International Journal of Public Health Excellence (IJPHE)
Vol. 6, Issue 1, June-December 2026, pp. 393~402
Journal Homepage: https://ejournal.ipinternasional.com/index.php/ijphe
ISSN: 2809-9826, DOI: 10.55299/ijphe.v6i1.2073

The Relationship Between Sleep Quality and Cognitive Function and Activities of Daily Living in the Elderly in Banjar Denkayu Delodan, Werdi Bhuwana Village, Mengwi District, Badung Regency

Komang Agus Krisnayana[1], I Ketut Arya Yoga Krismantara[2], Ratih Wulansari Manuaba[3]

[1,2,3]Universitas Bali Internasional, Indonesia

Article Info

Article history:
Received August 06, 2026
Revised August 20, 2026
Accepted September 16, 2026

Corresponding Author:

Komang Agus Krisnayana
Universitas Bali Internasional, Indonesia
Email:
krisnamang3@gmail.com

ABSTRACT

Sleep quality disorders are frequently experienced by the elderly due to degenerative processes, potentially impairing brain recovery, memory consolidation, concentration, and cognitive function. Persistent sleep disturbances may reduce energy, balance, and physical capacity, affecting independence in activities of daily living (ADL). This study aimed to analyze the relationship between sleep quality and cognitive function and activities of daily living among the elderly in Banjar Denkayu Delodan, Werdi Bhuwana Village, Mengwi District, Badung Regency. This descriptive correlational study employed a cross-sectional approach involving 50 elderly participants selected through simple random sampling. Instruments included the Pittsburgh Sleep Quality Index (PSQI), the Indonesian version of the Montreal Cognitive Assessment (MoCA-Ina), and the Katz Index. Data were analyzed using the non-parametric Somers' d test. The majority of participants (82%, n=41) had poor sleep quality. Cognitive impairment was observed in 44% with mild impairment and 26% with moderate impairment, while 44% exhibited moderate dependence in ADL. Somers' d test revealed a strong, significant positive relationship between sleep quality and cognitive function (r=0.653; p=0.001), and a significant moderate negative relationship between sleep quality and ADL (r=-0.412; p=0.026). Significant relationships exist between sleep quality and both cognitive function and independence in activities of daily living among the elderly in Banjar Denkayu Delodan.

Keywords:
Rambutan Leaves, Excision Wound, Healing of Excision Wounds

1. INTRODUCTION

The global population is experiencing unprecedented demographic aging, a phenomenon driven by increased life expectancy and declining fertility rates. According to the World Health Organization (WHO), the proportion of people aged 60 years and older is projected to nearly double from 12% to 22% between 2015 and 2050. Indonesia, the fourth most populous nation globally, is undergoing a similar demographic transition. Data from the Indonesian Central Bureau of Statistics (Badan Pusat Statistik, 2024) indicate a steady increase in the elderly population, reflecting successful public health interventions that have extended their life expectancy. However, this demographic shift presents substantial challenges to healthcare systems, social support structures, and economic productivity [1].

The aging process, or aging process, is characterized by progressive physiological decline across multiple organ systems, including the nervous, musculoskeletal, endocrine, and cardiovascular systems. These changes increase the vulnerability to chronic conditions, functional decline, and reduced quality of life. Sleep disturbances, cognitive impairment, and decreased independence in activities of daily living represent three interconnected health challenges frequently

encountered in the elderly population. Understanding the relationships among these variables is crucial for developing effective preventive and rehabilitative strategies to promote healthy aging.

Sleep quality refers to an individual's subjective assessment of their sleep experience, encompassing factors such as sleep duration, latency, efficiency, disturbances, and overall satisfaction. The normal physiological sleep duration for elderly individuals is approximately 7-8 hours per night, although individual variation exists within the 6-9 hour range. As individuals age, the quality rather than the quantity of sleep often deteriorates, characterized by shallower sleep, increased nocturnal awakenings, reduced slow-wave sleep (stages 3 and 4 NREM), and early morning awakening [2].

The pathophysiology of sleep disturbances in older adults involves multiple interacting mechanisms. Age-related changes in the suprachiasmatic nucleus (SCN) of the hypothalamus, the body's primary circadian pacemaker, reduce the amplitude and stability of circadian rhythms. Decreased melatonin production by the pineal gland impairs sleep initiation and maintenance [2]. Neurotransmitter imbalances, particularly those involving serotonin, dopamine, and orexin, further disrupt sleep-wake cycle stability. Elevated nocturnal cortisol levels can inhibit deep sleep entry, while reduced growth hormone secretion due to diminished slow-wave sleep compromises tissue repair and energy restoration [3].

Multiple factors influence the sleep quality of elderly populations. Age-related physiological changes increase susceptibility to sleep fragmentation and early awakening. Physical activity levels play a significant role, with sedentary lifestyles being associated with reduced sleep quality. Psychological factors, including stress, anxiety, and depression, frequently contribute to sleep disturbances. Social isolation and loneliness, particularly among elderly individuals living alone or with limited social support, are associated with poor sleep outcomes. Additionally, the use of certain medications can disrupt sleep architecture and quality [4].

