The Effect of Psychological Resilience on Cognitive Decline in Community-Dwelling Older Adults: The Korean Frailty and Aging Cohort Study

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Background: Chronic stress is associated with an increased risk of cognitive impairment and Alzheimer’s disease. This study aimed to assess whether better coping with stress, as assessed using the Brief Resilience Scale (BRS), is associated with slower cognitive decline in community-dwelling older adults.

Methods: This study used 2018/2019 data and 2-year follow-up data from the Korean Frailty and Aging Cohort Study. Of the 3,014 total participants, we included 1,826 participants (mean age, 77.6±3.7 years, 51.9% female) who completed BRS and Korean version of the Consortium to Establish a Registry for Alzheimer’s Disease Assessment Battery and the Korean version of the Frontal Assessment Battery (FAB).

Results: Higher BRS score at baseline was associated with a lesser decline in the Mini-Mental State Examination score over 2 years after adjusting for age, sex, years of education, smoking status, hypertension, diabetes, and depression (B, 0.175; 95% confidence interval, 0.025–0.325) for 2 years, which represents global cognitive function. Other cognitive function measurements (Word List Memory, Word List Recall, Word List Recognition, Digit Span, Trail Making Test-A, and FAB) did not change significantly with the BRS score at baseline.

Conclusion: These findings suggest that better stress-coping ability, meaning faster termination of the stress response, may limit the decline in cognitive function.

Keywords: Resilience; Psychological Resilience; Cognitive Dysfunction; Stress

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INTRODUCTION
As society ages, cognitive impairment is recognized as one of the major detrimental factors affecting the quality of life.1 Although cognitive decline is a natural aging process, modifiable factors should be identified to slow the process of preventing or delaying cognitive disorders and promoting successful aging. Understanding the risk factors of cognitive decline could help delay the progression of dementia.

Stress has been suggested as a modifiable factor of Alzheimer’s disease. Perceived stress, defined as a consequence of events or demands that exceed an individual’s professed ability to cope,2 can have long-term physiological and psychological consequences, and has been shown to be a modifiable risk factor for mild cognitive impairment and Alzheimer’s disease.3,4 Chronic or prolonged stress can have damaging effects on various brain functions by differing ways, including tau and amyloid accumulation and prolonged secretion of glucocorticoids via hypothalamus-pituitary-adrenal cortex axis activation.5

Resilience has been presented as a way to cope with psychological stress. Resilience is the ability to bounce back or recover from stress, adapt to stressful circumstances, not become ill despite significant adversity, and function above the norm despite stress or adversity.6,7 Studies have investigated the associations among resilience, stress coping ability, and cognitive impairment. Two studies from Korea found a significant positive correlation between psychological resilience and overall cognitive function in a middle-aged Korean population.8,9 However, these studies were cross-sectional and did not include older adults. Similarly, Lou et al.9 showed that older adults with high psychological resilience had a lower risk of cognitive decline in a prospective cohort study; however, this study only used the Mini Mental State Examination (MMSE) to measure cognitive function.

In this study, we hypothesized that older adults with better stress coping abilities would show a lesser decline in cognitive function, as assessed by comprehensive neuropsychological tests after 2 years.

METHODS
1. Study Population
The Korean Frailty and Aging Cohort Study (KFACS) is a nationwide multicenter longitudinal study with a baseline survey conducted in 2016/2017 on community-dwelling individuals aged 70–84 years.10 A total of 3,014 community-dwelling older adults were recruited for the 2016/2017 baseline study, which was conducted at 10 centers, including rural and urban areas across South Korea. Follow-ups were conducted at 2-year intervals. The Brief Resilience Scale (BRS) has been used in KFACS cohort studies since 2018.

Of the 3,014 participants in 2016/2017, 2,089 participants took part in the first follow-up study in 2018/2019. Out of them, those who had not completed BRS questionnaire or cognitive function test at baseline (n=281), answered “don’t know” on any of BRS questions (n=12) and had no follow-up cognitive function test scores (n=390) were excluded, leaving a final analytical sample of 1,826 participants (Figure 1).

