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Differences in handgrip strength and tooth loss between cognitively normal and impaired elderly: cross-sectional study

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ABSTRACT

Introduction: The aging process in elderly individuals triggers changes in the brain that can lead to a decline in cognitive function, impacting quality of life. Age-related physiological changes affect the muscles around the oral cavity and the musculoskeletal system. These changes manifest as a decrease in the mass and strength of the chewing muscles. Tooth loss further exacerbates the ability to chew. This study aims to analyze differences in handgrip strength and tooth loss between cognitively normal and impaired elderly. **Methods:** Observational analytic with cross-sectional design using the Mann-Whitney comparative significance test and independent sample t-test with a significance level of $p<0.05$ was conducted. A purposive sampling technique was applied to a population residing in Dago Village, Bandung. The inclusion criteria included elderly individuals aged ≥60 years, both male and female, able to communicate effectively, and willing to participate in the study by signing an informed consent form. Cognitive function was assessed through interviews using the Mini Mental State Examination (MMSE), along with an examination of the number of missing teeth and hand grip strength measured with the Electronic Hand Dynamometer (Camry EH101). Analyzed data used the Mann–Whitney test. **Results:** A total of 34 subjects met the inclusion criteria from the total population of 71 older adults examined. The independent sample t-test for handgrip strength showed that elderly individuals with cognitive impairment had weaker handgrip strength (mean=14.250, SD=5.0285) compared to cognitively normal individuals (mean=22.281, SD=6.0204), with a p-value of 0.0001 ($p<0.05$). The Mann–Whitney test results for tooth loss indicated that elderly individuals with cognitive impairment experienced greater tooth loss (range=11–32 teeth, mean=20.78) compared to cognitively normal individuals (range=0–10 teeth, mean=13.81), with a p-value of 0.041 ($p<0.05$). **Conclusion:** There are differences in hand grip strength and tooth loss were found between cognitively normal and impaired elderly.

KEYWORDS

Cognitive function, handgrip strength, tooth loss, elderly, aging

INTRODUCTION

Elderly individuals are defined as those who have reached the age of 60 years or older, according to Law Number 13 of 1998 concerning the Welfare of the Elderly and the guidelines of the Ministry of Health of the Republic Indonesia.[1,2] Since 2021, Indonesia has entered the stage of an ageing population, with approximately one in ten residents classified as elderly, accounting for a prevalence of 10.82% or around 29.8 million individuals. This global demographic shift towards an increasing elderly population presents significant social, economic, and health challenges, particularly related to the rise in age-related diseases such as cognitive impairment.[3,4]

Hospital-based studies in Indonesia have identified that about 32.8% of elderly patients exhibit mild cognitive impairment (MCI), and 45.7% have dementia, with vascular dementia being the most common type, followed by Alzheimer's disease.[5] Another study showed that around 21.2% of elderly individuals scored within the cognitive impairment range while 78.8% had normal cognitive function.[6] Furthermore, data indicate that approximately 30% of elderly participants in health screenings suffer from cognitive decline.[6–8] These figures highlight the significant burden of cognitive impairment within Indonesia's aging population, reflecting an important public health challenge that requires focused attention and interventions.

Cognitive impairment is defined as deficits in cognitive domains such as language, memory, planning and task execution, attention, and perception.[4] It is generally caused by disorders of the central nervous system, including impaired oxygen supply to the brain, neurodegenerative diseases such as Alzheimer's disease, malnutrition, and aging.[9] Physiological changes in the nervous system during the aging process can lead to a decline in both sensory and motor functions, ultimately resulting in reduced cognitive performance in older adults.[9,10]

A decline in cognitive function can negatively impact the lives of elderly by reducing self-confidence, limiting independence, and diminishing overall quality of life.[11] Optimal quality of life in elderly is strongly influenced by oral care and oral health.[12,13] Previous research indicates that elderly individuals with cognitive impairment frequently experience oral health problems.[14–16] A study conducted among elderly nursing home residents in Jakarta, Indonesia, found a significant association between poor periodontal health and cognitive impairment.[15,16] Parameters such as plaque index, oral hygiene index, bleeding on probing, pocket depths, gingival recession, attachment loss, and tooth loss were all significantly worse in cognitively impaired subjects compared to those with normal cognition.[17]

