

Original Research

Association of Cardiometabolic Parameters with Sleep Quality and Independence among Older Adults in Gianyar

Anak Agung Gede Angga Puspa Negara¹, I Gede Putu Wahyu Mahendra¹, Govinda Vittala¹, Ida Ayu Laksmi Dharmajayanti², Kadek Andre Yasa²

¹ Department of Physiotherapy, Faculty of Medicine, Udayana University, Indonesia 80361.

² Undergraduate Study Program in Physiotherapy and Physiotherapy Profession, Faculty of Medicine, Udayana University, Indonesia 80361.

ABSTRACT

Background: Sleep quality and independence are key indicators of well-being in older adults. Several physiological factors, including blood glucose, blood pressure, cholesterol, and body mass index (BMI), may affect these aspects. However, limited studies have explored these associations among the elderly in Indonesia. This study aimed to examine the relationship between selected health factors and sleep quality and independence in older adults in Gianyar Regency.

Methods: A cross-sectional analytical observational study was conducted with 129 community-dwelling older adults aged ≥ 60 years. Participants were selected using simple random sampling. Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI), and independence was measured using the Barthel Index. Spearman's correlation test was used due to the non-normal distribution of data.

Results: Blood glucose levels showed significant negative correlations with sleep quality ($r = -0.360$, $p < 0.001$) and independence ($r = -0.247$, $p < 0.001$). BMI was also negatively correlated with sleep quality ($r = -0.189$, $p = 0.015$). Blood pressure demonstrated a positive correlation with independence ($r = 0.170$, $p = 0.030$). Cholesterol levels had no significant associations with either outcome.

Conclusion: Higher blood glucose and BMI are associated with poorer sleep and reduced independence. These findings emphasize the importance of metabolic and weight control in geriatric health programs to promote healthy aging and functional ability.

ARTICLE HISTORY

Received: June 20th, 2026

Accepted: October 1st, 2026

KEYWORDS

blood glucose, body mass index, independence, older adults, sleep quality;

CONTACT

I Gede Putu Wahyu Mahendra



wahyumahendra10@unud.ac.id

Department of Physiotherapy,
Faculty of Medicine, Udayana
University. Jl. Raya Kampus
UNUD, Bukit Jimbaran, Kuta
Selatan, Badung-Bali Indonesia
80361.



This article is an open access article
licensed under [Creative Commons
Attribution 4.0 International
License \(CC BY 4.0\)](https://creativecommons.org/licenses/by/4.0/)

Cite this as: Association of Cardiometabolic Parameters with Sleep Quality and Independence among Older Adults in Gianyar. (2026). *Jurnal Keterapian Fisik*, 11(2), 150-158.
<https://jurnalketerapianfisik.com/index.php/jpt/article/view/513>

INTRODUCTION

Aging is a natural process experienced by all individuals, and the elderly population, which continues to grow, warrants special attention in the field of public health. In 2022, the Province of Bali recorded 568,380 elderly individuals, representing approximately 12.37% of its total population. Gianyar Regency reported the highest proportion, at 14.27%, according to data from Statistics Indonesia (BPS, 2023).

Furthermore, Bali ranked fourth among Indonesian provinces in terms of the largest elderly population (BKKBN Bali, 2023).

Given this demographic trend, research on elderly health, particularly in Gianyar Regency, is of significant importance. The elderly are prone to various complex health challenges, and ongoing research is expected to provide deeper insights into the factors affecting their quality of life (Halimsetiono, 2021). This study emphasizes sleep quality and functional independence as critical components of elderly well-being. Sleep quality significantly influences both physical health and psychological well-being (Susanto et al., 2022), whereas functional independence denotes the capacity of older adults to perform daily activities without assistance (Semariasih et al., 2019).

