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The Effect of Giving Delaru Cookies on The Blood Pressure of Hypertension Patients at The Tebing Tinggi Public Health Empat Lawang District

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ABSTRACT

Background: *Hypertension is an increase in blood pressure that is more than or equal to 140 mmHg during the systolic and 90 mmHg during the diastolic phases. The World Health Organization reports that the number of persons with hypertension climbed from 650 million to 1.3 billion between 1990 and 2019.*

Research Methods: *This quantitative study employs a quasi-experimental research design, a control group, and a pre-test-post-test design. Forty treatment groups and 40 comparator groups served as samples for this investigation. Data analysis was conducted univariately and bivariately.*

Research Result: *The findings of this study showed the acceptance of formula 2, which produced delaru cookies, in accordance with panelists' preferences for color, aroma, taste, and texture. The treatment group's hypertensive patients had an average diastolic blood pressure of 90.07 mmHg after therapy, and an average systolic blood pressure of 157.75 mmHg before and after treatment. With a score of p-value = 0.015 (<0.05), the t-dependent test revealed a difference between the treatment group's average systolic and diastolic blood pressure before and after.*

Conclusion: *Puskesmas Tebing Tinggi, Empat Lawang Regency, reduces the blood pressure of hypertensive patients with Delaru Cookies.*

BACKGROUND

A rise in systolic blood pressure of more than 140 mmHg and a rise in diastolic blood pressure of more than 90 mmHg is referred to as hypertension. According to the Indonesian Ministry of Health (2021), people with hypertension have the highest risk of stroke and cardiovascular disease. There are two forms of hypertension: primary and secondary. Secondary hypertension is caused by conditions affecting the kidneys, thyroid, blood vessels, and other organs, while primary hypertension has no known cause (Delfriana, 2022).

According to data from the Basic Health Research (2018), the percentage of the Indonesian population aged 18 years and older suffering from hypertension increased from 25.8% to 34.1%. According to the South Sumatra Provincial Health Profile (2022), there are an estimated 1,979,134 people in the province over the age of 15.

According to the Empat Lawang District Health Office profile, 52,373 people in the district are expected to suffer from hypertension in 2022 - 24,186 males and 28,187 females - aged over 15 years. Based on data from the NCD monitoring report of the Empat Lawang District Health Office, Puskesmas Tebing Tinggi ranked first in the number of estimated hypertensive patients in Empat Lawang District, with 9,212 people; this figure increased to 12,785 people in 2023.

Both pharmaceutical and non-pharmacological treatments are required for hypertensive patients. Using drugs to regulate blood pressure is known as pharmacological therapy, which aims to prevent and treat hypertension. Whereas nutritional therapy, which involves setting a hypertensive diet, lowering sodium intake, and increasing potassium, calcium, magnesium, and fiber intake, is a non-pharmacological treatment given to hypertensive patients (Saprila, 2019).

Soya beans are a functional food that can lower blood pressure. They contain isoflavones and tryptophan amino acids that can prevent blood vessel blockage, reduce fat accumulation in blood vessels, improve blood circulation throughout the body, cut the chance of developing coronary heart disease, and reduce muscle tension (Triandini et al., 2021).

Besides being rich in phenolic acids, anthocyanins, tocopherols, and beta carotene, sweet potatoes are also rich in dietary fiber, minerals, and vitamins. The multicolored flesh of sweet potato tubers also results from the content of antioxidants, carotenoids, and phenolic chemicals. The colors include white, yellow, orange, and purple (Tuhumury et al., 2018). The amount of anthocyanins in purple sweet potatoes is considerable. The function of anthocyanins in purple sweet potatoes is to counteract free radicals, antimutagens, anti-carcinogens, and anti-hypertension (Alifianita, 2022).

Most people's favorite snacks are pastries. Since cookies are a favorite food, they should have more nutritional content and a wider variety of products (Utami et al., 2018). This formula was developed to make healthy snacks that are alternative snacks for people with hypertension because, in general, there are still minimal healthy snacks on the market, especially snacks for people with certain diseases such as hypertension.

Research results (Zahra et al., 2022) show that giving hypertension patients at the Kertapati Palembang Health Center snack bars made of soy flour and yellow sweet potato flour affected their blood pressure levels both before and after.

