

7.1 DESIGN 1

Some of the *yogic* practices and their therapeutical benefits enhance the thyroid gland, liver, and gut functioning. In addition, practicing *yoga* relaxes the body and calms the mind by reducing stress. Regular *yoga* practice offers a balanced lifestyle with a healthy diet (Atkinson & Permuth-Levine, 2009; Kavalayananda, 1993; Raghuram & Nagendra, 2004; Woodyard, 2011). Understanding the anatomical and physiological dynamics of hypothyroidism helped design the *yoga* module for hypothyroidism. The developing *yoga* module intends to choose the appropriate *yogic* technique that helps manage hypothyroid conditions (Chatterjee & Mondal, 2017; Iyengar, 2001; Kavalayananda, 1993; Raghuram & Nagendra, 2004; Raghuram & Hongasandra, 2008). The IAYT program developed to treat or manage hypothyroid conditions includes some of the effective *yogic* techniques that address the hypothyroid condition and related issues at different *kosās*. The module's originality was based on factoring the anatomy, routes, dynamics, and physiology of hypothyroid disorders, as well as recognising appropriate *yogic* approaches by taking into account all *kosās* to handle hypothyroid difficulties holistically (attachment 3.0 and attachment 4.0). There have been a few studies that have validated the *yoga* module for various health conditions, such as caregivers of patients with low back pain (Nitin et al., 2015), schizophrenia (Govindaraj et al., 2016), psychosis (Varambally et al., 2013), cancer (Ram et al., 2012), Obesity (Rathi et al., 2018), depression (Naveen et al., 2013), and obsessive compulsive disorder (Bhat et al., 2016). Each study follows a different methodology in validating the module. During the development of the module approach, the present module was deemed the most effective of these trials. The study's major goal and strength is to provide diverse subject matter specialists, such as *yoga* therapists, *yoga* experts, physicians, naturopaths, *Āyurveda* doctors, and endocrinologists validated the IAYT *yoga* module. Medical specialists examined all of the information about internal and biological processes associated to hypothyroidism. Fifty three approaches were assessed, with 41 receiving a content validity ratio (CVR) of greater than 0.5 or a mean of mean, mode, and median of greater than 4. Eleven techniques received a score of less than 0.5, while one technique received a score of less than four. The 12 *yogic* techniques excluded from the list are hands stretch breathing, jogging, straight leg raise breathing, *Agni mudra*,

patriotic songs, *karma yoga*, *bhajans*, *parśvottanāsana*, *virabhadrāsana 1*, *gomukāsana*, *maricāsana*, *baradvajāsana*, and *śalabāsana*. With 35 participants, a pilot research was conducted to see if individuals with hypothyroidism would accept and be able to practice *yogic* practices. In total, 41 *yogic* methods were done in one and a half hours, with no side effects reported hours and never complained about the adverse effects.

7.2 DESIGN 2

This is the first randomized control study on Integrated Approach of Yoga Therapy (IAYT) on hypothyroidism related parameters. The current study aimed at analysing the effects of IAYT on the hypothyroidism subjects and to develop the IAYT *yoga* module for hypothyroidism. The current study is carried out with 74 hypothyroid clinically diagnosed subjects and study was carried out for three months, three subjects not considered for very long absent in post IAYT yoga group. Apart from TSH the current study aimed to assess the parameters such as T3, T4, Free T3, Free T4, Anti TPO, Anti Tg, Cortisol, CRP, SHBG, Weight, BMI and Quality of Life. The percentage change in the IAYT post study of T3, Free T3, T4, Free T4, TSH, Anti Tg, Anti TPO, Cortisol, Weight, BMI, CRP, SHBG, and Quality of Life were statistically significant compared to pre study. Similarly between group (IAYT post, control post) comparison showed IAYT *yoga* had significantly better improvement in all the above parameters except Weight and BMI compared to control post group. Weight and BMI showed improvement but it is not significant.

In this research Repeated measures “Analysis of Variances” (RM ANOVA) was used to test for (i) significant differences between the assessments at baseline and three months (post-test) and this was a within subjects factor denoted by time and (ii) differences between the groups (IAYT yoga and wait list control), this was a between subjects factor, and the test for a time by group interaction provide a test for an intervention effect. Post data were compared to pre data of respective group using post-hoc analysis with bonferroni adjustment. The level of significant was set at 0.05 levels ($p < 0.5$). Simple percentages (%) were also calculated from the mean value to see the quantitative changes of the *yogic* practices (Chatterjee & Mondal, 2017b; Curtis, K., Osadchuk, A., & Katz, 2011; Nirwan, M, Jyothish K J, Halder, S. Chakraborty S, 2019; Venkatesan R, 2022).

Correlation between Post IAYT yoga and Post Control group analysis was also measured (Table 35), it shows that Anti TPO is association and correlated with Anti Tg (0.666). Compared to Pre IAYT yoga Post control yoga shows 38.64% of subjects shows high level of change in all the variables together, 38.86% of change in subjects shows moderate change and 22.5% of subjects shows no change or maybe reversal (Table 36).

