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Different Effects of Cognitive and Non-exercise Physical Leisure Activities on Cognitive Function by Age in Elderly Korean Individuals

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Objectives: We aimed to examine the effects of various leisure activities on cognitive impairment in young-old (aged 65–74 years) and old-old (aged ≥ 75 years) adults.
Methods: In total, 10,279 elderly Korean individuals from the 2014 Korean National Survey on Older Adults' cohort were enrolled in our study. Cognitive impairment was assessed using the standardized score of the Mini-Mental State Examination for Dementia Screening, whereas leisure activities were recorded via self-reporting of the extent and type of leisure activity the subjects involved in over the past year. Multivariate logistic regression was used to assess the effect of leisure activities on cognitive impairment, while controlling for potential covariates.
Results: The subjects were more likely to participate in cognitive activities than in non-exercise physical activities. After controlling for selected covariates, involvement in cognitive activities was found to be a significant predictor of cognitive impairment in both the groups, whereas involvement in non-exercise physical activities was not a predictor of cognitive impairment in individuals aged ≥ 75 years. Moreover, depressive symptoms, rural residence, and hearing difficulties were common predictors of cognitive impairment among elderly-Korean-individuals.
Conclusion: Leisure activity involvement may help delay cognitive impairment, which is often concomitant with aging. Hence, an early intervention service may significantly benefit both young-old and old-old individuals.

Key Words: cognition, leisure activities, aged

INTRODUCTION

Cognitive aging, a decline in cognitive processing that occurs with increasing age, is observed in various basic processes of learning, memory, language, and higher-order executive functioning [1]. Although such age-related cognitive decline occurs naturally with aging, this type of neurological problem has raised considerable concerns, given that the increase in lifespan in most countries has concomitantly caused an increase in the proportion of individuals with impaired cognitive function [2]. Epidemiological data has shown that the number of Korean people diagnosed with dementia was approximately 540,755 (8.74% of people aged ≥ 65 years) in 2012. Similarly, 35.6 million people were diagnosed with dementia worldwide in 2010 [3,4]. Cognitive impairment may affect an individual's ability to live independently, which may consequently lead to functional challenges on a daily basis and a reduced quality-of-life [5,6].

Therefore, it is vital to identify modifiable factors to provide interventions for cognitive function maintenance and delay the onset of dementia in the older population.

Leisure activities, known as cognitively stimulating activities, may serve as a buffer against the neuropathological changes associated with dementia [7,8]. Accumulating evidence suggests that involvement in leisure activities may have protective effects on cognition, from the cellular level to the overall cognitive health [7,9]. According to the cognitive reserve theory, greater cognitive reserve is associated with greater resilience to neuropathological damage in the brain [10]. In addition to well-known factors such as education and complex occupations, frequent involvement in cognitively stimulating activities may lead to fewer cognitive deficits through improved neural processing efficiency and neural plasticity in the brain [11]. Particularly, cognitive engagement in leisure activities may facilitate cognition by preventing brain atrophy and β-amyloid burden, the percentage of areas occupied by β-amyloid across various brain regions [9,12].

Since the introduction of a new nomenclature for aging, including the labels of “young-old” and “old-old” in 1974 by Neugarten [13], studies have shown that the elderly population is not a homogeneous group of people considering cognitive impairment risk. According to the latest epidemiological study, the prevalence of dementia in young-old and old-old groups differs remarkably, ranging from 2.1% (those aged 65–74 years) to 6.9% (those aged 75–84 years) [14]. Similarly, the prevalence of dementia in Korean elders aged ≥ 75 years is much higher (11.3%–30.5%) than that in elderly people aged 65 to 74 years (3.6%–5.2%) [15].

