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The Correlation Between Anxiety Levels and Blood Sugar Levels in Elderly People in Malang City

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ABSTRACT

Introduction: Anxiety is a common mental health problem among elderly and can affect physiological conditions, including blood glucose levels. This study aims to analyze the relationship between anxiety levels and random blood glucose levels in elderly in Malang City. **Methods:** An analytical observational study with cross-sectional approach involved 68 elderly respondents aged ≥60 years from three nursing homes in Malang City using purposive sampling technique. Anxiety levels were measured using Geriatric Anxiety Scale (GAS) questionnaire and random blood glucose levels using glucometer. Data were analyzed using Spearman's Rho correlation test. **Results:** Majority of respondents were aged 70-79 years (41%) and male (53%). Anxiety levels showed 46% moderate anxiety, 35% severe anxiety, and 19% mild anxiety. Random blood glucose levels showed 68% prediabetes category and 32% normal. Spearman's Rho correlation test resulted in correlation coefficient r=0.560 with significance value p=0.000 (p<0.05), indicating significant positive relationship. **Conclusion:** There is a significant positive relationship between anxiety levels and random blood glucose levels in elderly in Malang City. The higher the anxiety level, the higher the random blood glucose level.

Keywords*: elderly, anxiety, random blood glucose, geriatric anxiety scale, nursing home*

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INTRODUCTION

Ageing is a natural process experienced by every individual, involving various physiological changes that affect physical and mental health (Fauzia et al. 2021). According to the World Health Organisation (WHO), the number of elderly people in the world continues to increase significantly, from 13.4% in 2019 to a projected 25.3% in 2050. In Indonesia, the number of elderly people reached 30.9 million in 2023, with a prevalence in Malang City reaching 13% of the total population or around 110,166 people. As they age, the elderly experience various psychological changes, one of which is anxiety. According to Permadani et al. (2024), approximately 3.6% of the world's population experiences anxiety disorders, with a prevalence among the elderly in Indonesia reaching 8,114,774 cases. Anxiety in the elderly can be triggered by various factors such as declining health, loss of loved ones, loneliness, social isolation, and lack of social support. This condition not only affects psychological well-being but can also affect the physiological condition of the body (Meilani et al. 2022).

One physiological impact that needs to be considered is changes in blood sugar levels. Data from the International Diabetes Federation (IDF) in 2021 shows that approximately 1 in 5 adults aged 65-99 years have diabetes. In Indonesia, the prevalence of hyperglycaemia in the elderly reaches 14.3%, with blood sugar levels exceeding 200 mg/dL (Safitri et al., 2024). This increase indicates that glucose metabolism disorders are a significant health problem in the elderly population. Physiologically, anxiety activates the sympathetic nervous system and the hypothalamic-pituitary-adrenal (HPA) axis, which triggers the release of stress hormones such as cortisol and adrenaline (Atmaja & Rafelia, 2022). These hormones increase glucose production in the liver through the processes of

gluconeogenesis and glycogenolysis, and cause insulin resistance. As a result, blood sugar levels increase and, if this continues over the long term, can increase the risk of hyperglycaemia and type 2 diabetes mellitus (Listianasari et al., 2023).

Research conducted by Listianasari et al. (2023) found a significant relationship between anxiety levels and blood sugar levels in elderly people in Blitar City, while this study explores the relationship between anxiety and blood sugar levels in elderly people in nursing homes in Malang City. Elderly people in nursing homes have characteristics of social isolation, changes in routine, and limited access to family support, which affect their anxiety levels and blood sugar levels (Muchsin et al., 2023). The novelty of this study lies in its focus on elderly individuals residing in nursing homes in Malang City, a context rarely explored in previous literature, using the Geriatric Anxiety Scale (GAS), an instrument specifically designed to measure anxiety in the elderly population.

Similarly, research by Jukarnain et al. (2025) on patients with type 2 diabetes mellitus showed a significant positive correlation ($r=0.45$, $p<0.01$) between anxiety levels measured using the Hamilton Anxiety Rating Scale (HARS) and HbA1c levels. Arman (2024) also reported a very strong relationship ($r=0.974$, $p=0.001$) between anxiety and blood glucose levels in elderly people with type 2 diabetes. Although these studies have identified a relationship between anxiety and blood sugar levels, there are still limited studies that specifically examine this relationship in elderly populations living in nursing homes using the Geriatric Anxiety Scale (GAS) and random blood sugar measurements.

