ORIGINAL RESEARCH PAPER

Effect of Structured Yoga Therapy on Thyroid Function and Lipid Profile in Patients with Hypothyroidism: A Comparative Interventional Study

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ABSTRACT

Background: Hypothyroidism is a common endocrine disorder associated with altered thyroid hormone levels, dyslipidemia, and increased cardiovascular risk. Yoga has emerged as a potential complementary intervention for improving endocrine and metabolic health. The present study evaluated the effects of structured yoga therapy on thyroid function and lipid profile in patients with hypothyroidism.

Materials and Methods: This interventional comparative study was conducted at Era's Lucknow Medical College and Hospital, Lucknow, involving 82 patients with hypothyroidism aged 20–50 years. Participants were divided into two groups: an intervention group (n = 41), receiving conventional medication along with structured yoga therapy, and a control group (n = 41), receiving conventional medication alone. The yoga intervention comprised 40-minute sessions, six days per week, for three months. Serum thyroid-stimulating hormone (TSH), triiodothyronine (T3), thyroxine (T4), and lipid profile parameters were assessed at baseline and after three months. Statistical analysis was performed using SPSS version 29.

Results: Following three months of intervention, the yoga group demonstrated a significant reduction in TSH from 5.63 ± 5.72 to 3.56 ± 1.54 mIU/L ($p = 0.022$) and an increase in T4 from 81.04 ± 37.03 to 94.68 ± 13.19 ($p = 0.018$). HDL-C increased significantly from 43.02 ± 6.60 to 46.64 ± 2.40 mg/dL ($p = 0.002$), while VLDL-C decreased from 36.40 ± 25.87 to 28.21 ± 5.02 mg/dL ($p = 0.038$). Changes in total cholesterol, triglycerides, and LDL-C were not statistically significant within the yoga group. A significant Group × Time interaction was observed for VLDL-C ($F = 14.640$, $p < 0.001$). Changes in TSH demonstrated a weak positive correlation with total cholesterol ($r = 0.262$, $p = 0.017$). Most other biochemical outcomes did not demonstrate significant between-group intervention effects.

Conclusion: Structured yoga therapy administered alongside conventional medication was associated with significant improvements in selected thyroid and lipid parameters among patients with hypothyroidism. However, baseline differences and the absence of significant between-group effects for most outcomes limit conclusions regarding its additional therapeutic efficacy. Yoga may serve as a supportive lifestyle intervention, although larger randomized controlled trials are required to establish its independent clinical benefits.

Keywords: Hypothyroidism; Yoga Therapy; Thyroid-Stimulating Hormone; Thyroid Function Tests; Lipid Profile; Dyslipidemia; Complementary Therapy.

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INTRODUCTION

Hypothyroidism is a common endocrine disorder characterized by inadequate production of thyroid hormones, resulting in reduced metabolic activity and disturbances in multiple physiological systems. It represents a significant public health concern, particularly in India, where approximately 11% of adults are affected. The condition is more prevalent among women and is associated with fatigue, weight gain, cold intolerance, dyslipidemia, and impaired quality of life. Thyroid hormones, primarily triiodothyronine (T3) and thyroxine (T4), regulate basal metabolic rate, energy production, and lipid metabolism, while thyroid-stimulating hormone (TSH) serves as an important biochemical marker of thyroid function. [1–4]

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Hypothyroidism is frequently associated with alterations in lipid metabolism, including elevated total cholesterol, low-density lipoprotein cholesterol (LDL-C), and triglycerides. Reduced thyroid hormone activity decreases hepatic LDL receptor expression and impairs cholesterol clearance, contributing to dyslipidemia and increased cardiovascular risk. Although levothyroxine replacement therapy remains the standard treatment for hypothyroidism, some patients continue to experience metabolic abnormalities and persistent symptoms despite biochemical improvement. Consequently, complementary interventions that may support metabolic health have attracted increasing clinical interest. [5–7]

