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The Difference in Mean Blood Pressure Before and After Dark Chocolate Administration in the Elderly

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Abstract

Hypertension is particularly prevalent among the elderly and requires careful therapy to minimize cardiovascular consequences. Flavanol chemicals found in dark chocolate are thought to enhance endothelial function by increasing the availability of nitric oxide, which may lower blood pressure. This study assessed the acute effect of dark chocolate consumption on systolic and diastolic blood pressure in older persons. A quasi-experimental pre–post design was undertaken among 65 elderly people of Panti Werdha Wisma Mulia and Panti Santa Anna who met the inclusion criteria and gave informed consent. A digital sphygmomanometer was used to assess each participant's blood pressure prior to consumption and at 15, 30, and 60 minutes after consuming 30 grammes of 72% dark chocolate. Data normality was assessed using the Kolmogorov–Smirnov test, and paired t-test or Wilcoxon analysis. Systolic blood pressure at 30 minutes (126.14 ± 16.17 mmHg; p = 0.015) and 60 minutes (122.57 ± 16.36 mmHg; p = 0.000) was significantly lower than baseline (130.51 ± 17.54 mmHg). Diastolic blood pressure revealed a significant drop only at 60 minutes (74.26 ± 9.98 mmHg; p = 0.005) from baseline (77.89 ± 14.24 mmHg). Although early post-consumption measures indicated no statistically significant changes, the overall results indicate that dark chocolate produces a considerable short-term hypotensive impact in the elderly. These data imply that dark chocolate may serve as a complementary non-pharmacological strategy to blood pressure management in older populations.

Keywords: Elderly, Blood Pressure, Hypertension, Chocolate

1. Introduction

The proportion of elderly people in Indonesia has exceeded one million. According to 2018 Riskesdas data, the prevalence of hypertension increased from 63.33% in the 65–74 age group to 69.53% in those aged 75 and above, indicating a strong correlation between increased blood pressure and aging.[1] Hypertension is a chronic cardiovascular disorder characterized by a sustained increase in systolic or diastolic blood pressure and is recognized as one of the leading causes of morbidity and mortality in the elderly.[2] Elderly people aged 60 and above are more susceptible to hypertension due to physiological changes caused by aging, such as decreased blood vessel elasticity and increased peripheral vascular resistance.

Hypertension in the elderly is influenced by both non-modifiable factors, such as age and genetic predisposition, and modifiable lifestyle factors, including excessive salt intake, obesity, low physical activity, smoking, alcohol consumption, and psychological stress.[3] Non-pharmacological therapies, such as dietary modifications and the use of natural products rich in antioxidants, are often recommended as part of hypertension management in addition to pharmacological therapy.[4] Consuming dark chocolate, which contains flavanol compounds that can increase the production of endothelial nitric oxide, which serves to improve vascular function and may lower blood pressure, is one such intervention that has been considered.[5] This has been proven by several previous studies that showed a decrease in systolic and diastolic blood pressure after consuming dark chocolate in the elderly and people with hypertension.[6]

Although several studies have reported the blood pressure–lowering effect of dark chocolate, most were conducted with longer intervention periods and limited data on acute effects in elderly populations, particularly in institutionalized elderly in Jakarta. Therefore, this study aims to evaluate the short-term effect.

2. Method

This study is a quasi-experimental study with a pre-test and post-test design that aims to analyze the difference in blood pressure before and after giving dark chocolate to the elderly. The intervention consisted of 30 g of commercially available 72% cocoa dark chocolate (Schoko®, Converture, Indonesia), which contains cocoa solids as the primary source of flavanol compounds. This design was carried out on the same group without a control group, so that changes in blood pressure could be observed immediately after the intervention. This study was conducted at the Wisma Mulia and Santa Anna nursing homes in January and July 2025.

The study population consisted of all elderly people aged ≥ 60 years living in both nursing homes. The sample was determined using total sampling, which included all elderly people who met the inclusion and exclusion criteria and were willing to sign an informed consent form. The inclusion criteria included elderly people (≥ 60 years) residing in nursing homes, while the exclusion criteria included a history of chocolate allergy, severe chronic disease, use of antihypertensive drugs, and severe cognitive impairment. A total of 65 respondents were involved in this study, in accordance with the minimum sample requirement calculated using the effect size formula.

Primary data were obtained by measuring blood pressure using a digital sphygmomanometer before the intervention and at 15, 30, and 60 minutes after the respondents consumed the chocolate. The research instruments included a digital sphygmomanometer, dark chocolate, consent forms, and data recording sheets.