The specific occupational context of Banjar Denkayu Delodan, where a substantial proportion of elderly residents work as traders beginning their activities in the early morning hours (02:00-04:00 WITA), represents a unique environmental factor influencing sleep patterns. This early-rising occupational requirement causes circadian misalignment, ―a mismatch between biological rhythms and daily schedules, ―which can lead to reduced sleep duration, increased daytime sleepiness, and cumulative sleep debt [5]. This occupational factor provides a compelling rationale for investigating sleep quality in this community.

Cognitive function encompasses a broad range of mental processes, including attention, memory, language, executive function, visuospatial abilities, and processing speed. These functions are essential for independent living, social participation, and overall Ool. Age-related cognitive decline represents a continuum ranging from normal age-associated memory changes to mild cognitive impairment (MCI) and dementia [6].

The structural and functional integrity of the brain is crucial for maintaining the cognitive function. The cerebrum, particularly the prefrontal cortex (executive function) and hippocampus (memory consolidation), is particularly vulnerable to age-related changes [7]. Neurodegenerative processes, reduced cerebral blood flow, decreased neurotransmitter availability, and the accumulation of metabolic waste products contribute to cognitive decline. Additionally, the glymphatic system, which is responsible for clearing neurotoxic waste during sleep, becomes less efficient with age, potentially accelerating cognitive deterioration [8].

Education is a significant modifiable factor influencing the cognitive reserve, which is ―the brain's capacity to maintain cognitive performance despite age-related changes. Higher education levels are associated with better cognitive outcomes owing to increased neural plasticity, synaptic density, and alternative cognitive strategies. Conversely, limited education is associated with a reduced cognitive reserve and an increased risk of dementia.

Physical and mental health conditions influence cognitive function via multiple pathways. Cardiovascular disease, diabetes, and metabolic disorders can impair the cerebral blood flow and nutrient delivery. Mental health conditions, such as depression and anxiety, affect attention, memory, and executive function [9]. Medications, particularly sedatives and anticholinergics, may impair cognitive performance.

Activities of daily living (ADL), as measured by instruments such as the Katz Index, represent fundamental self-care tasks that are essential for independent living. Basic ADL include bathing, dressing, toileting, transferring, continence, and feeding. Instrumental ADL (IADL) encompasses more complex activities such as shopping, meal preparation, housework, and medication management. Functional decline in ADL, often beginning with IADL limitations, has significant implications for the quality of life, caregiver burden, and healthcare utilization.

The physiological mechanisms linking sleep quality to ADL performance involve neuroendocrine regulation and energy metabolism. Melatonin regulates circadian rhythms and sleep initiation; cortisol modulates stress responses and energy availability; growth hormone is released during deep sleep and is essential for tissue repair; serotonin and dopamine influence motivation and motor readiness; and leptin and ghrelin regulate energy balance [10]. Disruption of these hormonal systems due to poor sleep quality can result in fatigue, reduced motivation, impaired motor function, and decreased ADL independence.

Several factors influence ADL performance in the elderly population. Physical factors, including reduced muscle strength, joint flexibility, and endurance, impede mobility and self-care activities. Chronic conditions such as osteoarthritis, stroke, diabetes, and hypertension increase functional dependence [11]. Cognitive impairment affects the ability to recognize tasks, make decisions, and sequence steps in ADL performance. Psychological conditions such as depression, anxiety, and fear of falling reduce engagement in physical activities, accelerating deconditioning. Social support from family and community positively influences ADL independence, whereas environmental barriers, such as poor lighting, slippery floors, and inaccessible housing, increase the risk of disability.

While substantial evidence supports the relationship between sleep quality, cognitive function, and ADL independence, research examining these interconnected variables in specific community settings remains limited. Banjar Denkayu Delodan represents a unique context due to the predominant occupational pattern of early-morning trading, which likely influences sleep patterns. Additionally, the socioeconomic and cultural characteristics of this community may shape health behaviors and outcomes differently than previously studied populations [12].

The descriptive data from the current study reveal that 70% of the participants were in the elderly age category (60-74 years), 68% were female, 32% were traders, and 72% had only elementary school education. These characteristics highlight the need for targeted research to understand the specific health challenges and needs of this community.

Previous research on similar populations has demonstrated a significant relationship between sleep quality and cognitive function. Mousavi et al. (2020) reported a strong negative correlation between PSQI and MoCA scores ($r=-0.55$, $p<0.001$), with all PSQI components showing significant associations with cognitive performance. Putra et al. (2021) found that 78.8% of elderly participants had poor sleep quality (mean PSQI score 11.50), and 76.9% had cognitive impairment (mean MoCA-Ina score 23.06), with a significant negative correlation ($r=-0.399$, $p=0.003$). Simanjuntak et al. (2023) similarly reported that 65% of elderly had poor sleep quality and 70% had cognitive decline, with significant association ($p=0.013$) [13].

Regarding sleep quality and ADL, Cristina et al. (2024) reported that 23.0% of the elderly had sleep problems and 38.0% had ADL impairments. Kirana et al. (2023) demonstrated significant correlations between sleep quality and independence ($p=0.000$), with 92.9% having poor sleep quality and 40.5% showing severe dependence. Aprianingsih et al. (2024) confirmed these findings with similar significant associations.