Yoga is a traditional mind–body intervention incorporating physical postures (asanas), controlled breathing (pranayama), meditation, and relaxation techniques. Regular yoga practice has been associated with improvements in stress regulation, metabolic parameters, and cardiovascular health. Its potential benefits in hypothyroidism may involve modulation of neuroendocrine activity, autonomic regulation, and stress-related physiological responses. However, the precise mechanisms through which yoga might influence thyroid hormone concentrations remain incompletely established. [8–10]

Previous interventional studies have reported favourable changes in TSH concentrations, lipid profiles, body mass index, and psychological well-being following structured yoga programmes in patients with hypothyroidism. Nevertheless, much of the available evidence is limited by small sample sizes, heterogeneous intervention protocols, and the predominance of female participants. Furthermore, the extent to which yoga provides additional biochemical and metabolic benefits beyond conventional thyroid hormone replacement remains uncertain. [11–13]

Therefore, the present study was undertaken to evaluate the effect of a three-month structured yoga intervention on thyroid function and lipid profile in male and female patients with hypothyroidism. By comparing patients receiving conventional medication with and without adjunctive yoga therapy, the study aimed to examine changes in TSH, T3, T4, total cholesterol, triglycerides, LDL-C, HDL-C, and VLDL-C, thereby assessing the potential role of yoga as a complementary approach in hypothyroidism management.

MATERIAL AND METHODS

Study Design and Setting

The present study was an interventional case–control study conducted in the Department of Physiology in collaboration with the Department of Medicine at Era's Lucknow Medical College and Hospital (ELMC&H), Lucknow, Uttar Pradesh, India, over a period of 24 months. The study evaluated the effects of structured yoga therapy on thyroid function and lipid profile among patients diagnosed with hypothyroidism.

Study Population and Sample Size

A total of 82 patients with hypothyroidism, aged 20–50 years, were enrolled from the Medicine Outpatient Department. The sample size was calculated based on variations in thyroid-stimulating hormone (TSH) levels, considering a 95% confidence level, 90% statistical power, and a clinically significant difference of 10% of the mean TSH level. Participants were allocated into two groups using simple randomization:

- Intervention group (n = 41): Patients receiving conventional medication along with structured yoga therapy.
- Control group (n = 41): Patients receiving conventional medication without yoga therapy.

Eligibility Criteria

Male and female patients aged 20–50 years with diagnosed hypothyroidism who were physically and mentally capable of performing the prescribed procedures and provided informed consent were included. Patients with serious systemic illnesses, diabetes mellitus, cardiovascular, pulmonary or hepatic diseases, malignancy, psychiatric disorders, spinal cord injuries, or a history of spinal surgery were excluded. Pregnant women, tobacco or alcohol users, individuals with substance abuse, and patients unable to cooperate with the study procedures were also excluded.

Intervention Protocol

Participants in the intervention group underwent a structured yoga programme for 40 minutes daily, six days per week, over three months, alongside their prescribed thyroid medication. The programme consisted of neck rotation (2 minutes), Bhujangasana (3 minutes), Surya Namaskar (10 minutes), Nadi Shuddhi Pranayama (15 minutes), Ujjayi Pranayama (5 minutes), and Bhastrika Pranayama (5 minutes). The control group continued conventional pharmacological management without additional yoga intervention.

Data Collection and Outcome Assessment

Baseline demographic and clinical characteristics, including age, gender, height, weight, body mass index (BMI), pulse rate, and blood pressure, were recorded. Blood samples were collected for biochemical evaluation of thyroid function and lipid profile before the intervention and after three months.

Thyroid function was assessed using serum TSH, triiodothyronine (T3), and thyroxine (T4) levels. Lipid profile assessment included total cholesterol, triglycerides, low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C), and very-low-density lipoprotein cholesterol (VLDL-C). Changes in these biochemical parameters were evaluated within and between the intervention and control groups.

