



The Effect of a Six-Week Course of Surya Namaskar Practice on Back Flexibility and Lumbar Flexion in Male College Students

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Abstract

Study purpose. The strenuous Surya Namaskar exercise programme has gained considerable popularity among contemporary yoga practitioners. Its special combination of yogic breathing techniques, asanas (postures) and dharana (focused mind concentration) helps to improve flexibility. The aim of this study was to investigate the effectiveness of an original six-week course of Surya Namaskar on back flexibility and lumbar flexion in male college students.

Materials and methods. Thirty male college students aged between eighteen and twenty years were randomly assigned to treatment group (Surya Namaskar practice) (n=15) and control group (n=15). The treatment group performed Surya Namaskar practice for six weeks, while the control group did not participate in any treatment other than their regular activities for six weeks. Back flexibility and lumbar flexion of the subjects were assessed at the baseline and after six weeks.

Results. Back flexibility and lumbar flexion increased in the treatment group after six weeks of Surya Namaskar practice.

Conclusions. The current Surya Namaskar procedure contributes to the kinanthropometric well-being of male college students in terms of back flexibility and lumbar flexion. Surya Namaskar should be included in school and college curriculum because of its numerous physical and physiological benefits.

Keywords: yoga, Surya Namaskar, back flexibility and lumbar flexion.

Introduction

Physical education programs have been a part of ancient cultures, including those in the Indian subcontinent, since antiquity. These programs have covered topics such as health, motor skills, military effectiveness, sports and leisure games, medical therapy, physical rehabilitation, and spiritual development (Deshpande, 2013). It is estimated that yoga originated between 4,000 and 8,000 years ago in the northwest Indian region of the Indus Valley civilization. Yoga is a traditional practise that aims to improve a person's

physical, mental, emotional, and spiritual well-being (Ross & Thomas, 2010). The meaning of the word yoga is union, joining, or linking as a single entity. Yoga is the art and science of uniting body, mind, and soul by resolving the inherent opposition in all things (Oliver, 2005). Eventually, publications in the fields of physiology and medicine began to use yoga's techniques and methods (Khalsa et al., 2016).

As the words Surya and Namaskara respectively mean "Sun" and "Salutation" or "to greet," Surya Namaskara is a customary yoga pose meant to honour the Sun. It is therefore also referred to as Surya Namaskar or Sun Salutation. The renowned "Patanjali" and his or her followers developed this specific breathing and posture regimen thousands of years ago (Vaibhav et al., 2016).

A set of asanas known as Surya Namaskar have precise breathing patterns. Every single cell in the body is revitalised

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by it, and it also provides mental clarity, physical strength, and flexibility (Saraswati, 1983). A series of 12 asanas (postures) make up Surya Namaskar. The entire body is profoundly stretched by these alternating backward and forward bending postures, which flex and stretch the spinal column through its maximum range (Nandar, & Raj, 2014).

A sedentary lifestyle, physical inactivity, or fat accumulation around the joints that limits full range of motion are some of the causes of reduced flexibility. Keeping the body flexible may help to lessen the stiffness and tension that can lead to long-term, frequently fatal medical problems. Surya Namaskar's profound effects on the body allow it to alter kinanthropometric and physiological aspects of the body on its own. Therefore, the purpose of this study was to determine how college-aged men's lumbar flexion and back flexibility were affected by suryanamaskar practice.

Hypothesis. We will presume that by following the surya namaskar routine, we will achieve better back flexibility and lumbar flexion. The hypothesis argued in this paper is that college men students can significantly increase the back flexibility and lumbar flexion by practicing suryanamaskar over a consecutive six weeks period. As a result, the goal of this study was to look into the changes in parameters that occurred during a six-week surya namaskar regimen in thirty college men.

Materials and methods

Search engines used to locate published articles included MEDLINE, EMBASE, Scopus, Science Direct Databases Directory of Open Access Journals (DOAJ), PubMed, and Google Scholar. The terms "Yoga", "Surya Namaskar", "flexibility", "lumbar flexion", and the conjunctions "OR/AND" were used as essential terms. Searches could only be conducted in English. The studies detailing how body flexibility is affected by suryanamasakar are considered for literature review.

