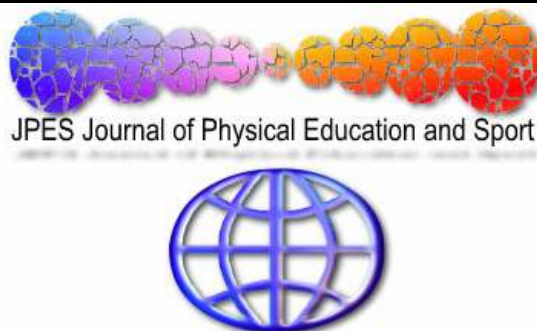




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ORIGINAL RESEARCH

THE EFFECT OF SURYANAMASKAR YOGASANA ON MUSCULAR ENDURANCE AND FLEXIBILITY AMONG INTERCOLLEGE YOGINIS

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Abstract

Study aim: To assess the effects of suryanamaskar yogasana on muscular endurance and flexibility. **Material and methods:** Thirty randomly selected female students aged 17-25 years volunteered to participate in the study. They were randomly assigned into two groups: A (experimental) and B (control). The subjects were subjected to a six week suryanamaskar yogasana training programme. The difference in the mean of each group for selected variable was tested for the significance of difference by “t” test. The level of significance was set at 0.05.

Results: The muscular endurance and flexibility significantly improved in group A compared with the control one. **Conclusions:** Suryanamaskar asana may be recommended to improve muscular endurance and flexibility.

Keywords: Suryanamaskar – Yogasana - Muscular Endurance – Flexibility - Yoginis

INTRODUCTION

India has a rich tradition of yogic practices. Now-a-days yoga, the ancient practice of postures, breathing and meditation is gaining a lot of attention from health care Professionals. With increasing scientific research in yoga, its therapeutic aspects are also being explored. Suryanamaskar – the salutation to the god sun is also a part of Indian traditional yogic practices. Each cycle of suryanamaskar is a sequence of certain ‘asanas’ performed along with pranayama. The nomenclature ‘suryanamaskar’ is composed of two terms ‘surya’ (meaning ‘the sun god’) and ‘namaskar’ (connoting obeisance). Both the words have their roots in Sanskrit. Surya Namaskara is a series of 12 physical postures made up of a variety of forward and backward bends. The sequence of asanas is such that each asana is complimentary to the next. During Suryanamaskar, muscles of the entire body experience stretch and pressure alternately and therefore it is said to give more benefits with less expenditure of time. The series of movements stretch the spinal column and massage, tone and stimulate vital organs through alternately flexing the body forwards and backwards. While performing surya namaskar the breathing exercise (pranayam) gives more oxygen to your lungs. The rhythm of breathing becomes heavy with vitality. Each breath becomes deep and clear. It carries more oxygen to the parts of your body. Surya namaskar has a deep effect in detoxifying the organs through copious oxygenation and has a deeper relaxing effect. It reduces stress, rejuvenates us and improves circulation and as a result this study was undertaken to find out the effects of suryanamaskar yogasana on muscular endurance and flexibility.

MATERIAL AND METHODS

Subjects: Thirty randomly selected female students of the DAV Institute of Engineering and Technology, Jalandhar (Punjab, India), aged 17 – 25 years, volunteered to participate in the study. They were randomly assigned into two groups: A (experimental) and B (control). The subjects from Group A were subjected to a 6-week suryanamaskar asana training programme. This lasted 6 weeks and consisted of daily sessions, lasting 90 min each, which included 12 positions: Mountain pose (Parvatasana), Raised Arms Pose (Hastha

uthanasana), Hand to Foot Pose (Padahastanasana), Equestrian Pose (Aswa sanchalanasana), Salute with eight limbs (Ashtanga namaskar), Serpent pose (Bhujangasana) and Prayer pose (Pranamasana). (Fig. 1).

Methodology: The sit-up test was used to measure the muscular endurance of the abdominals and hip-flexors and the sit and reach test used to measure the lower back and hamstring flexibility. The sit-up test consists of maximum number of sit ups performed in one (1) minute is recorded. Alternatively, the test may be performed at a set tempo, and the maximum number of total sit-ups is recorded. For this method, a metronome was set at the desired tempo. The sit and reach test involves stretching out to touch the toes or beyond with extended arms from a sitting position. The score is in inches reached on a yard stick with 15 inches being at the toes.

The between-group differences were assessed using the Student's *t*-test for dependent data. The level of $p \leq 0.05$ was considered significant.