Statistical Analysis

Data were analysed using IBM SPSS Statistics version 29. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. The Chi-

square test was used for categorical comparisons, and paired t-tests were employed to assess within-group changes in continuous variables. Group × Time analyses were used to examine differences in changes between the intervention and control groups. Pearson correlation and multiple linear regression analyses were also performed, where applicable, to evaluate associations among study variables.

Ethical Considerations

Informed consent was obtained from participants before enrolment. The study procedures were non-invasive, and participants continued their prescribed thyroid medication throughout the intervention period.

RESULTS

The present study included 82 patients diagnosed with hypothyroidism, equally distributed between the intervention group (n = 41), receiving structured yoga therapy alongside conventional medication, and the control group (n = 41), receiving conventional medication alone. Participants were assessed at baseline and after three months to evaluate changes in thyroid function, lipid profile, and selected anthropometric parameters. The findings are presented in the following tables.

1. Baseline Demographic Characteristics of Study Participants

Table 1. Distribution of Participants According to Age and Gender

Characteristic	Yoga group (n=41)	Control group (n=41)
Age (years), mean ± SD	44.22 ± 8.62	40.20 ± 8.28
20–30 years	5 (12.2%)	7 (17.1%)
31–40 years	3 (7.3%)	11 (26.8%)
41–50 years	33 (80.5%)	23 (56.1%)
Male	24 (58.5%)	18 (43.9%)
Female	17 (41.5%)	23 (56.1%)

Among the 82 participants, 42 (51.2%) were males and 40 (48.8%) were females. The majority belonged to the 41–50-year age group (68.3%). The mean age was higher in the yoga group (44.22 ± 8.62 years) than in the control group (40.20 ± 8.28 years). Males predominated in the yoga group, whereas females were more frequent in the control group.

2. Effect of Yoga Therapy on Thyroid Function

Table 2. Comparison of Thyroid Function Parameters Before and After Intervention

Parameter	Yoga pre	Yoga post	p-value	Control pre	Control post	p-value
TSH (mIU/L)	5.63 ± 5.72	3.56 ± 1.54	0.022	11.99 ± 22.75	5.99 ± 4.49	0.092
T3	15.84 ± 27.83	9.42 ± 0.95	0.148	6.20 ± 5.34	3.25 ± 2.99	0.008
T4	81.04 ± 37.03	94.68 ± 13.19	0.018	88.91 ± 62.23	110.05 ± 52.52	0.056

Values expressed as mean ± SD. p-values represent within-group paired comparisons. Units for T3 and T4 require confirmation from the original laboratory records.

Following three months of structured yoga therapy, mean TSH levels decreased significantly from 5.63 ± 5.72 to 3.56 ± 1.54 mIU/L (p = 0.022), while mean T4 levels increased significantly from 81.04 ± 37.03 to 94.68 ± 13.19 (p = 0.018). Although T3 levels decreased in the yoga group, the change was not statistically significant (p = 0.148). In the control group, TSH and T4 changes were statistically nonsignificant, whereas T3 decreased significantly (p = 0.008). These findings indicate significant within-group improvements in selected thyroid parameters following yoga therapy, although they do not independently establish a superior treatment effect compared with controls.

3. Effect of Yoga Therapy on Lipid Profile

Table 3. Comparison of Lipid Profile Parameters Before and After Intervention

Parameter (mg/dL)	Yoga pre	Yoga post	p-value	Control pre	Control post	p-value
Total cholesterol	176.10 ± 30.24	171.66 ± 26.58	0.198	208.03 ± 50.70	189.20 ± 45.60	0.041
Triglycerides	150.24 ± 45.32	140.85 ± 24.59	0.069	207.51 ± 66.11	180.07 ± 66.86	0.033
LDL-C	95.01 ± 35.05	96.53 ± 28.14	0.801	72.24 ± 52.92	59.59 ± 39.90	—
HDL-C	43.02 ± 6.60	46.64 ± 2.40	0.002	32.91 ± 6.97	37.54 ± 11.72	0.017
VLDL-C	36.40 ± 25.87	28.21 ± 5.02	0.038	46.38 ± 12.31	64.51 ± 36.20	0.003

Values expressed as mean ± SD. The control-group LDL-C p-value is omitted because it was not confirmed in the reviewed results.