The prevalence and condition of the elderly in Gianyar Regency provide a strong foundation for further understanding of their health challenges. This study explores how blood glucose, cholesterol levels, blood pressure, and body mass index influence sleep quality and functional independence among the elderly (Lusiana et al., 2019; Utami et al., 2021). The relationship between metabolic health and elderly well-being has been widely explored in health literature. Blood glucose, cholesterol, blood pressure, and body mass index (BMI) are key indicators of elderly health status (Nurhayati et al., 2019). Elevated glucose and cholesterol levels increase cardiovascular risk (Davies et al., 2022), while blood pressure and BMI reflect overall physical condition (Nugroho & Barkah, 2023). Additionally, sleep quality and functional independence are critical factors influencing both mental and physical well-being in older adults (Mashudi, 2020; Utami et al., 2021).

However, studies examining the simultaneous relationship between blood glucose, cholesterol, blood pressure, and BMI with sleep quality and independence among the elderly in Gianyar Regency remain limited. Most previous studies have assessed these cardiometabolic parameters individually or linked them to a single outcome, leaving unclear how they jointly relate to both sleep quality and functional independence, two interrelated determinants of healthy ageing. Moreover, evidence from community-dwelling older adults in Bali is scarce, even though their lifestyle, dietary patterns, and social structures may shape these relationships differently from populations studied elsewhere.

By integrating four cardiometabolic indicators and two functional outcomes within a single analytical framework, this study offers a more comprehensive picture of which metabolic factors are most closely associated with sleep and independence in this population. This study aims to address this gap through a comprehensive observational approach, providing insights into how metabolic factors interact with elderly well-being. The findings are expected to contribute to the development of more targeted and holistic health interventions at the local level.

MATERIALS AND METHOD

This study employed an analytical cross-sectional design, which enabled the simultaneous assessment of cardiometabolic parameters, sleep quality, and functional independence to identify their associations among older adults at a single point in time. We conducted an analytical cross-sectional study in Singapadu Tengah Village, Sukawati District, Gianyar Regency, in June 2024. All residents aged 60 years or older were invited (total sampling). Participants were included if they lived in the village, could understand and answer verbal questions, and gave written consent.

We excluded those who were acutely ill on the day of assessment, had hearing or cognitive problems that prevented them from completing the PSQI and Barthel interviews, or had incomplete data. Because every eligible older adult was approached, we did not calculate a sample size in advance. In total, 164 participants aged 60–85 years had complete data and were analysed. A post hoc check showed that this number was above the 124 participants needed to detect a correlation of $r = 0.25$ ($\alpha = 0.05$, two-tailed; power = 80%).

Blood glucose, total cholesterol, blood pressure, and BMI were treated as independent variables; sleep quality and functional independence were the outcomes. The Singapadu Tengah village office granted permission to collect data. Before any measurement, a member of the team explained the purpose of the study, what each procedure involved, and the brief discomfort of a finger-prick test. Participants signed a consent form and were told they could stop at any point. Names were replaced with ID codes, and only the research team had access to the data. Finger-prick samples were taken by trained staff using single-use lancets. Each participant received their results on the spot, and anyone with abnormal values was advised to visit the local primary health centre for follow-up.

The researcher assessed blood glucose, cholesterol levels, blood pressure, BMI, sleep quality, and functional independence of the elderly using the following Standard Operating Procedures. Blood glucose and cholesterol levels were measured using a glucometer. Preparations included checking the glucometer condition and preparing necessary tools such as test strips, lancets, alcohol swabs, and a sharps disposal container. After obtaining written informed consent, participants underwent fingertip blood sampling using a lancet. The test strip was inserted into the glucometer to obtain and record results, which were then conveyed to the participants.

Blood pressure was measured using a sphygmomanometer with appropriate cuff and stethoscope. Participants were asked to sit comfortably, and the cuff was placed on the upper arm. After measurement, the results were recorded and communicated to the participants, along with recommendations for follow-up if necessary.

