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SOCIODEMOGRAPHIC, NUTRITIONAL STATUS, LIFESTYLE, AND DIETARY HABITS AS FACTORS ASSOCIATED WITH HYPERTENSION IN KALIMANTAN
(STATUS SOSIODEMOGRAFI, STATUS GIZI, GAYA HIDUP, DAN KEBIASAAN MAKAN SEBAGAI FAKTOR TERKAIT HIPERTENSI DI KALIMANTAN)

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ABSTRACT

The prevalence of hypertension in Kalimantan, Indonesia, remains higher than the national average. This study aimed to examine the risk factors for hypertension that are relevant for people in the area. This observational study used a cross-sectional design using secondary data from the latest Basic Health Research (Riskesdas 2018). The dependent variable of this study is hypertension status, while the independent variables consist of sociodemographic status, nutritional status, health status and dietary habits. Multivariate logistic regression analysis was carried out to see the relationship of potential risk factors as independent variables with the subject's hypertension status. This research shows that 21.2% of non-pregnant adult subjects in Kalimantan have high blood pressure or hypertension. The results of statistical analysis show that significant risk factors for high blood pressure for this population include age, gender, education level, job category, smoking status, being an alcohol drinker, rarely consuming vegetables, frequently consuming grilled foods and instant seasonings, high Body Mass Index, and history of Diabetes Mellitus. Sociodemographic status as well as certain health status were found to be significant risk factors for hypertension in adults in Kalimantan. Only a few aspects of lifestyle and eating habits were identified as having a significant relationship with the incidence of hypertension.

Keywords*: hypertension, risk factors, nutritional status, lifestyle, dietary habits*

ABSTRAK

Prevalensi hipertensi di Kalimantan, Indonesia, masih lebih tinggi dari rata-rata nasional. Penelitian ini bertujuan untuk mengkaji faktor risiko hipertensi yang relevan bagi masyarakat di daerah tersebut. Penelitian observasional ini menggunakan rancangan potong lintang dengan menggunakan data sekunder dari Riset Kesehatan Dasar terbaru (Riskesdas 2018). Variabel dependen dari penelitian ini adalah status hipertensi, sedangkan variabel independennya terdiri dari status sosiodemografi, status gizi, daya hidup, dan kebiasaan makan. Analisis regresi logistik multivariat dilakukan untuk melihat hubungan faktor-faktor risiko potensial sebagai variabel independen dengan status hipertensi subjek. Penelitian ini menunjuukan bahwa 21,2% subjek dewasa tidak hamil di Kalimantan memiliki tekanan darah tinggi atau hipertensi. Hasil analisis statistik menunjukkan bahwa faktor risiko signifikan tekanan darah tinggi untuk populasi ini meliputi usia, jenis kelamin, tingkat pendidikan, kategori pekerjaan, status merokok, menjadi peminum alkohol, jarang mengonsumsi sayuran, sering mengonsumsi makanan panggang dan bumbu instan, Indeks Massa Tubuh tinggi, dan riwayat Diabetes Mellitus. Status sosiodemografi serta status kesehatan tertentu ditemukan sebagai faktor risiko yang signifikan untuk hipertensi pada orang dewasa di Kalimantan. Hanya beberapa aspek gaya hidup dan kebiasaan makan yang teridentifikasi memiliki hubungan yang signifikan dengan kejadian hipertensi. **[*Penel Gizi Makan* 2023, 46(1):21-30]**

Kata kunci: hipertensi, faktor risiko, status gizi, gaya hidup, kebiasaan makan

INTRODUCTION

Hypertension is a condition of increased blood pressure indicated by systolic and diastolic numbers on blood pressure examination using a blood pressure measuring device[1]. The rise of hypertension is part of an epidemiological transition influenced by the rise of an urbanized lifestyle that supports the development of various chronic non-communicable diseases (NCDs). Sociodemographic characteristics related to hypertension may include male sex, older age, youth unemployment, as well as the level of education. Physical chronic conditions like obesity and some non-communicable diseases (NCDs) may also influence blood pressure[2]. There are considerable risk factors for hypertension that are modifiable. In many cases, hypertension can be prevented and controlled by maintaining a healthy lifestyle. Typical unhealthy lifestyles such as smoking, alcohol intake, junk food consumption, as well as lack of physical activity may also be associated with high blood pressure[3,4].

