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Effect of Integrated Yoga Practice on *Pancha Koshas* (Five Sheaths) in healthy young adults-A Matched waitlist Control Trial"

Prabu.P[1], Kumaresan.P[2], Divya.D[3], Naveena.A[4]

[1]*Assistant medical officer/Lecturer-II, Department of Acupuncture and Energy medicine, Govt. Yoga and Naturopathy medical college & hospital, chennai-106.*

[2] *Assistant medical officer/Lecturer-II, Department of Yoga, Govt. Yoga and Naturopathy medical college & hospital, chennai-106.*

[3] *Assistant medical officer, Yoga and Naturopathy lifestyle clinic, Institute of Obstetrics & gynecology, Egmore, Chennai-8.*

[4]*Medical officer, Department of Yoga and Naturopathy, Southern railways headquarters hospital, Perambur, Chennai-23.*

Abstract:

Background*: Yoga is an ancient Indian philosophy and a way of life. Yoga is a mind-body practice involving different techniques such as physical postures (Asanas), controlled breathing (Pranayamas), deep relaxation (Yoganidra), and meditation. From the yogic point of view, the human body is comprised of five sheaths, which accounts for the different dimensions of human existence. These five shealths are known as pancha koshas namely Annamaya kosha, Pranamaya kosha, Manomaya kosha, Vijnanamaya kosha, and Anandamaya kosha. This study aims at understanding the effect of integrated yoga practice on all these Five Sheaths (pancha koshas) of the human body.*

Materials and Methods*: A total of 70 healthy volunteers of both the genders, undergoing degree course and undergraduate course were recruited from a residential college, Ujire, Karnataka, India. Subjects were matched for the age and gender, age ranging between 18-25 years, were randomly assigned into two groups. Intervention group (n=35) and Wait list control group (n=35), after satisfying the inclusion and exclusion criteria. Intervention group was given an integrated yoga Module (IYM), for 60 minutes in the morning for 12 months, 6 days in a week. Control group on the other hand was doing their regular work schedule. Both groups were assessed at baseline and after 12 months for sit and reach test, heart rate variability (HRV), Psychological assessment (PGWBI), Six letter cancellation task (SLCT), Digit letter substitution task (DLST) and Happiness Index.*

Results*: The Experimental group showed significant improvement in the Sit and Reach test ($p<0.00$), Respiratory Rate ($p<0.00$), Finger Plethysmogram ($p<0.00$), RMSSD($p<0.00$), NN50 ($p<0.00$), pNN50 ($p<0.00$), PGWBI ($p<0.00$), SLCT ($p<0.00$), DLST($p<0.00$) and Happiness Index ($p<0.00$) whereas there was no significant difference in Heart Rate ($p>0.09$), SBP ($p<0.57$) and DBP($p<0.60$) as compared to that of control group.*

Conclusion: *Experimental group showed significant improvements in spinal flexibility, psychological assessments, six letter cancellation task & digit letter substitution task. Increase in the heart rate variability, respiratory rate and happiness index was also seen after the intervention. Hence, the regular practice of yoga for a period of 12 months by young healthy students has shown a positive influence on all the five sheath of the human body.*

Key Word*: Integrated yoga; Pancha koshas; Autonomic function; Heart Rate Variability.*

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I. Introduction

Yoga is an ancient Philosophy designed to bring balance and health to the physical, mental, emotional, and spiritual dimensions of an individual.(1) The word yoga means 'unity' or 'oneness' and is derived from the Sanskrit word *'Yuj'* which means 'to join'. This unity or joining is described in spiritual terms as the union of the individual consciousness with the universal consciousness.(2) Yoga is recognized by the National Institutes of Health (NIH) National Center for Complementary and Alternative Medicine (NCCAM) as a form of CAM in the category of "mind-body" medicine.(3) According to yogic physiology, the human framework is comprised of five sheaths or bodies, which account for different dimensions of human existence. These five sheaths are

