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THE PROPORTION OF STARCH TUBER CONSUMPTION PATTERNS AND PREVALENCE OF HYPERTENSION AND DIABETES MELLITUS

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ABSTRACT

Background: *Hypertension and diabetes mellitus are major health problems in Indonesia. Consumption of starch tubers, such as cassava and sweet potatoes, has the potential to affect blood sugar levels and blood pressure. This study aims to analyze the relationship between the proportion of starch tuber consumption and the prevalence of hypertension and diabetes mellitus based on data from the 2023 Indonesian Health Survey (IHS).*
Method: *This study used a cross-sectional design with aggregate data from 38 provinces in Indonesia. Bivariate analysis used the Spearman correlation test.*
Result: *The results showed that consumption of starch tubers > 1 time per day and < 3 times per month had a significant relationship with the prevalence of hypertension (p = 0.00; p = 0.00) and diabetes mellitus (p = 0.00; p = 0.00). On the other hand, consumption of 1–6 times per week did not show a significant relationship with both diseases. The higher the proportion of starch tuber consumption, the lower the prevalence of hypertension and diabetes mellitus.*
Conclusion: *This study concluded that the overall consumption of starch tubers in Indonesia is low. Especially consumption of starch tubers in weekly periods in urban areas on the incidence of hypertension and diabetes mellitus. A nutritional education program policy is needed to reduce the risk of non-communicable diseases.*

Keywords: *Diabetes Mellitus, starch tubers, Hypertension*

INTRODUCTION

Non-communicable diseases such as hypertension and diabetes mellitus are major health problems in Indonesia. According to the 2018 Basic Health Research, the prevalence of hypertension reached 34.1%, while the prevalence of diabetes mellitus in adults and the elderly aged 20 to 79 years was around 10.6% (Zaddana et al., 2021). This condition shows that NCDs (Non-Communicable Diseases), especially hypertension and diabetes mellitus, are major challenges for the health sector in Indonesia. Diabetes Mellitus (DM) is a collection of metabolic symptoms that arise in a person due to an increase in blood glucose levels that exceed normal limits. This disease is caused by impaired glucose metabolism due to insulin deficiency, either absolutely or relatively. This condition occurs when the pancreas cannot produce enough insulin or because the body cannot effectively use the insulin (Zaddana et al., 2021). People with diabetes generally also experience hypertension. Hypertension is the main cause of morbidity and mortality for individuals with diabetes (Ihsan & Adisasmita, 2023). Hypertension is still the most common disease suffered by the Indonesian people. Hypertension is included in one of the non-communicable diseases that are currently a priority in the world of global health, besides being one type of non-communicable disease, hypertension is a major risk factor for cardiovascular diseases such as stroke, heart failure, and myocardial infarction (Budiawan et al., 2024).

In Asia, including Indonesia, the prevalence of these two diseases is also increasing. In China, the prevalence of

hypertension is estimated at around 25%, while the prevalence of type 2 diabetes reaches 11.5% (Wang et al., 2024). In Indonesia, based on the 2022 SSGI report, the prevalence of hypertension reached around 34.1% and the prevalence of diabetes mellitus reached 6.3%. The prevalence of diabetes mellitus in Indonesia according to the International Diabetes Federation (IDF) in 2021 was 19.47 million people. IDF estimates that diabetes mellitus sufferers in Indonesia in 2045 could reach 28.57 million people. This estimate is greater than in 2021. The estimated cases of hypertension in Bengkulu province in 2023 are 4,687 people, (9.6% of whom are in the ≥15 year age range) (BKPK, 2023).