The mechanism underlying this association can be explained by several factors. Cognitive impairment may reduce the individual's ability to maintain proper oral hygiene, leading to plaque accumulation and periodontal disease.[8,14,15] Tooth loss reduces masticatory function, which is important for stimulating brain regions involved in cognition.[7,16–19] Mastication increases cerebral blood flow and sensory input to the brain, supporting neural health.[20,21] Poor oral health can provoke systemic inflammation through the dissemination of oral bacteria and inflammatory mediators into the bloodstream, potentially exacerbating neuro inflammation, which contributes to cognitive decline.[17,22,23]

Oral health is closely associated with hygiene practices, as poor oral hygiene can contribute to a range of health complications.[12,13] Common oral health problems among the elderly are dental caries and periodontal disease,[10] which can ultimately lead to tooth loss.[13,20] Tooth loss refers to the condition in which a tooth is lost from its socket, typically due to extraction caused by caries, periodontal disease, trauma, or systemic conditions affecting the oral cavity.[21,22] Several studies have indicated that older adults with cognitive impairment tend to experience greater tooth loss.[7,23,24]

Hasegawa et al. in Japan reported that tooth loss in elderly individuals is associated with physical frailty resulting from the decline of whole-body skeletal muscle mass and strength, a condition known as sarcopenia.[12] The reduction in muscle mass contributes to reduced muscle strength among the elderly.[12,23] This finding is supported by a study conducted by Pratiwi et al. (2021) at Ryukyu Medicals Okinawa, Japan, which demonstrated that muscle strength declines with increasing age or the aging process in the elderly.[25] Older adults with cognitive impairment are particularly susceptible to a decline in muscle mass and strength due to reduced physical activity.[12,26–28]

Muscle strength is defined as the ability of a muscle to generate maximal force. Peak muscle strength is typically reached around the age of 30 and declines by approximately 12–15% after the age of 50.[23] Low muscle strength may impair functional mobility, leading to dependence in performing daily activities.[26,29]

Daily physical activity is closely related to upper extremity mobility.[30] Upper extremity muscle strength, measured through handgrip strength, is crucial for performing various functional tasks and maintaining independence in daily life.[3,4,30,31] Handgrip strength assessment is an effective method for evaluating the decline in muscle strength, as it is simple and easy to perform in older adults.[31] Handgrip strength reflects the ability of the upper extremity muscles to contract and exert or withstand maximal load during gripping movements, typically measured in the dominant hand.[32,33]

Cognitive decline, encompassing memory and cognitive ability, is a common issue affecting many older adults, while tooth loss and reduced muscle strength are two physical indicators frequently observed in this population.[34] Despite existing studies exploring the relationship between tooth loss, handgrip strength, and cognitive function separately,[10,13,35] there remains a notable research gap in simultaneously comparing these physical indicators between elderly individuals with normal cognition and those with cognitive impairment. Most previous studies examined these variables independently rather than in conjunction. This study addresses this gap by providing a comparative analysis of both handgrip strength and tooth loss across cognitive status groups, offering novel insights into their combined effect on aging populations.

The novelty of this study lies in its integrated approach, which can provide information for more comprehensive prevention and intervention strategies aimed at improving the quality of life in the elderly. This study aims to analyze differences in handgrip strength and tooth loss between cognitively normal and impaired elderly. By elucidating the interaction between muscle strength, tooth loss, and cognitive function, these findings have the potential to guide multidisciplinary clinical assessments as well as public health programs aimed at reducing cognitive decline in older adults.

METHODS

This study was an analytical observational study with a cross-sectional design. The research was conducted in December 2024 at the Elderly *Posyandu* in Dago Subdistrict, Coblong District, Bandung City, West Java. The study population consisted of elderly residents aged 60 years and above living in the Dago Subdistrict.

The sampling technique used in this study was purposive sampling, in which subjects were selected based on specific considerations or criteria.[36] The minimum required sample size was 25 respondents, determined using Slovin's formula with a 0.2 margin of error.[37] This study examined an elderly population consisting of 71 individuals with a total of 34 participants who met the inclusion criteria. The study subjects were individuals from the research population who met the inclusion criteria as follows: elderly individuals aged ≥ 60 years, both male and female, having ability to communicate effectively, and willing to participate by signing the informed consent form. The exclusion criteria included elderly individuals with conditions causing inability to move the fingers of both hands, currently taking medications that may affect muscle strength, suffering from neurological diseases, arthritis, systemic diseases, hearing impairments, diagnosed with dementia or Alzheimer's disease, and those using dentures.

