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Original Research

COGNITIVE DECLINE AMONG THE MIDDLE-AGED LIVING IN THE COASTAL AREA IN LOMBOK ISLAND

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ABSTRACT

Introduction: Dementia is a leading cause of disability, dependency, and reduced quality of life. Its prevalence has been steadily increasing in recent years. Coastal communities, due to limited access to healthcare services, face a heightened risk of developing degenerative diseases, including dementia.
Methods: A total of 154 middle-aged individuals from four coastal areas participated in this study. Sociodemographic characteristics, lifestyle, and medical histories were collected through interviews. Cognitive function was assessed using the Mini-Cog instrument.
Result: Of the 154 participants, 87 individuals (56%) exhibited cognitive decline, with 66% of these being female. Among participants with cognitive decline, 67% had a history of hypertension, 16% had diabetes mellitus (DM), 40% had a body mass index (BMI) ≥22.5, 23% had a history of smoking, and 45% reported a low physical activity level. Multiple linear regression analysis revealed that age and a history of hypertension were significantly associated with cognitive decline ($p = 0.005$ and $p = 0.037$, respectively). However, DM, BMI, smoking history, and activity level were not found to be significantly associated.
Discussion: More than half of middle-aged people on the coast of Lombok Island have cognitive decline. Age and history of hypertension are significant risk factors. Addressing modifiable risks through lifestyle interventions and improved healthcare access can help mitigate cognitive decline incidence in specific populations.
Conclusion: Understanding the comorbidity profiles of neurological diseases in elderly patients at the Taman Sari District Health Center has the potential to enhance patient care management and contribute to improved health outcomes.

Keywords: cognitive decline; characteristic; coastal area

INTRODUCTION

Dementia is a chronic, progressive disease characterized by memory impairment and cognitive decline, affecting 5% (47 million) of the elderly population in 2015. An increase in life expectancy is expected to raise the elderly population, thereby increasing the number of individuals with dementia. By 2030, it is estimated that there will be 75 million people with dementia, and this number is projected to double by 2050.[1]

Dementia is a leading cause of disability and dependency in the elderly population, accounting for 11.9% of disability caused by non-communicable diseases. Beyond health aspects, the cost of dementia care resulted in losses amounting to US$ 818 billion in 2015 and is projected to reach US$ 2 trillion by 2030. Socially, individuals with dementia often experience shame and withdrawal from their social environment, which negatively impact mental health and exacerbate their condition.[2] The multisectoral impact of dementia makes its status as a pressing public health issue that needs to be addressed promptly.[1]

Coastal communities have been found to experience a higher prevalence of certain diseases compared to other regions. Degenerative diseases, such as coronary heart disease, stroke, hypertension, diabetes mellitus, and dementia, have an incidence rate that is 2-8% higher in coastal areas.[3] Furthermore, hypertension, diabetes mellitus, and coronary heart disease are closely associated with an increased incidence and accelerated progression of dementia. Hypertension is linked to oxidative stress, endothelial dysfunction, decreased cerebral blood flow, hypoxia, and impaired beta-amyloid clearance, all of which ultimately contribute to dementia.[4] Insulin signaling disorders in patients with diabetes mellitus are associated with beta-amyloid plaque accumulation due to increased activity of the beta-secretase enzyme[5] and oxidative stress caused by the buildup of advanced glycation end products (AGE).[6]

Several demographic characteristics are associated with the incidence of

dementia, such as age, gender, education level, and marital status. Meta-analyses have shown that the incidence of dementia and Alzheimer's disease (AD) increases with age.[7] Advancing age is associated with a higher risk of degenerative diseases, such as hypertension, heart disease, and diabetes mellitus.[7,8] Low education levels are linked to an increased risk of dementia. In contrast, higher education levels are associated with better lifestyles, a lower risk of cardiovascular diseases, higher socioeconomic status, and greater intelligence.[9] Diabetes mellitus (DM) and hypertension (HT) are two degenerative diseases that are closely related to dementia. Diabetes mellitus is strongly associated with increased beta-amyloid plaques in AD.[10] Hypertension contributes to tau protein phosphorylation, beta-amyloid deposition, and neurofibrillary tangles.[11]

Unhealthy lifestyle factors, such as physical inactivity and smoking, also contribute to the increased incidence of dementia. Studies on animal models and humans have shown that aerobic exercise can prevent the progression of neurodegenerative processes and reduce age-related synapse loss.[12] In addition, physical activity helps reduce the risk of vascular diseases, including cerebrovascular events.[13] On the other hand, smoking contributes to an increase in free radicals that stimulate oxidative stress, thereby increasing the risk of cardiovascular diseases.[14]

To date, the exact etiopathogenesis of dementia remains unknown, and effective therapies for preventing and curing dementia have yet to be discovered. Dementia is also often undiagnosed in its early stages due to its chronic progressive nature. Therefore, analyzing the risk factors for cognitive impairment in late adulthood and the elderly population in coastal areas is expected to provide a basis for efforts to prevent the progression of dementia and reduce the incidence of dementia in the elderly population.