Study Participants

Thirty college men from Coimbatore District participated in this study. The selected subjects were divided into two groups. Table 1 below describes the characteristics of the participants. The advantages of the research as well as any possible risks were explained to participants prior to the experiment. They were examined by a qualified physician and all of them were fit for participating in this study.

Table 1. Participants Characteristics (Mean $\pm$ SD)

Groups	SNP (G1) n = 15	Control (G2) n = 15
Age (years)	21.20 $\pm$ 0.6	21.20 $\pm$ 0.7
Height (cm)	174.30 $\pm$ 4.4	174.20 $\pm$ 4.3
Weight (kg)	78.20 $\pm$ 5.9	78.20 $\pm$ 5.7
BMI (kg/m ²)	25.73 $\pm$ 1.32	25.76 $\pm$ 1.49

Study organization

An experimental approach with a two-group pretest-posttest design was employed in this investigation. The

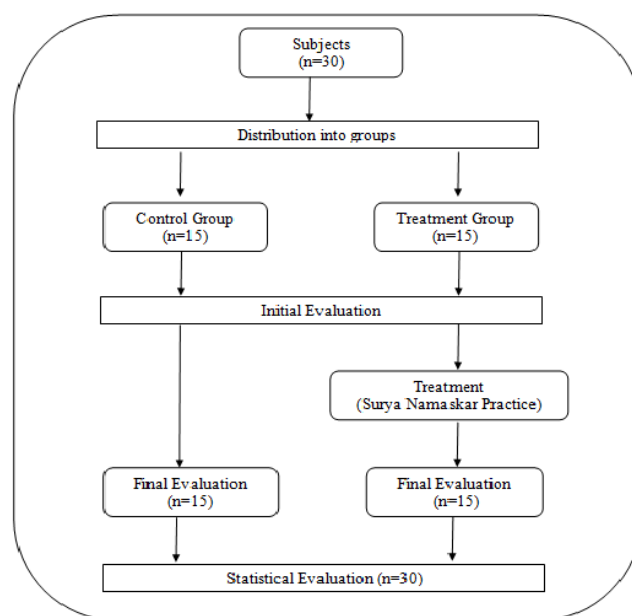


Fig. 1. Flow Diagram

treatment group (n=15) over the course of six weeks, fifteen college men will practice suryanamaskar, and group II was considered as control group (n=15). Participant's informed consents were obtained before the start of the study. Participants were free to withdraw their consent if they felt any discomfort during training programs. All participants were eligible for inclusion in this study because they had no history of musculoskeletal, neurological or orthopaedic disorders that might have affected their ability to perform physical fitness tests, and suryanamasakar practice. There were no dropouts in this study. The procedures followed were in accordance with the ethical standards in compliance with the 1964 Helsinki Declaration and its later amendments.

The Standard protocols were used to test the parameters. The participants warmed up with a five minutes low-intensity aerobic run and a ten minutes active and passive stretching of upper and lower extremity muscles before the experiments.

Anthropometric measurements:

A portable digital scale with a 0.1 kg precision was used to weigh participants who were minimal and did not wear shoes. Using a tape measure and a standard procedure, height was measured. The body mass index (BMI) was computed as follows: weight (kg) divided by height (m²) squared.

Sit and Reach Test

To evaluate the lower back and hamstring flexibility, participants performed the sit and reach test (Wells and Dillon, 1952). High values of ICC indicate that both versions, the chair sit and reach (0.92–0.96) (Jones et al., 1998) and the back saver sit and reach (0.99) (Patterson et al., 1996), are reliable. An apparatus which had 25 cm mark equivalent to the point where the feet touch the box was used. Participants were asked to warm-up by performing slow stretching exercises. They were asked to "sit barefoot with the legs fully extended with the soles of the feet placed flat against the horizontal cross board of the apparatus, with the inner edge of the sole placed 2 cm from the scale,

