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# Role of handgrip strength in predicting the quality of life in older adults: A cross-sectional study

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## Abstract:

**BACKGROUND:** Quality of life (QOL) is a vital component in assessing the standard of living for seniors. Hand grip strength (HGS) is a widely used measure to diagnose muscle strength decline that often occurs due to age-related loss of skeletal muscle mass and function. This study focuses on the HGS in predicting the QOL of older adults who are referred to retirement centers in Guilan Province.

**MATERIALS AND METHODS:** In 2021, a cross-sectional analytical study was conducted among 115 older adults who were residing in retirement centers located in Guilan Province, Northern Iran. The participants were selected using a two-stage sampling method, where three retirement centers were randomly chosen followed by convenience sampling from each center. The selected retirement centers were situated in Langrod, Sowme'eh Sara, and Rasht cities in the east, west, and center of the province, respectively. The data were collected through a demographic information questionnaire, QOL scale (CASP-19), and HGS measurement using a dynamometer.

**RESULTS:** Of the participants, 57.4% were male, 51.3% had middle income, and 96.5% were categorized as young elderly. The mean overall QOL score was found to be  $37.026 \pm 6.123$ , while the mean HGS level was  $31.74 \pm 7.45$  and  $18.48 \pm 5.13$  among males and females, respectively. There was a significant association between the level of education and QOL ( $P = 0.002$ ). Moreover, there was a positive and significant correlation between HGS and QOL ( $r = 0.54$ ,  $P = 0.001$ ). The results of the multiple linear regression identified HGS as a predictor of QOL (Adj  $R^2 = 0.44$ ,  $\beta_{HGS} = 0.79$ ).

**CONCLUSION:** Given that HGS has been identified as a predictor of QOL in older adults, improving this factor through exercise can lead to enhancement in their QOL. Therefore, regular sports exercises can be recommended as a means of improving HGS and subsequently enhancing the QOL of older adults.

## Keywords:

Aged, hand grip strength, quality of life

## Introduction

Old age is one of the evolutionary periods in the evolution of humans. This process naturally occurs after adulthood.<sup>[1]</sup> An improvement in living conditions, longevity, and life expectancy has led to the aging phenomenon in societies<sup>[2]</sup> so around 1.5 billion individuals are expected to be over 65 years old in the world by 2050.<sup>[3]</sup> Given the growth rate

reduction in Iran, as well as the rising trend of aging, the population pyramid of the country leans toward an increase in the older adult population. Based on the 2016 census, the number of Iranians over 60 years old was 7.3 million, which is predicted to reach 10 million in 2021 by considering this upward trend.<sup>[4]</sup> In general, a rise in the older adult population in each country represents better health indicators, social and economic development, and the success of health policies although it is introduced as one

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of the most fundamental challenges of the twenty-first century.<sup>[1]</sup> Because individuals are living longer lives, it is critical to consider the quality of life (QOL), even in the presence of chronic illnesses and diseases in the elderly. As a result, tackling the issue of aging and the QOL of the elderly is one of the most critical challenges for governments and legislators.<sup>[5]</sup> As life expectancy rises, it is becoming increasingly necessary to improve QOL and sustain the well-being of older persons for as long as possible.<sup>[6]</sup> Aging is accompanied by specific challenges affecting the QOL of older adults.<sup>[7]</sup> The QOL of individuals naturally reduces with age. Older adults experience levels of decline in health during the natural aging process, as well as developing a variety of chronic degenerative diseases.<sup>[8]</sup> According to the World Health Organization (WHO), the QOL is defined as the individuals' perception of their position in life in the context of culture, the value system where they live, and objectives, expectations, standards, and priorities, which are completely individual and cannot be observed by others. This concept includes the physical health, psychological status, autonomy level, social relations, and beliefs of an individual.<sup>[2]</sup> In addition, multidimensionality (physical, mental, spiritual, and social), subjectivity (personal evaluation of health and well-being), and dynamism (change over time) are the three specific properties of QOL.<sup>[1]</sup> Furthermore, QOL is a fundamental indicator and a complex notion that includes biological, functional, and existential components. QOL has emerged as a key topic in medical, social, and psychological studies.<sup>[9]</sup> In the current century, QOL is known as one of the basic aspects of health care, as well as among the most essential goals to promote older adult health.<sup>[10]</sup> Because of the increased risks of chronic diseases, physical limitations, cognitive impairments, and mental disorders with advanced age, older adults have poor QOL.<sup>[11]</sup>

