THE EFFECT OF RED APPLE *(Pyrus Malus)* TO BLOOD PRESSURE OF GRADE ONE HYPERTENSIVE PATIENTS

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ABSTRACT

Red Apple (*pyrus malus*) is a fruit that can be used as a diet approach to stop hypertension due to its potassium and flavonoid content. These content in the red apple can lower blood pressure and inhibit the production of renin that influences the production of angiotensin and angiontensin-converting enzyme. This study aims to seek the beneficial effects of red apples on the blood pressure of Grade I Hypertension patients. The method of the study is quasi experimental with one group pretest post test design. The 15 participants were given 150 grams of red apple for 10 consecutive days. The blood pressure of each patents were taken everyday to monitor on which day there is a change on the blood pressure compared to the first day before consuming the red apple. The data were analyzed with paired sample *t*-test. The results show that there is a significant change in blood pressure, from an average of 143.7/94.2 mmHg before consuming the red apple to 129/89.4 mmHg after 10 days of consumption. The blood pressure, both systole and diastole, showed significant changes after the first day of consuming the red apple.

Keywords: Red Apples, Flavonoid, Hypertension, Potassium

I. Introduction Hypertension

Hypertension is one of the leading causes of death were predominantly caused by non-communicable diseases, because hypertension is a major risk factor that causes death due to cardiovascular disease. Indonesian Ministry of Health (2014.b) estimates hypertension complications cause 45% of deaths due to heart disease and 51% of deaths due to stroke. The high mortality rate of both diseases can be lowered by controling person's blood pressure by lifestyle modifications.

Adib (2009) reported World Health Organisation states approximatly one billion people worldwide, or one out of four adults suffer from hypertension and the estimated number of people with hypertension will increase to 1.6 billion by the year 2025. About 10 to 30% of the adult population in all countries had hypertension.

Indonesian Ministry of health (2014.a) conducted basic Health survey in 2013 found out that estimated at 25 % of Indonesian population had hypertension. However, only few patients who comply on medication and do preventive precaution to avoid complications due to high blood pressure. the majority of people who suffer from high blood pressure, feel they have no health problems, or feel the disease has been cured, or feel no need to take regular medication for high blood and to maintain a healthy lifestyle. As a result, uncontrolled persistent hypertension have tendency to get complications of coronary heart disease, kidney failure and stroke.

Although large percentage of patients with hypertension, and complications of this health problem can be fatal, but often people with hypertension do not know that s/he was suffering from the disease because the symptoms of this disease is similar to other diseases, such as headache, feels weak and easily tired, shortness of breath, nausea, vomiting, upper abdominal pain, blurred vision and other dependent on the individuals (Diamond, 2012). The absence of typical symptoms of the disease makes people with hypertension often felt that s/he was suffering from a cold or other illness, so that hypertension is called the silent killer (Hartono, 2011).

A person diagnosed with hypertension when in twice taking of blood pressure with 5 minutes distance retrieval time and the patient

in a state of complete rest, systolic blood pressure over 140 mmHg and diastolic blood pressure above 90 mmHg. The Indonesian Ministry of Health (2014.a) describes the classification of blood pressure by citing the Joint National Committee on

Prevention, Detection, Evaluation and Treatment of High Blood Pressure-American (2013). A person is said to have normal blood pressure if the systolic blood pressure less than 120 mmHg and diastolic less than 80 mmHg, Prehypertension when systolic blood pressure ranged between 120-139 mmHg and diastolic 80 to 89 mmHg. Stage one hypertension whensystolic blood pressure 140-159 mmHg and 90-99 mmHg diastolic. Stage 2 hypertension if the systolic pressure and diastolic 160/100 or more.

The etiology of hypertension is unclear, but several risk factors states as predispositon of hypertension. Based on risk factors, hypertension can be categorized into two groups: primary hypertension that is not caused by impaired organs and the cause is unknown and secondary hypertension is generally caused by other diseases such as heart failure or kidney failure (Rudianto, 2013).

Several risk factors are suspected to trigger the occurrence of hypertension are grouped into risk factors that can be controlled and the risk factors that can not be controlled. Risk factors that can be controlled is an unhealthy lifestyle such as smoking, obesity, diet, lack of exercise, alcohol consumption, employment, high cholesterol levels, and emotional stress.

Risk factors that can not be controlled is heredity, where the tendency of a person to have hypertension is higher when one or both parents suffer from hypertension. Another factor is race, age, and gender, and so forth (Julianti, 2005).

