



INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Evaluate The Impact Of Varying Paces And Durations Of Suryanamaskar On

Vital capacity among College going Students

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The purpose of this study was to see the effect of Suryanamaskar practice with different paces on Vital capacity of college going students. The objective of the study finds the effect of training duration and paces of Suryanamaskar. Within and between designs was used. Three experimental intact groups were created Pace 1 group, Pace 2 groups and Pace 3 groups; each group had 40 subjects with age range between 17-24 years. Pace 1 group practiced one round (12 steps) of Suryanamaskar in 90 seconds, Pace 2 groups in 180 seconds and Pace 3 groups in 360 seconds. The Vital capacity of the subjects was measured by Dry Spirometer test under the expert supervision. Total 12 weeks training was given in which three observations were taken before the training (pre-test), after 6 weeks (mid-test) and after 12 weeks (post-test). ANOVA was used and level of significance was set at 0.05. Result demonstrates that practice of Suryanamaskar for 6 weeks and 12 weeks were sufficient to bring out significant improvement on Vital capacity (VC).

Key words: Suryanamaskar, Pace, Vital capacity, Spiro meter etc.

Introduction

Physical inactivity and sedentary lifestyles among college students have become major public health concerns, resulting in decreased physical fitness, poor pulmonary function, and an increased risk of chronic diseases. Academic workload, excessive screen time, and a lack of regular physical activity have all had a negative impact on young adults' general health. As a result, there is an increasing interest in discovering accessible, cost-effective, and evidence-based exercise programs that can enhance cardiopulmonary health in this population.

Vital capacity is the maximum amount of air you can exhale after taking the deepest breath possible. It serves as a key measure of lung function and respiratory muscle strength.

Several factors affect vital capacity, including age, sex, body composition, physical activity, and muscle strength. A higher vital capacity supports better oxygen delivery, greater endurance, and improved overall health.

Because of this, improving lung function is a valuable goal in health promotion and preventive medicine.

Suryanamaskar (Sun Salutation) is a traditional yogic practice that consists of 12 interconnected postures performed in synchronization with controlled breathing. It combines physical movement, breathing regulation, flexibility, muscular endurance, and awareness to provide a holistic form of exercise. Suryanamaskar may produce a variety of physiological responses depending on the pace at which it is performed. Slow-paced exercise focuses on breath awareness, flexibility, parasympathetic activation, and controlled respiratory movements, whereas fast-paced practice enhances cardiovascular demand, muscular endurance, and metabolic activity. These discrepancies indicate that the pace of Suryanamaskar may have a varied effect on respiratory measures, especially vital capacity.

The duration of Suryanamaskar practice is another important variable that may determine the extent of physiological adaptation. Longer practice durations may provide greater training stimuli, resulting in improved respiratory muscle strength, enhanced lung compliance, and increased Ventilatory efficiency. Conversely, shorter durations may produce limited but measurable improvements, particularly among previously sedentary individuals. Understanding the combined effects of varying pace and duration is essential for optimizing yoga-based interventions aimed at improving pulmonary function.

Previous studies have shown that yoga practices, such as pranayama, asanas, and comprehensive yoga programs, can notably enhance pulmonary function indicators, including vital capacity, forced vital capacity (FVC), forced expiratory volume in one second (FEV₁), peak expiratory flow rate (PEFR), and maximum voluntary ventilation (MVV). These enhancements are thought to stem from improved strength of respiratory muscles, increased thoracic flexibility, enhanced diaphragmatic performance, and more effective autonomic regulation. Nonetheless, even with an expanding collection of evidence highlighting the respiratory advantages of yoga, there is a scarcity of research specifically investigating how varying paces and durations of Suryanamaskar affect vital capacity in healthy college students.

College students represent an important target population for preventive health interventions because habits established during this stage of life often persist into adulthood. A structured Suryanamaskar program is practical, inexpensive, requires minimal equipment, and can be implemented within educational institutions to promote physical fitness and respiratory health. Determining the most effective pace and duration of practice may assist educators, physiotherapists, yoga practitioners, and health professionals in designing evidence-based exercise programs that maximize pulmonary benefits.