The latest Basic Health Research of Indonesia (Riskesdas, abbreviation in Indonesian) shows a considerable increase (34.1% from 27.8%) in the prevalence of hypertension or high blood pressure compared to the previous Riskesdas 2013[2,5]. All provinces in Kalimantan have hypertension rates above the national average based on the blood pressure measurements conducted in the Riskesdas 2018 survey. South Kalimantan has the highest prevalence while the other provinces were also among the top eleven with the highest prevalence of hypertension[3].

Increased blood pressure is one of the main causes of premature death and this condition can trigger various kinds of non-communicable diseases[6]. Consequently, it is critical to understand the risk factors for hypertension in order to prevent hypertension and its complications. It has been established that fruit and vegetable intake provides protective effects against hypertension[7]. Analysis of Riskesdas 2007 data reported that gender, age, education, physical activity, smoking status, alcohol consumption, BMI, and consumption of caffeinated drinks were significant risk factors for hypertension in Indonesia[8].

This study focuses on understanding hypertension prevalence in the Indonesian part of Borneo, which is the largest island in the country. We would like to know the risk of some factors related to the incidence of hypertension study is expected to deliver information about the risk factors for hypertension, especially the modifiable ones so that programs to prevent and control hypertension in this region can be more focused. Its novelty lies in the focused examination of Kalimantan, aiming for a deeper insight into risk factors relevant in this area. It takes a multidimensional approach, exploring socio-demographic, nutritional, lifestyle, and dietary factors. Also, it emphasizes the health impact of hypertension.

This analysis meant to guide targeted healthcare policies to effectively address hypertension in the region. Relevant findings may potentially provide a basis for the development of healthcare policies and interventions targeting the reduction of hypertension for people of Kalimantan. As such, this study aimed to determine related risk factors of high blood pressure or hypertension among the adult population in Kalimantan.

METHODS

The secondary data for this study were obtained from the latest Basic Health Research (Riskesdas 2018). Riskesdas is a nationwide health survey conducted by the Indonesian Ministry of Health every five years. The population of interest in this study was adults residing in Kalimantan, Indonesia. The sample in this study was adults aged 18 years old and older in Kalimantan who were selected as the Riskesdas 2018 participants. The inclusion criteria were adults aged 18 years old and over whose blood pressure was measured at least once and who answered survey questions about their chronic disease history. Pregnant respondents were excluded from this study. The initial dataset contained 62,619 non-pregnant adults. After removing 943 missing data, the total number of subjects used for the study is 61,676. The data were weighted to warrant that the sample was representative of the study population.

Access to the Riskesdas data had been approved by the National Institute of Health Research and Development, Ministry of Health of the Republic of Indonesia by submitting a proposal for data request. Riskesdas ethical approval has been issued by the Health Research Ethics Commission, Ministry of Health of the Republic of Indonesia with reference No. LB.02.01/2/KE.267/2017, and informed consent was obtained from all participants before the primary data collection process.

All subjects were interviewed and physically examined for survey purposes by trained interviewers. Blood pressures and anthropometric measurements were part of the physical examination. Hypertension or high

blood pressure, which become the dependent variable of this study, was defined as having systolic blood pressure ≥ 140 mmHg and/or diastolic blood pressure ≥ 90 mmHg when examined in the Riskesdas survey[5].

The independent variables of this study consisted of sociodemographic status, nutritional status, lifestyle, and dietary habits. A multi-function brand Stadiometer was used by well-trained interviewers to measure body height to the nearest 0.1 cm. Body weight was measured using a Camry digital weight scale with a capacity of 150 kg. The weight scale was calibrated daily before use. Body mass index (BMI) was calculated by dividing weight (kg) by height (m^2). Body Mass Index (BMI) was categorized into five levels following the classification established by the Ministry of Health of Indonesia[9]. History of heart disease, diabetes mellitus (DM), and chronic kidney disease (CKD) are determined by the relevant report provided by the subjects for the interview on the questions about their history of being diagnosed with the aforementioned diseases.