7.3 DIFFERENT FEATURES OF THE CURRENT STUDY

The current study is entirely different from the previous research in many ways. **Sample size:** The current study compares the previous study that was carried out with a nominal sample size. Duration of current study is moderately more than previous study. *Yoga* as an intervention different studies used different types of diet and exercises as an intervention. Here the primary focus is thyroid parameters and related parameters and the IAYT intervention is wholly based on the *pañca kośa* concept. The concept comes from the traditional *yoga* text, and this is the uniqueness of the current study. The IYAT offers complete support for the research and education based on *yoga*, and it is a professional methodology for *yoga* therapists and teachers from all over the world. The holistic approach of IYAT with the multidimensional interventions at emotional, physical, spiritual, and intellectual levels are entirely based on the WHO definition of health. **Practice Duration:** Most previous research and studies have limited dietary modules, basics of *yoga*, and exercise modules. However, the present study is done by regularly monitoring the participation and involvement in the *yoga* centre with the expert care premises. **Monitoring:** The progress was monitored regularly by well trained *yoga* experts and therapists personally. **Lifestyle:** Excellent guidance is given to the subjects on a simple and healthy lifestyle, including a vegetarian diet. No smoking and regular sleep is advised. Both the groups are ideally monitored by advising the above lifestyle habits. **Outcome:** When compared to earlier investigations, the new study's findings are outstanding. **Holistic approach:** In the current study, the integrated *yoga* module is used with *āsanās*, *prāṇayāma*, meditation, chanting, deep relaxation, and counseling sessions. By considering all these factors of the current study, it is considered that the current study has given importance to both physical, spiritual, and intellectual needs for thyroid parameters and related parameters. Therefore, these cumulative effects of increased practices regularly

are practical compared to the single targeted modules. Parameters T3, Free T3, T4, Free T4, TSH, Tg Antibody, TPO Antibody, SHBG, Cortisol, CRP, Weight, BMI, and Quality of Life are studied in this work contrary to other works based on minimal parameters. Work Sanjay (Sanjay, 2011) studied the effect of six month intense *yoga* practice on women suffering from TSH levels from hypothyroidism. TSH levels were shown to have significantly improved as a result of the study. Twenty two women were tested for the effect of one month of *yoga* practice, and the results revealed a substantial increase in Quality of Life (Singh et al., 2011). In recent study (Kumar et al., 2018) showed a significant reduction in TSH levels from 36.6 to 5.82 due to *yoga* therapy alone without any other medications. Work in Krishna (Krishna et al., 2014) reported parasympathetic activity and decreased sympathetic activity due to *Yoga*. A study (Rocha et al., 2012) demonstrated that anxiety is reduced in subjects with a comprehensive but brief *yoga* based lifestyle intervention. A study in Wallace (Wallace et al., 2017) on thyroid disorder patients concluded that *yoga* relaxation techniques might produce psychosomatic harmonization and induce a sense of calmness. Work in Pajai (Pajai & Pajai, 2014) showed a significant increase in T3 level due to a twelve week program of *yogic* practices. Work in Nilakanthan (Nilakanthan et al., 2016) studied the effect of *yoga* on hypothyroidism serum level TSH. The work was able to demonstrate a reduction of 9.72% in TSH levels. The efficiency of *yogic* practices on thyroid disorders was sufficiently proved in these works, but *yoga* effects on multiple clinical parameters were not studied extensively. According to current study we observed a significant reduction in TSH (48.34%), TPO Antibody (52.93%) Tg Antibody (54.64%), Cortisol (31.46%), CRP (47.06) and significant improvement in T3 (44.51%), T4 (21.82%), Free T3 (26.26%), Free T4 (24.96%) and SHBG (39.33%). The IAYT can reduce 48.34% in TSH levels compared to 9.72% in earlier work (Nilakanthan et al., 2016). Most of the researches has shown results T3, T4 and TSH and according to one of the recent study conducted by Chatterjee and Mondal on the effects of *yoga* on thyroid hormones shows value of both males and females where the T3 value of males is $p=0.90$ and females is $p=0.98$. The T4 value of males is $p=0.57$ and females is $p=0.77$ and the TSH value of males is $p=0.99$ and females is $p=0.95$. Compared to this recent study the current study results effective (Chatterjee & Mondal, 2017). One of the recent study conducted by Kashinath Metri on 6 months effects of *yoga* on thyroxine medication and serum TSH levels shows

the TSH level $p=0.452$ and comparing to the recent study the results of current study is effective (Savitri et al., 2016). Most of the recent studies and researches has been carried out on the effects of *yoga* on T3, T4, TSH, lipid profile and QOL. The current study deeply evaluated the relationship between hypothyroid and various related parameters such as TSH, Free T3, Free T4, Cortisol, CRP, SHBG, and Tg antibody and proven with effective results.

The IAYT is found to have a positive impact on Cortisol, and CRP level indicates that the reach of IAYT is not only thyroid disorder but also on the overall wellbeing of adrenal glands and liver. The Integrated Approach of *Yoga* Therapy also studied QOL using of WHO QOL scale. This demonstrated the effectiveness of *yoga* in managing the symptoms of hypothyroid patients. The Integrated Approach of *Yoga* Therapy has improved the WHO Quality of Life indicators on all four domains on subjects with thyroid disorders and helps drop body Weight and BMI. Weight (0.069) and BMI (0.101) were not significant. Results showed that IAYT has a significant impact on the WHO QOL BREF indicators. The study was based on the observation that QOL, is degraded by thyroid disorders (Kalra et al., 2014; Menon et al., 2009). To mention, a study in (Wallace et al., 1971) inferred that hypothyroidism affects the QOL of people. The study inferred the critical difference in mental health among the study group and control group. There have also been many studies on the effect of thyroid disorder on subjects and their physical health in terms of sudden Weight gain and obesity. Some research have shown that *yoga* has a favourable influence on patients' physical and mental health (Nilakanthan et al., 2016; Singh et al., 2011). However, there are very few studies on QOL assessment (Akhter, 2019; N. Gupta et al., 2006; Lin et al., 2011; Shivaprasad et al., 2018; Wallace et al., 1971). The WHO initiated to develop the QOL valuation to provide a Quality of Life international measure. This is the motivation for this study to conduct the impact of proposed IAYT therapy and the WHO's Quality of Life assessment guidelines. Mainly WHO Quality of Life BRIEF is found to be a comprehensive measure for the assessment of Quality of Life. It evaluated at the QOL in four areas: physical health, emotional well-being, social interactions, and the environment. This study used a questionnaire to compare two groups of people: control and *yoga*. The results found that domain scores across the domains increased significantly due to IAYT therapy. The result conforms many studies on the assessment of *yoga* on physical and mental health. However, the result showed that there is also a positive impact on social relationships