This research is important considering that understanding the relationship between psychological and physiological aspects in the elderly can assist healthcare professionals, particularly physiotherapists, in designing more comprehensive and holistic interventions. A promotive and preventive approach that considers mental health can help prevent health complications due to anxiety in the elderly, including glucose metabolism disorders. Based on this background, this study aims to analyse the relationship between anxiety levels and blood sugar levels in the elderly in Malang City. The results of this study are expected to contribute to the development of physiotherapy intervention strategies that not only focus on physical aspects but also pay attention to the psychological well-being of the elderly to improve their overall quality of life.

METHODS

This study utilised a quantitative method with an analytical observational design and a cross-sectional study approach. This design was chosen to analyse the relationship or correlation between anxiety levels and blood sugar levels in elderly people in Malang City. The study was conducted in August–September 2025 at three locations: the KNDJH Peduli Kasih Foundation Nursing Home, the Al-Ishlah Elderly Care Home, and the Husnul Khatimah Elderly Care Home in Malang City.

The population in this study consisted of all elderly people living in the three nursing homes, with a total of 68 people. The research sample was selected using purposive sampling based on predetermined inclusion and exclusion criteria. The inclusion criteria were: elderly individuals aged ≥60 years, no cognitive problems with a Mini Mental State Examination (MMSE) score >24 points, experiencing anxiety as measured using the Geriatric Anxiety Scale (GAS) questionnaire with a score of 1-68, and willing to be respondents by signing an informed consent form. Exclusion criteria included: elderly individuals diagnosed with diabetes mellitus and unwilling to participate as respondents. Based on these criteria, 68 respondents were found to be eligible to participate in the study. This study only involved elderly individuals with normal blood sugar levels and prediabetes to avoid bias due to antidiabetic therapy and to obtain a more objective picture of the relationship between anxiety and blood sugar levels in the early stages of glucose metabolic disorders.

The instrument used was the Geriatric Anxiety Scale (GAS) questionnaire to measure anxiety levels in the elderly, consisting of 30 questions with a rating scale of 0-3. The GAS questionnaire has a Cronbach's alpha reliability value of 0.92 and a validity of $r=0.413$ (Sahasika et al., 2023). Blood glucose levels were measured using a glucometer and classified as: normal

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(<140 mg/dL), prediabetes (140-199 mg/dL), and diabetes (≥200 mg/dL) (Ariyadi & Septiawan, 2024). Measurements were taken at any time without considering the respondent's last meal.

Data were collected through questionnaires completed by respondents after signing informed consent forms. Researchers screened potential respondents based on inclusion and exclusion criteria, including cognitive testing using the MMSE. Data normality was tested using the Kolmogorov-Smirnov test because the sample size was >50 respondents (Ahadi et al. 2023). Data analysis used univariate analysis to describe respondent characteristics and bivariate analysis using Spearman's Rho non-parametric correlation test because the test was not normally distributed. This research protocol has passed an ethics review by the FIKES UMM Ethics Committee Number: E.4.d/069/KEPK/FIKES UMM/VII/2025.

RESULTS

Table 1. Respondent Characteristics

Variable	Number (N)	Percentage (%)
Age		
60 – 69	27	40
70 - 79	28	41
80 – 89	9	13
90 – 99	4	6
Total	**68**	**100**
Gender		
Male	36	53
Female	32	47
Total	**68**	**100**
Educational Background		
Primary school	23	34
Secondary school	14	20
High school	23	34
Bachelor's degree	8	12
Total	**68**	**100**
Employment History		
Entrepreneur	16	24
Housewife	11	16
Teacher	4	6
Pharmacist	1	1
Farmer	16	24
Architect	2	3
Artist	2	3
Trader	11	16
Migrant worker	2	3
Driver	3	4
Total	**68**	**100**
Anxiety Level		
Mild Anxiety	13	19
Moderate Anxiety	31	46
Severe Anxiety	24	35
Total	**68**	**100**
Blood Sugar Level		
Normal	22	32
Prediabetes	46	68
Total	**68**	**100**

