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Social Activity and Cognitive Function of Older Adults: The Moderating Effect of Eelf-Perception of Aging

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This study examined whether subjective age (SA) protects against the adverse effects of low social activity on cognitive function in older people. Data from the National Survey of Older Koreans collected during the COVID-19 pandemic were analyzed to test this hypothesis. Among the 10,097 older adults aged 65 and older, 9,878 who met the inclusion criteria were selected. Participants were classified into "older SA" (n = 6,437) and "youthful SA" (n = 3,441). The results demonstrated that low social activities decreased cognitive function (B = .55, t = 6.20, p < .001), and this effect was more pronounced in the older SA group (B = .82, t = 11.55, p < .001), suggesting that the older SA group is more vulnerable to limited social activities. During the COVID-19 pandemic, the reduced social activity of older adults negatively affected their cognitive function. However, these results suggest that maintaining a youthful mind can protect older adults against the adverse effects of limited social activity on cognitive function.

Keywords: social activity, cognitive function, subjective age

Introduction

The coronavirus disease (COVID-19) pandemic has affected many aspectfs of our lives. In March 2020, the World Health Organization (WHO) declared a global pandemic (WHO, 2020), and countries worldwide began to prepare quarantine systems to prevent the spread of this infectious disease. The core of the quarantine system is preventing the spread of virus through social distancing. Korea raised the crisis alert level to 'level 2' since the first coronavirus case was confirmed in January 2020 (Korea Disease Control and Prevention Agency, KDCA, 2020). Various levels of social distancing have been implemented since. Statistics from the KDCA, dated July 2022, show that 93% of deaths due to COVID-19 occurred in 60 year-old individuals or older and that the mortality rate in 80 year-olds and older was 2.69% (KDCA, 2022).

The high mortality rate of older people and the closure of public facilities, including welfare centers for older adults, due to social distancing limited the social activities of older adults. This phenomenon is evident in the National Survey of Older Koreans conducted before and after COVID-19 (Korea Institute for Health and Social Affairs, 2020). The survey defined social activities as participation in cultural leisure, education, club attendance, social group meetings, political and social organization gatherings, and volunteering. Older adults who participated in the 2020 survey after the COVID-19 outbreak were less engaged in social activities than those who participated in the 2017 survey before COVID-19. According to a study investigating the psychosocial changes of older adults during the COVID-19 pandemic, 86.1% of older adults experienced changes in their daily life after the outbreak of COVID-19 (Gyeonggi Senior Counseling Center, 2021). The main diffi-

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culties they faced were "limited meeting with family and acquaintances (37%)," "limited going out or traveling (21.2%)," and "restrictions on hobbies and religious activities (14.7%)."

Although aging is inevitably accompanied by cognitive decline and dementia, individual differences exist in the manifestation of symptoms and the onset of dementia. Cognitive reserve, introduced to explain individual differences, is the capacity of the brain to delay the manifestation of brain pathology (Stern, 2002). First, educational level and occupational achievement were identified as proxies for cognitive reserve, and the protective roles of education and occupation against cognitive decline and dementia onset were repeatedly confirmed through studies (Brayne et al., 2010; Hall et al., 2007; Manly et al., 2005; Shin et al., 2020; Stern et al., 1992; Stern et al., 1994). Recently, social activity has attracted attention as a factor that influences cognitive reserve. Increased engagement in social pursuits is associated with increased cognitive ability (Marioni et al., 2015) and a lower risk of dementia (Wang et al., 2002); whereas social isolation negatively affects cognitive function (Evans et al., 2019) and increases the risk of dementia (Shen et al., 2022). In addition, longitudinal studies, including the English Longitudinal Study of Ageing (Rafnsson et al., 2020) and the Longitudinal Betula study in Sweden (Sundström et al., 2020), have shown that lonelinessis associated with a greater risk of dementia. Furthermore, social isolation is negatively associated with brain volume, including the temporal and frontal lobes and the hippocampus (Shen et al., 2022), and loneliness is associated with a higher cortical amyloid burden (Donovan et al., 2016). As such, various types of social activities positively affect cognitive function in older adults, whereas reduced social activities negatively affect cognitive function. Therefore, it is evident that restrictions on social activity during the COVID-19 pandemic have negatively affected cognitive function in older adults. Furthermore, recent studies have shown that social isolation during the COVID-19 impaired cognitive function (Ingram et al., 2021) and increased the dementia risk (Noguchi et al., 2021).

