

Handgrip Strength and Activities of Daily Living in Community-Dwelling Older Adults

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Abstract

Background: Age-related decline in musculoskeletal and neuromuscular function contributes to reduced functional independence among older adults. Grip strength is a simple and objective indicator of muscle strength and functional performance in the elderly population.

Objective: To determine the association between grip strength and activities of daily living (ADL) among community-dwelling older adults in Bali.

Methods: This analytical observational study used a cross-sectional design conducted in March 2026. A total of 104 older adults aged 60–80 years were recruited using purposive sampling. Grip strength was measured using a calibrated digital handgrip dynamometer following the American Society of Hand Therapists protocol, while ADL performance was assessed using the Barthel Index. Data were analyzed using Spearman's rank correlation test ($p < 0.05$). Ethical approval was obtained from the Ethics Committee of the Faculty of Medicine, Udayana University (No. 0998/UN14.2.2.VII.14/LT/2026).

Results: The mean age of participants was 69.83 ± 5.57 years, and 66.3% were female. The mean grip strength was 16.91 ± 7.27 kg, while 74.0% of participants had weak grip strength. Moderate ADL dependency was identified in 40.4% of participants. Grip strength showed a significant positive association with ADL performance ($r = 0.536$; 95% CI: 0.38–0.66; $p < 0.001$), indicating a moderate correlation.

Conclusion: Higher grip strength was associated with better ADL performance among community-dwelling older adults. Grip strength assessment may support early identification of older adults at risk of reduced functional independence.

Keywords

Grip Strength; Activities of Daily Living; Aged; Sarcopenia; Functional Independence

Introduction

Population ageing has become a major global public health issue due to increasing life expectancy and improvements in healthcare services. According to the World Health Organization (WHO), the proportion of older adults continues to rise worldwide, leading to an increased burden of age-related health problems, disability, and functional dependency.¹ Indonesia is experiencing a similar demographic transition, including in Bali Province, where the number of older adults has progressively increased in recent years.² This demographic shift has important implications for healthcare systems because ageing is closely associated with progressive physiological decline, particularly involving the musculoskeletal and neuromuscular systems.³

Age-related physiological changes include reductions in muscle mass, muscle quality, motor unit recruitment, and neuromuscular coordination, which collectively contribute to decreased muscle strength and impaired physical performance.³ These alterations are strongly associated with sarcopenia, a progressive skeletal muscle disorder characterized by reduced muscle strength and functional capacity.⁴ The Asian Working Group for Sarcopenia (AWGS) and the European Working Group on Sarcopenia in Older People 2 (EWGSOP2) emphasize that muscle strength is one of the most important determinants of physical function and healthy ageing in older adults.^{4, 5} Declining muscle strength may increase the risk of falls, mobility limitation, frailty, hospitalization, disability, and mortality among older populations.^{6, 7}

One of the most clinically relevant consequences of age-related functional decline is reduced activities of daily living (ADL) performance. ADL reflects an individual's ability to perform essential self-care activities independently, including feeding, bathing, dressing, toileting, transferring, and mobility.⁸ Functional dependency in ADL has been associated with lower quality of life, increased caregiver burden, social participation restriction, and higher healthcare utilization among older adults.⁹ In Indonesia, reduced functional independence among older adults remains an important public health concern because it may negatively affect physical, psychological, and socioeconomic well-being.¹⁰ However, epidemiological evidence regarding ADL impairment and its associated factors among community-dwelling older adults in Bali remains limited.¹¹

Grip strength is widely recognized as a simple, objective, inexpensive, and reliable method for evaluating overall muscle strength in older adults.^{4, 12} The EWGSOP2 recommends grip strength assessment as a primary screening parameter for sarcopenia because it strongly correlates with general muscle function and physical performance.⁵ Previous studies have demonstrated that low grip strength is associated with impaired mobility, poor balance, increased fall risk, reduced quality of life, hospitalization, and mortality among older adults.^{6, 7, 13} In addition, grip strength has been identified as an important predictor of functional independence and ADL performance among community-dwelling elderly populations.^{14, 15}

The physiological relationship between grip strength and ADL performance is multifactorial. Reduced muscle strength may impair the ability to perform functional movements requiring upper and lower extremity coordination, postural control, endurance, and mobility.^{3, 4} Decreased neuromuscular efficiency and sarcopenia-related muscle weakness can further limit an older adult's ability to perform routine daily activities independently.¹⁶ Moreover, chronic diseases, low physical activity levels, poor nutritional status, and

frailty may simultaneously contribute to both reduced grip strength and impaired ADL performance, thereby acting as potential confounding factors in geriatric functional assessment.^{17, 18} Therefore, grip strength evaluation may provide clinically meaningful information regarding overall functional capacity and independence in older adults.