known as *Pancha koshas*.(2) *Kosha* is referred to as "sheath", coverings of the Atma or Self according to Vedantic philosophy. The five sheath of the human body are as follow as, *Annamaya kosha* (physical sheath), *Pranamaya kosha*(vital air sheath), *Manomaya kosha*(mental sheath), *Vijnanamaya kosha(* intellect sheath) and *Anandamaya kosha*(Bliss sheath).(4) According to the yogic text, the imbalances start at *manomaya kosha* , and in *anandamaya kosha*, a man is healthiest with a perfect harmony and balance between all the systems of the body. These imbalances amplify themselves resulting in mental illnesses called *Aadhis*.(5) The World Health Organization (WHO) defines health as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.(6) One of the criteria to assess health status of the society is the judging the mental health status. Mental health plays an important role in dynamism and efficacy of each society.(7) The professional students are the key elements who form the most vulnerable social groups and their academic achievement is among the basic goals of educational programs.(8) Stressful environments not only lower their academic achievement but also affect student's personality growth and develop many negative and destructive behaviors among them.(9) Young adults, between the age of 18 to 26, have a higher mortality and morbidity rates than in adolescence, much of which is attributed to preventable factors such as binge drinking, substance use, weapon possession, risky sexual behaviors, distractions and sedentary lifestyle. Unhealthy behaviours tend to increase the risk of preventable chronic conditions such as cardiovascular and respiratory diseases and diabetes.(10) The ancient practice of yoga help children and young people to cope up with the stress and thus contribute positively to mental health.(11) Regular practice of yoga promotes strength, endurance, flexibility and facilitates characteristics of friendliness, compassion, and greater self-control.(12)

Studies on the benefits of integrated yoga on different sheath *(koshas*) of the human body are less documented. Hence, the present study is designed to understand the long term effect of integrated yoga practice on all Five Sheaths *(pancha koshas)* of the human body.

II. Material And Methods

A total of 60 subjects of both gender with age ranging between 18-25 years were participated in the study. Subjects those, who residing at the hostels, which have a regulated diet and activities as prescribed by the college authorities. Those who voluntarily agreed to participate in the study alone were selected. The study subjects were matched for their age, gender, and locality were recruited from the SDM College of Naturopathy and Yogic Sciences and SDM IT College, Ujire, Dakshina Kannada District, Karnataka, India.

Table: 1 Describes the demographic details of the subjects

	Experimental Group	Wait List Control Group
Age[Median ± SD] in yrs.	19.41 ± 1.46	18.5 ± 1.84
Gender distribution	26 Males, 9 Females (n=35), 4 males and 1 female Drop out	28 Males, 7 Females (n=35), 2 Males 3 Females Drop out
Total Participants completing the study	35	35
Age range	18-25 Years	

Study Design: A matched -waitlist control trail
Study Location: SDM Yoga and naturopathy medical college & IT College, Ujire, Dakshina Kannada District, Karnataka, India
Study Duration: October 2014 to October 2015.
Sample size: 70 subjects.
Inclusion criteria:

- Students with age ranging between 18 to 25 years.
- Both the genders.
- Subjects who are healthy based on routine clinical examination.
- Willingness to participate in the study by a signed informed consent form

Exclusion criteria:
Subjects would be excluded from the study if they have:

- Cardiovascular disorders, Diabetes mellitus, Respiratory disorders, Endocrinal disorders and any were underlying pathology.
- Subjects who are already exposed to yoga practices.
- Subjects not willing to participate in the study.

Procedure methodology

Hundred subjects were screened initially from the two different professional institutions namely SDM College of Naturopathy and Yogic Sciences and SDM College of Information Technology, Ujire. Among 100 subjects, seventy subjects who met the inclusion criteria were participated in the study. Subjects were assigned as two groups i.e., Study group as SDM College of Naturopathy and Yogic science (n=35) and wait list control group as SDM college of Information Technology (n=35). The study group was given an integrated yoga practice for 60 mins daily in the morning, 6 days in a week for 12 months, whereas the control group besides doing their daily work schedule received no intervention and was given an option to join the yoga sessions after the study completion.

Table: 2 -Integrated yoga module.

Name	Description	Rounds	Duration
Prayer	Starting slokas	1 round	2 mins
Loosening Exercise (with breathing)	Head and neck movements, shoulder rotation, elbow movements, wrist and finger movements, hip movements, knee and ankle joint movements.	3 rounds each movements	10 mins
Breathing practices	Hand in and out breathing, hand stretch breathing, Tiger breathing, Bhujangansana breathing.	2 rounds each	6 mins
Asanas	Surya namaskaras **Standing postures:** Tadasana, Katichakrasana, Ardha kati chakrasana, Ardha chakrasana, Pada hastasana. **Sitting postures**: Vajrasana, Badha konasana, Shashankasana, Ardha matsyendrasana. **Supine postures**: Uthitapadasana, Pawanamuktasana, Matsyasana, **Prone postures**: Ardha salabasana, Salabasana, Dhanurasana. **Inverted postures**: Vipareeta karani, Sarvangasana, Halasana ,	3 medium rounds. 2 rounds (2 asanas each in all categories on alternate days)	20 mins
Relaxation Technique	IRT- Instant Relaxation Technique	2 rounds (Alternate days)	5 mins
Pranayama	Breathing awareness, Anuloma viloma Nadishodhana pranayama Brahmari pranayama Sheethali, Sheetkari pranayama, Kapalbhathi, Bastrika pranayama.	5 rounds (alternate days)	10 mins
Meditation	'AUM' chanting Om chanting	5 rounds	5 mins
Prayer	Ending slokas	1 round	2 mins

