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THE PROPORTION OF SEASONING CONSUMPTION HABITS AND THE PREVALENCE OF HYPERTENSION AND DIABETES MELLITUS (INDONESIAN HEALTH SURVEY 2023)

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ABSTRACT

Background: *Non-communicable diseases such as hypertension and diabetes mellitus are increasing globally, including in Indonesia. One of the risk factors that is thought to contribute is the habit of consuming seasonings containing sodium and monosodium glutamate (MSG). This study aims to analyze the relationship between the proportion of seasoning consumption and the prevalence of hypertension and diabetes mellitus based on data from the 2023 Indonesian Health Survey (IHS).*
Method: *The research method used was a cross-sectional design with samples from households spread across 38 provinces in Indonesia. Data were collected through interviews, blood pressure measurements, and blood glucose level checks.*
Result: *The results of the analysis showed a significant relationship between daily seasoning consumption and an increase in the prevalence of hypertension based on a doctor's diagnosis (r = 0.470), while based on measurement results it was (r = 0.511), and for the prevalence of diabetes mellitus was (r = 0.364). Conversely, less frequent consumption tends to reduce the prevalence of both diseases.*
Conclusion: *The conclusion of this study confirms that high consumption of seasonings contributes to an increased risk of hypertension and diabetes mellitus, so education on balanced sodium consumption and control of seasoning use needs to be improved to prevent negative impacts on public health. These findings are expected to be the basis for consideration by policymakers in designing more effective nutrition interventions and health promotion programs.*

Keywords: *"Seasonings, Hypertension, Diabetes Mellitus, Public Health*

INTRODUCTION

Currently, the development of diseases in the world, including Indonesia, has shifted from infectious diseases to non-communicable diseases (NCDs) such as hypertension and diabetes mellitus, which continue to increase from year to year (Pakpahan et al., 2022). Non-communicable diseases (NCDs) are one of the global health problems and contribute to increased morbidity and mortality (Arifin et al., 2022). Non-communicable diseases are not diseases that can be transmitted between individuals but are chronic conditions that continue to increase throughout the world, especially in developing and poor countries (Soeroso et al., 2024) .

Hypertension also known as high blood pressure is an asymptomatic condition in which there is an increase in blood pressure in the arteries. A person is said to have high blood pressure if when sitting their systolic pressure is ≥140 mmHg or their diastolic pressure is ≥90 mmHg or both. Diabetes mellitus (DM) is a metabolic disease with symptoms of hyperglycemia caused by abnormalities in the insulin working mechanism, a diagnosis of DM can be made if there are classic complaints of DM with random plasma glucose test results ≥200 mg/dL or fasting plasma glucose test results ≥126 mg/dl (Damayanti et al., 2023) .

Consuming preserved foods too often, consuming excess salt, and using seasonings such as monosodium glutamate (MSG) in high

amounts can cause increased blood pressure due to the high sodium content in these foods (Nugroho et al., 2019) . Consumption of risky foods or drinks is divided into sweet foods, sweet drinks, fatty foods, cholesterol, fried foods, foods using seasonings, and fast food. Based on data analysis, it is known that consuming risky foods and drinks is one of the risk factors for the occurrence of diabetes mellitus (Aniska, 2022) .

Globally according to the World Health Organization (WHO) In 2021, diabetes was the direct cause of 1.6 million deaths and 47% of all deaths from diabetes occurred before the age of 70. Another 530,000 deaths from kidney disease were caused by diabetes, and high blood glucose caused about 11% of cardiovascular deaths (WHO, 2024) . The World Health Organization (WHO) estimates that the prevalence of hypertension will reach 33% in 2023 and two-thirds of these are in poor and developing countries (WHO, 2023) . The 2018 Basic Health Research data showed that the prevalence of hypertension was 34.1% in the population aged ≥18 years, increasing from 25.8% in 2013. Meanwhile, the prevalence of diabetes mellitus based on blood sugar examinations also increased from 6.9% to 8.5% in the same period (Riskesdas, 2018) . There is a relationship between Mono Sodium Glutamate (MSG) consumption and the incidence of hypertension. This study is in line with research conducted by Zainuddin and Yunawati (2018), MSG consumption has a significant relationship with the incidence of hypertension, where consuming large amounts of sodium will increase extracellular so that intracellular fluid is released which results in increased extracellular volume, this causes an increase in blood volume which has an impact on hypertension (Aristi et al., 2020) .