Several previous studies have reported significant associations between grip strength and ADL ability. Dai et al. demonstrated that older adults with low grip strength had a higher risk of ADL dependency in a prospective cohort study.¹⁴ Similarly, Kim et al. reported that grip strength could serve as an important predictor of physical fitness and functional performance among older populations.¹⁵ Local evidence from Indonesia also showed a significant association between grip strength and functional independence among elderly individuals.¹⁹ Nevertheless, most previous studies were conducted in different sociocultural and healthcare settings, while evidence involving community-dwelling older adults in Bali remains scarce. Differences in lifestyle, physical activity patterns, nutritional status, family support systems, and prevalence of chronic diseases may influence functional ageing characteristics in this population.¹¹

This study specifically focused on older adults aged 60–80 years because this age range represents a population with progressive age-related muscle decline while still allowing direct functional assessment and participation in community-based evaluation.²⁰ Furthermore, most older adults within this age category remain actively involved in household and social activities, making ADL assessment clinically relevant for early functional screening and physiotherapy intervention planning.

The novelty of this study lies in its focus on the association between grip strength and ADL among community-dwelling older adults in Bali using standardized grip strength assessment procedures based on the American Society of Hand Therapists (ASHT) protocol and functional evaluation using the Barthel Index. In addition, this study provides regional evidence regarding functional ageing among older Balinese adults, which remains underreported in the current literature.

Based on the aforementioned background, this study aimed to determine the association between grip strength and ADL among community-dwelling older adults in Gulingan Village, Mengwi District, Badung Regency, Bali. It was hypothesized that higher grip strength would be associated with better ADL performance in older adults.

Methods

This study employed an analytical observational design with a cross-sectional approach to evaluate the association between grip strength and activities of daily living (ADL) among community-dwelling older adults. The study was conducted in Gulingan Village, Mengwi District, Badung Regency, Bali, Indonesia, during March 2026.

The target population consisted of older adults aged 60–80 years residing in Gulingan Village. Participants were recruited using purposive sampling based on predefined inclusion and exclusion criteria. The minimum sample size was determined using a correlation study formula with a significance level of 5% and statistical power of 80%, resulting in a minimum required sample of 96 participants.²¹ A total of 104 participants were ultimately included in the final analysis.

Older adults were eligible for inclusion if they were aged between 60 and 80 years, able to communicate effectively, capable of understanding and following verbal instructions, and willing to participate by signing written informed consent. Participants were excluded if they had severe neurological disorders, severe cognitive impairment, acute musculoskeletal injury, upper extremity deformity, severe hand pain during assessment, or unstable medical conditions that could interfere with grip strength measurement. Participants with mild cognitive impairment who were still able to communicate effectively and follow verbal instructions were allowed to participate in the study. Older adults with mild chronic diseases such as controlled hypertension or diabetes mellitus were not excluded because these conditions are common among community-dwelling elderly populations.

The recruitment was conducted through coordination with local community health workers and elderly community groups in Gulingan Village. Initial screening was performed to assess eligibility criteria before enrollment. Respondents who fulfilled the inclusion criteria underwent direct assessment and interview sessions at the community health service location. No incomplete or missing participant data were identified during the study period.

The study variables consisted of grip strength as the independent variable and ADL performance as the dependent variable. Sociodemographic and clinical characteristics including age, sex, and chronic disease history were also collected through structured interviews and direct observation.

Grip strength was assessed using a calibrated digital handgrip dynamometer following the standardized protocol of the American Society of Hand Therapists (ASHT).²² Before data collection, evaluators received training regarding participant positioning, device handling, measurement procedures, and data recording to improve measurement consistency. Calibration of the dynamometer was checked before the assessment sessions began.

