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OUTCOME OF SIX MONTHS OF YOGIC PRACTICES ON PSYCHOLOGICAL PARAMETERS IN PATIENTS SUFFERING FROM HYPOTHYROIDISM

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ABSTRACT

Aim: To see the effect of Yoga on thyroid function tests, quality of life [WHO-QOL-BREF (WHO quality of life Brief version)], depression [BDI-II (Beck Depression Inventory)] and quality of sleep [PSQI (Pittsburgh sleep quality index)] at baseline and after 3 and 6 months of intervention.

Methods and Material: Out of the 100 hypothyroidism patients recruited, 83 completed the trial (41 in control group and 42 in Yoga group). The control group was given Thyroxine replacement therapy while Yoga group received Yoga along with Thyroxine replacement. Yoga sessions were of 45 minute and were given thrice a week for the first 2 months and twice in a week for the next 4 months.

Results: In Yoga group, significant improvement of quality of life for domain I (Physical) [p=0.001(from baseline to 6th month) and p=0.002 (from 3rd to 6th month)] and domain II (psychological) [p=0.045 (baseline to 3rd month) and p= 0.000 (baseline to 6th month)] was observed. Participants in both groups demonstrated significant improvement ($p \leq 0.001$) in BDI-II score from their baseline values but Yoga group also showed significant improvement when compared to control group after 6 months (p=0.002). At baseline, Global Pittsburgh Sleep (GPS) quality in control group was better (p=0.03) as compared to Yoga group. After intervention therapy improvement was seen in both the groups (In control group p= 0.039 after 3 months and p=0.001 after 6 months, in Yoga group $p \leq 0.001$ after 3 and 6 months). More improvement was seen in the Yoga group as compared to control group (p=0.000 after 3 and 6 months). Individual sleep Component for Sleep duration showed improvement only in Yoga group after 3 months (p= 0.03). Use of sleeping medication component showed significant decrease in control group (p=0.014). A significant increase in fT4 and significant reduction in TSH was observed in both the groups. In Yoga group levels of TSH were found to be in normal physiological range.

Conclusion: Yoga was effective in controlling quality of life in physical and psychological domain, improving sleep quality and reducing depression in hypothyroidism patients.

Clinical Significance: Yoga as an adjunct therapy can be effective in controlling hypothyroidism.

Keywords: Hypothyroidism; Yoga; WHO quality of life(WHO-QOL); Beck Depression Inventory(BDI-II); Pittsburgh sleep quality index (PSQI)

INTRODUCTION:

The thyroid gland controls growth and metabolism of every part of body. Untreated hypothyroidism can cause some additional health problems like joint pain, infertility, heart disease, neurological conditions namely depression, anxiety and forgetfulness, thus affecting the quality of life. It also causes other symptoms e.g. feeling tired, cold intolerance, dry skin, weight gain etc. Despite proper standard T4 therapy, patients still experience decrease in cognitive performance, change of mood and physical status. A range of therapeutic approaches is available for the management of depressive disorders, but many patients opt for complementary therapies due to the adverse effects of medication. In this scenario, it is important to look at lifestyle and environmental factors that may be contributing to low production of thyroid hormone[1]. Mental health problems such as depression, anxiety, stress, and insomnia are among the most common reasons for individuals to seek treatment with complementary therapies such as yoga[2]. Yogic practices reduce stress, anxiety, depression, and chronic pain, improve sleep patterns, and enhance overall well-being and quality of life in cancer patients[3]. Till date such effects have not been studied in hypothyroid patients who are more prone to suffer from depression, poor sleep and reduced quality of life. In this study a natural regime integrating yoga with conventional treatment was planned to assess its therapeutic effects on problems like quality of life, depression and sleep quality in patients with hypothyroidism.

AIMS AND OBJECTIVES

To see the effect of Yoga on thyroid function tests, quality of life [WHO-QOL-BREF (WHO quality of life Brief version)], depression [BDI-II (Beck Depression Inventory)] and quality of sleep [PSQI (Pittsburgh sleep quality index)] at baseline and after 3 and 6 months of intervention.