Fig. 1. The 12 steps of Suryanamaskar

RESULTS

The study was conducted to find out the effects of suryanamaskar yogasana on muscular endurance and flexibility among intercollege yoginis. The statistical analysis of data collected on thirty ($N=30$) subjects. For

each of the chosen variable, the results pertaining to significant difference, if any, between experimental and control groups were assessed by “t” test and are presented in following tables:

	Pre-Test	Post-Test
Sample size	15	15
Arithmetic mean	32.5333	36.2000
95% CI for the mean	29.7973 to 35.2693	33.9244 to 38.4756
Variance	24.4095	16.8857
Standard deviation	4.9406	4.1092
Standard error of the mean	1.2757	1.0610
Mean difference		3.6667
Standard deviation		1.7995
95% CI		2.6702 to 4.6632
Test statistic t		7.892
Degrees of Freedom (DF)		14
Two-tailed probability		P<0.0001

Table 1.. Muscular Endurance of Experimental Group Paired Samples t-Test

	Pre-Test	Post-Test
Sample size	15	15
Arithmetic mean	33.3333	33.2000
95% CI for the mean	30.6312 to 36.0355	30.7753 to 35.6247
Variance	23.8095	19.1714
Standard deviation	4.8795	4.3785
Standard error of the mean	1.2599	1.1305
Mean difference	-0.1333	
Standard deviation	2.2949	
95% CI	-1.4042 to 1.1376	
Test statistic t	-0.225	
Degrees of Freedom (DF)	14	
Two-tailed probability	P=0.8252	

Table 2. Muscular Endurance of Control Group Paired Samples t-Test

Group	Number	Mean	S.D.	SEM	't' Value
Experiment (Pre-test)	15	32.5333	4.9046	1.2757	7.892
Experimental (Post-test)	15	36.2000	4.1092	1.0610	
Control (Pre-test)	15	33.3333	4.8795	1.2599	-0.225
Control (Post-test)	15	33.2000	4.3785	1.1305	

Table 3. Mean, Standard Deviation (SD), Standard Error of Mean (SEM) of Muscular Endurance of Experimental and Control Group

Table-3 shows that the mean of muscular endurance of pretest of experimental group and posttest of experimental group was 32.5333 and 36.2000 respectively, whereas the mean of muscular endurance of pretest of control and posttest of control group was 33.3333 and 33.2000. The “t” value in case of experimental group was 7.892 and for control group it was -0.225. Since cal. t (=7.892) > tab t .05 (14) (=2.145), Ho (null hypothesis) is rejected at 0.05 level of significance. Thus it may be concluded that six week training program of Suryanamaskar yogasana showed significant improvement in muscular endurance. As per the study the above remark can be given at 95% confidence. The graphical representation of responses has been exhibited in (Fig. 2).

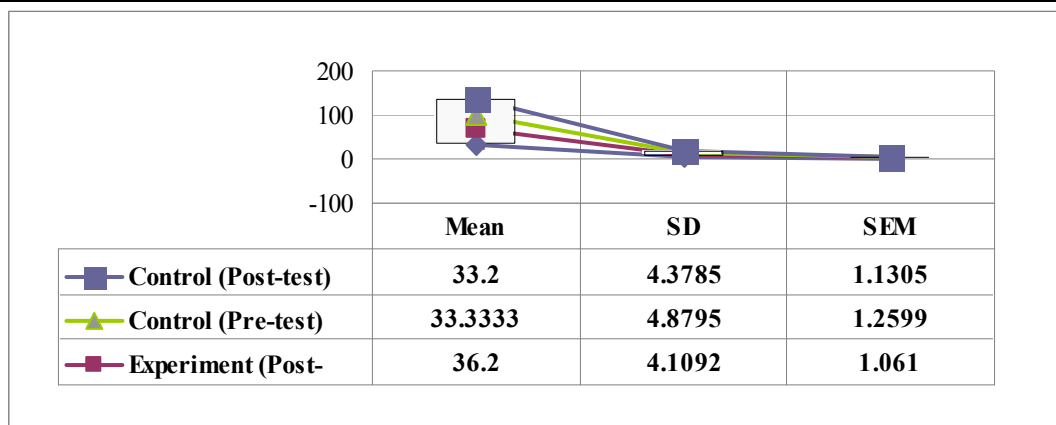


Fig. 2. Mean, Standard Deviation (SD), Standard Error of Mean (SEM) Of Muscular Endurance of Experimental and Control Group

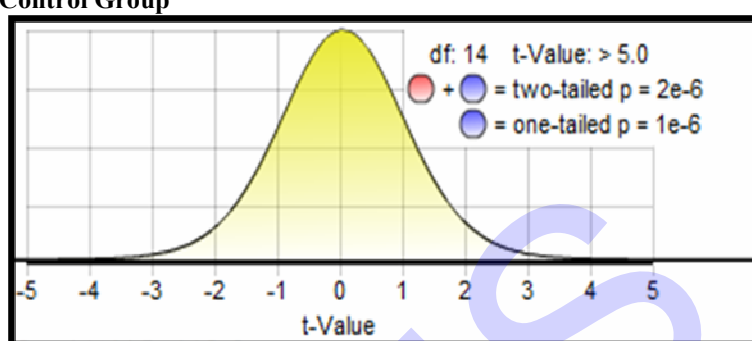


Fig. 3. P-Value, Two Tailed and One Tailed Probability Values of a t-Test of Experimental Group of Muscular Endurance