One of the significant risk factors for hypertension and diabetes mellitus is food consumption patterns, including carbohydrate intake such as tubers. Tubers such as cassava, sweet potatoes, arrowroot, gelimbi tubers, and other tubers are sources of carbohydrates that are commonly consumed in Indonesia. The glycemic index of these tubers varies; for example, cassava has a glycemic index of around 55, which is included in the medium category. Purple sweet potato has the lowest glycemic index value of 21.54 compared to yellow and red sweet potatoes, so purple sweet potatoes are a good food ingredient for consumption by people with diabetes mellitus (Zaddana et al., 2021). In the study Zaddana et al., (2021) stated that snack bars made from purple sweet potatoes also have very strong antioxidant activity because of their high anthocyanin content and low reducing sugar content so this snack bar is suitable for consumption by people with diabetes mellitus. However, consumption of tubers affects blood sugar levels which are closely related to blood pressure, especially in people with type 2 diabetes mellitus. Diabetes increases the risk of hypertension through physiological mechanisms involving insulin resistance and the Renin-Angiotensin-Aldosterone system (Farhan et al., 2024).Therefore, it is important to monitor and control blood sugar and blood pressure levels to maintain health.

In previous studies, it was said that purple sweet potato puff pastry with dragon fruit jam can be an alternative snack for diabetics because purple sweet potato flour is gluten-free flour. In addition, this purple sweet potato puff pastry does contain anthocyanin which can prevent increased blood sugar levels in the body. Consuming foods with a low to moderate glycemic index can help control blood sugar levels and blood pressure, thus potentially reducing the risk of diabetes mellitus and hypertension (Asnawi & Eliska, 2023). However, studies that specifically examine the proportion of starch consumption and its relationship to the incidence of hypertension and diabetes mellitus based on a doctor's diagnosis are still rare.

This study aims to describe and analyze 7 regional areas with the proportion of tuber consumption patterns with hypertension and diabetes mellitus based on doctor's diagnosis based on data from the 2023 Indonesian Health Survey (IHS). The results of this study, it is expected to provide recommendations regarding healthy eating patterns, especially tuber consumption, in preventing hypertension and diabetes mellitus in Indonesia. This study also aims to enrich the scientific literature on healthy diets.

METHODS

This study was conducted with a cross-sectional design using aggregate data from IHS 2023. This design allows us to determine the proportion of starch consumption patterns with hypertension and diabetes mellitus. The population used was all adolescents aged > 15 years in the provinces of Indonesia, the sample selected for this study was adolescents aged > 15 years in 38 provinces in Indonesia based on SKI 2023 data. The inclusion criteria were those aged > 15 years who experienced hypertension and diabetes mellitus. While the

exclusion criteria were those who had incomplete interview and examination data on all variables. The implementation of the 2023 Indonesian Health Survey (HIS) was carried out in August - October 2023 throughout Indonesia with 38 provinces, and 514 districts/ cities involving 568,000 households.

The independent variable in this study is the consumption pattern of starchy tubers while the dependent variables are hypertension and diabetes mellitus. Hypertension is said if blood pressure is > 140/90 mmHg while in diabetes mellitus, the results of blood sugar level examination using Point of Care Testing (POCT) in residents aged ≥ 15 years. Diabetes results if fasting blood glucose levels are ≥ 126 mg/dl; or blood glucose levels 2 hours after loading ≥ 200 mg/d. Calculated using the prevalence of DM based on examination (age ≥ 15 years) is the same as biomedical ART aged ≥ 15 years with the results of diabetes blood glucose levels divided by biomedical ART aged ≥ 15 years whose blood glucose levels are examined multiplied by 100%. In hypertension, it is calculated using the prevalence of hypertension based on a doctor's diagnosis equal to ART aged ≥ 15 years who have been diagnosed with hypertension by a doctor divided by ART aged ≥ 15 years who were interviewed multiplied by 100%.