The study (MS et al., 2023) showed a relationship between excessive salt consumption and the incidence of DM. Respondents who consume excess salt are also at high risk of suffering from DM. The results of the questionnaire showed that people prefer foods that taste salty. Previous research on the effect of diet on the potential risk of DM stated that consuming salty foods has a risk of 2.62 times experiencing DM. 65% of all respondents who consume salty foods experience DM. High salt intake in hypertension occurs through increased plasma volume and blood pressure. The high salt content in the body can also cause fluid accumulation in the body because it draws fluid outside the cells so that it is not excreted, which can cause increased blood volume and pressure.

Although there have been several studies examining the relationship between dietary patterns and the incidence of hypertension and diabetes mellitus in Indonesia, studies that specifically examine the effect of seasoning consumption habits on the prevalence of both diseases are still very limited. This study aims to determine the relationship between the proportion of seasoning consumption habits and the proportion of hypertension and diabetes mellitus cases based on doctors' diagnoses through analysis of the 2023 Indonesian Health Survey (IHS) data. With the results of this study, it is hoped that it can provide deeper insights to formulate more effective policies in dealing with health problems related to seasoning consumption, as well as reducing its negative impacts on the health of the Indonesian people.

METHODS

This study used a cross-sectional design to evaluate the relationship between the habit of consuming seasonings with the proportion of hypertension and diabetes mellitus based on the doctor's diagnosis and measurement results. This design allows for the simultaneous measurement of variables at one time to see the relationship between the habit of consuming seasonings with the incidence of hypertension and diabetes mellitus in Indonesia. The population in this study were residents aged

≥15 years recorded in the 2023 IHS data who experienced Hypertension and Diabetes Mellitus. The research sample came from the 2023 Indonesian Health Survey (IHS) data, which involved 586 thousand households in 38 provinces and 514 districts/cities. The sampling method was carried out randomly with stratification to ensure a representative distribution in each region. The inclusion criteria in this study were individuals who had complete data on their consumption habits of seasonings and a diagnosis of hypertension and diabetes mellitus by a doctor. Meanwhile, individuals with incomplete data or no medical diagnosis information were excluded from the analysis.

The data in this study came from IHS 2023, collected in the period from August to October 2023. The independent variable in this study was the proportion of seasoning consumption habits obtained through a questionnaire. The dependent variable was the proportion of hypertension and diabetes mellitus based on the results of the doctor's diagnosis and the results of the measurements. Data were generated through blood pressure and blood sugar measurements. Blood pressure measurements were carried out using a Tensimeter, while blood glucose levels were measured using the Point of Care Testing (POCT) method. The results of the doctor's diagnosis were then compared with the interview data.

The prevalence of hypertension was calculated using the comparison formula between household members aged ≥15 years who had been diagnosed with hypertension with household members aged ≥15 years who were interviewed. Hypertension was categorized if systolic blood pressure was ≥140 mmHg and/or diastolic blood pressure was ≥90 mmHg in residents aged ≥15 years. The prevalence of diabetes mellitus was calculated using the comparison formula between household members aged ≥15 years who had been diagnosed with diabetes mellitus with household members aged ≥15 years who were interviewed. Diabetes mellitus was categorized if fasting blood glucose levels were ≥126 mg/dL or blood glucose levels 2 hours after loading were ≥200 mg/dL.

Data analysis was performed using SPSS software version 22. Descriptive analysis was used to describe the characteristics of respondents, including the distribution of seasoning consumption and the proportion of hypertension and diabetes mellitus. Univariate analysis was performed to describe the characteristics of each variable using the middle and variance measures (mean, standard deviation, minimum value, and maximum value). To analyze the relationship between seasoning consumption habits and the prevalence of Hypertension and Diabetes Mellitus, bivariate analysis was performed using the Pearson correlation test, after the assumption of data normality was met. If the data was not normally distributed, the Spearman correlation test was performed. This research has been approved and has a code of ethics with the number HK.01.07/MENKES/156/2023.