Table 2. Surya Namaskar training protocol*

Protocol	Description	Duration
Starting Prayer	“Hiranmayena patrena satyasyapihitam mukham tat tvam pusannapavrunu satyadharmaya drstaye” Oh sun, your golden sphere protects the entrance to the reality like a lid on a vessel.	45 secs
Warm up & Conditioning	Joints stretching and rotation	5-10 mins
Suryanamaskar	Step 1: Hasta uttanasan (Pose with raised arms) Step 2: Padhahastasan (Forward bend when standing) Step 3: Ekapadaprasaranasana (Pose of a horse) Step 4: Dwipadaprasaranasana (Parallel pose with a steep angle) Step 5: Sasankasana (Pose of the moon) Step 6: Sashtanga Namaskar (Salute with eight limbs) Step 7: Bhujangasan (Pose of a cobra) Step 8: Parvatasan (Pose of a mountain) Step 9: Sasankasana (Pose of the moon) Step 10: Ekapadaprasaranasana (Pose of a horse) Step 11: Padhastasan (Forward bend when standing) Step 12: Hasta uttanasan (Pose with raised arms)	10-12 mins
Warm down	Technique for deep relaxation	
Closing Prayer	Ohm Shanti Shanti Shanti	10 secs.

*12 poses – Each pose is held for 5 seconds without a break. Begin with 5 cycles and increase by one every two weeks.

keeping the knees fully extended, arms evenly stretched, and palms down”. Participants were then asked to bend and reach forward (without jerking) while pushing the sliding marker along the scale with the fingertips as far forward as possible. They held maximum flexion position for approx. two seconds. The test was performed twice. The trial was not recorded if the knees flexed. The record taken was the max. distance reached to the nearest 0.5 cm.

Updated Schober test

The updated Schober test was used to determine lumbar flexion. The level of S2 was marked at the midpoint between the two PSISs (dimples of the pelvis), and points five centimeters below and ten centimeters above that level were marked. The subject is asked to flex forward after measuring the distance between the three lines, and the distance is measured again. The variation between the two scales indicates how much flexion in the lumbar spine is occurring (White & Norkin, 2011).

Training Protocol

The training was delivered over the course of forty five to sixty minutes in each session. The surya namasakar exercises consisted of a five minutes preparation and a five minutes relaxation procedure. The participants were given the protocol for a total of six weeks, five days per week (Table 2).

Intervention Procedure

Following the pre-test, one hour instruction session was provided to the intervention group to teach them the fundamental postures of the suryanamaskar. It was instructed to the subjects to breathe naturally. To follow the natural breath, focus on each inhalation and exhalation for the assigned amount of time. For the duration of one breath, or exhalation, depending on the exercise, subjects were instructed to hold each posture during the routine. The subjects were provided written instructions for each posture

along with an online video of a certified yoga instructor performing suryanamaskar, to aid in their understanding of the routine.

Statistical Analysis

In this study, there were two components to the data analysis process: the Shapiro-Wilk prerequisite test and the Paired Sample T-Test hypothesis test. A paired sample t-test hypothesis test is used in this investigation. The purpose of this test is to compare the outcomes of the pretest and post-test. IBM SPSS Statistics 16.0 was utilised for statistical analysis in this investigation (SPSS, Inc., Chicago, IL, USA).

Results

A total of 30 days of practice were used in this six-week study, which included one pretest, 28 treatments, and one post-test. Up to fifteen male college students are involved. The following are the findings from the computation of lumbar flexion and back flexibility.

Table 3. Normality test*

Groups	Variable	Tests	Shapiro-Wilk		
			Statistic	df	Sig.
EG	Back flexibility	Pre	0.91	15	0.11
		Post	0.91	15	0.11
	Lumbar Flexion	Pre	0.89	15	0.08
		Post	0.88	15	0.05
CG	Back flexibility	Pre	0.89	15	0.05
		Post	0.89	15	0.06
	Lumbar Flexion	Pre	0.88	15	0.06
		Post	0.89	15	0.07

* The data are displayed as means $\pm$ SD and sig. value; if the sig. $\geq$ 0.05, the data are considered normally distributed.

