risk of disability and cognitive impairment. These results imply that SCH may have a detrimental impact on several areas of older persons' health [10].

Rodondi et al., (2010) The connection between SCH and the risk of coronary heart disease (CHD) and death was explored in this large-scale prospective cohort investigation. According to the findings of the research, SCH was connected to a somewhat elevated risk of CHD as well as death, especially in those whose TSH levels were more than 10 mI/L. However, the research [11] did not discover any evidence of a substantial link between SCH and the risk of having a stroke or developing heart failure.

This review paper by Biondi and Cooper (2008) offers a detailed assessment of the clinical relevance of SCH and its relationship with a variety of health outcomes, including risks of CVD. In this article, the possible processes that underlie the relationship between SCH and the risks of CVD, as well as the issues surrounding the diagnosis and management of SCH, are discussed [12].

In general, the scientific literature shows that SCH may be related with an increased risk of cardiovascular disease and death, in especially in those whose TSH levels are more than 10 mI/L. On the other hand, the processes that underlie this relationship are difficult to comprehend in their

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entirety due to their complexity. It is possible that L-T4 medication will have a good impact on the risks of CVD in those who have SCH; nevertheless, the most effective management of SCH is still a contentious topic. The clinical importance of SCH has to be completely understood before appropriate management methods can be developed, and this can only be accomplished by the conduct of more research.

2. Methodology

The patients who had been clinically diagnosed with subclinical hypothyroidism served as the participants, and they were picked from the Hospital in Delhi. In the current investigation, a case-control study design was used to determine the different chemical and molecular biomarkers for the early diagnosis of cardiovascular disease in people with subclinical hypothyroidism. The goal of the study was to find participants who had subclinical hypothyroidism. Every participant who participated in the study, whether they were a test subject or a control subject, filled out a detailed questionnaire that asked about their medical history, family history, and demographic information. It has been established that anthropometric measures such as one's weight, height, and belly circumference may be used to determine one's body mass index and level of obesity. Under sterile conditions, venous blood samples (both with and without anticoagulant in the aliquots) were collected and processed in a laboratory for the purpose of assessing the DNA repair ability and determining the level of somatic DNA damage. After the development of a clot, the remaining blood was transferred to a plain tube, the serum was separated, and biochemical and ELISA tests were performed. The statistical programme SPSS version 16 was used to record and analyze the observations and results obtained from the study.

3. Data analysis and results

The participants in the current study are 125 (representing 60% of the total) and 82 (representing 40% of the total).

Table 1: Study and control subjects Distribution

Category	Study Subjects	Control Subjects
Number	125	82

The participants of the research demonstrated an MDA concentration that was significantly higher than the individuals of the control group according to statistical analysis (Table 2; Figure 2).

Table 2: MDA concentration comparison among study and control subjects

MDA	Study Subjects	Control Subjects
Mean	3.2	1.66
Sd	0.586	0.817
T	15.768	
P	<0.001	

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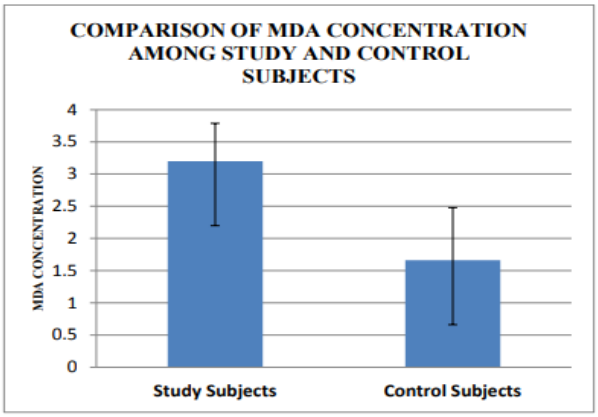

Figure 2: MDA concentration comparison among study and control subjects

In this study, the researchers found that male study participants had a higher mean CBMN frequency compared to female study subjects (Table 3; Figure 3).

Table 3: Emerging Risk comparison markers according to gender

Variables		**Gender**	
Category		Female	Male
MDA		3.22	3.17
PAPP- A		42.37	42.24
NT-	**pro BNP**	133.76	134.02
MEAN	**b/c VALUE**	0.819	0.824
MEAN CBMN	**FREQUENCY**	13.12	13.38

