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The Effectiveness of Extra Virgin Olive Oil on Blood Pressure Reduction in Obese Women

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A B S T R A C T

Extra virgin olive oil (EVOO), containing glycerol or subjected to hydrolysis, constitutes approximately 90-99% of the oil, primarily consisting of monounsaturated fatty acids (MUFA), with oleic acid comprising up to 80% of the total oil. This study aims to examine the influence of oleic acid in olive oil on reducing systolic blood pressure (SBP) and diastolic blood pressure (DBP). The intervention spanned 15 days, where the treatment group received EVOO, and the control group received a placebo (water), each administered twice a day at a dosage of 15 ml. Before the intervention, blood pressure was assessed with the Mann-Whitney test, while after intervention, measurements were analyzed using the Independent T-Test. Additional 15 ml Extra Virgin Olive Oil for 15 days results in significant decrease of systolic blood pressure and diastolic blood pressure compared to water only.

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INTRODUCTION

Hypertension is referred to as the '*silent killer*' because it often presents without symptoms, leading individuals to be unaware of their hypertensive condition until complications arise (Whelton et al., 2018). Hypertension is diagnosed with a threshold of a systolic blood pressure (SBP) of at least 130 mm Hg, a diastolic blood pressure (DBP) of at least 90 mm Hg, or both. Typically, this diagnosis is confirmed when, over two separate days, the systolic blood pressure readings register 130 mmHg or higher, and/or the diastolic blood pressure are 90 mmHg or higher (Levine et al., 2018) .

According to the 2018 data from the Research and Development Agency of the Ministry of Health of the Republic of Indonesia, the incidence of heart disease in Indonesia is on the rise, particularly with increasing age. Globally, cardiovascular disease results in around 17 million annual fatalities, of which 9.4 million are linked to complications arising from hypertension.. Hypertension is a significant risk factor for both heart disease and stroke, contributing to at least 45% of heart disease mortality and 51% of stroke mortality(Riset Kesehatan Dasar, 2018). The 2018 Basic Health Research (*RISKESDAS*) data indicates that a staggering 95.5% of the Indonesian population has inadequate consumption of vegetables and fruits. Additionally, 33.5% of the population lacks sufficient physical activity, 31% of the productive-age population experiences central obesity, and 21.8% of adults are categorized as obese (Oddo et al., 2019).

Globally, the prevalence of obesity is higher in women (15%) compared to men (11%). Women are more susceptible to cardiovascular diseases than men. This is due to a greater burden of cardiovascular risk factors in women, including elevated Low-Density Lipoprotein (LDL), high triglyceride levels, and insufficient physical activity. The three dominant risk factors for cardiovascular diseases in women are age, hypertension, and high cholesterol. The presence of endogenous estrogen hormones in women, which have protective properties, can contribute to a lower risk of heart disease. However, the production of estrogen hormones tends to decrease as age advances (Costantino et al., 2020)

Diet and lifestyle adjustments should be recommended for individuals experiencing hypertension due to environmental factors, temporary increases in blood pressure, and those with stage I hypertension who are not eligible for initial antihypertensive medication. The following modifications to diet and lifestyle are suggested and endorsed. Consider adopting diets like DASH (Dietary Approach to Stop Hypertension), which emphasizes the intake of fruits, vegetables, whole grains, and low-fat dairy products, while limiting saturated and overall fat consumption (Flack & Adekola, 2020).

The latest research on Polyphenols in Olive Oil in Lowering Enhancing Endothelial Function and Lowering Blood Pressure in Young Women with Mild Hypertension found that diet rich in polyphenol olive oil led to a substantial decrease ($P < 0.01$) in systolic blood pressure by 7.91 mmHg and diastolic blood pressure by 6.65 mmHg.(Moreno-Luna et al., 2012)

Specifically, Extra Virgin Olive Oil (EVOO) that includes glycerol or is susceptible to hydrolysis makes up approximately 90-99% of the oil and

represents the main component of hydrolysable compounds. This mainly consists of monounsaturated fatty acids (MUFA), where oleic acid accounts for up to 80% of the entire oil content. The polyphenols found in olive oil are associated with various properties, including hypoglycemic, anti-atherogenic, anti-tumor, anti-inflammatory, immunomodulatory, and antiviral effects. These effects are partly attributed to the antioxidant properties of olive oil (Bilal et al., 2021).

