The Relationship Between Nutritional Status and The Incidence of Hypertension in the Elderly in Kekeran Village, Mengwi District, Badung Regency, Bali

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Abstract

This study aims to analyze the relationship between nutritional status and the incidence of hypertension among elderly people in Kekeran Village, Mengwi District, Badung Regency, Bali. This study uses an observational analytical method with a cross-sectional research design. The results show that most elderly people in Kekeran Village are overweight, accounting for 53.15% of the total respondents. Meanwhile, 20.28% of the elderly were underweight, 18.18% had normal nutritional status, and 8.39% were obese. This condition illustrates that being overweight is still a prominent nutritional problem among the elderly in this region. Based on blood pressure distribution, most respondents were classified as having stage I hypertension (39.16%), followed by prehypertension (36.36%), stage II hypertension (18.88%), and only 5.59% of the elderly had normal blood pressure. This indicates that high blood pressure remains a fairly common health problem among the elderly in Kekeran Village. The results of the analysis using Spearman's rank correlation test showed a significant relationship between nutritional status and the incidence of hypertension in the elderly in Kekeran Village with a p-value of 0.003 (p < 0.05) and a correlation coefficient (r) of 0.244. This relationship is positive with weak strength, which means that an increase in nutritional status or body mass index is directly proportional to an increase in the risk of hypertension.

Keywords: ***Nutritional Status, Hypertension, Elderly***

INTRODUCTION

Old age or elderly refers to individuals who have reached the final phase of life. According to the Indonesian Ministry of Health in 2019, the elderly are individuals who have reached the age of 60 years and above. Based on the Indonesian Ministry of Health (2019), the elderly are grouped into: pre-elderly (45- 59 years old), elderly (60-74 years old), older elderly (75-90 years old), and very old (above 90 years old). Those who fall into this category will go through a process known as aging. Aging is a natural part of human life. Old age is the final stage of a person's life, during which individuals experience a gradual decline in physical, mental, and social functioning, making it difficult to perform daily activities (decline stage) (Siregar, 2022). Usually, the elderly experience various signs that arise due to a decline in biological functions, which results in changes in various systems, such as the sensory system, cardiovascular system, respiratory system, digestive system, urinary system, reproductive system, as well as psychosocial and economic aspects (Sakti & Luhung, 2025).

High blood pressure, or hypertension, has become a common health problem for many people in Indonesia. According to *The Seventh Report of the Joint National Committee* (JNC VII), blood pressure can be divided into four classifications, namely normal (<120 and <80), pre-hypertension (120-139 and 80-89), stage 1 hypertension (140-159 and 90-99), and stage 2 hypertension ($\geq$160 and $\geq$100) (Chobanian et al., 2003). This disease is characterized by increased blood pressure, namely systolic pressure exceeding 140 mmHg and diastolic pressure exceeding 90 mmHg (Widiyono et al., 2022). One of the main causes of high blood pressure is aging. As we age, blood vessels tend to become stiffer and less elastic, which can cause blood pressure to rise

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(Al-Fariqi, 2021). In 2015, approximately 1.13 billion people worldwide suffered from hypertension. Among adults, the prevalence of hypertension ranges from 30% to 45%. As people age, the risk of hypertension increases gradually, with a prevalence of more than 60% in those over 60 years of age. According to a report from the Basic Health Research (Riskesdas), the prevalence of hypertension increased from 25.8% in 2013 to 34.1% in 2018 (Sakti & Luhung, 2025). Hypertension in the elderly can cause adverse effects such as an increased risk of heart disease, impaired thinking, and psychological problems such as anxiety and depression. Socially, hypertension reduces quality of life and the ability to interact (Farhan et al., 2023).

In addition to age, nutritional status is also considered an important determinant in the incidence of hypertension. One method of determining nutritional status or obesity is by measuring body mass index (BMI). According to *the World Health Organization,* BMI can be divided into four classifications: *underweight (*<18.5), normal (18.5-24.9), *overweight (*25.0-29.9), and *obese (*≥30). This measurement tool is simple and is used to monitor the nutritional status of adults in terms of excess or insufficient body weight. By measuring height and weight, we can calculate the Body Mass Index (BMI). BMI is an easy-to-use and common indicator for evaluating nutritional status. The BMI value is obtained by dividing weight by height squared (Mukarromah & Nadhiroh, 2024).

