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Effect of 12-weeks training of mantras and breathing in surya namaskar on performance of six letter cancellation task

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Abstract
The purpose of the study was to investigate the effect of 12-weeks training of Surya Namaskar (SN) with two variations (SN mantra chanting and following fixed breathing pattern) from the ordinary SN on performance of six letter cancellation test (SLCT) in school children. For this purpose 36 male school children (12 in each group), of 13-15 years of age groups with a mean and SD of 13.72±0.88 were selected from Ram Krishna Vidya Mandir, Gwalior, Madhya Pradesh as the subjects for this study. In order to investigative the existence of significant difference among different group's performance on SLCT the analysis of co- variance (ANCOVA) was used and level of significant was set at 0.05. The result showed that there was significance difference in performance on SLCT between mantras and control group and mantras and breathing group. There was no significant difference between breathing and control group.

Keywords: six letter cancellation test (SLCT), surya namaskar, SN mantras, breathing pattern, attention

1. 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 suryanamaskar. Along with physical postures, suryanamaskar has specific spiritual connotations attached to it. Suryanamaskar is a graceful combined sequence of twelve positions along with regulated breathing and relaxation (Saraswati SS, 2002) [10, 11].

According to the scriptures, if performed correctly, Suryanamaskar 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 (Saraswati SS, 2002) [10, 11]. Though the greatness of Suryanamaskar has been greatly said in scriptures not much research has been done to understand its benefits.

Selective attention is important skills for academic and professional performance. Techniques to improve these skills are not taught either in education or company training courses. Any system which can systematically improve these skills will be of value in schools, universities, and workplaces. Substitution tests and letter cancellation tests are widely used as clinical and research tools in neuropsychology (Lezak, 1995) [6].

Cancellation tests require visual selectivity and a repetitive motor response. A six letter cancellation test was administered to assess functions such as selective and focused attention, visual scanning, and the activation and inhibition of rapid responses. The six letter cancellation test has been used in similar type of design on Indian population (Natu and Agarwal, 1997) [2].

An individual's performance on cancellation tests often depends on their vigilance, motivation, and arousal as they visually scan the array and select appropriate responses while suppressing inappropriate ones (Sandson and Bachna, 2000) [8]. These tasks are assigned as measures of the capacity for sustained attention, concentration, visual scanning, and rapid response activation and inhibition (Lezak, 1995) [6]. For others, they are measures of efficiency and speed of visual scanning, (Geldmacher, 1996) [5] or selective attention (Casco and Tressoldi, 1998) [3]. For yet others, they are administered primarily to assess potential hemi spatial inattention and visual neglect, (Adair and Na, 1998) [1] or motor perseverative behaviour (Na and Adair, 1998) [1].

In this study, the influence of 12-weeks training of two variation of suryanamaskar (SN with mantra chanting and with fixed breathing pattern) on performance of the six-letter cancellation test (SLCT) was investigated. The SLCT depends on selective attention and memory. It is easily understood and performed and suitable for subjects of all ages, including school students. It was therefore the test given to subjects participating in this study before and after the training. The main objective of this study was to investigate possible improvements in memory and selective attention, as measured by the six–letter cancellation test (SLCT) after completing 12-weeks training of suryanamaskar with chanting the mantras and by following the fixed breathing pattern.

2. Materials and methods
2.1 Subjects
For the purpose of the study 36 male (12 in each group i.e. SN with mantra chanting group, SN with fixed breathing pattern and ordinary SN group) school children from Ram Krishna Vidya Mandir, Gwalior, M.P. were selected randomly as the subjects for this study. The age of the subjects was between 13-15 Years.

2.2 Variable

2.2.1 Six-letter cancellation test (DLST)

Six-letter cancellations test (SLCT) for an adult is paper-and pencil test that uses a letter cancellation task that measures cognitive functions. It consists of a test worksheet that specifies six target letters to be cancelled and has a 'working section', which consists of letters of the alphabet, arranged randomly in 22 rows and 14 columns. The participants are asked to cancel as many of the six target letters as possible in a specified time of 90 seconds. The total number of cancellations and wrong cancellations are scored, and the net scores are calculated by deducting wrong cancellations from the total attempt.