Primary outcome Variables:

- *Annamaya kosha*- Sit and reach test, Heart rate variability.
- *Pranamaya kosha*- Respiratory Rate
- *Manomaya kosha*- Psychological and general well-being index
- *Vijnanamaya kosha*- Six letter cancellation task (SLCT), Digit letter substitution task (DLST)
- *Anandamaya kosha*- Oxford Happiness Questionnaire (OHQ)

Statistical analysis: The data was collected as self-reported observations using primary outcomes and secondary outcome variables. The assessments were done on the beginning of 1st month (baseline data) and end of 12th month (post data). The data was organized in Microsoft Excel Sheets (Version 2010). Data were analyzed using IBM SPSS 21.0. The data at baseline were assessed for normal distribution using Shapiro-Wilk's test, in both the groups, $p<0.05$ indicates significant for non-normal distribution. The Kruskal-wallis test (Mann-

Whitney U test), was performed to assess the significant difference between the two groups. For all the analysis, we present 95% confidence intervals and considered $p < 0.05$ as significant.

III. Result

The data obtained following the study were not found to be normally distributed across groups ($p<0.00$, Shapiro wilk's test).Hence the kruskal wallis one way analysis of variance (Mann Whitney U test) was performed to assess the significant different between the two groups. Results were compared between the groups, whereas data was extracted at both baseline and post-intervention. *Annamaya kosha* (Physical sheath): Mann Whitney U test showed that yoga group ($p<0.00$) had significantly higher Spinal Flexibility (Sit and Reach test) scores than control group. Autonomic variables (RMSSD, pNN50%, Pulse Rate) showed significant difference when compared to control group. Also, no significance difference was seen on Heart rate and Blood Pressure (both Systolic and Diastolic) ($p>0.05$, for both comparisons) *Pranamaya kosha* (Pranic Sheath): The change in Respiratory Rate was significantly higher in yoga group compared to control group. ($p<0.00$, for both comparison) *Manomaya kosha* (Mental sheath): Compared to that of control group, the scores of Anxiety, Depression, Positive well-being, Self-Control, General Health and Vitality are significantly higher in yoga group.($p<0.00$,for both comparison) *Vijnanamaya kosha* (Intellectual sheath): There was a significant difference across yoga group for the Net scores recorded following the substitution task and cancellation task ($p<0.00$, for both comparison). *Anandamaya kosha* (Bliss sheath): Between group comparison, Happiness Index scores showed a significant changes, ($p<0.00$ Mann Whitney U test) in yoga group**.**

Table-3: Kruskal Wallis One Way Analysis of Variance for Subjective variables between Experiment and Control group.

Variables	Experiment (Yoga) Group Median (SD)	Control Group Median (SD)	Mann Whitney U test value	p value
Anxiety	18.00(2.31)	12.50(1.77)	859.00	0.00**
Depression	13.00(1.01)	8.00(1.37)	899.00	0.00**
Positive well being	15.50(1.40)	10.00(1.35)	898.00	0.00**
Self-control	12.00(1.11)	8.00(1.41)	886.00	0.00**
General health	12.50(1.33)	8.00(1.32)	898.00	0.00**
Vitality	14.00(1.61)	8.00(1.21)	900.00	0.00**
SLCT Attempt	39.50(5.13)	32.50(4.61)	741.00	0.00**
SLCT Wrong	0.00(0.68)	1.00(1.46)	271.00	0.00**
SLCT Net	38.50(5.13)	30.50(4.62)	775.00	0.00**
DST Attempt	52.50(7.07)	48.50(8.56)	605.00	0.02**
DST Wrong	1.00(1.02)	2.00(1.28)	337.50	0.09
DST net	52.00(6.95)	45.50(8.40)	631.00	0.01**
Happiness index	4.56(0.43)	3.66(0.33)	841.50	0.00**

Note: Data are expressed as median, (SD)= standard deviation.**=$p<0.05$ represents significant. SLCT=Six letter cancellation test, DLST=Digit letter substitution test, p=probability.

