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Improvement in Handgrip Strength in Normal Volunteers Following Selective Sukshma Vyayam Practices: A Pilot Randomized Control Trial

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Abstract
Background: Reliable and valid evaluation of hand strength can provide an objective index of general upper body strength. The power grip is the result of forceful flexion of all finger joints with the maximum voluntary force that the subject is able to exert under normal bio-kinetic conditions. Certain group of yogic practices helps in improving the hand strength extensively. Among them the yogic asana gives excellent results in improving the hand strength.
Methods: A total of sixty subjects, mean aged 18 years were randomly assigned into two groups after satisfying the inclusion and exclusion criteria. Experimental group (EG, n=28, dropouts 2) and control group (CG, n=26, dropouts 4). Both groups were assessed at baseline and after 8 weeks with handgrip dynamometer. 8 subjects of experimental group and 26 subjects of control group completed the study successfully.
Results: The experimental group showed significant improvement in the hand grip strength as compared to the control group.
Interpretation and Conclusion: Selective sukshma vyayam practices administered for continuous 2 weeks showed good improvement in the hand strength.

Keywords: Hand Grip Strength, Sukshma Vyayam, Hand Strength

Introduction

There are several medicine and science available around us to treat and manage the human ailments. But very few sciences only have the potential to prescribe the correct way of living. One such universal science is Yoga. The science, yoga doesn't belong to any particular community, religion, caste or country. It is common to all and not patented to any particular section.[1]

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Yogic sukshma vyayam (YSV) comprises of all these practices together like it has asanas, pranayama, mudras and bandhas. There are about 48 practices explained in the yogic SV text by Swami Dhirendra Brahmachari.[2] The literal meaning of the word sukshma vyayam (SV) is nothing but subtle exercise. The complete sequence of 48 yogic SV starts with the top of the body that is the head, eyes, nose, ears, neck, shoulders, arms, elbows, fingers, upper chest, middle chest, abdomen, different aspects of trunk, thighs, buttocks, rectum, bladder, knees, ankles, foot and toes.

Reliable and valid evaluation of hand strength can provide an objective index of general upper body strength. The power grip is the result of forceful flexion of all finger joints with the maximum voluntary force that the subject is able to exert under normal bio-kinetic conditions. The synergistic action of flexor and extensor muscles and the interplay of muscle groups is an important factor in the strength of the resulting grip. Many factors influence the strength of the grip, including muscle strength, hand dominance, fatigue, time of day, age, nutritional status, restricted motion and pain[3-13].

The study is aimed at increasing the hand grip strength with the normal volunteers by incorporating the selective 10 SV practices and thereby introducing these practices to the hand grip strength weaker population.

Aim:

To know the effect of selective SV practices in hand grip strength among two groups of normal volunteers.

Variables	Yoga	Control
Age (yrs)	18.0±0.11	18.01±.012
Height (cm)	143.42±8.52	146.58±9.65
Weight (kg)	58.77±6.23	56.35±4.35
BMI (kg/m^2)	22.57±3.78	23.78±4.56

Objectives of the study:

To assess the effect of selective SV practices in hand grip strength.

Methodology

Subjects:

A total of 60 subjects of both gender with age group of 18 years participated in the study.

Description of the subjects including the selection of samples:

The study subjects were randomly recruited from Government Yoga and Naturopathy Medical College and Hospital, Arumbakkam, Chennai, Tamilnadu, India. Sixty participants were screened and those satisfying the criteria of the study were recruited for the study.

Ethical Clearance:

Ethical clearance was sought from the Institutional Ethics Committee prior to the start of the

study and the approval for the same was granted.

Written Informed Consent:
All the subjects expressed their willingness to participate in the study by giving a signed informed consent.

Screening of Subjects:
The subjects were taken into the study by measuring their height, weight and body mass index (BMI) with the help of standard height calibrator and weighing scale. The BMI was calculated as per the norms of World Health Organization. The normal BMI subjects were taken into the study.