The research subjects were given a brief explanation of the research procedures, followed by the completion of an informed consent form. Subsequently, the examiner collected information regarding the subjects personal and sociodemographic characteristics through a structured interview. All information and data were recorded in the examination form.

Cognitive function was assessed through an interview using the Mini Mental State Examination (MMSE) questionnaire. The MMSE is an instrument used to measure cognitive function with a score range of 0–30.[38,39] This score is utilized to evaluate the level of cognitive function and to differentiate normal cognitive

function and cognitive impairment.[39] Respondents with MMSE scores between 27–30 are classified as having normal cognitive function, while scores below 27 indicate cognitive impairment. Cognitive impairment is further classified into mild cognitive impairment (scores 21–26), moderate cognitive impairment (scores 11–20), and severe cognitive impairment (scores 0–10).[38,40]

Handgrip strength in older adults was measured using the Camry electronic hand dynamometer model EH101, which has been certified by SGS (Société Générale de Surveillance). This device automatically records the maximum handgrip strength in kilograms (kg).[33] The measurement results were immediately classified on the device's display as strong, normal, or weak according to manufacturer's criteria, as shown in Table 1.[31] For reference, the European Working Group on Sarcopenia in Older People (EWGSOP) defines low handgrip strength as < 27 kg for men and < 16–20 kg for women, whereas the Asian Working Group for Sarcopenia (AWGS) provides a comprehensive algorithm for diagnosing sarcopenia, with cut-off points for low muscle strength defined as < 28.0 kg for men and < 18.0 kg for women.[34,41]

The procedure for measuring handgrip strength in this study was referred to the method used by Sari et al., with several modifications.[31] Prior to use, the device settings were adjusted based on the subject's age and gender. Subjects were instructed to sit comfortably without leaning, with both feet flat on the floor, and arms hanging straight down at the sides.[32,33] Next, subjects were instructed to take a deep breath and then grip the dynamometer handle with maximum effort while exhaling.[27,30,32]

The grip duration lasted 3–5 seconds, and measurements were taken twice on the dominant hand with a minimum rest interval of 15 seconds between trials.[31–33] The highest value obtained was recorded as the final handgrip strength measurement.[32,42]

Table 1. Standard classification of hand grip strength in elderly using camry EH101

Age	Men			Woman		
	Weak	Normal	Strong	Weak	Normal	Strong
60-64	<30.2	30.2-48.0	>48.0	<17.2	17.2-31.0	>31.0
65-69	<28.2	28.2-44.0	>44.0	<15.4	15.4-27.2	>27.2
70-99	<21.3	21.3-35.1	>35.1	<14.7	14.7-24.5	>24.5

Tooth loss was assessed by examining the presence of teeth in the oral cavity of each participant, with residual roots not considered as missing teeth. Subjects were instructed to sit on the provided chair and open their mouths. The examiner assessed the presence of remaining teeth under adequate lighting conditions. The number of missing teeth was recorded on the examination sheet and classified according to the criteria used in previous studies by Okamoto et al. in Japan and Sari et al. in Bandung City, using the following categories: 0–10 missing teeth, 11–21 missing teeth, and 22–32 missing teeth.

The collected data were tabulated and tested for normality using the Shapiro-Wilk test. The p-values were 0.001, 0.260, and 0.018 for cognitive function, handgrip strength, and tooth loss, respectively. Comparative significance tests, specifically the Mann-Whitney and Independent Sample T-test, were applied to determine differences between variables. The data were analyzed using the Statistical Product and Service Solutions (SPSS) IBM version 26. The data and results of the statistical analyses are presented in tables and expressed as percentages.

RESULTS

A total of 71 elderly individuals participated in this study. A total of 34 participants met the inclusion criteria. Meanwhile, 37 older adults were excluded from the study due to systemic diseases (heart disease, diabetes mellitus, and hypertension), a history of stroke, or the use of removable dentures, either partial

or complete. All participants were functionally independent, with no limitations in daily activities. The sample demonstrated variability in demographic and social characteristics, including sex, age, occupation, education level, and residential status. The distribution of these characteristics is presented in Table 2.