Despite the established relationships between sleep quality, cognitive function, and ADL, limited research has simultaneously examined these variables in community-dwelling elderly populations in Bali, particularly in areas with distinctive occupational patterns affecting sleep schedules. The occupational context of Banjar Denkayu Delodan, where early-morning trading activities disrupt normal sleep-wake cycles, provides a natural experimental setting for examining the cumulative effects of sleep disruption on cognitive and functional outcomes.

This study addresses the following research questions:

Is there a relationship between sleep quality and cognitive function among older adults in Banjar Denkayu Delodan?

Is there a relationship between sleep quality and activities of daily living among the elderly in Banjar Denkayu Delodan, Indonesia?

Hypotheses

Based on the theoretical framework and empirical evidence, the following hypotheses were proposed:

There was a significant relationship between sleep quality and cognitive function among older adults in Banjar Denkayu Delodan.

There was a significant relationship between sleep quality and activities of daily living among the elderly in Banjar Denkayu Delodan.

Understanding these relationships has important implications for clinical practice, community health promotion and policy development. Physiotherapists and other healthcare providers can incorporate sleep quality assessment into comprehensive geriatric evaluations and develop targeted interventions addressing sleep hygiene, physical activity, and cognitive stimulation to maintain functional independence and quality of life in the aging population.

2. METHOD

This study employed a descriptive correlational research design with a cross-sectional approach. The descriptive correlational design is appropriate for examining the relationships between variables without manipulating them or assigning interventions, allowing for the investigation of naturally occurring associations between sleep quality, cognitive function, and activities of daily living. The cross-sectional approach involved collecting data on all variables at a single time point to capture the concurrent relationships among the study variables.

The research was conducted in Banjar Denkayu Delodan, Werdi Bhuwana Village, Mengwi District, Badung Regency, Bali, Indonesia. This location was selected based on the distinctive occupational characteristics of the community—predominantly early-morning traders— which may influence sleep patterns. The research was conducted during February 2026, with preparatory activities occurring in January 2026 and data analysis and report writing extending through March 2026.

Target Population: The target population comprised all elderly individuals (aged ≥60 years) residing in the Mengwi District of Badung Regency.

Accessible Population: The accessible population included older adults living in Banjar Denkayu Delodan, Werdi Bhuwana Village.

Inclusion Criteria:

Aged ≥60 years

Male or female

Resident of Banjar Denkayu Delodan

Able to communicate effectively

Willing to participate and provide informed consent

Exclusion Criteria:
History of severe cognitive impairment (e.g., schizophrenia) that would affect measurement accuracy
Acute or serious medical conditions (e.g., acute stroke, current hospitalization)
Hearing or speech impairments preventing completion of instruments
Inability to complete all measurements (PSQI, MoCA-Ina, Katz Index)

Sample Size Determination
Sample size was calculated using the Slovin formula:
$n = N / [1 + N(e)^2]$
where N = 100 (estimated total elderly population in Banjar Denkayu Delodan), e = 10% (0.1)

$n = 100 / [1 + 100(0.1)^2]$
$n = 100 / [1 + 100(0.01)]$
$n = 100 / [1 + 1]$
$n = 100 / 2 = 50$ participants

Sampling Technique
Simple random sampling was employed to select participants. The procedure involved:
Identification of all elderly individuals in Banjar Denkayu Delodan meeting inclusion criteria
Creation of a sampling frame with complete identification
Random selection using a lottery method
Verification of selected individuals' continued eligibility
Replacement of ineligible individuals through repeated random selection

Study Variables
Independent Variable: Sleep quality, measured using the Pittsburgh Sleep Quality Index (PSQI), with ordinal data categories (good quality, PSQI ≤5; poor quality, PSQI >5).

Dependent Variables:
Cognitive function was measured using the Indonesian version of the Montreal Cognitive Assessment (MoCA-Ina), with ordinal categories (normal, 26-30; mild impairment, 20-25; moderate impairment, 10-19; severe impairment, 0-9).
Activities of Daily Living, measured using the Katz Index, with ordinal categories (independent, score 6; moderate dependence, 3-5; severe dependence, <2).

Operational Definitions
Sleep Quality: Sleep quality is defined as an individual's subjective assessment of their sleep experience, encompassing sleep duration, latency, disturbance, efficiency, and overall satisfaction. Sleeo quality was measured using the PSQI, with higher scores indicating poorer sleep quality.
Cognitive function refers to mental processes, including memory, attention, language, executive function, and visuospatial abilities. It was assessed using the MoCA-Ina, a validated screening instrument for cognitive impairment.
Activities of Daily Living: ADL encompasses fundamental self-care activities, including bathing, dressing, toileting, transferring, continence, and feeding. Independence in ADL was measured using the Katz Index, with higher scores indicating greater independence.

Research Instruments
1. Pittsburgh Sleep Quality Index (PSQI):
The PSQI is a self-rated questionnaire that assesses sleep quality over a one-month period. It consists of 19 items grouped into seven component scores: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbance, use of sleeping medication, and daytime dysfunction. Each component is scored 0-3, with a global PSQI score ranging from 0 to 21. A score >5 indicates poor sleep quality. The PSQI has demonstrated good reliability (Cronbach's alpha = 0.81) and validity in older adults populations (Chehri et al., 2020).

