

# Analysing The Role of Lifestyle Factors on Hypertension Among Rural Indonesian Adults: A Case-Control Study

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## ABSTRACT

**Background:** Hypertension is a degenerative disease, arising from unhealthy lifestyle and becoming a world health problem. It is estimated that 46% of adults with hypertension are unaware of their condition, hence it is called the “silent killer”. This study aims to Lifestyle Risk Factors of Hypertension Incidence upon Productive Age.

**Methodology:** The type of research used was analytical observational with case control design the samples in this study were 152 (76 cases and 76 controls). The sampling technique in this research was probability sampling using systematic random sampling. Data were processed using Stata version 14 program. The analysis performed was chi-square test and logistic regression test.

**Results:** The results showed exposure to cigarette smoke (OR= 3.398; 95%CI=1.540-7.683), alcohol consumption (OR= 4.277; 95%CI=1.608-12.606), sleep patterns (OR= 2.628; 95%CI=1.299-5.337), physical activity (OR= 1.75; 95%CI=0.824-3.746), stressful state (OR= 1.793; 95%CI=0.897-3.590;), and coffee consumption (OR= 1.258; 95%CI=0.613- 2.587;). In multivariate analysis, the most risk factor for hypertension was alcohol consumption (OR=4.948; 95%CI=1.841-13.302; p-value =0.002).

**Conclusions:** Risk factors for hypertension included exposure to cigarette smoke, alcohol consumption and sleep patterns and the most risk factor for hypertension was alcohol consumption. It is highly suggested that relevant stake holders to determine programs and policies in order to prevent and treat hypertension more effectively.

**Keywords:** Case-control study, Risk Factor, Lifestyle, Hypertension

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## INTRODUCTION

Hypertension is a degenerative disease, arising from unhealthy lifestyle and becoming a world health problem. It is estimated that 46% of adults with hypertension are unaware of their condition, hence it is called the “silent killer”.<sup>1</sup> non-communicable diseases are health problem occurring world-widely. Most of them (80%) occur in developing countries, including Indonesia.<sup>2</sup> In accordance with statements by WHO and the International Society of Hypertension, there are 600 million patients with hypertension throughout the world with 3 million fatality rate every year.<sup>3</sup> Hypertension is a major challenge in world health problems.<sup>4</sup> Currently, more than 80% of hypertension cases are seen in low- and middle-income countries with variance across countries, gender, age and socio-economic categories.<sup>5</sup>

It is estimated that 1.28% of adults aged 30-79 years worldwide suffer from hypertension, two-thirds of whom live in low- and middle-income countries.<sup>6</sup> Thus, hypertension caused 10.9 million deaths worldwide (19.2% of all deaths) in 2019, of which 92% were caused by cardiovascular disease (CVD) (mainly heart attacks, heart failure and stroke) and 8% were caused by kidney disease (IHME). It is clear that hypertension is a complication resulting from other diseases and life-threatening.<sup>7</sup>

The prevalence of hypertension in Indonesia based on report of Basic Health Research (Riskesdas) in 2018, measuring the population aged 18 years old (34.1%), with the highest province in South Kalimantan (44.1%), while the lowest is in Papua (22.2%). The incidence of hypertension was also found in groups of teenagers to young-adults or in the productive age group<sup>8</sup>. The incidence of hypertension upon the productive age population in Indonesia has increased quite significantly, based on data from Riskesdas 2013 and Riskesdas 2018.<sup>4</sup>

Data from The Health Service of Central Buton, hypertension ranked first of the ten biggest diseases in the area. The prevalence of hypertension in 2019 was (19.2%), In 2020 was (18.92%), in 2021 was (27.48 %) and in 2022 was (36.84%) sufferers.<sup>9</sup> Data according to Gu-district’s public health center (PHC), in 2019 there were (4.69%), in 2020 there were (64.4%) in 2021 there were (42.7%), and in 2022 the number of hypertension cases were (38.2%) sufferers.<sup>10</sup>