As a result, a greater understanding of the factors related to QOL in older adults, particularly modifiable factors, is crucial for finding potential interventions for enhancing QOL. Grip strength is a controllable trait connected with QOL in older persons, according to research.<sup>[6]</sup>

Hand grip strength (HGS) diminishes with age due to the age-related loss of skeletal muscle mass and function. It is a widely used criterion for diagnosing muscle strength loss in older adults.<sup>[12]</sup> Grip strength is a simple, noninvasive test of upper limb strength that is tested with a hand dynamometer. In recent studies, it has been identified as a key indication of physical frailty, sarcopenia, and malnutrition.<sup>[6]</sup> The progressive age-related loss of skeletal muscle mass, strength, and physical function is defined as sarcopenia.<sup>[13]</sup> Sarcopenia syndrome leads to a decrease in overall strength and muscle, which is associated with physical

disability, motor limitations, poor QOL, and mortality.<sup>[14]</sup> Furthermore, HGS is considered a growing variable, which begins in childhood, progresses, and reaches its maximum in adulthood. Both sexes experience less HGS with age, and the strength reduction in the upper limb impairs the execution of manual activities. The American Society of Hand Therapists (ASHT) proposed HGS as an appropriate predictor of general muscle strength.<sup>[15]</sup> Today, HGS is used as a predictor of mortality, disability, complications, and prolonged hospitalization.<sup>[16]</sup> It is important to note that muscle strength is not wholly dependent on muscle mass, and the two can separate. Muscle strength declines at a faster pace than muscle mass loss with age, even when muscle mass is maintained or increased. Chen *et al.*<sup>[17]</sup> found that muscle strength is more closely related to mortality than muscle mass. HGS is connected to mental and physical QOL in community-dwelling elderly people, according to Laudisio *et al.*<sup>[18]</sup> Yang *et al.*<sup>[19]</sup> showed that decreased grip strength was associated with lower overall health-related quality of life (HRQOL) in a study of Chinese rural older adults. Due to the importance of the QOL of older adults in the current era and the lack of research about the role of HGS prediction on their QOL in Iran, this study sought to determine the role of HGS on the QOL of retired ones in Guilan Province, Northern Iran. The findings of the study can be used by policymakers to inform the development of targeted interventions and policies that can help improve the health and well-being of retired individuals, ultimately contributing to a better QOL for this population.

## Materials and Methods

### Study design and setting

From June to August 2021, 115 retired older adults referred to Guilan Province's retirement centers in Northern Iran were involved in this cross-sectional analytical study.

### Study participants and sampling

The sampling was performed in two stages. First, three centers were randomly selected from the retirement centers of Guilan Province, and older adults who met the criteria for entering the study were selected from each center using convenience sampling (30 people from the east of the province, Langrod City; 30 from the west of Somesara City; and 55 from the center of the province, Rasht City).

The inclusion criteria were appropriate mental and cognitive capability, informed consent to participate in this study, being 60 years old and more, and not suffering from musculoskeletal disorders and cancers according to the medical record. However, those withdrawing from cooperation during the study were excluded.

The study sample size of 108 people was determined based on a pilot study conducted on 25 older adults and the following formula:  $r = 0.268$ , a significance level of 0.05, and test power of 0.8. Taking into account a potential attrition rate of 5%, the final sample size was calculated to be 115 individuals.

$$n = \left( \frac{z_{1-\frac{\alpha}{2}} + z_{1-\beta}}{0.5 \ln\left(\frac{1+r}{1-r}\right)} \right)^2 + 3 = \left( \frac{z_{1-\frac{0.05}{2}} + z_{0.8}}{\left(\frac{1}{2} \ln \frac{1+0.268}{1-0.268}\right)} \right)^2 + 3$$

### Data collection tools and technique

A demographic information questionnaire and QOL scale (CASP-19) for older adults were applied to collect the data. The first of which covers age, sex, educational level, marital status and smoking status, retirement duration, financial adequacy, and the place of residence and number of children. The second, designed by Hyde *et al.* (2003)<sup>[20]</sup> in the UK based on a need-satisfaction model, consists of the four domains of control (four items), autonomy (five items), self-realization (five items), and pleasure (five items). This four-point Likert scale ranges from often to never, in which the minimum and maximum scores of each item are zero and 3, respectively. It is worth noting that items 1, 2, 4, 6, 8, and 9 are scored unlike the others. The highest and least level of the scale is equal to 57 (complete satisfaction with all four dimensions) and 0 (complete lack of QOL), respectively. The tool was validated by Heravi-Karimooi *et al.* in Iran.<sup>[21]</sup> Regarding this study, the reliability of the scale was 0.76.