METHOD

Study population and data collection

This study employed a cross-sectional design, recruiting 225 adults aged 18 years or older who met the inclusion criteria through consecutive

sampling. Participants were excluded if they were illiterate, had uncorrectable visual or hearing impairments, or decided to withdraw from the study. Data collection was conducted from June 2023 to December 2023 in four coastal locations: Maringkik Island, Sekotong, Ampenan, and Malaka.

Health and cognitive function assessment

Data collection was carried out in four regions: Maringkik Island, Ampenan Village, Sekotong Village, and Nipah Village. The study was conducted after obtaining an ethical clearance letter issued by the Health Research Ethics Committee of Universitas Mataram.

In the first stage, participants were given a detailed explanation of the study procedures and asked to provide their consent by signing an informed consent form. In the second stage, data on the sociodemographic characteristics, health status, and lifestyle of the participants were collected through structured interviews. Clinical data collected included hypertension, diabetes mellitus, and overweight status. Lifestyle-related data, such as physical activity levels, were also gathered.

Objective data requiring participant measurements were confirmed through examinations, including blood pressure measurements, height and weight assessments, and random blood glucose tests. In the fourth stage, cognitive function status was assessed using the Mini-Cog score instrument, which has a score range of 0–5. Data collection was conducted in a relaxed and comfortable setting to ensure accuracy and participant ease.

Statistical analysis

Sociodemographic characteristics, health status, lifestyle, and cognitive function status of participants were compared between hypertensive and non-hypertensive groups and presented in frequency distribution tables. The relationship between cognitive function and variables such as age group, physical activity level, hypertension status, diabetes mellitus, body mass index (BMI), and smoking habits was analyzed using logistic regression analysis. The results were reported as adjusted odds ratios (ORs) with 95% confidence intervals (CIs).

Age group, physical activity level, hypertension status, diabetes mellitus, BMI, and smoking habits were considered significant risk factors for cognitive impairment if they demonstrated a p-value of <0.05.

RESULT

Table 1. Characteristics of Respondents with Normal and Impaired Cognitive Function Based on Mini-Cog Assessment

Variable	Mini-Cog Score <2		Mini-Cog Score >2	
	n	%	n	%
Age > 45	87	56	67	44
Sex				
Male	30	34	34	51
Female	57	66	33	49
Physical activity level				
Active	48	55	42	63
Low	39	45	25	37
Hypertension				
With hypertension	58	67	37	55
Without hypertension	29	33	30	45
Diabetes mellitus				
With DM	14	16	16	24
Without DM	73	84	51	76
BMI				
< 22.5	35	40	42	63
>22.5	52	60	25	37
Smoking status				
Smoking	20	23	17	25
No Smoking	67	77	50	75

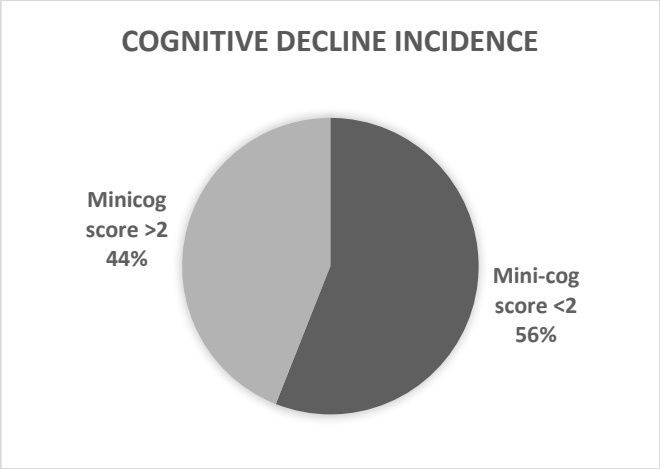

Figure 1. Incidence of Cognitive Function Decline Among All Respondents

Table 2. Multivariate Analysis of Factors Associated with Cognitive Function

Variable	Cognitive Decline		Sig.
	n	%	
Age >45th	87	56	0.005
Physical activity	48	55	0.377
Hypertension	58	67	0.037
Diabetes mellitus	14	16	0.961
BMI >22.5	35	40	0.356
Smoking	20	23	0.102

