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Factors related to the degree of hypertension in the working area of the Limboto Health Center

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ABSTRACT

Hypertension is a condition of increased blood pressure that is chronic and can cause serious complications if not controlled properly. Lifestyle factors such as physical activity, stress levels, and smoking behavior are thought to be related to the severity of hypertension. This study aims to analyze factors related to the degree of hypertension in the working area of the Limboto Health Center.

This research method is quantitative with a correlational analytical design through a cross sectional approach. The population is all hypertensive patients totaling 4,575 people, and a sample of 98 respondents using purposive sampling techniques. The research instruments are the Global Physical Activity Questionnaire (GPAQ), Perceived Stress Scale (PSS), Global Adult Tobacco Survey (GATS). The data was analyzed using the Spearman Rank test.

The results showed that most of the respondents had low physical activity (44.9%), moderate stress levels (42.9%), and moderate smoking behavior (36.7%). Based on the results of the Spearman Rank test, it was found that there was a significant relationship between physical activity and the degree of hypertension (p-value = 0.000 and the correlation coefficient r = -0.755), there was a significant relationship between the level of stress and the degree of hypertension (p-value = 0.000 and the correlation coefficient r = 0.469), and there was a significant relationship between smoking behavior and the degree of hypertension (p-value = 0.000 and the correlation coefficient r = 0.572).

The conclusion of this study shows that there is a relationship between physical activity, stress levels, and smoking behavior with the degree of hypertension in people in the Limboto Health Center Working Area. The lower the physical activity, the higher the level of stress, and the more severe the smoking behavior, the higher the degree of hypertension in the respondents. Thus, the target of this research is expected to be the basis for health workers in the work area of the Limboto Health Center to increase promotive and preventive efforts through health education, routine screening, and improvement of healthy living behaviors to reduce the risk and severity of hypertension in the community.

INTRODUCTION

Hypertension is one of the global health problems and the leading cause of morbidity and mortality worldwide. Hypertension is known as "the silent killer", because it often occurs without complaints in the sufferer. Hypertension is one of the categories of chronic diseases, Chronic diseases have become a significant global health problem to date because they have an impact on daily life and require continuous treatment (Affandi & Hamzah, 2025).

High blood pressure is a condition that is often found in primary health services with the risk of increased morbidity and mortality which can be the main cause of heart failure, stroke and kidney failure. Hypertension is a

condition when systolic blood pressure is ≥140 mmHg and diastolic blood pressure is ≥90 mmHg (Pawenrusi, & Ikram, 2024).

Based on data from the World Health Organization (WHO) In 2023, around 1.28 billion adults aged 30–79 years are living with hypertension worldwide. This figure continues to increase to around 1.4 billion in 2024, and is expected to reach 1.56 billion by 2025.

In addition, WHO reports that there are around 927 million people in the world suffering from hypertension with a global prevalence projected to increase to 29.2% by 2025. Each year, hypertension and its complications cause about 9.4 million deaths worldwide. Meanwhile, about 54% of adults have been diagnosed with hypertension, while another 46% are unaware of the condition, indicating that public awareness levels are still low. Then, hypertension is the main cause of death due to cardiovascular disease, namely 45% of heart disease and 51% of deaths due to stroke. It is estimated that the death rate due to cardiovascular disease will reach 23.3 million by 2030.

Based on data from the 2023 Indonesian Health Survey (SKI) and the 2011-2021 non-communicable disease cohort (NCD) study, it is known that hypertension is the highest risk factor for the fourth cause of death in Indonesia, with a percentage of 10.2%. The prevalence of hypertension in Indonesia also shows an increasing trend, where in the previous period the prevalence of hypertension showed 25.8%, reaching 34.1% in 2023. This shows that the prevalence of hypertension among Indonesians aged ≥ 18 years continues to increase. The highest prevalence of hypertension is in South Kalimantan Province at 44.1% while the lowest prevalence is in Papua Province, which is 22.2%. Gorontalo Province is 20th with a hypertension prevalence of 31.0% (Ministry of Health, 2024).

Based on data from the Gorontalo Provincial Health Office in 2025, the highest incidence of hypertension is in Gorontalo Regency, as many as 14,904 people or 27.85%, followed by Bone Bolango Regency as many as 3,334 people or 12.25 people, Boalemo Regency as many as 1,854 people or 12.40%, North Gorontalo Regency as many as 1,753 people or as much as 14.66%, Gorontalo City as many as 1,592 people or as much as 6.71% And the last case in Pahuwato Regency 720 people or by 6.85% (Profile of the Gorontalo Provincial Health Office, 2025).

Data obtained from the District Health Office in 2024 is 66,413 and 2025 is 35,307, Limboto Health Center ranks first in hypertension cases out of 23 health centers in Gorontalo Regency. Based on the results of initial observations at the Limboto Health Center in August 2025, the number of Hypertension patients recorded at the Limboto Health Center from January to July was 4,575. This shows the high number of cases, so it is important to understand the factors that can trigger hypertension.

Based on research (Muslimah et al., 2021), the three main factors, namely physical activity, smoking behavior, and psychological stress, show the most significant relationship with the incidence of hypertension. This is in line with the results of initial observations, where the proportion of individuals with low physical activity, smoking habits, and high levels of stress appeared to be more dominant than other risk factors. In the literature, less physical activity has been shown to increase the risk of hypertension through mechanisms of decreased endothelial function, increased insulin resistance, and disruption of autonomic regulation. Meanwhile, smoking is known to cause acute vasoconstriction, increased arterial stiffness, as well as endothelial damage to conditions that accelerate the development of hypertension. On the other hand, psychological stress triggers the activation of the sympathetic nervous system and the adrenal pituitary hypothalamus axis, thereby increasing the release of catecholamines and cortisol that have an impact on a sustained increase in blood pressure. Therefore, these three factors show a stronger and more consistent influence both in national and global research than other factors such as salt consumption, obesity, or family history. Thus, the selection of these three variables in the study is very relevant because it is supported by empirical evidence, is consistent with field phenomena, and has a clear physiological mechanism in its contribution to hypertension (Hidayani, 2024).

