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The effects of cognition and visual perception on activities daily living in the elderly

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Abstract: This study aimed to investigate the influence of cognition and visual perception on activities of daily living (ADL) among community-dwelling elderly individuals. Cognition was assessed using the Korean version of Montreal Cognitive Assessment, visual perception was assessed using the Motor Free Visual Perception Test -3, and ADL were assessed using the Modified Barthel Index. The results indicated that cognition, visual perception, and ADL were all positively correlated. Additionally, both cognition and visual perception were found to impact the ADL in the elderly. This study provides evidence that can be used to develop welfare and rehabilitation programs for the elderly, focusing on managing cognitive and visual perception abilities to support independent ADL and enhance quality of life.

Keywords: *Activities of daily living cognition, Elderly, Visual perception.*

1. Introduction

With advancements in medical technology and increasing life expectancy, the elderly population is growing rapidly, and Korea is experiencing a notably swift rate of aging. According to United Nations (UN) aging standards, Korea became an aging society in 2000, an aged society in 2017, and is projected to enter a super-aged society by 2025. Consequently, research related to the elderly is crucial for addressing the challenges of an aging society and preparing for a super-aged society.

As individuals age, they often experience declines in various functions, including physical function, cognitive function, activities of daily living (ADL), and visual perception, alongside an increase in the prevalence of geriatric diseases [1,2,3].

Key factors affecting the quality of life in the elderly include health status, cognitive function, ADL, social activities, social support, and demographic and socioeconomic characteristics [4,5,6]. Cognitive function encompasses short-term and long-term memory, concentration, calculation, endurance, language function, judgment, and comprehension. Declines in cognitive function due to aging reduce an individual's adaptability and can lead to emotional issues such as anxiety and depression. Additionally, cognitive decline affects the ability to perform ADL and engage in social activities, which in turn reduces life satisfaction and quality of life [7].

ADL are essential tasks performed to maintain an independent lifestyle, including eating, dressing, moving, personal hygiene, and toileting [8]. As aging impairs the ability to perform these tasks, maintaining independence without assistance becomes challenging, and participation in social activities may be limited, negatively impacting quality of life. The ability to perform ADL is influenced by various factors such as physical function, emotional well-being, and cognitive function [9].

Visual perception is the process by which the central nervous system integrates visual information to make decisions, converting basic data from the retina into cognitive concepts. This process allows individuals to accurately judge the size, shape, and spatial relationships of objects, aiding in environmental adaptation [10]. Visual perception encompasses visual concentration, visual memory,

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visual discrimination, visual cognition, visual form recognition, spatial perception, and visual imagery. Aging typically leads to a decline in visual perception abilities [11].

Previous studies have demonstrated that declines in cognitive and visual perception functions negatively impact the ability to perform ADL among the elderly [12]. When the ability to perform ADL diminishes, maintaining independence without assistance becomes increasingly difficult, contributing to the economic burden on society. Therefore, ADL is a critical concern for the elderly. Despite this, many previous studies have focused on elderly individuals with impaired cognitive function, such as those with dementia or mild cognitive impairment. To comprehensively understand the impact of cognitive and visual perception on ADL, it is necessary to explore these effects in the general elderly population. Therefore, this study aims to investigate the influence of cognitive function and visual perception ability on ADL among community-dwelling elderly individuals.

2. Materials and Methods

2.1. Subjects and period

This study targeted 30 elderly individuals aged 65 or older living in the community. The participants were selected from a senior welfare center in Region G. Cognitive function was assessed using the Korean version of the Montreal Cognitive Assessment (MoCA-K), visual perception ability was evaluated with the Motor-Free Visual Perception Test-3 (MVPT-3), and daily living ability was measured using the Modified Barthel Index (MBI). Participants were thoroughly briefed on the study's purpose and methods, and the study was conducted with those who consented to participate. The criteria for selecting subjects were as follows:

No diagnosis of central nervous system diseases such as dementia or stroke
Age 65 years or older
No signs of executive dysfunction

Consent from both the participants and family to the study's purpose

2.2. Assessment

2.2.1. MoCA-K

The MoCA-K includes assessments of visuospatial execution, vocabulary, attention, sentence structure, abstraction, delayed recall, and persistence. A total score of 22 or lower out of 30 points indicates mild cognitive impairment. The reliability of MoCA-K is 0.89 [13].

2.2.3. MVPT-3

The MVPT-3 is used to evaluate visual perception ability without involving motor functions. Its sub-domains include visual discrimination, form constancy, visual short-term memory, visual closure, spatial orientation, and figure-ground. Higher scores indicate better visual perception ability. The reliability of MVPT-3 ranges from 0.86 to 0.90 for inter-examiner reliability and is 0.89 for test-retest reliability [14].

2.2.3. Modified Barthel Index (MBI)

The MBI evaluates the level of activities of daily living (ADL) in stroke patients. The assessment items include personal hygiene, bathing, eating, toileting, climbing stairs, dressing, bowel control, urinary control, walking (with a wheelchair), and transferring from a chair/bed. Scores range from 0 to 100, with higher scores indicating greater independence in ADL. Each item is rated as complete independence, partial independence, partial dependence, or complete dependence based on the patient's functional level. A total score of 100 represents complete independence, while a score of 0 indicates complete dependence. The internal consistency of the MBI is 0.90, the test-retest reliability is 0.89, and the inter-rater reliability is 0.95 [15].

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2.3. Analysis

The results of this study were analyzed using SPSS 22.0. Descriptive statistics and frequency analysis were conducted on the participants' general characteristics, cognitive function, visual perception, and ADL scores. Pearson correlation analysis was performed to examine the relationships between cognition, visual perception, and ADL. To determine the impact of cognition and visual perception on ADL, multiple linear regression analysis was conducted. The significance level was set at $\alpha = 0.05$.

