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Original Research Article

# Spirometry in subclinical hypothyroidism

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ABSTRACT

**Introduction:** Hypothyroidism has been steadily increasing all over the world among all the endocrine dysfunctions. Subclinical hypothyroidism being more common than overt hypothyroidism, affects 3–15% of the adult population. Its incidence increases with advanced age, female gender, and increased dietary iodine intake.

**Aims & Objectives:** To study the Pulmonary Function Tests in a group of newly diagnosed subclinical hypothyroid females and to compare the Pulmonary Function Tests in subclinical hypothyroid females with controls.

**Materials and Methods:** The present study was undertaken in the Department of Physiology, KIMS, Hubballi. Thirty females with newly diagnosed subclinical hypothyroidism, without any pre-existing cardio pulmonary disorders in the age group of 20-40 years, residing in and around Hubballi city served as study subjects. Another group of 30 females, who were similar to study group but healthy persons, were taken from the staff and friends, served as control group. In the present study Lung function data were collected using the ndd EasyOn Spirometer (ndd Medical Technologies, Zurich, Switzerland). Clinical, biochemical & spirometry data were analysed using statistical software, 'Graphpad – Quickcals'.

**Results:** FVC, FEV1, FEV1/FVC, FEF25-75%, and PEF of spirometry showed significant decrease in subjects as compared to controls.

**Conclusion:** In the present study Spirometry changes in subclinical hypothyroidism cases included significant decrease in the parameters like FVC, FEV1, FEV1/FVC, FEF25-75%, and PEF compared to controls. This could be because of muscular dysfunction, fatigue and somnolence which have proved to exist in SCH subjects.



## 1. Introduction

Subclinical Hypothyroidism is highly prevalent in present days and its incidence is rising at a faster rate. Subclinical hypothyroidism is defined as the thyroid state associated with a serum Thyroid stimulating hormone (TSH) concentration above the statistically defined upper limit of the normal reference interval (typically 4.5 – 5.0 mIU/L) and serum free T4 ($fT_4$) and free T3 ($fT_3$) concentrations are within their normal reference intervals.[1]

Large population studies have suggested that the prevalence of subclinical hypothyroidism is much higher in women than men and increases with age. The risk of progression to overt hypothyroidism was found to be 4.3% per year in women with elevated TSH.[2]

Mild respiratory muscle weakness is a common finding in ambulatory patients with either primary or iatrogenic short duration hypothyroidism. This weakness was proportional to the degree of thyroid dysfunction.[3] Thus muscle weakness present in SCH may affect lung functions also.

Very few studies are present in literature about effects of SCH on lung functions. Thus we have made an effort to put light on this topic by studying spirometry in subclinical hypothyroid patients.

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## 2. Aims and Objectives

To study the Pulmonary Function Tests in a group of newly diagnosed subclinical hypothyroid females and to compare the Pulmonary Function Tests in subclinical hypothyroid females with controls.

**Table 1:** Clinical and biochemical data of controls and study subjects

| Parameters | Controls (Mean ± SD) | Subjects (Mean ± SD) |
|---|---|---|
| BMI (kg/m$^2$) | 22.16 ± 1.64 | 22.71 ± 1.99 |
| Heart Rate (bpm) | 76.1 ± 5.11 | 74.03 ± 6.4 |
| SBP (mmHg) | 116 ± 3.79 | 118.26 ± 3.88 |
| DBP (mmHg) | 76.6 ± 3.24 | 75.93 ± 4.01 |
| TSH (mIU/L) | 2.5 ± 0.7 | 7.39 ± 1.49 |
| T3 (ng/ml) | 0.13 ±0.03 | 0.12 ± 0.03 |
| T4 ($\mu$g/dl) | 8.05 ± 1.9 | 7.63 ± 1.78 |

[BMI – Body mass index, SBP- Systolic blood pressure, DBP- Diastolic blood pressure]

## 3. Materials and Methods

The present study was conducted in Karnataka Institute of Medical Sciences (KIMS), Hubballi, Karnataka for a time period of one year from 2016 to 2017. Study group was formed from patients attending KIMS outpatient department with nonspecific complaints such as fatigue, mild weight gain, dry skin and depressive feelings. They underwent routine investigation including thyroid profile. Subjects who were newly diagnosed with SCH and untreated patients were included in the study group. Controls were healthy medical personnel in the same age group as study group.

All the participants were in the age group of 20-40 years and BMI was below 30 kg/m$^2$. None of them were suffering from any known illness or taking any medication. They were non smokers and non alcoholics. Subjects with any physiologic or pathologic condition which affects respiration were excluded from the study.