RESULTS AND DISCUSSION

Based on Table 1, the highest proportion of seasoning consumption ≥1 time per day is in the Java and Bali regions with a maximum value of 86.5%. Meanwhile, the lowest proportion of daily seasoning consumption is in the Papua region with a minimum value of 37.7%. Nationally, the proportion of daily seasoning consumption in Indonesia is an average of 67.5%. For seasoning consumption 1-6 times per week, the highest proportion is in the Papua region with a maximum value of 39.1%, while the lowest proportion is in the Java and Bali regions with a minimum value of 10.0%. Nationally, the average consumption of seasoning per week in Indonesia is 20.8%. Meanwhile, for seasoning consumption ≤3 Times per month, the highest proportion is in

the Papua region with a maximum value of 35.3%, while the lowest proportion is in the Java and Bali regions with a minimum value of 3.3%. Nationally, the average consumption of seasoning per month in Indonesia is 11.5%.

Table 1. Distribution of Proportion of Seasoning Consumption by Region of Indonesia in 2023

Region	Consumption Habit of Seasoning ≥1 time per day			Consumption Habits of Seasonings 1 – 6 times per week			Consumption habits of seasonings ≤3 times per month		
	Min	Max	$\bar{X}$ ±SD	Min	Max	$\bar{X}$ ±SD	Min	Max	$\bar{X}$ ±SD
Sumatra	30.1	79.0	62.1 ± 16.8	15.7	34.7	23.3 ± 6.6	5.4	35.3	14.5 ± 10.9
Java And Bali	67.8	86.5	78.5 ± 6.2	10.0	26.1	15.1 ± 5.4	3.3	10.3	6.3 ± 2.5
Nusa Tenggara	71.2	78.6	74.9 ± 5.2	15.0	15.4	15.2 ± 0.2	6.0	13.8	9.9 ± 5.5
Kalimantan	62.1	76.4	69.5 ± 5.9	17.3	30.9	23.5 ± 5.2	6.1	9.0	6.9 ± 1.1
Sulawesi	61.8	73.4	69.1 ± 4.6	17.4	26.1	20.2 ± 3.7	8.6	12.4	10.6 ± 1.4
Maluku	63.8	71.4	67.6 ± 5.3	19.0	27.1	23.0 ± 5.7	9.1	9.7	9.4 ± 0.4
Papua	37.7	70.1	57.1 ± 11.6	14.9	39.1	23.5 ± 8.6	13.3	30.4	19.2 ± 6.4
Indonesia	**30.1**	**86.5**	**67.5 ± 12.2**	**10.0**	**39.1**	**20.8 ± 6.5**	**3.3**	**35.3**	**11.5 ± 7.4**

The results of this study indicate that there are differences in the proportion of seasoning consumption in various regions in Indonesia. In general, the national average of seasoning consumption ≥1 time per day is 66.2%, with the highest proportion in Java and Bali (78.5%) and the lowest in Papua (51.7%). Meanwhile, the habit of consuming 1–6 times per week has a national average of 20.8%, and consumption ≤3 times per month has a national average of 11.6%. The high consumption of seasonings, especially those containing Monosodium Glutamate (MSG), can have an impact on health (Rizkaprilisa et al., 2024) . The results of the study indicate that there are variations in the proportion of seasoning consumption in Indonesia, which can affect public health. Seasonings, especially Monosodium Glutamate (MSG), are often used to enhance the taste of food. However, excessive consumption of MSG can have negative impacts on health, such as increasing the risk of hypertension (Arapa et al., 2023)..

Other studies have shown that the use of natural flavor enhancers, such as those based on oyster mushrooms, can be a healthier alternative. Oyster mushroom-based flavor enhancer formulations have been evaluated and have shown positive results in enhancing flavor without adverse side effects. (Kadaryati et al., 2022). Thus, although synthetic flavorings such as MSG are widely used, it is important to consider natural alternatives that are safer for health. Education regarding the consumption of flavorings and their impact on health needs to be improved to encourage healthier eating patterns in the community (Rizkaprilisa et al., 2024).