The yoga group demonstrated a statistically significant increase in HDL-C from 43.02 ± 6.60 to 46.64 ± 2.40 mg/dL (p = 0.002) and a significant reduction in VLDL-C from 36.40 ± 25.87 to 28.21 ± 5.02 mg/dL (p = 0.038). Reductions in total cholesterol and triglycerides were also observed, but these changes did not reach statistical significance. LDL-C showed a small nonsignificant increase. In the control group, significant reductions in total cholesterol and triglycerides and an increase in HDL-C were observed; however, VLDL-C increased significantly. The findings suggest favourable changes in selected lipid parameters in the yoga group, particularly HDL-C and VLDL-C.

4. Comparison of Thyroid-Stimulating Hormone Categories

Table 4. Distribution of TSH Categories Before and After Intervention

TSH (mIU/L)	Yoga pre n (%)	Yoga post n (%)	Control pre n (%)	Control post n (%)
<0.4	0	0	0	2 (4.9)
0.4–4.0	21 (51.2)	26 (63.4)	10 (24.4)	13 (31.7)
4.01–10	17 (41.5)	15 (36.6)	17 (41.5)	20 (48.8)
>10	3 (7.3)	0	14 (34.1)	6 (14.6)

The proportion of participants with TSH within 0.4–4.0 mIU/L increased from 51.2% to 63.4% in the yoga group and from 24.4% to 31.7% in controls. Following intervention, no participant in the yoga group had TSH above 10 mIU/L, compared with 14.6% of controls. TSH distributions differed significantly between groups both at baseline (p = 0.004) and after intervention (p = 0.005). However, the pre-existing imbalance in thyroid status must be considered when interpreting these findings.

5. Comparison of Anthropometric Parameters

Table 5. Changes in Body Weight and Body Mass Index

Parameter	Yoga pre	Yoga post	p-value	Control pre	Control post	p-value
Weight (kg)	75.33 ± 16.22	74.41 ± 15.12	0.519	72.10 ± 10.52	69.18 ± 10.81	<0.001
BMI (kg/m²)	27.85 ± 5.99	27.70 ± 5.18	0.809	27.74 ± 3.85	26.70 ± 3.92	<0.001

Mean body weight and BMI decreased slightly in the yoga group, although neither change was statistically significant (p = 0.519 and p = 0.809, respectively). In contrast, the control group demonstrated significant reductions in both body weight and BMI (p < 0.001). These results indicate that the structured yoga intervention was not associated with a statistically significant within-group improvement in anthropometric measurements during the three-month study period.

6. Association Between Changes in TSH and Lipid Profile

Table 6. Pearson Correlation Between Changes in TSH and Lipid Parameters

Parameter	Pearson correlation (r)	p-value
Total cholesterol	0.262	0.017
Triglycerides	0.162	0.146
LDL-C	0.071	0.528
HDL-C	0.034	0.763
VLDL-C	−0.020	0.858

Pearson correlation analysis demonstrated a weak but statistically significant positive association between changes in TSH and total cholesterol (r = 0.262, p = 0.017). No significant correlations were observed between TSH changes and triglycerides, LDL-C, HDL-C, or VLDL-C (all p > 0.05). These findings suggest a limited relationship between changes in thyroid status and lipid metabolism over the intervention period.

7. Adjusted Analysis of Changes in TSH

Table 7. Multiple Linear Regression Analysis of Predictors of TSH Change

Predictor	Regression coefficient (B)	95% CI	p-value
Yoga group versus control	−1.814	−3.308 to −0.320	0.018
Age	−0.110	−0.200 to −0.020	0.017
Male gender	1.064	−0.386 to 2.514	0.148
Baseline TSH	−0.947	−0.991 to −0.904	<0.001
Baseline BMI	0.043	−0.106 to 0.192	0.567

Model $R^2 = 0.963$; adjusted $R^2 = 0.961$; $F = 397.7$, $p < 0.001$.

