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Research Article

The Effectivity of Flavonoid Content Which Contained in "*Dark Chocolate*" with Decreased Blood Pressure in Hypertension Without Complication Patients at Tresna Werdha Public Center in 2017

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Abstract

As the times progressed, lifestyle and food pattern alterations have taken place in society these days. Such things cause the health issues, such as hypertension. Research recently declared "*Dark Chocolate*" could be oneof the blood pressure-lowering food alternatives. This research aims to find out if "*Dark Chocolate*" could lower blood pressure in hypertension without complications in patients. The research method is a descriptive quantitative study, and the research has been done on 30 women 80-97 years old elderly at Tresna Werdha Public Center, Cibubur. The blood pressure was measured by calculating the systolic and diastolic blood pressure in mmHg before and after consuming *"Dark Chocolate"*. Data analysis was using the SPSS statistic test. The result of the research is that the blood pressure in 15 respondents who consumed *"Dark Chocolate"* began to decrease on the third day ($p<0,05$). Finally, it is concluded that "*Dark Chocolate"* could lower blood pressure.

Keywords: *"Dark Chocolate",* blood pressure

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INTRODUCTION

Along with the development of the current era, there has been a change in people's lifestyles to become more practical. Dense activities and activities make people prefer "Junk Food" to be consumed to save time and be more practical. These changes make people forget the meaning of a healthy lifestyle. It causes unavoidable health problems, one of which is hypertension.

Hypertension is a disease often found in adults and is a common health problem in society. This disease runs continuously throughout life and often without any typical complaints if there are no complications in the body's organs. So it is not surprising that hypertension is dubbed the silent killer. Hypertension is a disease that can attack anyone, regardless of age, race, or socioeconomic status. Therefore, hypertension is often a "heterogeneous group of diseases" [1]. This disease is not contagious but is the endpoint of the journey of various risk factors. These risk factors can come from behaviour or heredity. Many studies state that lifestyle changes are factors that cause hypertension. Sometimes it is often found that hypertension does not stand alone. Hypertension will be followed by other body reactions that will lead to abnormalities in the circulatory system in the blood vessels [2].

Increased blood pressure can affect the heart's blood vessels. If it lasts a long time, heart failure will occur, followed by shortness of breath, a more severe result is the occurrence of stroke and death because blood flow is not smooth, so the oxygen supply carried by red blood cells becomes obstructed. Almost one billion people worldwide have high blood pressure. Of that number, two-thirds come from developing countries, and we know that Indonesia is included in the group of developing countries [3]. It is the cause of death for nearly 8 million people every year, and nearly 1.5 million of them are from Southeast Asia. That way, it can be said that about a third of adults in Southeast Asia have hypertension [4]. In Indonesia, hypertension itself is still very often found in the community. The prevalence of hypertension is relatively high, namely 25.8%. These data were obtained by measuring people's blood pressure under>18 years [5]. If the data is described, it is found that the area with the highest prevalence is Bangka Belitung (30.9%), followed by South Kalimantan (30.8%), and East Kalimantan (29.6%), and West Java (29.4%) [6]. Hypertension is also a significant risk factor for cardiovascular diseases such as stroke and heart disease [7]. Cardiovascular disease is still the highest cause of death in many countries, especially in Indonesia and the highest cause of death in 15 districts/cities was a stroke, 17.7% [8]. Researchers have attempted various drugs and therapies to be an antidote to hypertension. One of the foods recently been investigated as a blood pressure-lowering agent is cocoa. The author hopes that this research can be a door to open other new research related to efforts to reduce blood pressure in people with hypertension so that future steps will make Indonesia healthier.

Based on the description in the background of the problem above, the formulation of the problem in this study is "Is "Dark Chocolate" effective in lowering blood pressure in patients suffering from hypertension without complications? The research aims to determine whether "Dark Chocolate" can lower blood pressure.