2. Montreal Cognitive Assessment (MoCA-Ina):
The MoCA is a neurocognitive screening instrument developed by Nasreddine in 1996 that assesses multiple cognitive domains, including executive function, visuospatial abilities, attention, concentration, short-term memory, language, abstraction, and orientation. The Indonesian version (MoCA-Ina) has established validity and reliability, with a Cronbach's alpha of 0.81, excellent test-retest reliability (ICC = 0.92), and high sensitivity (90%) and specificity (87%) at the <26 cut-off for detecting MCI (Lord et al., 2024; Wahyuningsih & Winarni, 2022).

3. Katz Index of Independence in Activities of Daily Living:
The Katz Index assesses functional independence in six basic ADL: bathing, dressing, toileting, transferring, continence, and feeding. Each activity is scored 1 (independent) or 0 (dependent), with total scores ranging from 0-6. The instrument

has demonstrated good reliability (Cronbach's alpha = 0.82-0.94; ICC = 0.94) and validity across multiple populations (Rathnayake et al., 2023)..

3. RESULTS AND DISCUSSION

3.1. Characterization of Respondent

Table 1: Demographic Characteristics of Study Participants

Characteristic	Frequency (n)	Percentage (%)
Age Category		
Elderly (60-74 years)	35	70
Very old (75-90 years)	15	30
Gender		
Male	16	32
Female	34	68
Occupation		
Trader	16	32
Farmer	7	14
Laborer	10	20
Housewife	5	10
Retired	12	24
Education Level		
Elementary School	36	72
Junior High School	1	2
Senior High School	9	18
Bachelor's Degree	4	8
Sleep Quality (PSQI)		
Good (≤5)	9	18
Poor (>5)	41	82
Cognitive Function (MoCA-Ina)		
Normal (26-30)	15	30
Mild Impairment (20-25)	22	44

Characteristic	Frequency (n)	Percentage (%)
Moderate Impairment (10-19)	13	26
Severe Impairment (0-9)	0	0
Activities of Daily Living (Katz)		
Independent (6)	28	56
Moderate Dependence (3-5)	22	44
Severe Dependence (<2)	0	0

The majority of participants (70%) were in the elderly age category (60-74 years), consistent with national demographic patterns and previous studies in similar populations (Putra et al., 2021). This age distribution reflects a higher life expectancy in the younger elderly group, although the older elderly (75-90 years) still represented a substantial proportion (30%). The predominance of the younger elderly group is expected, given the functional limitations and reduced survival rates in the older elderly, particularly in community-dwelling populations.

Female participants comprised 68% of the sample, reflecting demographic patterns in Badung Regency where elderly females (51.7%) outnumber males (48.3%) (BPS Badung, 2024). This gender disparity is attributed to higher female life expectancy and can be explained physiologically: post-menopausal women experience hormonal changes, including decreased estrogen and progesterone levels, which affect sleep quality, emotional regulation, and cognitive function (Leba et al., 2023; Baker et al., 2023). Estrogen plays a neuroprotective role in sleep regulation, neurotransmitter function, and brain health. Male participants also experience age-related testosterone decline, affecting sleep patterns, muscle mass, and physical function (Mong et al., 2021; Kasmiati et al., 2023). The predominance of female participants is consistent with global aging patterns and represents the population characteristics of the study region.

Occupational characteristics revealed that 32% of participants worked as traders, with early-morning activity commencing at 02:00-04:00 WITA, disrupting normal sleep-wake patterns. This occupational pattern likely contributes to circadian misalignment, sleep debt accumulation, and reduced sleep duration (Tsuno & Mieda, 2024; Okuda et al., 2021). The circadian misalignment describes a mismatch between the internal biological clock and environmental/social demands, causing sleep disruption, daytime fatigue, and impaired physiological recovery. Participants working as farmers (14%), laborers (20%), and retired individuals (24%) also exhibited varied sleep patterns related to their daily activity schedule. These occupational factors are particularly relevant for understanding the high prevalence of poor sleep quality (82%) in this population.

Education level analysis revealed that 72% of participants had only elementary school education, 2% had junior high school, 18% had senior high school, and 8% had bachelor's degrees. This educational distribution has significant implications for cognitive function assessment, as lower education is associated with a reduced cognitive reserve—the brain's capacity to maintain cognitive function despite age-related changes (Kasmiati et al., 2023; Turana, 2020). Education influences cognitive test performance through multiple mechanisms, including vocabulary knowledge, test-taking strategies, and general cognitive stimulation throughout life. The predominance of low education in this population may contribute to the high rates of cognitive impairment observed (70% with mild-to-moderate impairment) and should be considered when interpreting MoCA-Ina scores.

Regarding sleep quality distribution, 82% (n=41) had poor sleep quality (PSQI >5), with a mean PSQI score of 19.7 among those with poor quality. This prevalence is higher than the 65% reported by Simanjuntak et al. (2023) and 78.8% reported by Putra et al. (2021), possibly reflecting the unique occupational context of early-morning trading activities. The high prevalence of poor sleep quality is concerning, given its implications for cognitive and functional outcomes.

