

Effect of Surya Namaskar on Sustained Attention in School Children

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Abstract

Background: Sun salutation (Surya Namaskar) is a comprehensive Yoga technique which incorporates physical activity, breath regulation, relaxation and awareness. Apart from improving physical stamina and endurance, Surya namaskar has been shown to influence an individual's perception and performance. Hence, the present study has been designed to measure the performance of school children in a digit letter substitution task following the practice of Surya namaskar compared to physical exercise.

Methods: 320 school children between the age group of 12 to 14 years, belonging to both genders were screened and 64 healthy volunteers were selected. They were randomly allocated to 2 groups with 32 students each (Experimental group and Control group). Subjects were assessed at the beginning and end of 30 days of intervention (Surya namaskar or Physical Exercise) using a Digit Letter Substitution Task.

Results: The data were normally distributed and the baseline data across the groups were not statistically different ($p > .05$). The pre-post data within each group was analyzed using a paired 't' test. There was a significant increase in number of letters substituted per digits in both yoga ($p < .001$) as well as control groups ($p < .001$). The difference between the groups was not statistically significant ($p > .05$).

Conclusion: Physical activity given regularly in a structured manner followed by supine rest improves the process of attention.

Keywords: Yoga; Surya namaskar; Physical exercise; School children; Attention

Introduction

Sun salutation (Surya Namaskar) is an ancient Indian method of offering prayers to the rising Sun in the morning along with a series of physical postures with regulated breathing aiming at range of physical, mental and spiritual benefits. Facing east, in the early hours of morning, one standing with serene mind offers prayer to Lord Sun (Surya in sanskrit) with Surya namaskar. Along with physical postures, surya namaskar has specific spiritual connotations attached to it. Surya namaskar is a graceful combined sequence of twelve positions along with regulated breathing and relaxation.

According to the scriptures, if performed correctly, Surya namaskar does not strain or cause injury. If performed in the morning, it relieves stiffness, revitalizes the body, refreshes the mind and purifies subtle energy channels [1]. Though the greatness of Surya namaskar has been greatly said in scriptures not much research has been done to understand its benefits.

In an earlier study, it was speculated that Surya namaskar can be an ideal aerobic exercise as it involves both static stretching and slow dynamic component of exercise with optimal stress on the cardio-respiratory system [2]. A later study assessed the cardio-respiratory and metabolic responses of four rounds of Surya namaskar, a typical amount performed by practitioners, to determine its potential as a training and weight loss tool. It was found that participants exercised at 80% of age-predicted maximal heart rate (HRmax) during Round 2, 84% during Round 3, and 90% during Round 4. Average intensity during the four rounds was 80% HRmax, sufficient to elicit a cardio-respiratory training effect. Oxygen consumption averaged 26 ml/kg/min during each round, resulting in an energy expenditure of 230 kcal during a 30 min session for a 60 kg individual [3].

These findings support the use of Surya namaskar as an effective physical activity recommended by the American College of Sports Medicine i.e., 50% to 80% VO_2 Max and 60% to 90% heart rate reserve as effective physical activity. Recently Bhavanani & Colleagues evaluated the differential physiological effects of 6 months training in the fast and slow versions. The results suggested that Surya namaskar has positive physiological benefits as evidenced by an improvement in pulmonary functions, respiratory pressures, hand grip strength and endurance, and resting cardiovascular parameters. It also demonstrated the differences between Surya namaskar when performed in a slow versus fast manner, concluding that the effects of fast version are similar to physical aerobic exercises, whereas the effects of slow version are similar to those of yoga training [4].

While the above two studies have looked at the cardio-respiratory changes and metabolic cost during Surya namaskar in young adults, a single report evaluated its influence on children belonging to 8-14 years of age. The results showed that the Systolic Blood Pressure, Peak Expiratory Flow Rate and Forced Vital Capacity increased significantly and Respiratory Rate, Heart Rate and Diastolic Blood Pressure decreased significantly after the practice of Surya namaskar [5].

Apart from physical health and physiological rest, an improved attentional process and cognitive function determines the scholastic

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performance in school children. While the above studies have looked at Surya namaskar as an effective physical activity and earlier studies have suggested that physical exercise can improve executive functions in school children [6], we have designed the present study to evaluate the influence of Surya namaskar on attention span in school children.

Materials and Methods

Subjects

64 subjects selected from 320 students studying in a Marathi Medium school in Maharashtra, India. Subjects were screened based on the inclusion and exclusion criteria and the selected 64 subjects were randomly allocated to two groups i.e., Surya namaskar and physical exercise. The sample size was calculated based on an earlier study. Accordingly, the present study had a sample size of 32 subjects in each group.