and the environment due to IAYT. The observation of drop in Weight and BMI due to IAYT is in line with previous research on *yoga* reducing body Weight but is not significant.

There was a significant difference in the variable IAYT *yoga* within sessions (pre-during-post) in both the groups (IAYT *yoga* and control) at the baseline. Post hoc tests showed that difference between pre-during session and pre-post session were statistically significant. After the intervention, similar results were found, in both the groups. Post hoc tests showed that difference between pre-during session and pre-post session were statistically significant. However, in the post-test results, the control group showed a slight difference, whereas the IAYT *yoga* group showed a significant difference. There was significant difference within sessions in both the groups. Post hoc tests showed that difference between pre-during session and pre-post session were statistically significant. Post-test results have also showed significant difference within sessions in both the groups. Post hoc tests showed that difference between pre-during session and pre-post session were statistically significant.

7.4 MECHANISM OF THE STUDY

Possible mechanisms behind these findings include *yoga* and physical postures are the increased physical activities helped the above results (Malhotra et al., 2004). *Prāṇayāma*, meditation, and relaxation techniques reduced stress levels and modulated the HPA axis (Innes et al., 2005; Li & Hu, 2016). *Yoga* practices, on the other hand, had an effect on the HPA axis, lowering blood TSH levels and other indicators. One of the study showed the potential role of IAYT *yoga* in managing hypothyroidism and there is an excellent balance in the autonomic nervous through the *yoga* stem by stimulating the parasympathetic nervous system. The parasympathetic nervous system also increases blood flow to the brain, extremities, and sexual organs (Innes et al., 2005; Li & Hu, 2016). The HPA axis is one central neuroendocrine system of the body also activated (Stephens, 2017). The HPA axis controls a variety of bodily functions, including stress response, digestion, energy consumption, immunological function, and storage. *Yoga* practice activates the axis, which promotes the production of several neurotransmitters and hormones, including GABA, serotonin, and dopamine, all of which are natural antidepressants (Stephens, 2017).

According to the previous discussion, stress levels are reduced by practicing *yoga* by balancing the autonomic nervous system with parasympathetic and decreased sympathetic activities. This is how *yoga* optimizes and restores the body's homeostasis and decreases the all static load. *Yoga* also decreases the reactivity of the HPA axis. As a result of decreasing these pathways, *yoga* interrupts multiple inflammatory events on the cascade towards cardiovascular disease and increases the cardio vagal function (Malshe, 2011). According to one of the previous studies on the effect of *yoga* on hypothyroidism, the two parameters observed were lipid profile and serum level TSH. On the contrary, this present study has observed thirteen parameters. The reduction in TSH level in the earlier study showed only 9.72%. However, the IAYT *yoga* approach achieved a 48.34% reduction in the TSH level. It also included the five dimensions or *pañca kośa* concept in IAYT apart from *yoga* exercises; compared to the earlier studies, it significantly reduced TSH. *Yoga āsanās* such as *sarvaṅgāsana* (shoulder stand), *uṣṭrāsana* (camel pose), *halāsana* (plow pose), *bhujāṅgāsana* (cobra pose), *sethubandhāsana* (bridge pose), *matsyāsana* (fish pose), and *dhanurāsana* (bow pose) (Malshe, 2011) were found effective in regulating the functioning of the thyroid gland. Breathing practices such as *ujjayi prāṇayāma* effectively balance the metabolism and improve the reflex pathways within the throat (Singh, 2010). *Yoga* relaxation techniques reduce sympathetic activity, which is significant evidence from measuring autonomic parameters, breath volume, and oxygen consumption. Meditation therapy reduced stress and anxiety in students, and even brain imagining studies proved that meditation shifts brain activity during stressful fights. Finally, it helps in positively managing stress (Malshe, 2011). *Yoga* is a unique complementary for thyroid disorder and does not have complications when practiced under expert guidance. Apart from all, *yoga* is a cost effective treatment method (Hegde, 2020), and it can be selected by patients to prevent subclinical hypothyroidism before it develops into full blown hypothyroidism. Some of the techniques that stimulated the thyroid, including *viparītakaraṇi*, *sarvaṅgāsana* and *jalandhar banda*, are introduced to the subjects with *yoga* therapy. Catecholamine levels are reduced due to the head's low postures in *yoga*, and it also improves stress tolerance in the form of a tranquilizer (Udupa, 1978). All of these techniques help to increase thyroid