LITERATURE REVIEW

Hypertension is a condition where there is an increase in systolic blood pressure greater than 140 mmHg and diastolic more significant than 90 mmHg on two measurements with an interval of 5 minutes in a state of sufficient rest (calm). Hypertension is a condition with an increase in blood pressure of more than 140/90 mmHg [9]. Hypertension is a disease due to the interaction and correlation of various risk factors that a person has. The triggering factors for hypertension are divided into those that cannot be controlled, such as family history, gender, and age. However, several factors can be controlled, such as obesity, lack of physical activity, smoking behaviour, and consumption patterns of foods that contain too much sodium and saturated fat. Increased blood pressure dramatically affects the blood vessels of the heart [10]. If it lasts for a long time, heart failure will occur, followed by shortness of breath, a more severe result is the occurrence of stroke and death because blood flow is not smooth, so the oxygen supply carried by red blood cells becomes blocked.

Hypertension can be divided into three groups, namely systolic hypertension, diastolic hypertension, and mixed hypertension. Systolic hypertension (isolated systolic hypertension) increases systolic pressure without an increase in diastolic pressure and is generally found in the elderly [11]. Systolic pressure is related to the high pressure in the arteries when the heart contracts (heart rate). Systolic pressure is the maximum pressure in the arteries and is reflected in the blood pressure reading as the upper pressure is more significant. Diastolic hypertension (diastolic hypertension) increases diastolic pressure without an increase in systolic pressure, usually found in children and young adults. Diastolic hypertension occurs when small blood vessels narrow abnormally, increasing the blood flow resistance and increasing their diastolic pressure [12]. Diastolic blood pressure is related to arterial pressure when the heart is relaxed between beats. Mixed hypertension is an increase in systolic and diastolic pressure. Based on the cause, hypertension is divided into two groups, namely essential hypertension and secondary hypertension. Risk factors for hypertension are divided into two types: non-modifiable risk factors (age, gender, and family history) and modifiable risk factors (smoking, obesity, stress, physical activity, sodium intake) [13].

Blood pressure is a complex trait determined by the interaction of various factors such as genetic and environmental factors that affect two hemodynamic variables, namely cardiac output and total peripheral resistance [14]. Cardiac output is a factor that determines the value of systolic blood pressure and peripheral resistance. Total blood pressure determines diastolic blood pressure. An increase in blood pressure can occur due to an increase in cardiac output / or an increase in total peripheral resistance. The kidneys have a role in controlling blood pressure through the renin-angiotensin-aldosterone system. Renin produced by the juxtaglomerular cells of the kidney converts angiotensinogen to angiotensin-1, then angiotensin-1 is converted to angiotensin-2 by the angiotensin-converting enzyme (ACE). Angiotensin-2 can bind to angiotensin-2 type 1 (AT1) receptors or angiotensin-2 type 2 receptors (AT2). Stimulation of AT1 receptors can increase blood pressure through pressor effects and blood volume [15].

The pressor effects of angiotensin-2 include vasoconstriction, stimulation of catecholamine release from the adrenal medulla, and increased activity of the sympathetic nervous system. In addition, angiotensin-2 stimulates aldosterone synthesis from the adrenal cortex, which causes sodium and water retention [16]. This water results in an increase in blood volume, an increase in total peripheral resistance, and finally, blood pressure. Most clinical symptoms arise after experiencing hypertension for years. Unsteady due to nervous system damage, nocturia (increased urination at night) due to increased renal blood flow and glomerular filtration, dependent oedema due to increased capillary pressure. Involvement of cerebral vessels can lead to stroke or transient ischemic attack manifesting as transient paralysis of one side or hemiplegia or visual disturbances.

The evaluation of hypertensive patients has three objectives, namely: a) identifying the cause of hypertension; b) assessing the presence of target organ damage and cardiovascular disease, the severity of disease, and response to treatment; and c) identify the presence of other cardiovascular risk factors or comorbidities, which contribute to the prognosis and help determine treatment guidelines. The diagnosis of hypertension cannot be made in one measurement and can only be established after two or more measurements at different visits unless there is an increase in height or accompanying clinical symptoms [17]. Blood pressure measurements were performed while the patient sat after resting for 5 minutes. The instrument used to measure blood pressure is called a sphygmomanometer. There are several types of sphygmomanometer, but the most common consists of a rubber cuff wrapped in a material fixed around it evenly without causing constriction.