Inclusion criteria

Normal healthy students with ages ranging between 12 to 14 years, belonging to both genders. Subjects who would understand instructions given in English or Marathi. Those motivated to practice Surya namaskar and should have willingness to volunteer for the trial were included.

Exclusion criteria

Presence of cognitive and /or psychiatric, neurological disorders based on a clinical examination (which was obtained on request from the authorities of the school). Children with attention related problems were also excluded.

Source of subjects

Students studying in 7th Standard at Chiplun, Ratnagiri (district), Maharashtra, India.

Design

The present study was a Randomized controlled Trial. 64 students divided into 2 groups with 32 students each (Experimental group and Control group) by random selection using a random number table. The signed informed consent was obtained from their parents. Assessments were done at baseline (Day 1) and after 30 days of their respective interventions. Experimental group underwent Surya namaskar for a month. Control group was given routine physical exercises. This was same as the physical exercises given to all the students in the school except the Surya namaskar group.

Variables

Digit-letter substitution task (DLST): This task involves visual scanning, mental flexibility, sustained attention and psychomotor speed of information processing. Digit substitution test has already been standardized for use in Indian population [7].

Subjects were made to sit on the desk (two in a desk with a distance of two meters between them). They were given necessary instructions about the task. The DLST consisted of a worksheet which had 12 rows and 8 columns and randomly digits arranged in rows and columns. The participants were asked to substitute as many target digits as possible in the specified time of 90 seconds. They were instructed to substitute letter by their own choice either in a horizontal, vertical or randomized manner by selecting the particular digit. The total number

of substitutions and wrong substitutions are scored. The net score was obtained by deducting wrong substitutions from the total substitutions attempted [7].

Data extraction

The total number of substitutions and wrong substitutions were scored. The net score was obtained by deducting wrong substitutions from the total substitutions attempted. The scoring was done by the experimenter who was unaware of the names of the subjects to whom the data sheets belonged. This ensured masking of the data while doing the data extraction.

Plan of analysis

Data were analyzed using descriptive as well as inferential statistics. The data were assessed for normality distribution using the Shapiro-wilk test. The net scores recorded on Day 30 of Surya namaskar group as well as the Control group were compared with their respective Day 1 values using a paired 't' test. The differences across the groups were assessed using an independent samples 't' test.

Interventions

Surya namaskar has been a traditional Yoga based practice. The Sun has been revered as a deity and worshipped. Surya namaskar is a salutation to this powerful celestial body, around which other planets revolve and take light and heat from it. It is believed that whoever worships Lord Surya is bound to have a dynamic personality, as he rejuvenates life and makes one feel young, agile, brilliant and healthy [1]. The practice of Surya namaskar is detailed below separately.

Physical exercise

Subjects were given physical exercise for same duration of time as that of Surya namaskar which included: Loosening exercises, stretching exercises (forward, backward, sideward), Jogging followed by supine rest.

Results

Two groups (Surya namaskar and Physical Exercise) assessed after thirty days of respective interventions using a digit letter substitution task showed significant improvements. The data were normally distributed and the baseline data across the groups were not statistically different ($p > .05$).

The pre-post data within each group was analyzed using a paired 't' test. There was a significant increase in number of letters substituted per digits in both yoga ($p < .001$) as well as control groups ($p < .001$). The difference between the groups was assessed using an independent samples 't' test which was statistically not significant. The group mean values \pm Standard Deviations are given in Table 1. The same has been graphically represented in Figure 1.

Discussion

64 school children randomly divided into two groups (Surya namaskar & control) assessed using a task requiring attention span showed significant improvements after one month of practice of Surya namaskar or regular physical exercise. Earlier studies have attempted to understand the physiological changes following Surya namaskar. They have showed a positive change in energy cost and cardio respiratory performance in young adults. It was speculated that Surya

Name	Description	Duration
Starting Prayer	Hiranmayenapatrena Satyasyapihitam mukham Tatvam Pushanapavrunu satyadharmaya Drushtayet Like a lid to a vessel, Oh sun, your golden orb covers the entrance to the truth. Kindly open the entrance, to lead me to the truth.	30 sec.
Loosening exercise	Finger movement, wrist rotation, shoulder rotation, neck rotation, toe movements, ankle movement & rotation, knee movement, butterfly,	10 mins.
Sūryanamaskāra	Twelve Sun salutations. Step 1: Hasta uttanasan (raised arms pose) Step 2: Padhahastasan (standing forward bend pose) Step 3: Ekapadaprasaranasana (equestrian pose) Step 4: Dwipadaprasaranasana (steep parallel pose) Step 5: Sasankasana (moon pose) Step 6: Sashtanga Namaskar (Salute with 8 limbs pose) Step 7: Bhujangasan (cobra pose) Step 8: Parvatasan (mountain pose) Step 9: Sasankasana (moon pose) Step 10: Ekapadaprasaranasana (equestrian pose) Step 11: Padhastasan (standing forward bend pose) Step 12: Hasta uttanasan (raised arms pose)	12 mins.
DRT	Deep Relaxation Technique	10 mins.
Closing	Om Shantih Shantih Shantih	10 sec.