Several studies have been conducted to examine the relationship between nutritional status and the incidence of hypertension in the elderly. A study conducted by Nugroho et al. (2022) in Girisekar Village showed a significant positive relationship between nutritional status and the incidence of hypertension based on the *Spearman Rank* test (*p-value* = 0.001). Although the correlation strength was relatively weak (r = 0.242), these results indicate that the higher the nutritional status (especially in the obese category), the higher the risk of hypertension. Similar findings were obtained in a study by Kusuma et al. (2024) at the Sumanda Community Health Center, which used the Gamma test and showed a significant relationship between nutritional status and hypertension (*p-value* = 0.000). This study noted that most elderly people with obese and overweight nutritional status had grade I and II hypertension. Additionally, research by Al-Fariqi (2021) at the Narmada Lombok Barat Community Health Center also showed similar results using the *chi-square* test*,* which found a significant relationship between overweight nutritional status and hypertension (*p-value* = 0.031), as well as a higher proportion of moderate and severe hypertension in the group of elderly people with overweight nutritional status. However, not all studies show consistent results. Research by Rochim & Tantoso (2024) at the Karang Mulya Community Health Center found that there was no significant relationship between nutritional status (based on BMI and waist circumference) and the incidence of hypertension, as indicated by a *p-value* of 0.589 (p > 0.05). Although most respondents were *overweight* and suffered from hypertension, the relationship was not statistically significant ( ). These differing results indicate that further study is needed to understand the relationship between nutritional status and hypertension, particularly in the elderly population.

Based on the 2024 Mengwi Subdistrict in Figures from the Badung Regency BPS (September 26, 2024), the total number of elderly people (aged ≥ 60 years) in the entire Mengwi Subdistrict is estimated to reach 20,019 people in 2022, making it the subdistrict with the highest number of elderly people in Badung Regency. Based on data from the Mengwi I Community Health Center, it is known that in 2018 there were 1,307 cases of hypertension in the working area of the health center, which covers several villages in Mengwi District, Badung Regency. From the preliminary research conducted by researchers at the Mengwi 1 Community Health Center, it was found that the highest number of hypertension cases was in the working area of this health center. Therefore, it is very important to understand how nutritional status is related to the occurrence of hypertension in the elderly in Kekeran Village, Mengwi District, Badung Regency, Bali. This study can provide useful information to broaden the understanding of the relationship between nutritional status and the incidence of hypertension in the elderly, especially in Kekeran

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Village. It is hoped that with this study, preventive measures can be taken to maintain nutritional status within normal limits. A healthy nutritional status can reduce the risk of hypertension in the elderly. For elderly people who already have hypertension, it is important to take secondary preventive measures to avoid complications from the disease.

RESEARCH METHODS

This study was conducted in Kekeran Village, Mengwi District, Badung Regency, Bali, from March to December 2025. The research design used was an observational analytical study with a *cross-sectional* approach to determine the relationship between nutritional status and the incidence of hypertension in the elderly. The study population included all elderly people in Kekeran Village, totaling 350 individuals, with a sample size of 132 individuals selected using *purposive sampling* based on specific inclusion and exclusion criteria. The variables studied consisted of the dependent variable, namely the incidence of hypertension, and the independent variable, namely nutritional status, which was measured using a sphygmomanometer, stethoscope, body weight scale, and stadiometer. Data collection was carried out through blood pressure and Body Mass Index (BMI) measurements at Bale Pesamuan Br. Delod Sema after obtaining permission from the relevant parties. Data analysis included univariate analysis to describe the characteristics of the respondents and bivariate analysis to test the relationship between nutritional status and the incidence of hypertension using Pearson's correlation test or Spearman's Rank test according to the results of the normality test. The results were considered significant if the p-value was < 0.05, with the interpretation of the correlation strength based on the correlation coefficient (r) value.