All processes of collecting specific health data are carried out by data collectors with a minimum educational background in Diploma III health and have undergone training. The research instrument follows the existing procedures of IHS 2023, namely individual interviews conducted using a structured questionnaire instrument. Univariate analysis was carried out to describe the characteristics of each variable using the middle and variance measures (mean, standard deviation, maximum value, and minimum value). To analyze the relationship between the consumption of starchy tubers and the prevalence of hypertension and diabetes mellitus, a bivariate analysis was carried out using the Pearson correlation test if the normal assumption is met, but if the normal assumption is not met, the Spearman correlation test was carried out with SPSS version 22. This implementation has received ethical approval from the Health Research Ethics Commission Number HK.01.07/ MENKES/156/2023 to ensure that research procedures meet ethical standards applicable to health research.

RESULTS AND DISCUSSION

Table 1 shows that the highest proportion of daily starchy tuber consumption is in the Papua regional area (63.0%) and the lowest proportion of daily starchy tuber consumption is in the Sulawesi regional area (2.6%). The highest proportion of weekly tuber consumption is in the Sumatra regional area (62.5%) and the lowest proportion of weekly tuber consumption is in the Papua region (21.7%) and the highest proportion of monthly starchy tuber consumption is in the Sumatra regional area (59.0%) and the lowest proportion of starchy tuber consumption is in the Papua regional area (15.3%). The results of this study indicate that there are significant differences in the proportion of starch consumption and the prevalence of hypertension and diabetes mellitus between regions in Indonesia. In general, the proportion of starch consumption in Indonesia is still low with an average proportion of starch consumption in Indonesia for consumption >1 time/day at 9.6%, 1-6 times/week at 1.2% and <3 times/month of 38%.

The results of this study indicate that there are significant differences in the proportion of starch tuber consumption and the prevalence of hypertension and diabetes mellitus between regions in Indonesia. In general, the proportion of starch tuber consumption in Indonesia is still low, with a national average of >1 time per day 9.6%, consumption of 1-6 times per week at 1.2%, and consumption of <3 Times per month 3.8%.

This figure illustrates the low consumption of starch tuber foods which will have an impact on hypertension and diabetes mellitus. The proportion of starch tuber food consumption >1 time per day is highest in Papua while 1-6 times per week and <3 Times per month are found in Sumatra, while the lowest consumption of starch tubers >1 time per day is found in Sulawesi and consumption of starch tubers 1-6 times per week and <3 Times per month is found in Papua. This shows the inequality in access and consumption of starch tubers between regions in Indonesia which is influenced by geographical factors, culture, and the availability of food in each region. The low glycemic index has bioactive compounds such as water-soluble polysaccharides, dietary fiber, and diosgenin which can lower blood sugar (Setyaningrum&Adi,2022).

Table 1. Distribution of the Proportion of Starchy Tubers Consumption according

Region	>1 time/day			1-6 times/week			<3 times/month		
	Min	Max	$\bar{X}$ ± SD	Min	Max	$\bar{X}$ ± SD	Min	Max	$\bar{X}$ ± SD
Sumatera	3.0	7.0	4.8±1.2	37.9	62.5	53.8±7.9	32.8	59.0	41.3±8.9
Jawa dan Bali	4.2	7.2	5.6±0.9	45.7	54.8	51.8±3.0	38.0	50.2	42.6±3.9
Nusa Tenggara	5.7	7.6	6.6±1.3	56.0	57.0	56.5±0.7	35.4	38.2	36.8±1.9
Kalimantan	3.8	7.9	5.3±1.9	45.3	62.7	52.4±7.2	33.6	50.8	42.2±6.9
Sulawesi	2.6	8.5	5.2±2.3	39.9	54.7	49.2±5.3	36.8	57.4	44.6±7.0
Maluku	15.1	19.1	17.1±2.8	54.5	57.1	55.8±1.8	23.8	30.4	27.1±4.6
Papua	11.9	63.0	29.3±22.8	21.7	57.7	44.0±14.	15.3	40.8	26.6±9.5
Indonesia	**2.6**	**63.0**	**9.6±12.2**	**21.7**	**62.7**	**1.2±8.2**	**15.3**	**59.0**	**3.8±9.3**

