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# Impact Of Hypothyroidism On Physical Activity, Cardiac Fitness, Functional Capacity, And Health-Related Quality Of Life: A Brief Review

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***Abstract:*** Hypothyroidism is a common endocrine disorder that affects various physiological systems, including cardiovascular, pulmonary, and musculoskeletal functions. While the clinical symptoms of hypothyroidism are well understood, its effects on physical activity, cardiac fitness, functional capacity, and health-related quality of life (HRQoL) remain less explored. This review aims to evaluate the relationship between physical activity, cardiac fitness, functional capacity, and HRQoL in patients with hypothyroidism. A systematic search of PubMed, Google Scholar, and ResearchGate was conducted, focusing on studies that assessed these outcomes in patients with hypothyroidism. The findings revealed that individuals with hypothyroidism, including those with subclinical hypothyroidism, exhibit significantly lower physical activity levels, cardiorespiratory fitness, and muscle strength compared to healthy controls. Cardiorespiratory function, as measured by VO2 max, was consistently lower in hypothyroid patients. Pulmonary function tests also showed reduced respiratory capacity in hypothyroid individuals. Additionally, hypothyroidism was associated with diminished HRQoL, particularly in areas related to sleep, social isolation, and general well-being. These findings underscore the need for early diagnosis and management of hypothyroidism to mitigate its negative effects on both physical and emotional health. While thyroid hormone replacement therapy may improve some aspects of physical fitness and HRQoL, further research is necessary to explore the long-term benefits of treatment and to identify the most effective strategies for improving the quality of life in this population.

***Keywords*** **- Hypothyroidism, physical activity, cardiac fitness, functional capacity, health-related quality of life**

## I.INTRODUCTION

The thyroid hormone is well known for controlling metabolism, growth, and many other bodily functions. The thyroid gland, anterior pituitary gland, and hypothalamus comprise a self- regulatory circuit called the hypothalamic-pituitary-thyroid axis. The main hormones produced by the thyroid gland are thyroxine, or tetraiodothyronine (T4) and triiodothyronine (T3). Thyrotropin-releasing hormone (TRH) from the hypothalamus, thyroid-stimulating hormone (TSH) from the anterior pituitary gland, and T4 work in synchronous harmony to maintain proper feedback mechanisms and homeostasis. The thyroid hormone is well known for controlling metabolism, growth, and many other bodily functions. The thyroid gland, anterior pituitary gland, and hypothalamus comprise a self- regulatory circuit called the hypothalamic-pituitary-thyroid axis. The main hormones produced by the thyroid gland are thyroxine, or tetraiodothyronine (T4) and triiodothyronine (T3). Thyrotropin-releasing hormone (TRH) from the hypothalamus, thyroid-stimulating hormone (TSH) from the anterior pituitary gland, and T4 work in synchronous harmony to maintain proper feedback mechanisms and homeostasis. Hypothyroidism can be

classified as primary (due to thyroid hormone deficiency), secondary (due to TSH deficiency), tertiary (due to thyrotropin-releasing hormone deficiency), and peripheral (extra-thyroidal; panel).[1]
The most common symptoms of hypothyroidism in adults are fatigue, lethargy, cold intolerance, weight gain, constipation, change in voice, and dry skin, but the clinical presentation can include a wide variety of symptoms that differ with age, sex, and time between onset and diagnosis.[2]

Hypothyroidism affects respiratory muscle strength, and this weakness is linearly related to thyroid hormone levels. Respiratory muscle weakness is present in both the inspiratory and expiratory muscles. In healthy adults, a study by Padkao T. and Boonla O. (2020) on relationships between respiratory muscle strength, chest wall expansion, and functional capacity in healthy non-smokers has said that in healthy adults, respiratory muscle strength is proportional to functional capacity, so in the present study, functional capacity will be evaluated.[3]

The prevalence of overt hypothyroidism in the general population varies between 0–3% and 3– 7% in the USA and between 0–2% and 5–3% in Europe, depending on the definition used. A meta-analysis of studies across nine European countries estimated the prevalence of undiagnosed hypothyroidism, including both overt and mild cases, at around 5%.[4] Differences in iodine status affect the prevalence of hypothyroidism, which occurs more frequently both in populations with a relatively high iodine intake and in severely iodine-deficient populations.[5]

## II. METHODS

Studies are searched from the following search engines PubMed, Google scholar, and ResearchGate to review the literature. Studies include physical activity, cardiac fitness, functional capacity, HRQoL and hypothyroidism.

