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Mental Health and Handgrip Strength Among Older Adults: A Nationwide Study

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Abstract

Handgrip strength is used as an important indicator of health in older adults. We aimed to explore the association between stress, depression, and suicidal ideation and handgrip strength among older adults. We conducted this cross-sectional study involving 1254 individuals (aged ≥65 years), using data from the 2015 Korean National Health and Nutrition Examination Survey VI. We used logistic regression analysis to examine associations between handgrip strength and mental health. Among mental health factors, a significant difference was noted between stress and handgrip strength among the older adults. After adjusting for confounding factors, the odd ratio (OR) of stress among older adults with low handgrip strength was statistically significant in Models 1 (1.61 (95% CI: 1.01–2.57)) and 2 (1.59 (95% CI: 1.01–2.52)) but not in Model 3 (1.52 (95% CI: .96–2.43)). No significant association was found between depression or suicidal ideation and handgrip strength. The risk of stress was 1.59-1.61 times higher in older adults with low handgrip strength, compared to that in older adults with normal handgrip strength. It is necessary to develop strategies aimed at managing stress among older adults with low handgrip strength and educating them about the importance of handgrip strength and exercises that increase handgrip strength.

Keywords

depression, older adults, handgrip strength, stress, suicidal ideation

What do we already know about this topic?

- Reduction in handgrip strength among older adults negatively influences functional, psychological, and social health.
- The most prominent characteristic health problem of aging populations is the increased rate of depression, compared to younger individuals.
- There is little research on the association between handgrip strength and mental health among older adults.

How does your research contribute to the field?

- We found a significant association between stress and handgrip strength.
- Stress levels of older adults with weak handgrip strength were higher than those of older adults with normal handgrip strength.
- No significant differences were found between either depression or suicidal ideation and handgrip strength.

What are your research's implications toward theory, practice, or policy?

- Therefore, there is a need for strategies aimed at managing stress among older adults with low handgrip strength.
- Further, it is necessary to educate older adults about the importance of handgrip strength and provide exercises for increasing handgrip strength.

Introduction

Aging and an increased prevalence of chronic diseases associated with increasing age are associated with disabilities that may decrease physical function among older adults, which in turn increase the likelihood of unhealthy choices. These choices lead to further physical and mental deterioration, which are

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associated with social isolation.[1,2] Deterioration in quality of life, difficulty in living independently, and financial stress are associated with suicide among older adults.[3]

Gradual increase in the burden of living owing to the deterioration of physical function and presence of disease is also associated with suicide.[4] Stress and declining physical health have mutual detrimental effects, whereas stress in old age is related to mental health problems such as depression or despair.[2,5] Stress threatens quality of life and induces physical or mental health problems by increasing negative emotions, including anger, anxiety, and depression.[2,4]

Aging is often accompanied by general decline in physical function, resulting in the reduction of muscle mass and physical strength.[6-8] Decreased muscle strength interferes with physical activity (PA), which threatens independence and is associated with increased health care costs.[6,9] Furthermore, reduced PA increases the rate of depression, which affects approximately 20–50% of older adults.[10] These health-related challenges are in turn associated with social issues such as increased burden of care associated with an aging population and high suicide rates among older adults.

Handgrip strength is commonly used to assess changes in muscle strength in large-scale research studies involving older adults because it is easy and cost-effective to measure.[7,11,12] Handgrip strength has also been used to assess weakness and disability and has been suggested as a predictor of mortality.[11-13] Reduced handgrip strength is considered the most important element that negatively affects ADLs and the capacity to work[14] because reduced handgrip strength impedes independence. Additionally, reduced handgrip strength negatively affects the functional, psychological, and social health of older adults.[15]

We aimed to investigate the association between handgrip strength and mental health in older Korean adults using data from a large-scale, representative, and reliable study, the 2015 Korea National Health and Nutrition Examination Survey (KNHANES) VI.[16] The specific purposes of the study were to analyze handgrip strength, according to general characteristics, and explore the association between stress, depression, and suicidal ideation and handgrip strength among older Korean adults.

Materials and Methods

Study Design and Population

The Korea Centers for Disease Control and Prevention (KCDC) has been conducting the KNHANES, a nationally representative cross-sectional survey targeting non-institutionalized Koreans, since 1998. This study used the primary data of KNHANES VI.[16] During KNHANES VI, health and nutrition data were collected via face-to-face interviews and a self-administered questionnaire, and a specialist from the KCDC team performed health examinations. A stratified, multistage, cluster probability design was used to obtain a representative sample of the South Korean population. The number of subjects was 1188 when the minimum sample size was obtained by logistic regression analysis using the G power 3.1.9 program, under the conditions of odds ratio = 1.3, two-tailed test, significance level $\alpha = .05$, and power of .95. The inclusion criterion for this study was adults aged over 65 years, and the exclusion criterion was individuals who did not respond to questions about handgrip strength or mental health. We identified 1548 participants aged ≥65 years from the overall 2015 KNHANES VI study population (n = 7380) and excluded 294 participants with missing data. The data of the remaining 1254 participants were used in the final analysis. Therefore, the sample size of this study satisfied the minimum sample size.