Table 2. Distribution of prevalence of hypertension and diabetes mellitus by Indonesian Region in 2023

Region	Prevalence of Hypertension based on doctor's diagnosis			Prevalence of hypertension based on measurement results			Prevalence of Diabetes Mellitus based on doctor's diagnosis		
	Min	Max	$\bar{X}$ ±SD	Min	Max	$\bar{X}$ ±SD	Min	Max	$\bar{X}$ ±SD
Sumatra	4.3	8.8	6.9 ± 1.2	21.4	28.3	24.2 ± 2.0	1.3	2.8	1.8 ± 0.4
Java And Bali	6.9	12.6	9.5 ± 2.2	21.7	32.8	29.2 ±3.8	2.1	3.9	2.7 ± 0.7
Nusa Tenggara	6.3	6.8	6.5 ± 0.3	24.5	26.4	25.4 ±1.3	1.0	1.8	1.4 ± 0.5
Kalimantan	7.2	11.1	8.4 ± 1.5	28.0	38.7	31.8 ±4.5	1.7	3.1	2.1 ± 0.5
Sulawesi	5.3	12.1	7.8 ± 2.3	26.5	29.5	27.7 ±1.1	1.4	2.7	2.0 ± 0.4
Maluku	4.3	4.4	4.3 ± 0.0	20.8	25.6	23.2 ±3.3	0.9	1.2	1.0 ± 0.2
Papua	2.2	7.0	5.0 ± 1.9	19.4	27.5	23.7 ±2.9	0.2	1.8	1.2 ± 0.6
Indonesia	**2.2**	**12.6**	**7.3 ± 2.2**	**19.4**	**38.7**	**26.7 ± 3.9**	**0.2**	**3.9**	**1.9 ± 0.7**

Based on Table 2, the prevalence of hypertension based on the highest doctor's diagnosis occurred in the Java and Bali region, with an average value of 9.5%, while the lowest prevalence of hypertension occurred in the Maluku region, with an average value of 4.3%. Nationally, the prevalence of hypertension in Indonesia is an average of 7.3%. For the prevalence of hypertension based on measurement results, the region with the highest number is Kalimantan with an average value of 31.8%, while the region with the lowest prevalence of hypertension is Nusa Tenggara with an average value of 25.4%. Nationally, the prevalence of hypertension based on measurement results in Indonesia has an average of 26.7%. Meanwhile, for the prevalence of diabetes mellitus based on doctors' diagnosis, the region with the highest number is Java and Bali, with an average value of 2.7%, while the region with the lowest prevalence of diabetes mellitus is Papua, with an average value of 1.2%. Nationally, the prevalence of diabetes mellitus in Indonesia has an average of 1.9%.

This study revealed that the prevalence of hypertension and diabetes mellitus in Indonesia showed significant variations between regions. Nationally, the prevalence of hypertension based on a doctor's diagnosis was recorded at 7.3%, with Java and Bali recording the highest prevalence at 9.5%, while Papua had the lowest prevalence at 5.0%. Meanwhile, the prevalence of hypertension based on measurement results showed a national figure of 26.7%, with Kalimantan recording the highest prevalence at 31.8% and Papua having the lowest prevalence at 23.7%. In addition to hypertension, the prevalence of diabetes mellitus based on a doctor's diagnosis also showed variations between regions, with a national figure of 1.9%. The region with the highest prevalence was Java and Bali at 2.7%, while the lowest prevalence was recorded in Papua at 1.0%. These data show a striking difference in the distribution of non-communicable diseases in various regions of Indonesia.