MATERIALS AND METHODS:

Randomized control trial was carried out at Bapu Nature Cure Hospital and Yogashram, Mayur Vihar Phase 1, Delhi. Duration of the study was two years (March 2017-March 2019). Study was conducted after due approval from the Ethical Committee of Bapu Nature Cure Hospital and Yogashram. Biochemical investigations were carried out at GIPMER, New Delhi.

Subjects and Study design-100 hypothyroidism patients, in the age group 21-65 years, having TSH level >10 mIU/L and satisfying the eligibility criteria as per American Association of Clinical Endocrinologists (AACE), were randomly divided into two Groups of 50 each i.e. Group I (control group) and Group II (Yoga group). Out of 100 patients, 83 completed the trial [41 in control (6 Male 35 Female) and 42 in Yoga group (4 Male 38 Female)]. Written consents were obtained and patients were educated about the disease associated risk factors and benefits of Yoga. At the time of registration, complete clinical history of each patient was recorded. Patients were provided with a daily diary to record the compliance.

Yoga training protocol- The intervention group received Yoga therapy along with Thyroxine. Control group was given only Thyroxine therapy. Parameters were recorded for both the groups at baseline, after 3 months and 6 months.

Participants attended 45 minutes of Yoga training sessions (Table 1) between 6 AM to 9AM. The frequency of sessions were thrice a week for the first 2 months and twice in a week for next 4 months. On days without session, patients were advised to do Yoga at home for 20-25 minutes. The daily adherence was evaluated by analyzing patient diary at the end of every month. In case of any joint inflammation, the movements and postures were modified or omitted. Doses of Thyroxine were modified according to the activity of disease.

Table 1: Details of Yoga module for intervention group

S. No	Practice	Details	Duration
1	*OM* Chanting		3 times
2	Loosening exercises		12 minutes
3	*Suryanamaskara*	12 steps minimum 1 to maximum 4 rounds	8 minutes
4	*Asana* practices	*Simhasan,Saralamatsyasan,Vipareetakarani, Setubhandha, Sahavasana*	15 minutes
5	Bandha	*Jalandharabandha*	
6	Pranayama & kriyas	*Kapalabhati* (30 to 60 strokes) *Ujjayi* (10 breaths) *Naadishodhana* (10 rounds) *Surya anulomaviloma*(20 breaths) *Chandra anulomaviloma*(20breaths)	10 minutes
7	*OM* chanting		3 times
Total Time			45 Minutes

The method of selection of specific yoga and *asanas* was based on literature reports where study was designed to see effect of Yoga and *asanas* on hypothyroid patients as per Table 2

Table 2: Studies on Effect of Yoga on thyroid function

S. No	Study and Trail design	Samples	Yoga asanas	Outcomes
1	Swami et al.[4] Study to see any effect on respiratory functions in hypothyroid patients after Pranayamas (yoga). Control group consisted of healthy volunteers.	20 hypothyroid females	Kapalbathi 10 min Bhastrika 5 min Ujjai 7-11 times (3-5 min) Anulom vilom 15 min OM chanting 5-7 times (3-5 min) Bhramri 5-7 times (3-5 min)	1. Significant decrease of all Pulmonary function test parameters in hypothyroid patient (pre-yoga group) as compared to normal controls. 2. Decrease in TSH.