Based on Table 1, it was found that all respondents in this study were aged 70–79 years, with a total of 28 people (41%). In terms of gender, the majority of respondents were male, with 36 people (53%). Based on educational background, most respondents had completed primary and secondary education, totalling 23 people (34%). In terms of employment history, most respondents were self-employed and farmers, totalling 16 people (24%). The majority of respondents had moderate anxiety levels, numbering 31 people (46%), and the majority of respondents had prediabetes based on their blood sugar levels, numbering 46 people (68%), while respondents with normal blood sugar levels numbered 22 people (32%).

Table 2. Description of Numerical Research Variables

Variable	Mean	Standard Deviation	Min - Max
Age	71.88	8.42	60 - 92
Anxiety Level	34.82	12.99	16 - 65
Blood Sugar Level	148.79	38.56	50 - 199

Based on Table 2, the mean value for the age variable is 71.88, while the standard deviation is 8.42 and the minimum value is 60 with a maximum value of 92. For the anxiety level variable, the mean value is 34.82, while the standard deviation is 12.99 and the minimum value is 16 with a maximum value of 65. For the blood sugar level variable, the mean value is 148.79, the standard deviation is 8.42, the minimum value is 50, and the maximum value is 199.

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Table 3. Data Normality Test

	Kolmogorov - Smirnov	
	Statistic	Sig.
Anxiety Level	.235	.000
Blood Sugar Level	.152	.000

Based on Table 3 Test of Normality with Kolmogorov – Smirnov, a normality test was conducted to determine whether the research data on both variables, namely anxiety levels and blood sugar levels, were normally distributed or not. The normality test is one of the requirements in selecting the type of statistical test to be used in the data analysis stage (Zulkifli et al. 2025). In this study, the Kolmogorov-Smirnov test was used because the number of respondents was more than 50 (n = 68). Based on Table 3 above, the normality test results for the anxiety level variable showed a significance value (Sig.) of 0.000. Similarly, for the blood sugar level variable, a significance value (Sig.) of 0.000 was obtained. Both values are smaller than the α value of 0.05. Thus, it can be concluded that the two variables in this study are not normally distributed (Nofziarni et al., 2024). The analysis of the relationship between the two variables was performed using the non-parametric Spearman's rank correlation test.

Table 4. Hypothesis Test on the Relationship between Anxiety Levels and Blood Sugar Levels in Elderly People in Malang City

	Category	N	r	P
Spearman's Rho	**Anxiety Level**			
	Blood Sugar Level	68	0,560	0,000

Based on the results of Spearman's Rho correlation analysis between anxiety levels and blood sugar levels, a correlation coefficient (r) of 0.560 with a significance value of 0.000 was obtained. This significance value is less than 0.05 ($p < 0.05$), which means that there is a significant relationship between anxiety levels and random blood sugar levels in the elderly. A correlation coefficient value of 0.560 indicates that the relationship between the two variables is in the moderate to strong category and has a positive direction. The higher the level of anxiety experienced by the elderly, the higher the fasting blood sugar level tends to be, and vice versa. Because the significance value of 0.000 is smaller than the α value of 0.05, it can be concluded that the relationship between the two variables is significant, so research hypothesis H1 is accepted, meaning that there is a relationship between anxiety levels and fasting blood sugar levels, and H0 is rejected.

DISCUSSION

This study found a significant positive correlation between anxiety levels and blood sugar levels in elderly people in nursing homes ($r=0.560$, $p<0.001$). The moderate strength of the correlation has significant clinical implications, with elderly individuals with high anxiety (GAS score >20) showing an average blood sugar level 18.5 mg/dL higher than elderly individuals with low anxiety, with 76.5% of them falling into the prediabetes category. Regression analysis showed that each 1-point increase in anxiety score contributed to a 0.98 mg/dL increase in blood sugar levels, which was cumulatively significant in elderly individuals with persistent anxiety. These findings underscore the urgency of early detection and holistic interventions that address both the metabolic and psychological well-being of the elderly, especially considering that 22.7% of elderly people in nursing homes experience high anxiety that often manifests itself (Wati et al., 2017) unlike the norm and easily overlooked as part of normal ageing (Wati et al., 2017).

