Effect of Suryanamaskar on functioning of Attentional Network among healthy adults

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Suryanamaskar or Sun salutation is an ancient Indian method of offering prayers to the rising sun in the morning with a series of physical postures with regulated breathing aiming at range of physical, mental and spiritual benefits. The present study examines the effect of Suryanamaskar on attentional network among normal healthy participant. Thirty healthy participants (Age$_{range}$ =20 - 27 years; M$_{age}$ = 24.30 years, SD = 1.76) were taken from the Shiva Yog and Research Welfare Foundation, Varanasi. The participants were given the training of suryanamaskar regularly for 60-days (30 min/day). The attentional network performance measure of the participants was obtained before and after the suryanamaskar training sessions. Results showed that suryanamaskar practice improved attentional network performance of the participants. The finding also suggests the beneficial effect of suryanamaskar on attention network in terms of increase in alerting effect and executive control effect..

Keywords: Suryanamaskar, alerting, orienting, executive control

Suryanamaskar or Sun salutation is an effective yoga technique which incorporates awareness, breath regulation, relaxation and physical activities. Suryanamaskar is an ancient Indian technique of prayer to the rising sun in the morning along with regulated breathing and a series of physical postures. Suryanamaskar is an effective and graceful combination of twelve positions which, relieves stiffness, revitalizes the body, purifies subtle energy channels and refreshes the mind when performed sequentially. Though the impacts of Suryanamaskar have been described in scriptures extensively, but there is a growing need to understand its other cognitive benefits.

The 12 asanas link the physical basis of Suryanamaskar in a dynamically performed series. These asanas are performed in such a way that they alternately stretch the spine backward and forward. A full round of Suryanamaskar consists of 2 sets of all combinations of poses with a change in the second set to moving the opposite leg first through the series (see Appenix-1 for detail). Physical activity of any form followed by supine rest can influence attentional processes. Suryanamaskar has been reported earlier as physical exercise which shows its beneficial effects in improving the executive function (Chavhan, 2013), and influences the attentional span is well documented (Kondam, et. al., 2015). Suryanamaskar is useful in achieving concentration (Dalvi, 2012). It improves significantly both the physical and cognitive functioning areas (Daspute, 2005). The Suryanamaskar practice was found to be effective on the levels of emotional maturity and psychological wellbeing.

In an earlier study, it was speculated that Suryanamaskar can be an ideal aerobic exercise as it involves both static stretching and slow dynamic component of exercise with optimal stress on the cardiorespiratory system. Apart from physical health and physiological rest, an improved attentional process and cognitive function determines the scholastic performance on executive functioning (Chavhan, 2013).

Telles et al. (1993) observed the effect of yogic practices on school children in two groups and found a significant change in attention span and memory in the practice group after a ten days study. In another study, Batra et al. (2003) observed 322 children and found that the

selected practice of yoga improves the analyzing capacity of the children (p. 79). In 2003, Pushpa et al. also observed 300 children and found that the selected practice of yoga improves the memory of the children (p.77).

Suryanamaskar is therefore ideal for even the most active individuals, who have to spend a lot of mental energy like students and scientists. Regular practice of Suryanamaskar leading to a well-balanced energy system at both physical and mental levels (Vivekananda, 2005, p. 228). Suryanamaskar also influences the pineal gland and the hypothalamus, helping to prevent pineal degeneration and calcification (Satyananda, 2003, p. 18). Through this practice the breathing pattern can develop a habitual steadiness. The rhythmic breathing sequence within sun salutation gradually increases one's capacity for life.

There are limited researches which have been done to know the influence of Suryanamaskar on cognitive functioning such as, attentional network, memory, learning, thinking etc. as earlier studies documented that Suryanamaskar and physical exercise can improve executive functioning and attentional span, the present study designed to evaluate the effect of Suryanamaskar on attentional networks among university students. It is predicted that Suryanamaskar will improve the attentional network functioning of student.

Method

Participants

By using within group design, 30 right-handed participants (Age range = 20 - 27 years; Mage = 24.30 years, SD = 1.76) were recruited from Shiva Yog & Research Welfare Foundation, Varanasi, India. Participants were provided 60-days training of Suryanamaskar for half hour/day. They have no prior practice of doing any yogasana. Participants were given their written consent to participate in the study.
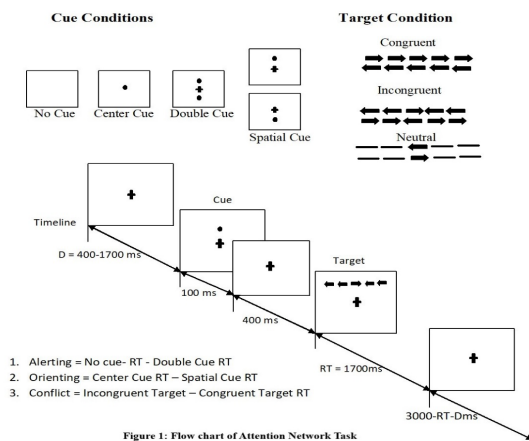
Attention Network Task