Thus, the current study is to assess how different Suryanamaskar speeds and durations affect college-bound kids' vital ability. The duration and speed of Suryanamaskar practice are thought to have a major impact on vital capacity, with longer practice sessions and properly recommended practice intensity leading to higher gains in pulmonary function. The results of this study should add to the body of knowledge on yoga-based exercise therapies and offer useful suggestions for improving young adults' respiratory health.

Objective

The purpose of the study were to assess the effect of the different paces of Suryanamaskar on Vital capacity variable to compare the effect of different training duration of Suryanamaskar practice on Vital capacity variable and to find out and assess the pattern of progress in different paces of Suryanamaskar practice in different training duration on selected Vital capacity.

Methodology

120 male students from aB.Tech degree program atCoAE JNKVV Jabalpur took part in this study. Their ages fell between 17 and 24 years. For practical reasons when running the study, three intact groups were put together (these were named group 1, group 2, and group 3). Different paces of training (pace 1, pace 2, and pace 3) were handed out randomly among these groups. Each group ended up with 40 students (so we had a pace 1 group, a pace 2 group, and a pace 3 group). These groups took part actively for twelve weeks, each following their own pace of Suryanamaskar. Vital capacity was one of the chosen variables for this study. It was measured using a dryspirometer. Before the training started (that's the pretest) and then again after 6 weeks and after 12 weeks of training, each person's measurements were taken with standard equipment. Descriptive statistics and ANOVA were used to look at the data to find out between groups the effect of different pace effect of training durations of Suryanamaskar on selected vital capacity variable and for this study level of significance was set at 0.05.

Table 1
Statistical analysis of various groups' vital capacity and Suryanamaskar
Training intervals

Duration		N	Mean	Std. Dev.
Pre- test	Pace 1	40	2.21	0.117
	Pace 2	40	2.21	0.096
	Pace 3	40	2.17	0.075
6 Weeks	Pace 1	40	2.51	0.155
	Pace 2	40	2.53	0.126
	Pace 3	40	2.51	0.084
12 Weeks	Pace 1	40	3.00	0.200
	Pace 2	40	2.96	0.166
	Pace 3	40	2.83	0.096

Above table 1 includes mean (M), standard deviation (S) in all the data readings i.e. on pre-test after 6 and 12 weeks of training. According to the table the highest mean value of vital capacity after 12 weeks was Pace 3 group followed by pace 2 groups and pace 1 group.

Above table explain the suggestive information of pretest, 6 weeks and 12 weeks group with different pace of Suryanamaskar the mean and standard of pretest group pace 1, pace 2 and pace 3 respectively are 2.21 ± 0.11 , 2.21 ± 0.09 and 2.17 ± 0.07 . the mean and standard deviation 6 weeks groups pace 1, pace 2 and pace 3 respectively are and the mean and standard deviation 12 weeks groups pace 1, pace 2 and pace 3 respectively are after 6 week 2.51 ± 0.155 , 2.53 ± 0.126 and 2.51 ± 0.084 after 12 week 3.00 ± 0.200 , 2.96 ± 0.166 and 2.83 ± 0.096 .

Below is a graphic representation of the marginal means for each training duration

