



**ANALYSIS OF PHYSIOLOGICAL CHANGES THROUGH DYNAMIC ASANAS  
AND VARIED SURYA NAMASKAR AMONG WORKING WOMEN**

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**ABSTRACT**

Physiological systems are highly adaptable to yogic exercise that is concerned with the assessment of how the body responds to single or repeated bouts of exercise. Hence the investigator was interested to analyze the changes in selected physiological variables through dynamic asanas and varied surya namaskar among working women. To achieve this purpose, the investigator randomly selected sixty women who were working in the private information technology (IT) sectors, Chennai and divided into three groups namely 'asana group (AG)', 'fast namaskar group' (FG) and 'slow namaskar group' (SG) and given selected dynamic asanas, fast suryanamaskar and slow suryanamaskar practice respectively for twelve weeks. All the data were collected before and after the selected yoga practice from three groups. The results of this study showed that SG had significantly increased the forced vital capacity due to eight weeks slow surya namaskar practice when compared to AG and FG. Whereas FG outperformed the AG and SG in pulmonary ventilation rate, forced vital capacity, due to fast surya namaskar practice for eight weeks. The result of this study implies that regular suryanamaskar practice improves physiological efficiency and is beneficial not only for working women but for everyone who wants to maintain health.

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**INTRODUCTION**

Yoga is a scientific system of physical and mental practices that originated in India more than three thousand years ago. The word Yoga comes from the Sanskrit word "Yuj" meaning to yoke, join or unite. This implies joining or integrating all aspects of the individual - body with mind and mind with soul - to achieve a happy, balanced and useful life, and spiritually, uniting the individual with the supreme. Thus Yoga means anything that man may do to purify his lower nature, to restrain his senses, to direct his mind towards God, to come into a deep interior level of worship of the Divine and finally to realize his eternal oneness with the Divine consciousness (Mehta, 1990).

**Dynamic Asanas**

The word asana in Sanskrit does appear in many contexts denoting a static physical position, although, as noted, traditional usage is specific to the practice of yoga. Asanas can be classified into two on the basis of mode of performing. They are Dynamic Asanas and Relaxing or static Asanas. Static asanas are performed with little or no movement to the body, often remaining in the one position for quite a few minutes.

Dynamic asanas may be considered those in which the pattern of the posture is constantly modified and adjusted to meet the changing demands of movements. The characteristics of this system of Yogasanas are speed and repetition. This has transformation in the structure of the body as aim. The Dynamic Yogasanas stimulate the nervous and glandular systems resulting in evocation of energy (Iyengar, 2002).

**Varied Suryanamaskar**

The basic translation of Surya Namaskar is salutations to the sun. It is a very ancient tradition which has been in existence since the Vedic age. It is an extremely effective system and is typically used for loosening up, developing, relaxing, and toning all of the physical structures including organs, muscles, joints, and bone structures of the body. It should be performed in a steady, rhythmic, and fluid sequence in which all parts of the mind, body, and soul work together in one harmonic movement. While standards for Surya Namaskara do exist, there are many variations of the series and every school or ashram has its own unique style of moving through the practice. These can be either done fastly without mantras or slowly with uttering mantras (Saraswati, 2002).

**Physiology**

Physiological systems are highly adaptable to yogic exercise that is concerned with the assessment of how the body responds to single or repeated bouts of exercise. In order to be

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fit, the physiological system of the human organism must function effectively to sustain the particular activity that the individual is performing. Research suggests that yoga can lower blood pressure and slower the resting heart rate. The heart is a muscular organ, becomes larger and more efficient as a pump with regular training. Resting heart rate is the lowest number of heart beats per minute when completely relaxed and without distraction. A lower heart rate at rest usually means that the heart is more efficient in pumping blood to the rest of the body (Devi, 2007).

Forced vital capacity is the maximum amount of air a person can expel from the lungs after a maximum inspiration. It is equal to the inspiratory reserve volume plus the tidal volume plus the expiratory reserve volume. Pulmonary ventilation rate refers to the ability of the lungs to exchange air from the environment into the body. The process of ventilation occurs by inspiring in air, allowing it to travel through the trachea, having it track through the bronchi and bronchioles, and finally enter the small pulmonary air sacs called the alveoli (Coulter, 2001).