Furthermore, low physical activity reflects changes in people's behavior patterns that have an impact on the increasing burden of health problems, especially the risk of hypertension. This condition occurs due to a lack of body movement in terms of infrequent frequency of activity, short duration, and low intensity can increase blood vessel resistance and reduce cardiovascular fitness, thereby contributing to an increase in blood pressure. Therefore, considering that physical activity has been proven to provide a protective effect on the cardiovascular system through improved endothelial function, decreased insulin resistance, stabilization of blood pressure, and improvement of blood fat levels, and most adults in Indonesia have not reached the recommendation of a minimum of 150 minutes of moderate-intensity physical activity per week, according to research conducted by Sihotang and Elon in 2021 on the variables of physical activity to be very It is important to understand its contribution to the risk of hypertension, as well as to design appropriate prevention strategies to reduce the burden of cardiovascular disease in the community In this study, physical activity was measured based on respondents' habits of doing strenuous, moderate, and light physical activity during the past week for at least 10 minutes continuously, which were then categorized into active (heavy or moderate) and less active (light or not at all) (Alfianur & Novikasari, 2023).

Furthermore, stress factors also play an important role in the development of hypertension. Stress is the body's and mind's response to external demands that are considered threatening, such as environmental pressure, workload, and social conflict and is often described as unpleasant psychological stress. As the burden of people's

lives increases, stress becomes a significant potential factor in the development of hypertension through the activation of the sympathetic nervous system and an increase in stress hormones such as cortisol. To examine the role of stress more objectively in hypertension, stress was analyzed using indicators of frequency (how often stress is experienced), duration (length of stress, especially when persistent for a long period of time), and intensity (severity of psychological stress: mild, moderate, severe). Based on these mechanisms, it can be estimated that individuals who experience stress repeatedly, last for a long time, and are accompanied by high levels of psychological stress have a greater tendency to experience increased blood pressure. This mechanism occurs because the body is in a state of constant alertness, thus triggering the release of stress hormones periodically and ultimately disrupting the blood pressure regulatory system (Febriyanti, 2024).

In addition, smoking is a public health problem that is consistently associated with the incidence of hypertension. This is because nicotine exposure can increase blood pressure acutely, while in the long term smoking can cause endothelial damage and increase the stiffness of blood vessels. The condition not only contributes to an increased risk of hypertension, but also has the potential to trigger other serious complications such as coronary heart disease and stroke.

Therefore, this study needs to describe smoking behavior in more detail through several indicators, including smoking status (never, never, and active smokers), the number of cigarettes smoked per day, and the duration of smoking in the year. These indicators are used to reflect the accumulated exposure to cigarettes that occur due to the intensity and length of a person smoking. With these measurements, the study is expected to be able to assess more clearly the effect of smoking on blood pressure (Jareebi, 2024).

The impact of hypertension that is not treated properly will cause various complications. If it hits the heart, heart failure and coronary heart can occur, stroke occurs in the brain, if it hits the kidneys, chronic kidney failure occurs, and if it hits the eyes, vision problems will occur. Various complications that may arise are very serious diseases and have an impact on the patient's psychology because of their low quality of life, especially in cases of stroke, kidney failure, and heart failure (Fitrhi, 2024).

Based on research conducted by (Riza, Hayati, & Setiawan, 2023). At Pertamina Bintang Amin Hospital with the title Analysis of factors related to the incidence of hypertension, it showed that in bivariate analysis there was a significant relationship between physical activity variables, fruit and vegetable consumption, salty food consumption, obesity, and smoking to hypertension ($p < 0.05$), and in multivariate analysis, the most dominant variable affecting hypertension was physical activity ($exp(B) = 9.086$).

Other research conducted by (Henny Dwi Hernita, Hermanto Hermanto, & Kristin Rosela, 2024). In the Working Area of the Tumbang Talaken Health Center, Gunung Mas Regency with the title Analysis of Factors – Factors related to the incidence of hypertension showed that there was a significant relationship between the variables of physical activity factors p-value = 0.000, stress p-value = 0.000 and smoking habit p-value = 0.000 with the incidence of hypertension.

Based on the results of interviews conducted in August 2025 at the Limboto Health Center on 10 hypertensive patients interviewed at the time of prolanis it was found that most of the respondents still had risk factors that had the potential to worsen the condition of hypertension. A total of 5 respondents still smoked, and 2 of them were heavy smokers who consumed more than 10 cigarettes per day. In addition, 3 respondents admitted that they often experience stress, which is mainly caused by economic stress, family problems, and lack of rest time. Meanwhile, the other 2 respondents reported low physical activity, with the dominant reason being old age and a feeling of tiredness so that their activities were limited to light household chores.

Based on the above background, the researcher is interested in conducting a research entitled "Factors Related to Hypertension in the Working Area of the Limboto Health Center".

RESEARCH METHODS

Research This will be held at the Limboto Health Center on January 6-20, 2026. Types of quantitative research The research design used in this study is quantitative research with an approach cross sectional. Research cross sectional is a type of research that emphasizes the time of measurement/observation of independent and dependent variable data only once at a time. The data collection method was through filling out questionnaires directly in the medicine waiting room, the waiting room of the Elderly Cluster Poly of the Limboto Health Center, as well as at the Elderly Posyandu activities, with a sample of 98 respondents. This research instrument uses a questionnaire Global Physical Activity (GPAQ), Questionnaire Perceived Stress Scale 10, and 4. Smoking behavior.