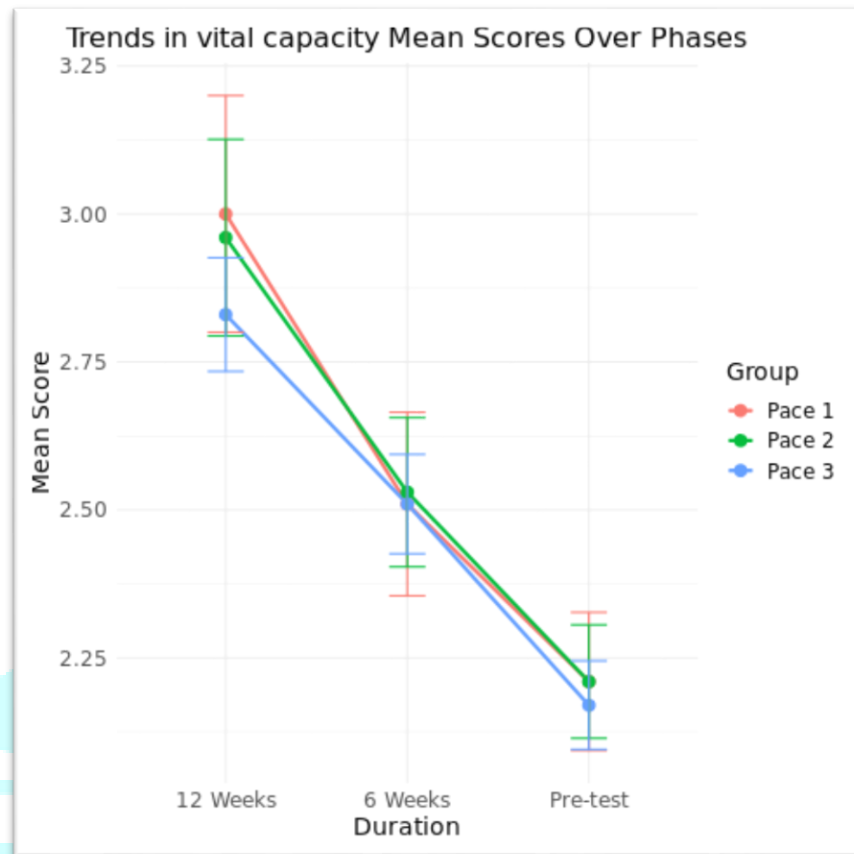


Figure 1: Pictorial Illustration of Vital Capacity Marginal Means throughout Training Intervals

The graph illustrates the progression of vital capacity (mean scores) across different training durations (Pre-test, 6 Weeks, and 12 Weeks) for three different pace groups (Pace 1, Pace 2, and Pace 3).

Table 2

**Analysis of Variance (ANOVA) Statistics of between the groups after 12 weeks
Among the different the group's i.e. pace 1, pace 2 and pace 3 in effect of
Suryanamaskar on vital capacity**

		Sum of Squares	df	Mean Square	F	Sig.
After 12 weeks vital capacity	Between Groups	.65	2	.329	12.76	.000
	Within Groups	3.01	117	.026		
	Total	3.67	119			

*. Significant at 0.05

Table 2 reveals that analysis of variance (ANOVA) was employed on after 12 weeks among the different groups of pace 1, pace 2 and pace 3 to find the variances of the groups after 12 weeks of training to show the effect of Suryanamaskar on the vital capacity. As significance difference was found in between the groups, whereas, the p value was found .000, which was lesser than the 0.05 level of significance.

Table 3

**Multiple Comparison (LSD) Statistics after 12 weeks training to Suryanamaskar
Among the pace 1, pace 2 and pace 3 groups for vital capacity**

Dependent Variable	(I) duration	(J) duration	Mean Difference (I-J)	Std. Error	Sig.
After 12 weeks vital capacity	90 sec	180 sec	.0412	.035	.253
		360 sec	.173*	.035	.000
	180 sec	90 sec	-.041	.035	.253
		360 sec	.132*	.035	.000
	360 sec	90 sec	-.173*	.035	.000
		180 sec	-.132*	.035	.000

*Significant at 0.05.

The means difference between the groups following 12 weeks of training in the Suryanamaskar LSD technique utilized in the pace 1, pace 2, and pace 3 groups was determined using the statistics of multiple comparison (LSD), as shown in Table 28. With p values of .000 and .000, respectively, which are below the 0.05 level of significance, mean differences between the pace 1 and pace 3 and pace 2 and pace 3 groups were determined to be significant. Additionally, the pace 1 to pace 2 groups showed no significant differences, with a p-value of .253, above the significance level of 0.05.

Table 4

**Analysis of Variance (ANOVA) Statistics of within pace1 group i.e. pretest, following
Six and twelve weeks of Suryanamaskar training on vital capacity**

		Sum of Squares	df	Mean Square	F	Sig.
Pace 1	Between Groups	12.79	2	6.39	245.23	.000
	Within Groups	3.05	117	.026		
	Total	15.84	119			

*Significant at 0.05.