DISCUSSION

Dementia is characterized by cognitive decline, often associated with aging processes. This syndrome affects memory, language ability, learning capacity, thinking skills, orientation, comprehension, and judgment.[1] Individuals with multimorbidity—defined as having two or more chronic diseases—are 2.4 times more likely to develop dementia. Several demographic characteristics are associated with dementia incidence, such as age, gender, education level, and marital status. Meta-analyses have shown that the incidence of dementia and Alzheimer's disease (AD) increases with age. The incidence of dementia among those aged 65–69 years is three times higher than in those under 65 years. Similarly, the incidence of dementia in individuals aged 75–79 years is three times higher than in those aged 70–74 years.[7]

Age is linked to an increased risk of chronic diseases that are closely associated with dementia, including systemic inflammation, metabolic dysregulation, and reduced pulmonary function, which contribute to higher rates of dementia.[8]

Education level is another significant risk factor for dementia. Low education levels are associated with a higher risk of dementia. In contrast, higher education is linked to better lifestyles, reduced cardiovascular disease risk, improved socioeconomic status, and greater intelligence—all of which are protective against dementia. Additionally, radiological studies have shown that higher education is associated with greater cerebral volume.[9]

Two degenerative diseases-Diabetes Mellitus (DM) and Hypertension (HT)-are strongly linked to dementia. DM disrupts insulin signaling and the PI3K-Akt cascade, contributing to

beta-amyloid plaque accumulation.[10] Reduced synthesis of endothelial nitric oxide synthase (eNOS) in DM causes vasoconstriction of blood vessels, impairing nutrient and oxygen supply to the brain, leading to oxidative stress and neuroinflammation. Insulin resistance also reduces the activity of insulin-degrading enzyme (IDE), which is responsible for breaking down beta-amyloid. Decreased IDE activity exacerbates beta-amyloid plaque accumulation.[15]

Hypertension is another major factor influencing cognitive decline, particularly in coastal areas. Degenerative diseases, such as coronary heart disease, stroke, hypertension, diabetes mellitus, and dementia, have a 2–8% higher incidence in coastal regions.[3] Hypertension contributes to oxidative stress, endothelial dysfunction, reduced cerebral blood flow, hypoxia, and impaired beta-amyloid clearance, ultimately leading to dementia.[4] Hypertension also promotes tau protein phosphorylation, beta-amyloid deposition, and neurofibrillary tangles, key pathological features of Alzheimer's disease, though also present in vascular dementia.[11] The loss of neurons in brain areas responsible for cognitive domains—such as memory, attention, language, executive function, and visuospatial skills—due to these pathological processes leads to cognitive decline, which is often progressive and accelerates in older age. Further research is needed to understand the high prevalence of hypertension in coastal areas.

Lifestyle factors, such as physical activity and smoking habits, also play a significant role in dementia incidence. Aerobic exercise has been associated with reduced cognitive impairment and dementia risk. Studies on both animal models and humans have shown that aerobic exercise can prevent the progression of neurodegenerative processes and synaptic loss associated with aging. This mechanism is linked to increased neurotrophic factors, which support neuroprotection and neuroplasticity.[12] Additionally, physical activity reduces the risk of vascular diseases, including cerebrovascular events, which are a known risk factor for dementia.[13]

Smoking, on the other hand, increases free radical production, stimulating

oxidative stress, and raising the risk of cardiovascular diseases, which are comorbid conditions of dementia.[14]

Dietary habits, particularly fish consumption, may also influence cognitive function. Fish consumption is significantly associated with reduced dementia risk. Fish is a primary source of n-3 polyunsaturated fatty acids (PUFAs), including DHA and EPA, collectively known as fish fatty acids. N-3 PUFAs improve endothelial function, reduce inflammation, and lower blood pressure, leading to a decreased risk of cardiovascular diseases, which are comorbidities of dementia.[16] Further research is required to explore the relationship between fish consumption and cognitive function in the elderly.

CONCLUSION

More than half of middle-aged individuals residing along the coast of Lombok Island experience cognitive decline, with age and a history of hypertension identified as significant influencing factors. Further research is needed to explore other potential risk factors for dementia in coastal areas, such as salt consumption, fish consumption, and other lifestyle or environmental factors.

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