Measurements were performed on the dominant hand because dominant-hand assessment is considered more representative of maximal voluntary muscle strength in functional evaluation.²³ Participants were positioned in a seated posture with the shoulder adducted and neutrally rotated, elbow flexed at 90°, forearm in neutral position, and wrist positioned between 0–30° extension and 0–15° ulnar deviation according to ASHT recommendations.²⁴ Each participant performed three maximal grip contractions with a one-minute rest interval between trials to minimize muscle fatigue. The highest value obtained from the three measurements was recorded as the final grip strength score and expressed in kilograms (kg). All measurements were performed during morning assessment sessions to minimize variability related to fatigue and daily activity.

Grip strength categories were classified according to the Asian Working Group for Sarcopenia (AWGS) criteria, with low grip strength defined as <28 kg for men and <18 kg for women.⁴ Participants not meeting these criteria were categorized as having normal grip strength.

Activities of daily living were assessed using the Barthel Index through face-to-face interviews conducted by trained evaluators. The Barthel Index is a widely validated and reliable instrument used to evaluate functional independence in older adults across various clinical and community settings.^{25, 24} The Indonesian version of the Barthel Index was used during the assessment process.²⁶ The instrument evaluates ten basic daily functional activities, including feeding, bathing, grooming, dressing, bowel control, bladder control, toileting, chair transfer, ambulation, and stair climbing. Total scores range from 0 to 100, with higher scores indicating greater independence.

Barthel Index scores were categorized into three functional dependency levels for descriptive analysis: moderate dependency, mild dependency, and independent status. Assessment interviews were conducted individually in a quiet environment to minimize distractions and reduce potential information bias.

Before participant recruitment, ethical approval was obtained from the Ethics Committee of the Faculty of Medicine, Udayana University/Prof. Dr. I.G.N.G. Ngoerah General Hospital with approval number 0998/UN14.2.2.VII.14/LT/2026. All participants provided

written informed consent before data collection began. Participant confidentiality and anonymity were maintained throughout the study.

Data analysis was performed using IBM SPSS Statistics version 27.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize participant characteristics. Normally distributed continuous variables were presented as mean $\pm$ standard deviation (SD), whereas non-normally distributed variables were additionally described using median and interquartile range (IQR). Categorical variables were presented as frequencies and percentages.

Data normality was evaluated using the Shapiro–Wilk test. Since the primary variables were not normally distributed, bivariate analysis was conducted using Spearman's rank correlation test to determine the association between grip strength and ADL performance. Correlation strength was interpreted as weak ($r < 0.30$), moderate ($r = 0.30–0.59$), or strong ($r \geq 0.60$).²⁷ Statistical significance was established at $p < 0.05$, and 95% confidence intervals (CI) were reported where applicable.

Potential confounding variables such as age, sex, chronic disease status, physical activity, and nutritional condition were recognized during interpretation of the findings; however, multivariable analysis was not performed because the study primarily aimed to identify the overall correlation between grip strength and ADL in this community-based population.

Results

A total of 180 older adults were initially screened for eligibility. Following the inclusion and exclusion process, 104 participants fulfilled the study criteria and completed all assessments. No missing or incomplete data were identified during the data collection process. The participant recruitment procedure is presented on Figure 1. to clarify the selection process and reasons for exclusion.

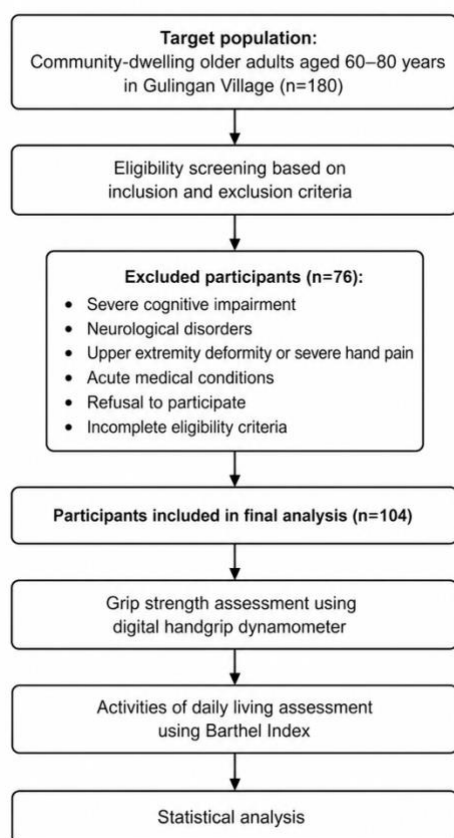


Figure 1. Participant Recruitment and Study Flow Diagram

The baseline characteristics of participants are summarized in Table 1. The table presents demographic characteristics, grip strength measurements, chronic disease status, and ADL categories to provide a comprehensive overview of the study population.