2.3 Statistical Technique

The statistical technique applied in order to examine the existence of significant difference among different group's performance on SLCT were, descriptive statistics such as mean and standard deviation and comparative statistics of analysis of co- variance (ANCOVA) at level of significance 0.05. SPSS 20 was also used.

The assumptions for applying analysis of co- variance (ANCOVA) were also taken into consideration.

2.4 Training Protocol

The total training duration for each day was forty-five to fifty minutes (5 days a week) for 12 weeks. The training was progressive in nature. It includes 2 minutes for stretching, 1 minute for starting prayer and 5 minutes for relaxation and closing prayer. Duration for per posture (12 postures in suryanamaskar) was fixed to 10 seconds. Total time duration for one round of suryanamaskar was fixed to 2 minutes and total rounds were sixteen. Group I perform the suryanamaskar without chanting the SN mantras and breathing pattern and act as the active control group. Group II perform the suryanamaskar with chanting the SN mantras along with respective asanas. Group III perform the suryanamaskar with fixed breathing pattern.

Table 1: Details of asana and respective mantras in suryanamaskar

	Asana	Related Mantra	Breathing Pattern
Position 1	Pranamasana	Om Mitraya Namaha	Breathe normally
Position 2	Hasta Utthanasana	Om Ravaye Namaha	Inhale
Position 3	Padahastasana	Om Suryaya Namaha	Exhale
Position 4	Ashwa Sanchalanasana	Om Bhanave Namaha	Inhale
Position 5	Parvatasana	Om Khagaye Namaha	Exhale
Position 6	Ashtanga Namaskara	Om Pushne Namaha	No respiration
Position 7	Bhujangasana	Om Hiranya Garbhaya Namaha	Inhale
Position 8	Parvatasana	Om Marichaye Namaha	Exhale
Position 9	Ashwa Sanchalanasana	Om Adityaya Namaha	Inhale
Position 10	Padahastasana	Om Savitre Namaha	Exhale
Position 11	Hasta Utthanasana	Om Arkoya Namaha	Inhale
Position 12	Pranamasana	Om Bhaskoraya Namaha	Exhale

3. Results and Findings

Table 2: Descriptive statistics for pre and post-performance in SLCT for different groups

Treatment Group	Mean (pre)	Mean (post)	SD (pre)	SD (post)	N
Control Group	40.42	43.58	12.47	12.23	12
Mantras Group	41.25	52.17	13.32	15.50	12
Breathing Group	41.33	42.83	8.57	7.64	12
Total		46.19		12.62	36

Table 2 shows the scores of mean and S.D. of control, mantras and breathing group on pre and post-performance in SLCT. The mean & S.D of control, mantras and breathing group for pre-performance in SLCT are 40.42±12.47; 41.25±13.32 and 41.33±8.57 respectively. The mean & S.D of control, mantras and breathing group for post-performance in SLCT are 43.58±12.23; 52.17±15.50 and 42.83±7.64 respectively. The mean for post-performance in SLCT of the mantras group is larger than that of the breathing group and control group.

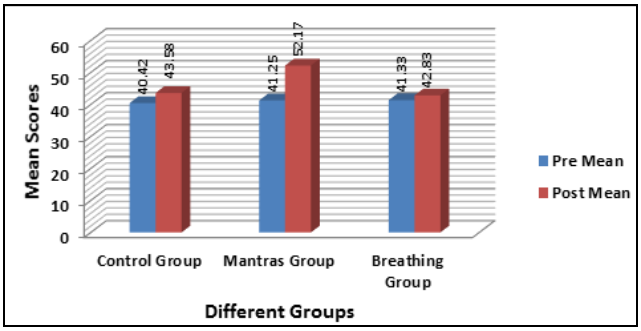

Fig 1: Graphical representation of Mean on performance in SLCT on pre and post-test among various groups

Table 4: Adjusted mean and standard error of both groups in post-testing

Suryanamaskar	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Control Group	44.15[a]	1.32	41.467	46.839
Mantras Group	51.92[a]	1.32	49.237	54.608
Breathing Group	42.51[a]	1.32	39.823	45.193
a. Covariates appearing in the model are evaluated at the following values: Pre Performance in DLST = 48.7222.				