RESULTS AND DISCUSSION
Data Description

In this study, the total elderly population involved was 350 people in Kekeran Village, Mengwi District, Badung Regency, Bali. When data collection was carried out on September 21, 2025, at Bale Pesamuan Br. Delod Sema, only 175 respondents were present. After the data was collected, selection was carried out using inclusion and exclusion criteria for data that met the research requirements, resulting in 143 respondents who met the requirements for this research sample. The data collection process in this study was carried out using the *Nonprobability Sampling (Purposive Sampling)* technique. The examination was conducted using a sphygmomanometer and stethoscope to measure blood pressure, as well as a weighing scale and stature meter (stadiometer) to measure weight and height. The research data obtained will be analyzed and presented in the form of tables and *pie charts* with research variables covering blood pressure distribution, body mass index, normality tests, and hypothesis tests. In this study, data processing and analysis will be performed using the *Spearman Rank* correlation test, assisted by Microsoft Excel software for initial data grouping and SPSS (*Statistical Package for the Social Sciences)* for further statistical analysis.

Characteristics of Research Respondents
Distribution of Respondents Based on Blood Pressure

Table 1. Distribution of Respondents Based on Blood Pressure

	Distribution	Frequency (n)	Percentage
Blood Pressure	Normal	8	5.59
	Prehypertension	52	36.36
	Stage I hypertension	56	39.16
	Stage II hypertension	27	18.88

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Total	143	100

The table above shows the distribution of respondents based on blood pressure, namely 143 respondents, of which 8 had normal blood pressure (5.59%), 52 respondents with pre-hypertension (36.36%), 56 respondents with stage I hypertension (39.16%), and 27 respondents with stage II hypertension (18.88%). This data can also be presented in a *pie chart* as follows:
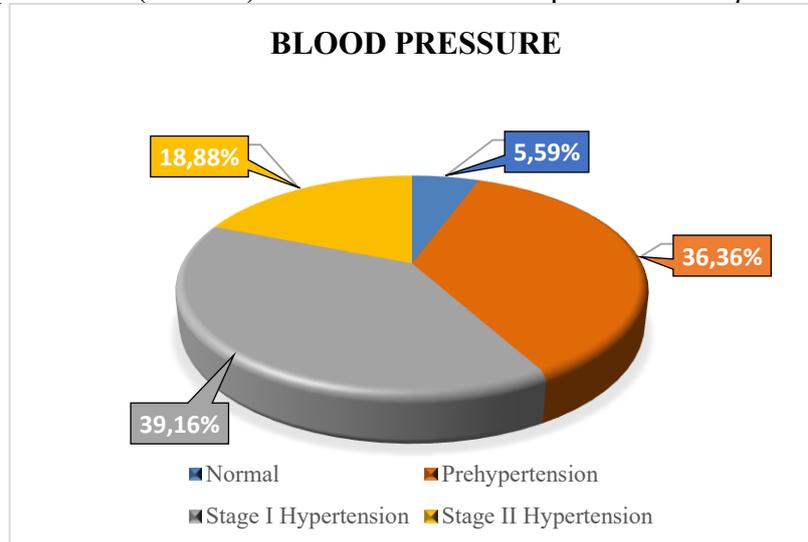

Figure 1. *Pie Chart* of Respondent Distribution Based on Blood Pressure

Based on the *pie chart* diagram above, it shows that the high percentage obtained from the research respondents who had blood pressure in the category of grade I hypertension was gray, followed by the group who had blood pressure in the category of pre-hypertension in orange, followed by the group who had blood pressure in the category of grade II hypertension in yellow, and then followed by the group who had blood pressure in the normal category in blue.