RESEARCH RESULTS

Univariate Results

Characteristics of Respondents Based on Demographic Data

Table 1. Characteristics of Respondents by Age

Yes	Age Group	Frequency (n)	Percentage (%)
1.	Adult (20–39)	11	11,2
2.	Pre-elderly (40–59)	54	55,1
3.	Elderly (≥60 years)	33	33,7
Total		98	100

Based on the table above, the characteristics of respondents based on ageare that the majority of respondents are in the pre-elderly age group (40-59 years) with a total of 54 respondents (55.1%), while adult age (20-39 years) is the age group with the least number, namely 11 respondents (11.2%). The age division is based on the Ministry of Health of the Republic of Indonesia (2009).

Table 2. Respondent Characteristics by Gender

Yes	Gender	Frequency(s)	Percentage (%)
1.	Male	42	42,9
2.	Women	56	57,1
Total		98	100

Based on the table above, the characteristics of respondents based on Gender, of the 98 respondents studied, the majority of respondents were female, namely 56 respondents (51.1%), while male respondents amounted to 42 respondents (42.9%).

Table 3. Characteristics of Respondents Based on Education Level

Yes	Marital Status	Frequency (n)	Percentage (%)
1.	Married	76	77,6
2.	Unmarried	10	10,2
3.	Widow	8	8,2
4.	Doubt	4	4,1
Total		98	100

Based on the table above, the characteristics of respondents based on the last education can be seen that the majority of respondents have a junior high school education as many as 47 respondents (48.0%), while elementary education is the least, namely 13 respondents (13.3%).

Characteristics of Respondents Based on Work

Based on the table, it shows that the majority of respondents work as housewives, namely 36 respondents (36.7%), while not working is the group with the least number, namely 11 respondents (11.2%).

Table 5. Characteristics of Respondents Based on Marital Status

Yes	Education	Frequency (n)	Percentage (%)
1.	SD	13	13,3
2.	Junior High School	47	48,0
3.	High School/Vocational School	19	19,4
4.	S1	19	19,4
Total		98	100

Based on the table above, the majority of respondents were married, namely 76 respondents (77.6%). Meanwhile, the least status is widower, which is 4 respondents (4.1%).

Table 6. Distribution of Respondents by Physical Activity

Yes	Physical Activity	Frequency (n)	Percentage (%)
1.	Low	44	44,9
2.	Medium	25	25,5
3.	Weight	29	29,6
Total		98	100

Based on the table, the majority of respondents had a low level of physical activity, namely 44 respondents (44.9%). Meanwhile, moderate physical activity levels were the least, with 25 respondents (25.5%).

Table 7 Distribution of Respondents Based on Stress

Yes	Stress Level	Frequency (n)	Percentage (%)
1.	Low	29	29,6
2.	Medium	42	42,9
3.	Weight	27	27,6
Total		98	100

Based on the table above, the majority of respondents had moderate levels of stress, namely 42 respondents (42.9%). Meanwhile, the level of severe stress was the least, with 27 respondents (27.6%).

Table 8. Distribution of Respondents Based on Smoking Behavior

Yes	Smoking Habits	Frequency (n)	Percentage (%)
1.	Lightweight	28	28,6
2.	Medium	36	36,7
3.	Weight	34	34,7
Total		98	100

Based on the table above, the majority of respondents have moderate smoking habits, namely 36 respondents (36.7%). Meanwhile, the habit of light smoking was the least, namely 28 respondents (28.6%).

Table 9. Distribution of Respondents Based on Blood Pressure

Yes	Hypertension Status	Frequency (n)	Percentage (%)
1.	Normal	4	4,1
2.	Pre-hypertension	10	10,2
3.	Hypertension level 1	19	19,4
4.	Grade 2 hypertension	23	23,5
5.	Severe hypertension	42	42,9
Total		98	100

Based on the table above, the majority of respondents are in the category of severe hypertension, which is 42 respondents (42.9%). Meanwhile, the normal category was the least, namely 4 respondents (4.1%).

Bivariate Results

Table 10 Physical Activity with Degree of Hypertension in the Working Area of the Limboto Health Center

Physical Activity	Normal		Pre-Hypertension		Hypertension Level 1		Hypertension Level 2		Hypertension Weight		Total		R	P Value
	N	%	N	%	N	%	N	%	N	%	N	%		
Low	0	0	0	0	1	2,3	9	20,5	34	77,3	44	100	-0,755	0,000
Medium	0	0	2	8	6	24	10	40	7	28	25	100		

Height	4	13,8	8	27,6	12	41,4	4	13,8	1	3,4	29	100		
Total	4	4,1	10	10,2	19	19,4	23	23,5	42	42,9	98	100		

Based on the table above, the bivariate data analysis technique used in this study used a Spearman Rank statistical test with a p-value of 0.000 (p<0.05), which shows that there is a significant relationship between physical activity and hypertension status in the working area of the Limboto Health Center. A Spearman correlation coefficient value of -0.755 indicates a strong and negative directional relationship between physical activity and hypertension status. This means that the higher the level of physical activity carried out by the respondents, the lower the level of hypertension experienced.

The results of cross-tabulation between physical activity and hypertension status were obtained which showed that the majority of respondents with low physical activity were in the category of severe hypertension, namely 34 respondents (77.3%). In respondents with moderate physical activity, most of them were in the category of level 2 hypertension, which was as many as 10 respondents (40%). Meanwhile, in respondents with high physical activity, the majority were in the category of level 1 hypertension, which was as many as 12 respondents (41.4%).