Table 4 shows the adjusted mean and standard error of control, mantras and breathing group on post-performance in SLCT after elimination of effect of covariate in comparing the effectiveness of treatment groups during post-testing. The adjusted mean & standard error of control, mantras and breathing group for post-performance in SLCT are 44.15±1.32; 51.92±1.32 and 42.51±1.32 respectively.

Table 5: ANCOVA table for the post-performance in SLCT

Source	Type I Sum of Squares	df	Mean Square	F	Sig. (p-value)
Pre DLST	4301.730	1	4301.730	206.338	0.000
Treatment Group	606.772	2	303.386	14.552	0.000
Error	667.136	32	20.848		
Corrected Total	5575.639	35			
a. R Squared = .880 (Adjusted R Squared = .869)					

Table 5 shows that the p-value for the F- statistic is 0.000 which is less than 0.05, so it is significant. Thus, the null hypothesis of no difference among the adjusted post-means for the data on performance in SLCT in three treatment groups may be rejected at 5% level.

Table 6: Pair-wise comparisons on performance in SLCT of different group means

(I) Treatment Group	(J) Treatment Group	Mean Difference (I-J)	Sig. (p-value)
Mantras Group	Control Group	7.769*	0.000
	Breathing Group	9.415*	0.000
Breathing Group	Control Group	1.645	0.384

Based on estimated marginal means

b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

* The mean difference is significant at the 0.05 level.

Since F- statistic is significant, post hoc comparison has been made for the adjusted means of both the groups. It may be noted that the p-value for the mean difference between mantras and control group is 0.000; mantras and breathing group is 0.000 and breathing and control group is 0.384. These p-values which are less than 0.05 are significant and which are greater than 0.05 are insignificant at 5% level. Thus, the following conclusions can be drawn:

1. There is a significant difference between the adjusted means of the mantras and control group on the data of performance in SLCT during post-testing.
2. There is a significant difference between the adjusted means of the mantras and breathing group on the data of performance in SLCT during post-testing.
3. There is no significant difference between the adjusted means of the breathing and control group on the data of performance in SLCT during post-testing.

Table 7: Post hoc comparison of adjusted means of the data on performance in SLCT obtained in post-measurement shown with graphics

Mantras Group	Control Group	Breathing Group
51.92	44.15	42.51

" ⌣ " represents no significant difference the means

Table 7 shows the adjusted post-means of different groups written in the descending order. A line drawn under the two groups shows the mean difference is not significant. So, it can be seen from the above table there is no significant difference between control and breathing group.

4. Discussion

On the basis of the results of the study, the hypothesis stated that there would be significant difference in performance on SLCT among different groups on school students was found to be true. In performance on SLCT, hence it can be concluded that practice of SN with mantra chanting for 12-weeks at school level can improves the level of memory and sustained attention (performance on SLCT) as compared to ordinary SN and SN with fixed breathing pattern group. This improvement of performance on SLCT may be because of practice of suryanamaskar with mantra chanting. Sripad (2006) studied the effect of Vedic chanting on memory and sustained attention and found the similar results i.e. significant increased scorings in memory tests and considerable reduction in total error and total time taken for cancellation tests compared to non-chanting practitioners. Gayatri mantra and poem chanting led to improvement in performance, as assessed by DLST. Gayatri mantra influences significantly higher than poem chanting led in net score of female group (Balaram, 2012). Another study also suggests i.e. maha mantra has potential in

addressing problems related to stress and depression (David, 2003).

In the case of control and breathing group, it can be clearly reveals from the descriptive table (table 2) the performance on SLCT in both the groups was also improved but statistically it was not significant at 5% level of significance. The results found in this study may reveal that the mantras chanting during the practice of suryanamaskar have the greater impact on performance in SLCT.

5. Conclusion

There is a significant difference found between the adjusted means of the SN with mantra chanting and ordinary SN group and SN with mantra chanting and SN with fixed breathing pattern group on the performance in SLCT during post-testing. There is no significant difference found between the adjusted means of the SN with fixed breathing pattern and ordinary SN group on the performance in SLCT during post-testing.

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