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Effects of aging on muscle velocity, balance, and agility in healthy Iranian females

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ABSTRACT

Loss of muscle strength as a result of normal aging is reported to impair functional ability in various communities. The purpose of this study was to examine the age at which loss of muscle velocity, balance, and agility in adult healthy Iranian females. A sample of 928 healthy Iranian females aged 20-60 years participated in this study. The subjects were divided into four age groups, each representing a decade. Tests we studied included velocity, balance, and agility that performed and timed by a digital stopwatch. The finding indicated that muscle velocity, balance, and agility remained unchanged in the 20 - and 30 – year - old age groups. But in the age of 40, began to gradually decline. By increasing age muscle velocity, balance, and agility began gradually increase One- way ANOVA test showed that muscle velocity, balance, and agility differed (P<0.01) among decades, except between the second and third decades (P<0.28). Age, muscle velocity, balance, agility and power displayed a significant relationship (P<0.001). Loss of muscle velocity, balance, and agility strength seem to begin in the fourth decade of life. The changes in muscle velocity, balance, and agility have a significant relationship with aging.

Keywords: Muscle velocity, balance, agility, and aging.

INTRODUCTION

In human, muscle mass and those force-generation capacities typically decline with age (7, 22).This process known as sarcopenia results in a cascade of events: the reduction in muscle strength impairs physical function in older adults and increases their susceptibility to falls, wiich can result in injury and loss of independence (37).In addition to the decline of muscle mass and strength with age, the speed of contraction slows(26, 28),likely due to selective atrophy of type II fibers(3,21).During dynamic contraction in older adults, loss of functional capacity resulting from decreased muscular strength may be compounded by this contractile sloweing.For example, rapid torque production is required to maintain balance after a postural disturbance(32).The relationship between joint torque and angular velocity is often used to quantify dynamic strength, similar to the force-velocity relationship in isolated muscle(10.36).The ability to perform a dynamic task often depends on boss torque production and the speed of contraction , the product of is power.Therfore , performance during dynamic muscle contractions can be examined by measuring torque and power production across a range of velocities.Balance,or the ability to control postural sway, worsens with age, and this age- related decline has been associated with increased fall risk(10).The relationship between aging and decreasing control of balance has become a topic of much discourse as investigator attempted to identify means of reducing the risk of falls and fall-related injures in older adults. Decreased muscular strength has repeatedly been associated risk of falling (3, 21, and 32).

MATERIALS AND METHODS

A subjects of 928 Iranian females aged 20-60 years volunteered to participate in this study .Before enrollment in the study, each subject completed a screening questionnaire, which inquired about health ststus,medication,past medical history, and habitual physical activity level. All subjects were healthy, and ranged from sedentary to recreationally active. Subject with any history of coronary artery disease, hypertension, or peripheral vascular disease were excluded. They were aware of the purpose of the tests. The characteristics of subjects grouped by decade are shown in table 1.

Table 1

Decade	Age(yr)	Weight(kg)	Height(cm)
20-30 (n=229)	26 ± 7	62.7 ± 10.0	161 ± 5
30-40 (n=317)	34 ± 2	68.6 ± 10.7	162 ± 2
40-50 (n=222)	45 ± 3	69.4 ± 11.0	159 ± 8
50-60 (n=160)	56 ± 6	72.01 ± 9.6	158 ± 3

Functional Ability Testing

Functional ability tests, which included velocity test, timed up- and- go(agility), and balance, were performed and timed in second (sec), using a digital stopwatch. These are quick and practical tests of basic mobility that form part of a functional ability in different age groups.

Velocity Test

Each subject stood in post of a small line consisting of 20 meter and they were instructed on the command “Go” to walk up and down staircase at a comfortable pace. They were not allowed to stop or use the handrail as support. The task was timed.

Timed Up-and-Go Test (Agility)

The subjects were seated in a chair arm rests and instructed on the command “Go” to rise from the chair without using the arms for support, run seven meters along a level corridor, turn, return to the chair, and sit down at their own comfortable speed. The task was timed.