Figure-1: Comparison of post values of Psychological general well-being index between Experimental and Control group

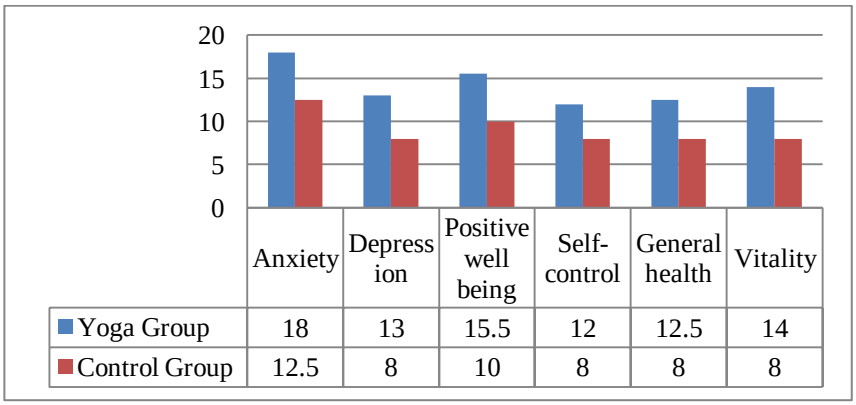


Figure-2: Comparison of post values of Six Letter cancellation and digit letter substitution test between Experimental and Control group.

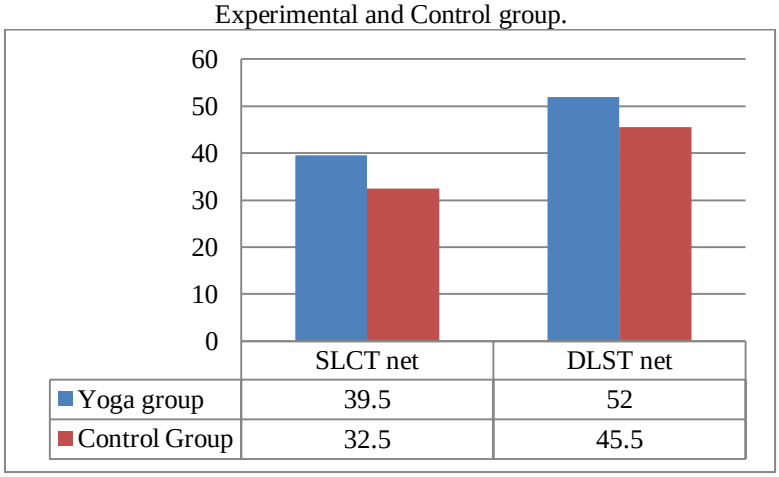


Figure-3: Comparison of post values of Happiness Index between Experimental and Control group.

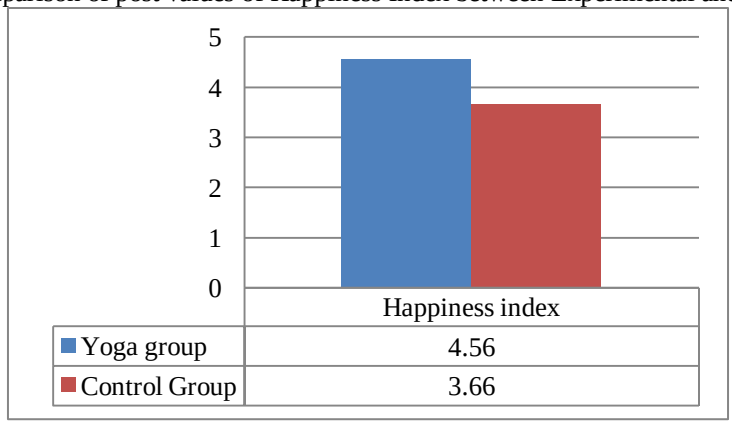


Table-4: Kruskal Wallis One Way Analysis of Variance for Objective variables between experiment and control group

Variables	Experiment (Yoga) Group Median (SD)	Control(no intervention Median (SD)	Kruskal- Wallis (Mann Whitney U test) value	p value
Mean R-R	820.45(169.50)	768.10(72.67)	529.00	0.21
RMSSD	90.25(40.21)	36.60(32.13)	730.00	0.00**
NN50 count	112.00(64.82)	54.50(69.84)	610.00	0.02**
pNN50 [%]	29.90(21.85)	13.75(16.31)	673.00	0.00**
VLF	32.35(14.50)	33.40(20.87)	467.50	0.80
LF	57.85(18.22)	62.85(19.59)	393.00	0.40
HF	39.90(18.21)	43.30(18.61)	479.00	0.67
LF/HF ratio	1.54(1.19)	1.46(1.58)	416.50	0.62
Heart Rate	70.21(13.96)	73.89(7.59)	335.00	0.09
Pulse Rate [bpm]	68.40(10.04)	75.41(5.37)	252.00	0.00**
Respiration Rate	14.31(1.66)	16.14(1.12)	145.00	0.00**
SBP[mmHg]	111.00(9.38)	114.00(11.99)	411.50	0.57
DBP[mmHg]	72.00(7.48)	75.00(9.58)	415.00	0.60
Sit and Reach test[cms]	24.5(0.94)	20.00(1.34)	890.50	0.00**