Data on age, gender, education level, job category, smoking behavior, and alcohol consumption were also collected by trained interviewers with a validated questionnaire. Simple questionnaires and food cards were used to ask about the consumption frequency of several food groups, including sugary foods, salty foods, fatty foods, grilled foods, preserved meat, instant foods, instant seasonings, carbonated drinks, and energy drinks. The frequency of consuming such foods was categorized into "frequent" if consumed ≥3 times/week and "not frequent" if consumed <3 times/week. The frequency of fruit and vegetable consumption was also asked and then categorized into ≥4 days/week and < 4 days/week. Physical activities are categorized into "active" and "inactive" based on the modified Global Physical Activity Questionnaire which is part of the WHO STEPS instrument[5].

The data were statistically analyzed using the International Business Machines Statistical Package for the Social Sciences (IBM SPSS) version 25. Descriptive statistics were performed to obtain the frequency of each of the tested variables. In multivariate logistic regression analysis, we calculated the odds ratios (OR) relating hypertension status to the independent variables. The associations between the variables were tested using the Chi-square test. The level of significance for all tests was $p<0.05$. Those analyses were performed with a complex sample design.

RESULTS

The sample included 61,676 adults (≥18 years old) living in Kalimantan. Based on this sample, 21.2% were detected as having high blood pressure during the survey. Over 90% of the study participants did not have higher education. Almost a third (28.5%) of them were out-of-job. Meanwhile, the most common occupation among the rest of the participants was farmers (22.2%).

Most of the study subjects admitted to being non-smokers (64.6%), having enough physical activity (70.6%), and not drinking alcohol (95.4%). Almost 80% of the respondents consumed vegetables at least 4 days/week. In contrast, similar percentages consumed fruits for less than 4 days/week. The respondents' characteristics towards the consumption of risky food items can be observed in Table 1.

In multivariate logistic regression analysis, several sociodemographic factors, physical chronic conditions, and lifestyle characteristics were associated with hypertension. The age group was the most remarkable risk factor of hypertension, in which the elderly population who are over 60 years old had 8 times higher risk to have high blood pressure compared to the group of young adults. In Kalimantan, the proportion of hypertension cases was quite similar across genders.

In terms of education, there seemed to be a pattern of decreasing risk along with an increase in the educational level. However, those having bachelor degrees were not less risky of hypertension compared to those having associate degrees as their highest level of education. Meanwhile, those who are still taking formal education at school have the lowest risk of high blood pressure compared to those who are unemployed or work in any sector. Based on the job category, unemployment has the highest risk of hypertension.

Table 1
Descriptive Statistics and Bivariate Analysis on Factors Related to Hypertension in Kalimantan

