



EFFECT OF PROGRESSIVE INTENSITIES OF SURYANAMASKAR ON MUSCULAR STRENGTH OF COLLEGE STUDENTS

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Abstract: To assess the effect of progressive intensities of Suryanamaskar practices with a fixed duration on muscular strength of college female students. To achieve the purpose of the study, total twenty eight (28) college students from Purnidevi Girls' College, Bolpur, West Bengal were selected randomly as subjects. The age category of the subject was 18-24 years. All the subjects were divided into two groups with 14 subjects each as experimental (N=14) and control (N=14) group. Experimental group underwent Suryanamaskar practices for a period of 12 weeks (3 months), five days a week, imparting progressive intensities of Suryanamaskar one month interval following a scheduled training protocol and control group did not participate in any training other than the regular routine. Pre-test and thrice post-tests on muscular strength in one month interval were conducted on the experimental and control groups. To determine the effect of progressive intensities of Suryanamaskar on muscular strength analysis of covariance (ANCOVA) was used. Muscular strength of experimental group was significantly improved compared with control group. As the intensities of Suryanamaskar increased the trend of Muscular strength ability showed significant gradual improvement over the period of three months. Progressive intensities of Suryanamaskar training interventions were effective for improving muscular strength.

KEY WORDS: Pre-test, mid-test, post-test, Suryanamaskar, muscular strength.

INTRODUCTION:

We are living in the age of 21st century and the need is not only to achieve medical excellence but also to prevent people falling from sick. At present, most of the people are suffering from various life style diseases such as hypertension, diabetes and cardiovascular diseases etc. due to stress, physical inactivity and high fatty diet.

Yoga has traditionally been a part of daily routine which is proved and meant for achieving a healthy life. Suryanamaskar also called sun salutation is a sequential combination of twelve powerful and graceful yogic postures performed dynamically in synchrony with the breath. Each cycle consists of 12 steps performed successively one after another. All these postures are placed in such a way that each step is complimentary to the other. Numerous scientific studies have reported beneficial physiological changes after short or long term yogic practices. The studies of Bhutkar, M.V et al. (2011), Vira J et al. (2012), Bhonde M.S. et al. (2014) reported that Suryanamaskar practice has positive and significant effect in the development of muscular strength. Suryanamaskar is an integral part of modern yoga training and may be performed either in a slow or rapid manner. Suryanamaskar at different speeds provide different benefits. Various schools of yoga differ in the practice of Suryanamaskar. Some schools advocate performance in a slow manner in tune with slow breathing, while others advocate a rapid method of performing multiple rounds in a fast manner similar to physical exercise. The study is an attempt to find out the effect of progressive intensities of Suryanamaskar practices from slow to fast towards the development of muscular strength.

OBJECTIVE:

To find out the effect of different progressive intensities with a fixed duration of Suryanamaskar practices on muscular strength.

MATERIAL AND METHODS:

Selection of subjects: To achieve the purpose of this study initially 18-24 years in age ranged 40 female students from Purnidevi Girls College, Bolpur, West Bengal, India were selected randomly. The selected subjects were divided into an experimental group and a control group with 20 subjects in each (N=20). Experimental group underwent Suryanamaskar practices with a scheduled training protocol. Finally 28 girls completed this investigation on which control group was (N=14) and experimental group was (N=14) for the training. The duration of Suryanamaskar training was continued for a period of 3 months (12 weeks).

Variables: Suryanamaskar was considered as independent variable and muscular strength was considered as dependent variable.

Test for Muscular Strength: To measure the upper body muscle strength flexed arm hang test was used.

The Suryanamaskar training protocol was set-up by the researcher for the experimental group. The duration of the training schedule was continued for 3 months (12 weeks) and after each month training with respective protocol post test was administered.

The Suryanamaskar Training protocol for the Experimental group was presented in the Table- 1.