Note: Data are expressed as median, (SD) = standard deviation.*=p<0.05 indicates significant, p=probability, ms=milli seconds, NN50 count = Number of pairs of adjacent NN intervals differing by more than 50 ms in the entire recording. This is highly correlated with frequency domain measures and recognized to be strongly dependent on vagal tone, pNN50% = NN50 count divided by the total number of all NN intervals. RMSSD = the square root of the mean of the sum of the squares of differences between adjacent NN intervals. LF = Power in low frequency range (0.04-0.15 Hz). LF measures withdrawal of vagal tone (Goldstein). HF = Power in high frequency range (0.15-0.4 Hz), indicates efferent vagal activity LF/HF ratio = Ratio is correlated with sympatho-vagal balance,n.u. = normalized units, mmHg= milli meter of mercury, bpm= beats per minute, SBP=systolic blood pressure, DBP=diastolic blood pressure. Cms = centimeters.

Figure-4: Comparison of post values of mean R-R between Experimental and Control

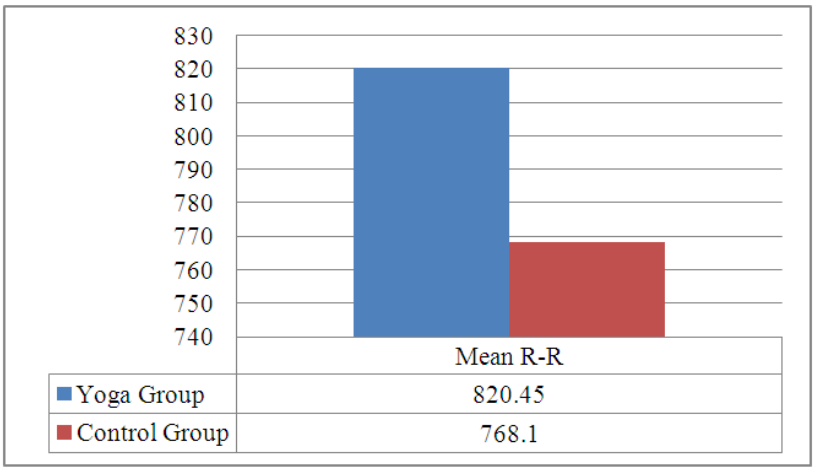


Figure-5: Comparison of post values of RMSSD, NN50 and pNN50 between Experimental and Control group.

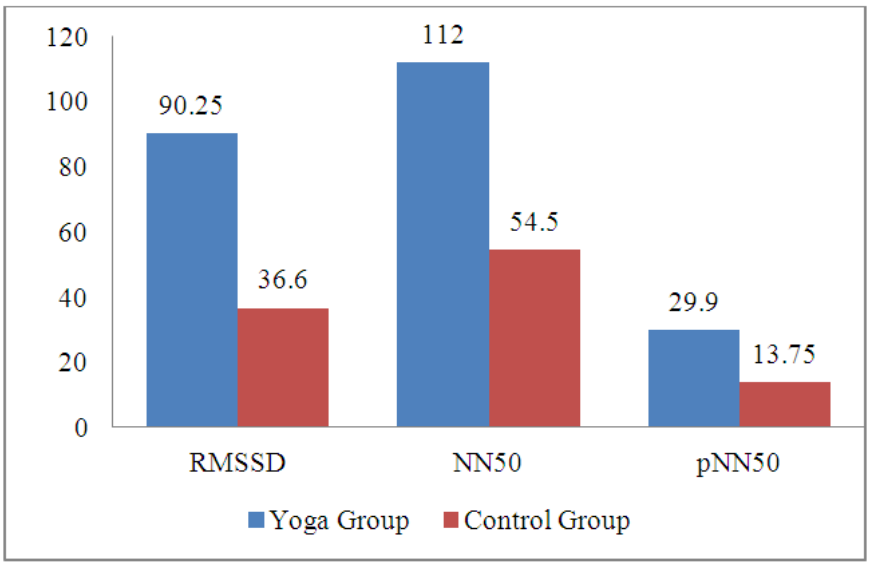


Figure-6: Comparison of post values of VLF, LF and HF between Experimental and Control group.