Variables	Hypertension		Odds ratio (95% CI)	*P*
	Yes (%)	No (%)		
Overall	78.8	21.2		
Age group				
60+	18.6	8.1	8.825 (7.929-9.822)	<0.001
50-59	25.5	11.0	8.844 (7.997-9.78)	
40-49	29.3	19.2	5.854 (5.307-6.457)	
30-39	17.6	26.8	2.522 (2.274-2.799)	
18-29	9.1	34.9	1	
Sex				
Male	47.6	53.7	0.785 (0.749-0.822)	<0.001
Female	52.4	46.3	1	
Education				
Never enrolled	8.2	4.6	2.223 (1.926-2.566)	<0.001
Unfinished elementary school	17.7	12.0	1.819 (1.598-2.07)	
Graduated elementary school	29.4	23.3	1.559 (1.38-1.763)	
Graduated junior high school	15.5	19.4	0.99 (0.871-1.125)	
Graduated high school	21.8	30.7	0.879 (0.778-0.994)	
Have associate degree	2.3	3.6	0.779 (0.634-0.957)	
Have bachelor degree	5.2	6.4	1	
Job category				
Unemployed	31.4	25.5	6.076 (4.759-7.756)	<0.001
In school	0.9	4.2	1	
Employed in public sectors	5.3	4.5	5.819 (4.461-7.591)	
Employed in private sectors	9.2	14.1	3.21 (2.492-4.135)	
Entrepreneur	14.9	15.2	4.865 (3.781-6.259)	
Farmers	23.5	20.9	5.548 (4.33-7.11)	
Fishermen	1.3	1.3	4.705 (3.429-6.454)	
Laborers / domestic helpers	5.8	7.1	3.981 (3.039-5.215)	
Others	7.8	7.2	5.353 (4.123-6.951)	
Residence				
Urban	46.9	46.8	1.005 (0.947-1.067)	0.871
Rural	53.1	53.2	1	
Smoking status				
Daily smoker	23.7	31	0.697 (0.659-0.738)	<0.001
Non-daily smoker	8.8	7.4	1.093 (0.995-1.201)	
Non-smoker	67.5	61.6	1	
Alcohol drinker				
Yes	4.2	5.1	0.821 (0.72-0.937)	0.003
No	95.8	94.9	1	
Physical activity				
Active	69.5	71.6	1	<0.001
Inactive	30.5	28.4	1.109 (1.047-1.174)	
Fruits				
>= 4 days/week	23.2	21.6	1	0.005
< 4 days/week	76.8	78.4	0.912 (0.856-0.972)	
Vegetables				
>= 4 days/week	76.6	76.1	1	0.327
< 4 days/week	23.4	23.9	1.030 (0.971-1.093)	
Salty foods				
Frequent	37.6	41.6	0.848 (0.804-0.894)	<0.001
Not frequent	62.4	58.4	1	
Fatty foods				
Frequent	51.3	54	0.897 (0.851-0.946)	<0.001
Not frequent	48.7	46	1	
Grilled foods				
Frequent	13.5	14.2	1.06 (0.987-1.14)	0.111
Not frequent	85.8	86.5	1	
Preserved meat				
Frequent	7	9.3	0.736 (0.671-0.808)	<0.001
Not frequent	93	90.7	1	

Variables	Hypertension		Odds ratio (95% CI)	*P*
	Yes (%)	No (%)		
Instant foods				
Frequent	25.3	31.1	0.747 (0.705-0.792)	<0.001
Not frequent	74.7	68.9	1	
Instant seasonings				
Frequent	80.9	80.7	1.013 (0.949-1.081)	0.704
Not frequent	19.1	19.3	1	
Carbonated drinks				
Frequent	5.9	4	0.673 (0.596-0.759)	<0.001
Not frequent	96	94.1	1	
Energy drinks				
Frequent	3.5	5.60	0.625 (0.554-0.704)	<0.001
Not frequent	96.5	94.40	1	
Body Mass index (BMI)				
Obese	34.70	16.80	2.844 (2.67-3.029)	<0.001
Overweight	16.60	12.80	1.785 (1.662-1.916)	
Normal	43.40	59.70	1	
Underweight (mild)	3.40	7.00	0.666 (0.582-0.762)	
Underweight (severe)	1.90	3.70	0.697 (0.592-0.82)	
DM				
Yes	4.20	1.70	2.624 (2.29-3.006)	<0.001
No	95.80	98.30	1	
Heart diseases				
Yes	2.80	1.60	1.812 (1.54-2.132)	<0.001
No	97.20	98.40	1	
Chronic Kidney Disease (CKD)				
Yes	0.60	0.30	1878 (1398-2635)	<0.001
No	99.40	99.70	1	

Table 2
Multivariate Logistic Regression on Factors Related to Hypertension in Kalimantan

Variables	Odds Ratio (95%CI)	*P*
Overall		
Age group		
60+	8.022 (7.104 – 9.058)	<0.001
50-59	7.500 (6.713 – 8.739)	
40-49	4.769 (4.301 – 5.288)	
30-39	2.114 (1.897 – 2.355)	
18-29	1	
Sex		
Male	1.171 (1.080 – 1.269)	<0.001
Female	1	
Education		
Never enrolled	1.520 (1.272 – 1.815)	<0.001
Unfinished elementary school	1.487 (1.270 – 1.741)	
Graduated elementary school	1.482 (1.275 – 1.722)	
Graduated junior high school	1.250 (1.075 – 1.455)	
Graduated high school	1.155 (1.005 – 1.328)	
Have associate degree	0.819 (0.663 – 1.011)	
Have bachelor degree	1	
Job category		
Unemployed	1.768 (1.357 – 2.304)	<0.001
In school	1	
Employed in public sectors	1.544 (1.148 – 2.077)	
Employed in private sectors	1.426 (1.086 – 1.874)	
Entrepreneur	1.407 (1.070 – 1.850)	
Farmers	1.447 (1.105 – 1.894)	
Fishermen	1.325 (0.941 – 0.864)	
Laborers / domestic helpers	1.396 (1.044 – 1.866)	
Others	1.721 (1.298 – 2.283)	