Institutional ethics committee approved our study. Consent was taken from all the participants in written format. They underwent detailed clinical history and physical examination. Blood samples were collected for thyroid hormone assay and pulmonary function tests were done using simple spirometry.

Thyroid hormones [$fT_3$, $fT_4$ & TSH] concentrations were measured using Roche Cobas E411 Immunology Analyzer, which is designed to detect glow-based chemiluminescent reactions. Lung function tests were done using the ndd EasyOn Spirometer (ndd Medical Technologies, Zurich, Switzerland), which was chosen for its portability and level of accuracy. Subjects with normal $fT_3$ & $fT_4$ with TSH more than 5.0 mIU/L & less than 10 mIU/L were included in SCH group. Controls were with normal $fT_3$, $fT_4$ & TSH levels.

Respiratory parameters like Forced vital capacity (FVC), Forced expiratory volume in 1st second ($FEV_1$), $FEV_1$ /FVC, Peak expiratory flow (PEF), Forced expiratory flow 25%-75% ($FEF_{25-75\%)}$ were measured. They were expressed in liter (L).

Statistical software, 'Graphpad – Quickcals' was used for the statistical analysis. Data were presented as means ± SD. A value of $p < 0.05$ was considered statistically significant.

## 4. Discussion

Research literature reveals that there are many studies on effect of clinical hypothyroidism on different systems but effect of SCH is not much studied. So we have made an effort to analyze the effect of SCH on respiratory system. Spirometric changes are well established in clinical hypothyroidism, which include significant reduction in FVC, $FEV_1$, $FEF_{25\%-75\%,}$ FVC% and DLCO (diffusing capacity of the lungs for carbon monoxide) compared to control group.[4] These changes in clinical hypothyroidism were explained to occur by alveolar hypoventilation secondary to respiratory muscle weakness, depressed respiratory center, limitation of neuromuscular transmission as a result of low FT4, and also decreased lung elasticity and increased work of breathing by Bassi et al.[5]

In the present study we observed that FVC (L), $FEV_1$ (L), $FEF_{25-75\%}$, PEF (L/sec) were significantly reduced in SCH patients compared to controls. Our results were comparable with observations made by Gulfidan Cakmak et al.[6] $FEV_1$ /FVC% did not show significant difference between subjects and controls which was similar to observation made by Lokman Koral et al.[7]

Peak expiratory flow (PEF) was significantly reduced in SCH patients compared to controls. No other studies showed similar observations. Peak expiratory flow is highly dependent on individual effort. It has about twice as much inter-subject and intra subject variability as $FEV_1$.

Reduced physical exercise capacity was documented in SCH patients, which may also contribute to reduced performance during spirometry procedure.[8] Since there were no systemic or respiratory disorders explaining this difference between the participants (controls and subjects), we relate this decrease to subclinical hypothyroidism.

Overweight and obesity complicate the analysis of pulmonary functions in hypothyroid patients.[9] Hence in the present study, the average BMI of the Subjects was 22.71 ± 1.99, which is within the recommended range for their age, sex and gender (Based on NIH/WHO guidelines). And there was no significant difference in terms of the BMI between the SCH subjects and the controls. Hence, the additive effects of obesity on spirometric parameters can be ruled out.

**Table 2:** Comparison of lung function tests in controls and study subjects

| Parameters | Controls (Mean ± SD) (n = 30) | Subjects (Mean ± SD) (n = 30) | 't' Value | 'p' Value | Significance |
|---|---|---|---|---|---|
| FVC (L) | 2.74 ± 0.49 | 2.42 ± 0.37 | 2.887 | 0.005 | HS |
| FEV1 (L) | 2.28 ± 0.43 | 1.93 ± 0.34 | 3.467 | 0.001 | HS |
| FEV1/FVC% | 82.76 ± 4.25 | 80.29 ± 6.11 | 1.822 | 0.0736 | NS |
| FEF 25-75% | 2.76 ± 0.32 | 2.24 ±0.39 | 5.612 | 0.0001 | ES |
| PEF (L/sec) | 5.75 ± 1.05 | 5.06 ± 0.64 | 3.074 | 0.0032 | HS |

[NS – Non significant, HS – Highly significant, ES – Extremely significant]

## 5. Conclusion

The present study concludes that all the parameters of the spirometry like FVC, $FEV_1$, $FEV_1$ /FVC, $FEF_{25-75\%}$, PEF were decreased in subclinical hypothyroidism as compared to the controls. The probable reason for the decrease in the pulmonary functions could be muscular dysfunction both in inspiratory and expiratory muscles, which occurs in subclinical hypothyroidism.

## 6. Source of Funding

None.

## 7. Conflict of Interest

None.

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