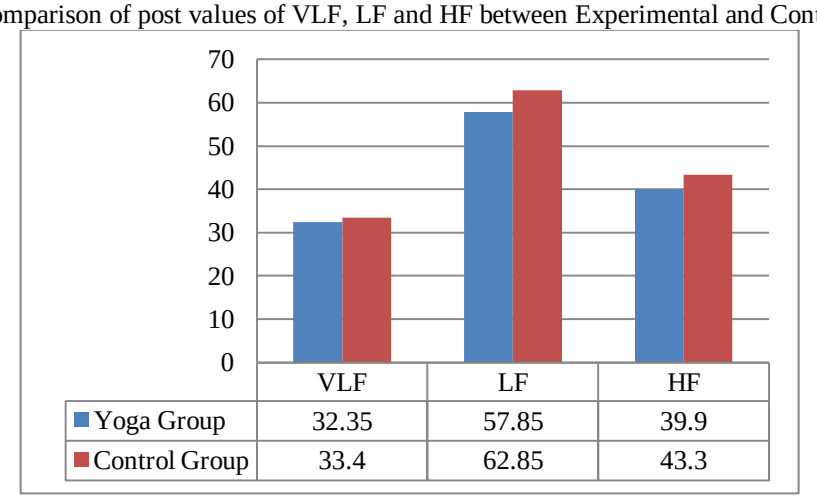


Figure-7: Comparison of post values of LF/HF ratio between Experimental and Control group.

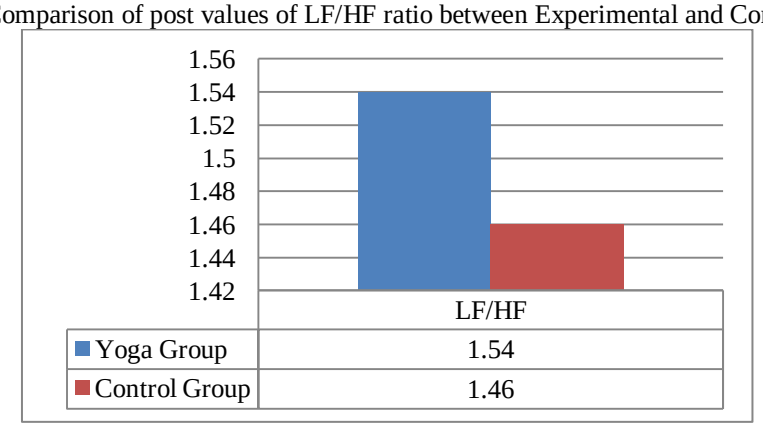


Figure-8: Comparison of post values of Heart rate, Pulse rate and Respiratory rate between Experimental and Control group.

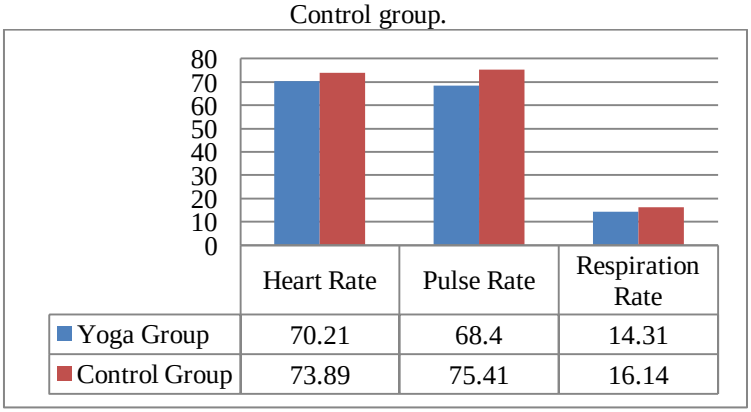


Figure-9: Comparison of post values of Systolic blood pressure and Diastolic blood pressure between Experimental and Control group.