Indonesia has a wealth of diverse local food ingredients, including various sources of carbohydrates. Plants that are sources of carbohydrates generally produce starch, such as tubers, cereals, and nuts. Starch itself is a polysaccharide that acts as an energy reserve for plants in the metabolic process. Each source of starch has a different composition and characteristics. Tubers are known to be the highest source of starch, while cereals and nuts in addition to containing starch also have protein and fat. The protein and fat content makes the process of extracting starch from cereals and nuts more complicated than tubers because it requires a protein separation stage first. Some types of tubers that are widely cultivated in Indonesia include cassava, potatoes, and sweet potatoes.

Table 2. Distribution of Hypertension and Diabetes Mellitus Prevalence according to the 2023 Indonesian Health Survey

Region	Hypertension Based on Doctor's Diagnosis			Diabetes Mellitus Based on Doctor's Diagnosis			Hypertension Based on Measurement Results		
	Min	Max	$\bar{X}$ ± SD	Min	Max	$\bar{X}$ ± SD	Min	Max	$\bar{X}$ ± SD
Sumatera	4.3	8.8	6.9±1.2	1.3	2.8	1.8±0.4	21.4	28.3	24.2±2.0
Jawa dan Bali	6.9	12.6	9.5±2.2	2.1	3.9	2.7±0.7	21.7	32.8	29.3±3.9
NusaTenggara	6.3	6.8	6.5±0.3	1.0	1.8	1.4±0.5	24.5	26.4	25.4±1.3
Kalimantan	7.2	11.1	8.4±1.5	1.7	3.1	2.1±0.5	28.0	38.7	31.8±4.5
Sulawesi	5.3	12.1	7.8 ± 2.3	1.4	2.7	2.0±0.4	26.5	29.5	27.7±1.1
Maluku	4.3	4.4	4.3 ± 0.0	0.9	1.2	1.0±0.2	20.8	25.6	23.2±3.3
Papua	2.2	7.0	5.0±1.9	0.2	1.8	1.2± 0.6	19.4	27.5	23.7±2.9
Indonesia	**2.2**	**12.6**	**7.3±2.2**	**0.2**	**3.9**	**1.9±0.7**	**19.4**	**38.7**	**26.7±3.9**

Tubers have very low protein and fat content, making it easier to isolate starch (Harni et al., 2022). Several previous studies have mentioned that consuming starch tubers has health benefits, especially in reducing the risk of metabolic diseases. A prolonged gap between energy intake and energy expenditure can increase the likelihood of non-communicable diseases, such as diabetes mellitus. It is important to determine the specific energy intake needed because energy or calorie needs vary from individual to individual (Amran et al., 2024). Starchy tubers, such as sweet potatoes, cassava, potatoes, and other tubers contain dietary fiber which can help control blood sugar levels and have a lower glycemic index compared to other carbohydrate sources such as white rice.

Table 2 shows that the prevalence of hypertension based on doctor's diagnosis is highest in the Java and Bali regions (12.6%) and the lowest prevalence of hypertension is in the Papua region (2.2%). The prevalence of diabetes mellitus based on a doctor's diagnosis is highest in the Java and Bali regions (3.9%) and the lowest prevalence of diabetes mellitus based on a doctor's diagnosis is in the Papua region (0.2%). For hypertension based on measurement results, the highest figure is in the Kalimantan region (38.7%) and the lowest figure is in the Papua region (19.4%). National figures show the prevalence of hypertension based on a doctor's diagnosis of 7.3% the prevalence of diabetes mellitus based on a doctor's diagnosis at 1.9% and hypertension based on measurement results of 26.7%.