A large number of studies have evaluated the preventive effect of leisure activities on cognitive impairment in old adults. However, very few studies have focused on whether there is a difference in the effects of leisure activities on cognitive impairment between age strata among the elderly. Moreover, previous studies have not indicated any leisure activities that may be more beneficial for preventing cognitive impairment depending on age strata. In previous studies, leisure activities have been broadly divided into cognitive and physical activities [16], and were both found to have beneficial effects on late-life cognition [7,17]. In the Bronx aging study, the cognitive type was found to have a significant effect on cognitive impairment, whereas the physical type did not have any noticeable effect on cognitive function among the participants aged ≥ 75 years [18]. Another cohort study on Austrian elderly population showed similar results [19]. However, as these studies were limited to individuals aged ≥ 75 years, it is unclear whether the beneficial effects of leisure activities on cognitive function differ according to age strata or activity type.

Depressive disorders need to be considered as a covariate in assessing the relationship between leisure activities and cognitive function. Changes in mood such as increased depressive symptoms/depression frequently occur in elderly people and are known to be associated with decreased cognitive function [20]. Additionally, several studies have evaluated the preventive effect of leisure activities on cognitive impairment in old adults after controlling for depressive symptoms/depression [7]. Therefore, this study aimed to compare the effects of 2 types of leisure activities, cognitive and non-exercise physical activities, on cognitive impairment, between young-old and old-old adults, and explore the possible cognitive impairment predictors in these age groups.

MATERIALS AND METHODS

1. Research design

This cross-sectional, analytic study was designed to explore the relationship between leisure activities and cognitive impairment according to age strata and leisure activity type among elderly Korean individuals aged ≥ 65 years.

2. Data source and participants

The dataset used in this study was obtained from the Korean National Survey on Older Adults (KNSOA), which was a national survey conducted by the Ministry of Health and Welfare of Korea from June 11, 2014 to September 4, 2014. This survey used a stratified, 2-stage cluster sampling approach to ensure that the resulting sample was representative of the country. The whole nation was stratified into 7 metropolitan cities and 9 provinces, and further divided into administrative districts such as ‘Dong’ and ‘Eup-Myeon’. The stratified districts were selected through systematic sampling, and sample households were randomly extracted. Interviewers visited sample households and collected data through individual interviews.

The KNSOA respondents included 10,451 community-dwelling Korean adults aged ≥ 65 years, residing in 1 of 16 metropolitan/provincial areas. During the process of building a dataset for our study, individuals who had a score for the Mini-Mental State Examination for Dementia Screening (MMSE-DS), and answered questions regarding leisure activities were selected from the original database. After excluding cases with missing data for the main variables, 10,279 participants were included in the final sample for this study, including 6,111 young-old adults and 4,168 old-old adults. The original national survey was approved by Statistics Korea (No. 11771). We obtained approval for this study from the Institutional Review Board of College of Nursing, Chungnam National University (No. 2-1046881-A-N-01-201701-

HR-003-09).

3. Measures

1) Cognitive impairment

Global cognitive function was evaluated using a Korean version of the MMSE-DS. The MMSE-DS has been widely used as a national screening tool for cognitive impairment in older adults [21]. The MMSE-DS comprises 30 items providing information regarding orientation to time/place, registration and recall, attention and calculation, naming, complex commands, spatiality, and judgment. Gender-, age-, and education-specific cutoff scores of the MMSE-DS were used to define cognitive impairment in this study. Scores higher than the suggested cutoff points indicated absence of cognitive impairment. This test was confirmed as a highly valid, reliable tool for use in elderly Korean individuals [21].

2) Leisure activities

Leisure activities were determined in the participants based on a question regarding engagement (e.g., "Have you ever participated in any leisure activity over the past year?"), and questions on 3 types of indoor/outdoor leisure activities they were commonly involved in over the past year. Activities listed by the participants in the survey were classified into 24 activities, and subsequently categorized as cognitive activities or non-exercise physical activities based on Stern and Munn's criteria [16]. Cognitive activities included intellectual/mental activities such as reading books, playing cards, and playing musical instruments. Non-exercise physical activities involved unstructured and unplanned physical activities that did not focus on improving physical fitness (e.g., power/endurance/strength) but were instead performed for enjoyment, including walking, dancing, and playing football. Watching television was not included as a leisure activity based on previous studies' results, wherein watching television was associated with an increased risk of cognitive impairment development [22]. The participation of individuals in each leisure activity type was coded on a binary form that indicated whether an individual participated in cognitive/non-exercise physical activities.