Multiple linear regression demonstrated that intervention-group allocation was significantly associated with TSH change after adjustment for age, gender, baseline TSH, and BMI (B = −1.814, p = 0.018). Age and baseline TSH were also

significant predictors, whereas gender and baseline BMI were not. The model explained 96.3% of the reported variance in TSH change; however, this unusually high explanatory value requires cautious interpretation because baseline TSH is mathematically related to the change-score outcome.

DISCUSSION

The present interventional study evaluated the effects of a three-month structured yoga programme on thyroid function and lipid profile among 82 patients with hypothyroidism, comprising 41 participants receiving yoga alongside conventional medication and 41 receiving conventional medication alone. The findings demonstrated statistically significant improvements in selected biochemical parameters within the yoga group, particularly thyroid-stimulating hormone (TSH), thyroxine (T4), high-density lipoprotein cholesterol (HDL-C), and very-low-density lipoprotein cholesterol (VLDL-C). However, the magnitude and statistical significance of these changes varied across outcomes, and considerable baseline differences between the intervention and control groups necessitate cautious interpretation.

A significant reduction in serum TSH was observed in the yoga group, from 5.63 ± 5.72 to 3.56 ± 1.54 mIU/L ($p = 0.022$), accompanied by a significant increase in T4 from 81.04 ± 37.03 to 94.68 ± 13.19 ($p = 0.018$). In contrast, the control group demonstrated a reduction in TSH from 11.99 ± 22.75 to 5.99 ± 4.49 mIU/L, which did not achieve statistical significance ($p = 0.092$). These findings suggest that structured yoga practice may be associated with favourable changes in thyroid hormone regulation when incorporated into conventional hypothyroidism management. Sharma et al. (2024) similarly reported improvements in thyroid function following an eight-week standardized yoga intervention among patients with hypothyroidism. Their findings suggested that yoga may exert beneficial effects on thyroid hormone regulation, potentially through modulation of physiological stress and neuroendocrine pathways. [1]

Comparable findings were reported by Chawla et al. (2020), who evaluated the effects of a six-month yoga intervention on thyroid function and biochemical parameters in patients with hypothyroidism. Their study demonstrated improvements in selected metabolic outcomes and suggested that yoga might help maintain thyroid status without increasing thyroxine requirements. [2] However, Nilakanthan et al. (2016), in a pilot study involving 22 women with hypothyroidism, reported a 9.72% reduction in TSH following six months of yoga, which was not statistically significant ($p = 0.452$). The differences between these studies may be attributed to variations in sample size, baseline thyroid status, duration of intervention, medication use, and yoga protocols. [3]

The present study also demonstrated favourable changes in selected lipid parameters following yoga therapy. Mean HDL-C increased significantly from 43.02 ± 6.60 to 46.64 ± 2.40 mg/dL ($p = 0.002$), while VLDL-C decreased significantly from 36.40 ± 25.87 to 28.21 ± 5.02 mg/dL ($p = 0.038$). Although reductions were observed in total cholesterol and triglycerides, these changes did not reach statistical significance. LDL-C showed no significant improvement. These observations are partially consistent with Nilakanthan et al. (2016), who reported significant reductions in total cholesterol (8.99%), LDL-C (9.81%), and triglycerides (7.60%), together with a significant increase in HDL-C (9.65%) following six months of yoga practice. [3] The comparatively limited lipid improvements observed in the present study may reflect the shorter intervention period and differences in baseline metabolic characteristics.