Many factors contribute to the occurrence of hypertension. Of all the risks, there are ones that can be controlled and there are that cannot. Risk factors that cannot be controlled include heredity, gender, race and age. Meanwhile, risk factors that can be controlled are obesity, physical activity, smoking, alcohol, stress, consumption patterns and sleep patterns.<sup>11</sup> Based on these problems, we see that it was necessary to look deeper in order to determine lifestyle risk factors of hypertension in the productive age population in the Gu-district PHC working terri-

tory. It is hoped that the results of this research will be taken into consideration when determining program activities and policies in the context of preventing and treating hypertension.

This study aims to determine lifestyle risk factors that contribute to hypertension in the community in the working area of the Gu Sub-district Health Centre, Central Buton Regency, Indonesia

## METHODOLOGY

**Research Type and Design:** The type of research used was analytical observational with case control design.

**Research Time and Location:** This research was carried out in the working territory of the Gu-District PHC, Central Buton Regency, Southeast Sulawesi, from August to September 2023.

**Population and Sample:** The population in this study were all patients who visited and received health services at Puskesmas Gu, starting from March-July 2023. Efforts to minimize recall bias made by the researcher were to select respondents who were newly diagnosed with the disease within the last 5 months, namely from March-July 2023 and could provide correct information regarding lifestyle before suffering from hypertension.

The sample in this study were some of the patients who received health services in the working area of Puskesmas Gu. The study sample was divided into two groups, namely the case group and the control group with a ratio of 1:1. Determination of the minimum sample size for case control research using the lemeshow formula (1990).<sup>12</sup> Lemeshow formula (1990)

$$n1 = n2 = \frac{[Z_{1-\alpha/2} \sqrt{2P(1-P)} + Z_{1-\beta} \sqrt{P_1(1-P_1) + P_2(1-P_2)}]^2}{(P_1 - P_2)^2}$$

Where, n was Minimum sample size;  $Z_{1-\alpha/2}$  was Z value at the upper limit for the 95% confidence level (1.96);  $Z_{1-\beta}$  was Standard normal distribution value of 80% (0.842);  $P_1$  was Proportion in the case group; and  $P_2$  value is the proportion in the control group, which is the prevalence of hypertension in Central Buton Regency based on the District Health Profile. (0,545)

$$P1 = \frac{(OR) P_2}{(OR) P_2 + (1 - P_2)}$$

The OR used was 2.82 based on previous research. The research displays Odds Ratio analysis. The selected OR value is the OR that produces the largest number of samples. The calculated  $P_1$  was 0.77.

The OR value used is 2.82 which is the result of the alcohol consumption variable based on previous research. The study used Odds Ratio analysis.<sup>13</sup>

So, using the formula mentioned earlier, the calculated sample size (n) = 69. The sample was increased by

10%, which is 14 samples from the total population as a reserve if there are samples that drop out. Therefore, the total sample required in this study was 152 people (76 cases and 76 controls). Respondents who were sampled in this study were people with productive age.

**Definition of Cases:** Case included hypertension patients recorded in the medical records of the Gu Sub-district Health Centre from March to July 2023. Hypertensive patients aged 15-59 years old who had been diagnosed with hypertension by health workers in the period March-July 2023, having a complete address in the medical record data of Gu sub-district health center and who were willing to be a respondent were included in the study. Patients with severe illness, or having comorbidities (diabetes mellitus, stroke, impaired renal function, heart failure) that cause incompatibility with the research objectives, where these comorbidities could cause secondary hypertension (data on patients with comorbidities are obtained from the health centre, potential respondents who suffer from these diseases automatically lose the opportunity to become research samples) were excluded from the study.