3. Results and Discussion

3.1. General Characteristics of the Study Participants

The general characteristics of the study participants are summarized as follows: the average age was 74.00 ± 5.02 years, with 21 females (70.0%) and 9 males (30.0%). The most common educational level was middle school, followed by elementary school and no formal education. The proportion of those with and without jobs was 50% each, and all participants were married. The MoCA-K score of the participants was 22.70 ± 2.91, the MVPT score was 27.00 ± 5.00, and the MBI score was 80.90 ± 3.29 (Table 1).

Table 1.
General characteristics of the participants (N=30).

Category		**M±SD OR N(%)**
Age		74.00±5.02
Gender	Mael	9(30.0)
	Female	21(70.0)
Education	College	3
	High school	3
	Middle school	12
	Elementary	6
	No education	6
Employment	Employmed	15(50.0)
	Unemployed	15(50.0)
Marital status	Married	30 (100.0)
	Single	0(0.0)
MOCA-K		22.70±2.91
MBI		80.90±3.29
MVPT		27.00±5.00

3.2. Correlations Between Cognitive Function, Visual Perception, and Activities of Daily Living

The analysis of correlations between MoCA-K scores and MVPT and MBI scores revealed significant positive correlations. The correlation coefficient between MoCA-K and MBI was 0.96, and between MVPT and MBI, it was 0.95(Table 2).

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Table 2.
Correlation between cognition, visual perception and acitivies of daily living.

	MOCA	MVPT	MBI
MOCA	1.00	0.988*	0.967*
MVPT	0.988*	1	0.952*
MBI	0.967*	0.952*	1

Note: *$p<0.05$

To examine the effects of cognition and visual perception on ADL, regression analysis was performed. Cognition and visual perception were identified as factors positively influencing the MBI score, and it was confirmed that these variables served as static explanatory factors for ADL. The F-test statistic for the MBI in the regression model was 229.395, with a p-value of 0.001, indicating statistical significance at the 0.05 level (Table 3).

Table 3.
The effects of cognitive function and visual perception on ADL.

Dependent variable	Independent variable	*B*	Standard error	β	*t*	*p*
MBI	A constant	63.000	5.488	-	11.480	.001
	MOCA-K	1.200	0.535	1.062	2.241**	
	MVPT-3	-0.250	0.638	-0.183	-0.392**	

Note: **$p<.01$

3.3. Discussion

This study was conducted to examine the effects of cognition and visual perception on ADL in elderly individuals. The results confirm that MoCA-K scores, which assess cognitive function, and MVPT-3 scores, which assess visual perception, significantly influence MBI scores, which measure ADL.

Previous studies have shown that cognitive decline negatively impacts the ability to perform ADL. For example, Farias et al. [16]and Zahodne et al. [17] found that cognitive decline adversely affects ADL abilities of the elderly. Wang [18] also concluded that there is a correlation between cognition and ADL. These findings are consistent with the results of this study, which indicate that cognitive function affects ADL. Figueiredo et al. [19] also analyzed the impact of cognitive decline on independence in ADL and concluded that improved cognitive function is closely linked to enhanced daily living abilities.

The relationship between MVPT-3 scores and MB1I scores suggests that visual perception is essential for performing ADL. Most daily activities are closely related to visual perception, and the recovery of visual perception is a crucial factor in the ability to perform ADL and determining prognosis [20]. Declines in visual perception can negatively impact an elderly person's daily independence. Saari et al. [21] reported that visual perception ability in dementia patients is related to ADL, which supports the findings of this study.

Among various conditions, dementia is one of the major causes of decreased independence in ADL among the elderly. Research related to the impact of cognition and visual perception on ADL has often focused on dementia. Calderon et al. [22] noted that visual perception disorders can occur during the progression of Alzheimer's dementia, while Koutrousmanos et al. [23] suggested that visual perception impairment may precede memory disorders in dementia. Impaired visual perception can lead to decreased quality of life, increased fall risk, and earlier admission to nursing homes [24, 25]. Additionally, dementia with Lewy bodies shows greater cognitive impairment in individuals with visual perception deficits compared to those without such impairments [26]. Studies have also shown that

visual perception training can improve both visual perception and daily living activities [27], supporting the findings of this study.

The rapid increase in elderly individuals unable to perform ADL independently due to cognitive impairments highlights the importance of identifying and managing factors affecting ADL abilities. Higher daily living ability is associated with greater life satisfaction and quality of life, leading to successful aging [28]. Therefore, understanding and managing the factors that impact ADL abilities are crucial for the health and quality of life of the elderly. The results of this study underscore the need for elderly welfare and rehabilitation programs that assess and enhance cognitive and visual perception abilities to support independent ADL and improve quality of life.

This study has some limitations. First, the sample size is limited, which may affect the generalizability of the results. Second, the data were analyzed at a single point in time, suggesting the need for longitudinal studies in the future. Third, the study did not comprehensively analyze other factors that could influence ADL.

3.4. Conclusion

This study confirms that cognitive function and visual perception are significant factors affecting ADL among the elderly. As the aging population grows, the increase in elderly individuals unable to perform ADL independently poses not only social costs related to caregiving but also various social issues. Therefore, it is necessary to identify and manage the relevant factors to support independent ADL and improve quality of life. This study suggests that elderly welfare and rehabilitation programs should focus on managing cognitive and visual perception abilities. Future research should involve a larger sample of elderly individuals and longitudinal studies to further investigate factors affecting independent ADL and quality of life.

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