Measurements

Handgrip Strength. Handgrip strength was determined by measuring the power of the handgrip when the coordinated action of all fingers and the thumb was involved. Handgrip strength was measured in kilograms using a digital grip strength dynamometer (Takei TKK 5401, Takei Scientific Instruments Co Ltd, Tokyo, Japan). Starting with the dominant hand, measurements were made 3 times for each hand alternately, and the average value was calculated. The lower limit of handgrip strength was set at <26 kg for men and 18 kg for women, as used in a previous study involving older adults of Asian descent.[17]

Mental Health. The variables used to assess the mental health of the participants were stress, depression, and suicidal ideation. Stress was categorized as "high" if the participants responded "a great deal" or "quite a lot" to the question: "How much stress do you feel in your daily life?" Stress was categorized as "low" if the answer was "a little" or "almost none."[18] Depression was categorized as "yes" or "no" in response to the question: "Have you ever felt sad or despair strong enough to interfere with your daily life for two consecutive weeks or longer during the past year?"[19] Suicidal ideation was categorized as "yes" or "no" in response to the question: "Have you ever thought that you wanted to die during the past year?"[20]

Covariates. The demographic variables of the participants were age, sex, education, marital status, living alone, body mass index (BMI), economic status, place of residence, occupation, smoking, alcohol consumption, PA, diabetes mellitus (DM), and hypertension. Education was classified as elementary school level or lower, middle school, high school, or bachelor's degree or higher. Marital status was classified as "I have a spouse" or "I do not have a spouse." BMI was calculated using the following formula: weight (kg)/height squared (m^2).[7] Economic status was classified into quartiles of adjusted household income per family member using the following formula: equivalent income (monthly average household income/√[number of family members]). Place of residence was classified as urban or rural, whereas employment was classified according to participants' current employment status. Smoking was classified as "yes" if

currently smoking and "no" if not. Alcohol consumption was classified as "yes" if the participants reported consuming ≥1 alcoholic drink per month and as "no" if they reported consuming <1 drink per month. PA was categorized as "yes" if a participant engaged in moderate-intensity PA for 2 h 30 min or more per week, high-intensity PA for 1 h 15 min or more per week, or in a mix of moderate and high-intensity PA; otherwise, PA was classified as "no."[21,22] Participants were deemed to have DM or hypertension on the basis of a current diagnosis at the time of the survey.

Statistical Analysis

All data are presented as means ± standard error (SE) for continuous variables or as percentage ± SE for categorical variables. SAS software (version 9.3; SAS Institute Inc., Cary, NC, USA) was used to run a complex sample design based on data analysis from the survey data, which provided sampling weights for KNHANES VI and nationally representative estimates.

Demographic characteristics of the participants and differences in handgrip strength according to demographic characteristics and mental health were analyzed using *t*-test and χ^2 test as appropriate. Finally, to identify the association between handgrip strength and the mental health of the participants, logistic regression analysis was performed using odds ratio and 95% confidence interval, after adjusting for demographic characteristics that were clinically important for mental health. Model 1 was adjusted for age and sex. Model 2 was adjusted for age, sex, education, marital status, living alone, BMI, economic status, place of residence, occupation, smoking, alcohol consumption, and PA. Model 3 was adjusted for hypertension and DM, in addition to Model 2 variables. The significance level was set at $P < .05$ for all tests.

Results

Handgrip Strength According to General Characteristics

Differences in handgrip strength among the participants according to their general characteristics are shown in Table 1. Among all participants, 213 (17.0%) had low handgrip strength (76.1% were women). Significant differences in handgrip strength categories (ie, low and normal) were found with respect to age, sex, education, marital status, living alone, economic status, occupation, alcohol consumption, PA, and DM ($P < .05$). Participants with low handgrip

Table 1. Handgrip Strength of Participants According to Demographic Characteristics.