Table-1: Suryanamaskar Training Protocol for the Experimental Group

Month	Training	Repetition	Duration	Days/Week	Test
1 st month	Suryanamaskar	5 rounds/day	30 minutes	5 days/ week	End of 1 st month Post test
2 nd month	Suryanamaskar	10 rounds/day	30 minutes	5 days/ week	End of 2 nd month Post test
3 rd month	Suryanamaskar	15 rounds/day	30 minutes	5 days/ week	End of 3 rd month Post test

Statistical Analysis:

To find out the mean, standard deviation and also the graphical representations Descriptive statistics was used by the researcher.

To find out the impact of different progressive intensities of Suryanamaskar training on the dependent variables Analysis of Covariance (ANCOVA) was used.

Whenever the 'F' ratio for adjusted post-test means was found significant, Scheffe's post hoc test was used to determine the significance of differences between two paired means.

RESULTS & DISCUSSION:

Descriptive statistics (mean and standard deviation) of dependent variable (muscular strength) for the experimental and control groups in Pre- test, Mid-test-1 (After 1 month) Mid-test-2 (After 2 month) and Post- test (After 3 months) were calculated and were presented in the Table- 2.

Table-2: Statement of Statistics (M & SD) of the Measures in Muscular Strength (Flexed arm hang) of the Girls at different duration

Groups	Muscular Strength (sec)			
	Pre-test (M±SD)	Mid-test-1 (After 1 month) (M±SD)	Mid-test-2 (After 2 months) (M±SD)	Post-test (After 3 months) (M±SD)
Exp, Group	14.70 (± 1.09)	17.35 (± 1.12)	19.66 (± 1.09)	20.18 (± 1.07)
Control Group	10.36 (± 1.23)	11.43 (± 1.50)	12.51 (± 1.47)	13.23 (± 1.53)

Table-3: Analysis of Covariance (ANCOVA) among Pre and Post-test data of the Experimental and Control group in Muscular Strength

Source	SS	df	MS	F
Groups	208.06	1	208.06	16.59**
Intervention	922.95	1	922.95	73.60**
Error	313.41	25	12.54	
Total	1444.42	27		

* $p < 0.05$ ** $p < 0.01$

Results of ANCOVA (Analysis of Covariance)

The results of ANCOVA (Table-3) revealed that the dependent variable (muscular strength) got remarkably significant changes ($F = 16.59$, $p < 0.01$) after different intensities of training of 30 minutes duration between the two groups (experimental and control). In fact, statistically significant changes were evident in case of the dependent variable after different training interventions ($F = 73.60$, $p < 0.01$). It appeared that all the training interventions had statistically significant effects on the dependent variable. These changes, therefore, had been discriminated further by Scheffe's post hoc test.

Table-4: Mean Recovery in Muscular Strength (Flexed arm hang)

Groups	Recovered Mean in Muscular strength (sec)			
	Pre-test (1)	Mid-test-1 (After 1 month) (2)	Mid-test-2 (After 2 months) (3)	Post-test (After 3 months) (4)
Exp, Group	11.45	17.35	20.37	22.53
Control Group	10.78	11.64	12.28	13.05

Results on Muscular strength:

Mean recovery indicated that adjusted mean scores in muscular strength in pre-test, mid-test-1 (after 1st month), mid-test-2 (after 2nd month) and post-test (after 3rd month) among the subjects of experimental group were 11.45, 17.35, 30.37 and 22.53 respectively (Table-4). Similarly, the adjusted mean scores in muscular strength in pre-test, mid-test-1 (after 1st month), mid-test-2 (after 2nd month) and post-test (after 3rd month) among the subjects of control group were 10.78, 11.64, 12.28 and 13.05 respectively.