Table 3. Relationship between the proportion of seasoning consumption with the prevalence of hypertension and diabetes mellitus in Indonesian Region 2023

Proportion seasoning Consumption	Prevalence of Hypertension based on doctor's diagnosis	Prevalence of hypertension based on measurement results	Prevalence of Diabetes Mellitus based on doctor's diagnosis
Consumption ≥1 time per day			
Beta	2.534	1.582	6.220
Constant	49.083	25.309	55.607
Correlation Coefficient (**r**)	0.470	0.511	0.364
p-value	0.003	0.001	0.023
Consumption 1 – 6 times per week			
Beta	-0.977	-0.574	-2.531
Constant	27.980	36.168	25.717
Correlation Coefficient (**r**)	-0.340	-0.347	-0.278
p-value	0.034	0.030	0.087
Consumption ≤3 times per month			
Beta	-1.552	-1.008	-3.674
Costan	22.919	38.524	18.660
Correlation Coefficient (**r**)	-0.472	-0.535	-0.353
p-value	0.002	0.000	0.027

Previous studies have shown that Indonesia faces significant challenges in reducing the prevalence of hypertension and diabetes mellitus. Data from the 2018 Basic Health Research (Riskesdas) showed that the prevalence of diabetes mellitus in Indonesia

was 10.9%. In addition, the prevalence of hypertension also showed a significant increase. In 2019, there were 15,971 cases of diabetes mellitus recorded in Indonesia, placing this disease in the top ten diseases with the highest number of cases (Nurhalizah k et al., 2022) . The findings of this study illustrate the imbalance in the prevalence of hypertension and diabetes mellitus between regions in Indonesia. The short-term impact of this problem is enormous, where individuals with hypertension and diabetes mellitus are at high risk of health problems, decreased organ function, and other serious complications. In the long term, this problem can affect individual productivity, increase vulnerability to other non-communicable diseases, and add to the burden on the country's health system and economy (Ednur et al., 2023).

The results in Table 3 show varying relationships between seasoning consumption and the prevalence of hypertension in Indonesia. In one analysis, a positive relationship was found, with correlation coefficients of r = 0.470 (based on the doctor's diagnosis) and r = 0.511 (based on measurements), indicating moderate to strong correlations, respectively. The p-values were 0.003 and 0.001, both below 0.05, suggesting statistically significant associations. These results imply that higher seasoning consumption is associated with a higher prevalence of hypertension. Conversely, other analyses revealed a negative relationship. For seasoning consumption 1–6 times per week, correlation coefficients were r = -0.340 (doctor's diagnosis) and r = -0.347 (measurement results), both indicating moderate negative relationships, with statistically significant p-values of 0.034 and 0.030, respectively. A separate analysis of seasoning consumption every month showed stronger negative correlations: r = -0.472 (doctor's diagnosis) and r = -0.535 (measurement), with p-values 0.002 and 0.000, respectively. These results suggest that less frequent seasoning consumption is associated with lower hypertension prevalence.

The results of the study showed a significant relationship between the consumption of seasonings and the prevalence of hypertension based on the doctor's diagnosis and measurement results. Consumption of seasonings ≥1 time per day has a positive correlation with the prevalence of hypertension based on the doctor's diagnosis. Based on the interpretation of the strength of the relationship, the R value shows a moderate to strong relationship, which means that the higher the frequency of seasoning consumption, the higher the prevalence of hypertension. This can happen because the use of seasonings such as monosodium glutamate (MSG) in high amounts can cause increased blood pressure due to the large amount of sodium contained in food. Excessive sodium consumption can retain water (retention), so there is an increase in blood volume. Because of the increase in blood volume, the heart has to work harder to pump it, and blood pressure increases.

In contrast, moderate consumption of seasonings (1–6 times per week) showed a negative correlation with the prevalence of hypertension. This suggests that moderate consumption may play a role in reducing the prevalence of hypertension. However, very low consumption of seasonings (≤3 times per month) showed a stronger negative relationship with the prevalence of hypertension based on measurement results (r = -0.535; p < 0.001). This suggests that the less frequent the consumption of seasonings, the lower the risk of hypertension. This study is in line with Mantuges et al. (2021), which states that the results of interviews with subjects showed that the use of seasonings in the food processing process also contributed to the incidence of hypertension. According to research from Hendriyani et al. (2024) explains the Consumption of high-sodium foods once or more than once a day or once in three days and more than five types of food is significantly

related to blood pressure status. Consumption of foods that contain high sodium can cause the diameter of the arteries to shrink, thus triggering the heart to work harder to pump blood, which causes increased blood pressure. In addition, excessive sodium consumption will increase extracellular fluid, which triggers an increase in blood volume, which causes hypertension.