Table 11 The Relationship of Stress with the Degree of Hypertension in the Working Area of the Limboto Health Center

Stress Level	**Normal**		**Pre-hypertension**		**Hypertension Level 1**		**Hypertension Level 2**		**Hypertension Weight**		**Total**		**R**	**p value**
	N	%	N	%	N	%	N	%	N	%	N	%		
Low	4	13,8	6	20,7	7	24,1	7	24,1	5	17,2	29	100	0,469	0,000
Medium	0	0,0	4	9,5	9	21,4	11	26,2	18	42,9	42	100		
Weight	0	0,0	0	0,0	3	11,1	5	18,5	19	70,4	27	100		
Total	4	4,1	10	10,2	19	19,4	23	23,5	42	42,9	98	100		

Based on the table above, the bivariate data analysis technique used in this study used a Spearman Rank statistical test with a p-value of 0.000 (p<0.05), which shows that there is a significant relationship between stress level and hypertension status in the working area of the Limboto Health Center. The value of the Spearman correlation coefficient of 0.469 indicates a relationship with moderate and positive direction between stress levels and hypertension status. This means that the higher the level of stress experienced by the respondents, the higher the level of hypertension experienced.

The results of cross-tabulation between stress level and hypertension status were obtained which showed that respondents with low stress levels were mostly in the category of level 1 hypertension and level 2 hypertension, as many as 7 respondents (24.1%) each. In respondents with moderate stress levels, most of them were in the category of severe hypertension, namely as many as 18 respondents (42.9%). Meanwhile, in respondents with severe stress levels, the majority were in the category of severe hypertension, which was 19 respondents (70.4%).

Table 12 The Relationship of Smoking Behavior with the Degree of Hypertension in the Working Area of the Limboto Health Center

Smoking Habits	**Normal**		**Pre-hypertension**		**Hypertension Level 1**		**Hypertension Level 2**		**Hypertension Weight**		**Total**		**R**	**p value**
	N	%	N	%	N	%	N	%	N	%	N	%		
Lightweight	4	14,3	6	21,4	8	28,6	5	17,9	5	17,9	28	100	0,572	0,000
Medium	0	0,0	4	11,1	7	19,4	16	44,4	9	25,0	36	100		
Weight	0	0,0	0	0,0	4	11,8	2	5,9	28	82,4	34	100		
Total	4	4,1	10	10,2	19	19,4	23	23,5	42	42,9	98	100		

Based on the table above, the bivariate data analysis technique used in this study used the Spearman Rank statistical test, with a p-value of 0.000 (p<0.05), which shows that there is a significant relationship between smoking habits and hypertension status in the working area of the Limboto Health Center. The value of the Spearman correlation coefficient of 0.572 indicates a fairly strong relationship with a positive direction between smoking habits and hypertension status. This means that the higher the level of the respondent's smoking habit, the higher the hypertension rate experienced.

The results of cross-tabulation between smoking habits and hypertension status were obtained which showed that the majority of respondents with mild smoking habits were in the category of level 1 hypertension, namely 8 respondents (28.6%). In respondents with moderate smoking habits, most of them were in the category

of level 2 hypertension, which was 16 respondents (44.4%). Meanwhile, in respondents with heavy smoking habits, the majority were in the category of severe hypertension, namely 28 respondents (82.4%).

DISCUSSION

Physical Activity

Based on the results of research conducted in the work area of the Limboto Health Center on 98 respondents, it was found that most of the respondents were in the category of low physical activity as many as 44 respondents (44.9%), followed by the category of heavy physical activity as many as 29 respondents (29.6%), and moderate physical activity as many as 25 respondents (25.5%). These findings show that respondents' physical activity levels are still dominated by the low category, which indicates that most respondents have not met the recommended physical activity component.

The determination of the physical activity category is based on the results of measurements using a questionnaire that refers to indicators of intensity, frequency, and duration of activity. Based on these three indicators, low physical activity is reflected in the respondents' answer pattern which is dominated by not doing moderate or heavy physical activity, low frequency of activity (only a few days a week), and short duration of activity (less than 10 minutes per day). Thus, respondents can be grouped into the category of low physical activity because they have not reached the minimum standard of recommended physical activity.

The low frequency and duration of these activities show that the contribution of physical activity to daily energy needs is still very lacking. This is also supported by the results of the study which showed that respondents did more light activities such as sitting, talking, or watching television. This condition further strengthens that the physical activity carried out has not met the minimum recommended criteria.

In the travel component, respondents with low categories showed limited involvement in walking or cycling activities, both in terms of frequency and duration, so they did not make an optimal contribution to daily physical activity. In the recreational activity component, most respondents did not exercise with either heavy or moderate intensity. If it is done, the frequency and duration are still relatively low and are not done regularly. In addition, in the sedentary component, respondents tended to have a long duration of sitting or lying down, such as watching television or using mobile phones, which also contributed to low physical activity.

Meanwhile, respondents with moderate physical activity categories showed better involvement in activities, such as walking and doing household activities with a frequency of several times a week and of moderate duration, although they were not done consistently every day and did not fully meet physical activity recommendations. Respondents with the category of heavy physical activity generally do regular physical activity with high intensity, more frequent frequency (≥3–5 days per week), and duration ≥30 minutes per day or close to ≥150 minutes per week, so that they have met most of the recommended physical activity components.

The differences in the categories of physical activity in this study were determined based on the intensity, frequency, and duration of activities. Low physical activity is characterized by the dominance of light activity as well as low frequency and duration. Moderate activity shows sufficient but not optimal activity involvement, while strenuous activity reflects activities that are carried out regularly with high intensity, more frequent frequency, and longer duration in accordance with health recommendations.

The results of this study are in line with the theory from the World Health Organization which states that adults are recommended to do physical activity for at least 150 minutes per week or about 30 minutes per day. Although the duration indicator is not explicitly listed in the questionnaire, it is used as a reference in assessing the adequacy of the respondents' physical activity.

In addition, research by Keith Diaz (2021) shows that high sedentary activity without physical activity can increase the risk of cardiovascular diseases, including hypertension. Research by Mats Hallgren (2020) also states that physical activity that is done regularly for at least 30 minutes per day plays a role in reducing the risk of chronic diseases.