3) Depressive symptoms

The Geriatric Depression Scale Short Form (GDS-SF) was used to determine depressive symptoms in older adults [23]. The participants were asked to respond with a "yes" or "no" to 15 items. A score between 0 and 7 was considered normal, whereas a score of > 7 was considered to indicate depressive symptoms. The reliability and validity of the Korean version of the GDS-SF were pre-established in a study involving elderly, Korean psychiatric patients [24].

4) Demographic and health-related characteristics

Personal characteristics were selected as potential confounders based on previous studies [25–30]. Demographic characteristics included age, educational level, gender, occupational status, living status, and residential location. Health-related characteristics included behaviors such as smoking/alcohol consumption, body mass index (BMI; obese or non-obese), number of comorbid diseases, and hearing and visual difficulties.

4. Statistical analysis

All analyses were conducted using SPSS Statistics software version 22.0 (IBM Co., Armonk, NY, USA). Descriptive statistics were used to describe the demographic and health-related characteristics of the sample, and comparative analyses were performed to identify homogeneity between groups. The chi-square test and independent *t*-test were used to compare the prevalence of cognitive impairment between the young-old and old-old groups, and identify the differences in the prevalence of cognitive impairment based on demographic and health-related characteristics, within and across groups. Multivariate logistic regression was used to examine the relationship between cognitive impairment and engagement in leisure activities, while controlling for selected demographic and health-related characteristics. The final model included cognitive impairment as a dependent variable and 9 characteristics as independent variables. Each independent variable was selected based on the results of *post-hoc* analyses.

RESULTS

1. Sample characteristics

The characteristics of the sample are presented in Table 1. The mean age of the participants was 73.7 years (standard deviation [SD], 6.5 years; range, 65–105 years), and more than half of the participants were elementary school graduates or elderly females. Approximately three-quarters of the participants were unemployed, lived with their families, or resided in urban areas. Significant differences in all demographic characteristics were observed between the two groups. Individuals in the old-old group were more likely to be less-educated, women, currently unemployed, living alone, and residing in rural areas, than those in the young-old group ($p < 0.001$). More than 70% of the participants had good health habits in terms of smoking/alcohol consumption. The average number of comorbid diseases was 2.6 (SD, 1.8; range, 0–15). Less than 40% of participants had depres-

Table 1. Demographic and health-related characteristics of elderly Korean individuals

Characteristic	All participants (n = 10,279)	Young-old group (n = 6,111)	Old-old group (n = 4,168)	χ^2 or t[a]
Education (y)				494.09
≤ 6	6,213 (60.4)	3,153 (51.6)	3,061 (73.4)	
> 6	4,066 (39.6)	2,959 (48.4)	1,107 (26.6)	
Gender				101.11
Male	4,292 (41.8)	2,799 (45.8)	1,493 (35.8)	
Female	5,987 (58.2)	3,312 (54.2)	2,675 (64.2)	
Occupational status				94.22
Currently employed	2,970 (28.9)	2,175 (35.6)	795 (19.1)	
Unemployed	7,309 (71.1)	3,936 (64.4)	3,373 (80.9)	
Living status				277.64
Alone	2,390 (23.2)	1,070 (17.5)	1,320 (31.7)	
Not alone	7,890 (76.8)	5,041 (82.5)	2,848 (68.3)	
Residential location				94.22
Urban	7,870 (76.6)	4,884 (79.4)	2,986 (71.6)	
Rural	2,409 (23.4)	1,227 (20.1)	1,182 (28.4)	
Number of comorbid diseases	2.6 ± 1.8	2.4 ± 1.8	2.8 ± 1.8	−9.79
Smoking				59.44
Yes	1,221 (11.9)	850 (13.9)	370 (8.9)	
No	9,058 (88.1)	5,261 (86.1)	3,797 (91.1)	
Alcohol consumption				203.20
Yes	2,842 (27.6)	2,007 (32.8)	834 (20.0)	
No	7,438 (72.4)	4,104 (67.2)	3,333 (80.0)	
Body mass index				163.44
Normal	4,592 (44.7)	2,412 (39.5)	2,180 (52.3)	
Overweight or obese	5,670 (55.2)	3,686 (60.3)	1,984 (47.6)	
Missing data	18 (0.2)	13 (0.2)	4 (0.1)	
Depressive symptoms				220.58
Yes	3,397 (33.0)	1,671 (27.3)	1,726 (41.4)	
No	6,864 (66.8)	4,428 (72.5)	2,436 (58.5)	
Missing data	18 (0.2)	13 (0.2)	5 (0.1)	
Hearing difficulties				466.54
Yes	2,531 (24.6)	1,041 (17.0)	1,490 (35.7)	
No	7,748 (75.4)	5,070 (83.0)	2,678 (64.3)	
Visual difficulties				154.50
Yes	4,055 (39.4)	2,108 (34.5)	1,947 (46.7)	
No	6,224 (60.6)	4,004 (65.5)	2,221 (53.3)	