Table 4 reveals that in order to determine the means difference within the pace 1 groups and the impact of Suryanamaskar on the vital capacity, analysis of variance (ANOVA) was used on the pace 1 group among the various pretest data, after six weeks, and after twelve weeks of training. The pace 1 group showed a significant difference, as indicated by the p value of .000, which is below the significance at 0.05.

Table 5

**Multiple Comparison (LSD) Statistics of within pace1 group i.e. pretest following
Six and twelve weeks of Suryanamaskar on vital capacity**

Dependent Variable	(I) duration	(J) duration	Mean Difference (I-J)	Std. Error	Sig.
Pace 1	pretest	6 week	-.298*	.036	.000
		12 week	-.791*	.036	.000
	6 weeks	pretest	.298*	.036	.000
		12 week	-.493*	.036	.000
	12 weeks	pretest	.791*	.036	.000
		6 week	.493*	.036	.000

* Significant at the 0.05

Table 5 reveals the statics of multiple comparison (LSD) was employed to find the means difference within the (pace 1) group after pretest, 6 weeks and 12 weeks training of Suryanamaskar. LSD technique used in compare the pretest, 6 weeks and 12 weekswithin the pace 1 on vital capacity. Significant differences in means between the pretest and 6 weeks, the pretest and 12 weeks, and the 6 weeks and 12 weeks were identified; the corresponding p values were.000, .000 and 0.00 all of which were below the 0.05 level of significance.

Table 6

**Analysis of Variance (ANOVA) Statistics of within pace 2 group i.e. pretest,
Following six weeks and twelve weeks of training of Suryanamaskar
On vital capacity**

		Sum of Squares	df	Mean Square	F	Sig.
pace 2 vital capacity	Between Groups	11.58	2	5.79	327.50	.000
	Within Groups	2.07	117	.018		
	Total	13.65	119			

*Significant at 0.05 level

Table 6 reveals that analysis of variance (ANOVA) was employed on pace 2 group among the different pretest data, following six weeks and twelve weeks of training of Suryanamaskar to find the means difference within the pace 2 groups and to find out the effect of Suryanamaskar on the vital capacity. As significance difference was found in within the pace 2 the group, the value of p was found .000, which were lesser than at 0.05.

Table 7

**Multiple Comparison (LSD) Statistics of within pace 2 groups i.e. pretest following
Six weeks and twelve weeks of training of Suryanamaskar
On vital capacity**

Dependent Variable	(I) duration	(J) duration	Mean Difference (I-J)	Std. Error	Sig.
Pace 2 Vital capacity	pretest	6 week	-.321*	.029	.000
		12 week	-.758*	.029	.000
	6 weeks	pretest	.321*	.029	.000
		12 week	-.436*	.029	.000
	12 weeks	pretest	.758*	.029	.000
		6 week	.436*	.029	.000

* Significant at the 0.05.

Table 7 reveals the statics of multiple comparison (LSD) was employed to find the means difference within the (pace 2) group after pretest, 6 weeks and 12 weeks training of Suryanamaskar. LSD technique used in compare the pretest, 6 weeks and 12 weekswithin the pace 2 on vital capacity. Significant differences in means across the pretest and 6 weeks, the pretest and 12 weeks, and between the first six weeks and twelve-week period were identified; the corresponding p values were.000,.000, and 0.00, the results of which were below the 0.05 level of significance.

Table8

**Analysis of Variance (ANOVA) Statistics of within pace 3 group i.e. pretest, after
Sixand twelve weeks of Suryanamaskar training
On vital capacity**

		Sum of Squares	df	Mean Square	F	Sig.
Pace 3 vital capacity	Between Groups	8.83	2	4.41	594.13	.000
	Within Groups	.87	117	.007		
	Total	9.70	119			

*Significant at 0.05 level

Table8 reveals that analysis of variance (ANOVA) was employed on pace 3 group among the different pretest data, after Six and twelve weeks of Suryanamaskar to find the means difference within the pace 3 groups and to find out the effect of Suryanamaskar on the vital capacity. As significance difference was found inwithin the pace 3 the group, as the p value was found .000, which were lesser at significant 0.05.