Overall, the results of this study show that low physical activity in respondents is related to the unfulfilled components of physical activity, especially in terms of intensity, frequency, duration, and high sedentary activity. The dominance of the low physical activity category in respondents confirmed that most had not reached the minimum recommended physical activity threshold, which was also reflected in the questionnaire response pattern dominated by light activity and low involvement in moderate to heavy physical activity.

Stress

Based on the results of research conducted in the Limboto Health Center Working Area on 98 respondents, it was found that 29 respondents (29.6%) had low stress levels, 42 respondents (42.9%) had moderate stress levels, and 27 respondents (27.6%) had severe stress levels. These findings show that respondents' stress levels vary, but are dominated by moderate stress categories, which indicates that most respondents experience considerable psychological distress in their daily lives.

The determination of stress level categories in this study is based on the results of measurements using a stress perception questionnaire consisting of 10 indicators, where stress categories are determined based on the accumulated score from the frequency of answers to each question item. Respondents with a dominance of "quite

often" and "sometimes" answers on indicators such as feeling unable to control the situation, feeling depressed, and having difficulty coping with problems, tended to be classified in the category of moderate stress.

The results of this study are in line with previous research that showed that most individuals with daily life pressures tend to be in the moderate stress category, because they still have the ability to adapt despite experiencing psychological stress.

Based on the results of the questionnaire, most of the respondents revealed that in the past month they were quite often upset about unexpected events, as well as feeling unable to control important things in their lives. In addition, respondents also stated that they often feel nervous or stressed, even in certain conditions they feel depressed due to various problems faced. This shows that the psychological pressure experienced by the respondents is real and quite often felt in daily life.

Furthermore, some respondents said that they sometimes feel unable to complete all the tasks or responsibilities that must be done, and feel that the problems faced are too many to overcome. This condition is generally related to economic problems, health conditions, and family burdens that must be met, thus causing a continuous burden on the mind.

However, not all respondents were in a completely uncontrollable state. Some respondents still stated that they often feel confident in their ability to overcome personal problems, and sometimes feel that everything can still go according to expectations. In addition, respondents also revealed that they were still able to control irritability in certain situations, which showed the ability to adapt and control themselves even under pressure.

Meanwhile, respondents with low stress levels generally stated that they almost never experienced feelings of stress, nervousness, or difficulty controlling the situation, and more often felt able to overcome the problems at hand. This condition suggests that this group has better emotional stability in the face of life stressors.

On the other hand, respondents with high levels of stress revealed that they often feel very depressed, irritable about things out of control, and find it difficult to control their daily lives. Some respondents also stated that they often felt that the problems they faced were too heavy and difficult to solve, thus affecting their psychological state and daily activities.

The difference in stress levels in this study is evident from the frequency of these feelings, where in moderate stress the respondents are still able to control the condition, while in heavy stress the respondents tend to experience more intense and repetitive stress.

This condition is also influenced by the characteristics of the respondents, most of whom are in the pre-elderly to elderly age. At that age, respondents tend to face various changes such as declining physical conditions, health problems, and economic stress, which indirectly increase their vulnerability to stress.

In addition, based on the results of research related to physical activity, most respondents were in the category of low physical activity, which is characterized by doing more light activities such as sitting, talking, or watching television. This condition shows that respondents are less active in activities that can help reduce stress. Lack of physical activity can cause the body to be less than optimal in releasing endorphins that play a role in improving mood.

In line with the stress theory from Hans Selye through the concept of General Adaptation Syndrome (GAS), stress explains that stress is the body's physiological response to demands or pressures from the environment (stressor), which can be positive (eustress) or negative (distress) depending on the individual's ability to deal with it. This theory emphasizes that stress that lasts for a long time can affect the balance of the body and contribute to various health disorders.

In line with research by Taha (2025) which shows that chronic stress can disrupt the autonomic nervous system through increased sympathetic neural activity and decreased parasympathetic activity, which has an impact on increased heart rate, blood pressure, and the risk of cardiovascular disease. This is also supported by research by McEwen (2020) who explains that long-term stress exposure causes allostatic load, which is a constant physiological load on the body due to repeated activation of the stress system.

Overall, the results of this study show that most of the respondents experience moderate stress which is influenced by daily living conditions and low physical activity. Therefore, good stress management efforts are needed, such as increasing regular physical activity, maintaining a healthy lifestyle, and obtaining social support, in order to reduce stress levels and help control blood pressure.

Smoking Behavior

Based on the results of research conducted in the Limboto Health Center Working Area on 98 respondents, it was found that 28 respondents (28.6%) had a light smoking habit, 36 respondents (36.7%), and 34 respondents (34.7%) were heavy. These findings show that respondents' smoking behavior varies, but is dominated by moderate categories, which indicates that most respondents have a fairly high smoking habit in daily life.

The determination of the smoking behavior category was based on the results of measurements using a questionnaire that refers to indicators of smoking status, frequency of cigarette consumption per day, and duration of smoking habits. Based on these indicators, respondents in the moderate category generally consume 10-20 cigarettes per day which is done regularly every day, and have a history of smoking for a long period of time, namely more than 5 years.

Based on the results of the questionnaire, most of the respondents stated that they still actively smoke with varied daily consumption, ranging from light to severe. However, the group with the moderate category is the largest group, which is characterized by the habit of smoking that is carried out consistently every day with a consumption that is not too low or very high. This shows that the exposure to cigarettes in the respondents is at a fairly significant level.

In the smoking frequency component, the majority of respondents were in the category of moderate smokers with the consumption of 10-20 cigarettes per day that was carried out regularly. Furthermore, almost most of the respondents were also in the category of heavy smokers with a consumption of more than 20 cigarettes per day. Meanwhile, only a small percentage of respondents were in the category of light smokers with consumption of less than 10 cigarettes per day. This condition shows that the intensity of smoking in the respondents tends to be high and is carried out consistently every day.