However, each person has a different way of coping with a situation. According to the stress-coping model of Lazarus (Lazarus, 1966), depending on the evaluation of the problem (i.e., stress source) and one's coping resources, the stress experience may vary, which may have a completely different effect on an individual's life. Subjective age (SA) has recently emerged as a protective factor for mental health in older adults. SA is a personal perception of the aging process (Gendron et al., 2018), which has a multidimensional construct (Kaufman & Elder Jr, 2002; Uotinen et al., 2003). A recent review reported that SA research has increased rapidly over the past five years, mainly in the United States, Germany, Sweden, Canada, and the United Kingdom (Hausknecht et al., 2020). These studies have investigated the SA with various terms such as 'attitude toward one's age', 'aging well', 'aging body', 'aging stereotype', 'subjective age', 'meaning of aging', and so forth. Studies have shown that SA is associated with physical health. For example, a positive self-perception of aging is related to longevity (Levy et al., 2002), and older SA increases cardiovascular disease risk (Stephan et al., 2021).

In addition, SA is also associated with mental health. Youthful SA is positively associated with subjective well-being and cognitive function and negatively associated with depressive symptoms (Alonso Debreczeni & Bailey, 2021). Previous studies have examined the underlying mechanisms by which SA affects physical and psychological health. They showed that younger SA was associated with high self-efficacy (Stephan et al., 2011), a healthy lifestyle (Stephan et al., 2014), and an optimistic attitude toward aging (Schafer & Shippee, 2010). In other words, according to the stress-coping model, individuals with younger SA have more resources to cope with stress; therefore, they are more likely to cope with situations that can negatively affect individuals.

SA is a multidimensional construct, ranging from a more personal view of aging to a more general view that includes perceptions of aging (Kaufman & Elder Jr, 2002; Uotinen et al., 2003). Previous studies have primarily defined SA from a personal view (Barak et al., 2006; Smith & Baltes, 1999; Teuscher, 2003; Uotinen, 1998), including feel age (how old do you feel?), desired age (how old do you want to be?), and look age (how old do you think you look?). A different construct of SA taps into the different aspects and underlying mechanisms of SA, and has unique implications (Barak, 2009; Shinan-Altman & Werner, 2019). However, a more general view of aging remains largely unstudied, such as perceived old age (at what age do you think old age begins?). Only a few studies have addressed perceived old age (Daignault et al., 2021; Kaufman & Elder Jr, 2002; Shinan-Altman & Werner, 2019). Since various factors, such as cul-

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tural values, personal experiences, health status, and social roles, influence individuals' perceptions of old age (Daignault et al., 2021; Kleinspehn-Ammerlahn et al., 2008; Stephan et al., 2015), perceived old age reflects individuals' beliefs and attitudes toward aging. Furthermore, it can shape how individuals view and interact with the environment, and in turn, affect their well-being and attitudes toward life. Therefore, being aware of one's aging process based on one's own defined age at the beginning of old age (i.e., perceived old age) may influence attitudes against stress.

This study aimed to examine whether SA plays a protective role against the adverse effects of low social activity on cognitive function in older adults. It was hypothesized that low social activity would have less impact on cognitive decline in people with youthful SA. Data from the National Survey of Older Koreans were analyzed to test this hypothesis. The National Survey of Older Koreans is conducted once every three years. The most recent survey analyzed in this study was completed in 2020 after the outbreak of COVID-19; therefore, it may well reflect the lives of older adults during the COVID-19 pandemic.