2	Bhavnani et al. [5] Case study Yoga intervention for 1 year	36 year old female with sub-clinical hypothyroid-ism and posi-tive Anti- TPO	Surya namaskara, Jaland-harabandha, Viparitkarni¸ Brahmamudra. trikoasana, vakra, ardha mat-syendra, pawanamukta and sarvagasana, suryannadi, pranava, ujj¡yi and bhr¡mari pranayama and shavasana	1. Decrease in TSH to normal range. 2. Normaliza-tion of fT4.
3	3 Gordon et al.[6] Prospective ran-domized study consisted of 33 ESRD patients in the Hatha yoga exercise group who were matched with 35 ESRD pa-tients in the con-trol group.	33 end-stage renal disease patients on haemodialysis in the Hatha yoga exercise group who were matched with 35 ESRD patients in the control group.	Pranayama (breath-control exercises) Asanas (yogic postures) Savasana	1. Significant decrease in TSH level, a signifi-cant increase of FT4.
4	Sharma et al. [7]	20 subjects with hypothy-roidism di-vided into 2 groups (Con-trol and Yoga). Yoga ther-apy was given for a period of 3 months,	35 different asanas per-formed	1. Significant decrease in T3, T4. 2. Significant increase in TSH
5	Savitri et al. [8] Study the effect of 6 months yoga practice on lipid profile, thyroxine requirement and serum TSH in women suffering from hypothy-roidism.	Twenty-two household women with hpothyroidism . Thyroxine dosage was constant	1.Sukshma Vyayama, 2.Suryanamaskar 6 sets fol-lowed by deep relaxation techniques (DRT) 3.Mind, sound resonance technique /cyclic meditation [once in a week 4.Balancing postures (Baka-sana, Vrikshasana, Sirsasana, Natarajasana, Ujjayi pranayama, Ardha Matsyen-drasana twist, Vashishtasana twist, Ardha Padmasana	1 .No significant reduction in TSH. 2.Significant reduction in to-tal cholesterol , LDL and triglycerides and significant in-crease in HDL. 3.Significant

			twist, Bhujangasana, Shalabhasana, Dhanurasana, Halasana, Matsyasana, Simha Mudra, Shashankasana) 5.Pranayama and Kriyas Nadi Shuddhi pranayama, Vibhagya pranayama, Bhastrika, Kapalabhati, Bhramri, Ujjayi pranayama	reduction in thyroxine medication score.
6	Chaturvedi et al.[9] Study the effect of Hatha yoga therapy and regular physical exercise on the Fasting Blood Sugar (FBS), Glycated Haemoglobin (GHB), Thyroid Stimulating Hormone (TSH), serum cortisol and total plasma thiol levels in perimenopausal women.	216 women with perimenopausal symptoms 111 in test group (Hatha yoga) and 105 in control group (physical exercise). The duration of intervention was 45 minutes every day for 12 weeks. Mean TSH was normal pre intervention.	Swastikasana - 2 min Vajrasana - 2 min Suptavajrasana - 2 min Tadasana - 2 min Trikonasana - 2 min Parsvakonasana - 2 min Paschimottasana - 2 min Purvatanasana - 2 min Janushirshana - 2 min Pavanamuktaasana - 2 min Bhujangasana - 2 min Shalabhasana - 2 min Dhanurasana - 2 min Vakrasana - 2 min Padottanasana - 2 min Shavasana - 5 min Pranayama Anuloma-viloma - 5 min Suryabhedana - 5 min Sheetali - 2 min Bhramari - 2 min	No change in TSH. Decres FBS and HbA1c, Incresae in cortisol.
7	Prajapati et al.[10]	II participants (9 females, 2 males)	Anulom Vilom, Kapalbhati and Pranayam for 2 weeks.	Lowering of TSH
8	Swathi et al. [11] Case study	A 50-year-old male participant diagnosed with Metabolic Syndrome (MetS) [obesity, Type-2 diabetes mellitus, hypertension] and hypothy-	Yoga Practices : Loosening practices Suryanamaskara Ardha chakrasana, Ardhakati Chakrasana, Padahastasana Ardha Machendrasana, Vakrasana Navasana, Parivrtta Trikonasana Pranayama (Kapalabhati, Surya anuloma, Vibhagiya pranayama)	Reduction in weight, BMI, Lipid profile, FBS. PP and TSH

		roidism		
9	Kumar et al. [12] Case Study	A 46 yrs old women diagnosed of Hypothyroidism	Saravangasana,(Halasana, Matsyasana, Ustrasana, Bhujangasana,Sethubandhasana, Dhanurasana Ujjayi pranayama	Reduction in TSH

Estimations

Thyroid profile: Thyroid function tests were performed using Roche CLIA-cobas-e411 analyzer.