| | Author, Journal, Year | Design & characteristics of participants' sample size | Materials & Method | Outcome Measures | Results |
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| 1 | Tanriverdi et al. 2018[6] | A Cross-sectional study include 60 women<br>32 women with newly diagnosed subclinical hypothyroidism (SCH)<br>28 healthy women (controls) | Physical activity monitor (SenseWear® Armband), pulse wave velocity (PWV) for arterial stiffness, dynamometer for handgrip and quadriceps muscle strength.<br>Participants wore a physical activity monitor for 4 consecutive days.<br>Handgrip and quadriceps muscle strength were assessed by dynamometer, and functional exercise capacity was evaluated using the 6-minute walk test (6MWT).<br>Neuromuscular symptoms were recorded. | Physical activity levels (PALs), arterial stiffness (PWV), muscle strength (handgrip and quadriceps), and 6MWT performance. | Women with SCH had significantly lower physical activity duration and number of steps than the control group (P<0.05).<br><br>□ Arterial stiffness (PWV) was significantly higher in the SCH group (P=0.006).<br>□ Women with SCH had significantly lower handgrip and quadriceps muscle strength, more neuromuscular symptoms, and shorter 6MWT distances compared to healthy controls (P<0.05). |

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| 2 | Pawaria et al. 2018[7] | Observational study design<br>60 subjects aged 30-40 years<br>Group I: 30 subjects with hypothyroidism<br>Group II: 30 euthyroid (healthy) subjects | Harvard step test equipment to evaluate VO2 max, tools for measuring height and weight for BMI calculations.<br>BMI was calculated using the height and weight of participants.<br>Cardio-respiratory fitness was measured by evaluating the VO2 max through the Harvard step test. | VO2 max (Cardio-respiratory fitness level) | There was a statistically significant difference ($p<0.01$) in cardio-respiratory fitness between the two groups.<br>Hypothyroid group: VO2 max = 36.19 ± 3.55<br>Euthyroid group: VO2 max = 45.76 ± 2.912<br>Cardio-respiratory fitness was significantly lower in the hypothyroid group compared to the euthyroid group. |
| 3 | Roel et al. 2014[8] | Observational study 42 subjects in total 21 hypothyroid subjects (TSH ≥10 mIU/L) aged between 18-52 years<br>21 healthy controls | Computerized spirometer (HELIOS 401/701, RMS, Chandigarh)<br>Spirometric parameters such as Forced Vital Capacity (FVC), Forced Expiratory Volume in 1 second ($FEV_1$), $FEV_1$/FVC ratio, Forced Expiratory Flow (FEF25-75%), and Peak Expiratory Flow Rate (PEFR) were assessed. | Spirometric parameters: FVC, $FEV_1$, $FEV_1$/FVC, FEF25-75%, PEFR | Hypothyroid subjects showed reduced % predicted values for FVC, $FEV_1$, FEF25-75%, and PEFR compared to controls.<br>A significant reduction was only observed for FVC ($P<0.05$).<br>The $FEV_1$/FVC ratio was significantly higher in hypothyroid subjects than in controls. |
| 4 | Ellegard et al. 2021[9] | A Cohort study<br>414 men and women, aged 39–78 years, from the WHO MONICA project in Gothenburg, Sweden | Instruments Used:<br>Health-related quality of life (HRQoL) measured using multiple tools:<br>Psychological General Well-Being Index (PGWB)<br>Nottingham Health Profile (NHP)<br>Short Form 36 Health | Health-related quality of life (HRQoL) across various domains including sleep, social isolation, and general well-being. | Hypothyroid subjects had worse HRQoL than controls, particularly in:<br>Sleep ($p < .001$)<br>Social isolation ($p = .01$)<br>Total NHP score ($p < .05$) |

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| | | | Survey (SF-36)<br>A single-item self-rated health scale (0–100)<br>Stress rating scale (1–6)<br>□ Adjustment Factors: Results were adjusted for age, sex, and comorbidity using analysis of covariance (ANOVA). | | |
| 5 | Udovcic et al. 2017[10] | This is a review article summarizing findings from various studies | This article is a literature review focusing on the effects of hypothyroidism on the cardiovascular system.<br>The review compiled and analyzed data from clinical studies to assess the relationship between hypothyroidism and heart function. | The impact of hypothyroidism on cardiovascular health, specifically looking at:<br>Lipid metabolism<br>Blood pressure regulation<br>Heart rate<br>Left ventricular function | Hypothyroidism is associated with:<br>Increased risk of cardiovascular diseases such as atherosclerosis and hypertension due to altered lipid metabolism.<br>Bradycardia (slower heart rate), reduced cardiac output, and diastolic dysfunction due to decreased thyroid hormone levels.<br>Increased peripheral vascular resistance, which raises blood pressure.<br>The effects of hypothyroidism on the heart can often be reversed with appropriate thyroid hormone replacement therapy (e.g., levothyroxine). |
| 6 | Padkao T, et al. 2020 [3] | A cross sectional study include<br>□ 76 healthy male and female nonsmokers.<br>□ Aged between 20 and 59 years.<br>□ Body mass index (BMI) ranging from 18.5 to 22.9 kg/m².<br>□ No respiratory disorders or other health issues that might influence the results. | □ Respiratory Muscle Strength:<br>Inspiratory Muscle Strength (MIP): Measured using maximum inspiratory pressure.<br>Expiratory Muscle Strength (MEP): Measured using maximum expiratory pressure.<br>□ Chest Wall Expansion Measurement: Thoracic Circumferences: Measured at three thoracic levels: upper, middle, and lower levels.<br>Diaphragmatic Movement: | Correlation of Respiratory Muscle Strength with:<br>Chest wall expansion (upper, middle, and lower thoracic levels).<br>Diaphragmatic movement.<br>Functional capacity (measured by 6MWT distance). | Significant Correlation Between:<br>Both MIP and MEP with chest wall expansion at the middle thoracic level ($P = 0.005$ and $P = 0.006$, respectively) and the lower thoracic level ($P = 0.012$ and $P = 0.020$, respectively).<br>MIP and MEP with diaphragmatic movement (both $P < 0.001$).<br>MIP and MEP with 6MWT distance ($P = 0.025$ and $P < 0.001$, respectively).<br>Respiratory Muscle Strength (both inspiratory and expiratory) is positively associated with chest wall expansion, diaphragmatic movement, and functional capacity in |