RESEARCH METHODS

Quantitative research utilizing a quasi-experimental design was the methodology used. To determine whether the comparison group and the treatment group differ from one another at baseline, two groups were selected and given a pretest as part of the pre-test-post design utilized in this research. In this two-subject research design, the comparison group did not receive treatment, while the treatment group received direct treatment from the investigator to ascertain how Delaru Cookies affect hypertension individuals' blood BP. The study was carried out at the Empat Lawang Regency's Tebing Tinggi Health Center in South Sumatra Province. The study was conducted in April 2024. Thirty people were selected as samples in each group. using systematic random sampling method for sampling. The respondents received treatment as snacks twice a day for seven consecutive days. SPSS was used for statistical data analysis in this study. No. for ethical clearance: 0436/KEPK/Adm2/III/2024.

RESULTS

Delaru cookies are used as a snack, especially as an alternative food for hypertensive patients. They are given twice a day for 7 consecutive days, and one serving weighs 57.5 grams. The nutritional content is 232.79 kcal, protein 6.46 grams, fat 8.89 grams, carbohydrates 31.75 grams, sodium 75.79 mg, potassium 326.23 mg, and fibre 5.44 grams.

The research findings, which were based on the characteristics of the respondents, showed that, out of 80 respondents with hypertension, the majority (77.5%, or 31 people) were classified into two groups: the treatment group (n = 34) and the comparison group (n = 85). The gender-specific characteristics of the respondents revealed that most of the hypertensive respondents (62.55%; 24 persons) were female in both the treatment group and the comparison group. Regarding the nutritional status of respondents in the treatment and comparison groups, most had normal nutritional status, namely 57.5% (23 people) and 62.5% (25 people), as shown in Table 1.

The treatment group's mean blood pressure analysis revealed a 1.68 mmHg drop in systolic blood pressure and a 2.1 mmHg drop in diastolic blood pressure. Table 2 demonstrates that the comparison group receiving no treatment did not experience a drop in blood pressure.

According to Table 3. Based on the analysis of respondents' energy intake data, the average macronutrient intake showed an increase of 482.65 kcal in the average energy intake of the treatment group respondents before and after the intervention.. The average protein intake increased by 14.29 grams. The fat intake of the treatment group respondents before the intervention was 44.32 grams, and after the intervention was 62.46 grams. Based on this, it was found that respondents in the treatment group consumed an average of 18.14 grams more fat and 229.55 grams more carbohydrate before and after the intervention, compared to 163.88 grams and 229.55 grams, respectively. This indicates that respondents in the treatment group experienced an average increase in carbohydrate intake of 65.67 grams.

Table 4 displays the findings of the micronutrient intake data analysis, which shows that the average sodium intake of respondents increased by 248.27 milligrams, the average potassium intake increased by 744.89 milligrams, and the average fiber intake increased by 11.81 grams in the treatment group.

Table 1. Characteristics of Respondents

Characteristics	Group			
	Treatment		Control	
	n	%	n	%
Age				
40 – 49	9	22,5	6	15
50 - 64	31	77,5	34	85
Gender				
Laki-laki	16	40	15	37,5
Wanita	24	60	25	62,5
Nutritional status				
Severe weight loss	0	0	0	0
Mild degree of weight loss	2	5	2	5
Normal	23	57,5	25	62,5
Mild degree of overweight	8	20	12	27,5
Severe overweight	7	17,5	2	5
Total	40	100	40	100

Table 2. Mean Blood Pressure Before and After Intervention

Blood pressure	Group		Min	Max	Mean±SD	SD
Systolic	Treatmnet	Before	141	174	157,75±7,88	1,24
		After	140	172	156,07±8,10	1,28
	Control	Before	140	168	155,20±6,8	1,08
		After	141	172	155,35±7,88	1,24
Diastolic	Treatmnet	Before	82	101	92,17±4,56	0,72
		After	83	99	90,07±4,00	0,63
	Control	Before	84	98	91,40±3,38	0,53
		After	81	101	91,37±4,49	0,71

Table 3. Mean Macronutrient Intake Before and After Intervention

Group	Nutrients		Min	Max	Mean±SD	SE
Treatment	Energy	Before	795,20	1703,50	1243,33±223,17	35,28
		After	1346,68	2042,98	1725,98±164,65	26,03
	Protein	Before	22,80	70,20	43,88±10,15	1,60
		After	38,97	74,87	58,17±7,6	1,20
	Fat	Before	20,80	86,80	44,32±17,56	2,77
		After	32,33	89,58	62,46±13,81	2,18
	Carbohydrate	Before	124,90	215,90	163,88±23,65	3,74
		After	150,08	273,45	229,55±23,87	3,77
Control	Energy	Before	796,40	1635,80	1160,55±200,38	31,68
		After	971,00	1713,75	1322,18±156,00	24,66
	Protein	Before	19,50	69,80	40,91±11,30	1,78
		After	30,05	73,50	46,92±8,05	1,27
	Fat	Before	10,80	78,80	40,11±13,41	2,12
		After	19,30	74,60	47,05±14,42	2,28
	Carbohydrate	Before	124,90	215,90	163,88±23,65	3,74
		After	150,08	273,45	229,55±23,87	3,77