Table 3. Relationship between the Proportion of Starch Tubers and the Prevalence of Hypertension and Diabetes Mellitus in Indonesia 2023

Consumption of Starch Tubers	Hypertension based on diagnosis	Hypertension measurement results	Diabetes Mellitus based on diagnosis
≥ 1 time per day			
Betta	-0.10	-0.14	-0.03
Constant	8.35	28.11	2.23
Correlation coefficient (r)	-0.58	-0.43	-0.55
p-value	0.00	0.05	0.00
1-6 times per week			
Betta	0.05	0.12	0.00
Constant	4.53	20.49	1.47
Correlation coefficient (r)	0.19	0.25	0.10
p-value	0.23	0.12	0.53
≤ 3 times per month			
Betta	0.14	0.15	0.04
Constant	1.63	20.88	0.01
Correlation coefficient (r)	0.59	0.35	0.64
p-value	0.00	0.02	0.00

The results of data analysis in Table 3 show that the proportion of starch consumption > 1 time per day is related to the prevalence of hypertension based on a doctor's diagnosis (p-value 0.00) and the prevalence of diabetes mellitus based on a doctor's diagnosis (p-value 0.00) and hypertension based on measurement results (p-value 0.05). Based on the beta coefficient value, it shows that the higher the consumption of starch > 1 time per day, the lower the prevalence of hypertension and diabetes mellitus. High consumption of starch > 1 time per day is moderately related to the prevalence of hypertension (r -0.58) and the prevalence of diabetes mellitus (r -0.55) based on a doctor's diagnosis and is moderately related to the prevalence of hypertension based on measurement results (r -0.43). On the other hand, the results of data analysis show that the proportion of starch consumption 1-6 times per week has no relationship to the prevalence of hypertension based on a doctor's diagnosis (p-

value 0.23) the prevalence of diabetes mellitus based on a doctor's diagnosis (p-value 0.53) and hypertension based on measurement results (p-value 0.12). Based on the beta coefficient value, it shows that the higher the proportion of starch tuber consumption, the higher the prevalence of hypertension, and the higher the proportion of starch tuber consumption, the lower the prevalence of diabetes mellitus. High consumption of starch tubers 1-6 times per week is very weakly related to the prevalence of hypertension (r 0.19) and the prevalence of diabetes mellitus based on a doctor's diagnosis (r 0.10) and is weakly related to the prevalence of hypertension based on measurement results (r 0.25). Data from the analysis of the proportion of starch tubers >3 times per month showed no relationship with the prevalence of hypertension based on a doctor's diagnosis (p-value 0.00) and the prevalence of hypertension based on measurement results (p-value 0.02) and the prevalence of diabetes mellitus based on a doctor's diagnosis (p-value 0.00). Based on the beta coefficient value, it shows that the higher the proportion of starch tuber consumption <3 times per month, the lower the prevalence of hypertension and diabetes mellitus. High consumption of starch tubers < 3 times per month is moderately related to the prevalence of hypertension based on a doctor's diagnosis (r 0.59) and the prevalence of diabetes mellitus based on a doctor's diagnosis (r 0.64) and is weakly related to the prevalence of hypertension based on measurement results (r 0.35).