Body Mass Index (BMI) was calculated based on body weight and height measurements using a scale and a height ruler or BMI calculator. The BMI was calculated using the formula $BMI = \text{weight (kg)} / \text{height}^2 (\text{m}^2)$, recorded, and the participants were informed about the normal range and given any necessary recommendations.

Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI). Participants were interviewed using the PSQI questionnaire, and the resulting scores were interpreted to provide information on their sleep quality. Functional independence was measured using the Barthel Index. Interviews and observations were conducted in accordance with the Barthel Index items. Scores were calculated and interpreted to assess participants' level of independence and to provide relevant follow-up advice if needed.

Univariate analysis was conducted to describe the general characteristics, including frequency, mean, and standard deviation of blood glucose, cholesterol levels, blood pressure, BMI, sleep quality, and functional independence among the elderly. Bivariate analysis was used to examine the relationship between the independent variables (blood glucose, cholesterol levels, blood pressure, and BMI) and the dependent variables (sleep quality and functional independence of the elderly).

RESULTS

Descriptive analysis of the measurement results obtained during the research process is presented in Table 1.

Table 1. Descriptive Statistics of Physiological and Health Characteristics of the Elderly

Variable	n	Minimum	Maksimum	Mean	Standard Deviation
Age	164	60.00	85.00	69.63	6.10
Height	164	147.00	175.00	161.38	7.54
Weight	164	32.00	88.00	61.92	13.28
Body Mass Index	164	14.29	31.18	23.52	3.34
Blood Pressure (Systolic)	164	102.00	231.00	141.38	16.49
Blood Pressure (Diastole)	164	55.00	130.00	79.07	8.08
Blood Glucose	164	73.00	238.00	113.73	18.99
Cholesterol	164	72.00	323.00	196.77	29.57
Functional Independence (Barthel Index)	164	50.00	100.00	82.53	13.26
Sleep Quality (PSQI)	164	2.00	16.00	7.25	1.76

The percentage distribution of the categorical variables in this study is presented in Table 2.

Table 2. Percentage Distribution of the Categorical Variables in the Study

Variable	n	Persentase (%)
Gender	164	100.00
Femele	87	53.00
Male	77	47.00
Blood Pressure	164	100.00
Normal	2	4.90
Elevated	2	54.30
Hypertension Stage 1	67	39.00
Hypertension Stage 2	93	1.80
Body Mass Index	164	100.00
Underweight	8	4.90
Normal	89	54.30
Overweight	64	39.00
Obese	3	1.80
Blood Glucose Level	164	100.00
Normal	158	96.30
Pre-Diabetes	6	3.70
Cholesterol Level	164	100.00
Normal	85	51.80
Borderline High	71	43.30

Variable	n	Persentase (%)
High	8	4.90
Independence (Barthel Index)	164	100.00
Fully Independent	30	18.30
Mildly Independent	17	10.40
Mildly Dependent	103	62.80
Moderately Dependent	14	8.5
Sleep Quality (PSQI)	164	100.00
Good Sleep	13	7.90
Fair Sleep, May Require Attention	145	88.40
Poor Sleep, Requires Further Attention	6	3.70

This study included 164 older adults aged 60–85 years (mean age = 69.63 years). Key health variables analyzed were BMI, blood pressure, blood glucose, cholesterol, sleep quality, and functional independence. The average BMI was 23.52 kg/m² (SD = 3.34), and mean blood pressure was 141.38/79.07 mmHg, with 39% classified as stage 1 hypertensive. The mean blood glucose level was 113.73 mg/dL, indicating a potential risk for diabetes, while the mean cholesterol level was 196.77 mg/dL, approaching borderline high levels. Sleep quality, assessed via PSQI, averaged 7.25, with 88.4% of participants reporting fairly good but suboptimal sleep. The mean Barthel Index score was 82.53, suggesting generally good independence, though 62.8% were mildly dependent—highlighting the need for targeted interventions to maintain or improve functional capacity.

The results of the correlation test between health factors and sleep quality and the level of independence in older adults are presented in Table 3.