Methods

Study Design and Participants

This study analyzed data collected in 2020 from The National Survey of Older Koreans conducted by the Korea Institute for Health and Social Affairs (Korea Institute for Health and Social Affairs, 2020). The National Survey of Older Koreans is a nationwide survey conducted every three years based on the welfare of senior citizens. This survey was designed to collect information on the health, everyday functioning, leisure and social activities, economic status, family and social relationships, and living environment of seniors aged 65 years or older. The first survey was conducted in 2008, the 5th survey was completed in 2020. A total of 10,097 older adults aged 65 and older participated in the 5th survey from March to November 2020. Data were downloaded from the Health and Welfare Data Portal (https://data.kihasa.re.kr/) of the Korea Institute for Health and Social Affairs. This study was exempt from review by the Ethics Committee, as it used publicly available panel data.

Procedure

This study used data from 5th survey from The National Survey of Older Koreans (Korea Institute for Health and Social Affairs, 2020). The participants were screened based on the following criteria: 1) completed the questionnaire including social activity and social age, and 2) had an available score for the Korean version of the Mini-Mental State Examination for Dementia Screening (MMSE-DS). Among the 10,097 older adults, 9,878 who met the inclusion criteria were selected. Participants were classified into two groups based on their SA. SA was obtained by subtracting perceived old age from chronological age. If SA was 0 or more, they were classified as an 'older SA group'; if SA was less than 0, they were classified as a 'youthful SA group.' Among the 9,878 participants, 6,437 (65.2%) were classified into the older SA group and 3,441 (34.8%) into the youthful SA group.

Measures

Social activity

Social activities were defined as the total number of activities in which older adults participated in the past year. The types of social activities included leisure or cultural activities, educational activities, club attendance, social group meetings, political or social organization gatherings, and volunteering activities. Possible scores range from 0 to 6. A high score indicated active social activity.

Cognitive function

Cognitive function was assessed by using the Korean version of the MMSE-DS (Kim et al., 2010). The MMSE-DS assesses general cognitive functioning using scores for time and place orientation, attention and concentration, memory, language and related functions, and visuoconstructional functioning. The maximum possible score was 30 points. A higher score indicates better cognitive function.

Subjective age (SA)

SA was defined based on the perceived old age. Perceived old age was measured using the question, "At what age do you think old age begins?" SA was defined as the discrepancy score between the participants' chronological age and what they perceived to be old age (Kaufman & Elder Jr. 2002). A positive discrepancy score

means that their actual age is beyond the age they defined as the beginning of old age, indicating that they feel old. A negative value of the difference means that their actual age is less than the age they defined as the beginning of old age, indicating that they feel that they are not yet old. Participants were classified into two groups based on the value of the difference. If the difference value was 0 or more, they were classified in the older SA group; if the difference value was less than 0, they were classified in the youthful SA group.

Statistical Analysis

Descriptive data were compared using the *t*-test or χ^2 test. Model 1 of the PROCESS macro was used to examine the moderating effect of SA on the relationship between social activities and cognitive function (95% CI, k = 5,000) (Hayes, 2015) adjusted for variables that could affect cognitive function, including demographic variables (age, sex, education, employment, marital status, and region), health-related variables (smoking, alcohol consumption, exercise, subjective wellness, number of chronic diseases, and depression), and everyday function (activities of daily living and instrumental activities of daily living). IBM SPSS ver. 26.0 software (IBM, 2019) and PROCESS Macro SPSS version 4.0 (Hayes, 2015) were used for all the statistical analyses.