Distribution of Respondents Based on BMI

Table 2. Distribution of Respondents Based on BMI

	Distribution	Frequency (n)	Percentage (%)
BMI	*Underweight*	29	20.28
	Normal	26	18.18
	Overweight	76	53.15
	Obesity	12	8.39
	Total	143	100

The table above shows the distribution of respondents based on BMI, namely 143 respondents, of which 29 people had a BMI in the *underweight* category (20.28%), 26 people had a BMI in the normal category (18.18%), 76 respondents with an BMI in the *Overweight* category (53.15%), and 12 respondents with an BMI in the *Obesity* category (8.39%). This data can also be presented in the form of *a pie chart* as follows:
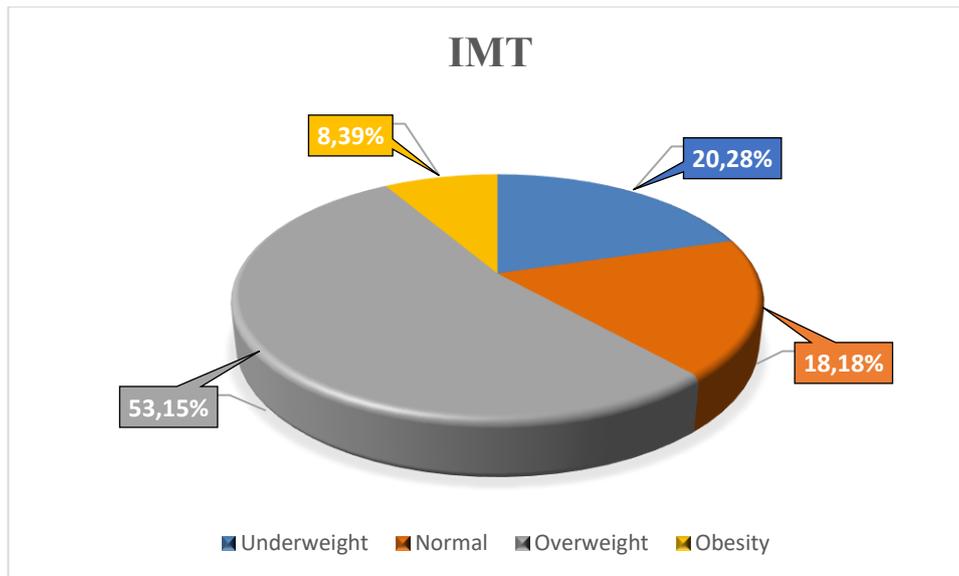
Figure 2. Pie Chart of Respondent Distribution Based on BMI

Based on the *pie chart* diagram above, it shows that the high percentage obtained from the research respondents who have an *overweight* BMI is gray, followed by the group with a normal BMI in orange, then followed by the group with *an underweight* BMI in blue, and then followed by the group with an *obese* BMI in yellow.

Normality Test

Table 3. Normality Test Results

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Kejadian Hipertensi	,158	143	<,001	,954	143	<,001
Status Gizi	,194	143	<,001	,942	143	<,001

a. Lilliefors Significance Correction

The normality test was conducted to assess whether the data for each research variable was normally distributed or not. This test is important because normal data distribution is one of the basic assumptions in the use of parametric statistical tests. In this study, normality tests were performed on two main variables, namely hypertension and nutritional status, using the *Lilliefors (Kolmogorov–Smirnov)* and *Shapiro–Wilk* tests at a significance level (α) of 0.05.

Based on the analysis results shown in the table, the significance value (Sig.) for the hypertension variable was $p < 0.001$ and for the nutritional status variable was $p < 0.001$. The values of both variables were smaller than $α = 0.05$, indicating that the data for both variables were not normally distributed. Thus, it can be concluded that the research data does not meet the normality assumption required for parametric tests.

Because the above data is not normally distributed, the analysis of the relationship between nutritional status and the incidence of hypertension in the elderly in Kekeran Village, Mengwi District, Badung Regency, Bali cannot be performed using parametric tests such as the *Pearson* correlation test. Alternatively, this study can use a non-parametric statistical test, namely the *Spearman Rank* correlation test, which is more suitable for data with a non-normal distribution. Thus, the results of the *Lilliefors* test become the basis for selecting the analysis method used in the next stage of the research, namely the analysis of variance ( ), to ensure that the results obtained remain valid and in accordance with the characteristics of the existing data.