2. Stress Coping Ability Assessment
In this study, the Korean version of the BRS was used to measure stress coping abilities.11,12 The BRS consisted of six questions. Questions 1, 3, and 5 were positively worded, whereas questions 2, 4, and 6 were negatively worded. The six items of the BRS are as follows: (1) I tend to bounce back quickly after hard times, (2) I have a hard time making it through stressful events, (3) It does not take me long to recover from a stressful event, (4) It is hard for me to snap back when something bad happens, (5) I usually come through difficult times with little trouble, and (6) I tend to take a long time to overcome setbacks in my life. The following instructions were used to administer the scale: “Please indicate the extent to which you agree with each of the following statements using the scale: 1=strongly agree, 2=agree, 3=neutral, 4=disagree, and 5=strongly disagree.” Negatively worded questions 2, 4, and 6 were reverse scored. The score was calculated by adding the number of questions. Higher scores indicate better stress coping abilities.13

3. Cognitive Function Assessment
Cognitive function was assessed by the Korean version of the Consortium to Establish a Registry for Alzheimer’s Disease Assessment Battery (CERAD-K)14 and the Korean version of the Frontal Assessment Battery (FAB).15 CERAD-K includes the Mini Mental State Examination (MMSE-KC), Word List Memory, Word List Recall, Word List Recognition Test, Digit Span Forward and Backward Test, and Trail Mak-

Figure 1. Study population and flow chart. KFACS, Korean Frailty and Aging Cohort Study; BRS score, Brief Resilience Scale score.
The MMSE-KC, which tests global cognitive function, comprises five domains: direction (10 points), memory (6 points), attention (5 points), language ability (6 points), and comprehension and judgment (3 points). A higher score indicated a better cognitive status, with a total score of 30 points. The word-list memory test estimates immediate memory ability after reading 10 words. Present 10 commonly used words at intervals of 2 seconds to read them and recall as many words as possible for 90 seconds. The total possible score is 30 points, with 10 points per session. Higher scores indicated better cognitive status.

Verbal memory was tested using wordlist memory, recall, and recognition tests. The Word List Recall Test evaluates the ability to recall the given 10 words from the Word List Memory task after 15 minutes. A maximum of 90 seconds is allowed and the maximum score is 10. The word-list recognition test measures recognition ability. The target word was distinguished from the 10 words presented in the Word List Memory Test and the new 10 words. The maximum score is also 10.

The Trail Making Test-A (TMT-A) assesses visual attention, executive function, and processing speed. A line was drawn connecting numbers from 1 to 25 in ascending order, and the total time taken was recorded. TMT-A tests of processing speed. The score was recorded as the time in seconds taken to complete the test.

The Digit Span Test assesses short-term memory, working memory, and attention by recalling the number sequence after hearing numbers forward and backward. Digit Span Forward and Backward Test was composed of 7-digit questions and presented in two trials. One point was scored when each digit was correctly recalled, and the total score was 14 points for each digit, spanning forward and backward directions. In this study, the total score was used to assess cognitive function.

The FAB is a widely used test to assess executive functions such as planning, working memory, mental flexibility, and inhibition. Higher scores indicate a better frontal lobe function. The FAB consists of the following: similarities (conceptualization), lexical verbal fluency (mental flexibility), motor series (programming), conflicting instructions (sensitivity to interference), Go-No go (inhibitory control), and prehension behavior (environmental autonomy); the total score is 18.

Cognitive function decline was assessed by the change in each of the seven test scores or time measurements over 2 years (baseline test score subtracted from the follow-up test score), meaning that the more negative the change, the greater the decline. The exception is TMT-A, which is measured in how much time (in seconds) is required to complete the task. Therefore, for TMT-A, the more positive the change, the greater the decline in cognitive function.