Results

The participants' characteristics are presented in Table 1. The mean age of the older SA group was 76.39 (± 6.03), which was higher than that of the youthful SA group (68.82 ± 2.82). The perceived mean of old age was 68.82 (± 3.50) in the older SA group and 72.97 (± 4.16) in the youthful SA group. The older SA group believed that old age began at an earlier age. Education year was higher in the youthful SA group (10.17 ± 3.12) than in the older SA

Table 1. *General Information about Participants by SA Group*

Variables		Older SA (*n* = 6,437)	Youthful SA (*n* = 3,441)	t/χ^2
Age		76.39 (6.03)	67.93 (2.82)	-94.87***
Education		7.13 (4.01)	10.17 (3.12)	41.56***
Sex	Male	3,994 (62.0%)	1,932 (56.1%)	32.53***
	Female	2,443 (38.0%)	1,509 (43.9%)	
Employment	Yes	1,876 (29.1%)	1,882 (54.7%)	620.99***
	No	4,561 (70.9%)	1,559 (45.3%)	
Spouse	Yes	3,447 (53.5%)	2,372 (68.9%)	219.23***
	No	2,990 (46.5%)	1,069 (31.1%)	
Region	Urban area	4,413 (68.6%)	2,649 (77.0%)	78.12***
	Rural area	2,024 (31.4%)	792 (23.0%)	
Smoking	Yes	564 (8.8%)	513 (14.9%)	87.21***
	No	5,873 (91.2%)	2,928 (85.2%)	
Alcohol	Yes	1,953 (30.3%)	1,712 (49.8%)	362.11***
	No	4,484 (69.7%)	1,729 (50.2%)	
Exercise	Yes	3,181 (49.4%)	1,979 (57.5%)	58.89***
	No	3,256 (50.6%)	1,462 (42.5%)	
Subjective wellness		3.17 (0.88)	3.65 (0.76)	28.36***
Number of Chronic diseases		2.03 (1.53)	1.46 (1.27)	-19.86***
Activity of daily living		0.24 (1.27)	0.06 (0.66)	-9.52***
Instrumental activity of daily living		0.84 (3.02)	0.16 (1.40)	-15.22***
SGDS		3.64 (3.58)	2.88 (2.99)	-11.15***
Social activity		1.25 (0.88)	1.66 (0.92)	21.45***
MMSE-DS		23.38 (5.19)	26.07 (5.08)	24.84***

Data were shown as M (SD) or N (%).
SA = Subjective age; SGDS = Short Form of Geriatric Depression Scale; MMSE-DS = Korean version of Mini-Mental State Examination for Dementia Screening.
****p < .001.*

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Table 2. *Moderation Effect of SA between Social Activity and Cognitive Function (Unadjusted Model)*

Variables	B	*SE*	*t*	LLCI	ULCI	R^2	*F*
Social activity	.91	.09	9.83***	.73	1.10		
SA[a]	-3.15	.21	-15.21***	-3.56	-2.75	.11	414.93
Social activity × SA[a]	.67	.12	5.75***	.44	.90		

SA = Subjective Age; CI = Confidence Interval; LL = Low Limit; UL = Upper Limit.
[a]Older SA was coded as 1.
****p < .001.*

Table 3. *Moderation Effect of SA between Social Activity and Cognitive Function (Adjusted Model[a])*

Variables	B	*SE*	*t*	LLCI	ULCI	R^2	*F*
Social activity	.55	.09	6.20***	.38	.73		
SA[b]	-.71	.22	-3.27**	-1.14	-.29	.22	152.51
Social activity × SA[b]	.27	.11	2.45*	.05	.49		

SA = Subjective Age; CI = Confidence Interval; LL = Low Limit; UL = Upper Limit.
[a]This model was employed after controlling for the confounding variables, including demographic variables (age, sex, education, employment, marital status, and region), health-related variables (smoking, alcohol consumption, exercise, subjective wellness, number of chronic diseases, and depression), and everyday function (activities of daily living and instrumental activities of daily living); [b]Older SA was coded as 1.
**p < .05, **p < .01, ***p < .001.*

group (7.13 ± 4.01). The proportion of women was higher in the youthful SA group (43.9%) than in the older SA group (38%). Participants in the older SA group were more likely to live alone, not work, have no spouse, live in rural areas, do not smoke, and do not drink alcohol. They also had more chronic diseases and higher depression scores than the youthful SA group. The youthful SA group had better subjective wellness, activities of daily living (ADL), and instrumental activities of daily living (IADL) than the older SA group. The participants in the older SA group were lower in the MMSE-DS total score (23.38 ± 5.19) and the number of social activities (1.25 ± 0.88) compared to the youthful SA group.