Univariate analysis was performed to describe the characteristics of respondents and the distribution of blood pressure data. The Kolmogorov–Smirnov test was used to assess data normality. Bivariate analysis used the paired t-test for normally distributed data and the Wilcoxon test for non-normally distributed data, with a significance value of $p \leq 0.05$ to determine the difference in blood pressure averages before and after the administration of dark chocolate.

Ethical approval was obtained through institutional permission from the Faculty of Medicine, Tarumanagara University (No. 189-D/202/FK-UNTAR/I/2025). Approval from the respective nursing homes was obtained prior to data collection, and written informed consent was secured from all participants.

3. Result

This study involved 65 elderly respondents consisting of 48 women (73.8%) and 17 men (26.2%). The respondents' ages ranged from 60 to 95 years, with a mean age of 75.31 years (SD = 1.15). Based on lifestyle characteristics, 32 respondents (49.2%) had a tendency to consume salty foods, 14 respondents (21.5%) had a history of smoking, and 9 respondents (13.8%) consumed alcohol. The majority of physical activities were not done regularly, with 40% never doing physical activities and only 21.5% doing physical activities every day. A total of 27 respondents (41.5%) had a history of hypertension, 11 respondents (16.9%) had hypertension accompanied by diabetes, and 30 respondents (46.2%) had a family history of hypertension.

Table 1. Respondent Characteristics

Characteristics	Frequency	Percentage	Mean(±SD)	Median (Min, Max)
Age			75.62 (± 8.681)	76 (60,95)
Gender				
Male	17	26.2%		
Female	48	73.8%		
Smoking History				
Smoker	14	21.5%		
Non-Smoker	51	78.5%		
Alcohol History				
Drinker	9	13.8%		
Non-Drinker	56	86.2%		
Physical Activity				
Never	26	40.0%		
2-3 times / Week	25	38.5%		
Every Day	14	21.5%		
Sleep History				
Insomnia	18	27.7%		
No	47	72.3%		
Other Medical History				
Hypertension, Diabetes	11	16.9%		
Hypertension	27	41.5%		
Diabetes	1	1.5%		
Others	2	3.1%		
None	24	36.9%		
Hypertension Medication				
Not Taking	37	56.9%		
Taking	28	43.1%		
Family History of Hypertension				
Yes	30	46.2%		
No.	35	53.8%		
Weight			51.891 (± 1.6908)	50 (26.7, 92)
Height			149.65 (± 1.506)	149 (116, 181)
Categorical BMI				
Obesity II	5	7.7%		
Obesity I	11	16.9%		
Overweight	12	18.5%		
Underweight	9	13.8%		
Normal	28	43.1%		

Table 2. Statistical Test of Mean Differences Before and After Chocolate Administration

Description	Mean (±SD)	P-value	Mean Diff(±SD)	95% CI
Systolic Blood Pressure (mmHg)				
Before Administration	130.51 (±17.537)			
15 Minutes After	128.49 (±16.580)	0.284	2.015 (±15.044)	-1.712 -5.743
30 Minutes After	126.14 (±16.168)	0.015	4.369 (±14.126)	0.869 – 7.870
60 Minutes After	122.57 (±16.355)	0.000	7.938 (±15.515)	4.094 – 11.783
Diastolic Blood Pressure (mmHg)				
Before Administration	77.89 (±14.235)			
15 Minutes After	78.40 (±11.746)	0.750	-0.508 (±12.772)	-3.672 – 2..657
30 Minutes After	76.28 (±11.073)	0.215	1.615 (±10.390)	-0.959 – 4.190
60 Minutes After	74.26 (±9.980)	0.005	3.631 (±10.116)	1.124 – 6.137