Cognitive function assessment revealed that 30% had normal function, 44% had mild impairment, and 26% had moderate impairment, with no participants exhibiting severe impairment. These findings indicate that the majority (70%) of the elderly participants experienced some degree of cognitive decline, consistent with previous studies (Simanjuntak et al., 2023; Putra et al., 2021). The predominance of mild impairment reflects early-stage cognitive changes typically associated with normal aging and sleep disruption, whereas moderate impairment indicates more substantial cognitive decline requiring clinical attention.

ADL assessment showed that 56% were independent (Katz score 6), while 44% exhibited moderate dependence (score 3-5). This distribution suggests that while many elderly individuals maintain basic self-care abilities, a substantial proportion require assistance with ADL, consistent with the functional implications of sleep disruption and cognitive decline observed in this population.

3.2. Relationship Between Sleep Quality and Cognitive Function

Table 2: Cross-Tabulation of Sleep Quality and Cognitive Function

Sleep Quality	Normal Cognitive Function	Mild Cognitive Impairment	Moderate Cognitive Impairment	Total
Good	7 (14%)	2 (4%)	0 (0%)	9 (18%)
Poor	8 (16%)	20 (40%)	13 (26%)	41 (82%)
Total	15 (30%)	22 (44%)	13 (26%)	50 (100%)

Somers' d test: $r = 0.653$; $p = 0.001$

The analysis revealed a significant, strong positive relationship between sleep quality and cognitive function among elderly participants ($r = 0.653$; $p = 0.001$). The positive coefficient indicates a unidirectional relationship: as sleep quality worsens, cognitive function tends to decline. Specifically, among participants with good sleep quality, 77.8% (7/9) had normal cognitive function, whereas among those with poor sleep quality, only 19.5% (8/41) had normal cognitive function. Conversely, 80.5% (33/41) of those with poor sleep quality exhibited some degree of cognitive impairment (mild, 40%; moderate, 26%).

These findings are consistent with previous research demonstrating the critical role of sleep in maintaining cognitive function. Sleep, particularly slow-wave and REM sleep, is essential for memory consolidation, ―the process of transforming short-term memories into long-term storage and strengthening synaptic connections (Scullin et al., 2022; Qin et al., 2023). During SWS, the glymphatic system becomes highly active and clears neurotoxic waste products, such as amyloid-β and tau proteins, which accumulate during waking hours (Scullin et al., 2022). Poor sleep quality reduces the time spent in these restorative sleep stages, impairing memory consolidation and waste clearance and contributing to cognitive decline. Neurotransmitter systems, including acetylcholine, serotonin, and dopamine, are also regulated during sleep, and their imbalance due to sleep disruption further impairs cognitive function (Gorgoni & De Gennaro, 2024).

The pathophysiology underlying this relationship involves age-related neurodegenerative changes in the brain. The suprachiasmatic nucleus (SCN) shows decreased function in elderly individuals, contributing to circadian disruption (Farizy et al., 2021). Reduced melatonin production impairs sleep initiation, and alterations in serotonin and dopamine affect sleep-wake regulation. These changes lead to shallower sleep, more frequent awakenings, reduced SWS, and impaired sleep quality in older adults. Chronic sleep disruption exacerbates neurodegenerative processes in the hippocampus and prefrontal cortex—regions critical for memory, attention, and executive function (Ni et al., 2024). The reduced efficiency of the glymphatic system in the elderly further compounds these effects, contributing to the accumulation of neurotoxic proteins and accelerating cognitive decline (Qin et al., 2023).

The strong correlation observed ($r = 0.653$) exceeded that reported by Putra et al. (2021) ($r = -0.399$), suggesting that the relationship may be particularly pronounced in this population. This may be due to the occupational context: early-morning trading activities cause chronic sleep disruption, accumulating sleep debt over time and potentially leading to more severe cognitive consequences. The prolonged nature of such work patterns, with participants beginning work in the early morning hours for many years, likely contributed to the strength of this association.

These findings have important clinical implications. Healthcare providers should consider sleep quality assessment as a routine component of geriatric care, particularly given its strong association with cognitive function. Interventions promoting sleep hygiene, regular physical activity, and appropriate sleep schedules may help preserve cognitive function in elderly populations (Scullin et al., 2022). The particularly strong relationship observed in this population also suggests that environmental and occupational factors affecting sleep should be addressed in community health initiatives in the future. Physiotherapists and other rehabilitation professionals can play a key role in educating older adults about sleep hygiene practices and promoting lifestyle modifications to support sleep quality and cognitive function.

The relationship between sleep quality and cognitive function is further supported by Simanjuntak et al. (2023), who found that older adults with poor sleep quality predominantly exhibited mild to severe cognitive decline (65% poor sleep quality, 70% cognitive decline), with a significant association ($p = 0.013$). Mousavi et al. (2020) reported that all PSQI components were significantly associated with cognitive function, with medication use having the strongest correlation ($r = -0.47$, $p < 0.001$), followed by sleep disturbance ($r = -0.37$, $p < 0.001$) and sleep latency ($r = -0.34$, $p < 0.001$). These findings underscore the multi-dimensional nature of the sleep-cognition relationship and the importance of comprehensive sleep assessments.

