Comparison of Handgrip Muscle Strength in Physically Exerciser and Sedentary Group: A cross sectional study

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Abstract

Introduction: Handgrip muscle strength is the maximum force developed during maximal voluntary contraction under given set of conditions. Nerve and muscle functions are closely related to human motor performance. Handgrip strength means muscular strength and force that the person can generate with their hands which can be quantified by measuring the amount of static force that a person’s hand can squeeze around a dynamometer.

Aims and Objectives: To measure and compare handgrip strength in sedentary group and those of physically exercised group

Materials and Methods: Present was conducted in 150 healthy medical students of DVVPF’s medical college. (75 sedentary group, 75 physically exerciser group) Using questionnaire items on physical exercise we divided them into two groups depending on metabolic equivalent task (MET).

Sedentary Group/Non-Exercised Group- not doing any kind of physical exercise in the last 1 year or amount metabolic equivalent (METS) is less than 600 MET-min/week.

Physically Exerciser Group – doing physical exercise for the period of 1 year in the form of aerobic exercise, bicycle riding, swimming Gym, etc. for 40-45 minutes, 5 day/week or MET is more than 600 MET-min/week.

Maximal handgrip strength of dominant hand was measured by handgrip dynamometer twice at an interval of 1 minute, and higher reading recorded was considered to be the maximum hand grip strength for each student data was analyzed by unpaired t test using SPSS. we found handgrip strength in physically exerciser student’s group (46.50+5.0) was statistically significant (p<0.001) as compared to sedentary /non exerciser student’s group (40.30+4.50).

Keywords: Dynamometer, Handgrip muscle strength, METS (metabolic equivalent task), Physically exerciser group, Sedentary group

Introduction

Handgrip muscle strength is the maximum force developed during maximal voluntary contraction under given set of conditions. Nerve and muscle functions are closely related to human motor performance. Handgrip strength means muscular strength and force that the person can generate with their hands which can be quantified by measuring the amount of static force that a person’s hand can squeeze around a dynamometer.
force that a person’s hand can squeeze around a dynamometer.\textsuperscript{2} It can therefore be considered as component of hand function. Handgrip strength is a general term used by athletes, referring to muscular strength and force that they can generate with hands. Handgrip strength is most commonly evaluated in clinical settings as an indicator of disease activity.\textsuperscript{3} Assessment of muscle strength tests has been a popular form of testing muscle function in sports and exercise. It is often used as an indicator of the overall physical strength.

Handgrip strength testing has been widely working in a number of human movement related disciplines likes in sportsmen, athletics, medical related studies etc. Evaluation of hand grip strength may be used in the investigations and follow up of patients with neuromuscular disorder.\textsuperscript{4} It is also used as a functional index of nutritional status.\textsuperscript{5} it is widely accepted that grip strength provides an objective index of the functional integrity of the upper extremity.\textsuperscript{6} Factors that can affect the handgrip strength include age, gender, left or right hand predominance, fatigue, physical exercise etc.\textsuperscript{7, 8} Physical activity in the form of exercise is claimed to have beneficial effects on various body functions including performance of neuromuscular system. Hence present study was conducted, which was aimed to find out association of physical exercise and handgrip strength in medical students.

**Aims and Objectives-**
To measure and compare handgrip strength in sedentary group and those of physically exercised group

**Materials and Methods**
The study was conducted in 150 medical students of DVVPF’s medical college.

**Inclusive criteria:** 150 healthy male medical students in age group of 18-24 yrs.

**Exclusive criteria:** Those having any major illness in the present or past, any history of previous wrist injuries or nerve damage, history of any medications affecting motor function, history of musculoskeletal disorder were excluded from the study. The study was approved by the Institutional Ethical committee. Using questionnaire items on physical exercise we first identified participants and divided them into two groups depending on metabolic equivalent task. Metabolic equivalent of TASK (MET)- is the objective measure of ratio of the rate at which a person expends energy, relative to mass of that person while performing some specific physical activity.\textsuperscript{1} MET is the energy you spend sitting at rest-i.e., Basal metabolic rate. Following charts provides approximate MET values for a variety of light, moderate and vigorous activities\textsuperscript{9}.

<table>
<thead>
<tr>
<th>Light &lt; 3.0 METs</th>
<th>Moderate 3.0-6.0 METs</th>
<th>Vigorous &gt; 6.0 METs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sitting at desk:1.3</td>
<td>Housework (cleaning, swiping) 3.5</td>
<td>Walking at very brisk pace (4.5 mph) 6.3</td>
</tr>
<tr>
<td>Sitting, playing card:1.5</td>
<td>Weight training (lighter weights) 3.5</td>
<td>Pushup’s sit-ups Bicycling 12-14 mph-8</td>
</tr>
<tr>
<td>Standing at desk 1.8</td>
<td>Brisk walking (3.5-4mph)5</td>
<td>Running (7mph) -11.5</td>
</tr>
</tbody>
</table>
A total 150 medical (75 sedentary group and 75 physically exercised group) students were selected.

Sedentary Group/Non-Exercised Group: Those subjects not doing any kind of physical exercise in the last 1 year or amount metabolic equivalent (METS) is less than 600 METmin/week.  