Psychological assessments- Pittsburgh Sleep Quality Index (PSQI) – A self report questionnaire was used to measure the quality and patterns of sleep. It has 19 items creating 7 components which produce one Global Pittsburgh Sleep (GPS) quality score (Table 3). It differentiates poor from good sleep by measuring seven areas over the last one month[13]. Improvement in QOS was observed through reduction in PSQI score.

Table 3: Nomenclature for components for PSQI

Components for PSQI	Nomenclature (measured on 0-3 interval scale)
Com_1	Subjective sleep quality
Com_2	Sleep latency
Com_3	Sleep duration
Com_4	Habitual sleep efficiency
Com_5	Sleep disturbances
Com_6	Use of sleeping medication
Com_7	Daytime dysfunction
GPS score	Totalling the score of seven components i.e.0-21(higher scores denote less sleep)

Beck Depression Inventory (BDI-II) - A 21 items self-report questionnaire was used to assesses depressive symptoms experienced during the past two weeks[14]. BDI-II items were measured on scale 0 to 3 (higher scores denote more depression). The maximum score was 63.

WHO- Quality of Life-in brief (WHO-QOL-BREF) - was used for assessment of an individual's perception of QOL[15]. It comprises of 26 items which are measured in the four broad domains (Table 4).

Table 4: WHO-QOL-BREF domains and their area for perception

WHO-QOL-BREF DOMAINS	Area for perception of QOL
DOMAIN-I	Physical health
DOMAIN-II	Psychological health
DOMAIN-IIII	Social relationships
DOMAIN-IV	Environment

The range of score is 4–20 for each domain. Improvement in QOL was observed through improvement in the score.

Data processing and analysis- The data was analyzed using SPSS16 software. The statistical significance was considered at $p<0.05$ levels for all the parameters and the values were expressed as mean ± SD.

OBSERVATIONS AND RESULTS: At baseline there was no significant differ-

ence in BDI-II and WHO- BREF between the two groups but Global PSQI score of Yoga patients was significantly more than control group (p=0.03) (Table 5).

Table 5: Baseline comparison of Control (Group I), Yoga (Group II) groups for psychological parameters.

	Group I	Group II	P value
BDI-II	12.93 ± 7.85	12.69±8.00	0.89
Global PSQI	7.54±0.58	7.79±0.48	0.03*
WHO-QOL			
Domain-I	12.10±1.79	12.45±1.84	0.38
Domain-II	12.80±2.48	13.45±2.36	0.22
Domain-III	13.10±3.75	14.10 ± 2.16	0.14
Domain-IV	12.44±2.47	13.43±2.14	0.054

* p≤0.05, ** p≤0.01, *** p≤0.001

In both the groups, a significant improvement in BDI-II score for depression was observed (p≤0.001) (Table 6).

Table 6 : Effect of intervention therapy on depression as per BDI-II score within Control (group I) and Yoga(Group II) group

Parameter	Group	Baseline	3rd Month	6th month	RM ANOVA	
		Mean+SD	Mean+SD	Mean+SD	F-stat	P-Value
BDI – II	Control	12.93±7.85	10.07±9.52	8.70±7.53	7.60	0.001***
	Yoga	12.69±8.00	9.38±9.08	4.29±4.95	19.82	0.000***

* p≤0.05, ** p≤0.01, *** p≤0.001

Table 7 shows that at baseline and at 3rd month there was no significant change in depression between control and Yoga group. After 6 months, Yoga group showed significant decrease as compared to control group (p=0.002).

Table 7 : Effect of intervention therapy on depression as per BDI-II score between Control (group I) and Yoga(Group II) group

Parameter	Group I	Group II	P value
Baseline	12.93 ± 7.85	12.69±8.00	0.89
BDI-II (3month)	10.07±9.52	9.38±9.08	0.74
BDI-II (6month)	8.70±7.53	4.29±4.95	0.002**

* p≤0.05, ** p≤0.01, *** p≤0.001

For sleep, a significant improvement in global PSQI (GPSQI) score was observed in both the groups (p≤0.001). Analysis of individual components of PSQI shows significant improvement of component 1, 5 and 7 in both groups. Component 6 showed significant improvement in control group (p=0.014) and component 3 (p=0.030) showed significant improvement in Yoga group (Table 8).