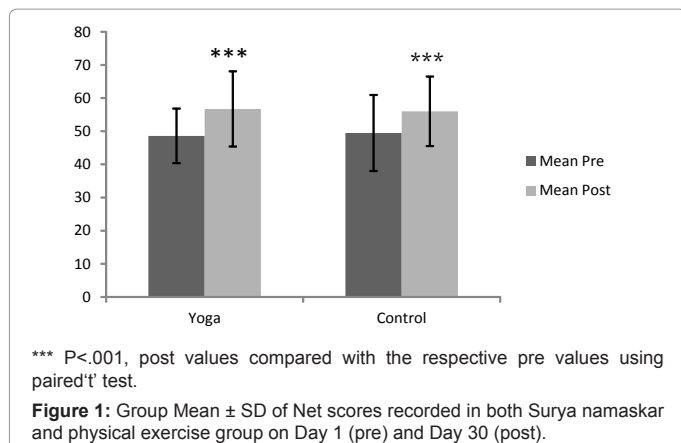
namaskar can be used as an ideal aerobic exercise as it involves both static stretching and slow dynamic component of exercise with optimal stress on the cardio-respiratory system [2]. Similar observations were made by other researchers. They assessed the cardio-respiratory and metabolic responses to practicing four rounds of Surya namaskar; it was shown that the average intensity during the four rounds was 80% Heart Rate maximum, sufficient to elicit a cardio-respiratory training effect [3].

These findings support the use of Surya namaskar as an effective

	Day 1 [Mean ± SD]	Day 30 [Mean ± SD]	Percentage change
Surya namaskar group	48.59 ± 8.24	56.71*** ± 11.34	16.7
Control group	49.47 ± 11.47	56*** ± 10.49	13.2

*** P<.001, post values compared with the respective pre values using paired't' test

Table 1: Net scores recorded on Day 1 and Day 30 in both Surya namaskar and Control groups. Values are group mean ± SD.



physical activity recommended by the American College of Sports Medicine i.e., 50% to 80 % VO2 Max and 60% to 90 % heart rate reserve as effective physical activity. A subsequent study evaluated the differential physiological effects of 6 months training in the fast and slow versions. Following Surya namaskar there was an improvement in pulmonary function, hand grip strength and endurance, and resting cardiovascular parameters. This study also demonstrated the differences between Surya namaskar training in a slow and fast manner, concluding that the effects of the fast version are similar to physical aerobic exercises, whereas the effects of slow version are similar to those of yoga training [4].

Apart from the two studies mentioned above which looked at the cardio-respiratory changes and metabolic cost during Surya namaskar in young adults, a single report has illustrated its influence on children belonging to 8-14 years of age. The Systolic blood pressure, Peak Expiratory Flow Rate and Forced Vital Capacity increased significantly and Respiratory Rate, Heart Rate and Diastolic Blood Pressure decreased significantly after the practice of Surya namaskar [5].

It is clear from earlier reports that Surya namaskar can be used as a potential equivalent to aerobic exercise with respect to cardio-respiratory endurance. However, its other applications are being explored recently. Improving scholastic performance in school children has been identified as a major application of Surya namaskar as earlier reports on physical exercise have shown its beneficial effects on improving the executive functions in children [6]. The results of the present study are in line with the earlier report that physical activity influences attentional tasks. Improvement following the practice of Surya namaskar can be attributed to physical activity interspersed with regulated breathing and relaxation as the influence of relaxation on attention span is well documented. The changes seen in the control group (physical exercise followed by supine rest) are similar to that of the experimental group suggesting that structured physical activity of any form followed by supine rest can induce alertful rest. The group which practiced Surya namaskar had 16.7% improvement compared to 13.2% in physical exercise group. However, the difference

between the groups was statistically not significant. The marginal better performance in the Surya namaskar group can be attributed to the aspect of Surya namaskar i.e. Physical activity interspersed and slow breathing and relaxation as mentioned earlier.

Hence, the present study speculates that physical activity of any form followed by supine rest can influence the attentional processes.

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