**Definition of Control:** Control included people who were not suffering from hypertension and who were recorded in the register book, using health services at the general clinic of the Gu sub-district puskesmas in the time span of March - July 2023. Person aged 15-59 years who had a complete address in the medical record data of the Gu sub-district health centre, was not suffering from hypertension as evidenced by blood pressure measurements based on medical record records and willing to be a respondent was included as a control in the study.

Person with comorbidities or complications (diabetes mellitus, stroke, impaired renal function, heart failure) that cause incompatibility with the research objectives, where these comorbidities can cause secondary hypertension (data on patients with comorbidities are obtained from the health centre, potential respondents who suffer from these diseases automatically lose the opportunity to become research samples) was excluded as a Control.

The sampling technique in this study was probability sampling using systematic random sampling, which give equal opportunities to each member of the population to become a sample. Researchers took registers of hypertensive and non-hypertensive patients (data derived from medical records) at the Gu sub-district health centre for the last 5 months starting from March-July 2023. The names of the patients were arranged alphabetically and were divided two groups, namely the case group and the control group according to the medical record data. Then, each patient's name who suffered from hypertension and who did not suffer from hypertension were given codes. A number from 1 to 6 was drawn. The selected number was then blinked once. For example, the selected number is 5, then the next respondent is 7, 9,

and so on which was adjusted to the list of patient names that have been compiled. This drawing was done both in the case group and the control group. If the number in selection did not meet the inclusion criteria, then the search for the next sample was carried out in the same way.

### Research variables

**Physical activity** which was categorized in to High risk (<1500 MET minutes/week) and Low risk ( $\geq$ 1500 MET minutes/week). using a standardized questionnaire IPAQ (International Physical Activity Questionair)<sup>14</sup>

**Exposure to cigarette smoke** which was categorized in to High risk (if the respondent smokes and or is exposed to cigarette smoke with a total score  $\geq$ 12) and Low risk (if the respondent does not smoke and or is not exposed to cigarette smoke with a total score  $\leq$  11). using a standardized questionnaire

**Stress state** which was categorized in to High risk (if the score is >14) and Low Risk (if the score is  $\leq$ 14). using a standardized questionnaire DASS-42 (Depression Anxiety Stress Scales-42).<sup>15</sup>

**Coffee consumption** which was categorized in to High risk (coffee consumption  $\geq$ 4 cups per day ( $\geq$ 400 mg)) and Low Risk (coffee consumption  $\leq$ 3 cups per day ( $\leq$ 300 mg)). using a standardized questionnaire

**Alcohol consumption** which was categorized in to High risk (consuming  $\geq$  6 glasses/week of traditional alcohol or 6 cans of beer ( $\geq$  360 millilitres) or 6 glasses of wine ( $\geq$  120 millilitres)) and Low Risk (consuming < 6 glasses/week or < 6 cans of beer (< 360 millilitres) or < 6 glasses of wine (< 120 millilitres)) using a standardized questionnaire

**Sleep patterns:** which was categorized in to High risk (if the calculation results obtain a score > 5) and Low Risk (if the calculation results obtain a score  $\leq$ 5) using a standardized questionnaire Pittsburgh Sleep Quality Index (PSQI).<sup>16</sup>

**Data Collection:** There were 2 types of data used, namely primary data which were obtained by direct interviews using questionnaires with respondents who met the criteria for both case samples and control samples. While secondary data were obtained from the relevant agency, which was medical record data the Gu PHC.

There were 2 types of data used, Primary data was obtained by direct interview using a questionnaire to respondents who met the criteria for case and control samples with 10-15 minutes. Primary data are Independent Variables (Physical activity, cigarette smoke exposure, stress, coffee consumption, alcohol consumption, sleep patterns). while secondary data are Dependent Variables, namely medical record data of blood pressure measurements according to the results of medical examinations.

**Data Analysis:** Data analysis was carried out using the STATA application. The data were analyzed in

three ways, namely univariate, bivariate and multivariate. Bivariate test analysis used the chi square test at the 95% confidence level ( $\alpha = 5\%$ ) and multivariate used logistic regression test with a confidence level of 95% ( $\alpha = 5\%$ ).