This study is research by Novitasari et al. (2024), which states that there is a significant relationship between sodium consumption and the incidence of hypertension in the Batu Health Center work area. Respondents who often consume foods containing sodium are more likely to suffer from hypertension than respondents who rarely consume sodium. This study found that the sources of sodium most often consumed by the people of Batu City are fried foods, meatballs, and seasonings such as soy sauce. People have a habit of adding seasonings to every dish, and soy sauce and salted fish are often eaten as side dishes. This can certainly cause blood pressure to increase and cause hypertension.

The results in Table 3 show there was a positive correlation between seasoning consumption and the prevalence of diabetes mellitus, with a correlation coefficient of r = 0.364 and a statistically significant p-value of 0.023. This suggests that higher daily seasoning consumption may be associated with a higher prevalence of diabetes. However, subsequent analyses revealed negative relationships. For seasoning consumption, 1–6 times per week, the correlation with diabetes mellitus, which indicates a low negative relationship, but the p-value of 0.087 shows this association was not statistically significant. In contrast, a more substantial negative relationship was observed when seasoning consumption was assessed monthly, with a correlation coefficient of r = -0.353 and a significant p-value of 0.027. These findings suggest that lower seasoning consumption may be linked to lower diabetes prevalence, although the strength of this relationship remains weak to moderate.

Consumption of seasonings also has a significant relationship with the prevalence of diabetes mellitus based on a doctor's diagnosis. Consumption of seasonings ≥1 time per day has a positive correlation with the prevalence of diabetes mellitus (r = 0.364; p = 0.023). This shows that the higher the frequency of consumption of seasonings, the higher the prevalence of diabetes mellitus. Excessive sodium consumption, including that from seasonings, can cause fluid retention in the body, which increases blood volume and blood pressure. In addition, high sodium intake can affect glucose metabolism and insulin sensitivity, which contributes to the development of diabetes mellitus (Hendriyani et al., 2024). According to research from Dewanti et al., (2022) Seasonings such as monosodium glutamate (MSG) added to food to add delicious taste in the long term can damage neurons in the nucleus and interfere with the delivery of leptin signals. This will cause leptin resistance which will exacerbate the risk of obesity and diabetes mellitus. research by Gultom and Ginting (2023) showed a relationship between blood glucose levels and hypertension in patients with type 2 diabetes mellitus, indicating that these two conditions are interrelated (Ginting et al., 2024) . Therefore, it is important to pay attention to the consumption pattern of seasonings, especially those containing MSG and sodium, to reduce the risk of hypertension and diabetes mellitus.

However, moderate consumption of seasonings (1–6 times per week) did not show a significant association with the prevalence of diabetes mellitus. This indicates that moderate consumption may not have a direct impact on the risk of diabetes mellitus. In contrast, very low consumption of seasonings (≤3 times per month) had a negative association with the prevalence of diabetes mellitus (r = -0.353; p = 0.027), meaning that the less frequent the

consumption of seasonings, the lower the risk of diabetes mellitus.

CONCLUSION

The results of this study can conclude that there is a significant relationship between the consumption of seasonings and the prevalence of hypertension and diabetes mellitus in Indonesia. High consumption of seasonings, especially those containing sodium and monosodium glutamate (MSG), contributes to increased blood pressure through the mechanism of fluid retention and increased blood volume. In addition, the habit of consuming seasonings more often is also associated with an increased risk of diabetes mellitus, which can be influenced by leptin resistance and metabolic disorders due to excessive MSG intake.

This study emphasizes the importance of nutritional education for the community to control the consumption of seasonings to reduce the risk of hypertension and diabetes mellitus. Regulation of sodium content in food products and promotion of the use of natural seasonings as a healthy alternative also needs to be improved. Thus, effective intervention policies in controlling the consumption of seasonings can contribute to improving overall public health.

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CONFLICT OF INTEREST

All authors declared that there was no conflict of interest.

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