In the smoking duration component, the majority of respondents have smoked for a long period of time, which is more than 5 years. Some of the other respondents were in the duration of 1–5 years, and only a small percentage smoked for less than 1 year. In addition, the initial age of smoking most begins in the adolescent age range (15–19 years), followed by the age of 20–29 years, and a small percentage even start before the age of 15 or at the age of ≥30 years. This shows that most respondents have been exposed to smoking habits from an early age and have lasted for a long time.

Based on findings in the field, the majority of respondents who fall into the category of moderate to heavy smokers revealed that smoking is done regularly as part of their daily habits as well as as a way to reduce stress or mental burden. Meanwhile, a small percentage of respondents with the category of light smokers tended to smoke only in certain situations and not every day.

The difference in smoker categories in this study was determined based on the number of cigarette consumption per day and the frequency of smoking. The majority of respondents were in the medium and heavy categories which showed higher consumption intensity and more frequent frequency. Meanwhile, a small number of respondents were in the light category with lower intensity. In addition, longer smoking durations in the majority of respondents also indicated greater exposure to harmful substances.

The characteristics of the respondents, most of whom are in pre-elderly to elderly age, also affect smoking behavior. In this group, the majority of respondents have a smoking habit that has lasted for a long time so that it becomes a persistent behavior that is difficult to stop, while only a small percentage have a smoking habit with a shorter duration.

In line with the theory of the World Health Organization, smoking is one of the main risk factors for non-communicable diseases, including hypertension and cardiovascular disease. The nicotine content in cigarettes can stimulate the sympathetic nervous system as well as increase the hormone cortisol, which leads to vasoconstriction of blood vessels and increased heart rate.

This is supported by research by Benowitz Neal (2021) who states that nicotine can increase sympathetic nerve activity so that it has an impact on increasing blood pressure. Another study by Banks Emily (2022) also showed that long-term smoking habits are associated with an increased risk of cardiovascular disease.

Thus, the dominance of respondents in the category of moderate to heavy smokers shows that the majority of respondents have a fairly high risk of health problems, especially increased blood pressure. Meanwhile, a small percentage of respondents with the light smoking category had a relatively lower risk. The higher the amount of cigarette consumption, the more often the habit is carried out, and the longer the duration of smoking, the greater the risk that can occur.

Based on the results of the measurement using a smoking behavior questionnaire which refers to indicators of smoking status, the number of cigarette consumption per day, and the duration of smoking, the most respondents, namely 36 people (36.7%) were classified in the category of moderate smokers because they showed a consumption pattern of 10-20 cigarettes per day that was carried out regularly every day and a smoking duration of more than 5 years.

Blood Pressure

Based on the results of research conducted in the Limboto Health Center Working Area on 98 respondents, it was found that respondents with normal blood pressure were 4 respondents (4.1%), pre-hypertension was 10 respondents (10.2%), level 1 hypertension was 19 respondents (19.4%), level 2 hypertension was 23 respondents (23.5%), and severe hypertension was 42 respondents (42.9%). These findings show that the blood pressure status of the respondents varied, but was dominated by the category of severe hypertension, which indicated that most of the respondents had uncontrolled blood pressure conditions in their daily lives.

Based on the results of blood pressure measurements in the field, the condition is influenced by various factors, such as smoking habits, low physical activity, stress levels, and unhealthy lifestyles. Respondents with normal blood pressure generally have a better lifestyle, such as sufficient physical activity, not smoking or light smoking, and being able to manage stress well.

Meanwhile, respondents in the pre-hypertension category showed an increase in blood pressure that had not reached the stage of hypertension. This condition is generally influenced by the onset of unhealthy habits, such

as lack of physical activity, poor diet, and mild psychological stress, so that blood pressure begins to increase but has not settled.

The respondents with level 1 and level 2 hypertension showed blood pressure conditions that were already above normal limits. Based on the results of measurements and findings in the field, this group generally has clearer risk factors, such as moderate to heavy smoking, low physical activity, and high stress levels, so that blood pressure increases gradually and begins to have an impact on health conditions.

Respondents with the severe hypertension category showed the most high and uncontrolled blood pressure conditions. Based on the results of measurements in the field, this group generally has a combination of risk factors that last for a long time, such as heavy smoking, low physical activity, and high stress levels, resulting in chronically elevated blood pressure and the potential for more serious health complications.

The difference between normal, pre-hypertension, level 1, level 2, and severe hypertension in this study lies in the severity of the increase in blood pressure and the associated risk factors. The higher the hypertension category, the greater the influence of risk factors owned by respondents, both in terms of behavior and psychological conditions.

Based on these results, it can be concluded that the grouping of hypertension status in this study has reflected the real condition of respondents in the field based on the results of direct blood pressure measurements. The characteristics of the respondents in this study also show that most of them are in the pre-elderly to elderly age group, who tend to experience decreased body function and have a higher risk of increased blood pressure.

In line with the theory from the World Health Organization, hypertension is a condition of increased blood pressure that is influenced by modifiable risk factors such as physical activity, smoking habits, and stress, as well as non-modifiable factors such as age. In addition, according to the American Heart Association, an increase in blood pressure occurs due to increased peripheral resistance and sympathetic nervous system activity triggered by an unhealthy lifestyle.

This is supported by recent research by Mills Katherine T (2020) which shows that the prevalence of hypertension continues to increase and is strongly influenced by lifestyle factors such as smoking, lack of physical activity, and stress. Another study by Zhou Bin (2021) also found that uncontrolled hypertension is associated with an increased risk of heart disease and premature death.

In addition, research by Carey Robert M (2022) states that a combination of risk factors such as smoking, stress, and lack of physical activity can increase the activation of the sympathetic nervous system and hormones such as cortisol, leading to vasoconstriction of blood vessels and a sustained increase in blood pressure.