The history taken includes the level of hypertension and duration of treatment, previous antihypertensive treatment, history and symptoms of related diseases such as coronary heart disease, cerebrovascular disease and others. Is there a history of disease in the family, symptoms related to hypertension, symptoms of organ damage, changes in activity or habits as risk factors for hypertension (such as smoking, food consumption, history and personal, family, environmental, work, and other factors) [18]. Supportive examinations that can be performed include routine laboratory examinations before starting therapy to determine the presence of organ damage and other risk factors or find the cause of hypertension. Urinalysis, complete peripheral blood, blood chemistry (potassium, sodium, creatinine, fasting blood sugar, total cholesterol), and ECG examinations are performed [19].

Additional Antihypertensive Therapy "Cocoa"/"Dark Chocolate" - Cocoa comes from the word "cacao", which is taken from the Mayan and Aztec languages. Chocolate is a processed product of cocoa beans derived from the Theobroma cacao tree. Theobroma is a member of the Sterculiaceae family. Cocoa pods are elliptical (about 15-25 cm long and 7-10 cm wide) with relatively thick skin (10-15 mm), and the green colour when young changes to yellow, orange, red or purple when ripe, although, in some varieties, the colour remains green when the fruit is ripe. The flesh of the fruit covers 20-40 cocoa beans. The flesh fruit has a soft and slimy consistency with a sweet taste and a milky white colour in the ripe fruit. The cocoa beans themselves are oval. Seeds are about 2 cm long, about 1 cm wide and weigh about 1 gram when dried.

Cocoa powder has a high polyphenol content compared to dark and white chocolate. Where the total polyphenol content for cocoa powder (catechin content, epicatechin) is 65 mg/g (2.96-3.27), dark chocolate is 36, 5 mg/g 90.48-1.37), and white chocolate 15 mg/g (0.15-0.16). Cocoa is rich in flavonols in the form of monomers (epicatechin and catechin), oligomers (procyanidins, B1, B2, and C1), and polymers

(procyanidins) [20]. The flavonols present in cocoa are stable in the stomach. The monomer form is absorbed in the small intestine, while the oligomeric and polymeric forms must be transformed by microbiota colonies in plasma after 2 hours of cocoa consumption (54.4 mg) and persist in plasma for 6-24 hours. 8 hours. The biological effects of flavonols are their antioxidant, anti-inflammatory, anti-thrombocytic and antihypertensive effects. Cocoa contains both quality and quantity of high antioxidants compared to other sources rich in flavonoids such as green tea, red wine, blueberries, garlic, and strawberries. The presence of these flavonoids causes cocoa to be beneficial for cardiovascular health. The increase in the concentration of epicatechin in plasma signals the release of vasoactive substances from the endothelium, namely the release of nitric oxide (NO) and prostacyclin [21]. NO's function is to vasodilate blood vessels, relax vascular smooth muscle, and inhibit platelet aggregation. Flavonoids increase cerebral blood flow. They have a positive impact on the ageing process and improve endothelial function. In addition, the antioxidant effect of cocoa also reduces or prevents oxidative stress and endothelial dysfunction so that vasoconstriction does not occur. Another ingredient that causes vasodilation of blood vessels is theobromine, which inhibits phosphodiesterase. The reduced capacity of endothelial cells characterizes endothelial dysfunction. To cause vasodilation by releasing NO.

According to recent studies, it is said that cocoa can lower blood pressure due to its flavonoid content which can cause the release of NO, causing vasodilation of blood vessels which reduces the burden on the heart and lowers blood pressure [22]. Hypertension is one of the significant risk factors for developing cardiovascular disease, including coronary disease, stroke, kidney disease, and heart failure [23]. Consumption of dark chocolate 100 grams per day (equivalent to 29 grams of cocoa powder) for at least seven days can have a blood pressure-lowering effect [24]. Cocoa for four days can cause vasodilation of peripheral blood vessels. The monomeric form of the monomeric catechin and epicatechin units is associated with the vasodilating effect. A slight reduction in blood pressure in hypertensive patients has a significant impact on reducing the cardiovascular risk of the population. The risk reduction is 2-3% per mmHg per day.