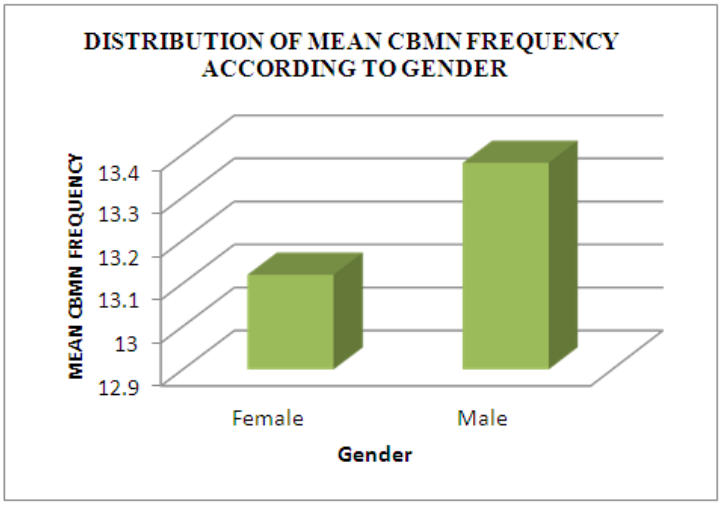

Figure 3: of Mean CBMN Comparison frequency according to gender

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According to the FBS concentration, mean CBMN frequency of study subjects was analyzed. It was observed that, subjects with increased level of FBS showed increased mean CBMN frequency of 13.62 than the rest (Table 4; Figure 4).

Table 4: Emerging risk comparison markers based on fasting blood sugar

	VARIABLES		**FBS**
	CATEGORY	≤110	>110
	MDA	3.1	3.36
	PAPP-A	40.61	44.97
NT-	proBNP	132.06	136.66
MEAN	b/c VALUE	0.815	0.83
MEAN CBMN FREQUENCY		12.96	13.62

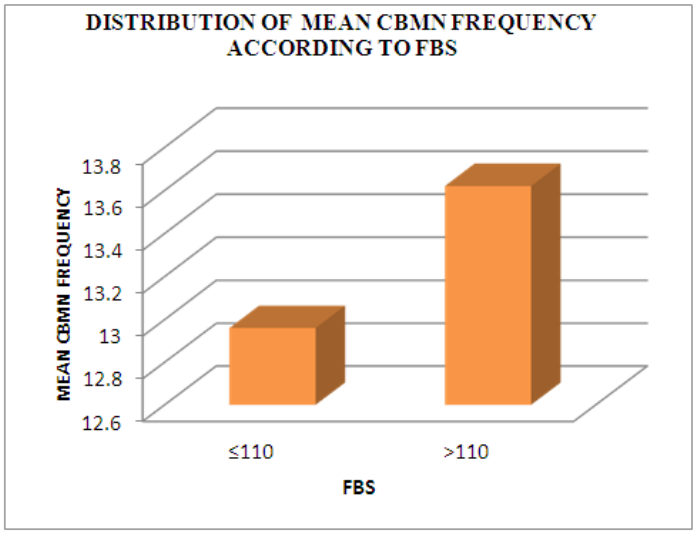

Figure 4: Mean CBMN frequency comparison according toFBS level

It is evident that, subjects withlower HDL-C showed increased mean MN frequency (Table 5; Figure 5).

Table 5: Emerging risk markers comparison based on hdl-c level

	Variables		**HDL-C**
	Category	≤40	>40
	MDA	3.32	3.09
PAPP- A		43.36	41.42

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NT-	proBNP	134.25	133.41
MEAN	b/c VALUE	0.841	0.803
MEAN	CBMN FREQUENCY	13.6	12.88

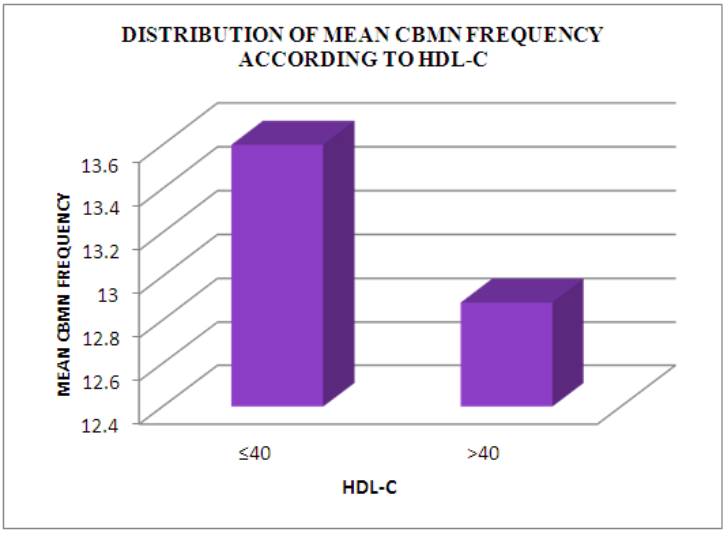

Figure 5: Mean CBMN frequency Comparison according to HDL-C

4. Conclusion:

The disease known as subclinical hypothyroidism (SCH) is rather widespread and affects anywhere between 4 and 20 percent of the adult population. In spite of the fact that SCH is often asymptomatic, it has been linked to an elevated risk of cardiovascular disease (CVD) and death, in particular in those whose TSH levels are more than >10 mIU/L. The processes that underlie this connection are complicated and include biochemical and molecular pathways that may increase atherosclerosis, decrease endothelial function, and affect the expression of genes involved in lipid metabolism, inflammation, and oxidative stress. These mechanisms may also be responsible for the fact that this correlation exists.

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