Physically Exerciser Group: Those subjects doing physical exercise for the period of 1 year in the form of aerobic exercise, bicycle riding, swimming Gym, etc. for 40-45 minutes, 5 day/week or MET is more than 600 MET-min/week.

The study was conducted in the research lab, Department of Physiology, Vikhe Patil Medical College, between 3.00pm and 5.00 pm. Prior to measurement, the purposes and procedures of this study were explained to all the participants. Informed written consent was taken from all the subjects. Maximal handgrip strength was measured with handgrip dynamometer (INCO AMBALA INDIA). The most common and easiest method of assessment for grip strength is the use of handheld dynamometer. The subjects exerted grip strength using the handgrip device while sitting in chair with their elbow straight and close to the body. The maximal grip strength of the dominant hands was measured twice within a one-minute time interval and greater value was used in this study.

The detailed data was entered into Microsoft excel sheet and subsequently analyzed by using SPSS (statistical package for social science) software. Values were reported as Mean + SD. Muscle strength in two groups was analyzed by unpaired “t” test.

**Results**

**Table I: Mean values of physical characteristics in sedentary group and physically exerciser group**

<table>
<thead>
<tr>
<th>Sr. no</th>
<th>Parameters</th>
<th>Sedentary group (Non exerciser group)</th>
<th>Physically exerciser group</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Age (years)</td>
<td>20.96+2.50</td>
<td>20.40+2.12</td>
</tr>
<tr>
<td>2</td>
<td>Height (cm)</td>
<td>170+5.98</td>
<td>164+5.10</td>
</tr>
</tbody>
</table>
*p<0.05 statistically significant **p<0.001 statistically significant
There was no significant difference in mean values of age, height and weight between sedentary group and physically exerciser group

Table II: Maximal handgrip strength in medical students (sedentary group and physically exerciser group)

<table>
<thead>
<tr>
<th></th>
<th>Muscle strength in Kg (Mean±SD)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sedentary students’ group (n-75)</td>
<td>40.30±4.50</td>
<td>&lt;0.001(significant)**</td>
</tr>
<tr>
<td>Physically exerciser students’ group (n-75)</td>
<td>46.50±5.0</td>
<td>&lt;0.001(significant)**</td>
</tr>
</tbody>
</table>

* p<0.05 statistically significant ** p<0.001 statistically significant

Graph 1: comparison of muscle strength in sedentary group and physically exerciser group

Discussion
Handgrip strength is one of the most commonly used tests for assessing muscular fitness in adults and it is also used as an important indicator of sports efficiency. The present study was aimed to compare maximal handgrip strength in sedentary group and physically exerciser group of medical college students.

We compared maximal handgrip strength in 75 sedentary group and 75 physically exerciser group. The present study gives a baseline data about handgrip strength in sample population of MBBS students. It also provides handgrip reference values in young healthy adults of 18-24 years of age group.

In the present study, we found handgrip strength in physically exerciser student’s group was more as compared to sedentary/non exerciser student’s group. Table 2 and Graph 1 shows handgrip muscle strength was statistically significant (p<0.001) in physically exerciser group.
student’s group (46.50+- 5.0) as compared to sedentary/non exerciser student’s group (40.30+-
4.50).

Study conducted by shymal Koley and M kumar Yadav found that more handgrip strength in
cricket players as compared to sedentary control group. Increased muscle strength in cricketers
may be due to regular physical activities and programmed training.11
Kraemer et al showed that isometric strength was greater in tennis players (dominant hand)
than non-tennis players.12 Any kind of exercise has positive effects on mind which in turn
decreases anxiety and helpful in improving mental as well as physical health.13
In literature review by Konopa and Harber, aerobic exercise was reported to increase muscle
fibers and overall muscle size via mechanisms involving modulation of the skeletal muscle and
protein metabolism.14 Crane et al showed that long term aerobic exercise improves
cardiopulmonary and metabolic functions and alleviated age-related loss of muscle strength.15
Handgrip strength reflects overall physical strength of an sportsmen and forearm muscle
performances
Probable mechanisms of increased muscle strength in physically exerciser group were13 14 15
• Improve cardiopulmonary and metabolic functions
• Improving mental as well as physical health
• Increase muscle fiber and overall muscle size via mechanisms involving modulation of the
skeletal muscle and protein metabolism • Increased mitochondrial activity and count
Probable mechanisms of decreased muscle strength in sedentary group were16 17
• Increased lipid inside the muscle fibers leading to impaired skeletal muscle function
• Increased levels of inflammatory factors (cytokines and tumor necrosis factor) and this leads
to reduced muscle strength
Thus, to conclude, value of our research is that we demonstrated very strong association
between exercise and hand grip strength.

Conclusion:
It is concluded that this study gives a baseline of normative data in sample population of MBBS
students at DVVPF’s medical college Maharashtra. In the present study hand grip strength in
physically exerciser group might have increased due to exercise thereby increasing has muscle
mass and protein metabolism. Handgrip strength is useful measure of reflective of the overall
physical health. Our results provide evidence that emphasizes the necessity for physical
exercise for better physical health

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References-
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