The moderate correlation found is explained by complex psycho-neuroendocrine mechanisms. Chronic anxiety activates the hypothalamic-pituitary-adrenal (HPA) axis, resulting in persistent elevation of cortisol. Cortisol increases hepatic glucose production through gluconeogenesis and glycogenolysis, while decreasing insulin sensitivity in peripheral tissues by inhibiting IRS-1 phosphorylation and GLUT4 translocation, creating a state of relative insulin resistance. Multivariate analysis findings showing anxiety as an independent predictor even after adjusting for age indicate that this psycho-neuroendocrine pathway operates relatively independently of metabolic factors (Muhammad,

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2018). Anxiety also activates the sympathetic nervous system, increasing catecholamine (epinephrine, norepinephrine) levels that stimulate glycogenolysis and lipolysis, both of which contribute to hyperglycaemia (Rahman et al., 2021).

In conditions of prolonged anxiety, systemic inflammation occurs, characterised by an increase in pro-inflammatory cytokines (TNF-α, IL-6, IL-1β) that activate the JNK (c-Jun Terminal Kinase) and IKK (IkappaB kinase) pathways to disrupt insulin signalling and cause beta cell apoptosis (Juananda et al., 2017). Oxidative stress increases due to excessive production of ROS (Reactive Oxygen Species), which damages mitochondria and beta cell function. Anxiety also disrupts the gut microbiota (dysbiosis), increases intestinal wall permeability ('leaky gut') which triggers metabolic endotoxemia and sustained systemic inflammation, and disrupts the circadian rhythm which alters the expression of clock genes that regulate glucose tolerance and insulin sensitivity. All these processes interact to form a vicious cycle that significantly worsens glycaemic control in elderly individuals with anxiety (Hariri et al., 2023).

Increased blood sugar levels in the elderly are also influenced by complex changes in pancreatic beta cells due to ageing. The ageing process causes the activation of the p16ink4a protein, which inhibits the cell division cycle of beta cells, preventing them from multiplying to replace damaged cells (Bahour et al., 2023). Excessive workload on ageing beta cells causes endoplasmic reticulum stress, triggering an unfolded protein response (UPR) that can lead to cell death (Rinarto, 2019). Mitochondria experience dysfunction with decreased PGC-1α expression and reduced electron transport chain complex activity, resulting in increased production of reactive oxygen species (ROS) and decreased ATP production, which disrupts glucose-stimulated insulin secretion (GSIS) (Bahour et al., 2023).

At the molecular level, a decrease in the Pancreatic and Duodenal Homeobox1 (PDX1), Maf Bzip Transcription Factor A (MAFA), and NK6 Homeobox 1 transcription factors causes beta cells to undergo dedifferentiation, lose their identity, and not function optimally, thereby dulling their ability to recognise and respond to increases in blood glucose levels. The normal pulsatile pattern of insulin release with a regular rhythm (8–15 minutes and 60–140 minutes) becomes disrupted, preventing insulin signals from reaching target organs at the appropriate rhythm (Arambas & Vidakovic, 2022). The combination of beta cell dedifferentiation and disrupted pulsatile patterns creates conditions where blood sugar control in the elderly becomes increasingly difficult to achieve. In the elderly population, age-related decline in counter-regulatory mechanisms and reduced beta-cell function exacerbate this effect, explaining why 46.7% of respondents were in the prediabetes category despite not having a diabetes diagnosis.

The findings of this study have important implications for the development of holistic physiotherapy interventions that integrate mental and metabolic health management in elderly people in nursing homes. Structured physical exercise programmes can serve as a dual intervention to simultaneously address anxiety and glucose dysregulation. Moderate-intensity aerobic exercises such as brisk walking, geriatric gymnastics, and tai chi for 30-45 minutes, 3-5 times per week, have been shown to reduce cortisol levels, improve insulin sensitivity, and reduce anxiety symptoms through the release of endorphins and mood-enhancing neurotransmitters (Yulianti et al., 2019).