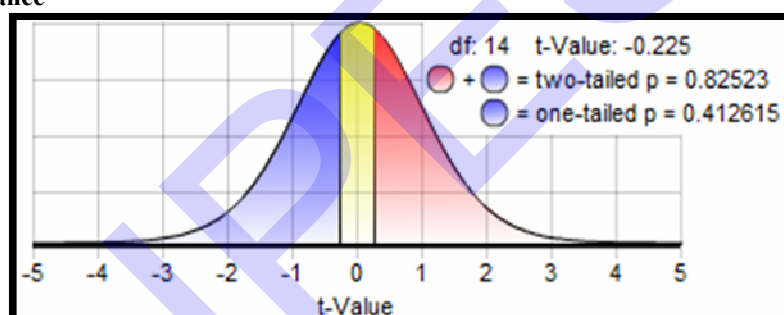


Fig. 4. P-Value, Two Tailed and One Tailed Probability Values of a t-Test of Control Group of Muscular Endurance

	Pre-Test	Post-Test
Sample size	15	15
Arithmetic mean	4.6667	5.7333
95% CI for the mean	3.8382 to 5.4951	4.8840 to 6.5827
Variance	2.2381	2.3524
Standard deviation	1.4960	1.5337
Standard error of the mean	0.3863	0.3960
Mean difference		1.0667
Standard deviation		1.0998
95% CI		0.4576 to 1.6757
Test statistic t		3.756
Degrees of Freedom (DF)		14
Two-tailed probability		P=0.0021

Table 4. Flexibility of Experimental Group Paired Samples t-Test

	Pre-Test	Post-Test
Sample size	15	15
Arithmetic mean	4.5333	4.4667
95% CI for the mean	3.6996 to 5.3671	3.4879 to 5.4454
Variance	2.2667	3.1238
Standard deviation	1.5055	1.7674
Standard error of the mean	0.3887	0.4563
Mean difference		-0.06667
Standard deviation		1.1629
95% CI		-0.7107 to 0.5773
Test statistic t		-0.222
Degrees of Freedom (DF)		14
Two-tailed probability		P=0.8275

Table 5. Flexibility of Control Group Paired Samples t-Test

Group	Number	Mean	S.D.	SEM	't' Value
Experiment (Pre-test)	15	4.6667	1.4960	0.3863	3.756
Experimental (Post-test)	15	5.7333	1.5337	0.3960	
Control (Pre-test)	15	4.5333	1.5055	0.3887	-0.222
Control (Post-test)	15	4.4667	1.7674	0.4563	

Table 6. Mean, Standard Deviation (SD), Standard Error of Mean (SEM) Flexibility of Experimental and Control Group

Table-6 shows that the mean of flexibility of pretest of experimental group and post test of experimental group was 4.6667 and 5.7333 respectively, whereas the mean of flexibility of pretest of control and posttest of control group was 4.5333 and 4.4667. The "t" value in case of experimental group was 3.756 and for control group it was 0.222. Since $\text{cal. } t (=3.756) > \text{tab } t_{.05} (14) (=2.145)$, H_0 (null hypothesis) is rejected at .05 level of significance. Thus it may be concluded that six week training program of suryanamaskar yogasana leads to significant improvement in flexibility. As per the study the above remark can be given at 95% confidence. The graphical representation of responses has been exhibited in (Fig. 5).