The Attention Network Test (ANT) developed by Fan et al. (2002) was used to measure the three attentional networks: (1) alerting, (2) orienting, and (3) executive control. The task was administered with the help of Inquisit 4

[Computer software]. (2015). The ANT combines attentional and spatial cues with a flanker task (a central imperative stimulus is flanked by distractors that can indicate the same or opposite response to the imperative stimulus). On each trial a spatial cue is presented, followed by an array of five arrows presented at either the top or the bottom of the computer screen. The subject must indicate the direction of the central arrow in the array of five. The cue that precedes the arrows can be non-existent, a center cue, a double cue (one presented at each of the two possible target locations), or a spatial cue that deterministically indicates the upcoming target location. Each network is assessed via reaction times (RTs). The alerting network contrasts performance with and without cues, the orienting network contrasts performance on the task with or without a reliable spatial cue, and executive control (conflict) is measured by assessing interference from flankers. Participant were instructed to press the key 'E' on the keyboard by using their left index finger for left side pointed arrow or the key 'I' with their right index finger for the right side pointed arrow as fast as possible when the target arrow appears, respectively (see figure1). Experimental task consists one practice session of 2 minutes and 3 blocks of main session for 5 minutes each. Total task was completed in about 20 minutes.

Procedure

Upon their arrival on day one (Pre-test Trial) at yoga center the participants were seated in a quiet room. All the instructions related to task were provided to the participant. Prior to the attention network task participants read instructions and experimenter ask them to move the chair into a marked position to ensure the screen was viewed from 45 cm. Participants completed the task in a self-paced manner on a HP computer with the majority completing it into maximum 30 minutes. After taking the data all participants were given training for Suryanamaskar for 60 days. The training session consisted the prayer and 12 mantras which are recited during the Suryanamaskar and shanti path (see Appendix-1). Each session had been completed in 30 min which includes prayer (5 minutes), Sun salutation (27 second per posture and 6.66 minutes for one round

of Suryanamaskar including 12+12 postures), Shanti Path (5 minutes). After completing the 60 days training session of Suryanamaskar again the attention network task was administered on same participants (Post-test Trial). After completion of task participants were debriefed, thanked and provided with information about yoga including a list of books and websites.

1. Alerting = No cue- RT - Double Cue RT
2. Orienting = Center Cue RT – Spatial Cue RT
3. Conflict = Incongruent Target – Congruent Target RT

Figure 1: Flow chart of Attention Network Task

Results

Paired sample t-test were performed to find the difference between pre and post treatment across various dependent measures. Different cue conditions (central, double, spatial and no cue) were used for calculating various attentional networks i.e., alerting, orienting and executive control (conflict effect). Mean reaction time as well as t-value and significance level were presented in table -1 for different dependent measures across pre and post treatment conditions.

The significant differences were found on both congruent (t = 15.14, p=0.000, MSE = 13.20) and incongruent (t = 14.96, p=0.000, MSE = 13.38) condition of task. Paired sample t-test on alerting measure revealed significant difference between pre and post condition (t = -3.24, p=0.001, MSE = 3.61), with faster RTs for double cue and no cue. The training of sun salutation improves alertness in participants. Paired sample t-test on orienting measure revealed no significance difference between pre and post condition (t = -.081, p = 0.46, MSE = 4.17) which suggests that 60 days training of sun salutation may not changes the orienting measure performance. Paired sample t-test on conflict effect measure revealed significant difference between pre and post condition (t = 4.16, p=0.000, MSE = 4.45).

Discussion and Conclusion

India has a rich and prosperous traditional value of yogic practices. In present scenario, the ancient practice of yogic postures, breath regulation and meditation are gaining a lot of attention from health care professionals. The aim of our study is to examine the extent to which the practice of Suryanamaskar can modulate attentional functions in healthy young adults using the ANT paradigm. This study is unique in many ways. Firstly, we concentrated on a combination of physical postures ie., Suryanamaskar. Secondly, in the present study a controlled selection criteria were used for the recruitment of participant. Third, the participant had no prior knowledge of any form of yogasana. They were provided 60-days of Suryanamaskar

Table-1. Mean RTs (in ms), SD, t-value and sig. level for congruent, incongruent and three dimensions of attentional network (alerting, orienting and executive control (conflict) as a function of pre and post treatment conditions

	Pre-Condition	Post-Condition	t-Value	p
	M (SD)	M (SD)		
Congruent	631.57 (78.22)	431.60 (34.18)	15.14***	0.000
Incongruent	697.44 (80.31)	497.23 (45.29)	14.96***	0.000
Alerting	45.42 (10.70)	57.14 (20.90)	-3.241***	0.001
Orienting	38.30 (18.31)	38.63 (16.94)	-.081	0.468
Executive control (Conflict)	80.17 (12.82)	61.64 (20.12)	4.16***	0.000

training, in which they practiced half an hours/day in a strict and controlled condition.