Variables	Odds Ratio (95%CI)	*P*
Smoking status		
Daily smoker	0.748 (0.688 – 0.814)	<0.001
Non-daily smoker	1.109 (0.983 – 1.252)	
Non-smoker	1	
Alcohol drinker		
Yes	1.322 (1.145 – 1.528)	<0.001
No	1	
Physical activity		
Active	1	0.521
Inactive	1.022 (0.956 – 1.092)	
Fruits		
>= 4 days/week	1	0.354
< 4 days/week	1.034 (0.963 – 1.111)	
Vegetables		
>= 4 days/week	1	0.001
< 4 days/week	1.111 (1.042 – 1.185)	
Salty foods		
Frequent	0.894 (0.842 – 0.949)	<0.001
Not frequent	1	
Fatty foods		
Frequent	0.973 (0.918 – 1.032)	0.362
Not frequent	1	
Grilled foods		
Frequent	1.096 (1.010 – 1.190)	0.028
Not frequent	1	
Preserved meat		
Frequent	0.860 (0.777 – 0.953)	0.004
Not frequent	1	
Instant foods		
Frequent	1.040 (0.975 – 1.110)	0.233
Not frequent	1	
Instant seasonings		
Frequent	1.104 (1.028 – 1.186)	0.007
Not frequent	1	
Carbonated drinks		
Frequent	1.070 (0.924 – 1.240)	0.366
Not frequent	1	
Energy drinks		
Frequent	0.930 (0.801 – 1.079)	0.337
Not frequent	1	
Body Mass Index (BMI)		
Obese	2.904 (2.699 – 3.125)	<0.001
Overweight	1.741 (1.612 – 1.879)	
Normal	1	
Underweight (mild)	0.675 (0.589 – 0.774)	
Underweight (severe)	0.533 (0.449 – 0.634)	
Diabetes Mellitus (DM)		
Yes	1.275 (1.095 – 1.484)	0.002
No	1	
Heart diseases		
Yes	1.039 (0.866 – 1.247)	0.681
No	1	
Chronic Kidney Disease (CKD)		
Yes	1.185 (0.850 – 1.653)	0.316
No	1	

In multivariate logistic regression analysis, several sociodemographic factors, physical chronic conditions, and lifestyle characteristics were associated with hypertension. The age group was the most remarkable risk factor of hypertension, in which the elderly population who are over 60 years old had 8 times higher risk to have high blood pressure compared to the group of young adults. In Kalimantan, the proportion of hypertension cases was quite similar across genders.

In terms of education, there seemed to be a pattern of decreasing risk along with an increase in the educational level. However, those having bachelor degrees were not less risky of hypertension compared to those having associate degrees as their highest level of education. Meanwhile, those who are still taking formal education at school have the lowest risk of high blood pressure compared to those who are unemployed or work in any sector. Based on the job category, unemployment has the highest risk of hypertension.

There was no evidence that smokers were at increased risk of hypertension in the studied population. People who smoke every day have a lower risk than nonsmokers. However, non-smokers are marginally proven to have a lower risk than non-daily smokers.

Lacking physical activity and fruit intake subtly increased the risk of hypertension but the differences were not significant. In general, frequent consumption of risky foods and beverages gave a marginally different risk of hypertension. The differences were not even significant for some food categories (fatty foods, instant foods, carbonated drinks, energy drinks).

Around half of the study subjects had normal BMI (51.5%). Less than three percent of the study participants were diagnosed with DM (2.9%), heart disease (2.2%), or CKD (0.5%). Obese subjects were almost 3 times more likely to be hypertensive than normal people. In contrast, those who were severely thin had a lower risk of hypertension. Having a history of DM, heart disease, and CKD also increased the risk of hypertension although the relationship was not significant for heart disease and CKD.