To specify HGS, the isometric strength of grip muscles in the dominant hand was determined using the Lafayette handheld dynamometer (model 47903). This dynamometer is a nonautomatic device for measuring the grip strength, equipped with a handle and a calibrated hand in kilogram. It can represent up to 100 kg with a measurement accuracy of 500 g. Pressing the knob results in moving calibrated hand and reflecting the HGS of individuals. Furthermore, the participants were positioned based on the standard positions suggested by ASHT. In this regard, they sat on a handleless chair with a suitable height, and their shoulder under study, on the side of which the dynamometer was placed, was in the adduction position with no distance from the body. Furthermore, the elbow was flexed at 90° to the arm. The wrist and ulnar were positioned between 0 and 30 extension and 0 and 15, respectively. The dynamometer handle was in the ready position, and the participants were recommended to apply maximum pressure. To prevent fatigue, three-min rest intervals were implemented between different test runs for each older adult.<sup>[22]</sup> Testing was repeated three times in the dominant hand, and the mean of obtained values was

recorded as HGS.<sup>[23]</sup> Then, the HGS of the individuals was classified into weak (<16 in females and <26 in males), medium (16–20 in females and 26–32 in males), and strong (>20 in females and >32 in males).<sup>[24]</sup>

### Data analysis

The descriptive (frequency distribution and mean  $\pm$  standard deviation) and inferential statistics (analysis of variance (ANOVA), independent-samples *t*-test, Pearson's and Spearman's correlation, and multiple linear regression tests), and Statistical Package for the Social Sciences (SPSS) version 20 software were applied to analyze the data. The variables were subjected to the Kolmogorov–Smirnov test for assessing normality. In all tests,  $P < 0.05$  was considered statistically significant.

### Ethical consideration

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of Guilan University of Medical Sciences (ethics code = IR.GUMS.REC.1399.473). Before the study onset, administrative approval was obtained from each retirement center. The anonymity and confidentiality of participants were ensured, and informed consent was obtained from each participant included in the study.

### Results

The study was conducted among 115 participants who referred to the retirement centers of Guilan Province, and the mean, minimum, and maximum age of whom was  $66.2 \pm 4.88$ , 60, and 90 years, respectively. Table 1 summarizes the frequency of demographic characteristics, as well as their relationship with QOL.

Based on the results, the mean  $\pm$  SD HGS was equal to  $31.74 \pm 7.45$  and  $18.48 \pm 5.13$  among males and females, respectively. Most of the individuals had medium and strong HGS.

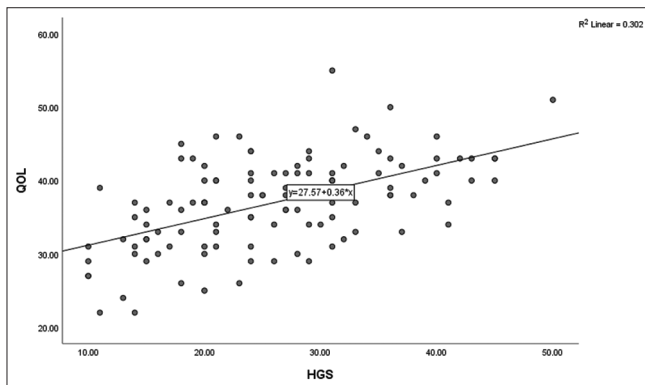
Regarding QOL, the mean overall score was  $37.02 \pm 6.12$ . Given that the maximum value of the scale was 57 and the majority scored above the mean, the QOL of the participants was good. The results of this study showed a significant relationship between educational level and QOL ( $P < 0.002$ ), but no significant relationship was observed between other demographic characteristics (age, sex, marital status, smoking status, retirement duration, financial adequacy, place of residence, and number of children) and QOL ( $P > 0.05$ ).

A positive and significant correlation was detected between HGS and QOL based on Pearson's correlation test ( $P = 0.001$ ,  $r = 0.54$ ) [Figure 1]. The QOL and its domains, and their relationship with HGS among older adults are demonstrated in Table 2.