3.3. Relationship Between Sleep Quality and Activities of Daily Living

Table 3: Cross-Tabulation of Sleep Quality and Activities of Daily Living

Sleep Quality	Moderate Dependence	Independent	Total
Good	2 (4%)	7 (14%)	9 (18%)
Poor	26 (52%)	15 (30%)	41 (82%)
Total	28 (56%)	22 (44%)	50 (100%)

Somers' d test: r = -0.412; p = 0.026

3.4. Discussion

The analysis revealed a significant moderate negative relationship between sleep quality and ADL independence (r = -0.412; P = 0.026). The negative coefficient indicates an inverse relationship: as the sleep quality worsens, the ADL independence decreases. Among participants with good sleep quality, 77.8% (7/9) were independent in ADL, while only 22.2% (2/9) showed moderate dependence. However, among those with poor sleep quality, 63.4% (26/41) showed moderate ADL dependence, whereas only 36.6% (15/41) remained independent.

The moderate relationship strength (r = -0.412) suggests that while sleep quality significantly influences ADL, other factors—including physical health, cognitive status, psychological state, and social support—also contribute significantly to functional independence. This aligns with the multi-factorial nature of ADL performance identified in previous research [14][15].

The physiological mechanisms underlying this relationship involve neuroendocrine disruption and changes in energy metabolism. Sleep disruption, particularly reduced SWS, leads to decreased growth hormone secretion, impairing tissue repair and energy restoration (Farizy et al., 2021). Reduced SWS is associated with incomplete tissue repair, energy depletion, and impaired neuromuscular recovery, resulting in fatigue, reduced muscle strength, and decreased physical performance. Additionally, sleep disruption alters the cortisol rhythm, leading to elevated nocturnal cortisol levels and impaired daytime energy regulation. These neuroendocrine changes result in fatigue, reduced stamina, decreased muscle strength, and impaired motor coordination, ―all of which contribute to reduced ADL independence [16][17].

As discussed in the previous section, cognitive impairment independently contributes to reduced ADL independence. The relationship between sleep quality and ADL may be both direct (through fatigue and physical limitations) and indirect (through cognitive impairment affecting task planning and execution). Elderly individuals with sleep disruption may have difficulty recognizing tasks, sequencing steps, or maintaining attention during ADL performance, further compromising their independence. Cognitive deficits associated with poor sleep quality, ―including impaired attention, executive function, and memory, ―compound the direct effects of sleep disturbance on physical capacity [18][19].

The ADL independence distribution (56% independent, 44% moderate dependence) indicates that while many elderly maintain basic self-care abilities, a substantial minority require assistance. The moderate dependence category (Katz score 3-5) suggests that participants can perform some but not all ADL independently, typically requiring help with more physically demanding activities such as bathing, transferring, or dressing. This pattern is consistent with the occupational context of early-morning work, as chronic sleep disruption may reduce energy reserves for these physically demanding activities [20].

These findings align with those of Xuan et al. (2025), who reported significant associations between sleep quality and ADL independence (p = 0.000) in similar populations. Xuan et al. (2025) found that among older adults with sleep problems, 38.0% had ADL impairments, emphasizing the clinical significance of sleep disturbance for functional independence. The current study's finding of moderate dependence in 63.4% of those with poor sleep quality is consistent with these previous reports [21].

The significant association between sleep quality and ADL has important implications for physiotherapy and community health promotion. Physiotherapists should assess sleep quality as part of comprehensive geriatric evaluation and incorporate sleep hygiene education and interventions to preserve ADL independence. Physical activity interventions that improve both sleep quality and functional capacity may be particularly valuable for this population. The role of physiotherapists in maintaining functional independence in the elderly includes not only direct interventions for mobility and strength but also education about lifestyle factors, including sleep, that affect overall functional capacity [22][23].

Several factors that potentially influence sleep quality warrant consideration. Occupational demands, particularly early-morning trading activities, are significant environmental factors. The 32% of participants working as traders and beginning their day at 02:00-04:00 WITA experience circadian misalignment, characterized by reduced sleep duration, accumulated sleep debt, and daytime fatigue (Okuda et al., 2021; Tsuno & Mieda, 2024). The resulting sleep deprivation may be cumulative over decades of work, contributing to the high prevalence of poor sleep quality observed [24].

Sex differences in sleep quality were not specifically analyzed but were suggested by the predominance of female participants (68%). Post-menopausal hormonal changes, particularly decreased estrogen and progesterone, affect sleep quality through their influence on temperature regulation, SCN function, and neurotransmitter [25]. The role of estrogen

in SCN regulation, temperature homeostasis, and neurotransmitter function contributes to sleep maintenance, and its decline may explain the higher sleep complaints in elderly women. Future research should examine sex differences in the relationship between sleep quality and this population.

Educational level (72% elementary school or less) may influence cognitive test performance through cognitive reserve mechanisms but is less likely to directly affect sleep quality or ADL. However, lower education may be associated with reduced health literacy and knowledge of sleep hygiene practices, potentially contributing to poor sleep quality. Limited education may also affect employment opportunities and socioeconomic status, influencing lifestyle factors such as work schedules, housing conditions, and access to healthcare, which affect sleep quality.