Values are presented as number (%) or mean ± standard deviation.
[a]$p < 0.001$.

sive symptoms as well as hearing and visual difficulties. The participants in the young-old group were more likely to smoke, consume alcohol, and become obese than those in the old-old group ($p < 0.001$). As expected, the old-old group had more health problems, including depressive symptoms and hearing and visual difficulties than the young-old group.

2. Leisure activities and cognitive impairment between groups

Individuals were more likely to participate in cognitive activities (n = 8,439) than in non-exercise physical activities (n = 3,215). Approximately 10% (n = 1,196) of the participants had not engaged in any leisure activity over the past year, and similar engagement in cognitive activities was observed in both groups (Table 2). Engagement in non-exercise physical activities differed between groups; more participants in the young-old group engaged in non-exercise physical activities than those in the old-old group (χ^2 =130.00, $p < 0.001$) With regard to cognitive impairment, 31.4% (n = 3,225) of all participants had lower scores than the gender-, age-, and education-specific cutoff MMSE-DS scores. Particularly, participants in the old-old group were more likely to have cognitive impairment than those in the young-old group (χ^2 =59.06, $p < 0.001$).

3. Differences in cognitive impairment according to demographic and health-related characteristics

The prevalence of cognitive impairment significantly differed according to the educational level in the old-old group (χ^2 = 18.32, $p < 0.001$), thus indicating that individuals with less than an elementary school diploma were more likely to develop cognitive impairment than those with higher than elementary school education (Table 3). Occupational status was associated with cognitive impairment in the old-old group (χ^2 = 20.12, $p < 0.001$). Depending on the type of residential location, cognitive impairment differed significantly in both the young-old (χ^2 = 27.68, $p < 0.001$) and old-old groups (χ^2 = 21.81, $p < 0.001$). Alcohol consumption (χ^2 = 6.63, p = 0.010) and BMI (χ^2 = 5.29, p = 0.021) significantly influenced cognitive impairment in the old-old group, whereas no significant effect of these variables was observed in the young-old group. Other health-related variables such as the number of comorbid diseases, depressive symptoms, hearing and visual difficulties significantly influenced cognitive impairment in both groups.

4. Factors associated with cognitive impairment

Multiple-logistic-regression was performed to examine the effect of engagement in leisure activities on cognitive impairment in elderly, Korean individuals. The Hosmer-Lemeshow test was used to assess the similarity of expected and observed event rates in the subgroups; no significant result was observed (p = 0.602, young-old group; p = 0.574, old-old group). After adjusting for 9 variables including occupational status, residential location, smoking, alcohol consumption, number of comorbid diseases, BMI, depressive symptoms, and hearing and visual difficulties, both types of leisure activities and 6 variables were found to be significantly associated with cognitive impairment in all participants (Table 4). On conducting multivariate logistic regression analysis for each group, some differences emerged in factors associated with cognitive impairment, between young-old and old-old individuals. Particularly, non-exercise physical activities (odds ratio [OR], 1.16; 95% confidence interval [CI], 1.03–1.31), cognitive activities (OR, 1.21; 95% CI, 1.05–1.41), residential location (OR, 1.42; 95% CI, 1.24–1.64), depressive symptoms (OR, 1.28; 95% CI, 1.12–1.46), and hearing difficulties (OR, 1.41; 95% CI,

