Effect of different paces of suryanamaskar on leg strength of school students

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Abstract---The aim of this study was to see the effect of suryanamaskar practice with different paces on leg strength of school students. Study had three objectives, first see the interaction effect of training duration and groups, second the main effect of duration, and third the main effect of groups. Within between mixed design was used. Three experimental intact groups were created Pace 1 group, Pace 2 group and Pace 4 group, each group had 15 subjects with age range between 15-17 years. Pace 1 group practiced one round (12 steps) of suryanamaskar in 1 minute, Pace 2 group in 2 minutes and Pace 4 group in 4 minutes. The maximum strength of the legs was measured by the leg dynamometer test. Total 12 weeks training was given in which three observations were taken before the training (pre-test), after 6 weeks (mid-test) and after 12 weeks (post-test). 3 X 3 mixed factorial ANOVA was used and level of significance was set at 0.05. Result showed that practice of Suryanamaskar for 6 weeks and 12 weeks were sufficient to bring out significant improvement on leg strength (main effect of training duration). There was no significant difference found among three groups (main effect of groups) and interaction effect (combined effect of training durations and groups) on leg strength after 6 weeks and after 12 weeks.

Keywords---Suryanamaskar, Pace, leg strength and Mixed ANOVA.

Introduction

Suryanamaskar is one of most widely practice among yoga practitioners over the globe. Suryanamaskar is a perfect combination of Asana, Pranayama and Meditation. Suryanamaskar practice is a sequence of 12 yogic postures (asana), which purpose is to stretch muscles and joints, massaging and toning internal

organs of the body. (Choudhary, 2010). Regular practice of Suryanamaskar gives us benefits at physical, physiological, psychological and even spiritual dimension of personality. (Saraswati, 2009)

Resistance training for school children has gained more popularity nowadays. Limited research evidence indicates that for better strength among young children is low resistance and high repetition resistance training improve proper muscle strength without adverse effect on bones and connective tissues. (McArdled, 2001)

Regular practice of asanas is one of the best ways to improve muscular strength in children because during asana practice body weight act as a resistance and rounds as repetitions. Number of research studies reveled that regular practice of yogic postures improves strength in children and Suryanamaskar is itself combination of asanas. Some studies shown that regular Suryanamaskar practice improve strength of school students, but these all studies were silent about the pace of Suryanamaskar which they used in the studies. Going through many research papers this query had been raised that change in the pace of Suryanamaskar would be effective differently on leg strength of school students. (Bhavanani, 2011)

Try to fulfilling gape of knowledge, this study had three objectives, first to see the interaction effect of training durations and groups, second to see the main effect of durations, and third to see the main effect of groups on leg strength of school students due to practices of Suryanamaskar. (Sisodia, 2014)

Methods

Subjects: Total forty-five school boys in the range of 15 – 17 years from class 11th and 12th were selected from the Kiddy's Corner School, Gwalior for this study. Three students were not able to completed 12 weeks Suryanamaskar practice.

Variables: Leg strength was a dependent variable. Suryanamaskar was an independent variable, which had two factors: Group and Training Duration. Bothe factors, Group and Training Duration had three levels.

Test for Leg strength: The maximum strength of the legs was measured by the leg dynamometer test. (Miller, 2006)

Experimental Design: Mixed-Model design was used. Three experiment groups were created and each group had 15 subjects. Treatment (different pace of Suryanamaskar) was assigned randomly into the groups. The data was collected from all the three groups before the training (pre-test), after 6 weeks (mid-test) and after 12 weeks(post-test) training of Suryanamaskar. (William, 1999).
First experimental group preformed one round of Suryanamaskar in 1 minute (pace one group), second experimental group performed in 2 minutes (pace two group), third experimental group performed in 4 minutes (pace four group).
Suryanamaskar training was carried for a period of twelve weeks, five days per week. The scheduled time of practice was during their physical education period for 40-45 minutes. The pace of Suryanamaskar was control by watch. To

determine the effect of different paces of Suryanamaskar on leg strength on school students 3 x 3 between-within factorial ANOVA was applied and level of significant was set at 0.05.