Inclusion Criteria
- Age group: 18 to 28 years
- Both sexes
- Normal BMI individuals
- Persons who are ready to give their consent

Exclusion Criteria
- People who are underweight and overweight
- People with underlying pathological conditions in their upper limbs.
- People who are doing regular physical activities like sports, gym and aerobic exercises
- Females who are pregnant, lactating and menstruating.

Type of the Design
Randomized Controlled Trial.

Randomization
Simple randomization was used in the study. Among the various simple randomization methods, in this study the lottery method was incorporated.

Allocation of Patient into Study and Control Groups
The patients were allocated randomly to the experimental or the control group. Neither the investigator nor the patients were blinded to the intervention. The subjects were not informed of the group they were taken in. 68 subjects were initially screened and sixty of them were recruited and randomly assigned to two groups based on the lottery method as Experimental group (Group A) (n=30) and Control Group (Group B)(n=30).

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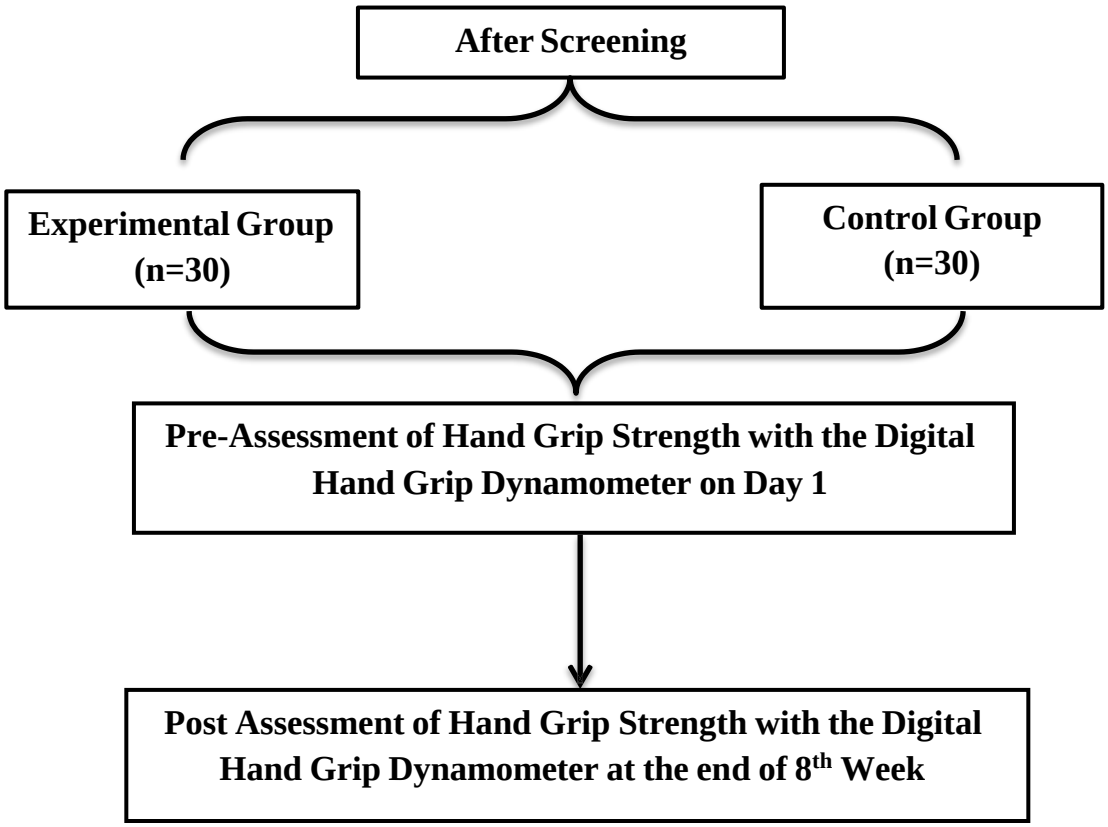
Figure 1:



Trial Profile

The trail profile of the study is presented as **Figure 2** which illustrates the study plan, flow of patients across data points.