DISCUSSION

The findings from this study highlight various risk factors associated with hypertension in Kalimantan, shedding light on the complex interplay between sociodemographic characteristics, lifestyle factors, and dietary habits in this population. Specifically, this study showed that the risk factors of hypertension in Kalimantan include age, sex, education, job category, smoking status, vegetable consumption, BMI, DM status, as well as consumption of several risky food groups. were linked to increased hypertension risk. The implications of these analyses could inform public health policies aimed at tackling hypertension within the region of Kalimantan, Indonesia.

Contrary to conservative expectations, our results revealed some unexpected associations, such as daily smokers showing lower likelihoods of hypertension compared to non-smokers, emphasizing the intricate relationship between smoking and blood pressure. Some presumed risky dietary behaviors, like excessive salt consumption and certain food types, did not exhibit associations that are in line to clinical theory. These findings underscore the complexity of dietary habits' role in hypertension and emphasize the need for comprehensive considerations when addressing risk factors for hypertension.

Notably, older age, male gender, lower education levels, and certain occupational categories. Analysis from another Indonesian survey shows that being overweight was associated with high blood pressure and older age was consistently linked with nutrition-related chronic diseases[10]. The relationship between age and blood pressure among Indonesians has been reported to be significant[11]. In line with our result, men have been reported more likely to have hypertension than women[12]. Differences in sociodemographic had a differential impact on the diagnosis of hypertension and in receiving treatment[12].

Educated people tend to be more aware of their health so it is suspected that the risk of hypertension is lower as the education level becomes higher. Our results confirm that elementary education is positively correlated with hypertension[11]. However, among our study subjects, those having associate degrees have a lower risk of hypertension compared to those having bachelor degree which is a higher level of education. Subjects who are still enrolled in school were the least likely to have high blood pressure. In contrast, those who are jobless but also not undergoing education anymore are almost twice likely to get hypertension. Indeed, a longitudinal study found that youth unemployment is correlated with hypertension[13].

Lifestyle may influence the risk of having high blood pressure. Smoking has been known to be the most common risk factor for cardiovascular disease. It directly raises blood pressure by increasing sympathetic nerve activity and narrowing arterial blood vessels[14]. However, our results oddly indicated that daily smokers are less likely to get hypertension than non-smokers. This could be because smoking cessation may lead to temporary increases in blood pressure before it eventually drops to normal levels[15]. Concerning the effect of chronic smoking on blood pressure, available data do not clearly establish a direct causal relationship between these two cardiovascular

risk factors, a concept supported by the fact that no lower blood pressure values have been observed after chronic smoking cessation[16].

Fixed-effects models analyzing cohorts from the Indonesian Family Life Survey (IFLS) also show no relation between smoking to hypertension[17]. Similarly, current smoking status was revealed to have a negative correlation with high blood pressure among Indonesians[11]. Researches from other countries also show inconsistent results. In Korea, it was found that smoking was not associated with hypertension in the overall population[18]. Meanwhile, a Malaysian study showed that daily smoking with a maximum number of cigarettes of five was having a significant association with high systolic blood pressure[19].

Lower blood pressures and reduced cardiovascular risks are related to regular physical activity. Physical activity has been linked to paradoxical regression or prevention of left ventricular hypertrophy in hypertension individuals, suggesting a mechanism by which exercise can help hypertensive patients[20]. According to our analysis, not getting enough physical activity increased the risk of having high blood pressure just slightly which was not statistically significant.

According to our findings, drinking alcohol increases the risk of hypertension by about 30%. In a meta-analysis, chronic alcohol consumption was shown to be related to a high rate of hypertension. The destructive effects of alcohol on blood pressure do not support the claim that low-to-moderate alcoholic beverage consumption is cardioprotective[21].

A previous study showed that additional intake of potassium derived from fruits in the diet is successful in lowering systolic blood pressure[22]. If potassium consumption is inadequate, sodium will accumulate in the blood which leads to hypertension[4]. A diet lack of fruits and vegetables tends to increase blood pressure because apart from being a source of potassium, vegetables, and fruit are also low in calories but rich in fiber and water [23].