Results

Table1: Descriptive Statistics of Leg Strength of different paces and time duration of Suryanamaskar

Groups	Pre-Test		6 Weeks		12 Weeks		
	Mean	S. D	Mean	S. D	Mean	S. D	N
Pace 1	58.42	3.03	61.64	2.24	65.64	1.90	14
Pace 2	58.14	3.43	64.64	2.16	68.35	1.97	14
Pace 4	61.64	2.93	68.00	2.14	71.35	2.23	14

Table 2: Mauchly's Test of Sphericity for Training Duration of Leg Strength

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	Df	p-value	Epsilon[b]		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Duration	0.29	47.02	2	0.00	0.58	0.62	0.50

*p value > 0.05 is significant

Above table shows that the assumption of sphericity was violated, thus Greenhouse-Geisser correction was applied (epsilon value was less than 0.75).

Table 3: F- Table for Training Durations (Within-Subjects Effects) and Interaction Effect of Leg Strength

Source		Type III Sum of Squares	Df	Mean Square	F	p-value	Partial Eta Squared
Training Duration	Greenhouse-Geisser	1738.49	1.17	1486.30	76.56	0.00	0.66
Duration X Groups	Greenhouse-Geisser	57.27	2.39	24.48	1.261	0.29	0.06
Error(duration)	Greenhouse-Geisser	885.57	45.61	19.41			

*p value < 0.05 is significant.

Above table shows that there was a significant main effect of training durations on leg strength as the   p-value was 0.00, which was less than 0.05. It also shows that there was no significant interaction effect between groups and training durations as the p-value was 0.29 which was greater than 0.05.

Partial eta squared in the above table explains 66% of variance of training durations and 6% of variance explained by the interaction, which shows variance of interaction between training durations and groups. Partial eta squared of training duration indicates very large effect size and interaction indicate low effect size.

Table 4: F- Table for Groups (Between-Subjects Effects) of Leg Strength

Source	Type III Sum of Squares	Df	Mean Square	F	p-value	Partial Eta Squared
Groups	560.44	2	280.22	1.163	0.32	0.05
Error	9398.85	39	240.99			

* p value < 0.05 is significant

Above table shows that there was no significant main effect of groups (pace 1, pace2 and pace 4) on leg strength due to Suryanamaskar practice as the p-value was 0.32 which was greater than 0.05. Partial eta squared in the above table explains 5% of variance of groups, which indicated low effect size.

Table 5: Marginal Means of Leg Strength among Training Durations Irrespective of Groups

Time	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Pretest	59.405	1.814	55.735	63.075
6 weeks	64.762	1.262	62.208	67.315
12 weeks	68.452	1.180	66.065	70.840

The marginal mean of leg strength for overall pretest irrespective of groups (pace 1, pace 2 and pace 4 group) suggests that its mean score and standard error of mean score were 59.40 and 1.81 respectively. The marginal mean of leg strength for overall after 6 weeks irrespective of groups (pace 1, pace 2 and pace 4 group) suggests that its mean score and standard error of mean score were 64.76 and 1.26 respectively. The marginal mean of leg strength for overall after 12 weeks irrespective of groups (pace 1, pace 2 and pace 4 group) suggests that its mean score and standard error of mean score were 68.45 and 1.18 respectively Marginal means of all the training durations are presented graphically below.
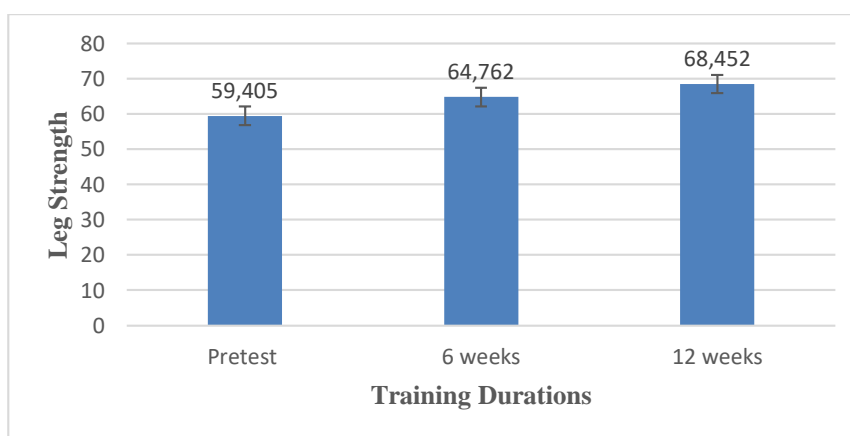

Figure: Graphical Representation of Marginal Means of Leg Strength among Training Durations