Assessments

Hand Grip Strength Assessment with the help of CAMRY digital hand grip dynamometer.

Hand Grip Strength:

Hand grip strength is a reliable and valid measurement when the standardized methods and calibrated equipment are used[14]. The hand grip strength is measured with the help of hand grip dynamometer. There are numerous types of dynamometers available presently out of which few are only validated and reliable. The normative data is available for very few dynamometers only[15].

Hand Grip Dynamometer:

The Camry electronic handgrip dynamometer is incorporated in this study. It captures maximum grip strength in either pounds or kilograms. It measures the isometric grip force up to 200 lb / 90 kg. It has adjustable grip sizes so that it can used by varying hand sizes[16].

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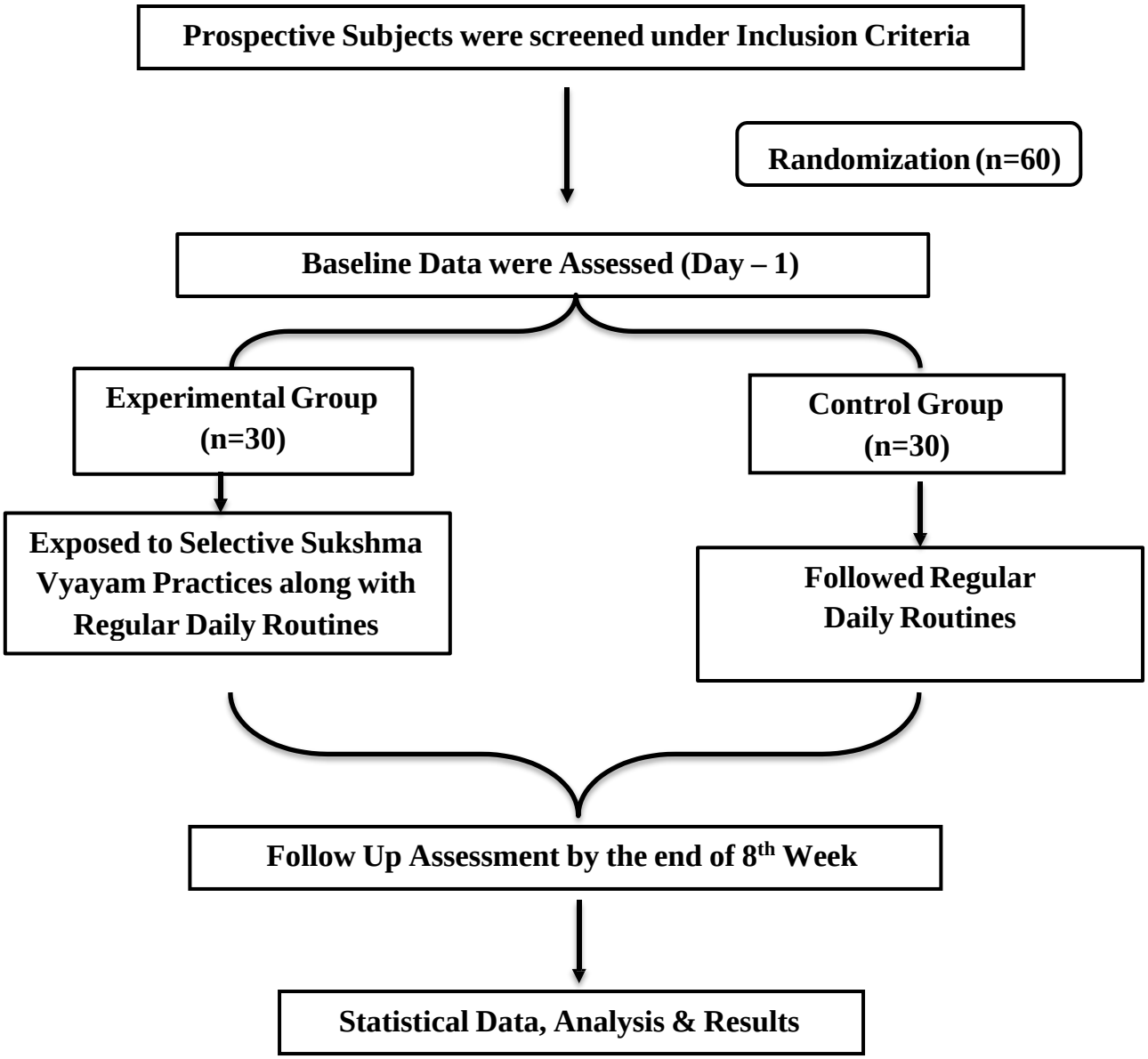
Figure 2:



Intervention

The 10 selective SV practices involved in the study are as follows:

1. Skandha Tatha Bahu Mula Sakthi Vikasaka
2. Bhuja Bandha Sakthi Vikasaka
3. Kaphoni Sakthi Vikasaka
4. Bhuja Valli Sakthi Vikasaka
5. Purna Bhuja Sakthi Vikasaka
6. Mani Bandha Sakthi Vikasaka
7. Kara Tala Sakthi Vikasaka
8. Kara Prstha Sakthi Vikasaka
9. Angula Mula Sakthi Vikasaka
10. Anguli Sakthi Vikasaka

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Control Intervention:

The control group participants are said to follow their daily routine activities. No special exercise or yogic practices were taught to them. They followed their regular day to day activities for the continuous 8 weeks and the assessments were done with them.

Data Extraction

The data were collected using the outcome variable. The assessments were done on the first day (baseline data) and on the last day of the intervention (post data). The data were organized in Microsoft Excel Sheets (Version 2010).

Data Analysis

Data expressed Mean ±SD. Comparison of Mean in between the pre and post intervention was analyzed by paired t test. R statistical software version 3.1.1 was used for the analysis. $P<0.05$ set as significant.

Results

The pre and post interventional assessments results of both the groups are evaluated under different headings, like

- Comparison of hand grip strength before and after yoga
- Comparison of Handgrip strength before and after yoga among the male participants
- Comparison of Handgrip strength before and after yoga among the Female participants
- Comparison of Handgrip strength between Yoga and Control group

Table 1: Comparison of handgrip strength before and after yoga

Right Hand		P value	Left Hand		P value
Pre	**Post**		**Pre**	**Post**	
30.42±8.65	35.82±7.20	0.02	28.50±5.60	31.50±4.82	0.04

The above table explains the results of pre and post intervention assessment of the hand grip strength. The results are obtained from the 30 experimental group subjects. The results encoded above are from both the right hand and left hand assessment.

The significance in the experimental group with the right hand is $p=0.02$ and with the left hand is $p=0.04$ which is considerably significant ($p<0.05$). This shows that the hand grip strength is improved considerably over the 8 weeks of the intervention (selective SV practices).

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Table 2: Comparison of Handgrip strength before and after yoga among the male participants

Right Hand		P value	Left Hand		P value
Pre	Post		Pre	Post	
34.58±4.64	38.50±7.54	0.01	29.60±5.50	32.45±8.48	0.03

The above table explains the results of pre and post intervention assessment of the hand grip strength of male subjects. The results encoded above are from both the right hand and left-hand assessment.

The significance in the experimental group, male subjects with the right hand is p=0.01 and with the left hand is p=0.03 which is considerably significant (p<0.05). This shows that the hand grip strength is improved considerably after the 8 weeks of the intervention (selective SV practices) among the male subjects.

Table 3: Comparison of Handgrip strength before and after yoga among the Female participants

Right Hand		P value	Left Hand		P value
Pre	Post		Pre	Post	
19.47±4.56	21.25±9.54	0.05	17.68±4.86	19.56±7.67	0.05

The above table explains the results of pre and post intervention assessment of the hand grip strength of female subjects. The results encoded above are from both the right hand and left hand assessment.

The significance in the experimental group, female subjects with the right hand is p=0.05 and with the left hand is p=0.05 which is considerably significant (p<0.05). This shows that the hand grip strength is improved considerably over the 8 weeks of the intervention (selective SV practices) among the female subjects.