The moderating effect of SA on the relationship between social activities and cognitive function was analyzed using PROCESS macro model 1. A multicollinearity diagnosis showed that the tolerance of all variables was more than 0.1, and the variance inflation factor (VIF) of all variables did not exceed 10, indicating that there was no multicollinearity problem.

The moderation effect of SA was initially analyzed in an unadjusted model without controlling for confounding variables (Table 2). Social activities were found to positively affect cognitive function (B = .91, t = 9.83, p < .001), whereas SA negatively affects cognitive function (B = -3.15, t = -15.21, p < .001). Furthermore, the analysis indicated that the effect of social activities was moderated by SA (B = .67, t = 5.75, p < .001). Subsequently, as differences were observed in variables related to demographics, health, and everyday functioning between the two groups, all of these variables, including age, particularly relevant to SA, were controlled for in the adjusted model (Table 3). Even after controlling for these confounding variables, the results remained consistent with those obtained in the unadjusted model. Specifically, social activities continued to positively affect cognitive function (B = .55, t = 6.20, p < .001), while SA still negatively affects cognitive function (B = -.71, t = -3.27, p < .01). Additionally, the interaction between social activities and SA remained significant (B = .27, t = 2.45, p < .05), suggesting that the effect of social activities on cognitive function was moderated

Table 4. *Conditioned Effect of SA on Cognitive Function (Adjusted Model[a])*

Group	B	*SE*	*t*	LLCI	ULCI
Older SA	.82	.07	11.55***	.68	.96
Youthful SA	.55	.09	6.20***	.38	.73

SA = Subjective Age; CI = Confidence Interval; LL = Low Limit; UL = Upper Limit.
[a]This model was employed after controlling for the confounding variables, including demographic variables (age, sex, education, employment, marital status, and region), health-related variables (smoking, alcohol consumption, exercise, subjective wellness, number of chronic diseases, and depression), and everyday function (activities of daily living and instrumental activities of daily living).
****p < .001.*

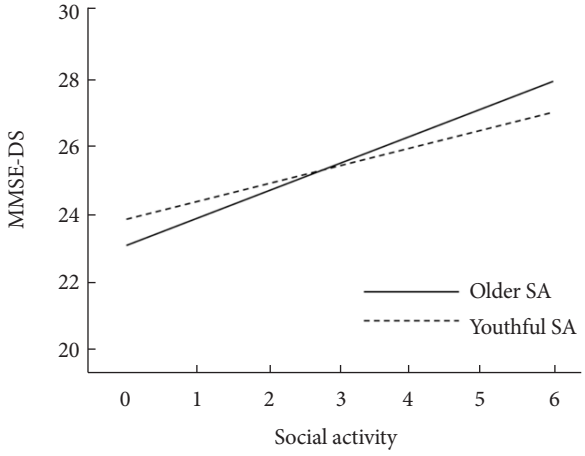

Figure 1. *Conditioned effect of social activity on cognitive function by SA group.*
MMSE-DS = Korean version of the Mini-Mental State Examination for Dementia Screening; SA = Subjective age.

by SA. Table 4 presents the conditional effects of the group. The coefficient of social activities in the older SA group was B = .82 (t = 11.55, p < .001), while that in the youthful SA group was B = .55 (t = 6.20, p < .001), indicating the positive effect of social activities on cognitive function was higher in the older SA group than in the youthful SA group (Figure 1). In other words, reduced social activity had a more deleterious effect on cognitive function in the older SA group than in the youthful SA group.