The results of the pretest and posttest for the treatment group as well as the control group were obtained using the Shapiro-Wilk test instrument, based on the results of table 3 above. Each and every value is ≥ 0.05 . The paired sample t-test in parametric statistics was then used to test the hypothesis because all of the research results' data were normally distributed.

Table 4. Paired Sample t Test

Variables	Group	Test	Mean $\pm$ SD	t	Sig. 2 tailed
BF	CON	Pre	30.40 $\pm$ 0.83	1.47	0.164
		Post	30.27 $\pm$ 0.88		
	EXP	Pre	30.47 $\pm$ 1.13	17.75*	0.000
		Post	33.47 $\pm$ 1.12		
LF	CON	Pre	6.27 $\pm$ 0.88	0.22	0.827
		Post	6.33 $\pm$ 0.96		
	EXP	Pre	6.80 $\pm$ 1.42	3.86*	0.002
		Post	8.20 $\pm$ 0.86		

* Statistically significant difference, mean scores at point comparisons from baseline: sig (2-tailed) value of ≤ 0.05 ; data are presented as means $\pm$ SD.

Table 4 indicates that in the treatment group, the obtained 't' values on variables were 17.75 (Back Flexibility) and 3.86 (Lumbar Flexion). These values were found to be statistically significant at the 0.05 level of confidence for degrees of freedom 1 and 14. They were higher than the minimum table value of 2.14. The obtained 't' ratios between pre- and post-test in the control group were 1.47 (Back Flexibility) and 0.22 (Lumbar Flexion) which were less than the necessary table value of 2.14 and were found to be not statistically significant.

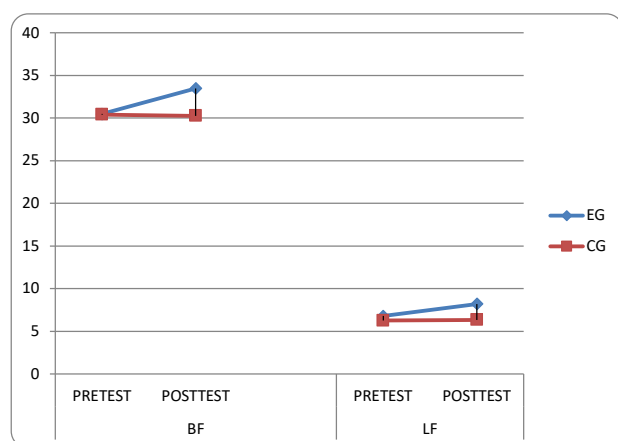


Fig. 2. Bar diagram displays the pre- and post-test results for the treatment and control groups for lumbar flexion (LF) and back flexibility (BF)

Discussion

This study assesses the impact of suryanamaskar practice on lumbar flexion and back flexibility in college men. According to our findings, Suryanamaskar practice

for six weeks improved back flexibility and lumbar flexion in college men students. Other research studies have found that suryanamaskar practice improves important kinanthropometric parameters.

Time is often considered a constraint when it comes to exercising, so for those who struggle with time management, doing Surya Namaskara, or "salute to the sun," every day, may be the ideal solution (Saraswati, 2004). Flexibility variations can lead to a variety of biomechanical changes in joints and altered postures. Accordingly, flexibility is necessary to perform daily tasks with ease.

These findings are in line with those of previous studies, which demonstrated a significant increase in back and lumbar flexibility. An investigation comparing the effects of Surya Namaskar and dynamic stretching on hamstring flexibility in physiotherapy students found that Surya Namaskar is superior to dynamic stretching in terms of enhancing hamstring flexibility (Mangaonkar et al 2018). Comparable results were established by Sisodia (2017), discovered that the pace 2 group, pace 4 group, and control group had average versatility of 24.95 $\pm$ 2.60 cm, 26.70 $\pm$ 2.03 cm, and 21.20 $\pm$ 3.15 cm, in that order. This indicates that practicing suryanamaskar, which increases hip joint flexibility, lower back flexibility, and posterior thigh muscle flexibility, can result in either hyperextension or flexion of the hip joint.