Hypothesis Testing

Table 4. Hypothesis Test Results

			Kejadian Hipertensi	Status Gizi
Spearman's rho	Kejadian Hipertensi	Correlation Coefficient	1,000	,244**
		Sig. (2-tailed)	.	,003
		N	143	143
	Status Gizi	Correlation Coefficient	,244**	1,000
		Sig. (2-tailed)	,003	.
		N	143	143

**. Correlation is significant at the 0.01 level (2-tailed).

Spearman's rank correlation test was used to analyze the relationship between two variables with non-normally distributed data. This test was chosen because previous normality analysis showed that the data on nutritional status and hypertension were not normally distributed, so a non-parametric statistical test was more appropriate than a parametric test such as *Pearson's* correlation test. This analysis aims to determine whether there is a significant relationship between nutritional status and the incidence of hypertension among the elderly in Kekeran Village, Mengwi District, Badung Regency, Bali.

Based on the analysis results presented in the table, the *Spearman Rank* correlation coefficient (r) value obtained was 0.244 with a significance value (*p-value*) of 0.003. A p-value smaller than the significance level of α = 0.05 indicates that there is a statistically significant relationship between nutritional status and the incidence of hypertension in the elderly in Kekeran Village, Mengwi District, Badung Regency, Bali. The positive direction of the relationship (r = 0.244) indicates that the higher a person's nutritional status, the greater the tendency to develop hypertension. In other words, an increase in body mass index leading to the overweight or obese category is associated with an increase in the incidence of hypertension.

However, the value of the *Spearman Rank* correlation coefficient (r = 0.244) indicates that the strength of the relationship between the two variables is relatively low, as it falls within the range of 0.20-0.399 according to the interpretation criteria for the *Spearman Rank* correlation coefficient. This means that nutritional status only has a relatively small contribution to the incidence of hypertension and there are other factors that are likely to have a more dominant influence, such as age, physical activity, salt consumption, stress, and a family history of hypertension.

Thus, the results of this study indicate that there is a low but statistically significant positive relationship between nutritional status and the incidence of hypertension in the elderly in the study area. This finding is in line with the theory that an increase in body mass can increase total peripheral resistance and the activity of the sympathetic nervous system and *renin-angiotensin-aldosterone,* which can ultimately lead to an increase in blood pressure. Therefore, efforts to prevent and control hypertension in the elderly should not only focus on medical management but also on controlling nutritional status through dietary modifications and a sustainable healthy lifestyle.

DISCUSSION

Nutritional Status of Elderly People in Kekeran Village, Mengwi District, Badung Regency, Bali

Based on the results of a study conducted on 143 elderly respondents in Kekeran Village, Mengwi District, Badung Regency, Bali, it was found that most respondents were overweight, namely 76 people (53.15%). Furthermore, 29 people (20.28%) were classified *as underweight,* 26 people (18.18%) had normal nutritional status, and 12 people (8.39%) were classified as obese.

This distribution shows that most elderly people in the study area have a body weight that exceeds the normal range, which indicates a tendency for an increase in overweight status among the elderly in Kekeran Village.

This phenomenon is in line with the national nutritional condition, in which Indonesia is facing *a double burden of malnutrition*, namely a double burden of undernutrition and overnutrition. According to Irawati *et al*. (2020), the elderly in Indonesia have diverse nutritional profiles with a fairly high proportion of undernutrition and overnutrition, caused by changes in consumption patterns and decreased physical activity. Elderly people with excess energy intake but low energy expenditure tend to experience progressive weight gain. Permatasari (2016) , expressed a similar viewstating that a balanced diet has a significant effect on the nutritional status of the elderly, where those who do not follow a balanced diet are at risk of overnutrition.