Table 8: Effect of Yoga therapy on sleep as per PSQI score (component wise and Global PSQI score) in Control (group I) and Yoga(Group II) group

Group	Baseline	3rd Month	6th Month	Baseline vs. 3rd month		Baseline vs. 6th month	
				Z-Stat	P-Value	Z-Stat	P-Value

Group I							
Com_1 Subjective sleep quality	1.39	1.10	0.98	1.75	0.080	2.23	0.026*
Com_2 Sleep latency	1.54	1.39	1.32	0.66	0.504	0.88	0.382
Com_3 Sleep duration	1.37	1.32	1.05	-0.05	0.964	1.68	0.093
Com_4 sleep efficiency	0.51	0.51	0.29	-0.48	0.633	1.02	0.306
Com_5 Sleep disturbances	1.32	1.10	0.90	0.98	0.326	2.05	0.041*
Com_6 Use of sleeping medication	0.61	0.27	0.20	1.46	0.145	2.45	0.014*
Com_7 Daytime dysfunction	0.80	0.24	0.29	3.68	0.001**	3.25	0.001**
GPS	7.54±0.58	5.93±0.57	5.02±0.53	2.07	0.039*	3.34	0.001**
Group II							
Com_1 Subjective sleep quality	1.33	0.98	1.00	2.59	0.009**	2.33	0.020**
Com_2 Sleep latency	1.57	1.19	1.19	1.73	0.084	1.75	0.081
Com_3 Sleep duration	1.40	1.10	1.29	2.17	0.030**	0.71	0.475
Com_4 sleep efficiency	0.62	0.40	0.29	1.35	0.177	1.74	0.083
Com_5 Sleep disturbances	1.57	0.95	0.79	3.37	0.001**	4.31	0.000**
Com_6	0.33	0.17	0.14				

Use of sleeping medication				1.05	0.294	1.44	0.150
Com_7 Daytime dysfunction	0.95	0.60	0.21	1.90	0.04*	4.23	0.000**
GPS	7.79±0.48	5.38±0.54	4.90±0.45	3.54	0.001**	4.24	0.000**

* p≤0.05, ** p≤0.01, *** p≤0.001

At baseline sleep was significantly less (p=0.03) in Yoga group as compared to control group which significantly improved after 3 months(p=0.000) and 6 months (p=0.000) (Table 9).

Table 9: Effect of Yoga therapy on sleep as per Global PSQI score between Control (group I) and Yoga(Group II) group

Parameter	Group I	Group II	P value
PSQI (Baseline)	7.54±0.58	7.79±0.48	0.03*
PSQI (3month)	5.93+0.57	5.38+0.54	0.000**
PSQI (6 month)	5.02+0.53	4.90+0.45	0.000**

* p≤0.05, ** p≤0.01, *** p≤0.001

For quality of life it was observed that Domain 3 and 4 i.e. social and environment behaviour were statistically significant in both the groups but domain 1 and 2 i.e. physical and psychological parameters were statistically significant only in Yoga group (p=0.008 for Domain 1 and p=0.000 for Domain 2) (Table 10).

Table 10: Effect of intervention therapy on quality of life as per WHO-QOL-BREF score in Control (group I) and Yoga(Group II) group.