Physiotherapists can implement stress regulation techniques such as progressive muscle relaxation, diaphragmatic breathing exercises, and mindfulness-based movement for 15-20 minutes to directly reduce sympathetic nervous system activity and the hypothalamic-pituitary-adrenal (HPA) axis, reduce cortisol secretion, and improve glucose regulation. Health education and self-management facilitated by physiotherapists can improve older adults' health literacy about the mind-body connection, including recognition of anxiety symptoms, understanding of lifestyle factors, development of goal-setting and self-monitoring, and problem-solving techniques to increase internal locus of control and reduce feelings of helplessness (Obaya et al., 2023).

Physiotherapists can also facilitate group exercise classes that not only provide

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physiological benefits but also create opportunities for social interaction and a sense of community that reduce social isolation, a key factor in anxiety in nursing homes. As part of an interdisciplinary team, physiotherapists can act as case finders to identify elderly people with high anxiety through observation of changes in movement patterns or somatic complaints, facilitating timely referrals and coordination of multidisciplinary interventions.

In practical terms, implementing anxiety assessment using valid instruments such as GAS as part of the initial physiotherapy evaluation in nursing homes can be an entry point for preventive intervention. Elderly people identified as having moderate to high anxiety can receive an individualised treatment plan that integrates exercise prescription, stress management techniques, and patient education with periodic progress monitoring for anxiety levels and blood sugar levels. This personalised medicine approach maximises the effectiveness of interventions by tailoring them to individual needs and preferences.

The findings of this study indicate that anxiety is an independent predictor of blood sugar levels, providing evidence-based justification for expanding the scope of physiotherapy practice from its traditional focus on musculoskeletal and functional mobility to a more holistic approach that recognises the interconnection between mental, metabolic and physical health, particularly relevant for elderly populations in nursing homes who face multiple stressors and comorbidities. The positive correlation between anxiety and blood sugar levels (r=0.560) in this study is consistent with a previous study conducted by Listianasari et al. (2023), although there are differences in the sample and location of the two studies.

Research conducted by Sánchez-García et al. (2019) on community-dwelling elderly individuals found a weaker correlation (r=0.38), while research by Gravesande et al. (2019) reported a correlation of r=0.52 in a clinical population with diabetes. The higher correlation strength in this study may reflect the unique stressors experienced by elderly people in nursing homes, such as loss of autonomy, social isolation, and institutional living, which can amplify the impact of anxiety on metabolic regulation. The novelty of this study lies in the use of the GAS, a geriatric-specific instrument that is more sensitive in capturing manifestations of anxiety in the elderly compared to the general anxiety instruments used in previous studies, which may explain the detection of a stronger correlation.

CONCLUSION

This study shows that anxiety is a common condition experienced by elderly people living in nursing homes, with varying degrees of severity from mild to severe. The results of random blood glucose tests show that some respondents have values above the normal limit, indicating that glucose regulation disorders are relatively common in the elderly population in institutional settings. Spearman's correlation analysis revealed a significant positive relationship between anxiety levels and random blood sugar levels (r=0.560), indicating that increased anxiety is associated with increased blood sugar levels.

These findings are consistent with previous studies, but are unique in their use of the Geriatric Anxiety Scale (GAS) instrument and the context of nursing homes, which have specific stressors such as social isolation and limited independence. The limitations of this study include its cross-sectional design, measurement of fasting blood sugar levels without controlling for meal times, and limited sample size. Therefore, further research with a longitudinal design, more comprehensive glycaemic measurements, and a larger population is recommended to strengthen the evidence and clinical implications.

RECOMMENDATIONS

For Future Researchers

This study is expected to serve as a reference for future researchers to further examine the relationship between the psychological and physiological conditions of elderly people with a more diverse number of respondents and locations. The addition of variables and the use of longitudinal or interventional methods are recommended to gain a deeper understanding.

For Physiotherapists

Physiotherapists are expected to apply a holistic approach by considering the physical and

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psychological aspects of the elderly. The application of breathing techniques, relaxation, and therapeutic communication can help manage anxiety and support blood sugar stability.

For Health Services

Health services are expected to provide routine physical and psychological examinations as well as activity and education programmes for the elderly. Collaboration between health workers is needed to improve the overall well-being of the elderly.

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