Table 4. Mean Micronutrient Intake Before and After Intervention

Group	Nutrients		Min	Max	Mean±SD	SE
Treatment	Sodium	Before	55,10	1269,40	219,22±232,62	36,78
		After	225,58	882,14	467,49±184,94	29,24
	Pottasium	Before	350,10	1488,60	859,20±281,88	44,56
		After	1066,61	2267,27	1604,09±280,02	44,27
	Fibre	Before	2,20	9,20	4,85±1,77	0,28
		After	13,88	20,88	16,66±1,46	0,23
Control	Sodium	Before	47,90	1269,80	239,23±254,22	40,19
		After	70,65	1747,05	247,53±300,91	47,57
	Pottasium	Before	340,10	1701,70	917,95±309,22	48,89
		After	469,00	1614,90	996,70±598,84	94,68
	Fibre	Before	1,80	9,50	5,09±1,88	0,29
		After	3,10	8,75	5,60±1,34	0,21

Based on Table 5, statistical tests (t-dependent tests) revealed a significant difference in the treatment group's average systolic and diastolic blood pressure before and after they were given antihypertensive medications and delaru biscuits.

The statistical test (t-dependent) results showed that the mean systolic and diastolic blood pressure in the treatment group differed substantially before and after the intervention. Conduct a statistical test using the independent t-test to ascertain whether Delaru Cookies affect decreasing blood pressure. It is possible to conclude that the administration of Delaru was successful because the results of the t-independent statistical test showed a p-value of less than 0.05.

Table 5. Mean Difference in Blood Pressure Before and After Intervention

Blood pressure	Group		Mean±SD	SE	*p-value*
Systolic	Treatmnet	Before	157,75±7,88	1,24	0,015
		After	156,07±8,10	1,28	
	Control	Before	155,20±6,82	1,08	0,796
		After	156,35±7,88	1,24	
Diastolic	Treatmnet	Before	92,17±4,56	0,72	0,000
		After	90,07±4,00	0,63	
	Control	Before	91,40±3,38	0,53	0,954
		After	91,37±4,49	0,71	

Table 6. Average Difference in Blood Pressure

Blood pressure	Group	Mean±SD	SE	Δ *Mean*	*p-value*
Systolic	Treatmnet	1,67±4,14	0,65	1,825	0,040
	Control	-0,15±3,64	0,57		
Diastolic	Treatmnet	2,10±2,35	0,37	2,075	0,000
	Control	0,02±2,71	0,32		

DISCUSSION

Characteristics of Respondents

According to the research findings, the majority of the 80 respondents who had hypertension were between the ages of 50 and 64. When a person reaches the age of 45, the buildup of collagen substances in the muscle layer causes the artery walls to thicken, narrowing and stiffening the blood vessels. Age-related increases in blood pressure can result from narrowing of blood arteries that impair circulation (Maulia et al., 2021).

The characteristics of respondents based on gender show that respondents who suffer from hypertension are primarily female. Gender is one of the variables that can affect the increase in blood pressure resulting in hypertension, this is due to a decrease in estrogen in women who have menopause (Falah, 2023).

Abnormal dietary status impacts blood pressure, particularly in obese people. Individuals who are obese require more blood to fill all body tissues with oxygen and nutrients, which causes the amount of blood flowing through the blood arteries to increase. Hypertension in adults results from decreased elasticity of blood vessels and increased arterial stiffness. Arterial stiffness causes hypertension, which can be overcome by physical activity, such as strengthening the smooth muscles of the heart (Melini, 2021).

Nutrient Intake

The results of data analysis of respondents' energy intake show that the respondents' average daily energy consumption before and after the intervention, in the treatment group, has increased by 482.65 kcal. In this study, respondents' energy intake consumed was rice, noodles, vermicelli, tubers such as sweet potatoes, and foods made from processed flour, such as pempek. Energy intake is not directly related to hypertension, but excessive consumption levels can produce nutritional problems affecting blood pressure, such as being overweight (Fadillah, 2023).