Table 3. Correlation Test Results Between Health Factors and Sleep Quality and Level of Independence in Older Adults

Variable	Sleep Quality (PSQI)		Independence (Barthel Index)	
	r	p	r	P
Blood Glucose Level	-0.360	<0.001	-0.247	<0.001
Cholesterol Level	-0.010	0.898	-0.042	0.592
Blood Pressure	-0.070	0.372	0.170	0.030
Body Mass Index	-0.189	0.015	0.078	0.322

The findings of this study indicate significant associations between certain health factors and both sleep quality and independence among older adults in Gianyar Regency. Blood glucose level was negatively correlated with sleep quality ($r = -0.360$; $p < 0.001$), suggesting that higher glucose levels are associated with poorer sleep. Similarly, Body Mass Index (BMI) showed a negative correlation with sleep quality ($r = -0.189$; $p = 0.015$), which may be attributed to sleep disturbances related to excess body weight, such as sleep apnea.

A significant negative correlation was also found between blood glucose level and level of independence ($r = -0.247$; $p < 0.001$), indicating that elevated glucose levels are linked to reduced functional independence. Conversely, blood pressure was positively correlated with independence ($r = 0.170$; $p = 0.030$), possibly reflecting that some older adults with elevated blood pressure remain physically active and functionally independent.

No significant associations were observed between cholesterol levels and either sleep quality ($r = -0.010$; $p = 0.898$) or independence ($r = -0.042$; $p = 0.592$). Similarly, no significant relationships were found between blood pressure and sleep quality ($r = -0.070$; $p = 0.372$), or between BMI and independence ($r = 0.078$; $p = 0.322$).

Overall, these findings highlight that blood glucose level and BMI are significantly related to sleep quality, while blood glucose and blood pressure are associated with functional independence. These results underscore the need for targeted health interventions focused on glycemic control and optimal weight management to improve sleep and maintain independence in the elderly population of Gianyar Regency.

DISCUSSION

The results of this study provide an overview of the physiological and health profiles of older adults in Gianyar Regency, with a mean age of 69.63 years. Most participants had a normal Body Mass Index (BMI), although the prevalence of hypertension was notably high, with 39% falling into the stage 1 hypertension category. The average blood glucose level was within the normal range but approached the threshold for diabetes risk, while cholesterol levels were predominantly classified as borderline high. The average Pittsburgh Sleep Quality Index (PSQI) score indicated that the majority of participants had fairly good sleep quality, though further attention is warranted. In terms of independence, most participants were mildly independent, but 62.8% were categorized as mildly dependent, highlighting the need for interventions to prevent further functional decline.

The correlation analysis between health factors and both sleep quality and level of independence revealed a significant negative association between blood glucose levels and both outcomes. This aligns with the theory of metabolic homeostasis, which suggests that unstable glucose levels can disrupt hormonal regulation particularly insulin and cortisol—thus impairing circadian rhythms and sleep quality (Firdaus et al., 2022). Chronic hyperglycemia is also known to cause systemic inflammation, contributing to sleep disturbances (Sumah, 2019). Additionally, elevated blood glucose levels may impair physical function through neuropathy and vascular complications, resulting in reduced independence among older adults (Priyanto et al., 2022). Higher BMI also demonstrated a negative correlation with sleep quality, likely due to the increased risk of sleep disorders such as sleep apnea among individuals with obesity (Hasan et al., 2020).

Blood pressure was significantly positively associated with the level of independence. This may be linked to physical activity, as older adults with well-managed blood pressure may remain more physically active and thus maintain better functional independence (Sutria et al., 2022). However, cholesterol levels were not significantly associated with either sleep quality or independence, suggesting their influence may be indirect or mediated by other factors such as physical activity or dietary habits. In practice, these findings suggest that routine glucose, blood pressure, and BMI checks at posyandu lansia and primary health centres could also serve as an

entry point for screening sleep problems and functional limitations, not only metabolic disease. Programmes that combine metabolic control with regular physical activity, sleep hygiene education, and functional training may be more useful than approaches that address each problem separately, although longitudinal or intervention studies are needed before such approaches are adopted as routine practice.