From table 4 it is evident that there was a significant main effect of training duration. In order to compare different training durations (i.e. pretest, after 6 and 12 weeks) pairwise comparisons were made after Bonferroni adjustment. The results are shown in the table underneath:

Table 6: Pairwise Comparisons between Training Durations of Leg Strength

(I) time	(J) time	Mean Difference (I-J)	Std. Error	p-value	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
Pre teat	6 weeks	-5.35*	0.70	0.00	-7.12	-3.58
	12 weeks	-9.04*	0.97	0.00	-11.49	-6.60
6 weeks	Pre teat	5.35*	0.70	0.00	3.58	7.12
	12 weeks	-3.69*	0.40	0.00	-4.71	-2.66

* p value < 0.05 is significant

Above table shows that there was a significant difference between pretest - after 6 weeks, pre-test - after 12 weeks and after 6 weeks - after 12 weeks as the p-value were less than 0.05. Graphical representation of leg strength for all the three experimental groups in all the durations of training is shown in figure below:
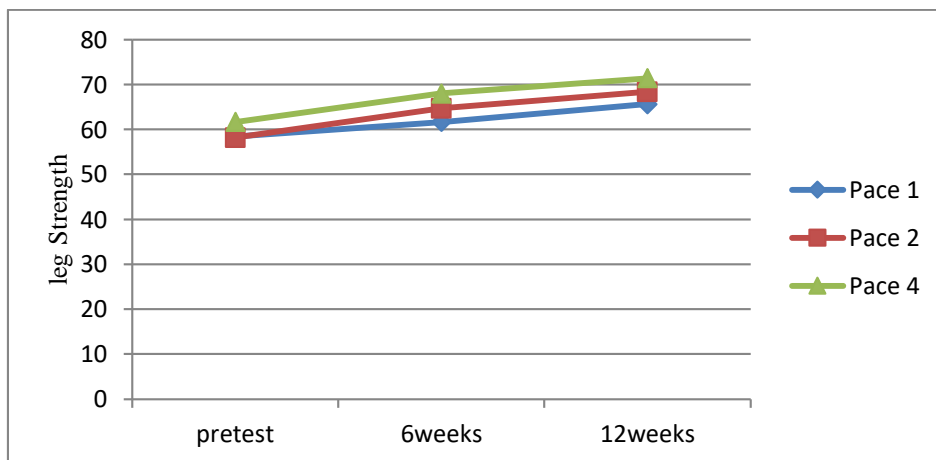

Figure: Graphical Representation of leg Strength of Training Groups through Different Durations of Training

On the basis of the findings the conclusion was that the practice of Suryanamaskar for 6 and 12 weeks is sufficient to bring out significant improvement on leg strength (main effect of training duration). In all three groups, the pattern of improvement in leg strength is almost similar after 6 weeks and 12 weeks.

Discussion

The main effect of training durations was significant on leg strength. There were no significant effects of groups (main effect of groups) and interaction effect on leg strength. Strength is ability of neuromuscular system to act against the external

resistance. (Hardyal, 1991). There are several studies which have shown that regular yogic practices improve muscular strength (Cowen & Adams., 2005; Mohan et al., 2003S; Gaurav., 2011; Sekhon & Shelvam., 2013; Tran et al., 2001; Souza & Avadhany., 2014). There are some specific studies which have shown that the practice of Suryanamaskar improve muscular strength (Bhutkar et al., 2011; Mathew & Vasanthi., 2013).

The effect of training duration and descriptive statistics concluded that the Suryanamaskar practice for 12 weeks improved leg strength. During training of Suryanamaskar Pace 1 group took around 5 seconds for each asana, pace 2 group took around 10 seconds and pace 4 group took around 20 seconds of Suryanamaskar in every training session. The key-factor for strength development is high resistance and low repetitions (miller. 2006). In pace 4 group each asana took around 20 seconds and 8 repetitions of Suryanamaskar, it means that muscles get more resistance due to more hold duration as compared to pace 1 and pace 2 group, this may be the reason for development of leg strength in pace 4 group. It was also concluded that Suryanamaskar practice for 12 weeks with pace 4 helped to improve better leg strength as compared to pace 1, pace 2 group. There were no significant differences found among three groups (main effect of paces) on leg muscles strength at pretest, after 6 and 12 weeks because improvement leg muscles strength was almost similar after 6 and 12 weeks in all three groups (interaction effect found insignificant).

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