The Effects of Aging on Hand Grip Strength in The Adult Iranian Population

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Abstract: A decline in strength is inherent process of aging which has been reported extensively as a result of muscle atrophy. The aim of this study was to determine the effect of aging on grip hand strength of healthy Iranian males. A sample of 1537 healthy Iranian males aged 20-60 years participated in this study. The subjects were divided into 4 age groups, each representing a decade. General health and lifestyle data were collected from each subject using a standard questionnaire. Weight and height were measured prior to testing. Positioning and instructions based on several hand grip protocols were used and data were collected. 95% of the subjects were right-hand dominant and 5% were left-hand dominant. Hand grip strength was significantly correlated with hand dominance, occupation, height and weight, but not body mass index. In both right-and left hand dominant groups, the dominant was consistently stronger than the non-dominant side. The strongest hand grip strength in the right-hand dominant group occurred in the age-group of 20 to 30 years. In the left-hand dominant group it was in the age-group of 20 to 30 years. By increasing age from 20 to 60 year grip hand strength gradually decline. One-way ANOVA test showed that grip hand strength differed (P<0.01) among decades but unchanged in the 20 - and 30 - year - old age groups. Loss of muscle strength seems to begin in the fourth decade of life. The changes in muscle strength have a significant relationship with aging.

Key words: Aging, Grip hand strength.

INTRODUCTION

Sufficient grip strength is necessary to successfully complete daily and industrial activities such as removing lid and using hand tools. Hand strength data is needed for the analysis and design of equipment that is held or manipulated by the hands. Advantage adult age is associated with profound change in body composition. One of the most prominent of this change is sarcopenia. Sarcopenia is a life - long process that likely begins in young adulthood this loss of skeletal muscle mass is also associated with increasing body fatness. A reliable hand grip assessment is important when assessing the results of various surgical treatments. A baseline grip strength value for the normal population is needed. There has been no study of the normal grip strength in the adult Iranian population. Most normative data are based on the western literature and may not apply. This information can provide clinicians with accurate guidelines for the normal changes in muscle strength throughout aging. This study aims to establish a preliminary baseline for the effects of aging on hand grip strength of healthy adult Iranian males.

Subjects and Methods:

A samples of 1587 Iranian males aged 20-60 years volunteered to participate in this study. All were Tehran residents, originally from different parts of the Tehran. Subjects were healthy and claimed no known musculoskeletal, neuromuscular or cardiovascular pathology affecting their functional ability and were excluded if they had a history of upper-limb injury or deformity. They were aware of the purpose of the tests and were not paid for their participation. All were able to follow instructions. The age, height and weight of subjects were recorded (Table 1).

Table 1: Characteristics of subjects grouped by decade (mean ± SD); n= number of subjects.

<table>
<thead>
<tr>
<th>Decade</th>
<th>Age(yr)</th>
<th>Height(cm)</th>
<th>Weight(kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-30 (n=417)</td>
<td>25 ± 7</td>
<td>171 ± 8</td>
<td>73 ± 8</td>
</tr>
<tr>
<td>30-40 (n=369)</td>
<td>36 ± 5</td>
<td>171 ± 11</td>
<td>75 ± 6</td>
</tr>
<tr>
<td>40-50 (n=408)</td>
<td>44 ± 7</td>
<td>172 ± 9</td>
<td>79 ± 9</td>
</tr>
<tr>
<td>50-60 (n=381)</td>
<td>53 ± 6</td>
<td>175 ± 8</td>
<td>81 ± 7</td>
</tr>
</tbody>
</table>
Grip Hand Strength Testing:
The subject was seated upright with shoulder in adduction: The elbow was flexed at 90 degree. The wrist was in a neutral position facing inwards. The devise handle was opened to fit onto the palm with the fingers in 90 degree flexion at the proximal and distal interphalangeal joints with the thumb in 90 degree abduction. Grip strength, or torque, was measured in KG. Subjects were instructed to grasp the handle for 5 seconds and rest for 5 seconds and perform the action a total of 6 time. The contra lateral hand was then examined using the same protocol. The mean value of the 3 most powerful grips was recorded and used for comparison.

Data Analyses:
One- way ANOVA was used to determine the difference among the age groups. If a statistical difference existed, Bonferroni post-hoc test was used to determine which group was different from the other groups, with alpha level set at 0.05. Multiple regression analysis was also used to determine the nature and degree of the relationship between grip hand strength and age. The SPSS software statistical program was used to analyze the data.