Table 2. Sociodemographic characteristics of the elderly

Characteristics	Normal Cognitive Function		Cognitive Impairment		Total	
	n	%	n	%	n	%
Gender						
Female	12	44.4	15	55.5	27	79.4
Male	4	57.1	3	42.9	7	20.6
Age						
60-64	9	56.3	7	43.7	16	47.1
65-69	5	62.5	3	37.5	8	23.5
70-99	2	20	8	80	10	29.4
Occupation						
Laborer	0	0	2	100	2	5.8
Housewife	10	41.7	14	58.3	24	70.6
Retired	1	50	1	50	2	5.8
Merchant	1	50	1	50	2	5.8
Entrepreneur	4	100	0	0	4	11.8
Education						
Elementary	5	31.3	11	68.7	16	47.1
Secondary	9	56.3	7	43.8	16	47.1
Advanced	2	100	0	0	2	5.8
Residence status						
Partner/Family	15	57.7	11	43.3	26	76.5
Alone	1	12.5	7	87.5	8	23.5
Elderly Care Home	0	0	0	0	0	0
Total	16	47.1	18	52.9	34	100

This research successfully recruited 34 respondents who met the inclusion criteria. As shown in Table 2, 18 out of 34 subjects (52.9%) exhibited cognitive impairment. The majority of participants were female (79.4%), and 16 subjects (47.1%) were aged between 60 and 64 years. Most participants were housewives (70.6%). Regarding educational attainment, both elementary and secondary school graduates accounted for 16 subjects each (47.1%). Furthermore, most elderly participants lived with their spouses or family members (76.5%). The homogeneity test yielded a p-value greater than 0.05. Comparisons of handgrip strength and tooth loss are presented in Table 3.

Table 3. Comparison of handgrip strength and tooth loss between cognitively normal and impaired elderly

Variable	Normal Cognitive		Cognitive Impairment						Total	
			Mild		Moderate		Severe			
	n	%	n	%	n	%	n	%	n	%
Handgrip Strength										
Strong	0	0	0	0	0	0	0	0	0	0
Normal	13	81.2	3	18.8	2	66.7	0	0	18	52.9
Weak	3	20	12	80	1	33.3	0	0	16	47.1
Tooth Loss										
0-10	11	68.8	6	40	0	0	0	0	17	50
11-21	3	18.8	4	26.7	2	66.7	0	0	9	26.5
22-32	2	12.5	5	33.3	1	33.3	0	0	8	23.5
Total	16	47.1	15	44.1	3	8.8	0	0	34	100

Table 3 shows that the majority of older adults with normal cognitive function had normal handgrip strength (81.2%), whereas most older adults with cognitive impairment exhibit weak muscle strength (72.2%). In this study, no elderly individuals with strong handgrip strength were found, either among those with normal cognitive function or those with cognitive impairment.

Furthermore, based on Table 3, most older adults with normal cognitive function experienced fewer tooth losses (0–10 teeth), totaling 11 individuals (68.8%), while greater tooth loss (11–32 teeth) was observed among older adults with cognitive impairment, comprising 12 individuals (35.2%).

Table 4. Statistical test results of differences in handgrip strength and tooth loss between cognitively normal and impaired elderly

Variable	Technic	N	Mean	P value	Details
Handgrip Strength					
Elderly with Normal Cognitive	*Independent sample t-test*	16	22.281	0.0001*	Significant
Elderly with Cognitive Impairment		18	14.250		
Tooth Loss					
Elderly with Normal Cognitive	*Mann-Whitney*	16	13.81	0.041*	Significant
Elderly with Cognitive Impairment		18	20.78		

Note: *P value <0,05 = significant

Table 4 shows that the p-values for each test group are below 0.05. These results indicate a significant difference in handgrip strength (p = 0.0001) and tooth loss (p = 0.041) between elderly with normal cognitive function and those with cognitive impairment.

DISCUSSION

In this study, older adults living alone without family or a partner tended to experience cognitive impairment compared to those living with family. This finding is in line with Untung's research, which stated that older adults living alone often experience loneliness, receive less social support, and face increased stress, which can negatively impact brain health and cognitive function.[4,10,43] Further research is needed to explore stress levels in relation to marital status among older adults, a factor not examined in this study.