Table 1. Characteristics of Community-Dwelling Older Adults

Variables	Mean $\pm$ SD	Median (IQR)	Minimum–Maximum	n (%)
Age (years)	69.83 $\pm$ 5.57	70 (65–74)	60–80	—
Grip strength (kg)	16.91 $\pm$ 7.27	16.10 (11.80–21.50)	1.2–46.1	—
Sex	—	—	—	—
Male	—	—	—	35 (33.7)
Female	—	—	—	69 (66.3)
Chronic disease status	—	—	—	—
No chronic disease	—	—	—	40 (38.5)
Chronic disease present	—	—	—	64 (61.5)
Grip strength category	—	—	—	—
Weak grip strength	—	—	—	77 (74.0)
Normal grip strength	—	—	—	27 (26.0)
ADL category	—	—	—	—
Moderate dependency	—	—	—	42 (40.4)
Mild dependency	—	—	—	28 (26.9)
Independent	—	—	—	34 (32.7)

Abbreviations: ADL = activities of daily living; IQR = interquartile range; SD = standard deviation.

The mean age of participants was 69.83 ± 5.57 years, indicating that most respondents were within the early-old to middle-old age category. Female participants constituted approximately two-thirds of the study population. Chronic diseases were identified in 61.5% of respondents, reflecting the common coexistence of age-related health conditions among community-dwelling older adults.

The average grip strength value was 16.91 ± 7.27 kg, with a median of 16.10 kg, indicating generally reduced muscle strength in the study population. Based on AWGS criteria, 74.0% of participants were categorized as having weak grip strength. Regarding functional status, moderate dependency in ADL was the most common category, accounting for 40.4% of participants. These findings suggest that decreased muscle strength and functional limitation remain prevalent among older adults in this community setting.

To further describe the functional distribution of participants, Table 2 presents the cross-tabulation between grip strength category and ADL status. This analysis was included to provide a clearer clinical overview of the relationship between muscle strength and functional independence.

Table 2. Distribution of ADL Categories Based on Grip Strength Classification

Grip Strength Category	Moderate Dependency n (%)	Mild Dependency n (%)	Independent n (%)
Weak grip strength	39 (50.6)	23 (29.9)	15 (19.5)
Normal grip strength	3 (11.1)	5 (18.5)	19 (70.4)

Abbreviations: ADL = activities of daily living.

Participants with weak grip strength demonstrated a substantially higher proportion of moderate dependency, whereas those with normal grip strength were predominantly categorized as functionally independent. Clinically, these findings indicate that lower muscle strength may be associated with reduced ability to perform basic daily activities independently.

The primary objective of this study was to determine the association between grip strength and ADL performance among community-dwelling older adults. Because normality testing using the Shapiro–Wilk test indicated non-normal data distribution, Spearman's rank correlation test was used for bivariate analysis.

Table 3. Correlation Between Grip Strength and ADL Performance

Variables	r	95% CI	p-value
Grip strength and ADL	0.536	0.38–0.66	<0.001

Abbreviations: ADL = activities of daily living; CI = confidence interval.

Spearman correlation analysis demonstrated a statistically significant positive association between grip strength and ADL performance ($r=0.536$; 95% CI: 0.38–0.66; $p<0.001$). The correlation coefficient indicated a moderate correlation strength, suggesting that higher grip strength values tended to be associated with better functional independence among older adults.

From a clinical perspective, the observed moderate correlation suggests that grip strength may represent an important functional marker in geriatric assessment. Although grip strength alone cannot fully explain ADL performance, reduced muscle strength may reflect broader declines in musculoskeletal and neuromuscular function that contribute to limitations in daily activity performance.

Additional descriptive analysis demonstrated that female participants generally exhibited lower grip strength values compared with male participants. Similarly, older participants within the upper age range tended to demonstrate lower functional independence scores. However, subgroup statistical analysis based on sex and age category was not performed because it was beyond the primary objective of the present study.