function and neuro-endocrine feedback systems. According to the previous studies, it was reported that due to *yoga*, there was a significant increase in parasympathetic activity and a reduction in sympathetic activity (Gupta et al., 2006; Kanojia et al., 2013). With comprehensive, brief *yoga* based lifestyle intervention, *yoga* also reduced anxiety in the subjects (Gupta et al., 2006). Wallace's study on thyroid disorder patients described that the relaxation techniques in *yoga* produce psychosomatic harmonization and induce calmness, which happens because of hypo mental activity (Wallace et al., 1971). The previous study conducted by Rawal (1994) described a reduction in physical demand for thyroxin because of metabolic activity reduction (Rawal et al., 1994). In a study, there is a great improvement in the T4 levels, which was observed in the subjects of hypothyroidism. This observation supported the previous findings (Bhavanani et al., 2011) and significant TSH control was observed. One of the research found that yoga practices resulted in a considerable rise in T3 over the course of a twelve-week program (Saraswati, 2009). According to the study on *yoga* programs on female hypothyroidism patients, there was a significant improvement in endocrine activity, body metabolism, and physiological function due to practicing *yoga*. Quality of Life of hypothyroid females was studied using the WHO Quality of Life scale (Singh et al., 2011). All these together demonstrated the effectiveness of *yoga* in managing the hypothyroid symptoms in the patients (Bhavanani, 2011). According to the study conducted by Oken the *yoga* study group concluded with good improvement in QOL and physical measures compared to the exercise and waitlist control group (Oken, et al., 2006). According to the study conducted by Mischalsen, there was a significant decrease in depression, mood state wellbeing, joint pain, anxiety, bodily complaints, and psychological Quality of Life. All these aspects are well among the distressed woman who was following *yoga* intervention for three months (Burns et al., 2001; Klaauw et al., 2008). One of the study exposed *yoga* as superior to physical activity as it improves cognitive functions that are accredited to correct breathing, relaxation, mindful rest, and synchronizing breathing with body movements, some *yoga* therapy introduced to the subjects includes thyroid function stimulating techniques such as *viparitakarani*, *jalandhar bandha* and *ṣarvoṅgāsana*, One of the innovators of research in *yoga*, (Udupa, 1978) of the BHU., Varanasi, described head low posture effectively reduces the catecholamine circulation levels and increases the stress tolerating Quality. Therefore, it acts as a tranquilizer, and it also helps the subjects

normalize thyroid functioning and improves the neuro-endocrine feedback mechanism. *Bramari* and *pranava* are effective *prāṇayāma* practices and highly benefit the limbic cortex's central action or hypothalamus. Forfar et al., described the reduction in left ventricular ejection fraction and myocardial contractile performance in hypothyroidism patients (Forfar et al., 1982). A study of systolic time intervals in hypothyroidism patients by Crowley described prolonging the projection period and reducing the left ventricular ejection period to characterize pretreatment systolic time interval (Crowley et al., 1977). The past laboratory studies concluded that *prāṇayāma* practice for three months modulated the ventricular performance, and it is done by raising parasympathetic activity and sympathetic activity decrease (Udupa et al., 2003). Practicing *yoga* can reduce the sense of subjects as well. According to a study conducted by Integral Health Clinic AIIMS, New Delhi, trait anxiety scores were decreased due to following the *yoga* based brief lifestyle (Gupta et al., 2006). Wallace's study describes *yogic* techniques that produce psychosomatic harmonization, calmness, and hypo metabolic activity (Wallace et al., 1971). When there is a decrease in metabolic activity, it directly reduces the thyroxin demanded by the body (Rawal et al., 1994). Advanced investigations with bigger samples are needed now to validate the findings and explore the mechanism underlying *yoga* effects and advantages in thyroid disease patients. The current study also showed significant reduction in TSH, Cortisol, CRP, Weight and BMI, TPO antibody and TG antibody. There is significant increase in T3, T4, Free T3, Free T4 and Quality of Life of the subjects.

7.5 HYPOTHYROID AND DIET

Iodine deficiency is one of the fundamental reasons for hypothyroidism (Chung, 2014). Vegetarian research suggested that diet is effective in reducing the risk of hypothyroidism compared to the omnivorous diet. These are the result of study that are followed up for six years. Including the goitrogenic substance in the diet is one of the practical reasons for persistent goiter during the post iodization phase (Tonstad et al., 2011). The essential substances that should be included in the hypothyroidism diet are iodine, selenium, and zinc. Iodine deficiency is one of the everyday things found in both hypothyroid and thyroid patients. Intake of iodized salt, oily fish, and seaweed in the diet is advisable. Selenium is also an essential mineral that activates thyroid hormones and makes it bioavailable for the