Related to the prevalence of hypertension and diabetes mellitus, the data shows that the Sumatra region has the highest consumption of starch tubers 1-6 times per week (62.5%). The results of the analysis in Table 3 of the prevalence of hypertension based on a doctor's diagnosis show that the p-value 0.23, the prevalence of hypertension based on the results measurement of the p-value 0.12, and the results of the prevalence of diabetes mellitus with consumption of starch tubers 1-6 times per week obtained a p-value 0.53 greater than 0.05 which means that there is no relationship between the proportion of starch tuber consumption 1-6 times per week with the prevalence of hypertension and diabetes mellitus in the Indonesian region. This study is in line with research (Elmawati, 2019) that does not indicate that carbohydrate consumption, which is the main component in starch tubers, is not directly related to increased blood pressure in the population. Tubers, as a source of complex carbohydrates, have characteristics that can affect the risk of hypertension and diabetes mellitus, but in general starch, tubers do not have a direct relationship with hypertension and diabetes mellitus because each tuber has a glycemic index that can help maintain blood sugar levels in people with diabetes mellitus, if the carbohydrate content is low glycemic, such as sutoimo tubers and is rich in fiber which plays a role in controlling blood glucose levels and lipid profiles (Sukmawati, 2022). On the other hand, consumption of tubers affects blood sugar levels which are closely related to blood pressure, especially in people with type 2 diabetes mellitus. Diabetes increases the risk of hypertension through physiological mechanisms involving insulin resistance and the Renin-angiotensin-aldosterone system. Therefore, it is important to monitor and control blood sugar levels and blood pressure to maintain health (Farhan et al.,2024). The results of the study Sarifah & Siyam (2023) stated that hypertension is the most influential risk factor for the risk of type II diabetes mellitus. Hypertension is the most dominant factor associated with the incidence of type II DM at the Posbindu PTM in the Pegandon Health Center work area. There are several factors associated with hypertension and diabetes mellitus including age, gender, education, marital status, blood type, total cholesterol levels, HDL cholesterol levels, LDL cholesterol levels, triglyceride levels, smoking habits, occupation, physical activity, body mass

index (BMI), heredity of hypertension, heredity of DM, and duration of DM, and one of them is blood glucose levels (Damayanti et al., 2023).

The results in Table 3 show hypertension prevalence based on a doctor's diagnosis with consumption of starch tubers > 1 time per day (p-value 0.00), prevalence of diabetes mellitus based on a doctor's diagnosis (p-value 0.00), and prevalence of hypertension measurement results (p-value 0.05) and the results of hypertension prevalence based on doctor's diagnosis with consumption of starch tubers <3 Times per month (p-value 0.00) prevalence of hypertension based on measurement results (p-value 0.02) and prevalence of diabetes mellitus based on doctor's diagnosis results (p-value 0.00), there is a significant relationship between the proportion of starch tuber consumption > 1 time per day and the proportion of starch tubers < 3 times per month with the prevalence of hypertension and diabetes mellitus based on doctor's diagnosis in Indonesia. This study is not in line with the study Elmawati (2019) that does not indicate that carbohydrate consumption, which is the main component in starch tubers, is not directly related to increased blood pressure in the population. Although the consumption of starch tubers as a source of carbohydrates is not directly related to an increase in the prevalence of hypertension, a balanced diet with attention to fiber and potassium intake remains important in the management and prevention of hypertension. Consumption of diverse foods is closely related to systolic blood pressure. The most consumed food group by the subjects is starchy staple foods. The types of food in this food group that are most consumed are rice, noodles, lontong, and cassava (Izzati et al., 2022). Although tubers are an important source of carbohydrates and have nutritional benefits, excessive consumption without proper regulation can contribute to increased blood pressure. Therefore, it is important to maintain a balanced diet and regulate carbohydrate intake according to individual needs.

On the other hand, this study is in line with the findings Setyaningrum & Adi (2022) that the consumption of foods with a high glycemic index is significantly associated with increased blood sugar levels. Consumption of starchy tubers with a high glycemic index can contribute to an increased risk of diabetes mellitus, indicating that consuming foods with a high glycemic index is significantly associated with increased blood sugar levels at any time and 2 hours postprandial and in the results of the study (Mustikaningrum et al., 2021) showed that the high proportion of purple sweet potato increased the total anthocyanin Snack bar. Anthocyanins can inhibit α-amylase and α-glucosidase in digestion, indicating that the compound is slowly digested, thereby reducing the release and absorption of glucose in the intestine. Therefore, high consumption of anthocyanins can reduce the risk of diabetes mellitus, obesity, and cardiovascular disease. The amylose content contained in sweet potatoes greatly affects carbohydrate levels. Purple sweet potatoes contain high amylose (> 25%) which can reduce the rate of glucose absorption so that consuming purple sweet potatoes does not increase glucose levels significantly. Sweet potatoes that have high amylose content can reduce the metabolizability of starch in vitro. Decreased starch digestibility can confirm hypoglycemic activity, this occurs because it can produce little glucose and slow down glucose (Winayu et al., 2019). At the time of consumption of certain tubers can affect the risk of hypertension and diabetes mellitus, especially depending on the type of tuber, the content of simple carbohydrates that are easily digested and absorbed, which can cause an increase in blood sugar levels, and the method of processing it is not appropriate (Izzati et al., 2022). In the case of giving analog rice made from gembili tubers to type 2 diabetes mellitus rats, it has been proven to reduce triglyceride levels by 20-30. This states that analog rice from gembili tubers has the potential as an alternative diet for