Table 2. Leisure activities and cognitive impairment

Category	All participants (n = 10,279)	Young-old group (n = 6,111)	Old-old group (n = 4,168)	χ^2 (p)
Non-exercise physical activities				130.00 (< 0.001)
Yes	3,215 (31.3)	2,175 (35.6)	1,040 (25.0)	
No	7,064 (68.7)	3,936 (64.4)	3,128 (75.0)	
Cognitive activities				8.39 (0.004)
Yes	8,489 (82.6)	5,102 (83.5)	3,387 (81.3)	
No	1,790 (17.4)	1,009 (16.5)	781 (18.7)	
Cognitive impairment				59.06 (< 0.001)
Yes	3,225 (31.4)	1,740 (28.5)	1,486 (35.6)	
No	7,054 (68.6)	4,371 (71.5)	2,682 (64.4)	

Values are presented as number (%).

Table 3. Differences in cognitive impairment according to socio-demographic and health-related characteristics

Characteristic	Young-old group (n = 6,111)		χ^2 or t (p)	Old-old group (n = 4,168)		χ^2 or t (p)
	Normal (n = 4,371)	Impairment (n = 1,740)		Normal (n = 2,682)	Impairment (n = 1,486)	
Education (y)			0.01 (0.927)			18.32 (< 0.001)
≤ 6	2,257 (51.6)	895 (51.5)		2,028 (75.6)	1,032 (69.4)	
> 6	2,114 (48.4)	844 (48.5)		654 (24.4)	454 (30.6)	
Gender			2.48 (0.116)			0.12 (0.725)
Male	1,974 (45.2)	825 (47.4)		955 (35.6)	538 (36.2)	
Female	2,398 (54.8)	915 (52.6)		1,727 (64.4)	948 (63.8)	
Occupational status			0.10 (0.758)			20.12 (< 0.001)
Currently employed	1,550 (35.5)	625 (35.9)		566 (21.1)	228 (15.4)	
Unemployed	2,821 (64.5)	1,115 (64.1)		2,116 (78.9)	1,257 (84.6)	
Living status			1.83 (0.177)			1.77 (0.184)
Alone	784 (17.9)	286 (16.4)		869 (32.4)	451 (30.3)	
Not alone	3,588 (82.1)	1,454 (83.6)		1,813 (67.6)	1,035 (69.7)	
Residential location			27.68 (< 0.001)			21.81 (< 0.001)
Urban	3,569 (81.6)	1,315 (75.6)		1,987 (74.1)	999 (67.2)	
Rural	803 (18.4)	424 (24.4)		695 (25.9)	487 (32.8)	
Number of comorbid diseases			–1.626 (0.104)			0.163 (0.870)
Smoking			0.05 (0.833)			0.40 (0.525)
Yes	605 (13.8)	245 (14.1)		232 (8.7)	138 (9.3)	
No	3,766 (86.2)	1,494 (85.9)		2,450 (91.3)	1,348 (90.7)	
Alcohol consumption			0.41 (0.521)			6.63 (0.010)
Yes	1,447 (33.1)	560 (32.2)		569 (21.2)	265 (17.8)	
No	2,925 (66.9)	1,179 (67.8)		2,113 (78.8)	1,221 (82.2)	
Body mass index			2.57 (0.109)			5.29 (0.021)
Normal	1,696 (38.9)	715 (41.2)		1,366 (51.0)	814 (54.8)	
Overweight or obese	2,664 (61.1)	1,022 (58.8)		1,312 (49.0)	672 (45.2)	
Depressive symptoms			24.38 (< 0.001)			63.71 (< 0.001)
Yes	1,116 (25.6)	554 (31.9)		989 (36.9)	737 (49.7)	
No	3,245 (74.4)	1,184 (68.1)		1,690 (63.1)	746 (50.3)	
Hearing difficulties			28.74 (< 0.001)			58.81 (< 0.001)
Yes	673 (15.4)	368 (21.1)		845 (31.5)	645 (43.4)	
No	3,698 (84.6)	1,372 (78.9)		1,838 (68.5)	840 (56.6)	
Visual difficulties			6.69 (0.010)			33.54 (< 0.001)
Yes	1,464 (33.5)	644 (37.0)		1,163 (43.4)	784 (52.8)	
No	2,908 (66.5)	1,096 (63.0)		1,519 (56.6)	702 (47.2)	

Values are presented as number (%).