Thus, this condition shows that the higher the blood pressure level of the respondent, the greater the risk of health problems, such as heart and blood vessel diseases. Therefore, comprehensive control efforts are needed, including regulating a healthy lifestyle, increasing physical activity, managing stress, and reducing smoking habits to keep blood pressure within normal limits.

The Relationship of Physical Activity with the Degree of Hypertension in the Working Area of the Limboto Health Center

The results of the statistical test using the Spearman Rank test in bivariate analysis obtained a p-value of 0.000 (< 0.05) with a correlation coefficient of r = -0.755, which shows that there is a significant relationship with the strength of the strong correlation between physical activity and hypertension degree in respondents in the Limboto Health Center Working Area. The direction of the negative relationship shows that the lower the physical activity, the heavier the degree of hypertension. Based on these results, H0 was rejected and H1 was accepted, which means that there is a relationship between physical activity and the degree of hypertension.

According to the theory, this relationship is explained through the concept of cardiovascular health by Cooper in Exercise and Health and the World Health Organization (2021), which states that physical activity can increase the elasticity of blood vessels, improve heart function, and decrease peripheral vascular resistance thereby helping to keep blood pressure stable.

In the low physical activity group (44 respondents), most of them were in severe hypertension, namely 34 respondents (77.3%), followed by level 2 hypertension as many as 9 respondents (20.5%), and level 1 hypertension as many as 1 respondent (2.3%), without normal or pre-hypertension respondents. This condition illustrates that low physical activity is associated with an increase in the degree of hypertension through decreased cardiovascular function and increased peripheral vascular resistance.

In the moderate physical activity group (25 respondents), most of them were in level 1 hypertension, namely 10 respondents (40%), followed by level 2 hypertension as many as 7 respondents (28%), mild hypertension 6 respondents (24%), and pre-hypertension 2 respondents (8%), without normal respondents. This shows that physical activity is providing a tendency to have a protective effect on blood pressure, but it is not optimal in maintaining normal conditions according to Cooper's theory which states that the benefits of physical activity are only optimal if it is done regularly, for sufficient duration, and consistently.

In the high physical activity group (29 respondents), there were 4 respondents (13.8%) with normal blood pressure, 8 respondents (27.6%) pre-hypertension, 12 respondents (41.4%) with level 1 hypertension, 4 respondents (13.8%) with type 2 hypertension, and 1 respondent (3.4%) with severe hypertension. This suggests that high

physical activity tends to describe better blood pressure conditions, although there are still variations influenced by other factors such as age, stress, diet, and smoking habits.

The results of this study are supported by research by Priyanti et al. (2021) and Nurfitafera & Sartika (2024) which show that low physical activity is associated with an increase in the degree of hypertension, while higher physical activity tends to be associated with more controlled blood pressure.

Overall, the results of the study showed a gradient relationship pattern, namely low physical activity dominated by severe hypertension, moderate physical activity dominated by level 1 hypertension, and high physical activity began to show normal blood pressure proportions. These findings show a tendency to inversely proportional relationship between physical activity and hypertension degrees, where an increase in physical activity is followed by a consistent decrease in hypertension degrees in respondents in the Limboto Health Center Working Area. Therefore, increasing physical activity in accordance with individual abilities, carried out regularly and continuously, needs to be increased in people's daily lives as an effort to maintain blood pressure stability, prevent the worsening of hypertension, and support a healthy lifestyle as a whole.

The Relationship Between Stress and the Degree of Hypertension in the Working Area of the Limboto Health Center

The results of the statistical test using the Spearman Rank test in bivariate analysis obtained a p-value of 0.000 (< 0.05) with a correlation coefficient r = 0.469, which shows that there is a significant relationship with the strength of moderate correlation between stress level and hypertension degree in respondents in the Limboto Health Center Working Area. The direction of the positive relationship showed that the higher the level of stress, the heavier the degree of hypertension experienced by the respondents. Based on these results, H0 was rejected and H1 was accepted, which means that there is a relationship between stress levels and the degree of hypertension.

According to the theory, this relationship can be explained through the concept of fight or flight response by Walter Cannon, who states that stress can activate the sympathetic nervous system thereby increasing heart rate, vasoconstriction, and blood pressure. This is reinforced by Hirooka (2020) in the American Journal of Hypertension who explains that sympathetic nerve activation and autonomic system dysregulation play a role in a chronic increase in blood pressure.

In the low-stress group (29 respondents), most of them were in the category of level 1 hypertension, namely 7 respondents (24.1%) and level 2 hypertension as many as 7 respondents (24.1%), followed by severe hypertension of 5 respondents (17.2%), pre-hypertension of 6 respondents (20.7%), and normal 4 respondents (13.8%). This condition shows that even though the stress level is low, there are still respondents with degrees of hypertension, but tend to be in the milder category.

In the moderate stress group (42 respondents), most of them were in the category of severe hypertension, namely 18 respondents (42.9%), followed by level 2 hypertension as many as 11 respondents (26.2%), level 1 hypertension as many as 9 respondents (21.4%), and pre-hypertension 4 respondents (9.5%), without normal respondents. This suggests that increased stress begins to be associated with an increase in the degree of hypertension, characterized by the predominance of the more severe hypertension category.

In the severe stress group (27 respondents), most of them were in the category of severe hypertension, namely 19 respondents (70.4%), followed by level 2 hypertension as many as 5 respondents (18.5%), and level 1 hypertension as many as 3 respondents (11.1%), without normal or pre-hypertension respondents. This condition suggests that severe stress tends to be associated with an increase in higher degrees of hypertension, due to the continuous activation of the sympathetic nervous system.

The results of this study are supported by research by Stamler et al. (2020) and Steptoe et al. (2021) which shows that psychological stress is associated with increased blood pressure through the activation of the sympathetic nervous system as well as an increase in hormonal responses that affect blood pressure regulation.