Table9

Multiple Comparison (LSD) Statistics of within pace 3 group i.e. pretest, after 6 weeks and after 12 weeks of Suryanamaskar training on vital capacity

Dependent Variable	(I) duration	(J) duration	Mean Difference (I-J)	Std. Error	Sig.
Pace 3 Vital capacity	pretest	6 week	-.341*	.019	.000
		12 week	-.664*	.019	.000
	6 weeks	pretest	.341*	.019	.000
		12 week	-.323*	.019	.000
	12 weeks	pretest	.664*	.019	.000
		6 week	.323*	.019	.000

*Significant at the 0.05.

Table 9 reveals the statics of multiple comparison (LSD) was employed to find the means difference within the (pace 3) group after pretest, 6 weeks and 12 weeks training of Suryanamaskar. LSD technique used in compare the pretest, 6 weeks and 12 weeks within the pace 3 on vital capacity. Significant differences in means between the pretest and 6 weeks, the pretest and 12 weeks, and the period of six weeks and twelve-week period were identified; the corresponding p values were.000,.000, and 0.00, all of which were below the 0.05 level of significance.

Results and Discussion

The main effect of training duration's groups and interaction effect were significant on vital capacity.

The primary approach to enhancing vital capacity is through consistent aerobic exercise. Such activities effectively strengthen and condition both the heart and lungs, facilitating an increase in the maximum oxygen intake that the pulmonary system can accommodate. Aerobic workouts enhance the body's aerobic metabolism and improve the efficiency of both respiratory and circulatory systems. Similarly, engaging in Suryanamaskar at a moderate intensity for 30 to 35 minutes contributes positively to aerobic metabolism. This form of exercise necessitates a greater oxygen supply, thereby augmenting the efficiency of the pulmonary system and subsequently enhancing vital capacity.

The results of the interaction effect indicated that a 12-week practice of Suryanamaskar at pace 1 significantly enhances maximum vital capacity when compared to the groups practicing at pace 2 and pace 4. The participants in the pace 1 group completed approximately 24 rounds of Suryanamaskar, while those in the pace 2 group completed around 12 rounds, and participants in the pace 3 group performed 6 rounds. Based on these findings, it can be concluded that the pace 1 group engaged in a greater number of Suryanamaskar rounds. This increased frequency likely resulted in greater physiological demands on both the circulatory and respiratory systems. Consequently, the efficiency of these systems improved more significantly in the pace 1 group compared to those in the pace 2 and pace 3 groups.

In physiological variables, the benefits of Suryanamaskar training for 12 weeks were sufficient to provide a considerable improvement in vital capacity. Pace 3 contributes to improved maximal vital capacity when compared to paces 2 and 1. However, after six weeks of Suryanamaskar training, there was no significant distinction among the groups. However, there has been improvement at all groups of paces. The results revealed that training rate and duration had a substantial impact on essential capacity. We came to the view that the 12-week Suryanamaskar practice was sufficient to produce a noticeable increase in vital capacity, and that pace 3 helps increase maximal vital capacity in comparison to paces 2 and 1. However, there were petite differences between the groups following the six weeks of Suryanamaskar training. However, there was progress in every pace. The mean vital capacity shows a consistent increase across all groups from the

pre-test to the final assessment after training. The data demonstrates a clear trend of increasing vital capacity across all pacing groups over time with Suryanamaskar training: There is a significant improvement in vital capacity from pre-test through both training durations (6 weeks and then again at the end of the full training period at 12 weeks). The consistent rise in means indicates effective training outcomes, while relatively low standard deviations suggest that subjects are achieving similar improvements in vital capacity.

Conclusion

Based on our observations, we conclude that the Suryanamaskar (Sun Salutation) is an excellent exercise for maintaining optimal fitness levels along with physical and physiological.

Recommendations

The findings of this study clearly demonstrate that Suryanamaskar training can improve the vital capacity additionally, it also practice of Suryanamaskar is more effective for over all development of health and fitness. Hence it is recommended that coaches and physical educators to incorporate practice Suryanamaskar in their training sessions on regular basis.

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