Physical activity significantly influences cognitive function.[44] This is consistent with studies by D'Aurizio et al. and Noor et al., which found that older adults engaging in low levels of physical activity (including sedentary and under-active levels) were more likely to exhibit cognitive impairment.[12,44] A lack of physical activity can lead to decreased muscle mass, resulting in reduced myokine synthesis, which negatively impacts cognitive function.[45] Myokines, as products of muscle contraction, play a crucial role in signaling between muscles and the brain, enhancing neuronal proliferation, differentiation, synaptic formation, and brain plasticity.[26] Moderate to vigorous physical activity, which requires moderate to high effort (such as cycling, running, and weightlifting), can enhance cardiovascular function, increasing blood flow and perfusion that ultimately enhance oxygen transport to the brain.[12]

In the elderly population, there is a decline in both muscle fiber number and muscle mass, leading to decreased dexterity and handgrip strength.[45] This study found that older adults with cognitive impairment exhibited significantly (p=0.001) lower handgrip strength. This finding aligns with research by Hang Su et al. in China, which reported individuals with mild cognitive impairment had lower handgrip strength compared to cognitively normal individuals, with further reductions observed in those with severe cognitive impairment.[35] Muscle activity that generates physical strength may stimulate neural growth and help prevent cognitive decline in older adults.[32,44]

Research by Weni et al. and Sumandar et al. stated that muscle-strengthening activities may enhance cognitive function through increased neurotrophin levels, improved physical fitness, and reduced depression.[27,29] Elevated neurotrophin levels strengthen synaptic connectivity between neurons, supporting learning and memory processes, thereby improving cognitive function. These effects are partly explained by the role of the frontal and parietal brain regions, which are essential for motor skill learning, motor output, and higher-order cognitive functions.[46] Muscle activity helps maintains cerebral vascularization and increases blood flow, facilitating the delivery of oxygen and essential nutrients to the brain.[29] The increased blood flow supports neurogenesis, the formation of new neurons in the hippocampus, which plays a crucial role for cognitive function.[9]

Occupational activity can also influence muscle strength, as the type of muscle contraction varies according to the activity and intensity of the workload.[47] In this study, most elderly with weak handgrip strength were housewives. Previous studies by D'Aurizio et al., Noor et al., and the citation of Widajanti et al. in Ratmawati et al. classified household chores as a light-intensity physical activity.[12,28,44]

According to Bielak's analogy, the human brain functions like a muscle that requires regular stimulation to maintain optimal performance.[18] Similarly, cognitive function must be supported through consistent engagement and stimulation, including proper masticatory activity, which depends on the presence of sufficient teeth.[8,18,26] Oral health affects the quality of life of older adults, therefore it is important to maintain dental health to prevent both tooth loss and cognitive impairment in later life.[23,48]

Handgrip strength plays a crucial role in maintaining the quality of life among older adults, including their ability to perform oral hygiene, both in those with normal cognitive function and those with cognitive impairment. This is aligned with findings by Rizki et al. and Sari et al., which indicated that handgrip strength is associated with functional ability in older adults, particularly in daily activities such as toothbrushing.[31]

Effective toothbrushing requires adequate grip strength to ensure proper plaque removal and prevent various oral health issues, including tooth loss.[31,49] Therefore, it is important for older adults to maintain overall physical health and activity levels to prevent significant declines in handgrip strength, which in turn supports oral health and may help reduce the risk of cognitive decline.

In this research, the majority of subjects with fewer missing teeth (0–10 teeth) exhibited normal cognitive function, whereas those with a greater number of missing teeth (22–32 teeth) experienced cognitive impairment. These results indicate a significant difference in tooth loss ($p = 0.041$) between elderly with normal cognitive function and those with cognitive impairment.

Research by Sari et al. and Setyowati et al. aligns with these findings, showing that most respondents with 21–32 missing teeth experienced a decline in cognitive function.[23,48] Shavitri's research also reported that older adults with more than 12 missing teeth exhibited mild to severe cognitive impairment, while those with fewer than 12 missing teeth had normal cognitive function.[13] These studies indicated that a lower number of remaining teeth in older adults is associated with greater cognitive decline, and conversely, more teeth are linked to better cognitive function.[13,23,48]

This may occur because tooth loss impacts cognitive function through several mechanisms, including reduced masticatory activity, neurobiological changes, nutritional deficiencies, and systemic inflammation.[13,17,18,24,48] Greater tooth loss leads to decreased masticatory ability, which can increase the risk of cognitive decline.[8,13,23,50] Mastication involves the masticatory muscles innervated by the motor branches of the trigeminal nerve.[17,18] This activity sends afferent impulses

to the brainstem, particularly to the masticatory center within the brainstem nuclei, which subsequently influences other brain regions, including the prefrontal cortex and hippocampus-areas involved in cognitive functions such as memory and attention.[18,24]

Reduced sensory stimulation resulting from tooth loss has been shown to decrease the number of pyramidal cells in the hippocampus and induce structural changes in the brain.[18] These changes may contribute to cognitive impairment and increase the risk of dementia.