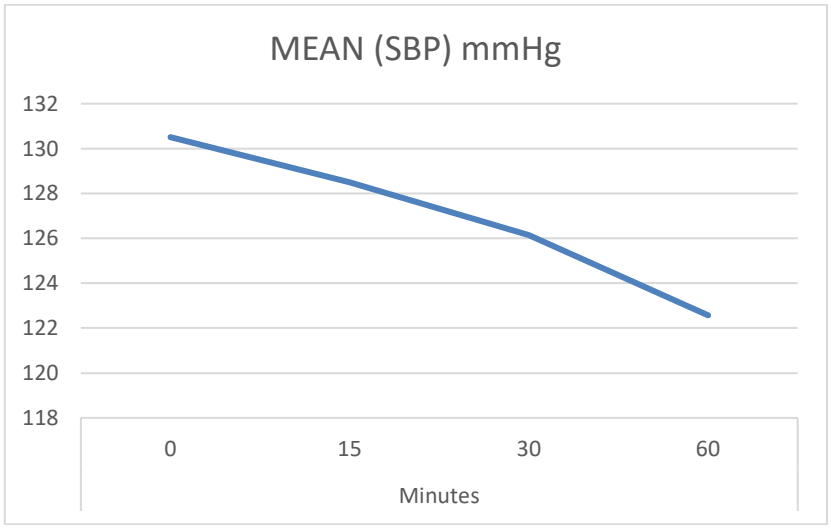

Figure 1. The Average Systolic Blood Pressure (SBP) Before and After Chocolate Administration

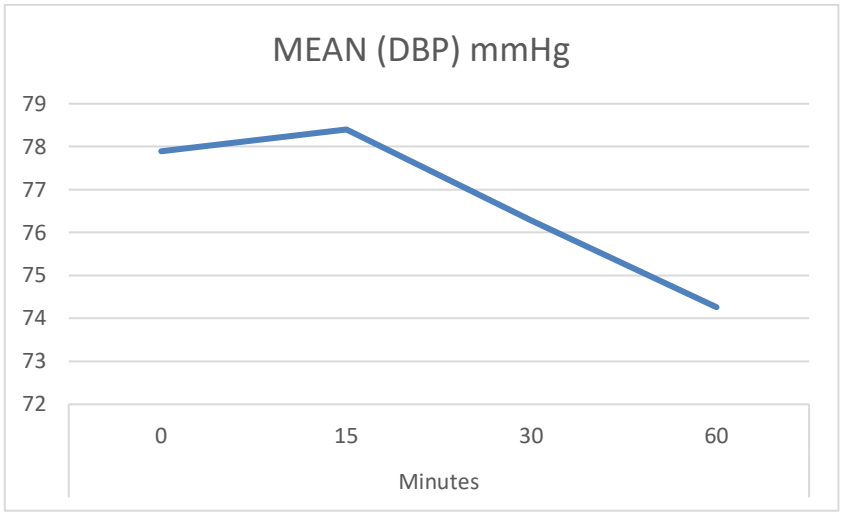

Figure 2. The Average Diastolic Blood Pressure (DBP) Before and After Chocolate Administration

BMI values showed that 43.1% of respondents were of normal weight, while the rest were classified as underweight, overweight, or obese. Information regarding

the specific classes of antihypertensive medications used by participants was not recorded in detail.

The average systolic blood pressure before intervention was 130.51 mmHg, and diastolic blood pressure was 77.89 mmHg. After consuming 30 grams of 72% dark chocolate, blood pressure showed a gradual decrease at 15, 30, and 60 minutes, with the most significant decrease at 60 minutes, namely 122.57 ± 16.355 mmHg for systolic and 74.26 ± 9.980 mmHg for diastolic. The data were normally distributed or meaningful and significant if the p-value ≤ 0.05. The Kolmogorov–Smirnov test showed that the systolic data were mostly normally distributed, while some diastolic data were not normally distributed. Based on these results, the analysis was continued using a paired t-test for normal data and a Wilcoxon test for non-normal data. Both statistical tests showed that systolic pressure decreased significantly at 30 and 60 minutes, while diastolic pressure decreased significantly at 60 minutes. These findings suggest that dark chocolate consumption is associated with a short-term reduction in blood pressure among elderly individuals following a single dose.

4. Discussion

The study population was predominantly female with an advanced mean age, reflecting a typical elderly cohort in which age-related vascular changes and postmenopausal estrogen decline may increase susceptibility to hypertension. Reduced estrogen levels have been associated with decreased arterial elasticity and unfavorable lipid profiles, which may partly explain the higher prevalence of elevated blood pressure in older women.[7] In addition, several lifestyle factors observed among participants—including higher salt intake, smoking history, and limited physical activity—are well-established contributors to increased vascular resistance and sympathetic activation, further influencing blood pressure regulation in the elderly.[8,9] The coexistence of hypertension, diabetes, and abnormal BMI among participants also highlights the role of metabolic burden in this population.