**Working Women**

Women always have to endure more in life than men due to the additional responsibilities entrusted to women as a homemaker and as professionalism in this modern society. Yoga for women works on both the mind and body. It makes both physically and emotionally strong to handle the challenges of life. By practicing yoga regularly, most of the common issues affecting women can be resolved (Sparrowe, 2002).

**Need For the Study**

Many studies proved the effects of different type of exercise benefited positively on selected physiological variables. But no study was found on physiological changes due to dynamic asanas and suryanamaskar among working women. Thus the investigator was interested to make a scientific research to analyze the changes in selected physiological variables through dynamic asanas and varied surya namaskar among working women.

**Statement of the Problem**

The purpose of the study was to analyze the changes in selected physiological variables through dynamic asanas and surya namaskar among working women.

**Hypothesis**

It is hypothesized that there would be significant improvement in the selected physiological variables such as forced vital capacity, resting heart rate and pulmonary ventilation rate due to dynamic asanas and varied surya namaskar practice among working women.

**METHODOLOGY**

The investigator randomly selected sixty women who were working in the private information technology (IT) sectors, Chennai and staying in the working women’s hostel, Chennai whose age were ranged between 24 and 30 years. They were divided into three groups namely ‘asanas’, ‘fast namaskar and ‘slow namaskar group’ and given selected dynamic asanas, fast suryanamaskar and slow suryanamaskar practice respectively for twelve weeks. All the data were collected before and after the selected yoga practice schedule from the

three groups. The pre and post test data on selected physiological variables such as forced vital capacity, resting heart rate and pulmonary ventilation rate were collected by using lab equipments such as stethoscope and spirometer.

**Dynamic Asanas**

Asana group practiced the, following dynamic asanas for twelve weeks. Trikonasana - The Triangle Pose, Vrikshasana - The Tree Pose, Padahastasana - The Hand-to-Feet Pose, Utkatasana - The Half-Squat Pose, Baddha Konasana- Bound Angle Pose, Vakrasana - The Twisted Pose, Uttanapadasana - The Raised-leg Pose, Viparita Karani - The Inverted Pose, Sarvangasana - The All-Parts Pose, Halasana - The Plough Pose, Ardha Shalabhasana - The Half-Locust Pose, Shalabhasana - The Locust Pose, Bhujangasana - Cobra Pose, Naukasana - The Boat Pose, Dhanurasana - The Bow Pose.

**Varied Surya Namaskar**

Bihar school of yoga (surya namaskar) style was followed with variations in speed alone. The same count was followed for both fast surya namaskar and slow surya namaskar practice. The pace followed was differed from each other. The fast namaskar group performed the suryanamaskar practice fastly without holding the posture anywhere and completed in two minutes. Fifteen rounds were performed in 30-40 minutes. After two weeks of training they practiced the same under the investigator’s direct supervision for a total duration of eight weeks. The slow surya namaskar group was trained to perform suryanamaskar in a slow manner so that each of the twelve poses were held for a duration of thirty seconds. Each round took six minutes to complete and five rounds were performed in 30-40 minutes.

**RESULTS AND DISCUSSIONS**

No attempt was made to equate the groups in any manner during the study. Hence to make adjustments for differences in the initial means and test the adjusted post test means for significant difference the analysis of covariance was used. If significant difference was found, Scheffe’s post-hoc test was applied to determine which of the two paired means had a significant difference.

The results showed that slow surya group had significantly increased the forced vital capacity due to eight weeks slow surya namaskar practice when compared to asana and slow surya group. However, statistically no significant difference was found in forced vital capacity between asana and slow surya group as the obtained mean difference was lesser than the required Scheffe’s confidence interval.