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| | | | Measured using the circumference at the lower edge of the 10th rib.<br>□ Functional Capacity: 6-Minute Walk Test (6MWT):<br>Used to evaluate functional capacity by recording the distance participants walked in 6 minutes. | | healthy participants. |

## III. DISCUSSION

To the best of our knowledge, this review is among the first to comprehensively evaluate the relationship between physical activity levels, cardiac fitness, functional capacity, and health-related quality of life (HRQoL) in patients with hypothyroidism. Each of the studies included in this review assessed the connection between decreased physical fitness, reduced functional capacity, and the overall decline in HRQoL in hypothyroid patients. Studies such as [3,6,7,8,9,] have utilized various assessment tools, such as the 6-minute walk test (6MWT) for functional capacity and questionnaires specific to HRQoL. While some research has examined the impact of hypothyroidism on physical activity and HRQoL in a single study, others have addressed these factors separately.

The findings of these studies underscore the need for further research to directly explore the impact of hypothyroidism on both physical and emotional well-being, as well as the mechanisms underlying these relationships. Future studies could provide valuable insights into how improving physical fitness and addressing the functional limitations in hypothyroid patients could lead to enhanced quality of life outcomes.

## IV. CONCLUSION

The findings from the reviewed studies show that hypothyroidism has a wide-ranging impact on physical activity, heart and lung fitness, and overall quality of life. Even in its early stages, hypothyroidism leads to weaker muscles, reduced heart and lung fitness, and lower quality of life compared to healthy individuals. These problems highlight the importance of diagnosing and treating hypothyroidism early to reduce its negative effects on both physical and emotional well-being. Proper thyroid hormone treatment may help bring back normal function and improve quality of life, but more studies are needed to understand its long-term effects and the best treatment options.

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## VI. DECLARATIONS

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*Ethical approval: Not required*

## VII. REFERENCES


1. Shahid, M. A., Ashraf, M. A., & Sharma, S. (2023). Physiology, thyroid hormone. *StatPearls Publishing*.
2. Chaker, L., Bianco, A. C., Jonklaas, J., & Peeters, R. P. (2017). Hypothyroidism. *Lancet, 390*(10101), 1550–1562.
3. Padkao, T., & Boonla, O. (2020). Relationships between respiratory muscle strength, chest wall expansion, and functional capacity in healthy nonsmokers. *Journal of Exercise Rehabilitation, 16*(2), 189.
4. Garmendia Madariaga, A., Santos Palacios, S., Guillén-Grima, F., & Galofré, J. C. (2014). The incidence and prevalence of thyroid dysfunction in Europe: A meta-analysis. *Journal of Clinical Endocrinology & Metabolism, 99*(3), 923–931.
5. Teng, W., Shan, Z., Teng, X., et al. (2006). Effect of iodine intake on thyroid diseases in China. *New England Journal of Medicine, 354*(26), 2783–2793.
6. Tanriverdi, A. Y., Ozcan Kahraman, B., Ozsoy, I., Bayraktar, F. I., Ozgen Saydam, B., Acar, S., Ozpelit, E., Akdeniz, B., & Savci, S. (2019). Physical activity in women with subclinical hypothyroidism. *Journal of Endocrinological Investigation, 42*, 779–785.
7. Pawaria, S., Sheetal, K., & Pal, S. (2018). Effects of hypothyroidism on cardio-respiratory fitness. *International Journal of Health Sciences Research, 8*(4), 71–73.
8. Roel, S., Punyabati, O., Prasad, L., Salam, R., Ningshen, K., Shimray, A. J., Sangma, M. A., Hungyo, H., & Devi, A. N. (2014). Assessment of functional lung impairment in hypothyroidism. *IOSR Journal of Dental and Medical Sciences, 13*(9), 4–7.
9. Ellegard, L., Almqvist, M., Andersson, M., Björkelund, C., & Hange, D. (2021). Health-related quality of life in patients with hypothyroidism: A cohort study. *Journal of Clinical Endocrinology & Metabolism, 106*(8), 2397–2406. https://doi.org/10.1210/clinem/dgab209
10. Udovcic, M., Pena, R. H., Patham, B., Tabatabai, L., & Kansara, A. (2017). Hypothyroidism and the heart. *Methodist DeBakey Cardiovascular Journal, 13*(2), 55.