Domain	Gp	Baseline	3 month	6 month	F- value	p- Value
DOMAIN-I	I	12.10±1.77	12.24±1.71	12.46±1.73	0.742	0.450
	II	12.45±1.84	12.55±1.65	13.45±1.30	6.32	0.008**
DOMAIN-II	I	12.80±2.48	12.63±2.53	13.32±1.96	1.60	0.210
	II	13.45±2.36	14.48±2.62	15.38±2.65	10.80	0.000***
DOMAIN-III	I	13.10±3.75	14.49±2.94	14.39±3.20	3.99	0.028*
	II	14.10±2.16	14.88±2.62	15.33±2.44	3.94	0.027*
DOMAIN-IV	I	12.44±2.47	12.95±2.38	13.39±2.06	3.75	0.028*
	II	13.43±2.14	14.03±2.52	14.88±2.16	7.25	0.001**

* p≤0.05, ** p≤0.01, *** p≤0.001

For depression, Pair wise mean effect between the test intervals using Bonferroni comparison in control group showed that BDI-II score improved significantly from baseline to 3rd month (p=0.029) and baseline to 6th months (p=0.003) (Table 10). For quality of life, Bonferroni comparison in control group, showed significant improvement in WHO-QOL-BREF score for domain III between baseline and 3rd month (p=0.025) and for domain IV between baseline and 6th month (p=0.035) (Table 11).

Table 11: Pair wise mean effect between the test interval using Bonferroni comparison in control Group for BDI-II and WHO-BREF

	Time Interval		Mean Difference	SE	P-Value	95% Confidence Interval for Difference	
						Lower Bound	Upper Bound
BDI-II	Baseline	3rd Month	2.85	1.050	0.029*	0.231	5.477
		6th Month	4.22	1.186	0.003**	1.257	7.182
	3rd Month		1.366	1.07	0.632	-1.316	4.048
WHO-BREF (Domain III)	Baseline	3rd Month	-1.390	0.496	0.025*	-2.63	-0.150
		6th Month	-1.293	0.649	0.160	-2.91	0.329
	3rd Month	6th Month	0.098	0.489	1.0	-1.120	1.316
WHO-BREF (Domain IV)	Baseline	3rd Month	-0.512	0.355	0.469	-1.398	0.347
		6th Month	-0.951	0.359	0.035 *	-1.849	-0.053
	3rd Month	6th Month	-0.439	0.328	0.564	-1.258	0.380

* p≤0.05, ** p≤0.01, *** p≤0.001

Bonferroni analysis for Yoga group showed significant improvement in BDI-II scores between baseline and 6th month (p=0.000) and between 3rd month and 6th month(p=0.004) (Table 11). Bonferroni analysis for Yoga group for WHO-QOL-BREF score showed that for domains I,III and IV, significant improvement was there after 6th month. For domain II (psychological) improvement was observed after 3rd month (p=0.045) (Table 12).

Table 12: Pair wise mean effect between the test interval using Bonferroni comparison in Yoga (Group II) for BDI-II and WHO-BREF

	Time Interval		Mean Difference	SE	P-Value	95% C I for Difference	
						Lower Bound	Upper Bound
BDI-II	Baseline	3rd Month	3.31	1.36	0.6	-0.100	6.719
		6th Month	8.40	1.31	0.000***	5.13	11.675
	3rd Month	6th Month	5.09	1.35	0.004**	0.706	8.48
WHO-	Baseline	3rd Month	-0.100	0.398	1.00	-1.097	0.897

BREF (Domain-I)		6th Month	-1.00	0.263	0.001**	-1.658	-0.342
	3rd Month	6th Month	-0.900	0.245	0.002**	-1.513	-0.287
WHO-BREF (Domain II)	Baseline	3rd Month	-1.025	0.403	0.045*	-2.032	-0.98
		6th Month	-1.925	0.441	0.000***	-3.027	-0.823
	3rd Month	6th Month	-0.900	0.398	0.089	-1.897	-0.97
WHO-BREF (Domain III)	Baseline	3rd Month	-0.775	0.366	0.122	-1.691	0.141
		6th Month	-1.225	0.478	0.043*	-2.422	-0.028
	3rd Month	6th Month	-0.450	0.471	1.00	-1.628	0.728
WHO-BREF (Domain IV)	Baseline	3rd Month	-0.600	0.350	0.284	-1.477	0.277
		6th Month	-1.450	0.410	0.003**	-2.475	-0.425
	3rd Month	6th Month	-0.850	0.385	0.099	-1.813	0.113

*p≤0.05, ** p≤0.01, *** p≤0.001 Patients of both groups matched for Thyroid function tests and there was no statistical difference(Table 13).