Discussion

This study examined the moderating effect of SA on the relationship between social activities and cognitive function in older adults. The results of this study demonstrate that low social activities decrease cognitive function, and this effect is more pronounced in the older SA group, suggesting that the older SA group is more vulnerable to cognitive dysfunction due to limited social activities.

Social activities positively affected cognitive function, consistent with previous studies showing that social activities are associated with higher cognitive function (Marioni et al., 2015) and a lower risk of dementia (Wang et al., 2002). The cognitive reserve theory explains this phenomenon as the effect of continuous and repeated brain stimulation inherent in social activities. Reduced social activities limit various intellectual, occupational, physical, and interpersonal activities mediated by social engagement. This stimulation allows the brain to operate efficiently through plastic changes, such as increased cerebral blood flow in the resting state, brain network connectivity, and integration of brain white matter (Chapman et al., 2013). In a study that investigated the effects of social participation on cognitive function in older adults at risk of dementia, participants were involved in various types of assistant work at an elementary school for 15 hours per week for six months. The participants showed improved cognitive control compared with the control group and significant functional changes in brain areas involved in attentional control, such as the left dorsal prefrontal cortex, ventral prefrontal cortex, and anterior cingulate cortex (Carlson et al., 2009). Given that cognitive control declines with age (Braver et al., 2005; Craik & Byrd, 1982), social engagement appears protective against brain aging. The results of this study also support the previous findings.

Although the decline in social activity cannot be directly attributed to the outbreak of COVID-19, the data collected in 2017, prior to the pandemic, quite differ from the data collected in 2020, during the COVID-19 pandemic. In the 2017 survey, both the mean of social activity score (1.52 ± 0.91) and MMSE-DS score (25 ± 3.89) are significantly higher compared to the 2020 survey (1.40 ± 0.91 for social activity, 24.32 ± 5.31 for MMSE-DS). This difference is notable because the 2020 participants were younger and more educated than those in 2017, suggesting that the cognitive function of the 2020 participants should be superior. Thus, while participants in 2017 and 2020 were not identical, these differences have implications for the impact of COVID-19 on social activity, as participants in each survey were recruited nationwide based on demographic data, and the sample size was sufficiently large.

The moderating effect of SA on the relationship between social activity and cognitive function was significant, and the significant moderating effect of SA persisted even after controlling for chronological age. These findings provide clear evidence that the moderation effect of SA cannot be solely explained by chronological age, despite the relevance of SA to chronological age. The impact of social activities on cognitive function was more substantial in the older SA group than in the youthful SA group, indicating that limited social activities had a more negative effect on cognitive function in the older SA group. These results suggest that limited

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social activities during COVID-19 may have a more significant negative impact on those who consider themselves older adults.

The mechanism by which the subjective perception of aging acts as a protective factor for physical and mental health is unclear. There were differences in several variables, including demographic variables, health-related variables, and everyday function, between the two groups in this study. These variables may reflect characteristic features of these two groups; however, they cannot explain the underlying mechanism because the moderating effect was calculated after accounting for these confounding variables. Several studies have suggested possible mechanisms for this phenomenon. For example, individuals who perceive themselves as younger possess a positive attitude toward cognitive aging (Schafer & Shippee, 2010), and feeling younger increases life satisfaction through self-efficacy in memory (Stephan et al., 2011). Stereotype embodiment theory (Levy, 2009) posits that negative age stereotypes can affect attitudes toward an individual's life. These studies suggest that those who consider themselves to be aged adopt passive and avoidant instead of active and adaptive problem-solving attitudes. This negative attitude lowers feelings of control over one's life and can negatively affect psychological adaptation. On the other hand, Stephan et al. (2014) showed that a positive attitude could increase psychological well-being. In a follow-up study of 1,352 older adults aged 50-75 years, subjective perception of being younger was related to a lower body mass index (BMI) and frequent physical activity, which increased episodic memory and executive function, respectively. This result suggests that older adults who perceive themselves as younger maintain a healthy lifestyle and eating habits, and that this personal character plays a protective role against cognitive aging.