Result show substantial support for the hypothesis that Suryanamaskar is associated with more efficient attentional network when we compare to those who do not practicing Suryanamaskar at all and start practicing. The difference within these two conditions detects changes in the attentional networks, also reported in previous studies that regular meditation may enhance the cognitive behavior (Chavhan, 2013).

In previous researches it is tested that short term Suryanamaskar practice can improve the executive functions. In the present study it is found that sun salutation practice can positively change the executive functions as well as alertness (Telles, et. al., 1993). Moreover, no significant differences were seen on orienting measure across pre and post condition (p=0.468).

The present study assessed the effect of Suryanamaskar on attentional network task performance on healthy participants. The result implied a positive effect especially on alertness and executive functioning. The study faces some challenges due to gender differences and small duration of Suryanamaskar practice. Further research in this area could help to confirm the validity of recent results.

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APPENDIX-1

The Steps of Suryanamaskar (Sun Salutation):

Pranamasana (vksme fe=k; ue%): Also known as prayer pose, Pranamasana is the start of your Suryanamaskar. Stand upright on your mat with your both feet closely aligned. Inhale deeply, expanding your chest and relaxing your shoulders.

While you inhale, raise your arms from the sides. And as you exhale, join your palms together as if praying in front of deity. This is the Pratham Namaskar or first salutation towards the sun.

Hastauttanasana (vksme jo;s ue%): Keeping the palms joined in the previous prayer position, breathe in and lift your arms up and bend backwards slightly. Your biceps should lie close to your ears. This posture is to loosen up your body by stretching the entire body backwards, standing at your tip toes.

Hasta Padasana (vksme lw;kZ ue%): Now breathe out, and bend forward from the waist. Go down and touch you're the ground but keeping your spine erect. Do this as your exhale slowly and completely.

Ashwa Sanchalanasana (vksme Hkkuos ue%): Now breathe in, and stretch your body parally to the ground. Keep your hands to the side, and bring your right knee towards the right part of the chest and let your left leg stretch behind. Look up.

Dandasana (vksme [kxk; ue%): Now as your inhale, fling your right leg also backwards aligning your entire body parally to the ground.

Ashtanga Namaskara (vksme iw'.ks ue%): This is also known as giving salutations using eight parts or points. After staying in Dandasana, gently bring down your knees towards the floor and exhale. Now bring your chin to rest on the floor, keep your hops elevated in the air. Hence, your eight parts which are two hands, two knees, chin and chest will rest on the floor while your hip stays elevated in the air.

Bhujangasana (vksme fgj.;xHkkZ; ue%): This is also known as Cobra pose. This is simply aligning your chest and torso 90 degrees to the ground, keeping your legs and mid-section flat on the ground. Make sure you use your hands to support your body and are not tempted to transfer your entire weight onto them.

Parvatasana (vksme ejhpS ue%): Again, return to the parvatasana from bhujangasana. Keep your palm and feet where they are, and slowly raise your mid-section. Breathe out as you enter parvatasana.

Ashwa Sanchalanasana (vksme vkfnR;; ue%): Now from Parvatasana, return to the ashwa sanchalanasana. But this time, we do the opposite of what we did in the 4th step. Procedure- Bring your right foot forward, while resting the left foot behind, at its original position.

Hasta Padasana (vksme Ifo=S ue%): Now slowly bring your left foot forward, next to the right foot as you exhale. Keeping the position of your hands intact, lift yourself up to slowly enter Hasta Padasana.

Hastauttanasana (vksme vdkZ; ue%): Now inhale, raise your hands upward, and bend backward to enter Ardha Chakra Asana.

Pranama asana (vksme Hkk'djk; ue%): Finally, exhale and stand in a relaxed manner in the namaskara mudra. Feel the positive vibrations in your body. This is how you complete one repetition of Suryanamaskar. Twelve repetitions of this holistic exercise are said to yield maximum benefit.

After practicing Suryanamaskar (Sun salutation) the participants were reciting the OM mantra and then recitation of shanty path starts to end the session.

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