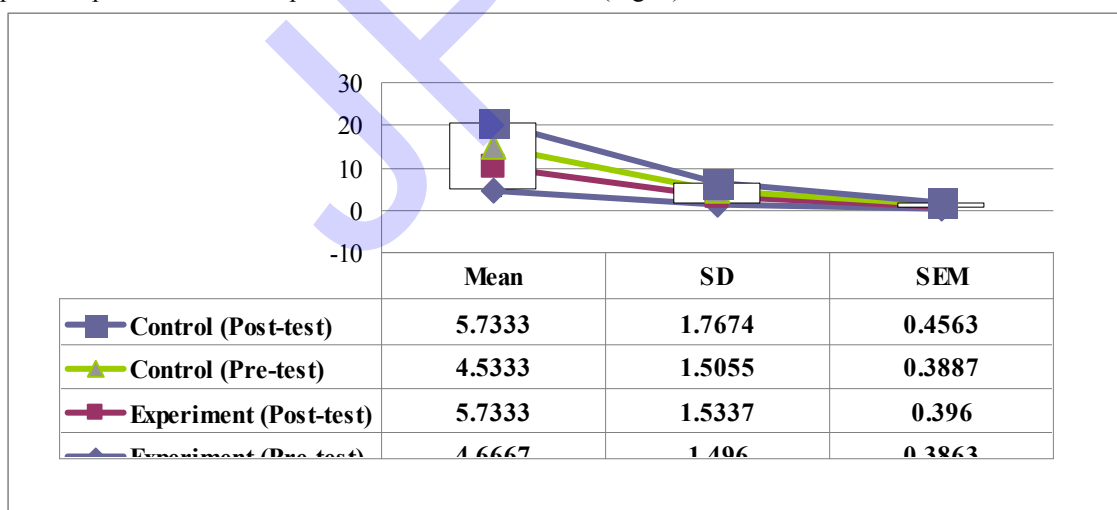


Fig. 5. Mean, Standard Deviation (SD), Standard Error of Mean (SEM) of Flexibility Volume of Experimental and Control Group

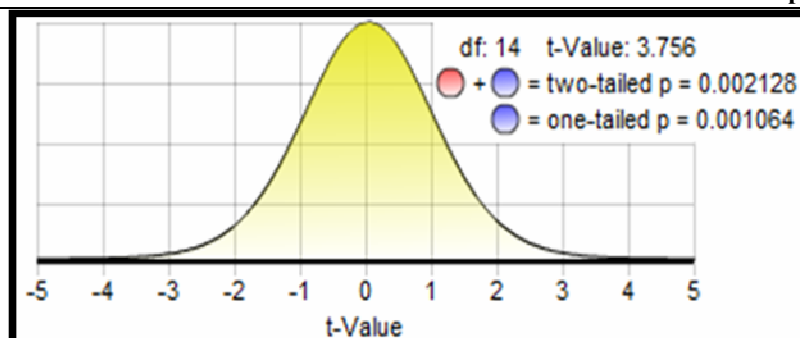


Fig. 6. P-Value, Two Tailed and One Tailed Probability Values of a t-Test of Experimental Group of Flexibility

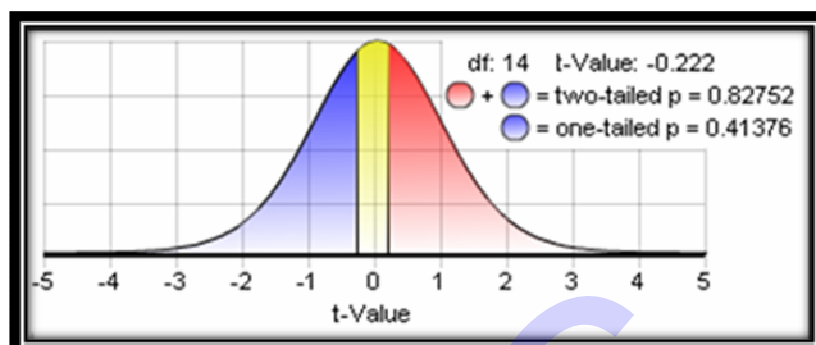


Fig. 7. P-Value, Two Tailed and One Tailed Probability Values of a t-Test of Control Group of Flexibility

DISCUSSION

From the results it is evident that the six week Suryanamaskar *yogasana* training programme has shown a significant improvement in muscular endurance and flexibility among intercollege yoginis. The results have shown a significant improvement in muscular endurance. The findings are supported by the study conducted by Alisha Bauman titled “Is yoga enough to keep you fit?” which concluded that statistically significant improvement indicates better respiratory endurance after regular practice of Suryanamaskar. It also confirmed the increase in VO₂ max by yoga training. The study is also supported by Makwana K., Khirwadkar N. and Gupta H.C. who presented a paper titled “Effects of short term yoga practice on ventilatory function tests” which stated that regular yogic practices strengthen the respiratory muscles. Nayar H.S. and Mathur R.M also carried out a study titled “Effects of yogic exercises on human physical efficiency” which also stated that practice of Suryanamaskar increases the excursions of diaphragm and lungs as well as thoracic compliance. The results have also shown a significant improvement in flexibility. It is supported by the study of Marieke Van Puymbroeck, Laura L. Payne and Pei-Chun Hsieh in a study titled “A Phase I Feasibility Study of Yoga on the Physical Health and Coping of Informal Caregivers” which concluded that that an 8-week Hatha yoga program for informal caregivers has the potential to increase the coping ability, strength, flexibility and endurance of informal caregivers.

CONCLUSION

Summing up, the 6-week training programme of suryanamaskar asanas had significant effect on muscular endurance and flexibility. Thus, such training may be recommended to improve physical fitness-based performance.

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