**Table I** Computation of Ancova on Forced Vital Capacity

Test	Asana Group	Slow Surya Group	Fast Surya Group	Source of variance	Sum of squares	df	Mean Squares	Obtained F
Pre-Test	1.67	1.56	1.57	between	0.13	2	0.064	2.68
				within	1.35	57	0.02	
Post-Test	2.50	2.52	2.73	between	0.62	2	0.31	5.07*
				within	3.49	57	0.06	
Adjusted Post-Test	2.47	2.54	2.74	between	0.78	2	0.39	6.95*
				within	3.128	56	0.06	
Mean Gain	0.83	0.955	1.16					

Table value at .05 level of confidence for 2 and 57 (df) is 3.23  
\*Significant at .05 level of confidence

The analysis of data obtained for forced vital capacity of the pre-test and post-test means of selected groups have been presented in table I and II respectively.

**Table II** Scheffe's Post Hoc Test on Forced Vital Capacity

Adjusted Test Mean			Mean Difference	Required CI
Asana Group	Slow Surya Group	Fast Surya Group		
2.47	2.54	-	0.07	0.19
2.47	-	2.74	0.27*	0.19
-	2.54	2.74	0.20*	0.19

\*significant

The ordered pre test, post test and adjusted post test mean values of asana group, slow surya group and fast surya group on forced vital capacity are graphically illustrated through bar diagram in Figure 1.

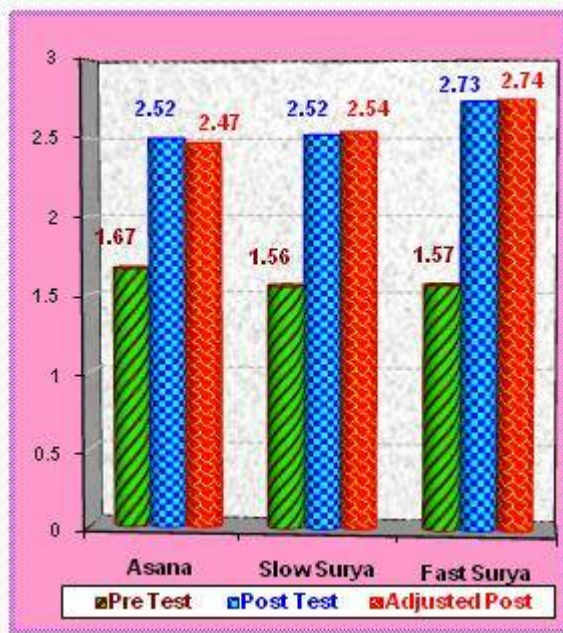


Figure 1

## RESULTS ON RESTING HEART RATE

The obtained results showed that fast surya group had significantly decreased the resting heart rate due to eight weeks slow surya namaskar practice when compared to asana and slow surya group. However, statistically no significant difference was found in resting heart rate between asana and slow surya group as the obtained mean difference was lesser than the required Scheffe's confidence interval.

The analysis of data obtained for resting heart rate of the pre-test and post-test means of selected groups have been presented in table III and IV respectively.

The ordered pre test, post test and adjusted post test mean values of asana group, slow surya group and fast surya group on resting heart rate are graphically illustrated through bar diagram in Fig. 2.