		HGS		
		Low (n = 213)	Normal (n = 1041)	
Characteristics		Mean ± SE or % (SE)	Mean ± SE or % (SE)	*P*-value
Age (years)		76.1 ± 0.3	71.9 ± 0.2	<.001*
Sex (%)	Female	77.5 (1.3)	50.5 (1.4)	<.001*
Education (%)	Elementary school or lower	86.4 (1.6)	55.9 (2)	<.001*
	Middle school graduation	5.6 (.3)	14.2 (1.1)	
	High school graduation	4.5 (.2)	20.4 (1.5)	
	Bachelor's degree or higher	3.5 (.4)	9.5 (1)	
Married (%)	Yes	54.8 (1)	30.2 (1.6)	<.001*
Living alone (%)	Yes	72.9 (1.3)	83.7 (1.8)	<.001*
BMI (kg/m^2)		24.1 ± 0.3	24.4 ± 0.1	.226
Economic status (%)[1]	Q1 (Lower 25%)	42.1 (1.1)	23.0 (1.5)	<.001*
	Q2 (Lower 26-50%)	21.9 (.6)	24.7 (1.7)	
	Q3 (Upper 26-50%)	18.3 (.6)	25.2 (1.5)	
	Q4 (Upper 25%)	17.7 (.7)	27.0 (1.7)	
Place of residence (%)	Rural	33.9 (1.4)	24.6 (3.2)	.054
Employed (%)	No	77.8 (1.5)	65.6 (2.1)	.002*
Smoking (%)	Yes	6.1 (.3)	10.0 (.9)	.076
Alcohol consumption (%)	More than once a month	23.7 (.7)	39.2 (1.4)	<.001*
Physical activity (%)[2]	Yes	16.4 (.5)	37.2 (1.9)	<.001*
Hypertension (%)	Yes	60.2 (1.1)	55.8 (1.7)	.342
Diabetes mellitus (%)	Yes	35.6 (.9)	17.7 (1.3)	<.001*

BMI, body mass index; HGS, handgrip strength; SE, standard error.
*Statistically significant difference between the two groups.
[1]Economic status: monthly average gross household income/√ (number of household members); expressed in quartiles.
[2]Physical activity: engaging in moderate-intensity activity for 2 h and 30 m or more per week, high-intensity activity for 1 h and 15 min or more, or a mix of moderate and high intensity for the time corresponding to the applicable intensity.

Table 2. Mental Health of Participants According to Handgrip Strength.

		HGS		
		Low (n = 213)	Normal (n = 1041)	
Variables		% (SE)	% (SE)	*P*-value
Stress	Low	76.6 (1.4)	84.6 (1.8)	.013*
	High	23.4 (.7)	15.4 (1.1)	
Depression	No	81.9 (1.5)	86.0 (2.1)	.258
	Yes	18.1 (.6)	14.0 (1.1)	
Suicidal ideation	No	92.4 (1.5)	94.1 (1.7)	.429
	Yes	7.6 (.4)	5.9 (.6)	

HGS, handgrip strength; SE, standard error.
*Statistically significant difference between the two groups.

Table 3. Mental Health According to Handgrip Strength.

		Stress	Depression	Suicidal ideation
Model 1				
HGS	Normal	1	1	1
	Low	1.61 (1.01–2.57)	1.25 (.68–2.31)	.77 (.36–1.65)
	P-value	<.05*	.46	.49
Model 2				
HGS	Normal	1	1	1
	Low	1.59 (1.01–2.52)	1.12 (.59–2.14)	.69 (.31–1.56)
	P-value	<.05*	.73	.36
Model 3				
HGS	Normal	1	1	1
	Low	1.52 (.96–2.43)	1.04 (.54–1.98)	.7 (.3–1.62)
	P-value	.07	.92	.39

P-value: *P*-value of odds ratio
*Statistically significant.
HGS, handgrip strength.
Model 1: Adjusted for age and sex.
Model 2: Model 1 and adjusted for education, marital status, living alone, body mass index, economic status, place of residence, employment status, smoking, alcohol consumption, and physical activity.
Model 3: Model 2 and adjusted for hypertension and diabetes mellitus.

strength were older than subjects with normal handgrip strength and were female. Further, more participants with low handgrip strength had a low education level, with a high percentage of married individuals and a low percentage of individuals who were living alone, compared to those with normal grip strength. In addition, participants with low handgrip strength had a lower economic status than those with normal handgrip strength, had a higher current unemployment rate, lower alcohol consumption rate, lower PA percentage, and higher DM percentage.

Mental Health According to Handgrip Strength

Differences in mental health according to handgrip strength among older adults are shown in Table 2. High stress levels were associated with low handgrip strength (P = .013). However, no differences were found between levels of depression or suicidal ideation and handgrip strength.

The association between handgrip strength and mental health is shown in Table 3. Comparisons were made among participants with normal handgrip strength. After adjusting for confounding factors, we found that among the mental health factors, stress increased the risk of low handgrip strength in Model 1 (odds ratio [OR] = 1.61; 95% confidence interval [CI]: 1.01–2.57; $P < .05$) and Model 2 (OR = 1.59; 95% CI: 1.01-2.52; $P < .05$), but there was no significant association between stress and low handgrip strength in Model 3 (OR = 1.52; 95% CI: .96–2.43; $P = .07$). There was no significant association between low handgrip strength and depression or suicidal ideation in any of the models.