RESEARCH METHOD

This study used a parallel non-matching parallel experimental clinical trial study design with random allocation, open trial. The use of "Dark Chocolate" was determined as the independent variable and the decrease in blood pressure as the dependent variable. The clinical endpoint that we want to see is the effect of cocoa administration on reducing blood pressure in hypertensive patients with hypertension patients taking antihypertensives in general. This research was conducted at Sasana Tresna Werdha (STW), Cibubur JL. Karya Bhakti Km 17, Cibubur. This study was conducted from November 26, 2017 – to December 2, 2017. The population of this study were all patients with hypertension without complications. In contrast, the sample of this study was all affordable populations selected by consecutive random sampling of as many as 30 hypertensive patients who had previously undergone therapy without complications (already signed informed consent). The variables of this research are the provision of "Dark Chocolate" (independent variable), the blood pressure profile of research subjects (dependent variable), and the effects that occur due to intervention (respond variable). The research instruments are complex data forms, soft data forms, sphygmomanometer, stethoscope, medical record data and questionnaires. Research data processing is done using a computer through the SPSS program. The data processing steps are carried out, namely editing, coding, tabulation, and displaying the data.

RESULT AND DISCUSSION

As explained briefly in the introductory chapter, cocoa itself can lower blood pressure due to its flavonoid content which can cause the release of NO, causing vasodilation of blood vessels which reduces the heart's burden and lowers blood pressure. Hypertension is one of the significant risk factors for developing cardiovascular disease, including coronary disease, stroke, kidney disease, and heart failure. Consumption of dark chocolate 100 grams per day (equivalent to 29 grams of cocoa powder) for at least seven days can have a blood pressure-lowering effect. The use of cocoa for four days can cause vasodilation of blood vessels. The monomeric form of the monomeric catechin and epicatechin units is associated with the vasodilating effect. A slight reduction in blood pressure in hypertensive patients has a significant impact on reducing cardiovascular risk. The risk reduction is 2-3% per mmHg per day.

Researchers chose Dark Chocolate as a test material because previous studies have proven that the levels of polyphenols contained can lower blood pressure by acting on the function of the endothelial wall in blood vessels of patients with stage 1 hypertension without complications. Cocoa (Theobroma Cocoa) has long been the main component in the manufacture of chocolate. Cocoa itself is a rich food source of polyphenols, which account for 6-8% of the dry weight of cocoa beans. Flavonoids themselves have thousands of derivatives from the polyphenol family. There are several subgroups. Avoids include flavonols, avone, avanone, avan3-ols (sometimes known as avanols), iso avones, and anthocyanins. They are found in many vegetables, fruits, grains, and plants. In addition to cocoa, avanol compounds are naturally found in strawberries, apricots, grapes, apples, pomegranates, black tea, and green tea.

Table 1: Flavanol Content of Various Nutrients

Type of Nutrition	Flavanol Content (mg/L)
Chocolate	460-610
Green tea	100-800
Black Tea	60-500
Apple	20-120
Apricot	100-250
Strawberry	130

The macronutrient content is found in chocolate, namely carbohydrates (50-60%), fat (32-35%), and protein (3-7%). Chocolate contains theobromine, minerals (magnesium and phosphorus), and vitamins.

Flavanols reach plasma concentrations within 2 to 3 hours after ingestion. However, the bioavailability of chocolate is low and can only be detected at a non-molar level. The presence of hydrophobic and hydrophilic residues of the avanol molecule allows interaction with phospholipid groups and adsorption to the membrane surface. Such interactions alter the function of functional enzymes, receptors, and protein receptors present on the membrane.

Table 2: Cardiovascular Mechanisms by Flavanols in "Dark Chocolate"

Important Mechanisms Caused by Flavanols Found in "Dark Chocolate"
Decreases LDL-C and TG levels increase HDL-C. levels
Inhibits / Decreases Oxidation in LDL
Reduces endothelial NO activity
Reduces platelet aggregation
Decreases the expression of several mediators of inflammatory genes (IL 1, IL2, IL4, IL6 and TNF)
Reduced cellular adhesion molecule expression (VCAM-1, ICAM-1) ACE. inhibition/reduction
Important Mechanisms Caused by Flavanols Found in "Dark Chocolate"

Respondents in this study were older women who live in Sasana Tresna Werdha Cibubur, with as many as 30 respondents. The rules for drinking have been informed to the respondents through each respondent's initial informed Consent stage, which contains the drinking schedule and the possible side effects for each respondent. Researchers have also carried out initial screening through blood pressure measurements before consuming Dark Chocolate in the form of powder and drunks like drinking milk or tea. All respondents received the same treatment at Sasana Tresna Werdha Cibubur, which includes: food consumed every day, drinks consumed, activities that they do every day, bedtime, and even having classes every day to keep learning and train their memory.