Data were analysed using the Stata version 14 application program. Data were analysed in three ways, namely univariate, bivariate and multivariate. Univariate analysis used statistical methods of frequency distribution and presentation of respondent characteristics, physical activity variables, cigarette smoke exposure, stress, coffee consumption, sleep patterns and alcohol consumption.

Bivariate analysis was performed using the chi-square test to determine the Odds Ratio value with a 95% Confidence Interval (CI) between the independent and dependent variables.

Multivariate analysis was performed to analyse risk factors simultaneously. The variables in this multivariate analysis were independent variables that were statistically significant risk factors in the bivariate analysis (cigarette smoke exposure, alcohol consumption, and sleep patterns). The test statistic used was the logistic regression test with a 95% confidence level ( $\alpha = 0.05$ ).

**Ethical Approval:** This research had already been approved by the Hasanuddin University Health Research Ethics Committee with approval recommendation number 4636/UN4.14.1/TP.01.02/2023. Data confidentiality is an agreement between the researcher and the respondent and will not be disseminated in accordance with the research Informed Consent, that the respondent is asked to provide information as honestly as possible, the respondent's identity will be kept confidential and will not be published, so the name will be displayed according to the initials, on the research documentation the face will

be disguised.

## RESULTS

Table 1 Table 1 shows that the proportion of respondents in male gender who suffer from hypertension as much as (42.11%), while in the female gender who tend to be normotensive as much as (59.21%)]. Based the research result, it appears that the majority of respondents around 23.68% aged 50-54 suffer from hypertension. Meanwhile, the fewest people suffering from hypertension were aged 25-29 years, namely 1.32%. the mean age of respondents is 44.08 with a standard deviation of 7.961. Then the distribution based on domicile showed that walando vilage tended to be normotensive (59.21%), while watulea, waliko and bombonawulu villages tended to be more hypertensive (42.11%) (17.11%) (25%).

**Table 1: Distribution of Respondents Based on Characteristics**

Characteristics	Hypertension (n=76) (%)	Normotensive (n=76) (%)
<b>Gender</b>		
Male	32 (42,11)	31 (40,79)
Female	44 (57,89)	45 (59,21)
<b>Age</b>		
25-29	1 (1,32)	1(1,32)
30-34	7 (9,21)	7 (9,21)
35-39	9 (11,84)	9 (11,84)
40-44	13 (17,11)	13 (17,11)
45-49	16 (21,05)	16 (21,05)
50-54	18 (23,68)	18 (23,68)
55-59	12 (15,79)	12 (15,79)
<b>Domicile</b>		
Walando	12 (15,79)	45 (59,21)
Watulea	32 (42,11)	15 (19,74)
Waliko	13 (17,11)	11 (14,47)
Bombonawulu	19 (25,00)	5 (6,58)

**Table 2 Bivariate Analysis of Hypertension Risk Factors**

Risk Factors	Hypertension (n=76) (%)	Normal (n=76) (%)	OR (CI 95% LL-UL)	p-value
<b>Physical Activity</b>				
High Risk	28 (36.8)	19 (25)	1.75 (0.82-3.75)	0,114
Low Risk	48 (63.2)	57 (75)	Ref	
<b>Exposure to Cigarette Smoke</b>				
High Risk	62 (81.6)	43 (56.6)	3.39 (1.54-7.68)	0,000
Low Risk	14 (18.4)	33 (43.4)	Ref	
<b>Stress State</b>				
High Risk	42 (55.3)	31 (40.8)	1.79 (0.89-3.59)	0,074
Low Risk	34 (44.7)	45 (59.2)	Ref	
<b>Coffee Consumption</b>				
High Risk	29 (38.2)	25 (32.9)	1.26 (0.61-2.59)	0,497
Low Risk	47 (61.8)	51 (67.1)	Ref	
<b>Alcohol Consumption</b>				
High Risk	23 (30.3)	7 (9.2)	4.28 (1.61-12.61)	0,001
Low Risk	53 (69.7)	69 (90.8)	Ref	
<b>Sleep Pattern</b>				
High Risk	48 (63.2)	30 (39.5)	2.63 (1.29-5.34)	0,003
Low Risk	28 (36.8)	46 (60.5)	Ref	