Balance Test

The subjects were asked to stand on their preferred leg with open eyes. The task was timed from the moment the leg was lifted off the floor until balance was lost or the foot was placed on the floor again.

Data Analyses

One- way ANOVA was used to determine the difference among the age groups. 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 muscle velocity, balance, and agility and age. The SPSS software statistical program was used to analyze the data.

RESULTS

A summary of the velocity, balance, and agility measurements for each age group is presented in Table 2. The velocity in the second decade was 6.03 ± .03s and 6.30 ± .06s in third decade, respectively. A gradual decline in the velocity continued to the force decade. One-way analysis of variance test showed no significant difference between the agility in the second and third decade ($P<0.18$). In contrast, a significant difference was found in muscle strength among the age groups ($P<0.001$).

Table 2. Mean ± SD of muscle strength and functional ability tests of different age groups

Decade	agility	velocity	balance)
20-30 (n=229)	10.03 ± .06	6.03 ± .03	139 ± 91
30-40 (n=317)	11.04 ± .03	6.30 ± .06	136 ± 65
40-50 (n=222)	13.23 ± .04	7.91 ± .05	109 ± 37
50-60 (n=160)	15.76 ± .06	8.76 ± .09	65 ± 47

DISCUSSION AND CONCLUSION

In this study, muscle velocity, balance, and agility remained fairly stable throughout the second and third decade of life. A gradual significant loss started at the fourth decade in these groups of subjects. It is not clear to somehow the reduction in muscle strength and functional ability during the fourth decade was due to age-related changes or from a sedentary lifestyle, or a combination of both. However, the significant correlation was found between age and, muscle velocity, balance, and agility among the subjects in their fourth 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 in their forties. Whatever the causes of declining muscle strength and functional ability, the fourth decade is considered a turning point for muscle strength and physical performance.

The gradual declines in muscle strength and functional ability as a result of aging have also been reported in various communities (2, 5, 9, 18). This decline is related to normal aging processes, (9, 11, 19) lifestyle, and vocational, behavioral, cultural and physical activities (1, 2). 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 muscle strength and/ or functional ability. Also, specific comparisons are difficult because of the inconsistent grouping of the subjects in various studies.(11)

The results of this study, demonstrate a relationship between age, lower extremity muscle strength and functional ability. It has also been observed that increase in gait speed is associated with a higher level of muscle activity (4, 8,11, 18). Thus, muscle strength generation is essential to ambulation.

The speed of the tested functional activity is important because of its implications for community ambulation (21, 22) and because of its relationship with independent living (23), risk for falls (24), and muscle strength (12, 13).

In this study the loss of strength in the isometric quadriceps began during the fourth decade of life. In another study, isometric quadriceps \strength began to decline in the fifth decade (12). The awareness of losing muscle strength and endurance was also reported to occur at about age 50(25). These variations may be due to different anthropometric characteristics and habitual level of functional activity of the participants in the various studies (12, 13, 25). Differences in equipments and procedures used to measure muscle strength may also contribute to the variations. Body weight and height have been shown to correlate with quadriceps strength (12, 26). Habitual level of physical activity and the degree of physical effort have been reported to affect muscle strength (1, 2).

This study confines the extreme importance strength for activities of daily living (8, 9, 18). A regular quadriceps muscle strengthening program may be helpful in maintaining functional activity involving the lower extremity (16). 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 fourth 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(26).

Health care expenditures increase when subjects begin to lose their functional ability (14). This could imply that people aged 40 and older 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 (26). These exercises and health promotion in the workplace could also be used in Iranian to reduce declining functional ability. The reduction in muscle velocity, balance, and agility between the fourth and the sex decades of life could indicate an increased risk of falling. 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 (24). Quadriceps 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 (14).

In summary,muscle strength is able to determine the level of physical activities that can be performed during the aging process. Subjects in their fourth decade of life and above are at increased risk for a variety of physical and functional limitations. The figures produced in this study can provide therapists with a guide to normal isometric quadriceps strength level and functional ability of a healthy and active population.

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