Results:
A summary of the grip hand strength measurements for each age group is presented in Table 2. A stable pattern of grip hand strength continued throughout. A gradual decline in the grip hand strength continued to the four decade. One-way analysis of variance test showed a significant difference was not found between the grip hand strength, in the second and third decade. (P<0.001)

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Mean Torque (grip strength)</th>
<th>Right-hand Dominant Group</th>
<th>Left-hand Dominant Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right-hand</td>
<td>Left hand</td>
<td>Right-hand</td>
<td>Left hand</td>
</tr>
<tr>
<td>20-30(n=417)</td>
<td>48/2 ± 7</td>
<td>42/9 ± 6</td>
<td>39/5 ± 3/5</td>
</tr>
<tr>
<td>30-40(n=369)</td>
<td>45/4 ± 5</td>
<td>41/8 ± 4</td>
<td>38/6 ± 4/8</td>
</tr>
<tr>
<td>40-50(n=466)</td>
<td>36/5 ± 7</td>
<td>31/4 ± 5</td>
<td>30/5 ± 6/6</td>
</tr>
<tr>
<td>50-60(n=381)</td>
<td>26/8 ± 6</td>
<td>22/5 ± 6</td>
<td>24/6 ± 4/5</td>
</tr>
</tbody>
</table>

Discussion and Conclusion:
Grip strength has been previously reported to correlate with age and hand dominance. In this study, grip strength correlated with height and weight (r²=0.11 to 0.29). Height and weight proved to be better predictors for grip strength than age. It is therefore important to account for such other factors not age alone, to predict grip strength.

In this study, the grip hand strength not remained stable throughout the second and third decade of life. A gradual significant loss started at the third decade in these groups of subjects. It is not clear if the reduction in muscle strength during the third decade was due to age-related changes or from a sedentary lifestyle, or a combination of both. However, the significant correlation between age and grip hand strength among the subjects in their third decade. Researchers may be encouraged by this study to review the relationship between the muscle morphology and biochemistry, sensory input and the impact of lifestyle on muscle strength and physical performance of people. Whatever the causes of declining muscle strength and remarkable number of change in body composition third decade is considered a turning point for muscle strength and physical performance.

The gradual declines in grip hand strength as a result of aging have also been reported in various communities (Bohannon, R., 1997; Cochrane, T. et al., 1998; Iverson, B.D. et al., 1990; Ploeg, R. et al., 1991). This decline is related to various normal aging processes, (Iverson, B.D. et al., 1990; Jackson, A.S. et al., 2002; Rantanen, T. et al., 1996) lifestyle and vocation, behavioral, cultural and physical activities (Andrews, A.W. et al., 1996; ohannon, R., 1997). However, the degree and pattern of decline differ from one community to another. These studies cannot be compared with our study because of differences in equipment and procedures used in measuring. Also, specific comparisons are difficult because of the inconsistent grouping of the subjects in various studies.


In this study the loss of strength began during the third decade of life. In another study, isometric grip hand strength began to decline in the fourth or fifth decade (Larsson, L. et al., 1979). The awareness of losing muscle strength and endurance was also reported to occur at about age 40(25). These variations may be due to different anthropometric characteristics and habitual level of functional activity of the participants in the various studies (Larsson, L. et al., 1979; Marks, R., 1992; Tinetti, M. et al., 1988). Differences in equipments and procedures
used to measure muscle strength may also contribute to the variations (Larsson, L. et al., 1979; Tseng, B. et al., 1995).

This study confines the extreme importance of muscle strength for activities of daily living (Hurley, M. et al., 1998; Ivrson, B.D. et al., 1990; Ploeg, R. et al., 1991). A regular endurance and muscle strengthening program may be helpful in maintaining functional activity (Wilmore, J., 1991).

Muscle strength has an integral role in the structure and function of joints and bone mass. The degree to which muscle strength loss in the third decade of life will affect the structure and function of joints and bone mass in the elderly is a question that needs to be answered (Tseng, B. et al., 1995; Vandervoort, A.A., 1992). Health care expenditures increase when subjects begin to lose their functional ability (Wilmore, J., 1991). This could imply that people aged 30 and older in Iranian may spend more money on health care than the younger population. Consequently, to lower health care expenditure for people aged 40 and over, it is necessary to find a proper solution to reduce the reported loss in functional ability. Regular physical exercise, such as balancing, strength training, low-impact aerobic exercises, body flexibility exercise and functional exercise and health promotion in the workplace, have been documented to improve functional ability and self-reported health status in various communities. These exercises and health promotion in the workplace could also be used in Iranian to reduce declining functional ability.

The increasing in body fat percentage and reduction in strength and VO2max between the third and the sixth decades of life could indicate an increased risk factor. Falls are the most important reason for elderly people being admitted to the hospital and apprehension about falling is a source of distress in 25% to 50% of community-dwelling elderly people (Snow-Harter, C. et al., 1990). Strength and endurance weakness has been associated with an increased incidence of falls in elderly subjects. An intervention program of muscle strength and balance exercise has been suggested to prevent falls (Miyashita, M. et al., 1971).

In summary, endurance and strength is able to determine the level of physical activities that can be performed during the aging process. Subjects in their third decade of life and above are at increased risk for a variety of physical and functional limitations.

REFERENCES