Table 4. Effects of leisure activities on cognitive function among elderly Korean individuals

Variable	Young-old group		Old-old group	
	OR (95% CI)	*p*-value	OR (95% CI)	*p*-value
Non-exercise physical activities				
No	1.16 (1.03–1.31)	0.015	1.05 (0.90–1.23)	0.519
Cognitive activities				
No	1.21 (1.05–1.41)	0.009	1.47 (1.25–1.73)	< 0.001
Occupational status				
Not employed	1.03 (0.91–1.17)	0.631	1.47 (1.23–1.76)	< 0.001
Residential location				
Rural	1.42 (1.24–1.64)	< 0.001	1.45 (1.25–1.68)	< 0.001
Number of comorbid diseases	0.99 (0.96–1.03)	0.916	1.04 (1.01–1.08)	0.027
Smoking				
Yes	0.99 (0.84–1.17)	0.876	1.10 (0.87–1.39)	0.427
Alcohol consumption				
Yes	1.01 (0.89–1.14)	0.925	0.89 (0.75–1.06)	0.183
Body mass index				
Overweight or obese	0.92 (0.82–1.03)	0.148	0.94 (0.82–1.07)	0.325
Depressive symptoms				
Yes	1.28 (1.12–1.46)	< 0.001	1.48 (1.29–1.69)	< 0.001
Hearing difficulties				
Yes	1.41 (1.23–1.63)	< 0.001	1.46 (1.27–1.68)	< 0.001
Visual difficulties				
Yes	1.06 (0.94–1.19)	0.353	1.22 (1.06–1.40)	0.005

OR, odds ratio; CI, confidence interval.

1.23–1.63) were significantly associated with cognitive impairment in the young-old group. In contrast, cognitive activities (OR, 1.47; 95% CI, 1.25–1.73), occupational status (OR, 1.47; 95% CI, 1.23–1.76), residential location (OR, 1.45; 95% CI, 1.25–1.68), number of comorbid diseases (OR, 1.04; 95% CI, 1.01–1.08), depressive symptoms (OR, 1.48; 95% CI, 1.29–1.69), and hearing (OR, 1.46; 95% CI, 1.27–1.68) and visual difficulties (OR, 1.22; 95% CI, 1.06–1.40) were found to be significant factors in the old-old group.

DISCUSSION

In this study, we aimed to examine the relationship between leisure activities and late-life cognition according to age groups and leisure activity type, to confirm the results of prior research and facilitate the development of a standardized classification of cognitively stimulating activities for individuals at risk of cognitive impairment. We found that individuals participating in leisure activities were more likely to have better cognitive function than those who did not. Importantly, engagement in cognitive activities was found to protect cognitive function in all elderly participants. Engagement in non-exercise physical activities was positively associated with the prevention of cognitive impairment only in young-old participants.

Previous studies have shown that cognitive activities yield protective benefits against dementia in all age groups [16]. A recently published meta-analysis of 19 studies found similar results, in that engagement in cognitive activities was significantly associated with late-life cognition in global and specific cognitive domains such as memory, speed of processing, and executive function [8]. However, studies investigating the effects of non-exercise physical activities on cognitive function report mixed results. A systematic review of 52 longitudinal studies showed that beneficial effects of non-exercise physical activities were noted in approximately 70%–73% of observational studies, although the effect of these interventions differed according to the methodological heterogeneity of randomized controlled trials [7]. It should be noted that the positive effect of this type of intervention is more likely to be produced in studies with relatively younger elderly individuals. Two studies reported the positive effects of exercise interventions on cognitive function, brain volume, and neural activity in participants aged in their 60s and participants with a mean age of 66 years, respectively [29,30]. However, a randomized controlled trial failed to identify any effect of a walking program in participants aged 70–80 years [31]. One possible explanation could be that non-exercise physical activities have beneficial effects on the aging brain by improving its plasticity within the young-old elderly population.