Socioeconomic changes and lifestyle changes also contribute to an increase in overnutrition. Modernization and easy access to high-energy foods make it easier for the elderly to obtain foods high in fat and sugar, while their physical activity tends to decline. A study by Wilujeng *et al.* (2019) shows that *overweight elderly people* have a higher intake of micronutrients and macronutrients than elderly people of normal weight, especially among those with hypertension. This condition reinforces the view that the balance between energy intake and physical activity is a major factor in maintaining nutritional status in old age.

In addition to behavioral factors, the aging process also plays a role in changes in body composition and metabolism in older adults. A study by Arjuna *et al*. (2017) in Yogyakarta showed that older adults tend to experience physiological changes that affect appetite, energy metabolism, and body fat composition. Older adults with high energy intake but low physical activity are at greater risk of becoming overweight. These findings are consistent with the condition of the elderly in Kekeran Village, most of whom have switched from heavy physical work to household activities or lighter activities, resulting in reduced energy expenditure.

Thus, it can be concluded that most elderly people in Kekeran Village are overweight, reflecting high energy consumption and low physical activity. Community-based promotional and preventive efforts are expected to help control these nutritional problems so that the quality of life of the elderly can be optimally maintained.

Incidence of Hypertension among the Elderly in Kekeran Village, Mengwi District, Badung Regency, Bali

Based on the results of a study of 143 elderly respondents in Kekeran Village, Mengwi District, Badung Regency, Bali, it was found that most elderly people experienced an increase in blood pressure. The data showed that 56 people (39.16%) were classified as having grade I hypertension, 52 people (36.36%) had prehypertension, 27 people (18.88%) had grade II hypertension, and only 8 people (5.59%) had normal blood pressure. This distribution shows that more than half of the elderly in the study area suffer from hypertension, both mild and severe. These results indicate that the incidence of hypertension among the elderly in Kekeran Village is relatively high, in line with the increase in the national prevalence of hypertension reported by Riskesdas (2018), which rose from 25.8% in 2013 to 34.1% in 2018.

The high prevalence of hypertension in Kekeran Village can be attributed to several factors, including the aging process, physiological changes in blood vessels, and a sedentary lifestyle. With age, arterial elasticity decreases and peripheral resistance increases, causing blood pressure to rise more easily (Widiyono *et al*., 2022). In addition, people's consumption patterns, particularly their intake of salt, fat, and alcohol, have the potential to exacerbate hypertension. In Bali itself, the habit of consuming traditional fermented beverages such as arak and tuak can also contribute to increased blood pressure if consumed in excess (Wijaya *et al.*, 2024).

Social and behavioral factors such as low levels of physical activity, psychological stress, and lack of routine health monitoring also contribute to anemia in the elderly. Regular physical

activity can help maintain blood vessel elasticity and improve blood pressure balance, making physical inactivity one of the main determinants of hypertension in old age (Widiyono *et al.*, 2022).

Overall, the high incidence of hypertension in Kekeran Village indicates the need for a promotive and preventive approach through collaboration between health workers and the community to increase awareness and healthy behaviors among the elderly. This approach is expected to reduce the incidence of hypertension and improve the quality of life of the elderly in the region.

The Relationship Between Nutritional Status and Hypertension Incidence Among the Elderly in Kekeran Village, Mengwi District, Badung Regency, Bali

Table 5. Relationship Between Nutritional Status and Hypertension Incidence

Body Mass Index	Blood Pressure Classification				Total	p-value	r
	Normal	Prehypertension	Stage I Hypertension	Stage II Hypertension			
Underweight	0	14	12	3	29		
Normal	7	18	1	0	26	**0.003**	**0.244**
Overweight	0	15	39	22	76		
Obesity	1	5	4	2	12		
Total	8	52	56	27	143		

Based on the results of this study, a *Spearman Rank* correlation coefficient (r) of 0.244 with *a p-value* = 0.003 was obtained, which means that there is a statistically significant relationship between nutritional status and the incidence of hypertension in the elderly in Kekeran Village. The positive direction of the relationship indicates that the higher a person's nutritional status (especially in the overweight and obese categories), the greater the tendency to develop hypertension. However, the strength of this relationship is relatively low, indicating that other factors such as age, salt consumption patterns, physical activity, stress, and family history also play a role in the emergence of hypertension in the elderly group.