Each respondent has agreed to participate in the study through an informed consent form that the researcher has given. Respondents were also tested for initial blood pressure and assessed the primary data obtained through history taking. In the history, the researchers paid great attention to past medical history, family history of illness, and personal habits, both before living at STW Cibubur and after living at STW Cibubur.

Researchers have also ensured that while participating in this study, respondents did not consume certain drugs or solutions that could interfere with the work activities of cocoa in the respondent's body. Initial Blood Pressure measurements and primary data were taken through history taking at the end of November 2017 at Sasana Tresna Werdha Cibubur. The next step is on November 26, 2017-December 2, 2017, the respondents started consuming 450 mg of flavanol or the equivalent of 2 cups of chocolate taken two times in 1 day.

The drinking rules that each respondent must obey are: a) the drinking schedule is one time after breakfast and one time after dinner; b) it must not be mixed with anything (sweeteners, any kind of sugar, milk, or other ingredients); c) only use warm water (no cold water, ice cubes, or other mixed water); d) brewed using a glass that has been distributed by the researcher (same size); e) If you are taking medication, the respondent should temporarily stop consuming Dark Chocolate; f) If there are side effects (diarrhoea, nausea, vomiting, difficulty in defecating/BAK) the respondent is obliged to report it to the supervisor/researcher; and g) if the respondent feels unpleasant changes in the body, the respondent has the right to refuse to continue this research.

As long as the respondent participates in the study by consuming Dark Chocolate 2 times in 1 day, the supervisor will measure the respondent's blood pressure and see if each respondent experiences any side effects. It is done every morning and night after consuming Dark Chocolate. It is done in order to reduce the morning bias of this study. The study was conducted for seven days or one week. On the seventh day or the last day, the researcher returned and did the final Blood Pressure Measurement and saw whether or not there were side effects or changes that occurred in each respondent.

Table 3: Distribution of Age Profile in Patients with Uncomplicated Hypertension at Sasana Tresna Werdha in 2017.

Age	**Respondents**	**%**
80 – 82	12	40 %
83 – 85	6	20 %
86 – 88	4	13,33 %
90 – 91	2	6,67 %
92 – 94	4	13,33 %
95 – 97	2	6,67 %
Number	**30**	**100 %**

Based on the table above, which is table 3, it is stated that of the 30 respondents with uncomplicated hypertension at Sasana Tresna Werdha. Most of them came from the middle elderly age group, namely those aged 80 – 82 years were as many as 12 respondents (40%), while the second-highest score for the number of respondents affected by uncomplicated hypertension in the second middle age group, namely at the age of 83-85 years as many as six respondents (20%). It is related to epidemiological studies, which were found researchers that the incidence of hypertension in the elderly is high. After the age of 69 years, the prevalence of hypertension increases up to 50%. In Asia, a study in the city of Tainan, Taiwan, showed the following results: a study over the age of 75 years with hypertension criteria based on JNC VII found that the prevalence of hypertension was 60.4% (men 59.1% and women 61.9%), previously diagnosed hypertension was 31.1% (men 29.4% and women 33.1%), newly diagnosed hypertension was 29.3% (men 29.7% and women 28.8%). In this group, there is a family history of hypertension, one of the risk factors for hypertension (Lu et al., 2001).

Table 4: Distribution of Blood Pressure Profiles in Patients with Hypertension without Complications at Sasana Tresna Werdha in 2017.

Hypertension Category (Based on JNC VIII)	Respondents	%
Normal High	4	13,33 %
Hypertension Grade 1	16	53,33 %
Hypertension Grade 2	10	33,33 %
Total	**30**	**100 %**

Based on the table above, which is table 4, it is stated that the hypertension category with the highest number of respondents with hypertension is grade 1 hypertension, with the systolic blood pressure of 140 -159 mmHg and diastolic blood pressure of 90-99 mmHg, which is 16 respondents (53.33%), while for hypertension grade 2 with the systolic blood pressure of 160 – 179 mmHg and diastolic blood pressure of 100 – 109 mmHg, as many as ten respondents (33.33%). The hypertension category was adjusted according to The Joint National Committee (JNC) VIII.