Discussion

This study demonstrated a significant positive association between grip strength and activities of daily living (ADL) performance among community-dwelling older adults in Gulingan Village, Bali. The moderate positive correlation observed in this study indicates that older adults with higher muscle strength tended to exhibit better functional independence in performing daily activities. These findings support previous evidence suggesting that muscle strength plays an important role in maintaining functional capacity and healthy ageing among older populations.

This finding is consistent with previous studies reporting significant relationships between grip strength and functional independence in older adults. Dai et al. demonstrated that low grip strength was associated with a higher risk of ADL disability in older adults.¹⁴ Similarly, Kim et al. reported that grip strength could predict overall physical fitness and functional performance among elderly populations.¹⁵ Local evidence from Indonesia also identified a significant relationship between grip strength and functional independence among older individuals.²⁸ The consistency of these findings across different populations suggests that grip strength may serve as a reliable functional indicator in geriatric assessment despite sociocultural differences among older adult populations.²⁹

From a physiological perspective, the relationship between grip strength and ADL performance may be explained through age-related musculoskeletal and neuromuscular decline. Ageing is associated with progressive loss of muscle mass, decreased motor unit recruitment, impaired neuromuscular transmission, and reduced muscle quality, all of which contribute to diminished muscle strength and physical performance.^{3,4} These alterations are closely related to sarcopenia, which has been recognized as a major contributor to disability and reduced functional independence in older adults.^{4, 5} Reduced muscle strength may impair mobility, postural stability, transfer ability, and upper extremity function, thereby limiting the ability to perform essential daily activities independently.¹⁶ Consequently, older adults with lower grip strength are more likely to experience difficulty in performing self-care activities such as bathing, dressing, transferring, and ambulation.¹⁴

The moderate correlation strength identified in this study also has important clinical implications. Although grip strength alone cannot fully explain ADL performance, the observed correlation indicates that muscle strength represents a clinically meaningful component of functional independence. ADL performance is influenced by multiple interrelated factors including balance, cognition, nutritional status, chronic disease burden, physical activity level, psychological condition, and environmental support.^{17, 18} Therefore, the moderate magnitude of correlation observed in this study is considered clinically relevant because it reflects the multifactorial nature of functional ageing rather than a single direct determinant.²⁹

The high proportion of participants categorized as having weak grip strength further emphasizes the importance of functional screening among community-dwelling older adults. According to the Asian Working Group for Sarcopenia, low grip strength represents an important early marker of sarcopenia and declining physical function.⁴ In the present study, most participants with weak grip strength also demonstrated moderate dependency in ADL, suggesting that reduced muscle strength may reflect broader declines in physical capability. These findings support previous studies demonstrating that low grip strength is associated with increased risks of falls, hospitalization, frailty, disability, and mortality among older adults.^{6, 7, 13, 30}

Sex-related differences may also partially explain the variability in grip strength observed in this study. Female participants constituted the majority of respondents and generally demonstrated lower grip strength values compared with male participants. This finding is physiologically plausible because women tend to have lower muscle mass and muscle fiber cross-sectional area than men, particularly after menopause due to hormonal changes affecting muscle metabolism.¹⁷ Previous studies have also reported significantly lower grip strength values among older women compared with older men.¹³ However, subgroup statistical analysis based on sex was not performed in the present study because it was beyond the primary objective of the research.

Several potential confounding variables should also be considered when interpreting the findings. Chronic diseases were identified in more than half of the study population and may have influenced both grip strength and ADL performance. Conditions such as hypertension, diabetes mellitus, osteoarthritis, and cardiovascular disease may contribute to reduced physical activity, muscle weakness, fatigue, and mobility limitation in older adults.¹⁸ In addition, low physical activity levels and inadequate nutritional status may accelerate sarcopenia progression and functional decline.¹⁷ These factors were recognized during interpretation; however, multivariable analysis was not performed because the primary aim of this study was to identify the overall association between grip strength and ADL.

The present findings should also be interpreted cautiously because the cross-sectional design does not allow causal inference. Although lower grip strength was associated with poorer ADL performance, the direction of the relationship cannot be definitively established. Reverse causality remains possible because older adults with impaired ADL may become less physically active, leading to progressive muscle weakness and lower grip strength over time. Similar bidirectional relationships between muscle strength and functional dependency have been discussed in longitudinal geriatric studies.¹⁴ Therefore, prospective cohort or longitudinal studies are needed to further clarify temporal and causal relationships between grip strength decline and functional dependency.