4. Other covariates

We controlled for potential confounding variables related to psychological resilience or cognitive function in our analyses, including age, sex, years of education, smoking status, hypertension, diabetes mellitus, and depression. Information on sociodemographic characteristics, lifestyle, and health status was collected through face-to-face interview in 2018/2019. Depression was defined as a score of greater than or equal to 6 on short form of Geriatric Depression Scale in Korean (SGDS-K).

| Table 1. Demographic and clinical characteristics of participants at baseline |
|-----------------------------|-----------------|-----------------|
| Characteristic               | Total           | BRS score ≤2.00* | BRS score >2.00* |
| No. of participants         | 1,826           | 940             | 886             |
| Age (y)                     | 77.6±3.7        | 77.5±3.7        | 77.6±3.6        |
| Male sex                    | 879 (48.1)      | 515 (54.8)      | 364 (41.1)      |
| Education years             | 9.2±6.8         | 9.65±6.4        | 8.73±7.2        |
| Currently smoking           | 176 (9.6)       | 101 (10.7)      | 75 (8.5)        |
| Hypertension                | 8.38±4.93       | 541 (57.6)      | 543 (61.3)      |
| Diabetes                    | 49 (5.8)        | 233 (24.8)      | 226 (25.5)      |
| SGDS-K ≥6                   | 620 (73.0)      | 54 (5.7)        | 303 (34.2)      |
| BRS score                   | 2.36            | -               | -               |
| Global cognitive function   |                 |                 |                 |
| Mini-Mental State Examination| 25.9±3.0        | 26.0±2.9        | 25.7±3.1        |
| Verbal memory               |                 |                 |                 |
| Word List Memory score      | 18.0±4.2        | 18.2±4.1        | 17.8±4.3        |
| Word list recall score      | 5.9±2.0         | 6.1±2.0         | 5.8±2.0         |
| Word list recognition score | 8.8±1.6         | 8.9±1.6         | 8.78±1.6        |
| Attention                   |                 |                 |                 |
| Digit Span, total score     | 10.2±1.6        | 10.5±3.6        | 9.8±3.6         |
| Processing speed            |                 |                 |                 |
| Trail Making Test-A (s)     | 77.5±57.4       | 72.5±50.3       | 82.85±63.6      |
| Executive function          |                 |                 |                 |
| Frontal Assessment Battery score | 13.7±3.0      | 14.0±3.0        | 13.5±2.9        |

Values are presented as number, mean±standard deviation, or number (%).
BRS, Brief Resilience Scale; SGDS-K, Geriatric Depression Scale in Korean.
*BRS score of 2 is the median score (50th percentile).
5. Statistical Analysis

The characteristics of the participants were described using means and standard deviations for continuous variables and frequency counts and percentages for categorical variables. The association between the BRS score at baseline and cognitive function change over 2 years was assessed using linear regression analysis in model 1. In model 2, multivariable linear regression was used to adjust for age, sex, years of education, smoking status, hypertension, diabetes mellitus, and depression. All statistical analyses were performed using IBM SPSS Statistics for Windows ver. 25.0 (IBM Corp., Armonk, NY, USA). The level of statistical significance was set at P<0.05.

6. Ethical Approval

The KFACS protocol was approved by the institutional review boards (IRBs) of the Clinical Research Ethics Committee of all 10 participating centers, including the coordinating center, Kyung Hee University Medical Center, Seoul, Korea (IRB no., 2015–12-103).

RESULTS

1. Baseline Characteristics

The baseline characteristics of the study participants are presented in Table 1. The mean age was 77.6±3.7 years and approximately one-half of the participants were women (947 [51.9%]). The participants had an average of 9.2±6.8 years of education and the majority of participants were never-smokers or quitted more than 10 years (1,650 [90.4%]). Of the participants, 1,084 participants (59.4%) had hypertension, and 459 participants (9.6%) had diabetes. The mean SGDS-K score was 2.92±3.5.

2. Association between BRS Score and 2-Year Change in Cognitive Function

In the unadjusted linear regression model (Table 2), the baseline BRS score was positively associated with the difference in the MMSE-KC score over 2 years (B, 0.182; 95% confidence interval [CI], 0.047–0.317; P=0.008). The BRS score was one unit higher (on average, the MMSE-KC score was 0.18 unit higher 2 years later, indicating that participants with higher BRS scores at baseline had less decline in MMSE-KC score or improvements in MMSE-KC scores. Other domains of the cognitive function tests (Word List Memory, Word List Recall, Digit Span, TMT-A, and FAB) did not show any statistically significant association with the BRS score.