Another factor that plays a role in increasing blood pressures is the renin angiotensin system. Enzyme Renin is produced by juxtaglomerular cell by the sympathetic nervous stimulus or due to a reduction in renal perfusion fluid. Renin converts angiotensin to angiotensin I. Angiotensin I by the stimulation of Angiotensin converting enzyme effect (ACE) is converted into angiotensin II. Angiotensin II makes the blood vessels constrict that causes resistancies of blood flows and increasing of blood pressure. Angiotensin II also stimulate the pituitary gland to release vasopressin hormone and adrenal gland to release noradrenaline and adrenaline. These hormones make more vasoconstriction of blood vessels and making the retention of water and sodium resulting in an increase in blood volume that lead to heart work harder to pump blood through to constrict arteries and make blood pressure rise (Bayer Pharma AG, 2015).

Uncontrolled Hypertension will lead to various complications in various vital organs such as heart problems, brain damage, kidney failure, eyes problem, etc and may lead to death. Therefore, controlling high blood pressure is very important to prevent unwanted complications. Some prevention ways are by regularly check blood pressure, take antihypertensive medicines, or by non pharmacological treatment (Marrelli, 2008).

Pharmacological treatment is usually with the use of antihypertensive drugs such as diuretics, beta-blockers, converting enzymes inhibitors, angiotensin II antagonists, calcium channel blockers, and alpha blockers. Behavior modification can be done by stop smoking, alcohol, and caffeine. Moreover, it can be done by avoiding stress, get enough rest and regular exercises. Beside that, hypertensive patients need to used diet approach to stop hypertension by avoiding high sodium intake, increase the consumption of fiber-rich foods, and increase the consumption of food containing hign vitamin C, potassium, calcium and flavonoids, such as red apple (Soenanto, 2009).

Red Apple (*pyrus malus*)

An apple a day keep doctors away is an old saying which recommends that everyone must consume apples to maintain good health. This is because apples contain various substances that are important for health such as vitamin C which is good for improving immune system, phenols to lower cholesterol, and pectin in the form of soluble fiber to lower blood pressure, blood sugar, LDL and helps in the digestive process. Apple also contains baron which is beneficial for bone strength, vitamin A, E and beta carotene which also works as an antidote to free radicals and good for cardiovascular, people with diabetes and

asthma (Hunter, 2015).

Red apple (Pyrus malus) also can lower the blood pressure of hypertensive patients, because red apples content flavonoids and potassium (Yudhadhi, 2005). Flavonoids in plants give color to flowers and fruits that are useful as an antidote to pathogenic agents, sunlight and stress (Lotito, 2013). Flavonoids in form of catechin and quercetin in red apple have an antihypertensive effect because it can inhibit the action of Angiotensin Converting Enzyme (ACE). Catechin is antioxidant that destroy free radicals so it works as anticancer, heart diseases and many other degenerative health problems. According to Manach et al (2004) in every hundred grams of apples, there are about 1043 mg of catechins.

Quercetin works as neutralizing free radicals may lower the risk of various cancers and diseases involving age and can lower the blood pressure of hypertensive patients. Research conducted by Knekt, et al (2002) showed that individuals who frequently consume quercetin in high doses has low mortality rate from ischemic heart diseases, cerebrovascular diseases including hypertension and other chronic diseases. Lotito (2013) states that there are 200-1200 mg of flavonoids in a hundred grams of red apples, and to lower the blood pressure of hypertensive patients grade one, it needs 730 mg of flavonoids per day.

The effect of consuming flavonoids in lowering blood pressure is by affecting the ACE inhibitors so that angiotensin I can't be converted to angiotensin II that lead to vosodilation of blood vessels and blood pressure will drop (Kwon et al, 2010 & Larson et al, 2012). Beside that, the ACE inhibitors makes sympathetic nerve activity decreased, preventing vosoconstriction of smooth muscle, and avoid the retention of water and sodium (Price, 2005).

High potassium content in red apples also worked as an antihypertensive. FatSecret Indonesia (2014) stated that in a red apple with 7cm diameter containing 148 mg of potassium. High potassium content in apples can lower blood pressure (Hakimah, 2013). Potassium works by inhibiting renin production which fails to converts angiotensinogen to angiotensin I. As a result, blood vessels are vasodilation and followed by decreased heart rate and cause decreased cardiac output and blood pressure (Guyton and Hall, 2007).

Potassium can lower aldosterone expenditure, so that water and sodium excretion by the kidneys increase causes decreased blood volume and cardiac output effect of lowering blood pressure. Potassium also had impact in relaxation of the blood vessel so that the blood vessels become more elastic and ultimately lowered blood pressure (Guyton and Hall, 2007). Potassium causing vasodilation, and decrease in total peripheral retention. Enough potassium intake will increase the concentration in the intracellular fluid that tends to pull fluid from the extracellular effect of lowering blood pressure (Amran et al, 2010).

Not much study has been done to prove the benefits of red apples on blood pressure. Yudhadhi (2005) conducted a study to 15 subjects with normal blood pressure. He gave 250 cc pure red aplle juice to each subjects. The average blood pressure before red apple juice consumption was 105.8 / 63.47 mmHg dropped to 95.73 / 56.53 mmHg after consuming red apple (Yudhadhi, 2005). Based on the literature review and the results of Yudhadhi research, of researchers wanted to conduct simple experiment the effect of red apple (pyrus malus) to blood pressure of grade one hypertensive patients.