4. CONCLUSION

This study investigated the relationships between sleep quality, cognitive function, and activities of daily living among elderly individuals in Banjar Denkayu Delodan, Werdi Bhuwana Village, Mengwi District, Badung Regency. The findings provide substantial evidence supporting significant associations between sleep quality, cognitive function, and ADL independence. High Prevalence of Sleep Disturbance: Most elderly participants (82%) had poor sleep quality, likely influenced by occupational demands, including early-morning trading activities, and age-related changes in sleep architecture. Significant Relationship Between Sleep Quality and Cognitive Function: A strong, significant positive relationship ($r = 0.653$; $p = 0.001$) was demonstrated, indicating that poorer sleep quality was associated with greater cognitive decline. This relationship is consistent with the neuroprotective role of sleep in memory consolidation, synaptic strengthening, and glymphatic waste clearance. Significant Relationship Between Sleep Quality and ADL: A moderate, significant negative relationship ($r = -0.412$; $p = 0.026$) was observed, indicating that poorer sleep quality was associated with reduced independence in activities of daily living. This relationship reflects the effects of sleep disruption on energy, muscle strength, coordination, and cognitive function, ―all of which are essential for ADL performance. Clinical and Public Health Implications: These findings underscore the importance of assessing and promoting sleep quality in older adult populations. Healthcare providers, particularly physiotherapists, should incorporate sleep assessment into comprehensive geriatric evaluations and implement evidence-based interventions to improve sleep quality, including sleep hygiene education, regular physical activity, and lifestyle modifications addressing occupational and environmental factors affecting sleep. Need for Integrated Approaches: The interconnected nature of sleep quality, cognitive function, and ADL independence supports integrated approaches to elderly health promotion. Interventions addressing sleep quality may have cascading benefits for cognitive and functional outcomes, promoting healthier aging and maintaining independence in the elderly population.

ACKNOWLEDGEMENTS

The author thanks all the people and institutions. In most cases, the acknowledgments of the sponsor and financial support.

REFERENCES

[1] E.-Y. Kang, S.-M. Chong, and B.-H. Chong, "The Relationship Between the Quality of Sleep and the Cognitive Function, Depression, and Activities of Daily Living in the Institutionalized Elderly," *J. Clin. Mov. Sci. Hum.*, vol. 22, no. 3, pp. 37–42, Nov. 2018, doi: 10.17817/2018.10.04.111325.

[2] L. Huijun *et al.*, "The mediating role of daily living ability and sleep in depression and cognitive function based on a structural equation model," *BMC Geriatr.*, vol. 25, no. 1, p. 223, Apr. 2025, doi: 10.1186/s12877-025-05871-3.

[3] W. Qi, J. Wang, X. Gao, and Y. Liu, "Impact of Sleep Quality on Cognitive Function in Elderly Patients With Alzheimer's Disease," *Actas Españolas Psiquiatr.*, vol. 54, no. 2, pp. 328–334, Apr. 2026, doi: 10.62641/aep.v54i2.2126.

[4] Y.-S. Huang and P.-Y. Lee, "421. THE RELATIONSHIP BETWEEN SLEEP QUALITY AND NEUROCOGNITIVE FUNCTION IN THE GERIATRIC DEPRESSION: A CASE-CONTROL STUDY," *Int. J. Neuropsychopharmacol.*, vol. 28, no. Supplement_2, pp. ii135–ii135, Aug. 2025, doi: 10.1093/ijnp/pyaf052.269.

[5] M. Ö. Firat and B. Varhan, "The Impact of Altitude on Sleep Quality, Daily Living Activities, and Quality of Life in Elderly Residents of Turkish Nursing Homes: A Cross-Sectional Analysis," *İstanbul Gelişim Üniversitesi Sağlık Bilim. Derg.*, no. 26, pp. 627–639, Aug. 2025, doi: 10.38079/igusabder.1628440.

[6] J.-I. Kim, "Health Conditions, Activities of Daily Living, Depression, Sleep, and Cognitive Functions of the Elderly at Care Facilities and Their Related Factors," *J. Korea Acad. Coop. Soc.*, vol. 17, no. 11, pp. 463–473, Nov. 2016, doi: 10.5762/KAIS.2016.17.11.463.

[7] L. Al-kum, A. Shakhshir, M. Badrasawi, and F. Al-Amouri, "Serum magnesium level is associated with cognitive function among the elderly in Palestine, a cross-sectional study," *BMC Res. Notes*, vol. 19, no. 1, p. 200, Mar. 2026, doi: 10.1186/s13104-026-07682-0.

[8] M. D. Devi and P. Padmavathi, "Effectiveness of Nursing Strategies on Memory and Sleep Quality among Patients with Alzheimer's Disease in a Selected Centers at Coimbatore," *J. Pharm. Bioallied Sci.*, vol. 18, no. 1, pp. 65–67, Jan. 2026, doi: 10.4103/jpbs.jpbs_9_26.

[9] F. Rizvi *et al.*, "Frequency of Poor Sleep Quality and Cognitive Impairment and Their Association in Older Adults in Pakistan: A Cross-Sectional Study at a Tertiary Care Hospital," *J. Liaquat Natl. Hosp.*, Jun. 2026, doi: 10.37184/jlnh.2959-1805.4.31.