Ultimately, the subjective perception of aging affects attitudes toward interpreting and coping with various changes that individuals face as they grow older. Langer (2009) showed that psychological belief and expectation could affect the physical condition in the 1979 Counterclockwise study. The study participants who spent five days in a residence that perfectly recreated the environment 20 years ago, as if they were living in that era, showed positive changes in their health, including hearing, memory, dexterity, and appetite (Langer, 2009). Pagnini et al. (2019) value the Counterclockwise experiment as the first study showed a strong connection between mind and body, arguing that one reason for falling into negative stereotypes about aging is a loss of perceived control. SA is the degree to which a person perceives their own aging process by incorporating it at various psychological, social, and biological levels. Thus, it is likely that people who subjectively perceive themselves as older adults have a low sense of psychological, social, and biological control over their lives. This low sense of control may make it easier for people to accept negative stereotypes about aging.

This study has clinical implications insofar as it analyzed large-scale nationwide data and investigated the relationship between social activities and cognitive function in older adults during COVID-19. In this study, the impact of reduced social activity on cognitive function was more substantial among participants who perceived themselves as older adults. These results suggest that maintaining psychological youth is beneficial in our lives and provide empirical evidence as to why we should keep youthful minds. Perceiving themselves as non-older adults protects individuals from the adverse effects of reduced social activity on cognitive function. Therefore, it will be possible to strengthen the protective shield against cognitive decline by exploring the factors affecting the subjective perception of aging. In this study, the youthful SA group had more education, better subjective health status and daily function, fewer chronic diseases, and more socioeconomic activity than the older SA group. Continuous education, participation in socioeconomic activities, and chronic disease maintenance can play a positive role in maintaining a youthful mind, as they can be achieved through individual or social efforts and social systems.

This study had several limitations. First, the cognitive function test used in this study was developed for screening purposes. Thus, it is insufficient for detecting a cognitive decline in the cognitive domain. Therefore, future studies should examine which cognitive functions are particularly affected by reduced social activity using comprehensive neuropsychological tests. Second, the data used in this study were collected nationwide using surveyors. Thus, it is possible that the characteristics of the surveyors and the environment in which the survey was conducted influenced the data. Therefore, it is necessary to consider this when interpreting these results. Third, this study did not explore the mechanism by which SA affects cognitive health. Understanding this could be

the basis for interventions in healthy aging. Future research must employ appropriate study designs, such as investigating mediation effects or utilizing longitudinal models, to comprehensively explore the underlying mechanisms. Fourth, the definition of subjective age may have inherent limitations when classifying individuals aged 80 and above, as they often surpass the conventional age threshold associated with the onset of old age. Among these older adults, individuals who acknowledge having exceeded the age traditionally regarded as old yet continue to maintain an active and vibrant lifestyle may exist. To address this concern and minimize its potential impact on the results, a reanalysis was conducted, restricting the study sample to individuals under the age of 80 years. Subsequent analysis yielded results that were consistent with the original findings. For future research, it is essential to explore methods that can accurately measure the subjective age of older adults aged 80 years and older, thereby enabling a more comprehensive exploration of the moderating influences associated with subjective age.

In conclusion, the social activity of older adults affected their cognitive function, and the negative influence of reduced social activity on cognitive function was more significant in the participants who perceived themselves as older adults. These results suggest that maintaining a youthful mind can protect older adults against the adverse effects of limited social activity on cognitive function.

Author contributions statement

Minyoung Shin is an assistant professor at the Seoul Graduate School of Counseling Psychology in South Korea. She is the sole author of this paper. She contributed to the development of the research topic, suggested the analytical strategy, performed the data analysis, interpreted the results, and drafted the manuscript.

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