body to function. The antioxidant properties in selenium protect the thyroid gland from the free radicals, and selenium is commonly present in legumes, Brazil nuts, sardines, and tuna fish. Zinc regulates the TSH level, and it is available in foods like chickpeas, dark chocolates, and pumpkins (Ventura et al., 2017). The foods that thyroid patients should avoid are broccoli, soybeans, tempeh, tofu, cabbage, and cauliflower because these foods affect thyroid synthesis seriously. Excess iodine diet results in transient hypothyroidism and known as wolfchai off's effect. Autoregulation in thyroid hormone synthesis is carried out when the iodine intake is decreased. Suppose the thyroid did not escape from the harmful effects of excess iodine intake, hypothyroidism, and goiter. According to the previous studies, it was shown that modifying the diet normalized the thyroid stimulating hormones in children (Tonstad et al., 2011). Healthier diets are associated with lower CRP levels and signifying that diet is linked to systemic inflammation (Kuczmarski et al., 2013). The fiber rich diet, fruits, and vegetables are associated with lower CRP levels. Western diet and foods that contain fat, sugar, and the refined grains increase the CRP levels. High dietary fiber intake is associated with lower CRP levels (Bernaud et al., 2014; Ning et al., 2014). A good whole food diet list that is effective for both hypothyroidism is that if these diets are followed correctly, it increases energy levels and helps lose Weight. Intake of gluten foods triggers inflammatory conditions (Soares et al., 2013). Intake of these foods weakens the immune system and reduces thyroid function (Mancini et al., 2016). Diet, processed foods, refined foods, and foods containing gluten should be avoided at least for 60 days. Dairy foods should be avoided because most thyroid patients are intolerant to dairy products (Hoyt, 2014). Soy should be avoided because it influences the hormones and impacts the thyroid negatively (Messina & Redmond, 2006). Consuming organic foods and drinking plenty of filtered water and healthy fats, a balanced ratio of proteins and carbohydrates are helpful. Intake should help metabolism overeating and underreacting impact the metabolism negatively. Choose the diet that helps sustain for a long time, and following the diet plan only for a few days or weeks will not be effective. **Supplements:** Required nutrients are available in one supplement as well as it contains thyroid boosting botanicals. Adrenal adaptogens usage are recommended if the subject is suffering from stress or cortisol dysfunction. Adaptogens improve thyroid function through balancing cortisol as results body capacity to tolerate stress is increased. A supplement containing both adaptogens and adrenal glandular is advisable for best results. Activated B vitamins are easy to absorb and utilize by the body and helps to improve energy instantly. Choosing a natural cure includes both dietary changes, exercise protocols, and supplements. If the natural therapies do not

help the thyroid, they will still benefit the overall health, and they are worth trying. Following various changes, including diet improvement, exercising, sufficient sleep, intake of supplements, and LDN should drop the levels over the next few months.

7.6 Mechanism of PAÑCA KOŚĀS

Ānnamaya Kośa Mechanisms

Effects of Exercises and Rest

Practicing physical exercises plays a crucial role in curing the hypothyroid disorder. Numerous studies on *yoga*, diet, and nutritional counseling have significantly decreased fasting insulin and the normalized thyroid hormone level. The three month analysis and study of subjects of *yoga* IAYT practices showed better hormonal and biochemical variables. Apart from psychological components, *yoga* has its significant contribution to improving both the physical and mental wellbeing of the subjects (Oken, et al., 2006). Through *yoga* postures and physical exercises seem similar; they are both differentiated in one aspect called relaxation techniques and their hidden benefits. *Yogāsanas* (physical practices) stretches muscles easily.

धिरसुखम्सनम् ॥ प यो रु । २ । ४६ ॥

ṣthirasukhamsanam || pa yo sü | 2 | 46 ||

The *ṣthirasukhamsanam* offers steadiness and comfort.

प्रयत्नशैथिल्यानन्तसमापत्तिभ्याम् ॥ प यो सु २ ४७ ॥

prayatnaśaithilyānantasamāpattibhyām || PYS 2.47||

According to sage *Patañjali*, the two most important things to be followed during *āsana* practice that helps in achieving the ultimate objective are conscious relaxation (*prayatna saithilya*), feeling the unlimited expansion (*anantasampatti*)

ततो द्वन्द्वानभिघातः ॥ प यो सु २ ४८ ॥

tato dvandvānabighātaḥ ||PYS 2.48||

The influence of *āsana*s to get release from the dualities of mind, for example, joy and sorrow, heat and cold, honour and dishonour, pleasure and pain, and ultimately experience total happiness, from then on, the *āsana* practitioner is not disturbed by dualities. Then the mind, which is at the root of dualistic perception, loses its individuality and ceases to disturb.

Practicing the *yoga* postures offers deep relaxation of the bodily parts at the time of stretching. The conscious effortlessness and the muscle relaxation at stretching change the muscle tone and decrease the basal metabolic rate (Chaya et al., 2006). Relaxation also helps the subjects to meet infinite where they cannot feel anything, including happiness, sorrow, and distress. The Basal Metabolic Rate level is low in senior *yoga* practitioners. Balancing between exercise and inner relaxation is an essential technique as it develops the local cellular function of the body. *Āsana* are one of the easiest ways to achieve the above objective, and it also interchanges between *prayatna* (effort) and *prayatna śaithilya* (effortlessness) (Woodyard, 2011).

लये सम्बोदयेथ् चित्तम् विवृष्यम् समयेथ् पुनह

सकअयम् विजनेयथ् समप्रथम् न चलयेथ् ॥ मन्दुक्वोपनिसत् वरिक्

laye sambodayeth cittam vikṣiptham samayeth punaha | ॥ मन्दु कर ३/ ४४ ॥

sakaśayam vijaneeyath samapraptham na calayeth// MN KAR | 3 | 44 |

The mind that is sleeping should be brought back to tranquility, and it is essential to realize that the mind is the passion tinged and not disturbed.

Oxidative stress measures are talked of as tissue toxins (*āma*) according to *yoga* and *Āyurveda* (Narasimhan et al., 2011). *Āyurveda* and *yoga* have many amazing *kriyās* to cleanse these endotoxins, and *kapālabhati* is one of the fantastic *kriyās* that helps in cleansing the endotoxins. Oxidative stress is one of the root causes of insulin resistance development, and it is released with regular *yoga* practice (Hegde et al., 2011).