In the fully adjusted multivariable linear regression analysis (Table 2), after adjusting for age, sex, years of education, smoking status, hypertension, diabetes, and depression, the association between the BRS score at baseline and the change in the MMSE-KC score over 2 years was still statistically significant, with a P-value of 0.022 (B, 0.175; 95% CI, 0.025–0.325). In line with the unadjusted model, as the BRS score increased by one unit, on average, the MMSE-KC score was 0.175 units higher 2 years later. The other domains of the cognitive function tests did not show any statistically significant changes in association with BRS at baseline.

DISCUSSION

In this longitudinal study, we found that better psychological resilience
was associated with a slower rate of global cognitive function decline, which was represented by the MMSE-KC score, although it was not associated with decline in other domains of cognitive tests. Participants with better stress-coping abilities showed less global cognitive function decline than those who had a hard time bouncing back from stress. The positive effect of BRS on cognitive function was still significant after adjusting for depression. Depression is known to adversely affect cognitive function in older adults, and individuals with low psychological resilience are at a higher risk of developing depression. 

Previous studies have shown that perceived stress is associated with lower cognitive scores and a faster rate of cognitive decline in older adults. Kulshreshtha et al. showed that elevated levels of perceived stress (dichotomized as low stress vs elevated stress) were associated with 1.37 times higher odds of poor cognition after adjustment for sociodemographic variables, cardiovascular risk factors, and depression (adjusted odds ratio [AOR], 1.37; 95% CI, 1.22–1.53). In line with this study, two previous studies in Korea investigating the association between resilience and cognitive impairment also found a correlation between resilience and overall cognitive function in a middle-aged Korean population. Another prospective cohort study showed that older adults with high psychological resilience have a lower risk of cognitive decline. This study corroborates previous studies showing that a higher BRS score is associated with a slower decline in cognitive function. In addition, this prospective study analyzed not only the MMMSE-KC but also every domain of testable cognitive function in a nationwide sample of older adults, broadening the spectrum of the effects of psychological resilience and cognitive function in future studies.

Several studies have identified the biological pathways involved. Studies have shown that stress is related to tau accumulation and amyloid deposition, and that elevated brain amyloid levels are associated with a stronger decline in cognitive function in older adults than in adults without elevated cerebral amyloid levels. Therefore, if stress increases tau and amyloid accumulation during aging, stress resilience could be a preventive factor, and early intervention area for intervention earlier in life may prevent or slow the cognitive function decline process. Potential explanations for how perceived stress is associated with several unfavorable health outcomes include dysfunctional regulation of glucocorticoid secretion, alterations in autonomic tone, and an increased risk of unhealthy lifestyle behaviors. In addition, changes in the integrity of brain regions may affect brain network function, specifically the default emotion network, cognitive control network, emotion/frontal network, and cortical brain circuits, thereby affecting global cognitive function, as shown by the MMSE-KC score before each specific domain of cognitive function.

This study had some limitations. First, we could not assess the severity of psychological stress experienced by the participants. Therefore, we could not determine whether all participants had the same resilience, given the same stress severity. Second, the follow-up period of 2 years may be too short to observe declines in all aspects of cognitive function. This may explain why better stress coping ability was associated with a slower decline in global cognitive function but not with each component of cognitive function. Third, we did not consider the effects of depression on cognitive function, including diagnosis and treatment. Although depression was controlled as a covariate in this study, whether the relationship between the BRS and MMSE-KC is different in participants with and without depression needs to be analyzed.

However, this study has several strengths. First, this was a prospective study that showed an association between baseline stress resilience ability and 2-year cognitive decline, which allows for more temporal relationships than previous cross-sectional studies. Second, this study included a neuropsychological battery test to assess global cognitive function. Third, we used KFACS cohort data, which included a relatively large number of community-dwelling older adults and represented the Korean older population.

In conclusion, improved stress-coping ability is associated with a slower rate of decline in global cognitive function.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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