**Table 1: Demographic characteristics and their relationship with the QOL of older adults referred to retirement centers (n=115)**

| Variable            | Variable levels             | n (%)      | QOL        | P      |
|---------------------|-----------------------------|------------|------------|--------|
| Gender              | Female                      | 49 (42.6)  | 35.87±6.31 | 0.08*  |
|                     | Male                        | 66 (57.4)  | 37.87±5.88 |        |
| Age                 | Young-older adults (60–74)  | 111 (96.5) | 37.08±6.15 | 0.71** |
|                     | Middle-older adults (75–84) | 2 (1.7)    | 37.50±9.19 |        |
|                     | Old-older adult (85–100)    | 2 (1.7)    | 33.50±0.07 |        |
| Marital status      | Single                      | 26 (22.6)  | 35.34±7.21 | 0.11*  |
|                     | Married                     | 89 (77.4)  | 37.51±5.71 |        |
| Number of children  | No child                    | 5 (4.3)    | 36.60±9.23 | 0.36** |
|                     | 1–3                         | 83 (72.2)  | 37.51±5.93 |        |
|                     | 4 and more                  | 27 (23.5)  | 35.59±6.10 |        |
| Place of residence  | City                        | 106 (92.2) | 37.22±6.03 | 0.23*  |
|                     | Village                     | 9 (7.8)    | 34.66±7.03 |        |
| Smoking             | Never                       | 91 (79.1)  | 37.26±6.24 | 0.47** |
|                     | Former smoker               | 19 (16.5)  | 35.52±5.86 |        |
|                     | Current smoker              | 5 (4.3)    | 38.40±4.77 |        |
| Education level     | <Diploma                    | 52 (45.2)  | 35.07±5.40 | 0.002* |
|                     | >Diploma                    | 63 (54.8)  | 38.63±6.25 |        |
| Retirement duration | <5 years                    | 15 (13)    | 39.80±5.17 | 0.06*  |
|                     | >5 years                    | 100 (87)   | 36.61±6.16 |        |
| Financial adequacy  | Inadequate                  | 32 (27.8)  | 36.25±6.13 | 0.05** |
|                     | Medium                      | 59 (51.3)  | 34.75±5.93 |        |
|                     | Adequate income             | 24 (20.9)  | 37.18±5.90 |        |

\*Independent-samples t-test, \*\*ANOVA,  $P < 0.05$



**Figure 1:** Correlation between HGS and QOL. The HGS was positively correlated with QOL ( $r = 0.54$ ;  $P = 0.001$ ). HGS, hand grip strength; QOL, quality of life

The results of the multiple linear regression test after adjusting the effect of variables sex, income, retirement duration, education level, and marital status suggested HGS as an independent predictor of determining QOL (Adj  $R^2 = 0.44$ ,  $\beta_{\text{HGS}} = 0.79$ ,  $P = 0.001$ ). Table 3 outlines the QOL predictors.

## Discussion

This study determined the role of HGS in predicting the QOL of older adults referring to the retirement centers of Guilan Province, Iran. HGS measurement is considered

a cost-effective and simple method for examining the change in upper body muscle strength, which has been utilized in many studies focusing on the population.<sup>[25]</sup>

Based on the results of the present study, HGS was significantly correlated with QOL ( $P = 0.001$ ,  $r = 0.54$ ). In addition, HGS was introduced as a proper predictor of the QOL of older adults, which can be one of their QOL indicators. McNicholl *et al.*<sup>[26]</sup> found that the significant relationship of HGS with the physical dimension of QOL (SF-12) ( $r = 0.19$ ,  $P < 0.0001$ ) revealed HGS as a predictor of QOL. According to Wiraguna *et al.*,<sup>[8]</sup> HGS is positively and significantly correlated with both QOL components (EQ-5D and EQ-5D VAS) although the correlation level is less than that of the present study (EQ-5D:  $P = 0.015$ ,  $r = 0.219$ ; EQ-5D VAS:  $P = 0.003$ ,  $r = 0.26$ ). Marques *et al.* (2019)<sup>[27]</sup> proposed a positive relationship between QOL and HGS among females (Coef = 0.40, 95% CI = 0.22, 0.58) and males (Coef = 0.26, 95% CI = 0.14, 0.38), which is consistent with the results of the present study. Kim *et al.*<sup>[28]</sup> also found that people with weak HGS had a higher probability of having a lower QOL (OR = 1.429,  $P < 0.001$ ). According to Xie and Ma (2021), maintaining or developing grip strength is vital in delaying or reducing QOL among the community-dwelling elderly.<sup>[6]</sup> However, Gopinath *et al.*<sup>[29]</sup> reported no significant relationship between HGS and QOL. The contradictory results can be ascribed to the difference in the geography of the individuals under study and type of tool.