people with diabetes mellitus in maintaining normal triglyceride levels (Eliana & Mustikaningrum, 2023). Factors that can cause diabetes mellitus due to consuming starchy tubers such as the glycemic index in food, dietary fiber content, and food processing methods. The research in Aek Godang Village, North Padang Lawas Regency in 2022 found that there was no relationship between consumption of high-carbohydrate foods and the incidence of DM in the elderly. The amount of carbohydrates consumed will affect blood glucose and insulin levels, because carbohydrates will be broken down and absorbed in the form of monosaccharides, especially sugar (Siregar, 2022). In the study Puspitaningrum & Kusmita, (2013) it was stated that kimpul tubers can lower blood glucose levels or as anti-diabetes mellitus suspected due to flavonoid content. Flavonoid and andrographolide content, are apparently significantly able to increase GLUT-4 protein translocation in thigh muscle cells and lower blood glucose levels in test animals induced by fructose and high-fat feed. Flavonoids are possible to increase glucose use in tissues by increasing tyrosine kinase phosphorylation on insulin receptor substrates so that there is an increase in the activity of the P1-3 kinase enzyme which will form and translocate GLUT-4 protein to the cell wall so that blood glucose levels decrease. In starch tubers such as cassava, and sweet potatoes, potatoes contain nutrients in the form of carbohydrates, fiber, potassium, and other nutrients. Potassium has an important role in electrolyte circulation, muscle contraction, nerve function, and blood pressure in the human body. This mineral can be found in all cells in the body and potassium levels are regulated by the kidneys. Potassium functions to smooth the balance of water and minerals in the body, and potassium also works with sodium to maintain normal blood pressure in the human body. Increasing potassium consumption can be a preventive effect against hypertension by increasing the amount of sodium secreted in the body and potassium contained in starch tubers such as potatoes is quite high, while the sodium content is low (Fina & Rindiani, 2024).

The results of this study indicate that limiting the proportion of starch consumption is an important step in reducing the incidence of hypertension and diabetes mellitus. Therefore, a nutritional education program is needed for the community and support for local farmers to increase food diversity. In addition, a more integrated policy between the health, education, and agriculture sectors is needed to overcome the problem of non-communicable diseases, such as hypertension and diabetes mellitus, in Indonesia.

CONCLUSION

This study shows that there is a significant relationship between the proportion of starch consumption <1 time per day with the prevalence of hypertension and diabetes mellitus. In contrast, starch consumption with a frequency of 1-6 times per week does not show a significant relationship with hypertension and diabetes mellitus. Meanwhile, starch consumption <3 Times per month has a significant relationship with the prevalence of hypertension and diabetes mellitus. The more often someone consumes tubers in the right amount, the lower the possibility of developing hypertension and diabetes. However, not all types of tubers have the same effect. This study concludes that overall starch consumption in Indonesia is low. Differences in tuber consumption between regions in Indonesia are also influenced by geographical, cultural, and food availability factors. For further research, more in-depth research is needed to explore the differences in the types of starch consumed and their impact on health, including clinical trials on the effects of glycemic index and bioactive content, and can expand the variables to be used.

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CONFLICT OF INTEREST

All authors declared that there was no conflict of interest.

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