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Table 4: Comparison of Handgrip strength between Yoga and Control group

	Yoga		P value	Control		P value
	Before	After		Before	After	
Right Hand	30.42±8.65	35.82±7.20	0.02	30.25±4.58	31.24±8.97	0.24
Left Hand	27.50±5.60	31.50±4.82	0.05	27.54±4.87	28.12±5.20	0.85

The above table explains the results of pre and post assessment of the hand grip strength among the experimental group and the control group. The results are obtained from the 30 experimental group subjects and 30 control group subjects. The results encoded above are from both the right hand and left-hand assessment.
The significance in the experimental group with the right hand is p=0.02 and with the left hand is p=0.05 which is considerably significant ($p<0.05$).

Similar data were obtained from the control group also and the significance in the experimental group with the right hand is p=0.24 and with the left hand is p=0.85. This was also significant but less as compared to the experimental group. This signifies that shows that the hand grip strength is improved considerably in the experimental group when compared to the control group.

Discussion

A high grip strength is associated with preserved mobility, decreased disability and higher activities of daily living[17]. In this study the physical well-being was estimated by the hand grip strength only[18]. The hand grip strength is significantly positively related to health – related quality of life[19]. The Hertford Shire cohort study proved a significant association between higher grip strength and proved health related quality of life[20]. The meta-analysis of Rjik et al, showed a high predictive validity of hand grip strength for the decline in cognition, mobility, functional status and mortality[21].

According to Taekerna et al, poor hand grip strength predicts accelerated dependency and cognitive decline. Consequently, hand grip strength is increasingly seen as an appropriate indication of physical well-being and social, psychic and somatic health[22]. There is no doubt that hand grip strength is first of all a strong indicator of muscle strength and muscle mass[23].

Reduced muscle strength and muscle mass are indicators of the condition of sarcopenia. In combination with reduced bone mass i.e., osteoporosis sarcopenia has dramatic consequences such as impaired functional performance, increased risk of falls and consequently an increased risk of fragility fracture[24].

In general, the maintenance of muscle strength, physical fitness and physical well-being is an important factor to preserve independence and consequently a high quality of life[25-27].

The yogic SV practices involve sustained isometric contraction and relaxation of the shoulders, chest and arm muscles. Consequent improvement in the strength and endurance of these muscles can explain the significant increase in hand grip strength[28].

According to the study conducted by Dr. A. S. Barman et al, the metabolic count of yogic asana represents 2 to 4 K Cal/ min. The energy expenditure of asana was 1003 K Cal/week (450 minutes/week)[29].

Scientists have shown that yoga training improves the cardiac-respiratory index, cardiovascular endurance and anaerobic power and decreased blood pressure either at rest or during exercise. Yoga in long duration affects hypothalamus and bring about decrease in the systolic and diastolic blood pressure through its influence on vasomotor center which leads to reduction in sympathetic tone and peripheral resistance[30-32].

In this study, the 8 weeks practice of the selective SV showed significant improvement in the hand grip strength. The results showed good improvement in the hand grip strength in both right and left hand of both male and female subjects of the experimental group when comparing to the control group. This signifies that regular practice of yogic SV will increase the hand grip strength which in turn improves the quality of life. Hence this can be administered for the people who are using their upper limbs extensively in their daily life.

Limitations

The sample size is relatively smaller. A single outcome variable is taken up in the study. More objective measures could validate the study. All the participants of this study were the college students, which limit the generalization of the result of a diverse group of people. This study should be replicated with a larger sample size conducted in a generalized population with a prolonged duration.

Conclusion

The practice of the selective SV in this study showed compromising results in improving the hand grip strength. The results are obtained from both sexes and hence any person can practice these SV to improve their hand grip strength and endurance of the body.

Hence, by incorporating these selective SV practices as a regular regime, one can improve the endurance and strength of the upper limbs effectively and therefore by regular practice of this, the persons who have weak stamina, endurance and strength in the body can improve better and thereby the production of work and quality of life can also be improvised further.

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