Table 13: Baseline levels of Thyroid function tests in Control (group I) and Yoga(Group II) group.

Parameters	Group I	Group II	p-value
fT3 (pg/ml)	2.9±0.44	2.87±0.66	0.73
fT4 (ng/dl)	1.04±0.23	1.02±0.42	0.70
TSH (uIU/ml)	14.53±9.58	16.36±10.05	0.40

* p≤0.05, ** p≤0.01, *** p≤0.001

A significant increase in fT4 levels was observed in both the groups (P=0.001, P=0.004 in control and Yoga groups respectively). Serum TSH concentration showed significant reduction (p= 0.000) after 6th month in both the groups. Levels of TSH only in Yoga group were found to be in normal physiological range (Table 14).

Table 14: Comparison of changes in Thyroid function test in Control Group (I) and Yoga Group (II)

		Baseline	3rd Month	6th Month	RM ANOVA	
Parameters	**Groups**	**Mean ± SD**	**Mean ±SD**	**Mean±SD**	**F-stat**	**P-Value**
fT3 (pg/ml)	I	2.90±0.44	3.01±0.79	2.97±0.42	0.42	0.61
	II	2.87±0.66	3.01±0.43	3.09±0.53	2.60	0.09
fT4 (ng/dl)	I	1.04±0.23	1.18±0.24	1.19±0.25	7.48	0.001**
	II	1.02±0.42	1.20±0.26	1.21±0.23	6.68	0.004***
TSH (uIU/ml)	I	14.53±9.58	7.33±8.35	7.74±8.08	26.38	0.000***
	II	16.36±10.05	5.81±4.83	3.97±3.18	53.71	0.000***

* p≤0.05, ** p≤0.01, *** p≤0.001

DISCUSSION:

In hypothyroidism despite replacement therapy, persistent complaints such as reduced health-related quality of life, reduced daily functioning are common[16]. Yoga offers a unique combination of mild

to moderate physical exercise (*surya-anamaskar and asana*), cleansing process (*kriya*), breathing control (*pranayama*) and meditation (*dhyana*)[17] and studies demonstrate the potential beneficial effects of yoga on depression, stress, and anxiety in alcohol dependent adults[18] and young adults[19]. The present study was undertaken because hypothyroid patients suffer from poor quality of life, sleep disorders and depression and there are hardly any studies of effect of yoga on these parameters.

In our study, it was observed that in Yoga group TSH levels decreased to clinical euthyroid range. Specific yogic poses can stimulate throat area by squeezing and stretching the thyroid gland. Regular practice of *pranayama* and meditation may send positive stimulus to the hypothalamus and pituitary[20].Yoga encourages one to relax, slow the breath and focus on the present life, shifting the balance from the sympathetic nervous system and the flight-or-fight response to the parasympathetic system relaxation response[21]. This decreases blood pressure and increases blood flow to the intestines and vital organs. Thus the practice of yoga generates balanced energy which is vital to the function of the immune system[22].

Hypothyroidism has been found to be associated with sleep disorders like sleep apnoea[23]. Hypothyroid patients in our study had poor sleep quality. This is because thyroid is linked to the adrenal glands and when thyroid is suffering, adrenal glands can become imbalanced and can trigger health issues and results in fatigue and sleep disorders. Yoga, because of its ability to induce a balanced mental state, has been studied to evaluate its possible effects on sleep quality and improving insomnia in patients with lymphoma[24] and in geriatric population[25]. GPSQI score above 5 indicates poor sleep quality[26]. In our study, it was observed that at baseline, the mean GPSQI values in both groups were above the score of 5. After intervention, participants in both groups demonstrated significant improvement in sleep quality within the groups i.e. as compared to its own baseline values (paired group comparison). Comparison with control group showed that at the start of study sleep quality was significantly less in Yoga group which improved significantly after 3 and 6 months as compared to control group.