Several methodological limitations should also be acknowledged. First, purposive sampling may increase the risk of selection bias because participants were recruited from a single community setting and may not fully represent the broader elderly population in Bali or Indonesia. Second, ADL assessment using the Barthel Index relied partly on interview-based responses, which may introduce information bias and recall bias. Third, important variables such as nutritional status, depression, cognitive performance, physical activity level, balance function, and socioeconomic condition were not analyzed in depth. These factors may contribute to functional independence and should be included in future research models.

Despite these limitations, this study has several strengths. Standardized grip strength measurement procedures based on the American Society of Hand Therapists protocol were applied consistently, and validated functional assessment using the Barthel Index was performed directly among community-dwelling older adults. In addition, this study provides regional evidence regarding functional ageing among older adults in Bali, where geriatric functional assessment research remains relatively limited.

Clinically, the findings highlight the importance of incorporating grip strength assessment into routine geriatric physiotherapy and primary healthcare evaluation. Because grip strength measurement is simple, inexpensive, objective, and practical, it may serve as an early screening tool to identify older adults at risk of functional decline and dependency.³¹ Physiotherapy interventions focusing on resistance exercise, functional training, balance exercise, and regular physical activity may help preserve muscle strength and maintain ADL independence among older adults.³² Furthermore, promoting muscle strength maintenance aligns with the broader concept of healthy ageing, which emphasizes preserving functional ability and quality of life throughout the ageing process.¹

Future studies are recommended to use longitudinal or cohort designs involving larger and more diverse populations. Additional variables such as nutritional status, cognitive function, physical activity level, frailty, and psychosocial factors should also be included to provide a more comprehensive understanding of factors influencing functional independence among older adults.

Conclusion

This study demonstrated a significant moderate positive association between grip strength and activities of daily living (ADL) among community-dwelling older adults in Gulingan Village, Bali. Older adults with higher grip strength tended to exhibit better functional independence in performing daily activities.

These findings indicate that grip strength may serve as a practical and clinically meaningful functional indicator in geriatric assessment. Routine evaluation of grip strength in physiotherapy and primary healthcare settings may help support early identification of older adults at risk of functional decline and dependency.³¹ However, grip strength should be interpreted as one component of comprehensive geriatric functional assessment rather than as a single determinant of functional status.

Study Limitations

Several limitations should be considered when interpreting the findings of this study. First, the cross-sectional design does not allow determination of causal relationships between grip strength and ADL performance. Second, purposive sampling from a single community setting may limit the generalizability of the findings to broader older adult populations. Third, several potential confounding variables, including nutritional status, physical activity level, cognitive function, and psychosocial factors, were not analyzed comprehensively. In addition, ADL assessment using interview-based responses may introduce information bias and recall bias.

Clinical Implications

The findings of this study highlight the importance of incorporating grip strength assessment into routine geriatric physiotherapy and community-based health evaluation. Grip strength measurement may serve as a simple, inexpensive, and objective screening method to identify older adults at risk of reduced functional independence. Physiotherapy interventions focusing on resistance exercise, balance training, functional exercise, and promotion of regular physical activity may contribute to maintaining muscle strength and ADL independence among older adults.

Recommendations for Future Research

Future studies are recommended to use longitudinal or cohort designs involving larger and more diverse populations to further evaluate temporal relationships between grip strength and functional independence. Additional variables such as nutritional status, frailty, cognitive function, physical activity level, and chronic disease severity should also be included to provide a more comprehensive understanding of factors affecting ADL performance in older adults.

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Conflict of Interest

The authors declare that there is no conflict of interest related to this study.

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Ethical Approval

This study was approved by the Ethics Committee of the Faculty of Medicine, Udayana University/Prof. Dr. I.G.N.G. Ngoerah General Hospital with ethical approval number 0998/UN14.2.2.VII.14/LT/2026. Written informed consent was obtained from all participants prior to data collection.

Author Contributions

I Dewa Made Aditya Darma: Conceptualization, Methodology, Formal Analysis, Investigation, Data Curation, Writing – Original Draft Preparation.

M. Widnyana: Conceptualization, Methodology, Validation, Supervision, Writing – Review & Editing.

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Data Availability

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

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