Prāṇamaya Kośa Mechanisms

Prāṇa the subtle vital energy that combines entire cellular functions and increases or decreases *prāṇa* results in a balance of homeostatic physiology. When this dynamic

mechanism is disturbed, humans fall ill. The flow of vital energy to the tissues results in the disorganized release of *prāṇa* resulting in blockages in the energy channel (*nadīs*). This causes high demand from the mind (*monomaya kosa*) and the mind stuck at uncontrolled speed due to negativity, habituation, and emotional stress. When the high insulin level decreases the circulating level of the sex hormones binding globulin, it increases the circulating androgen level (Plymate et al., 1988). Thus, the physiological functions of *prāṇa* indicators, and *prāṇa* imbalance affects hormones in the human body. *Prāṇa* imbalance model is proposed in *yoga* where the core concept should be understood under expert guidance. The *prāṇa* imbalance models are proposed by referring to scriptures and discussions with expert *yoga* practitioners (Mishra et al., 2021).

तस्मिन्सति श्वासप्रश्वासयोगीतिविच्छेदः प्राणायामः ॥ प यो सु २ ४९ ॥
tasminsati śvāsapraśvāsayorgativicchedaḥ prāṇāyāmaḥ ॥ PYS 2.49॥

When the production is interrupted through inhaling and exhaling, the energy is harmonized. Further, this results in the harmony of the physical body. Therefore, it is essential to focus on the stretched body parts during *āsana*.

चले वते चलम् चित्तम् निश्चले निश्चलम् भवेत्
योगि स्थानुत्वमप्नोति ततो वयुम् निरोधयेत् ह यो प्र । ह यो प्र २ । २ ॥
chale vāte chalaṃ chittaṃ niśchale niśchalaṃ bhavet ॥
yoghī sthāṇutvamāpnoti tato vāyuṃ nirodhayet ॥ HYP 2.2 ॥

When the breathing flow is restless mind becomes restless and vice versa. *Yoga* can be realized with the help of breathing control—internal awareness and focusing (*dāraṇa*) through relaxation release the blockages and restores *prāṇa*'s free flow (Sengupta, 2012).

According to “*ṣvara yoga*”, the *yogic* literature (Muktibodhananda 2009), there are two energy channels *pingala* or sun and *ida* or moon. The physiological functions of *prāṇa* are carried out through these two channels. *Prāṇa* Rushes through *pingala* or right channel when there is a need for heightened activity, and *prāṇa* flows through *īda* or left channel when the body is at the restful stage. Thus, *prāṇa* flows in a balanced way when the person is healthy

(Rakesh et al., 2019). Control of breath is an essential factor for nostril breathing on both the left and right sides. Most studies on uninostril breathing support the above point (Raghuraj & Telles, 2008). The nostril dominance should be equally distributed between the *prāṇa* in 24 hours (Sasaki et al., 2003). If this dominance changes every two to six hours, a person may fall sick due to interruption in ultradian rhythm. The study describes the proper nostril breathing or *Sūrya anuloma villoma* (in this study *Sūrya bhedana*) linking sympathetic dominance in increased metabolic rates (Telles & Raghuram, 1995). Therefore, *prāṇayāma* balances the metabolic rates and helps in Weight loss and improving hypothyroid condition (Patra, 2017). In this study *Sūryabhedana* and *nādisuddi* or nostril breathing exercises, the balance between two *nādīs* is restored, which is included in the current study as a part of *yoga* intervention on hypothyroid (Ansari, 2016).

Manomaya Kośa Mechanism – An imbalance in *manomaya kośa* results in hypothyroid problems, mind and body diseases. When the mind works at an excessive and uncontrolled speed, it is stimulated in a heightened state. *Yoga* therapy creates awareness from the physical body to attain bliss. The entire process is attained systematically and passes through *prāṇa*, *manomaya kośa* practice includes *dāraṇa* or focusing, *dhyana* or effortless focus, and *bhakti* or emotion culture practice (Patra, 2017). *Dāraṇa* trains the mind to focus intensely without distraction and leads to *dhyana* or effortlessness. *Dāraṇa* slows the thought rates and provides deep relaxation (Telles, Nagarathna, 1995). The slowdown and mind resting process are critical phenomena as it offers a pleasant environment for inner healing. Negative emotions are the root cause of diseases, hormonal and biochemical imbalance. The *OM* meditation is one of the parts of intervention in the study for achieving effortless focused healing (Shirley et al., 2000; Srinivasan, 2012). The previous study used a non-pharmacological intervention by focusing on Weight loss. However, the current study focused entirely on *yogic* lifestyle change, mind restoration, and body balance intervention for the hypothyroid disorder. Finally, the subjects experienced better changes through a *yoga* lifestyle. The *yogic* lifestyle is also related to the direct (Ross et al., 2016) mind or stress management. The stress management components include *OM* meditation, *yoga* hymns for emotional culturing, deep relaxation techniques, and *yoga* counseling. Different meditation

types studies proved a constant increase in mental alertness as there is psychological relaxation (Harne et al., 2019). The *OM* meditation and the cyclic meditation reduced oxygen consumption and suggested the study's psychophysiological rest (Telles & Raghuram, 1995). The *OM* meditation showed a concurrent effect in the current study and created a combined effect on physical activity; meditation and breathing offer better mental alertness even in a physiologically relaxed state. Furthermore, anxiety and depression are reduced with illness due to regular *yoga* practice in the individuals as these two factors are the critical reason for hypothyroid diseases (Subramanya & Telles, 2009). The perceived information buildup and repeats results in emotional responses, resulting in a lack of awareness about the buildup responses. With the help of *yoga* techniques, chanting hymns, and counseling, it is easy to overcome the emotional responses. By following these techniques, the subjects can recognize the speed and remove the repetitive intrusiveness. Therefore, the emotional expression or suppression happens in a balanced manner with awareness, and it does not form *ādhi* or stress. Finally, subjects stay away from *vyādhi*. This is called mastery over emotions. According to the studies, the *yoga* lifestyle has reduced the adverse effects on health (Narasimhan et al., 2011), and the stress is reduced in subjects with the harmful disease (Sohl et al., 2012; West et al., 2004).