This study has several limitations. The cross-sectional design limits the ability to determine causal relationships between the analyzed variables. Furthermore, the data were limited to older adults in Gianyar Regency, and caution should be exercised when generalizing the findings to other elderly populations. Other potentially influential factors such as physical activity level, dietary patterns, and social support were not analyzed, despite their relevance to sleep quality and independence.

Based on these findings, elderly health programs should prioritize blood glucose control and weight management to improve sleep quality and independence. Health education initiatives promoting physical activity and hypertension management are also essential to reduce the risk of further complications. Future research employing longitudinal designs and incorporating a broader range of variables is necessary to strengthen these findings and provide a deeper understanding of the causal links between health factors and quality of life in the elderly.

CONCLUSION

This study concludes that higher blood glucose levels and BMI are significantly associated with poorer sleep quality among older adults, while elevated blood glucose also correlates with lower functional independence. Conversely, blood pressure shows a positive association with independence, suggesting that some physically active older adults may maintain higher blood pressure levels. No significant relationship was found between cholesterol levels and either sleep quality or independence. These findings highlight the importance of managing blood glucose and body weight to enhance sleep quality and autonomy among the elderly in Gianyar Regency. Targeted interventions are essential to improve their overall health and quality of life.

ACKNOWLEDGEMENT

The authors would like to express their sincere gratitude to the Gianyar District Health Office and the heads of participating Posyandu Lansia for their support and cooperation throughout the research process. We also extend our appreciation to all elderly participants who willingly took part in this study. Special thanks to the research team and enumerators for their dedication and contribution during data collection. This study would not have been possible without their valuable assistance.

REFERENCES

- BKKBN Bali. (2023). *Statistik Demografi dan Sosial Ekonomi Rumah Tangga Provinsi Bali 2022*. [Statistik Demografi dan Sosial Ekonomi Rumah Tangga Provinsi Bali 2022 - Badan Pusat Statistik Provinsi Bali](#)
- BPS. (2023). *statistik-penduduk-lanjut-usia-2023*. 20, 16–21.
- Davies, M. J., Aroda, V. R., Collins, B. S., Gabbay, R. A., Green, J., Maruthur, N. M., Rosas, S. E., Del Prato, S., Mathieu, C., Mingrone, G., Rossing, P., Tankova, T., Tsapas, A., & Buse, J. B. (2022). Management of Hyperglycemia in Type 2