The results of this study are in line with the research by Mukarromah & Nadhiroh (2024), who conducted *a systematic literature review* and concluded that elderly people with poor nutritional status have a 1.5-2 times greater risk of hypertension than elderly people with normal nutritional status. The biological mechanisms underlying this include increased sympathetic nervous system activity, sodium retention, and activation of the renin-angiotensin-aldosterone system (RAAS), which causes an increase in blood pressure (Meouchy *et al.*, 2022).

In addition, research by Kusuma et al. (2024) at the Sumanda Community Health Center, Tanggamus Regency, showed a significant relationship between nutritional status and hypertension ($p = 0.002$), where most respondents with a BMI ≥ 25 kg/m² had grade I and II hypertension. This is consistent with the findings of a study in Kekeran Village, where the overweight group (53.15%) dominated and was at higher risk of hypertension.

International research also supports these findings. According to Cecchini *et al.* (2024) in *the Hypertension Journal*, obesity and overweight increase the risk of hypertension through increased circulating blood volume, endothelial dysfunction, and systemic chronic inflammation that reduces insulin sensitivity and slows blood pressure control. This condition is exacerbated in the elderly due to physiological changes that reduce blood vessel elasticity and decreased kidney function (*Leslie & Hankey,* 2016).

However, the results of this study also show that the relationship between nutritional status and hypertension is not very strong. This can be explained by other factors such as high salt consumption, lack of physical activity, and psychosocial stress. A study by Widiyono *et al.* (2022)

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confirms that a lack of physical activity can significantly increase the risk of hypertension in the elderly due to decreased blood vessel elasticity and increased peripheral resistance.

Thus, the results of this study reinforce the evidence that controlling ideal nutritional status is an important component in the prevention of hypertension in the elderly. Promotive and preventive efforts such as nutrition education, salt intake, increased physical activity, and regular blood pressure monitoring need to be promoted in the Kekeran Village community. A cross-sectoral approach between health workers and village officials can raise awareness of healthy living in order to reduce the incidence of hypertension among the elderly.

Research Limitations

This study has several limitations that need to be considered in interpreting the results. The research design used was *cross-sectional,* so that the relationship found between nutritional status and the incidence of hypertension only describes the conditions at the time the research was conducted without being able to explain the direct cause-and-effect relationship. The measurement of nutritional status in this study only used the Body Mass Index (BMI) parameter without considering body fat distribution, which could provide a more comprehensive picture of the risk of hypertension. In addition, this study did not analyze other factors that could potentially affect blood pressure, such as dietary patterns, physical activity, stress levels, and lifestyle habits of respondents, which could be variables influencing the study results. The limited sample size and the use of *purposive sampling* techniques also limited the generalization of the study results to the wider elderly population in the Badung Regency.

CONCLUSION

Based on the results of the study conducted on the Relationship between Nutritional Status and the Incidence of Hypertension in Elderly People in Kekeran Village, Mengwi District, Badung Regency, Bali, the following conclusions were obtained. The results show that most elderly people in Kekeran Village are overweight, accounting for 53.15% of the total respondents. Meanwhile, 20.28% of the elderly are *underweight*, 18.18% have normal nutritional status, and 8.39% are *obese*. This condition illustrates that excess weight is still a prominent nutritional problem among the elderly in this region. Based on blood pressure distribution, most respondents were classified as having stage I hypertension (39.16%), followed by prehypertension (36.36%), stage II hypertension (18.88%), and only 5.59% of elderly people had normal blood pressure. This indicates that high blood pressure remains a fairly common health problem among the elderly in Kekeran Village. The results of the analysis using *Spearman's rank* correlation test showed a significant relationship between nutritional status and the incidence of hypertension in the elderly in Kekeran Village with a p-value of 0.003 ($p < 0.05$) and a correlation coefficient (r) of 0.244. This relationship is positive with weak strength, which means that an increase in nutritional status or body mass index is directly proportional to an increase in the risk of hypertension.

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