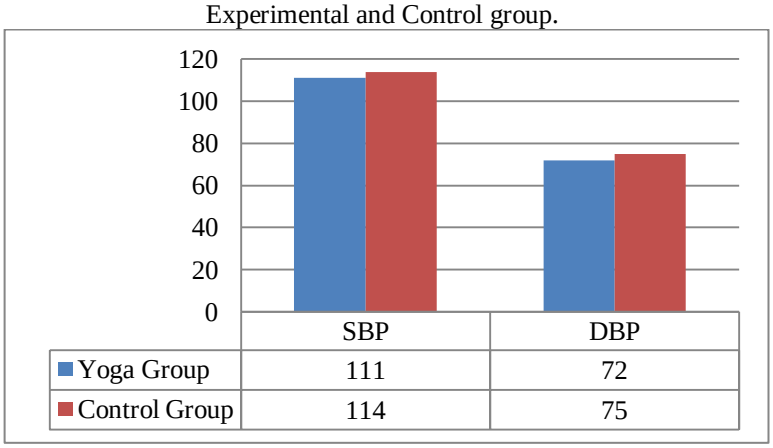
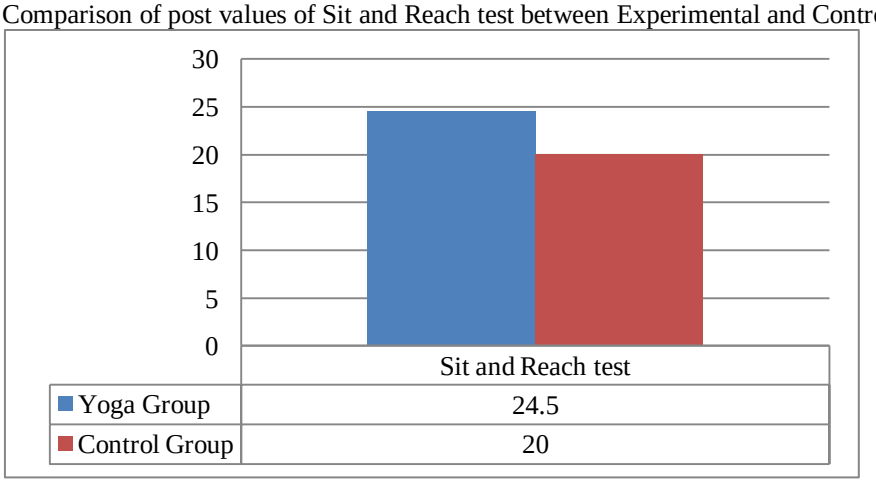


Figure-10: Comparison of post values of Sit and Reach test between Experimental and Control group.



IV. Discussion

Practicing yoga regularly for longer durations has been shown to influence five shealths of the body (*pancha koshas*) positively. When compared between the groups, those practicing yoga for one year had significantly increase in spinal flexibility and autonomic variables, following psychological assessment, cancellation & substitution task and happiness index. Studies have shown the possibilities of improving the balance and flexibility following long term practice of yoga among male athletes (13). This was followed by a study done on low back and hip flexibility by Cheema et al., in 2011, suggesting that the improvement in the physical parameters after 10 weeks of office work site based yoga program in sedentary workers. (14) The result of the present study related to increase in spinal flexibility appears to be in line with the above findings.

RMSSD is an estimate of short-term components of HRV data. In an attempt to understand the influence of breathing technique on the autonomic variables, a study demonstrated that decreased RMSSD component of the HRV, following alternate nostril breathing, suggestive of vagal dominance i.e., reducing the sympathetic activity and stimulating the vagal efferent activity. (15).These results co-relates to our present study, showing significant variation in autonomic variables of RMSSD, indicating the parasympathetic pre dominance, following yoga practice. The normalized spectral heart rate variability (HRV) measures low-frequency (LF) nu and high-frequency (HF) nu are frequently used in contemporary sleep research studies to quantify modulation of the sympathetic and parasympathetic branches of the autonomic nervous system. LF nu, HF nu, and LF: HF ratio should be considered equivalent carriers of information about sympathovagal balance.(16) In our study results shows increase in the High Frequency (HF) and LF/HF ratio, whereas Low Frequency power (LF) is decreased but statistically not significant. This result is similar to the study conducted by Telles et.al, in 2010 concluded that 8 week of hatha yoga program showed that there is an improvement in the HF power component, and the LF/HF ratio, but failed to reach statistical significance. (17)

Findings from previous small-scale studies have suggested that yoga postures and yogic breathing exercises significantly increase cardiac vagal modulation which, in turn, suggests a greater parasympathetic control. Despite previous studies showing significant effects on BP after 3-8 weeks of yoga in hypertensive individuals (18), no such effects was observed in our current study. Nevertheless, the current findings are in line

with previous research showing that 15 minutes of yoga postures had no effect on blood pressure but instead had a significant effect on HRV, on SDNN (square root of variance)(19) This was probably due to participants in the current study being normotensive, i.e. their blood pressure was low or normal already at baseline. Consequently, large changes in blood pressure were not to be expected.