Overall, the relationship pattern showed a gradient tendency, i.e. low stress levels were dominated by milder hypertension categories, moderate stress levels began to be dominated by level 2 hypertension and severe hypertension, while severe stress levels entirely led to the dominance of severe hypertension. These findings show a tendency for a one-way (positive) relationship, where an increase in stress levels is followed by a consistent increase in the degree of hypertension in respondents in the Limboto Health Center Working Area. Therefore, promotive and preventive efforts are needed through stress management, mental health education, and improving adaptive coping mechanisms to prevent an increase in the degree of hypertension in the community.

7. The Relationship of Smoking Behavior with the Degree of Hypertension in the Working Area of the Limboto Health Center

The results of the statistical test using the Spearman Rank test in bivariate analysis obtained a p-value of 0.000 (< 0.05) with a correlation coefficient r = 0.572, which shows that there is a significant relationship with the strength of moderate correlation between smoking habits and hypertension degrees in respondents in the Limboto Health Center Working Area. The direction of the positive relationship shows that the heavier the smoking habit, the heavier the degree of hypertension experienced by the respondents. Based on these results, H0 was rejected and H1 was accepted, which means that there is a relationship between smoking habits and the degree of hypertension.

According to the theory, this relationship can be explained by the nicotine content in cigarettes which can stimulate the release of catecholamines thus causing vasoconstriction, increased heart rate, and increased blood pressure. This is also reinforced by the World Health Organization (2021) which states that smoking is a major risk factor for cardiovascular disease because it can damage the endothelium of blood vessels and increase peripheral vascular resistance.

In the group of light smoking habits (28 respondents), most of them were in the category of level 1 hypertension, namely 8 respondents (28.6%) and pre-hypertension 6 respondents (21.4%), followed by normal 4 respondents (14.3%), level 2 hypertension as many as 5 respondents (17.9%), and severe hypertension 5 respondents (17.9%). This condition shows that in light smoking habits, there are still variations in the degree of hypertension, but tend to be in the milder category.

In the moderate smoking habit group (36 respondents), most were in the category of level 1 hypertension, namely 16 respondents (44.4%), followed by severe hypertension of 9 respondents (25.0%), level 2 hypertension of 7 respondents (19.4%), and pre-hypertension of 4 respondents (11.1%), without normal respondents. This suggests that an increase in smoking habits begins to be associated with an increase in the degree of hypertension, characterized by the dominance of type 1 hypertension and an increasing proportion of type 2 hypertension.

In the group of heavy smoking habits (34 respondents), most of them were in the category of severe hypertension, namely 28 respondents (82.4%), followed by level 1 hypertension as many as 4 respondents (11.8%), and level 2 hypertension as many as 2 respondents (5.9%), without normal or pre-hypertension respondents. This condition suggests that heavy smoking habits tend to be associated with an increased degree of higher degrees of hypertension due to endothelial damage and a chronic increase in the activity of the sympathetic nervous system.

The results of this study are supported by research by Kishore et al. (2021) which states that smoking intensity is significantly related to increased blood pressure and the risk of hypertension through endothelial dysfunction mechanisms. In addition, research by Primatesta & Poulter (2020) also showed that active smokers had higher blood pressure than non-smokers due to the effect of nicotine on the activation of the cardiovascular system.

Overall, the relationship pattern showed a gradient tendency, namely light smoking habits were dominated by mild hypertension, moderate smoking habits were dominated by level 1 hypertension, and heavy smoking habits were dominated by severe hypertension. These findings show a tendency to have a positive relationship, where an increase in smoking habits is followed by a consistent increase in the degree of hypertension in respondents in the Limboto Health Center Working Area. Therefore, promotive and preventive efforts are needed through health education and the control of smoking risk factors to prevent an increase in the degree of hypertension in the community.

CONCLUSION

The results showed that most of the respondents had low physical activity, namely 44 respondents (44.9%), followed by high physical activity as many as 29 respondents (29.6%) and moderate physical activity as many as 25 respondents (25.5%). For stress levels, most respondents were in the category of moderate and severe stress, namely 42 respondents (42.9%) and 27 respondents (27.6%) respectively. Meanwhile, for smoking behavior, most of the respondents were included in the category of moderate and heavy smokers, namely 36 respondents (36.7%) and 34 respondents (34.7%) respectively.

There was a significant relationship between physical activity and the degree of hypertension in the Limboto Health Center Working Area based on the results of the Spearman Rank test with p-value = 0.000 ($< \alpha = 0.05$), with the direction of the negative relationship, meaning that the lower the physical activity, the higher the degree of hypertension in the respondents.

There was a significant relationship between the level of stress and the degree of hypertension in the Working Area of the Limboto Health Center based on the results of the Spearman Rank test with p-value = 0.000 ($< \alpha = 0.05$), with the direction of a positive relationship, meaning that the higher the stress level, the higher the degree of hypertension in the respondents.

There was a significant relationship between smoking behavior and the degree of hypertension in the Limboto Health Center Working Area based on the results of the Spearman Rank test with p-value = 0.000 ($< \alpha = 0.05$), with the direction of a positive relationship, meaning that the heavier the smoking habit, the higher the degree of hypertension in the respondents.

ADVICE

For Educational Institutions

It is hoped that educational institutions can utilize the results of this research as additional reference and reading materials in the development of nursing and health curriculum or learning materials, especially related to factors that affect hypertension in the preelderly and elderly, such as physical activity, stress levels, and smoking behavior.

For Families and Communities

It is recommended that families and the community use the findings of this study as a guideline to understand hypertension, adopt a healthy lifestyle, manage stress, reduce smoking habits, and strengthen family

support and communication to prevent or control hypertension.

For the Next Researcher

It is recommended that researchers further use this study as a reference to develop further studies on factors related to hypertension and design effective prevention strategies, including physical activity interventions, stress management, and changes in smoking behavior.

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