- Diabetes, 2022. A Consensus Report by the American Diabetes Association (ADA) and the European Association for the Study of Diabetes (EASD). *Diabetes Care*, 45(11), 2753–2786. <https://doi.org/10.2337/dci22-0034>
- Firdaus, R. A. O., Indrawati, U., Wahdi, A., Puspitosari, D. R., & Arham, A. H. (2022). Hubungan kadar gula darah dengan kebutuhan tidur pada pasien Diabetes Mellitus. *Jurnal Keperawatan*, 20(3), 1–12. <https://doi.org/10.35874/jkp.v20i3.1039>
- Halimsetiono, E. (2021). Pelayanan Kesehatan pada Warga Lanjut Usia. *KELUWIH: Jurnal Kesehatan Dan Kedokteran*, 3(1), 64–70. <https://doi.org/10.24123/kesdok.V3i1.4067>
- Hasan, M. N. Bin, William, W., & Rumiati, F. (2020). Hubungan Berat Badan dengan Kualitas Tidur pada Mahasiswa Fakultas Kedokteran dan Ilmu Kesehatan, Universitas Kristen Krida Wacana Angkatan 2016. *Jurnal Kedokteran Meditek*, 26(2). <https://doi.org/10.36452/jkdoktmeditek.v26i2.1847>
- Lusiana, N., Widayanti, L. P., Mustika, I., & Andiarna, F. (2019). Korelasi Usia dengan Indeks Massa Tubuh, Tekanan darah Sistol-Diastol, Kadar Glukosa, Kolesterol, dan Asam Urat. *Journal of Health Science and Prevention*, 3(2), 101–108. <https://doi.org/10.29080/jhsp.v3i2.242>
- Mashudi, M. (2020). Hubungan Kualitas Tidur dan Tingkat Kemandirian Activity of Daily Living dengan Risiko Jatuh Pada Lanjut Usia di Puskesmas Simpang IV Sipin Kota Jambi. *Jurnal Ilmiah Universitas Batanghari Jambi*, 20(1), 237. <https://doi.org/10.33087/jiubj.v20i1.879>
- Nugroho, M. F., & Barkah, A. (2023). Hubungan Indeks Massa Tubuh dengan Tekanan Darah pada Lansia di Wilayah Kerja Puskesmas Kelurahan Cipinang Kecamatan Pulogadung Jakarta Timur. *MAHESA : Malahayati Health Student Journal*, 3(10), 3151–3165. <https://doi.org/10.33024/mahesa.v3i10.11065>
- Nurhayati, I., Riyani, A., Kurnaeni, N., Wiryanti, W., & Rinaldi, S. F. (2019). Validasi Metode God-Pap Pada Pemeriksaan Glukosa Darah Dengan Pemakaian Setengah Volume Reagen Dan Sampel. *Jurnal Riset Kesehatan Poltekkes Depkes Bandung*, 11(1), 322. <https://doi.org/10.34011/juriskesbdg.v11i1.792>
- Priyanto, A. N., Wirakhmi, I. N., & Susanto, A. (2022). Gambaran Faktor-Faktor Yang Mempengaruhi Tingkat Kemandirian Lansia Dalam Pemenuhan Activity Of Daily Living. *Jurnal Cakrawala Ilmiah*, 2(1), 173–180. DOI <https://doi.org/10.53625/jcijurnalcakrawailmiah.v2i1.3506>
- Semariasih, N. K. D., Andayani, N. L. N., & Muliarta, I. M. (2019). THE Corelation Between Grip Muscles' Strentgh And A Level Of Functional Ability Among The Elderly Women In Tista Kerambitan, Tabanan. *Majalah Ilmiah Fisioterapi Indonesia*, 7(2), 40. <https://doi.org/10.24843/MIFI.2019.v07.i02.p11>

- Sumah, D. F. (2019). Hubungan Kualitas Tidur dengan Kadar Gula Darah Pada Pasien Diabetes Melitus Tipe 2 di RSUD dr. M. Haulussy Ambon. *JURNAL BIOSAINSTEK*, 1(01), 56–60. <https://doi.org/10.52046/biosainstek.v1i01.216>
- Susanto, J., Makhfudli, M., Ilkafah, I., Sairozi, A., Tyas, A. P. M., Wijayanti, E. S., Iswatun, I., & Umam, K. (2022). Kondisi Psikologis dan Kualitas Tidur pada Lansia Kelompok Prolanis. *Jurnal Kesehatan Vokasional*, 7(4), 204. <https://doi.org/10.22146/jkesvo.74460>
- Sutria, E., Fitriani, F., & Hafid, M. A. (2022). Hubungan Tingkat Kemandirian Dengan Kualitas Hidup Lansia Yang Menderita Hipertensi Di Wilayah Kerja Puskesmas Bajeng Kabupaten GOWA. *Alauddin Scientific Journal of Nursing*, 3(2), 120–130. <https://doi.org/10.24252/asjn.v3i2.33318>
- Utami, R. J., Indarwati, R., & Pradanie, R. (2021). Analisa Faktor Yang Mempengaruhi Kualitas Tidur Lansia Di Panti. *Jurnal Health Sains*, 2(3), 362–380. <https://doi.org/10.46799/jhs.v2i3.135>