**Table 3 Logistic Regression Analysis of Hypertension Risk Factors**

Variable	OR	95%CI	p-value
Exposure to Cigarette Smoke	2.946	1.348-6.435	0.007
Alcohol Consumption	4.948	1.841-13.302	0.002
Sleep Pattern	2.997	1.457-6.164	0.003

Table 2 shows the results of analysis of physical activity on the incidence of hypertension, obtained an OR of 1.75. Since the 95% CI of 0.824-3.746 included value of one, the risk was not significant. Thus, physical activity was not a risk factor for hypertension. The results of the analysis of history of exposure to cigarette smoke, the OR was 3.398. This meant that people who have a history of being exposed to cigarette smoke more often, both active smokers and passive smokers, had a risk of developing hypertension 3.398 times more than people who occasionally smoke or are almost never exposed to cigarette smoke. Since the 95% CI of 1.540-7.683 did not include a value of one, the risk was significant. Thus, history of exposure to cigarette smoke was a risk factor for hypertension. The results of the analysis of stress state on the incidence of hypertension, obtained an OR of 1.793. Since the 95% CI of 0.897-3.590 included a value of one, the risk was not significant. The results of the analysis of coffee consumption history made an OR of 1.258. Since the 95% CI of 0.613-2.587 included a value of one, the risk was not significant. Thus, coffee consumption and stress state were not risk factors for hypertension. The results of the analysis of alcohol consumption on the incidence of hypertension, obtained an OR of 4.277. This meant that people who consume alcohol more often or excessively had a 4.277 times higher risk of developing hypertension compared to people who did not. Since the 95% CI of 1.608-12.606 did not include a value of one, the risk was significant. Furthermore, the results of the sleep patterns regarding the incidence of hypertension obtained an OR of 2.628. This meant that people who had a poor sleep pattern were 2.628 times more at risk of hypertension compared to people who have a good sleep pattern. Since the 95% CI of 1.299-5.337 did not include a value of one, the risk was significant. Thus, alcohol consumption and sleep patterns were risk factors for hypertension.

Table 3 Based on the results of the logistic regression test, multivariate analysis produced a p-value <0.05 for the variables of exposure to cigarette smoke, alcohol consumption and sleep patterns. Based on the OR value, it could be seen that alcohol consumption had the highest OR value of 4.948, meaning that alcohol consumption was the most dominant risk factor affecting the incidence of hypertension in the working territory of the Gu-district PHC, Central Buton Regency in 2023.

## DISCUSSION

**Physical Activity:** Physical activity is movement car-

ried out by the body's muscles and its supporting systems. People with low activity have a 30-50% risk of developing hypertension than those who are active. Therefore, physical activity between 30-45 minutes >3 times/week is important as primary prevention of hypertension. Sports or physical activity that can burn 800-1000 calories will increase high density lipoprotein (HDL) by 4.4 mmHg.<sup>17</sup> Appropriate physical activity is very good for the health of the heart and circulatory system.<sup>11</sup>

Based on the research results, physical activity was not a risk factor for the incidence of hypertension. It could be seen that good physical activity was not a parameter for not being exposed to hypertension or vice versa, that Respondents' poor physical activity would have a significant impact on hypertension. The researchers' assumed that physical activity could not be used as a parameter because there were other factors that also contribute to the incidence of hypertension.