Moreover, tooth loss can restrict food choices, especially in older adults, leading to a preference for foods with lower fiber content and nutritional value. Such dietary limitations may result in deficiencies of essential nutrients, including vitamin B12 and folic acid, which are known to contribute to cognitive decline.[22,23,48] Additionally, tooth loss can provoke a systemic inflammatory response through the release of pro-inflammatory cytokines into the bloodstream, potentially leading to neuronal and brain tissue damage, resulting in further reductions in cognitive function.[48]

Research by Sari et al. indicated that older adults with cognitive impairment tend to experience greater tooth loss and have fewer occlusal support zones, which can disrupt mastication and elevate the risk of cognitive decline.[8,13,50] However, this study only considered the number of missing teeth without considering occlusal support. The World Health Organization (WHO) states that older adults aged ≥ 60 years should have at least 20 teeth to preserve adequate masticatory function, speech, and aesthetics.[13]

Future research should consider occlusal support in older adults, given its importance for activating perioral muscles and stimulating brain regions during mastication, as emphasized by Sari et al. and Vega et al.[8,50] Additionally, Sari et al. reported that impaired mastication may increase the risk of neurodegenerative diseases, such as Alzheimer's disease and dementia due to reduced cerebral blood flow and brain activity.[17]

Several factors may influence the differences in tooth loss between elderly with normal cognition and those with cognitive impairment, including age, gender, education, and place of residence. As age increases, the risk of cognitive impairment and tooth loss also rises. Advanced age leads to structural brain changes such as atrophy and a 10–20% reduction in brain weight (including the frontal lobes), as well as a decrease in the number of neurons and neurotransmitters.[26,51,52]

These changes disrupt synaptic connections and neural impulse transmission, resulting in cognitive decline.[26,52] This is consistent with findings by Widianti and Proverawati, who reported that brain weight reduction can slow thinking processes, reduce concentration, and impair memory and cognitive function.[51] Aging also contributes to tooth loss through physiological changes, such as gingival thinning and reduced alveolar bone density, which increase vulnerability to dental damage and tooth loss.

This study has several limitations. The assessment of tooth loss was limited to the number of remaining teeth without evaluating occlusal support. Future research is needed to consider the occlusal support zones in the oral cavity of older adults and investigate stress levels in relation to cognitive function. Additionally, this study used a cross-sectional design, which limits the ability to establish causal relationships between variables. Future studies are recommended to explore the relationship between handgrip strength, tooth loss, and cognitive function using a larger sample size and a longitudinal design to better identify causal sequences. Despite these limitations, this study provides valuable data on differences in muscle strength and tooth loss between elderly with normal cognition and those with cognitive impairment.

The findings of this study underscore the significant association between tooth loss and cognitive decline in older adults, highlighting important

contributions to clinical practice and public health. Clinically, these results emphasize the critical need for early dental assessments and interventions aimed at preserving natural dentition in elderly populations.

Maintaining adequate masticatory function not only supports nutritional intake but also appears to have neuroprotective effects by stimulating brain regions involved in cognitive processes, such as the hippocampus and prefrontal cortex. This suggests that dental health care should be integrated into routine geriatric assessments to potentially mitigate the risk of cognitive impairment and dementia.

From a public health perspective, the results advocate for comprehensive oral health programs targeting older adults, particularly those at risk of significant tooth loss. Such programs should encompass preventive dental care, education on the importance of oral hygiene, and access to restorative dental services. Given the documented links between tooth loss, systemic inflammation, nutritional deficiencies, and cognitive decline, promoting oral health may contribute to broader strategies aiming to preserve cognitive function and quality of life among aging populations.

Furthermore, these findings call for interdisciplinary collaboration between dental practitioners, neurologists, nutritionists, and geriatric specialists to develop integrated approaches for the prevention and management of cognitive disorders. Future longitudinal studies incorporating occlusal support evaluation and stress assessments will be invaluable to further elucidate causal pathways and optimize clinical and public health strategies.

CONCLUSION

This study demonstrates that weaker handgrip strength and greater tooth loss increase the risk of cognitive impairment in elderly individuals. The main contribution is the identification of handgrip strength and oral health as crucial factors influencing cognitive function. These implications findings suggest the importance of regular monitoring and targeted interventions to maintain physical health and prevent cognitive decline.

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