Olive oil is widely consumed in Mediterranean countries, often as part of the Mediterranean diet. It remains unclear whether the beneficial effects associated with olive oil are solely attributable to the oil itself or if they result from the overall dietary pattern. The aim of this study is to evaluate whether the intake of olive oil lowers blood pressure in obese women with no history of cardiovascular events (De Pergola & D'alessandro, 2018).

METHODOLOGY

Tool

The tools used in this research were spring scales, microtoise stature meter, manual stethoscope, cholesterol auto-check, measuring spoon.

Material

The materials used in this research is extra virgin olive oil extracted from olive oil. This study investigates the potential impact of oleic acid found in extra virgin olive oil (EVOO) on systolic blood pressure (SBP) and diastolic blood pressure (DBP). EVOO, comprising primarily monounsaturated fatty acids, particularly oleic acid, has been associated with potential benefits for hypertension and cardiovascular disease prevention.

Design

The true experimental study utilized a pre ± post-test with a control group design, enrolling 30 women with systolic blood pressure up to 130 mmHg and diastolic blood pressure up to 90 mmHg. With the research design, 15 control samples and 15 treatment samples will be determined. The intervention involved extra virgin olive oil for 15 days with a dosage of 15ml or one teaspoon each morning and evening.

Data Analysis

The data analysis was conducted using statistical analysis software. The Mann-Whitney test was employed to compare two independent groups and determine whether there was a significant difference in the distribution of their data. The impact of the addition of olive oil was analyzed using the Independent T-test.

RESULTS

Characteristics of respondents of the study

The initial and final characteristics of the subjects are displayed to ascertain the homogeneity of variables in both groups, as outlined in the following description.

Table 1. Sample Characteristics at The Initial of Study

Variables	Intervention (n=15) Mean ± SD	Control (n=15) Mean ± SD
Age (year)	19,20±0,56	20,20±0,94
Body Mass Index (kg/m²)	30,14±3,80	29,07±3,41
Initial Systolic Blood Pressure (mmHg)	136,67±5,88	133,67±6,40
Initial Diastolic Blood Pressure (mmHg)	92,33±6,23	88,00±7,75
Initial Total Cholesterol (mg/dL)	230,87±26,75	213,33±11,78

Based on the research results, table 1 reveals no distinctions in age, Body Mass Index (BMI), initial systolic, and diastolic blood pressure., and initial total cholesterol between the two groups before the intervention.

Table 2. Sample Characteristics at The End of Study

Variables	Intervention (n=15) Mean ± SD	Control (n=15) Mean ± SD
Body Mass Index (kg/m²)	29,52±3,87	29,78±3,38
Systolic Blood Pressure (mmHg)	119,67±11,72	133,00±10,99
Diastolic Blood Pressure (mmHg)	84,00±10,56	92,67±5,94
Total Cholesterol (mg/dL)	205,93±21,95	209,67±22,31

Based on the study's concluding results, table 2 reveals noteworthy variations in Body Mass Index (BMI), ultimate systolic and diastolic blood pressure, with no substantial difference in total cholesterol between the two groups before the intervention.

Compliance Rates in the Consumption of Extra Virgin Olive Oil (EVOO) and Placebo

Table 3. Compliance Levels in the Consumption of EVOO and Placebo During the Intervention in Both Groups.

Variable	Intervention (n=15) Mean ± SD	Control (n=15) Mean ± SD
Compliance Rate	14,87±0,35	14,80±0,77

Based on the research findings, the compliance rates for both groups reached 99.13% for the treatment group consuming EVOO and 98.67% for the control group consuming the Placebo.

The Effect of Extra Virgin Olive Oil (EVOO) Consumption on Systolic Blood Pressure

Table 4. The Influence of Extra Virgin Olive Oil (EVOO) Consumption on Systolic Blood Pressure

Systolic Blood Pressure	Intervention (n=15) Mean ± SD	Control (n=15) Mean ± SD	*P-Value*
Before	136,67±5,88	133,67±6,40	0,226
After	119,67±11,72	133,00±10,99	0,003
Δ (Before – after)	17,00±10,49	0,67±8,84	0,000

Based on the research results, it was found that the use of EVOO is more significant in reducing systolic blood pressure, as evidenced by the Independent T-Test result showing a p-value of 0.000.