Apart from that, physical activity was not a risk factor for the incidence of hypertension because people in Gu-district mostly carry out their daily activities on foot, their work mostly involved physical activities, such as pedicab drivers, fishermen, construction workers and gardeners. Based on these, it was known that the physical activity variable was not a risk factor for the incidence of hypertension in the research location, although in theory it states that physical activity is a risk factor.

**Exposure to Cigarette Smoke:** The population aged ≥15 years who smoked in 2020 was 28.69%, in 2021 was 28.96%, in 2022 was 28.26%.<sup>18</sup> From this data, it could be seen that most active smokers were found in productive age group, whereas the younger a person starts smoking, the greater the addictive effect caused by cigarettes. In teenage period, someone tends to imitate adult behavior.

Based on the results, history of exposure to cigarette smoke was a risk factor for hypertension in patients visiting the Gu-district PHC, Central Buton Regency in 2023. In addition, the respondents in this study were dominated by women, even though women were not active smokers however their husbands and those closest to them were active ones hence these women were oftenly exposed to cigarette smoke.

This was in accordance with research which showed that there was a correlation between exposure to cigarette smoke and the incidence of hypertension<sup>19</sup>, and other research showed that smoking was a risk factor that closely related to the incidence of hyper-

tension in productive age<sup>20</sup>, in addition to a study conducted in Japan showing that exposure to cigarette smoke was significantly related to the prevalence of hypertension in non-smokers. People who were exposed almost every day had a higher risk of developing hypertension, with OR 1.26, 95%CI=1.04–1.54, compared to those who were exposed occasionally or almost never exposed to cigarette smoke.<sup>21</sup> There is no safe limit for passive smoking, exposure to tobacco smoke for even a moment can cause harm, research shows that being a passive smoker can be dangerous even if only exposed for a moment. If someone smokes indoors, the harmful chemicals in tobacco smoke can linger in the air for hours.<sup>22</sup> Therefore, the longer a person is exposed to cigarette smoke, the greater the detrimental effects on health.

**Stress State:** In stressful situations, the body will feel emotional discomfort. The body reacts by releasing the cortisol and adrenaline hormones into the blood. These hormones prepare the body for a “fight or flee” response. This makes the heart beat faster and the blood vessels narrow hence the blood pressure increases.<sup>23</sup>

Based on the research results, stress state was not a risk factor for hypertension. Stress does not cause persistent hypertension, but stress might result in a temporary increase in high blood pressure. This statement is supported by Donsu's theory which states that the correlation between stress and hypertension is thought to be through activation of the sympathetic nerves (nerves that work during activity). Increased sympathetic nerve activation can cause intermittent (erratic) increases in blood pressure. Stress can temporarily increase blood pressure due to the release of adrenaline and non-adrenaline (stress hormones), which have vasoconstrictive properties.<sup>24</sup>

Based on the discussion previously described, the researchers concluded that stress did not cause persistent hypertension, but stress might lead to a temporary increase in high blood pressure. Many experts believe that stress is only temporary. This means that the mental state returns to calm, the blood pressure will also decrease. Experiencing a constant state of stress causes the body to become conditioned with high blood pressure.<sup>25</sup>

**Coffee Consumption:** Coffee consumption has become a lifestyle nowadays. Coffee is one of the most popular drinks and is loved by all groups. Consuming coffee is considered to have detrimental effects on health. This is caused by the presence of chemical compounds, namely caffeine, which contribute to the occurrence of hypertension.<sup>26</sup> According to the National Coffee Association USA (2021), approximately 25 billion cups are drunk worldwide every day, for a total of approximately 500 billion cups/year.<sup>27</sup>