Multivariate logistic regression analysis showed that cognitive impairment is associated with 3 covariates including depressive symptoms, rural residence, and hearing difficulties, in both groups. Depression is a well-known factor strongly associated with cognitive impairment, as determined by various studies in the elderly [32]. The prevalence of cases of cognitive impairment combined with depression is likely to increase in the elderly population. A previous study reported that the coexistence frequency of cognitive impairment and depressive symptoms doubles in 5-year-intervals after the age of 70 years in the general population [33]. Thus, the present study provides strong evidence that older individuals with depressive symptoms should be more carefully managed to prevent cognitive impairment. Considering the effect of residential location on late-life cognition, previous studies have shown inconsistent results. A systematic review showed that differences in dementia and associated factors are present between rural and urban areas in Latin America, but not in Africa, Asia, and developed countries [34]. Some studies showed that age and education status-based disparity in residents between rural and urban areas could account for the difference in the prevalence of cognitive impairment [35,36]. A similar explanation could be applied to our study. Participants residing in rural areas were significantly less educated and older than those living in urban areas; this disparity could partly explain the contrast in the prevalence of cognitive impairment in our study. Hearing difficulties were also an important predictor of cognitive impairment in both groups in our study. Aging has a direct effect on both sensory perception and cognitive function [26]. Moreover, age-related hearing impairment has been suggested as a modifiable risk factor for cognitive impairment [37]. A recent review reported that difficulties in hearing could cause poor verbal communication, social isolation, and loneliness, and that these problems could exacerbate the loss of cognitive reserve, resulting in cognitive impairment in older adults [37].

Three additional factors, including occupational status, the number of comorbid diseases, and the presence of visual difficulties, were found to be significantly associated with cognitive impairment in old-old individuals in our study. In a previous study, employment status was suggested as a positive factor for good cognitive function, as involvement in economic activity in late-life might contribute to cognitive reserve maintenance, regardless of the occupation complexity [11]. Comorbidity is a well-known factor influencing cognitive functioning in healthy subjects and those with dementia. A study reported that medical comorbidity is associated with dementia severity after controlling for other covariates. Furthermore, greater medical comorbidity is related to greater impairment in cognition in elderly participants aged > 77 years [38]. Visual difficulties were found to be associated with cognitive impairment in old-old individuals in our study. Previous studies showed an obvious interaction between visual problems and cognitive impairment in old adults [39]. Moreover, an increase in cognitive task difficulty due to impaired visual perception led to the recruitment of compensational activities by the human brain in order to maintain performance. However, the compensation peak for perception impairments decreases with age [26]. Hence, a decreased ability to compensate for impaired sensation may explain why old-old individuals with perceptional difficulties are more vulnerable to cognitive impairment.

Some limitations should be considered when interpreting the findings of the study. The current study had a cross-sectional design, which limits the investigation of the causal relationship between cognitive impairment and leisure activities. Moreover, detailed information on leisure activities such as the frequency, intensity, and duration of leisure activities was also limited.

Despite these limitations, to our knowledge, this is the first study to compare the effects of leisure activities on cognitive function between young-old and old-old individuals from a homogenous elderly population, and assess differences in proposed, protective factors of cognitive impairment according to age strata in elderly people. This study highlights the importance of engagement in leisure activities among the elderly for cognitive function maintenance. Our findings provide a greater understanding of preventive factors against cognitive impairment and suggest the need for developing age-specific interventions in the elderly population.

This study showed that the beneficial effects of leisure activities on cognitive function differ according to activity type and the age of the participating elderly individuals. Possible benefits of both cognitive and non-exercise physical activities on cognitive function were indicated in elderly Korean individuals aged < 75 years, whereas only cognitive activities were found to be beneficial for individuals aged ≥ 75 years. Early, appropriate activity intervention programs should be developed based on our findings to promote resistance to declining cognitive capacity that is often concomitant with aging.

CONFLICTS OF INTEREST

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

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