While attempting to understand the underlying mechanisms for the influence of yoga on respiratory rate, a recent report demonstrated that long term meditation practitioners had higher gray matter density in lower brain stem regions compared to age-matched non meditators. It was inferred that long-term practitioners would have structural differences in brainstem regions concerned with cardio-respiratory control. It was also speculated that the above mentioned finding might have contributed to some of the cardio-respiratory parasympathetic effects, as well as the cognitive and emotional, impact reported in several studies of different meditation practices. (20)

Prefrontal cortex regulates physiological functions by integrating information from ongoing cognitive processes, emotional processes and current stress level. Chronic (perceived) stress alters normal patterns of prefrontal cortex activation during cognitive tasks, resulting in enhanced autonomic arousal.(21) The reduced stress could enabled their improved cognitive functions. Previous study (22) by Granath et al., in 2006 concluded that yoga practice reduces stress and negative feelings and shows improvement in psychological symptoms by lowering the levels of anxiety and anger.

Another Small study had been reported that, yoga tends to be effective in coping up of negative psychological symptoms, such as anxiety, and depression.(23) specifically, in our present study we observed a significant change ($p<0.00$) in the scores of psychological assessments viz., Anxiety, Depression, General well-being, Self-control, Positive health and Vitality in yoga group. Previous work done by Brown R P et, al., in a study of sudharshan kriya yogic breathing technique, concluded that practice of pranayama helps in reduction of stress and stress related disorders and is mediated by the activation of bidirectional vagal system. Vagal afferents from peripheral receptors are connected with the nucleus Tractus solitarius from which fibres ascend to the thalamus, limbic areas and anterior cortical areas. The descending projections then modulate autonomic, visceral, and stress arousal mechanisms at the different levels of the neuraxis. The bottom-up mechanisms of pranayama practice may be induced through the stretch of respiratory muscles, specifically the diaphragm. During above tidal inhalation (as was seen in Hering Breuer's reflex), stretch of lung tissue produces inhibitory signals in the vagus nerve, which ultimately shifts the autonomic nervous system into parasympatho-dominance, that results in a calm and alert state of mind. It was also speculated that the above mentioned findings might have contributed to the parasympathetic effect, as well as the emotional and cognitive impact reported in several studies of yoga practices. (24) Hence, Pranayama plays a key role in reduction of the stress level and thereby improves the scores of psychological assessment by the mechanism of parasympatho-dominance in our present study.

In our study we performed six letter cancellation task and digit letter substitution task for assessing attention, memory and concentration. The task consists of total attempts, wrong attempts and net attempts. Net attempt= total attempt –wrong attempts. Compared to the baseline scores of six letter cancellation task, there is increase in scores of total attempts and net attempts, and decrease in scores of wrong attempts ($p<0.00$) in yoga group. Meanwhile, the scores of Total attempts and Net scores of Digit letter substitution task ($p<0.00$) showed significant changes, and scores of Wong attempts is increased ($p<0.09$) in yoga group.

Improvement of psychosocial functioning not only require Sustained Attention, but also visual scanning, activation and inhibition of rapid responses. In a study done by Raghuraj et al., showed there is a decrease in total time taken to complete the task following yoga practice.(25) Considering the above findings, our study shows an improvements in the net scores of SLCT (Six letter cancellation Test) and DST (Digit substitution test), [net score=Total attempts-Wrong Attempts], and also decrease in the score of wrong attempts, when compared to that of the control group suggest that improvement in sustained attention and memory following yoga Module.

A study(26) by Elizabeth monk et.,al suggest that yoga had a positive impact on physical ,mental, and spiritual health of the college students who practiced yoga for longer duration. Further yoga helps in positive emotions (contentment, happiness), character traits (love, courage), positive outcome and quality of life. In contrary, our results also shows significant changes in the scores of happiness Index ($p<0.00$), when compared to that of the control group.

Overall, the integrated practice of yoga for 12 months among healthy individuals had an effect on all the Five Sheaths of the human body (*Pancha kosha*). Viz.., *Annamaya kosha ,pranamaya kosha, Manomayakosha, Vijnanamaya kosha* and *Anandamaya kosha.*

V. Conclusion

The present study showed that 12 months of Integrated Yoga Module (IYM) had improvements in Spinal flexibility, Heart rate and respiratory variables, Psychological assessment, Letter Cancellation task & Substitution task and Happiness Index among healthy Individuals.

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