

Effect of 4 months yoga training on handgrip strength and handgrip endurance in children at Nagpur

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Abstract

Background: Childhood health forms a foundation for adult health. Any form of regular exercise during childhood improves the strength of skeletal muscles. Yoga training includes practice of various postural asana, controlled breathing, and relaxation.

Objective: To study the effect of yoga training on handgrip strength (HGS) and handgrip endurance (HGE) in schoolchildren.

Materials and Methods: This prospective case-control study was conducted among sixty healthy school children in the age group of 12–15 years. A total of 30 children (study group) were given yoga training for 45 min, 5 days a week for 4 months. Thirty children (control group) were not put to yoga training. HGS and HGE were measured at the outset and after 4 months in all 60 children. Results were analyzed by student's paired 't'-test.

Result: Yoga training produced statistically significant improvement in HGS and HGE in study group when compared with controlled group.

Conclusion: Our study concludes that yoga training for 4 months improves the strength of skeletal muscles in school children as measured by HGS and HGE.

KEY WORDS: Yoga training, children, handgrip strength (HGS), handgrip endurance (HGE)

Introduction


Role of any sports activity and regular exercise in the development of strength of skeletal muscles is well documented. Yoga training includes practice of various postural asana, controlled breathing, and relaxation. Although yoga has been enjoying popularity with adult for many years, we have only recently come to understand how helpful it can be for children. However, very few reports are available on effect of yoga on improvement of skeletal muscle strength in children by measuring handgrip strength (HGS) and handgrip endurance (HGE).^[1–4]

With this, we aim to study the effect of 4 months yoga training on HGS and HGE in children.

Materials and Methods

This prospective case-control study was carried out on the students of 7th and 8th standard of Government High School at Nagpur. Sixty students between the age group 12–15 years with 30 boys and 30 girls were selected. Students were asked about practice of yoga and also regular practice of any sports activity. Daily informal playing was taken into consideration. Students with previous exposure to yoga training and regular practice of any sports were excluded. Detail history was taken and clinical examination was done. Students with malnourishment, cardiorespiratory diseases, and congenital anomalies were excluded.

These students were divided into two equal groups. One study group comprised 30 students with 15 boys and 15 girls and other control group 30 students with 15 boys and 15 girls.

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Ethics

Informed consent was taken from the subjects and their guardian after explaining the study design. The protocol of project was submitted to institutional ethics committee, and the project was started after approval.

At the outset of study, students of both the groups were subjected to measurement of anthropological parameters such as height in cm and weight in kg. Both the groups were subjected to measurement of HGS and HGE.

Recording of Handgrip Strength

HGS was tested by using grip dynamometer. The dominant hand was used. Test was performed in standing position, with the arm by the side of body and flexion of 90° at elbow joint. The handle of the dynamometer was adjusted as required—the base should rest on first metacarpal, while the handle should rest on middle of four fingers. Demonstration of test was given to students. Later, students were asked to perform the test. Readings were taken by asking the subject to squeeze the dynamometer with maximum efforts. No other body movements were allowed. The test was performed for three times, and the highest value was noted. Results were expressed as kilograms of force.

Recording of Handgrip Endurance

HGE was measured by using grip dynamometer. The dominant hand was used. Test was performed in same position. For determining HGE, the subject was asked to maintain one third of HGS in sustained squeeze for as long as possible, and the time was to be noted. Demonstration of test was given to students. Later, students were asked to perform the test. The test was performed for three times, and the highest value was noted. Results were expressed in seconds.

Students of study group were put to yoga session for 45 min duration from 4.00 pm to 4.45 pm in their school hours from Monday to Friday for 4 months. Students of control group did not receive any yoga training. They were advised to continue study in a classroom, while students of study group were undergoing yoga training.

Students of study group were put to Integrated Yoga Module as prescribed by Swami Vivekananda Yoga Anussandhana Samsthana (SVYASA), Bangalore.^[5] It was done under supervision. Module included the following practices:

1. Loosening exercises: 5–6 min
2. Quick relaxation technique: 2–3 min
3. Asana: 15 min
4. Preparation for pranayam (i.e., sectional breathing): 2–3 min
5. Kapalbhathi: 1–2 min
6. Pranayam (Nadi-shuddhi; 6 rounds): 6 min
7. Deep Relaxation technique: 10 min

At the end of 4 months, both the groups were again subjected to measurement of anthropometric parameters and HGS and HGE.