Discussion

In this study, older age, female sex, low socioeconomic status, living with others, drinking status, low PA, and DM were related with lower handgrip strength.

With age, muscle mass and physical strength decrease because of deterioration in overall function, and this is associated with a decrease in physical performance among older adults.[6,8,9,23] Consequently, the decrease in muscle mass negatively affects the health of older adults.[7,8,24]

Several studies have reported deterioration in handgrip strength owing to poor nutritional management among older adults living alone, who are more likely to skip meals and take nutritional risks.[12,25,26] This is different from the results of this study. Further research is required to establish behavioral patterns that may lead to deterioration in handgrip under these circumstances.

Reduced PA levels owing to aging and loss of appetite due to decreasing quantity and quality of meals accelerate loss of skeletal muscle.[23,24,26] Economic status, education level, and family composition are factors that are reported to negatively affect eating habits and health in old age.[2,26] Therefore, it is necessary to promote the health of older adults through the development of nutritional intake and exercise-related programs.

In Models 1 and 2 in the present study, older adults with low handgrip strength showed higher stress levels than older adults with normal handgrip strength. In Model 3, mental health did not appear to be statistically significant. Model 3 was additionally adjusted for hypertension and DM. The handgrip strength of the older adults showed statistically significant differences according to DM, and after adjustments, the association with handgrip strength, even under stress, was found to be statistically non-significant. It was found that the handgrip strength of subjects diagnosed with DM was lower than that of those without DM,[27] and it was argued that handgrip strength was an independent predictor of new-onset DM in the middle-aged and older European population.[28] There is a strong correlation between handgrip strength and DM, and it is considered that the relationship with stress was not statistically significant because DM was included as an adjustment variable. Therefore, it is necessary to be more careful with subjects with DM when managing stress in a group of individuals with low handgrip strength.

The decrease in muscle strength in older adults interferes with PA, affecting independent living, with a very low frequency of outdoor activities and a high probability of living in isolation,[9,29] which negatively affects mental health.

On the basis of the present results, we could not determine whether physical function deteriorated because of high stress levels or whether high stress levels developed owing to poor physical function. However, physical illness among older adults negatively affects stress levels, nutritional status, and competency in ADLs, and it is also significantly associated with depression.[30] The deterioration of physical function owing to decreased handgrip strength appears to be related to mental health.

In some studies, reduced handgrip strength affected cognitive decline and depression.[15,31] In participants aged 85 years, low handgrip strength was correlated with poorer scores in functional, psychological, and social health domains.[15] Stress, which tends to be elevated in older adults with illnesses and limitations in ADLs, is an important indicator of progression to depression.[3,30] Because of the close association between physical and mental health, careful evaluation and active application of nursing interventions are needed to protect the mental health of older adults who have difficulties with PA.

Depression or suicidal ideation did not show any statistically significant results in this study. This may be linked to our measurement of mental health in this study; using one sentence to measure mental status may have been too superficial. However, we recommend that further research be conducted to investigate how mental health varies according to handgrip strength and to determine the effect of handgrip strength on depression and suicidal ideation when stress acts as a mediator.

While a strength of this study was its use of a large, nationally representative sample, this study had some limitations. First, the defining cut-off point for low handgrip strength among the older adults was not clear, and further research is needed to establish this. Second, we could not determine causality owing to the cross-sectional study design; therefore, a longitudinal study is suggested to further elucidate the relationship between handgrip strength and mental health. Lastly, although this study used a tool with good reliability and validity that verified mental health status, it is necessary to measure mental health from multiple perspectives. Nevertheless, despite these limitations, this is the first study to clearly identify an association between handgrip strength and mental health among older South Korean adults.

Conclusion

This study confirmed an association between stress levels in older Korean adults and handgrip strength. Although it was not statistically significant in the final model, we confirmed that the risk of stress increased in older adults with low handgrip strength. Handgrip strength is an important predictor of strength in older adults. Therefore, it is necessary to develop a strategy to educate older adults with weak handgrip strength on the importance of stress management and exercises for improving handgrip strength.

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Author Contributions

The first author designed the study, analyzed and interpreted the data, and wrote the article. The corresponding author provided assistance in the interpretation of the data and preparation of the manuscript. All authors read and approved the final version of the article.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Ethical approval

The KNHANES VI was conducted with approval from the Institutional Review Board of KCDC (IRB No. 2013-12EXP-03-5C).

Informed consent

Informed consent was obtained from each participant prior to the survey. Formal approval from the corresponding institution was obtained for the analysis of raw data.

Data Accessibility

This study used the primary data from KNHANES VI (Available online: knhanes.cdc.go.kr/knhanes/index.do).

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