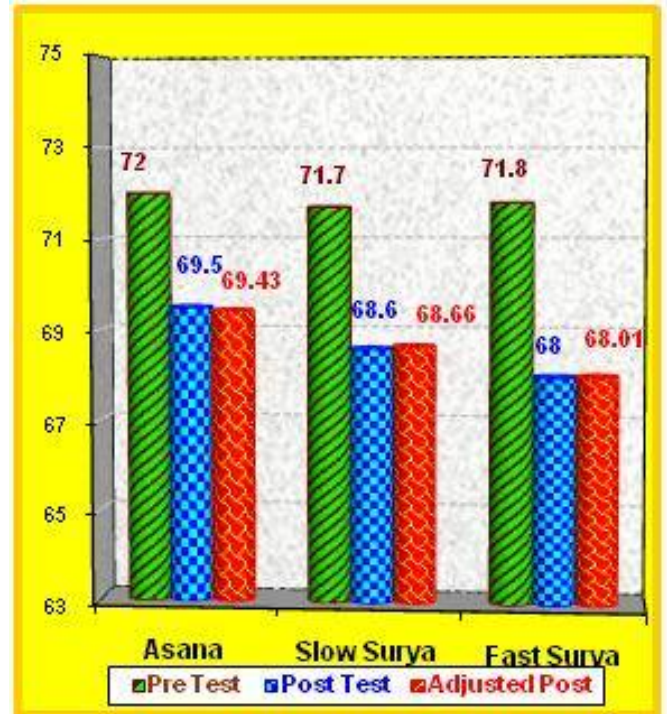


Figure 2

## Results on Pulmonary Ventilation Rate

The obtained results showed that fast surya group had significantly decreased the pulmonary ventilation rate due to eight weeks fast surya namaskar practice when compared to asana and slow surya group. However, statistically no significant difference was found in pulmonary ventilation rate between asana and slow surya group as the obtained mean difference was lesser than the required Scheffe's confidence interval.

The ordered pre, post and adjusted post test mean values of asana, slow surya and fast surya groups on pulmonary ventilation rate are graphically illustrated through bar diagram in Figure 3.

**Table III** Computation of Ancova on Resting Heart Rate

Test	Asana Group	Slow Surya Group	Fast Surya Group	Source of variance	Sum of squares	DF	Mean Squares	Obtained f-ratio
Pre-Test	72.00	71.7	71.80	between	0.93	2	0.467	0.31
				within	85.40	57	1.50	
Post-Test	69.50	68.6	68.00	between	22.80	2	11.40	7.94*
				within	81.80	57	1.44	
Adjusted Post-Test	69.43	68.66	68.01	between	20.02	2	10.01	8.37*
				within	66.960	56	1.20	
Mean Gain	2.50	3.1	3.80					

Table F-ratio at 0.05 level of confidence for 2 and 57 (df) is 3.23

\*Significant at .05 level of confidence



**Table XIII** Scheffe’s Post Hoc Test on Resting Heart Rate

Asana Group	Adjusted Test Mean		Mean Difference	Required C I
	Slow Surya Group	Fast Surya Group		
69.43	68.66	-	0.77	0.86
69.43	-	68.01	1.42*	0.86
-	68.66	68.01	0.64	0.86

\* Significant

**Table XIV** Computation of Ancova on Pulmonary Ventilation Rate

Test	Asana Group	Slow Surya Group	Fast Surya Group	Source of variance	Sum of squares	df	Mean Squares	Obtained F
Pre-Test	20.00	20.05	20.10	between	0.10	2	0.050	0.02
				within	122.75	57	2.15	
Post-Test	16.30	16.4	14.95	between	26.23	2	13.12	6.45*
				within	115.95	57	2.03	
Adjusted Post-Test	16.34	16.40	14.91	between	28.29	2	14.14	16.70*
				within	47.446	56	0.85	
Mean Gain	3.70	3.65	5.15					

Table f-ratio at 0.05 level of confidence for 2 and 57 (df) is 3.23  
\*Significant at .05 level of confidence

**Table XV** Scheffe’s Post Hoc Test on Pulmonary Ventilation Rate

Asana Group	Adjusted Test Mean		Mean Difference	Required C I
	Slow Surya Group	Fast Surya Group		
16.34	16.40	-	0.06	0.72
16.34	-	14.91	1.42*	0.72
-	16.40	14.91	1.49*	0.72

\* Significant



Figure 3

## DISCUSSION ON HYPOTHESIS

Result of this study showed significant improvement in the selected physiological variables such as forced vital capacity, resting heart rate and pulmonary ventilation rate due to twelve weeks of dynamic asanas and varied surya namaskar practice among working women. Hence the stated research hypothesis was accepted at .05 level

## CONCLUSION

The findings of this study showed that there was significant improvement due to the twelve weeks of dynamic asanas and varied surya namaskar among the selected women software engineers. The fast surya namaskar group outperformed the asana group and slow surya namaskar groups in pulmonary ventilation rate, forced vital capacity, due to fast surya namaskar practice for twelve weeks. This study suggests that regular suryanamaskar practice improves physiological efficiency and is beneficial not only for working women but for everyone who wants to maintain health.

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