Vijñānamaya Kośa Mechanisms: *Vijñānamaya kośa* creates the correct information that directs mind and body to the right actions. According to the present study, the present study received complete education regarding hypothyroid, emotional management, and diet. In IAYT *yoga* intervention sessions are offered to the subjects to clarify their doubts where the wrong notions are ideally replaced into the right information by correcting the cognition and influencing the behaviour. Through these sessions, the stress source in subjects was found out and suggested a generic solution to cure the stress. Complete guidance with scriptural suggestions was given to the subjects (Raina, 2016.). The suggestions include happiness analysis, historical anecdotes, knowledge of the *pañca kośa*, and moral behavior. These suggestions are introduced to the subjects as relevant and exciting according to their age and ethnicity (Biswajit, 2018) . *Yoga* science and *vedānta* offers a systematic methodology to the person who is trained and established an experimental knowledge of true nature. This stage is also called the steady state of bliss (*satcidānanda*) (Ranganathananda, 1983).

Ānandamaya Kośa Mechanisms: Practicing the *ānandamaya kośa* offers a state of happiness and bliss. When the great desire for happiness is merged with exact knowledge, mental balance, and emotional culturing, it regulates the energy flow and supplies it to the entire body. The final posture should be maintained perfectly while performing the *āsana*s, and stretch should be observed and relaxed (Aiswarya & Nair, 2019) (*ānanta samāpati āsana*). At the *prāṇayāma* sessions, slowness and relaxation with special attention on cessation of the breath are emphasized. It is suggested to maintain mental emptiness and visualization during the *OM* meditation session and the Deep Relaxation Technique (DRT) sessions. According to the *yoga* scriptures, the logical analysis of happiness leads the person to relearn nature and teach them to reach it. It is a great thing to realize that once happiness lies within them and experiencing it can completely change their life and increases the positive attitude towards their environment. Subjects start loving themselves as well as their surroundings. To conclude, *yoga* IAYT is a comprehensive method to boost awareness, eliminate negativity and ill health. *Yoga* is achieved by correcting the false notional constructs in the intellect. It brings mastery over emotions and mental speed. *Yoga* balances the vital energy flow and offers relaxation to the human body. The therapy has many unique techniques that rectify the imbalance of various levels that contribute to hypothyroid disorders' perfect correction. *Yoga* is one of the special activities that offers many incredible benefits to the practitioner. The health benefits of *yoga* are categorized into three types physiological (Davis et al., 2009; Harrison et al., 2004), psychological (Iyengar BKS, 2001), and biochemical (Rossigno et al., 2009). *Yoga* poses such as shoulder stand (*sarvaṅgāsana*), fish pose (*matsyāsana*), plow pose (*halāsana*), shoulder stand pose, cobra pose (*bhujāṅgāsana*), camel pose (*uṣṭrāsana*), bridge formation pose (*sethubandhāsana*), and bow pose (*dhanurāsana*) balances and regulates the thyroid gland functioning. *Ujjayi prāṇayāma* is one of the beautiful techniques to rebalance the metabolism, improve the reflex pathways in the throat, and cure the thyroid imbalance.

Autonomic indicators, oxygen consumption, and breath volume all show that *yoga* based relaxation reduces sympathetic activity. After eight weeks of meditation, both medical and

premedical students had reduced anxiety and tension throughout the assessment. Studies on brain imagination showed that meditation shifts brain activity in the prefrontal cortex via the right hemisphere to the left, indicating that the brain is reoriented from the traumatic flight more to acceptance, this shift indicates better contentment (Telles, & Nagarathna, 1995). The IAYT was highly helpful in treating hypothyroidism patients, and the IAYT approach is taken for further hypothyroidism treatment (Kumar et al., 2018). Through *yoga*, high level consciousness is achieved during the rested and relaxed state and awake and relaxed mind (Wallace et al., 1971). *Yoga* impacts on bodily function are linked to a reduction in arousal or sympathetic nervous system activity. Meditation or relaxation practices, according to *yogic* texts, quiet the mind, slow the breath, and relax muscles (Yogi, 1969; Nagendra & Raghuram, 1977; Taimni, 1980). This is reliable with minor changes in psychological state on the respiratory rate, energy expenditure, and heart rate (Telles & Nagarathna, 1995; Wallace, 1972; Wenger & Bagchi, 1961). Previous research has shown that *yogic* meditation, zen meditation, transcendental meditation, *prāṇayāma* and relaxation techniques lower oxygen consumption, metabolic rate, pulse rate, and breath rate. These strategies similarly improve CO₂ removal when measured before, during, and after meditation or other relaxation techniques (Kasamatsu & Hirai, 2017; Telles et al., 2000; Telles, 1991; Wenger & Bagchi, 1961).