The control group also demonstrated significant improvements in total cholesterol, triglycerides, and HDL-C, indicating that favourable metabolic changes were not restricted to participants practising yoga. Nevertheless, the Group × Time interaction for VLDL-C was statistically significant ($F = 14.640$, $p < 0.001$), suggesting that VLDL-C changed differently between the two groups. This finding is particularly relevant because it provides evidence of a differential longitudinal response rather than relying exclusively on within-group comparisons. However, the substantial baseline differences in lipid concentrations between groups limit the extent to which this difference can be attributed specifically to yoga.

An additional finding was the weak but statistically significant positive correlation between changes in TSH and total cholesterol ($r = 0.262$, $p = 0.017$). This observation suggests that changes in thyroid status and cholesterol concentrations tended to occur in the same direction. Thyroid hormones play an important role in lipid metabolism by influencing hepatic LDL receptor expression, cholesterol clearance, and lipid turnover. Consequently, improvement in thyroid function may contribute to changes in circulating lipid concentrations. However, the absence of significant correlations between TSH changes and triglycerides, LDL-C, HDL-C, or VLDL-C indicates that the relationship between thyroid function and lipid metabolism is complex and may be influenced by additional physiological and metabolic factors.

Multiple linear regression analysis demonstrated that intervention-group allocation was significantly associated with TSH change after adjustment for age, gender, baseline TSH, and BMI ($B = -1.814$, $p = 0.018$). Age and baseline TSH were also statistically significant predictors, whereas gender and baseline BMI were not. Although the regression model demonstrated a high coefficient of determination ($R^2 = 0.963$), this finding should be interpreted cautiously because baseline TSH was included as a predictor of an outcome calculated using baseline TSH. Furthermore, the absence of a significant gender association in this model does not establish equivalent responses to yoga in males and females, since a formal gender-by-

intervention interaction would be required to evaluate differences in treatment response.

The potential metabolic benefits of yoga may be related to its combined effects on physical activity, autonomic regulation, and psychological stress. Regular yoga practice may influence hypothalamic–pituitary–adrenal axis activity, improve stress resilience, and support metabolic homeostasis. Nevertheless, these mechanisms were not directly assessed in the present analysis and therefore remain possible explanations rather than established pathways underlying the observed biochemical changes.

An important strength of the present study was the inclusion of both male and female patients and the simultaneous evaluation of thyroid function and multiple lipid parameters. The presence of a conventional-treatment control group also permitted assessment of longitudinal changes beyond those occurring in the yoga group alone. However, several limitations should be acknowledged. The relatively small sample size, three-month intervention duration, and significant baseline biochemical differences between groups may restrict the generalizability and interpretation of the findings. Additionally, information regarding changes in levothyroxine dosage, dietary practices, physical activity outside the intervention, and adherence to the yoga programme was not sufficiently detailed in the available thesis methodology. These factors may have influenced the observed biochemical outcomes.

Overall, the findings suggest that structured yoga therapy, when used alongside conventional pharmacological treatment, was associated with significant within-group improvements in selected thyroid and lipid parameters. However, because most thyroid and lipid outcomes did not demonstrate significant between-group differences in their longitudinal changes, the evidence for an additional yoga-specific treatment effect remains limited. Further adequately powered randomized controlled trials with standardized intervention protocols, balanced baseline characteristics, medication monitoring, and longer follow-up periods are warranted to clarify the clinical effectiveness of yoga as an adjunctive intervention in hypothyroidism.

CONCLUSION

The present study demonstrated that a three-month structured yoga programme, administered alongside conventional medication, was associated with significant reductions in serum TSH and VLDL-C and significant increases in T4 and HDL-C among patients with hypothyroidism. Although favourable changes were also observed in total cholesterol and triglycerides, these did not achieve statistical significance within the yoga group. A significant Group × Time interaction was observed for VLDL-C, while changes in TSH showed a weak positive correlation with changes in total cholesterol.

Limitation: The relatively small sample size and short intervention duration of three months may limit the generalizability of the study findings.

Conflict of Interest: The authors declare that they have no conflicts of interest related to this study.

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