Following the administration of 72% dark chocolate, a gradual reduction in blood pressure was observed, with systolic blood pressure showing an earlier and more pronounced decline than diastolic pressure. While no significant change was detected at 15 minutes, systolic blood pressure decreased significantly at 30 and 60 minutes, whereas diastolic pressure reached statistical significance only at 60 minutes. This pattern suggests that systolic pressure may be more responsive to acute vascular changes. The observed effect is biologically plausible, as flavonoid compounds in dark chocolate are known to enhance nitric oxide bioavailability, leading to vasodilation and improved endothelial function.[5] Similar temporal patterns of blood pressure reduction have been reported in previous studies, despite differences in study design, supporting the consistency of this acute response.[5,6] Taken together, these findings indicate that dark chocolate consumption may exert a short-term blood pressure–lowering effect in elderly individuals, although its role should be viewed as complementary rather than definitive in hypertension management.

The more rapid and pronounced reduction in systolic blood pressure compared to diastolic blood pressure observed in this study may be explained by physiological differences in their determinants. Systolic blood pressure is strongly influenced by arterial stiffness and endothelial function, which are highly responsive to acute vasodilatory stimuli. Flavanol compounds in dark chocolate have been shown to enhance endothelial nitric oxide bioavailability, leading

to improved arterial compliance and reduced systolic pressure.[10,11] In contrast, diastolic blood pressure is more closely related to peripheral vascular resistance at the arteriolar level, which may require a longer duration to demonstrate measurable changes.[12]

The absence of statistically significant blood pressure reduction at 15 minutes, followed by significant changes at 30–60 minutes, may be explained by the pharmacokinetics of cocoa flavanols. After oral ingestion, flavanols require time for gastrointestinal absorption, metabolism, and subsequent activation of endothelial nitric oxide pathways. Previous studies have shown that improvements in endothelial function and nitric oxide–mediated vasodilation typically occur within 30 to 120 minutes after cocoa or dark chocolate consumption.[11,13] Therefore, the delayed onset of significant blood pressure reduction observed in this study is physiologically plausible and consistent with the known time course of flavanol-induced vascular responses.

The magnitude of systolic blood pressure reduction observed in this study (approximately 8 mmHg at 60 minutes) is not only statistically significant but may also be clinically meaningful. Evidence from large epidemiological studies and meta-analyses indicates that a reduction of 5–10 mmHg in systolic blood pressure is associated with a substantial decrease in the risk of major cardiovascular events, including stroke and coronary heart disease.[14,15] However, this potential clinical relevance should be interpreted with caution, as the observed blood pressure reduction reflects an acute, short-term physiological response measured within a limited time frame. Therefore, while the magnitude of systolic blood pressure reduction appears clinically relevant, it does not necessarily indicate sustained blood pressure control or long-term cardiovascular benefit.

There are a number of limitations to this study. First, the lack of a control group makes it more difficult to prove a link between eating dark chocolate and lowering blood pressure. In the absence of a control group, extrinsic variables, including natural blood pressure variability, placebo effects, or measurement-related factors, could have affected the observed changes in blood pressure. Because this quasi-experimental pre-post design can only show an association rather than a clear causal effect, the results should be considered cautiously. Furthermore, because the study only assessed the acute impact of consuming dark chocolate, the brief observation period further restricts the results' generalisability.

Another important limitation of this study is the short duration of blood pressure measurement. Only 60 minutes after consuming dark chocolate was blood pressure measured, indicating an acute physiological reaction rather than a long-term blood pressure-lowering effect. As a result, the results cannot be applied to the management of chronic hypertension or long-term blood pressure control. Even while there was a noticeable drop in systolic blood pressure at 30 to 60 minutes, this effect could not last.

A limitation of this study is the lack of detailed information regarding the types and classes of antihypertensive medications used by participants. As different antihypertensive agents may have varying effects on blood pressure, this factor could not be controlled and may have influenced the observed blood pressure changes. Future studies should stratify participants based on antihypertensive medication classes or control medication use prior to intervention.

To validate these results and assess the long-term clinical impact of dark chocolate consumption on blood pressure, more research using randomised controlled trial designs with longer follow-up periods is needed to confirm these findings.

5. Conclusion

This study shows that the consumption of 30 g of 72% dark chocolate is associated with a short-term reduction in systolic and diastolic blood pressure in elderly individuals, particularly 30 to 60 minutes after ingestion. These results, however, should not be taken as proof of long-term blood pressure regulation because they represent an acute physiological reaction. To verify the therapeutic significance of these outcomes, more research with controlled designs and longer follow-up times is needed.

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