The amino acid arginine, contained in protein, can trigger a vasodilating effect, resulting in dilation of blood vessels. This can reduce blood vessel tension, lowering blood pressure (Hasni et al., 2021). Tryptophan and tyrosine, antihypertensive amino acids found in animal protein, form serotonin in the central

nervous system. Blood pressure can also be lowered by essential amino acids, which are present in plant proteins. This amino acid prevents insulin from catabolizing proteins by increasing protein synthesis in heart and muscle cells. This leads to increased peripheral blood flow and cardiac output, which can reduce blood pressure (Ramadhini, 2019).

Respondents' frequent use of fat comes partly from oil and other fat-containing foods such as eggs, coconut milk, and fried foods. Eating too much fat can cause an increase in blood cholesterol levels, particularly Low-Density Lipoprotein (LDL). This may result in the accumulation of cholesterol plaques on blood vessel walls, narrowing and stiffening the arteries. An increase in blood pressure volume may result from the blockage of blood vessels caused by plaque, which reduces their flexibility (Yuriah et al., 2019).

Excess energy consumption will be stored as fat, which can lead to obesity. Obesity increases a person's risk of cardiovascular disease, including hypertension (Mulyasari & Srimiati, 2020). Consuming too many carbohydrates often leads to increased blood triglyceride levels. These excess carbohydrates will be converted into fat, which can eventually lead to atherosclerosis and hypertension (Masriadi, 2022).

The research findings on participants' sodium intake were mainly due to flavorings, salt, canned foods, processed foods with soy sauce, and fast food noodles. An excessive salt diet may cause the arteries to narrow, which makes the heart work harder to pump blood through smaller openings. As a result, blood pressure rises, thus increasing the chances of hypertension. Study conducted by (Fitri et al., 2018)

Insufficient potassium consumption may increase blood pressure. Adequate potassium consumption in accordance with daily requirements can lower blood pressure in hypertensive patients. High potassium consumption can increase the potassium concentration in intracellular fluid, thereby drawing in extracellular fluid and lowering blood pressure.

Consuming fiber is connected to the development of hypertension and helps lower the risk of hypertension. Because fiber can excrete cholesterol through feces and can reduce energy intake, fiber can provide a longer feeling of satiety, preventing obesity, which in turn will lower the chance of developing hypertension (Utari et al., 2021).

Effect of Giving Cookies on Blood Pressure

According to the study's findings, the therapy group's mean systolic blood pressure was 1.68 mmHg lower before and after the intervention, measuring 157.75 mmHg and 156.07 mmHg, respectively. The diastolic blood pressure decreased by 2.1 mmHg due to the intervention, reaching 90.07 mmHg and 92.17 mmHg, respectively.

The results of the t-dependent test, which revealed a p value <0.05, demonstrated that the treatment group's average systolic and diastolic blood pressure varied considerably before and after receiving antihypertensive medications and delaru crackers. Thus, the administration of delaru biscuits had an impact on blood pressure. Given that the t-independent statistical test produces a p-value of less than 0.05, delivering Delaru Cookies to hypertensive patients impacts lowering blood pressure.

Soy bean flour and purple sweet potato flour, which are high in potassium and fiber, make delaru cake. Soy protein, which is high in potassium and arginine, helps lower blood pressure. Increasing potassium and protein intake can lower blood pressure because potassium in food acts as an antihypertensive, and protein is beneficial for both systolic and diastolic blood pressure (Kusumastuty et al., 2016). Sweet potatoes' high potassium content also helps to keep the heart functioning correctly, which lowers blood pressure (Darmawati, 2018).

Fiber can lower blood pressure by up to 5.5 mmHg in the systolic range and up to 3 mmHg in the diastolic range. Consumption of a good amount of fiber, which is 25-30 grams per day, can bind bile acids, thus reducing the absorption of fat and cholesterol in the blood, which thereby lowers the likelihood of hypertension (Sunarti, 2017).

Research conducted by Zahra (2022) at the Kertapati Palembang Health Center revealed that giving figbar snacks of soy bean flour, with a p-value of less than 0.05 or 0.013, yellow sweet potato flour reduced

blood pressure in the treatment group both before and after the experiment. This research is consistent with Puspitasari (2018), who found that giving soya bean biscuits to participants throughout the seven-day experiment may lower their blood pressure in both the systolic and diastolic ranges.

CONCLUSIONS

Giving delaru biscuits impacts reducing blood pressure, according to an independent t-test's findings (p-value <0.05). People with hypertension are advised to eat meals high in fiber and potassium and low in sodium.

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