The Effect of Extra Virgin Olive Oil (EVOO) Consumption on Diastolic Blood Pressure

Table 5. The Influence of Extra Virgin Olive Oil (EVOO) Consumption on Diastolic Blood Pressure

Diastolic Blood Pressure	Intervention (n=15) Mean ± SD	Control (n=15) Mean ± SD	*P-Value*
Before	92,33±6,23	88,00±7,75	0,109
After	84,00±10,56	92,67±5,94	0,005
Δ (Before – after)	8,33±9,57	4,67±5,16	0,000

Based on the research results, it was found that the use of EVOO is more significant in reducing diastolic blood pressure, as evidenced by the Independent T-Test result showing a p-value of 0.000.

The Percentage of Blood Pressure Remaining Above 130/80 mmHg

The comparison of blood pressure in both groups, including both systolic and diastolic measurements, is visually presented in a graph to evaluate the effectiveness of EVOO compared to the placebo.

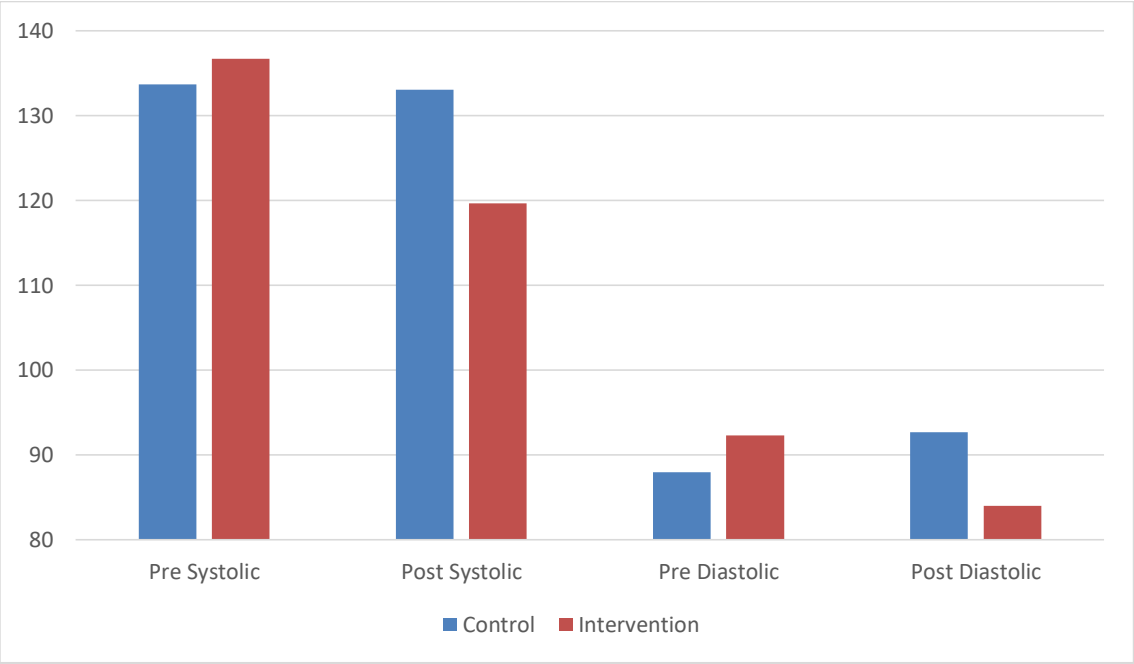

Figure 1. Comparison of Changes in Systolic and Diastolic Mean Blood Pressure Before and After the Study in both Group

Figure 1 shows that all subjects in both groups experienced hypertension before the study. Based on the average blood pressure data in both groups, a significant decrease in systolic and diastolic blood pressure was observed in the intervention group, while there was no significant decrease in systolic blood pressure and an increase in diastolic blood pressure in the control group. After 15 days of intervention, in the intervention group, systolic blood pressure normalized in 12 out of 15 subjects (80%), and diastolic blood pressure normalized in 10 out of 15 subjects (67%). Meanwhile, in the control group, systolic blood pressure normalized in 6 out of 15 subjects (40%), and diastolic blood pressure normalized in 2 out of 15 subjects (13%).

DISCUSSION

There were no significant disparities in age, nutritional status, systolic and diastolic blood pressure, and total cholesterol at the study's commencement between the control and treatment groups. Hence, age, nutritional status, and hypercholesterolemia were not considered confounding variables.

In previous research, the reduction in blood pressure in the treatment group, consisting of all obese subjects, indicates a greater reduction in blood pressure compared to the control group. Individuals with obesity have a 4.02 times higher risk of developing hypertension compared to non-obese individuals, emphasizing the importance for hypertensive individuals to maintain a normal nutritional status (Ali et al., 2022).