In the present study, a significant relationship was observed between the level of education and QOL, so those holding greater education degree expressed a better QOL, which is in line with the results of Maghsoudi *et al.* ( $P = 0.007$ )<sup>[10]</sup> and Schorr *et al.* ( $r = 0.26$ ,  $P = 0.001$ ).<sup>[30]</sup> Chi *et al.*<sup>[31]</sup> also reported that older adults with higher levels of education, particularly those with a master's degree or above, tend to have higher levels of QOL ( $P < 0.001$ ). This may be because education enhances one's problem-solving skills and capabilities, ultimately leading to an improved QOL.

Furthermore, sex ( $\beta_{\text{sex}} = 0.41$ ,  $P = 0.001$ ) and income ( $\beta_{\text{income}} = 0.2$ ,  $P = 0.005$ ) were suggested as other QOL predictors. Ko *et al.*<sup>[32]</sup> introduced sex as a predictor of QOL ( $\beta = -0.047$ ,  $p < 0.001$ ) and Maghsoudi *et al.*<sup>[10]</sup> found the effectiveness of sex on QOL ( $P = 0.001$ ), which is in agreement with the results of the present study. Regarding income, Kustiar *et al.*<sup>[33]</sup> outlined a significant relationship with QOL ( $P = 0.002$ ). Individuals with higher income had a significant link with all dimensions of QOL ( $P = 0.000$ ), according to a study performed by Gobbens *et al.*<sup>[34]</sup> Another study by Chi *et al.* discovered that increased income

**Table 2: Relationship between HGS with QOL and its domains in retired older adults**

| Criterion               | M±SD       | Correlation level with HGS (r) | P       |
|-------------------------|------------|--------------------------------|---------|
| Total QOL               | 37.02±6.12 | 0.54                           | 0.001*  |
| Control domain          | 7.40±1.87  | 0.35                           | 0.001** |
| Autonomy domain         | 9.57±2.65  | 0.36                           | 0.001** |
| Self-realization domain | 8.86±2.02  | 0.41                           | 0.001** |
| Pleasure domain         | 11.20±1.96 | 0.53                           | 0.001** |

HGS, hand grip ;P<0.05; Pearson's correlation\*\* Spearman's correlation\* strength, QOL, quality of life

**Table 3: Determining factors effective in QOL using linear multiple regression analysis in older adults**

| Variable            | B     | SE                   | Beta  | 95% CI               |       | P      |
|---------------------|-------|----------------------|-------|----------------------|-------|--------|
|                     |       |                      |       | Lower                | Upper |        |
| HGS                 | 0.52  | 0.06                 | 0.79  | 0.38                 | 0.66  | 0.001  |
| Sex                 | 5.07  | 1.3                  | 0.41  | 2.49                 | 7.66  | 0.001  |
| Income              | 1.64  | 0.57                 | 0.2   | 0.51                 | 2.78  | 0.005  |
| Retirement duration | -1.82 | 1.29                 | -0.1  | -4.39                | 0.73  | 0.16   |
| Educational level   | 0.85  | 0.94                 | 0.06  | -1.01                | 2.72  | 0.36   |
| Place of residence  | -1.63 | 1.65                 | -0.07 | -4.98                | 1.59  | 0.31   |
| Marital status      | 1.02  | 1.13                 | 0.07  | -1.21                | 3.26  | 0.36   |
| Constant            | 13.47 | 5.64                 | -     | 2.27                 | 24.67 | 0.01   |
|                     | Adj   | R <sup>2</sup> =0.44 |       | F <sup>2</sup> =0.47 |       | R=0.68 |

QOL, quality of life; HGS, hand grip strength

among older adults is associated with improved QOL ( $P = 0.004$ )<sup>[31]</sup> and Souza *et al.*<sup>[35]</sup> referred to more QOL among higher-income ones ( $P < 0.05$ ), which confirms the results of the present study. The results seem logical since appropriate income is associated with an increase in individuals' welfare, which influences their QOL.