The regularity of fruit consumption did not statistically differ in the risk of hypertension among our subjects. Secondary analysis of Riskesdas 2007 data showed that there is no relationship between hypertension not only with fruit consumption but also vegetable consumption among the Indonesian population[8]. Meanwhile, this present study showed that a lower frequency of vegetable intake did increase the hypertension risk by about 10%.

It has been reported that most Indonesian people have consumed vegetables regularly, but less than half are regular consumers of fruits[24]. This is consistent with our findings, in which we discovered that more people frequently consume vegetables than fruits (76.6% vs. 23.2%, Table 1). Many vegetables especially green, leafy ones also contain a considerable amount of nitrate. Recent clinical research has shown that dietary nitrate consumption has health benefits, particularly in the areas of vascular and metabolic health[25].

Too much salt intake has been proven to increase blood pressure since sodium retains body fluid, thereby increasing the pressure of blood vessels[3]. A high-salt diet also increases the body's need for potassium to balance cation levels in the body's cells. A study reported the increased hypertension risk by daily consumption of salty foods among Indonesian pregnant women[26]. In contrast, our analysis revealed that the risk of hypertension was lower among those who frequently consume salty foods. This result shows that epidemiological findings do not always agree with clinical theories.

Our analysis regarding other food items that are typically well-thought-out as “risky” for health was also not found to be relevant risk factors for hypertension among the adult population of Kalimantan. Only grilled foods and instant seasonings were proven to raise the risk of hypertension. This is in line with the result of a Chinese study which shows that a preference for grilled foods possesses a significant correlation with hypertension[27]. A Thai study reported that the modern was positively correlated with hypertension; meanwhile, a prudent diet was not correlated with hypertension[28]. Another Indonesian study using older Riskesdas data also found no difference in hypertension risk between different frequencies of consuming salty foods as well as fatty foods[8].

The lack of association between some dietary habits and hypertension could be due to several reasons. For example, the study may not have enough power to detect a significant association, or the effect of the dietary habits may be too small to be detected. It is important to note that the association between dietary habits and hypertension is complex and may be influenced by other factors such as age, sex, and lifestyle characteristics. Therefore, it is essential to consider these factors when interpreting the results of studies that examine the association between dietary habits and hypertension.

Hypertension is known to happen more commonly in obese than in lean individuals at practically every age[29,30]. Obesity status, especially central obesity, increases sodium reabsorption in the kidneys and affects the renin-angiotensin-aldosterone hormone production system that regulates blood pressure[2]. Our analysis showed that subjects who had or have been diagnosed with DM, heart disease, as well as CKD have higher odds of hypertension. However, the relationships were not statistically significant with heart disease and CKD. There is indeed a significant linear association between blood pressure and BMI found among the Indonesian population[11].

The main constraint of this study is the use of a self-reporting and cross-sectional design to analyze the variables that might hamper this study. For more accurate information, assessments of dietary habits and physical activity need to be done with a more valid method, such as 24-h dietary recall. Besides that, some medical conditions like central obesity and a history of stroke were not examined in our analysis. Nevertheless, this is likely the first epidemiological study about hypertension in Kalimantan.

CONCLUSION

Among adults living in Kalimantan, we found that hypertension or high blood pressure was correlated to several factors. Sociodemographic factors (age group, gender, education level, and job category), obesity status as well as history of DM, were found to be significant risk factors for high blood pressure in this population. Meanwhile, only a few aspects of lifestyle and dietary habits were identified as having significant associations with high blood pressure.

RECOMMENDATION

It is recommended to implement targeted interventions to address the identified risk factors. Awareness programs should be developed to educate individuals about the impact of sociodemographic factors on hypertension risk. Likewise, screening programs should be prioritized towards the group whose sociodemographic profiles tend to be riskier in getting high blood pressure. Given the significant associations between obesity, DM, and hypertension, strategies aimed at weight management and control of blood sugar should be implemented in Kalimantan.

These recommendations are directed towards stakeholders involved in public health program development in Kalimantan. Targeted prevention and intervention programs would significantly benefit by focusing on groups with higher risks of hypertension. Recommendations also extend to individuals who require a deeper understanding of the impact of sociodemographic factors.

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