Based on the results, coffee consumption was not a risk factor for the incidence of hypertension. At the

research location, it showed that in both the case group and the control group, coffee consumption was still in the moderate stage, where most of respondents consume coffee at certain times, not all the time, such as respondents who consume coffee when they want to work at night (fisherman), one of the main reasons why fishermen fish at night is because fish are more active at that time. During the day, the water temperature is higher and sunlight makes it more difficult for fish to move. However, at night, the water temperature is cooler and the fish are freer to move. So, to get rid of drowsiness, respondents usually bring coffee to consume, because coffee contains caffeine which creates a mild stimulant that can overcome fatigue, increase concentration and cheering up mood. Coffee is the largest source of caffeine. Other research explained that coffee intake was significantly associated with a lower risk of hypertension but might have an interactive correlation between the risk of hypertension and coffee consumption if consumed regularly and excessively.<sup>28</sup>

**Alcohol Consumption:** Excessive alcohol consumption can increase blood pressure drastically.<sup>11</sup> Alcohol has the same effect as carbon dioxide which it can increase blood acidity so that the blood becomes thicker and the heart is forced to pump. Based on the research results, alcohol consumption was a risk factor for the incidence of hypertension and the results of multivariate analysis showed it as the most dominant risk factor for patients visiting the Gu sub-district health center, Central Buton Regency in 2023. This was in accordance with research conducted<sup>29</sup>, that alcohol consumption was the most influencing factor on the incidence of hypertension in RSUD DR. RM. Djoelham, Binjai City.

The general description of the people in the research location had a history of alcohol consumption, however, it is still within moderate limits, which means that the majority of respondents in terms of alcohol consumption are still under control. Based on the results of interviews, information was obtained that the majority of respondents consumed alcoholic drinks during celebrations of certain days or commemorating holidays. For example, weddings, village events (harvest), celebration events (thanksgiving for a new house), New Year's Eve, Eid night. Respondents usually consume alcohol at home, in the forest (quiet places), beaches, or recreational places that are not visited by people all the time, considering that the location is still in the countryside. Most respondents obtained alcoholic drinks by buying them themselves, but there were also respondents who obtained alcoholic drinks from celebration organizers on certain days or were treated by friends. The habit of consuming alcohol is usually accompanied by grilling of fish and chicken and is considered normal by local people.

According to WHO, alcohol is a psychoactive substance with addictive properties that has been wide-

ly used in many cultures for centuries. Harmful alcohol use causes a high burden of disease and has significant social, health and economic consequences.<sup>30</sup>

**Sleep Patterns:** Sleep is one of basic human needs, meaning that humans naturally need sleep as a necessity every day. Sleep pattern was a risk factor for the incidence of hypertension in patients visiting the Gu District Health Center, Central Buton Regency in 2023. This was in accordance with research conducted in China, which concluded that based on the results of the PSQI questionnaire, it was associated with an increased likelihood of hypertension in the studied population, someone who have poor sleep patterns such as short sleep duration, poor sleep quality, prolonged sleep latency, and sleep disorders had an increased chance of hypertension. Poor sleep patterns will result in higher activation of the sympathetic nervous system.<sup>31</sup>

Moi's opinion is that experiencing less sleep disorders will result in normal blood pressure, while more sleep disorders will result in low or high blood pressure.<sup>32</sup> Sleep disturbances, poor sleep quality and short sleep duration will have an impact on high blood pressure in the long term. The results of research conducted in Korea revealed that lack of sleep could be a significant factor in increasing the risk of hypertension.<sup>33,34</sup>

## CONCLUSION

Risk factors for hypertension included exposure to cigarette smoke, alcohol consumption and sleep patterns. Meanwhile physical activity, stress and coffee consumption were not. And the most risky factor for the incidence of hypertension in productive age in the Gu-district PHC working territory was alcohol consumption. This study can be one of the solutions to create a health promotion programme, especially in the productive age group (15-59 years) so that the prevention and control of hypertension can run well. In addition, based on the results of the study, alcohol consumption is the most risky factor, so it is expected that local governments make regulations on the free sale of alcoholic beverages, and limit the minimum age of consumers, as well as coordinate with alcohol producers, so that the SDGs 2030 agenda can achieve the 3rd goal of good health and well-being.

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