II. Methods

The method of the study is quasi experimental with one group pretest post test design. Fifteen participants was selected on october 27, 2014, with aged range between 23-56 years old with blood pressure between 140/90 to 159/99. Three times blood pressure examinations was done with 15 minutes gap between examination and subject at rest. All subjects was not taking any antihypertesive medication and voluntaried consumed 150 mg red apples every day for ten consecutive days. The blood pressure of each patents were taken everyday prior consumtion of red apples to monitor on which day there is a change on the blood pressure compared to the first day before consuming the red apple.

III. Results

After 10 days of intervention data before consuming red apples were compared with every day data for ten days.

Systollic blood pressure, showed significant changes from day two through day ten (*p* <0.05) as show in table1.

Table 1 Comparison of Systolic Blood Pressure

Paired	Systole day 1	Systole day 2 and after	Change	SEM	t-	p Value
Systole1–Systole2	143.7±3.8	139.7±3.9	4.01±4.6	1.2	3.4	.004
Systole1–Systole3	143.7±3.8	139.8±3.5	3.9±4.8	1.3	3.2	.007
Systole1–Systole4	143.7±3.8	136.9±4.7	6.9±6.2	1.6	4.3	.001
Systole1–Systole5	143.7±3.8	135.7±5.6	8.1±6.8	1.8	4.6	.000
Systole1–Systole6	143.7±3.8	132.3±7.3	11.4±7.9	2.1	5.6	.000
Systole1–Systole7	143.7±3.8	133.1±8.3	10.6±8.6	2.2	4.8	.000
Systole1–Systole8	143.7±3.8	130,7±6.8	13.1±7.5	1.9	6.8	.000
Systole1–Systole9	143.7±3.8	128.2±8.6	15.5±9.0	2.3	6.7	.000
Systole1–Systole10	143.7±3.8	129±6.4	13.8±6.6	1.7	8.2	.000
Systole1–Systole11	143.7±3.8	129±5.4	14.7±5.4	1.4	10.7	.000

Comparison of diastolic blood pressure with data before consuming red apple with day two through day ten also shows significant changes (p<0.05) as shown in table 2.

Table 2. Comparison of Diastolic Blood Pressure

Paired	Diastole day 1	Diastole day 2 and after	Change	SEM	t-	p Value
Diastole1–Diastole2	94.2±3.7	90.1±6.8	4±5.5	1.4	2.9	.012
Diastole1–Diastole3	94.2±3.7	90.2±4.9	4±6.2	1.5	2.5	.025

Diastole1–Diastole4	94.2±3.7	91.2±4.5 3±5.2		1.3 2.2	.043
Diastole1–Diastole5	94.2±3.7	90.7±4.6 3.5±5.7		1.5 2.4	.033
Diastole1–Diastole6	94.2±3.7	90.0±14.9 4.2±4.2		1.1 3.8	.002
Diastole1–Diastole7	94.2±3.7	89.2±15.5 5±5.6		1.4 3.4	.004
Diastole1–Diastole8	94.2±3.7	90.9±15.0	3.3±4.9 6	1.3 2.7	.019
Diastole1–Diastole9	94.2±3.7	87.1±15.2	7.1±7.5 4	1.9 3.6	.003
Diastole1–Diastole10	94.2±3.7	89.6±10.5	4.6±5.7 4	1.4 3.1	.007
Diastole1–Diastole11	94.2±3.7	89.5±5.7 4.7±6.2		1.6 2.9	.011

The results show that there is a significant change in blood pressure, from an average of 143.7/94.2 mmHg before consuming the red apple to 129/89.4 mmHg after 10 days of consumption. The blood pressure, both systole and diastole, showed significant changes after the first day of consuming the red apple.

Discussion Red apple rich in flavonoids and potassium approach to stop hypertension for alternative therapy or as an additional supplement to controlled blood pressure of hipertensive grade one patients. The results of this study support the research that has been done by Yudhadhi (2005) to 15 adult women who have normal blood pressure, which, after taking the 250 cc apple juice showed decreases in blood pressure

Although red apples in this study can lower blood pressure, it does not mean people with hypertension can be cured by simply eating red apple. Red apple as well as the others fruit which is rich in potassium and / or flavonoids are only helps to control blood pressure, not to heal the hypertension, because hypertension can't be heal. Blood pressure is very sensitive to various factors which can increase blood pressure. Therefore, it is recommended to hypertensive patients regularly taking antihyperensive medication or regularly take alternative therapis to prevent unwanted complications.

Hypertensive patients who choose to use alternative therapies in controlling blood pressure, must regularly checked their blood pressure to health professional restricted salt intake, and modyfing healthy lifestyle.

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