Statistical Analysis

Continuous variables (HGS and HGE) were presented as mean \pm SD. Pre- and posttraining data were compared by performing paired *t*-test for normalized data. Wilcoxon rank sum test was performed to compare mean changes in different study parameters between study and control groups. Value of $P < 0.05$ was considered as statistical significance. Statistical software STATA, version 13.0 was used for data analysis.

Result

Table 1 shows anthropological observations of study subjects and control subjects before study and at end of study. This table shows students from study and control groups who were age, height, and weight matched. The mean height and weight in study group and control group did not change significantly after 4 months.

Table 2 shows yoga training of 4 months produced significant ($P < 0.05$) increase in HGE and very highly significant ($P < 0.0001$) increase in HGS in study group subjects. In contrast, the changes in these parameters in the control group subjects were statistically insignificant.

Discussion

HGS and HGE are simple methods to assess the skeletal muscle strength and nutritional status. In this study, HGS increased very high significantly ($P < 0.0001$), and HGE increased significantly ($P < 0.05$) after 4 months of yoga training in study group. This is consistent with earlier study of Madanmohan et al.^[1] in which he found yoga training produces a significant increase in HGS. Raghuraj et al.^[2] had reported that pranayama training results in significant increase in the HGS of both the hands. On the other hand, Telles et al.^[6] had concluded that yoga training produces an increase in motor speed for repetitive finger movements but not in strength and endurance. The increase in HGS and HGE in our yoga group is also consistent with the findings of Tran et al.^[7] who had reported that 8 weeks hatha yoga training results in significant increase in muscular strength and muscular endurance. Our observations are also consistent with Ray et al.^[8] who had reported that yoga exercise produces a significant increase in muscle endurance time and he also noted delay in the onset of fatigue. However, this is not an agreement with the observation of Udupa et al.^[9] which shows that in contrast to physical exercise, yoga asanas specifically influences vital organs without affecting muscular functions.

Dash M and Telles^[3] studied yoga practice improves HGS in normal persons and in patients with rheumatoid arthritis. In another study by Madanmohan et al.^[4] they found yoga training produces a significant increase in HGE, but HGS not changed significantly after yoga training. Raju et al.^[10] reported that yoga training results in significant increase in

Table 1: Demographic profile of subjects (control group, $n = 30$; study group, $n = 30$)

Parameters	Preyoga			Postyoga		
	Study group	Control group	P	Study group	Control group	P
Height (cm)	146.2 ± 6.727	148.5 ± 8.378	>0.05	147.1 ± 6.727	148.9 ± 8.378	>0.05
Weight (kg)	32.63 ± 4.78	33.33 ± 5.23	>0.05	32.73 ± 4.53	33.43 ± 4.743	>0.05

Results are expressed in mean ± SD.

$P > 0.05$, not significant.

Table 2: Values of HGS and HGE before and after 4 months yoga training in study and control groups

Parameters	Study group			Control group		
	Before training	After training	P	Before training	After training	P
HGS (kg)	32.2 ± 7.871	38.43 ± 9.800	<0.0001	31.63 ± 10.96	31.57 ± 10.23	>0.05
HGE (s)	6.5 ± 1.33	8.36 ± 1.37	<0.05	6.43 ± 1.59	6.6 ± 1.79	>0.05

Results are expressed in mean ± SD.

$P > 0.05$, not significant; $P < 0.05$, significant; $P < 0.0001$, very highly significant.

maximal work output with significant reduced level of oxygen consumption per unit work.

Most of the effects could be explained on the following basis. Some of the asanas in our study such as ardhakati chakrasana, pascimatanasana, and bhujangasana involve sustained isometric contraction of shoulder, chest, and arm muscles. Consequent improvement in the strength and endurance of these muscles can explain the significant increases in HGS and HGE. Mudras involves keeping the fingers in specific posture, which could possibly influence HGS.

Breathing through one nostril in anulom vilom pranayama increases the resistance. The effects of resistance training on skeletal muscle are well documented.^[11] The availability of energy and oxidation of glucose is believed to influence the HGS.^[12] The pranayama practice may increase HGS and endurance by reducing the oxygen requirement.

Conclusion

Our study shows that yoga exerts the positive impact on the HGS and endurance (i.e., skeletal muscle strength). Thus, yoga may be helpful in improving overall health and performance of school children.

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