Furthermore, the HGS levels of males and females were, respectively, determined as  $31.74 \pm 7.45$  and  $18.48 \pm 5.13$ , representing medium HGS in the majority of the participants. According to Halaweh *et al.*,<sup>[12]</sup> the mean values of right and left HGS were, respectively, obtained as  $32.6 \pm 9.6$  and  $31.5 \pm 7.9$  among males and  $19.7 \pm 5.7$  and  $18.3 \pm 5.5$  among females, which indicates medium mean HGS in most older adults, and the results are consistent with those of the present study. Zhang *et al.*<sup>[23]</sup> reported  $21.0 \pm 8.7$  as the HGS of the population. In another study, Winiowska-Szurlej *et al.* (2021)<sup>[36]</sup> found that HGS was 19.98 kg on average (16.91 kg for men and 26.19 kg for women), while the level was determined as  $18.586 \pm 6.726$  by Akbar *et al.*<sup>[16]</sup> and  $18.82 \pm 6.62$  by Wiraguna *et al.*,<sup>[8]</sup> demonstrating weak HGS. This study highlighted healthy older adults, while the abovementioned ones focused on those admitted to the hospital. This issue can be addressed as one of the most important reasons for the difference in muscle strength between the studies. Additionally, the contradiction can be attributed to geographical differences, which play a significant role in individuals' lifestyle. The

majority of residents in Guilan Province are somehow involved in agriculture, and agricultural activities are a kind of physical activity that results in maintaining and enhancing muscle strength. Another issue justifying this inconsistency includes the mean age of the participants in the present study so that most of them were young-older adults (60–74), whose muscle strength was still not influenced by aging.

The results revealed that the mean QOL score of those referring to retirement centers was  $37.026 \pm 6.123$ , illustrating that the QOL of the majority was above the mean score. In this regard, it is possible to refer to the study of Nazari *et al.* (2021)<sup>[5]</sup> who, using the same questionnaire as the present research, reported the average QOL among older adults as 37.4. This finding is consistent with our study, indicating that the QOL among the majority of older adults is above average. Based on the results of Hosseini Nesar *et al.*,<sup>[7]</sup> the mean QOL levels of older adults living in home and nursing home were, respectively, equal to 3.78 and 2.88 according to the LEIPAD QOL questionnaire, which represents relatively high and poor QOL, respectively. Maghsoudi *et al.*<sup>[10]</sup> referred to  $28.17 \pm 24.79$  and  $82.16 \pm 30.66$  as the mean QOL of older adults residing in home and nursing home, which reflects their high QOL. Wiraguna *et al.*<sup>[8]</sup> reported 0.750 (0.423–1) and 70 (0–100) as the median QOL value of older adults using the questionnaires of EQ-5D and EQ-5D VAS, respectively, indicating medium upward QOL. The results of the abovementioned research are in line with those of the present study on older adults living in home, which reveals the appropriate QOL of older adults living in home. Several points can be noted regarding the high QOL of the population under study. The majority, even those with chronic diseases, had autonomy in their actions to a large extent. Furthermore, the culture and geography of their place of residence were effective in this regard, and most of the participants possessed a university education.

It is important to note that HGS is a simple and noninvasive measure of physical function, and it is among the most widely used indicators of muscle strength and function in older adults. While the relationship between HGS and QOL may not be consistent across all studies, the overall evidence suggests that maintaining and improving HGS may have positive effects on the physical and mental well-being of older adults.

**Limitation and recommendation**

The study was conducted only among older adults who are referred to retirement centers in Guilan Province, which may not be representative of the entire older adult population in Iran. Therefore, caution should be taken when generalizing the findings to other populations. The study design was cross-sectional, which limits the ability

to establish a causal relationship between HGS and QOL. Therefore, it is recommended that future studies should consider a longitudinal design to establish a causal relationship between HGS and QOL in older adults and also investigate other factors that may influence QOL in older adults, such as social support, access to health care, and other physical and cognitive functions. The study recommends that healthcare providers and policymakers should incorporate HGS testing and exercise programs into routine care for older adults, to help improve their QOL.

## Conclusion

The study suggests that higher levels of HGS are associated with better QOL. Therefore, the study emphasizes the importance of exercise and muscle training programs that can help improve HGS by increasing muscle strength. Policymakers and healthcare providers can use this information to develop targeted interventions and programs that promote physical activity and muscle training among older adults, ultimately leading to improved HGS and better QOL. Overall, this study highlights the importance of considering HGS as a predictor of QOL in older adults and emphasizes the potential benefits of exercise and muscle training programs in improving HGS and enhancing the QOL of the elderly population.

## Ethics approval

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of Guilan University of Medical Sciences (ethics code = IR.GUMS.REC.1399.473).

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Nil.

## Conflicts of interest

There are no conflicts of interest.

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