In the present study, analysis of each components of PSQI showed significant improvement of component 1(subjective sleep quality), 5(sleep disturbances) and 7 (daytime dysfunction) in both the groups. Component 6 (use of sleeping medication) showed significant decrease only in control group. Less usage of sleep medication in control group after 6 months may be because of baseline difference in sleep quality (GPS) of two groups and control group was on higher medication for sleep(score =0.61) as compared to Yoga group (score= 0.33) at the beginning of the study. Component 3(Sleep duration) showed improvement only in Yoga group after 3 months. Study conducted by Ebrahami et al.[27] concluded that Yoga exercise is more effective in improving the sleep quality in comparison to aerobic exercise in Type II diabetic women. Study conducted by Nagendra et al.[28] reported improvement in sleep quality among metastatic breast cancer patients, after 12 weeks of Yoga intervention. Restorative postures, savasana, pranayama, and meditation encourage *pratyahara,* a turning inward of the senses, enabling improved sleep.

Patients with thyroid disorders are more prone to develop depressive symptoms and Myxedema madness is a mental state of patients with hypothyroidism[29]. Thyroid autoimmunity may have a role in the pathogenesis of depression. Stress has been found to have a negative impact on the immune system in numerous diseases[30, 31]. Prolonged stress increases susceptibility to disease and leads to physical and mental health problems such as anxiety and depression[22, 32]. Reason for depression in hypothyroid patients may be that thyroid hormones influence noradrenergic neurotransmission. It is observed that in case of hypothyroidism there is decreased serotonin synthesis in the brain which has an inhibitory effect on thyrotropin-releasing hormone (TRH) [33, 34] .Yoga is recognized as a form of mind-body medicine that integrates an individual's physical, mental and spiritual components to improve aspects of health in normal adults[35]. Results of our study show that the baselines mean BDI-II scores in both groups were within the 11– 16 range which according to the BDI-II interpretation is a mild mood disturbance[36]. In both control and Yoga groups, a significant improvement was observed in BDI-II scores as compared to its own baseline values (paired group comparison). But in Yoga group after 6 months improvement of depression was also observed as compared to control group (unpaired group comparison). Significant reduction in stress, anxiety, and depression was observed in non-athlete and non-pregnant women after 12 sessions of Yoga practice[37]. A study by Vadiraja et al.[38] reported significant decrease in depression, anxiety after 6 weeks of Yoga therapy in early breast cancer patients undergoing adjuvant radiotherapy. Improvement in BDI-II scores in the control group may be attributed to thyroxine replacement because in depressed patients Thyroxine is used as augmentation for patients who respond insufficiently to antidepressant monotherapy[39]. The integrated approach of Yoga including *Pranayam* and meditation, help to manage psychological stress thereby leading to the physical benefits in normal population[40].

In this study, yoga treatment to patients with Hypothyroidism was given to observe their quality of life and it was found that domain III (Social relationships) and domain IV (Environment) were significantly improved in both the groups but domain I (Physical) and domain II (psychological) were statistically significant only in Yoga group. Numerous patients treated for primary hypothyroidism with levothyroxine complain of a reduced quality of life despite serum thyroid hormone levels within the reference range[41, 42] So some form of alternative therapy like Yoga along with allopathic medication, can help to improve psychological symptoms. Improvement in quality of life were found in elderly population[43] in cancer patient[44,45]. A significant improvement in perception of the overall quality of life was observed in 20 female hypothyroid patients, attending one hour yoga sessions daily for a period of one month[46]. Our study was unique as it comprised of large number of hypothyroid patients, given yoga therapy for a longer duration, so as to cure psychological symptoms. Yoga as an adjunct therapy in our study resulted in improved quality of life, better sleep and reduced depression in hypothyroid patients.

CONCLUSION:

Analysis of the outcome revealed that the Yoga was more effective in controlling

quality of life in physical and psychological domains. Global Pittsburgh sleep Quality Index in Yoga patients was better as compared to control group. Analysis of individual sleep components in Yoga group showed longer duration of sleep. Improvement observed in depression was more in Yoga group as compared to control group. So use of Yoga in daily life can help in preventing and treating thyroid gland dysfunction and in attaining better psychological health.

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