Suryanamaskar is said to improve general health and fitness and offer benefits in asana and pranayama (Borker, & Pednekar, 2003). It was shown that hamstring flexibility and muscular endurance were greatly enhanced by Suryanamaskar (Singh et al., 2010). It has also been shown that suryanamaskar improves muscle endurance, upper body strength, and hamstring flexibility (Fondran, 2008). The superficial back line contracts in tandem with the superficial front line during suryanamaskar. Whereas dynamic stretching solely targets the targeted muscle and joint, back contraction strengthens all of the muscles in the back and even the smallest ones in the spinal column. Suryanamaskar stimulates the circulation of blood in the vertebral region, which in turn stimulates the nerves there. Apart from the hamstrings, suryanamaskar enhances and preserves the flexibility of the spine. Based on the findings of this research, suryanamaskar practice has beneficial effects on the kinanthropometric parameters of college men.

Limitations

The small sample size and narrow age range of the study are among its limitations, which limit how broadly the study's conclusions can be applied. Moreover, gender-related differences in the results and related factors could not be examined because the sample did not contain any college women.

Future Recommendations

With a larger sample size, long-term effects of suryanamaskar can be studied. Furthermore, more research is required to determine the effectiveness of Surya Namaskar as a strategy for enhancing physical health and quality of life aspects in a range of medical conditions. An analysis that is longitudinal can also be carried out. It is feasible to

look into how suryanamaskar affects injury frequency and athletic performance. Because of Surya Namaskar, other motor fitness variables can also be investigated.

Conclusions

Surya Namaskar is an easy process that anyone with a little adaptability can perform and has no negative effects. Today's college men have very little time for their personal well-being in between their coursework. Thus, maintaining their general health can be facilitated by performing a few Surya Namaskar cycles daily.

It was evident from the study's limitations and the findings that college-aged men who practiced suryanamaskar five days a week for six weeks saw improvements in their lumbar flexion and back flexibility. These kinds of yoga practices are beneficial for people who want to improve their kinanthropometric, physical, and physiological performance.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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Вплив шеститижневого курсу практики сур'я-намаскара на розвиток гнучкості спини та згинання поперекового відділу хребта у студентів коледжу чоловічої статі

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Авторський вклад: А – дизайн дослідження; В – збір даних; С – статаналіз; D – підготовка рукопису; Е – збір коштів

Реферат. Стаття: 6 с., 4 табл., 2 рис., 17 джерел.

Мета дослідження. Інтенсивна програма комплексу вправ сур'я-намаскара набула значної популярності серед сучасних практиків йоги. Особливе поєднання методик йогівського дихання, асан (поз) і дхарани (сфокусованої концентрації свідомості) сприяє покращенню показників гнучкості. Метою цього дослідження було вивчити ефективність оригінального шеститижневого курсу сур'я-намаскара на розвиток гнучкості спини та згинання поперекового відділу хребта у студентів коледжу чоловічої статі.

Матеріали та методи. Тридцять студентів коледжу чоловічої статі віком від вісімнадцяти до двадцяти років були рандомізовані до основної групи (практика сур'я-намаскара) (n=15) і контрольної групи (n=15). Основна група виконувала комплекс вправ сур'я-намаскара протягом шести тижнів, тоді як контрольна група не брала участі в жодному курсі тренувань, окрім своїх звичайних видів активності протягом шести тижнів. Гнучкість спини та згинання поперекового відділу хребта у досліджуваних осіб оцінювали на початковому етапі та через шість тижнів.

Результати. Зростання показників гнучкості спини та згинання поперекового відділу хребта спостерігалось в основній групі дослідження після проведення шести тижнів практики сур'я-намаскара.

Висновки. Сучасна процедура комплексу вправ сур'я-намаскара сприяє покращенню стану кінантропометричних показників у студентів коледжу чоловічої статі з точки зору гнучкості спини та згинання поперекового відділу хребта. Завдяки численним фізичним і фізіологічним перевагам, сур'я-намаскара має бути включена до навчальної програми шкіл та коледжів.

Ключові слова: йога, сур'я-намаскара, гнучкість спини та згинання поперекового відділу хребта.

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