The recommendations in JNC 8 are based on the JNC 8: Evidence-based Guideline issued by the Division of Cardiology, Department of Internal Medicine, Faculty of Medicine Indonesia. Several guidelines, such as the American Diabetes Association, have raised the systolic blood pressure target to a value similar to the JNC 8 guideline. The European Society of Hypertension/European Society of Cardiology also recommends a target systolic blood pressure lower than 150 mmHg. However, it is unclear what age benchmark is in the general population, and there is a lack of study evidence in many clinical situations. One of the new, critical points in the JNC 8 guidelines is the change in the target systolic blood pressure for patients aged 70 and over (target systolic <150mmHg and target diastolic <90mmHg) compared to the target systolic blood pressure <140mmHg and target diastolic <90 mmHg in the previous guidelines.

Table 5: Changes in Blood Pressure by Days After Giving "Dark Chocolate" to Patients with Hypertension without Complications at Sasana Tresna Werdha in 2017.

Changes in blood pressure day -	Number of Respondents with Changes in Blood Pressure	%
2	2	13,33 %
3	9	60 %
4	4	26,67 %
Total	**15**	**100 %**

Based on the table above, namely table IV.2.3, it can be seen that the change in blood pressure in patients with hypertension without complications in Sasana Tresna Werdha in 2017 was highest on day 3, namely, nine respondents (60%) of 15 respondents who given "Dark Chocolate". Meanwhile, four respondents (26.67%) of 15 respondents experienced changes in blood pressure on the fourth day after giving "Dark Chocolate". Based on the results obtained by the researchers, the changes in blood pressure after consumption of "Dark Chocolate" were mainly on the third day after administration for seven days/1 a week. Rich in polyphenols, it can lower blood pressure in patients with hypertension without complications and prevent various other pathological conditions related to blood pressure and blood vessel walls, especially in hypertensive patients who are over 70 years of age.

The distribution of changes in blood pressure after consumption of "Dark Chocolate" was observed in the Kuna people in 2014. In that population, changes in blood pressure after administration of "Dark Chocolate" occurred on day 4. Previous studies even detailed the food consumed by the respondents studied. It is contrary to the results obtained by the researcher that changes in blood pressure were obtained on day 3. This difference could occur due to the type of activity carried out by 15 respondents in Sasana Tresna Werdha and related to the type of food and drink consumed by the respondent.

Table 6: Changes in Blood Pressure in Uncomplicated Hypertensive Patients Consuming “Dark Chocolate” and Placebo at Sasana Tresna Werdha in 2017.

Test Material	Changes in respondent's blood pressure blood pressure	There is no change in the respondent's blood pressure	Percentage of Respondents Experienced Changes Blood pressure	P-value
“Dark Chocolate”	15	0	50 %	<0,05
Placebo	3	12	10 %	
Total	**18**	**12**	**60 %**	

Based on the table above, it was found that as many as 15 respondents (50%) experienced changes in blood pressure after giving "Dark Chocolate" for seven days, where "Dark Chocolate" was consumed two times a day, after breakfast and after dinner. Meanwhile, for respondents who received Placebo, only three respondents (10%) experienced changes in blood pressure with the same consumption rules as respondents who consumed "Dark Chocolate". The final results obtained came from calculating the decrease in systolic and diastolic pressure, which were calculated separately for each respondent after that, divided by the total number of respondents. The results of statistical tests can be concluded that there is a relationship between the administration of "Dark Chocolate" with a decrease in blood pressure (p<0, 05). The data from the calculation of the decrease in systolic pressure after consuming Dark Chocolate for seven days (1 week) every morning after breakfast and at night after dinner was 36.67 mmHg, while the diastolic pressure decreased by an average of 16.67 mmHg.

Before discussing further the content of cocoa or what is commonly known to the public as Dark Chocolate, we can first discuss how hypertension itself can affect the quality of life of a person, both young and those who have entered old age. Hypertension itself has been discussed in full in the introduction and literature review. In the discussion here, we will repeat a little so that later it can be connected to the consumption of Dark Chocolate and how it affects it to reduce systolic pressure and diastolic pressure in each respondent.