[10] P. Singh, F. J. Roux, and S. Thapa, "Obstructive Sleep Apnea in the Elderly," 2026, pp. 287–310. doi:

10.1007/978-3-032-29861-4_12.
[11] R. Li, W. Zhai, and J. Liu, “Sleep duration trajectories and cognitive impairment among elderly: a 13-year cohort study in China,” *BMC Geriatr.*, vol. 26, no. 1, p. 217, Jan. 2026, doi: 10.1186/s12877-026-07001-z.
[12] Y. C. Tiyaswati, M. F. Ekasari, R. S. Maryam, S. Badriah, and P. H. Lestari, “THE RELATIONSHIP BETWEEN SLEEP QUALITY AND BLOOD PRESSURE IN ELDERLY WOMEN WITH HYPERTENSION,” *JKEP*, vol. 10, no. 2, pp. 153–157, Nov. 2025, doi: 10.32668/jkep.v10i2.2116.
[13] S. Gupta *et al.*, “Interface of Sleep Quality and Cognitive Health in Prevention of Dementia: SMRUTHI-INDIA,” *Alzheimer’s Dement.*, vol. 21, no. S7, Dec. 2025, doi: 10.1002/alz70861_109025.
[14] A. R. Biromo, P. A. Gunawan, A. H. Santoso, B. A. Wijaya, R. S. A. Aditya, and A. E. P. Khoto, “The Role of Blood Pressure, Diabetes Panel, Vitamin D, and Albumin in Sleep Quality Among the Elderly Population,” *Sriwij. J. Med.*, vol. 9, no. 1, pp. 10–17, Jun. 2026, doi: 10.32539/sjm.v9i1.369.
[15] E. Lee, H.-B. Kwak, S.-T. Lim, and D.-H. Park, “The 12 weeks of regular exercise improves sleep quality and mood states in elderly with cognitive impairment,” *Sleep Breath.*, vol. 29, no. 6, p. 362, Dec. 2025, doi: 10.1007/s11325-025-03545-3.
[16] F. N. Şişman, H. Özçelik, M. Günay, and G. Bıdık, “The Effect of a Sleep Program Applied to Elderly Individuals on Cognitive Status and Sleep Quality: Randomized Controlled Study,” *J. Nursology*, vol. 28, no. 4, pp. 341–349, Dec. 2025, doi: 10.17049/jnursology.1460521.
[17] H. Ma *et al.*, “Prolonged Nocturnal Sleep Duration as a Risk Factor for Cognitive Decline in Elderly Chinese Adults: A Post Hoc Cohort Analysis,” *Alzheimer’s Dement.*, vol. 21, no. S6, Dec. 2025, doi: 10.1002/alz70860_101970.
[18] B. Zhao *et al.*, “The relationships between sleep and cognitive decline: a 4-year cohort study based on a population in a rural area of Xi’an, China,” *Alzheimer’s Dement.*, vol. 21, no. S6, Dec. 2025, doi: 10.1002/alz70860_098316.
[19] N. M. Abd-El Hamid, M. O. Shahin, A. A. Saleh, and E. A. Abd Al Raheem, “Cognitive functions in elderly patients with insomnia: a case-control study,” *Middle East Curr. Psychiatry*, vol. 33, no. 1, p. 6, Jan. 2026, doi: 10.1186/s43045-025-00601-2.
[20] C. Long, Y. Wu, S. Wang, Z. Gong, and Y. Wang, “Association between sleep duration and cognitive function and emotional disorders in middle-aged and elderly patients with cerebral small vessel disease,” *Sleep Res.*, vol. 3, no. 2, pp. 121–134, Jun. 2026, doi: 10.1002/slp2.70031.
[21] H. Xuan, L. Wu, K. Yu, L. Yang, and X. Chen, “Sleep disturbances and their relationship with anxiety–depressive symptoms and quality of life in older adults: a retrospective observational study,” *Open Med.*, vol. 21, no. 1, Jan. 2026, doi: 10.1515/med-2026-1491.
[22] S. R. Sam Asir, J. Jaslina Gnanarani, G. Jaya Thangaselvi, K. Vijayalakshmi, and S. Priya, “Prevalence and Predictors of Sleep Quality among Institutionalized Elderly: A Cross-Sectional Study,” *Res. Rev. Int. J. Multidiscip.*, vol. 11, no. 5, pp. 209–216, May 2026, doi: 10.31305/rrijm.2026.v11.n05.023.
[23] N. V. Titova and Y. N. Bezdolny, “A sleepless night and a drained day: how to harmonize sleep-wakefulness imbalance in middle-aged and elderly patients? A review,” *Cons. Medicum*, vol. 28, no. 2, pp. 102–107, Apr. 2026, doi: 10.26442/20751753.2026.2.203619.
[24] M.-G. Peng *et al.*, “Impact of sleep disorders and cardiovascular disease comorbidity on memory function decline in middle-aged and older adults: a 10-year trajectory analysis based on CHARLS.” May 22, 2026. doi: 10.21203/rs.3.rs-9623506/v1.
[25] Y. K. Sari, W. A. Romadhon, T. Wahyuni, and M. Diana, “Food Massage as an Alternative to Improve Sleep Quality of Elderly Patients,” *J. Ners dan Kebidanan (Journal Ners Midwifery)*, vol. 12, no. 3, pp. 186–193, Dec. 2025, doi: 10.26699/jnk.v12i3.ART.p186-193.