7.7 MECHANISM OF ACTION ACCORDING TO YOGA

Practicing *āsana*s improves flexibility and offers controlled stretch to the muscles. *Savāsana* is a relaxing *āsana* that relaxes both body and mind, and *prāṇayāma* gives reasonable control over breath. Controlling *prāṇa* is an effective way to control the mind (*Svatmarama*, 1998). *Prāṇayāma* techniques such as *bhramari* soothes the mind, and meditation practice improves concentration and relaxation. Chanting the *OM* mantra control the mind from unwanted thoughts (Gururaja et al., 2011). *Yoga* promotes relaxation, normalises breathing, and improves concentration by rebalancing the sympathetic nervous system's fight-or-flight reaction to the parasympathetic nervous system's relaxation response. *Yoga* inhabits the posterior area of the hypothalamus. Furthermore, the inhibition improves sympathetic responses to traumatic stimuli and restores stress-related autonomic regulating reflex

systems. As a result, *yoga* suppresses the areas of the brain that are linked to aggression, fear, and fury. In addition, *yoga* exercise stimulates rewarding areas. The inhibition is effective and results oriented in the students practicing *yoga* as it reduces the anxiety, respiratory rate, cardiac output, and heart rate (Bharshankar et al., 2003; Birkel & Edgren, 2000; Desikachar et al., 2005; Javnbakht et al., 2009). Studies comparing the gene expression in the practitioners who were practicing *yoga* for a long time with controls suggest that *yoga* positively affects gene expression profiles in immune cells (Saatcioglu, 2013). Stimulating the vagal nerve causes the autonomic nervous system's parasympathetic activity to increase, as well as GABA action in the brain (Streeter et al., 2012). According to *yoga*, it is said that a flexible body is one of the effective ways to gain a flexible mind. Further, it helps people to develop patience, controls anger, sadness and increases forgiving nature. *Yoga* increases the natural selves through imitation of nature, the ending activity of *yoga* classes is *savāsana* (Parks & Steelman, 2008). Integral Health Clinic of AIIMS, New Delhi, showed a significant decrease in the state and trait anxiety scores by adopting *yoga* based lifestyle intervention, the study also included thyroid disorder patients (Gupta, 2006). *Yoga* relaxation techniques produced psychosomatic harmonization, and a sense of calmness was encouraged due to hypometabolic activity was described in meditation (Wallace et al., 1971). Decrease in metabolic activity indirectly decreased the bodily demand for thyroxine (Rawal et al., 1994). Previous studies on *yoga* in depression have improved depression symptoms, serum cortisol levels, and cognitive mood function (Parks & Steelman, 2008; Saatcioglu, 2013). The present study findings are consistent with the previous studies. Stress aggravates the underlying autoimmunity, whereas *yoga* reduces the sympathetic arousal hypothalamus-pituitary-adrenal axis activity (Cahn et al., 2017; Streeter et al., 2012).

7.8 THE POSSIBLE REASONS FOR THIS RESULT OUTCOME ARE LISTED BELOW

- Physical activity has increased due to *sūryanamaskāra* and physical postures (*āsana*s) (Bhutkar et al., 2011).

- Stress is reduced due to *prāṇāyāma* relaxation practices and meditation. Also, it has resulted in modulation of the hypo-thalamic-pituitary-adrenal axis (HPA) (Arora & Bhattacharjee, 2008).
- The hypo-thalamic-pituitary-thyroid axis has been influenced, resulting in lower serum TSH and other indicators (Mariotti & Peccoz, 2021).
- Autonomic nervous system is brought by stimulating parasympathetic nervous system (Kenney & Ganta, 2014; Mariotti & Peccoz, 2021) .
- The HPA axis, is the major neuroendocrine systems of the body, is set in motion system (Kenney & Ganta, 2014; Mariotti & Beck-Peccoz, 2021)
- Neurotransmitters and hormones, namely GABA, serotonin, and dopamine, increase all natural antidepressants levels due to the IAYT system (Kenney & Ganta, 2014; Mariotti & Peccoz, 2021).
- Raise in parasympathetic and decrease in sympathetic activities balances the autonomic nervous system and have reduced the stress, body's homeostasis is optimized and restored, Cardiovagal functions have enhanced due to interruption of different inflammatory actions on the cascade toward cardiovascular disease (Innes et al., 2005).

7.9 THE OUTCOME OF EACH COMPONENT OF IAYT IS SUMMARIZED BELOW.

- *Yogaāsanaś* in IAYT like *śarvāṅgāsana* (shoulder stand), *ḥalāsana* (plow pose), *matsysāsana* (fish pose), *uśtrāsana* (camel pose), *bhujāṅgāsana* (cobra pose), and *setubandāsana* (bridge pose) are found to have reasonable control on thyroid gland functions.
- Metabolism balance and reflex pathways improvement within the throat is made with breathing practice (*ujjayi prāṇāyāma*) of IAYT (Kumar et al., 2018) .
- Sympathetic activity is reduced with relaxation methods of IAYT, head low postures in IAYT is found to reduce the catecholamine levels and improve the stress tolerance in the form of tranquilizer, American Thyroid Association (ATA) has benchmarked 4.5 mIU/L as the upper limit of TSH. The report also declared that the TSH value of 4.5 to 10 mIU/L is average. Integrated Approach of *Yoga* Therapy experiments has kept the TSH and other values within the limit set by. Improvement in the level of

T4 due to IAYT is in line with the observation in the study (Rawal et al., 1994) which showed a reduction in physical demand for thyroxin due to a reduction in metabolic activity. Hypothyroidism related clinical parameters also impact by IAYT *yoga* and align with previous *yoga* studies.

From the results of IAYT, it can be observed that *yoga* is a better complementary therapy for thyroid disorders; it does not have any complications when practiced under the guidance of an expert. Furthermore, *yoga* practiced at the earlier onset helps prevention of subclinical hypothyroidism from developing to full blown hypothyroidism.

The current chapter discusses about the study where the IAYT module for hypothyroidism is discussed in detail. The next chapter discusses about the summary of the findings, conclusion, strength and weakness of the study.