The elevated blood pressure in obese women of reproductive age is impacted by a combination of intricate factors. Obesity, with excessive fat accumulation in the body, particularly around vital organs, contributes to elevated levels of cholesterol and triglycerides. Low physical activity, unhealthy eating patterns, and genetic factors all play crucial roles (Ali et al., 2022).

A significant difference in the reduction of both systolic and diastolic blood pressure was observed between the two groups, with a p-value of 0.000. The mean decrease in systolic and diastolic blood pressure in the treatment group is greater than the mean decrease in systolic and diastolic blood pressure in the control group. In the treatment group, the mean decrease in systolic blood pressure is 17.00±10.49 mmHg, while in the control group, it is a decrease of 0.67±8.84 mmHg. In the treatment group, the mean decrease in diastolic blood pressure is 8.33±9.57 mmHg, while in the control group, there is an increase of 4.67±8.84 mmHg.

Through SPSS analysis with the T Independent test, it was found that the average percentage reduction after the administration of extra virgin olive oil (EVOO) was considered significant, with a p-value of 0.003 for systolic pressure and 0.000 for diastolic pressure in intervention group.

Katerina Sarapis et al.'s study published in the journal Nutrients on the 'Influence of High Polyphenol Extra Virgin Olive Oil on Blood Pressure and Arterial Stiffness in Australian Adults: A Crossover Study' found that at the beginning, the average Systolic Blood Pressure (SBP) for the cohort was 120.0 ± 13.4 mmHg, and Diastolic Blood Pressure (DBP) was 69.9 ± 8.4 mmHg. The participants in the study were categorized as having high blood pressure, with 20% classified as Hypertension 1 and 8% as Hypertension 2. (Sarapis et al., 2020). Additionally, Mary Flynn et al.'s report on 'Olive Oil as Medicine: Its Effects on Blood Pressure' revealed findings from 24 women aged 24-27 years, with high blood pressure or stage 1 essential hypertension, where SBP was 135 mmHg (±13) and DBP was 90 mmHg (±8) (Liang et al., 2023).

The treatment group demonstrated a more pronounced decline in systolic blood pressure compared to the control group, which can be attributed to the supplementary consumption of olive oil. Olive oil, rich in monounsaturated fatty acids such as oleic acid, is recognized for its capacity to lower blood pressure through the promotion of nitric oxide production. The decrease in blood pressure is associated with changes in the composition of endothelial cell membranes caused by oleic acid, impacting their functionality. The inverse association between olive oil consumption, adherence to a Mediterranean diet, and blood pressure is evident. The ingestion of 60 ml of olive oil has demonstrated a notable reduction of 14 to 15 mmHg in systolic blood pressure among hypertensive elderly individuals over a four-week period (Daniati & Kartasurya, n.d.).

Extra Virgin Olive Oil (EVOO) is rich in polyphenols and flavonoids. Polyphenols found in EVOO include oleuropein, hydroxytyrosol, and tyrosol. Flavonoid content includes beta-carotene, squalene, and alpha-tocopherol. The polyphenolic compounds contribute to the relaxation of blood vessels and enhancement of blood flow, leading to a decrease in blood pressure. Polyphenols act as antioxidants, balancing free radicals by providing missing electrons and inhibiting chain reactions that lead to free radical formation (S Cicerale et al., 2012).

The high-fat saturated diet has been associated with the development of obesity and hypertension. Conversely, the Mediterranean diet, characterized by its high content of monounsaturated fatty acids, has been proposed as a dietary factor capable of positively regulating cardiovascular function. This effect has been linked to changes in the local kidney renin-angiotensin system (RAS) and sympathetic nervous system activity. The Mediterranean diet (MD) is characterized by its main fat source, pure olive oil (VOO; from Olea europaea L.; Oleaceae), a natural oil with high Monounsaturated Fatty Acid (MUFA) content and numerous bioactive components. Pure olive oil has demonstrated a crucial role as a cardiac protector and antihypertensive (Domínguez-Vías et al., 2021).

CONCLUSIONS AND RECOMMENDATIONS

The initial blood pressure measurements indicated hypertension in both the treatment and control groups. However, after the intervention, the treatment group no longer exhibited hypertension. There was a significant reduction in both systolic and diastolic blood pressure in the treatment group compared to the control group. The use of EVOO olive oil proved effective in lowering blood pressure in obese women with hypercholesterolemia.

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