Table-5: Ordered Treatment Means (after Mean Recovery) of Control group after different intensities of training followed by Scheffe's post hoc test in Muscular strength

Group (Control)	Tests in Muscular strength			
Tests	(4)	(3)	(2)	(1)
(4)	--	0.10	0.14	0.12
(3)		--	0.10	0.11
(2)			--	0.09
(1)				--
* p<0.05, ** p<0.01				

Where, (1) = Pre-test
 (2) = After 1st Month
 (3) = After 2nd Month
 (4) = After 3rd Month

A) Results of Control Group in Muscular strength (Table-5):

The subjects of control group could not show any change in muscular strength score after 1st month (CD=0.09, p>0.05), 2nd month (CD=0.11, p>0.05) and 3rd month (CD=0.12, p>0.05) while compared with the pre-test score. This result indicated insignificant change in muscular strength over the period of 3 months. Since the control group was not exposed to any training intervention, perhaps it could not help to change the scores of muscular strength during 1st, 2nd and 3rd months respectively.

Table-6: Ordered Treatment Means (after Mean Recovery) of Experimental group after different intensities of training followed by Scheffe's post hoc test in Muscular strength

Group (Experimental)	(4)	(3)	(2)	(1)
(4)	--	0.18	0.30*	0.42**
(3)		--	0.27*	0.40**
(2)			--	0.35*
(1)				--
* p<0.05, ** p<0.01				

- Where,
- (1) = Pre-test
 - (2) = After 1st Month
 - (3) = After 2nd Month
 - (4) = After 3rd Month

B) Results of Experimental Group in Muscular strength (Table-6):

Significant improvement in muscular strength scores of the experimental group was observed after 1st month (CD=0.35, $p<0.05$), 2nd month (CD=0.40, $p<0.01$) and 3rd month (CD=0.42, $p<0.01$) Suryanamaskar training while compared with the pre-test scores. Statistically significant changes were also evident in the scores of muscular strength between the training intensities of 1st month and 2nd month (CD=0.27, $p<0.05$), between the scores of 1st and 3rd months (CD=0.30, $p<0.05$), and between the scores of 2nd and 3rd months (CD=0.18, $p>0.05$). The result revealed that experimental group improved in muscular strength ability during 1st and 2nd months of training interventions and also helped to maintain the improved status of muscular strength during 3rd months. This suggested that the trend of muscular strength ability showed gradual improvement over the period of three months. The overall result also indicated that the training interventions of both 2nd and 3rd month was comparatively more effective as compared to the training imparted during 1st month in improving muscular strength abilities.

Table-7: Overall Mean Recovery in Muscular strength

Groups	Muscular strength (sec)		
	After 1 st month (a)	After 2 nd month (b)	After 3 rd month (c)
Cont. Vs Exp. Gr.	15.75	19.30	21.10

C) Results of Control Vs Experimental Groups in Muscular strength:

The result of three months separate training interventions revealed that adjusted mean scores in muscular strength during 1st month, 2nd month and 3rd month were 15.75, 19.30 and 21.10 respectively (Table-7).

However, the comparison of the adjusted mean on muscular strength between 1st, 2nd and 3rd months was presented below (Table- 8):

Table-8: Difference between Adjusted recovered means on Scheffe's post hoc test in Muscular strength after different intensities of training intervention

Groups	(c)	(b)	(a)
(c)	--	0.17	0.29*
(b)		--	0.26*
(a)			--
* p<0.05, ** p<0.01			

Where, (a) = After 1st Month
 (b) = After 2nd Month
 (c) = After 3rd Month

- 1st month training intervention alone helped to improve the scores in muscular strength (CD=0.26, p<0.05), which suggested the improvement in strength ability of muscles.
- 2nd month training intervention showed better strength ability of muscles than the 1st month of training (CD=0.29, p<0.05).
- 3rd month training intervention showed improved muscular strength similar to the 2nd month of training (CD=0.17, p>0.05).

Thus, the overall result revealed that the three separate training interventions for three months duration showed gradual improvement in muscular strength scores; however, the impact of 2nd and 3rd month of training showed comparatively better than 1st month of training interventions for better strength ability of the muscles.

CONCLUSION:

Progressive intensities of Suryanamaskar training was effective in the development of muscular strength but the 3rd month of intervention i.e. 15 rounds within 30 minutes duration/ day, 5 days a week was more effective compared to 1st and 2nd month training for improving muscular strength.

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