Endothelium or what is known as the endothelial wall has been recognized as one of the primary regulators of venous homeostasis, where this endothelium acts as an active signal transducer for metabolic factors, hemodynamic regulation, and also as a signal if there is an inflammation that will modify the function and morphology of the blood wall vessel [25]. Changes in endothelial cell function can affect the state of blood vessels that will provide changes, such as atherosclerosis and also the development of cardiovascular diseases. Hypertension itself has a high prevalence in Indonesia. Hypertension has an important role and is one of the risk factors for endothelial dysfunction. An increase in blood pressure above normal is responsible for 13% of deaths globally [26]. Lifestyle interventions, including diet, can affect endothelial function. An exciting thing has recently emerged as an alternative for the wider community, namely the consumption of chocolate which is 70% derived from cocoa pods, or it could also be called Dark Chocolate which has a

percentage of more than 70%- 95%.

Many journals published in large countries prove that chocolate or cocoa pods can lower blood pressure. Even in this study, it was proven that cocoa could be consumed by the elderly who have physiologically experienced a decline in all organ functions, including blood pressure regulation. This effect results from some of the ingredients present in cocoa pods or those processed in powder form, namely cocoa powder or Dark Chocolate, namely flavonoids [27]. These flavonoids themselves are a sub-group of polyphenols and are antioxidants. Flavonoids are commonly found in fruits, vegetables, red wine, and tea. Judging from the number of isomers contained in flavonoids are Catechin and Epitelechin, both of which have strong antioxidant properties. Cocoa itself contains a high content of Epitechin and is known to have antioxidant content two times higher than red wine and almost three times higher than green tea.

There are several mechanisms produced by polyphenols that can improve endothelial function so that later it will lower blood pressure. In addition to their antioxidant effect, which is assumed to increase the biodisponability of Nitric Oxide (NO), polyphenols have also been shown to increase NO formation by Endothelial NO Synthase through increasing calcium levels and also P13-kinase activation [28]. Polyphenols also act on (1) increasing the production of Hyperpolarizing Endothelium factor (EDHF) and prostacyclin and also (2) inhibiting the synthesis of vasoconstrictors such as endothelin-1 and angiotensin-converting enzymes.

Recent research has also shown the beneficial effects of Dark Chocolate on insulin resistance, lipid function in the body, and repairing tissue damaged by inflammation. Cocoa products rich in avanol have been shown to have vasodilating effects on blood vessel walls [29]. Blood pressure-lowering effects produced by Flavonoid-rich "Dark Chocolate" are primarily associated with NO. Inhibition of the angiotensin-converting enzyme (ACE), which is involved in the conversion of angiotensin I to angiotensin II, is the main goal used in treating hypertension [30]. This study also proves that cocoa or chocolate's polyphenols and flavonoid content inhibit ACE activity, so the effect will be seen in reducing blood pressure in patients with hypertension.

A meta-analysis published in 2012 describes the effects of cocoa on blood pressure and the condition of blood vessel walls. This meta-analysis of 20 studies involving 856 patients showed a significant reduction in blood pressure among the subgroups consuming "Dark Chocolate" products. Rich in avanol for 2 to 18 weeks. The results obtained from previous studies that the decrease in systolic blood pressure reached 2.77 mmHg and a decrease of 2.2 mmHg in diastolic blood pressure.

CONCLUSION

Based on experimental research on "The effectiveness of "Dark Chocolate" on reducing blood pressure in patients with hypertension without complications at Sasana Tresna Werdha Cibubur in 2017", it was found that of the 30 total respondents with an age range of 80-97 years, it was found that the most hypertension sufferers were respondents. With the age of 80-82 years. After going through several stages, it was also found that 53.33% of respondents who were at Sasana Tresna Werdha Cibubur had grade 1 hypertension without any complications, where this classification was determined based on The Joint National Committee (JNC) VIII. Of the 15 respondents who were given "Dark Chocolate" for seven days, the researcher determined the rule of drinking one drink after breakfast and one drink after dinner with a glass dose. It was found that all 15 respondents experienced changes in blood pressure, where what is meant is that each respondent experienced the most significant decrease in blood pressure on the third day, as many as nine respondents (60%). Changes in blood pressure experienced by respondents who received "Dark Chocolate" were related to research that had been done previously, that the content of polyphenols and flavonoids, which are present in cocoa, can affect several mechanisms in blood vessel walls and blood vessel walls, namely causing a vasodilating effect on vessel walls. Blood can also inhibit several mediators that play an essential role in increasing blood pressure, especially in patients with uncomplicated hypertension.

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