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EFFECTIVENESS OF COCONUT WATER CONSUMPTION ON BLOOD PRESSURE

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Abstract

Blood pressure as a circulatory system is influenced by psychosocial (stress), genetic, age, sex, nutritional status, and lifestyle (diet, lack of fibre consumption, smoking, lack of physical activity). 30 ml of young coconut water containing 61 mg of potassium, 5.45 mg of sodium, and 1.3 mg of sugar can affect changes in blood pressure. This study aims to determine the effect of consumption of young coconut water on blood pressure nursing students at Respati University Yogyakarta. This type of research is a quasi-experiment with the design of a pre and posttest nonequivalent control group. The sampling technique used simple random sampling, as many as 36 samples. Test using T-test Paired and Wilcoxon. The results of the analysis of systolic and diastolic blood pressure pretest-posttest in the control group obtained p-value of 0.121 and 0.361. The systolic blood pressure analysis and diastole pre-post test results in the experimental group obtained p-values of 0.030 and 0.194. The posttest systolic and diastolic blood pressure analysis in the control and experimental groups obtained p-values of 0.021 and 0.371, which concluded that there was an effect of consumption of coconut water on systolic blood pressure in nursing students.

Keywords: *Blood Pressure; Diastolic; Systolic; Young Coconut Water*

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1. Introduction

Blood pressure is always needed for the driving force of blood to flow in the arteries, arterioles, capillaries, and venous systems to form a steady blood flow. If the blood circulation becomes inadequate, there is a disturbance in the transport system for oxygen, carbon dioxide, and various other products of metabolism. On the other hand, the function of the body's organs will experience disturbances such as disturbances in the process of urine formation in the kidneys or the appearance of cerebrospinal fluid and others (Anggara & Prayitno, 2013).

WHO reports that hypertension is the number 1 cause of death in the world. Data from 2010 in the United States showed that 28.6% of adults aged 18 years and over had hypertension2. Another blood pressure disorder is hypotension. The incidence of orthostatic hypotension in the United States is 30% of older adults and 70% of nursing home residents. Furthermore, it was found that the incidence of orthostatic hypotension occurred in 47-58% of patients with Parkinson's disease, 13-32% of those with hypertension, 16-25% of those with diabetes mellitus and 24% of those with carotid artery stenosis (Indra, B., Widodo, U., & Widyastuti, 2016). Riskesdes data in 2013 stated that the prevalence of hypertension in Indonesia reached 25.8%, with the incidence of cardiovascular disease complications more in women 52% and men 48% (Kemenkes RI, 2013).

Based on data from the Indonesian Ministry of Health, hypertension in Indonesia reaches 31.7% of the population aged 18 years and over. In Yogyakarta, it is included in the top 5 incidences of hypertension; in 2012, the percentage in rural areas was 51.7%, and in big cities, the ratio was 47.7% (Suidah, 2011).

Fruits and vegetables contain high potassium and low sodium to maintain blood pressure within normal limits. One example of a fruit that is rich in benefits is coconut. Where this coconut contains 95.5% water, 0.1% protein, <0.1% fat, 4.0% carbohydrates, and 0.4% ash. Coconut water contains vitamin C 2.2 – 3.4 mg/100ml and vitamin B complex. In addition, young coconut water also contains nutrients. 30 ml of coconut water contains 61 mg of potassium (potassium), 5.45 mg of sodium, and 1.3 mg of sugar (Vita, 2016).

Consuming mineral K can also reduce hypertension (Vita, 2016). The role of mineral K in lowering blood pressure is through the mechanism of natriuresis in the kidneys, endothelial-dependent vasodilatation, and also through its significant effect, namely a decrease in renin-angiotensin-aldosterone (RAA) activity and an increase in neural Na pump, which reduces sympathetic nerves (Farapti dan Sayagono, 2014).

Based on a preliminary study conducted by researchers, it was found that the number of nursing students from the 2013 Respati Yogyakarta University was 160 students, consisting of 63 males and 97 females. The measuring blood pressure in 10 students obtained a blood pressure of at least 100/70 mmHg, a maximum of 130/90 mmHg, and an average of 117/80 mmHg. The interview results showed that students often stayed up late at night, had trouble sleeping, the nape was often tense and often felt dizzy when they woke up in the morning.

2. Method

The research design used was a quasi-experimental design with a Pretest and Post-Test, Nonequivalent Control Group approach. Researchers conducted measurements or research before and after the intervention in two groups, namely the control group and the intervention group. This research was conducted at Universitas Respati Yogyakarta on September 04-12, 2021. The selection of respondents used a simple random sampling technique with a total of 18 respondents per group. The sample was selected based on the inclusion criteria: age 18-23 years, BMI 18.5-22.9, while the exclusion sample was students taking drugs for hypo/hypertension and students with kidney and heart disorders.

Data on blood pressure in the intervention group (given coconut water) and the control group were measured with a digital sphygmomanometer and recorded on the observation sheet. Respondents in the intervention group respondents received 170 ml of young coconut water, given once a day during the day, for seven days. Pretest blood pressure was measured before getting the intervention. While the posttest blood pressure was measured after the seventh day. Blood pressure measurements were carried out on the left arm, and before the measurement, the respondent sat down for 15 minutes. after that, the data was tested using the T-Test Paired and Wilcoxon test.

3. Result And Discussion

Table 1 shows that in the control group, the most age was 20 (50%) years, the sex mainly was male 11 (61.1%), and non-smokers 13 (72.2%). The characteristics of the intervention group were 22 (44.4%), female sex 12 (66.7%), and non-smoking 12 (88.9%).

The average pretest systolic blood pressure in the control group was 119.83 mmHg. In contrast, the average of the experimental group was 115.67 mmHg. The control group's moderate pretest diastolic blood pressure was 78.11 mmHg, while the experimental group was 73.56 mmHg. The data in tables 2 and 3 show that at the pretest, the systolic blood pressure was the minimum value (110 mmHg) in the normal category, for the maximum value (139 mmHg) and the average (119.83 mmHg) in the prehypertension category. Meanwhile, the minimum diastolic blood pressure (72 mmHg) and the average value (78.11 mmHg) were in the normal type, while the maximum value (86 mmHg) was in the prehypertension category.

Table 1. Characteristic of Respondents

Characteristic of Respondents	Control Group		Intervention Group	
	f	%	f	%
Age				
20	-	-	1	5,6
21	7	38,9	7	38,9
22	9	50,0	8	44,4
23	2	11,1	2	11,1
Total	**18**	**100,0**	**18**	**100,0**
Gender				
Male	11	61,1	6	33,3
Female	7	38,9	12	66,7
Total	**18**	**100,0**	**18**	**100,0**
Smoking				
Yes	5	27,8	2	11,1
No	13	72,2	12	88,9
Total	**18**	**100,0**	**18**	**100,0**

Tabel 2. Blood Pressure Pretest in Students

Blood Pressure (mmHg)	∑	Min	Max	Mean	SD
Systolic Pretest					
Control	18	110	139	119,83	8,57
Intervention	18	110	129	115,67	6,48
Diastolic Pretest					
Control	18	72	86	78,11	4,51
Intervention	18	60	88	73,56	5,28

Tabel 3. Blood Pressure Prosttest in Students

Blood Pressure (mmHg)	∑	Min	Max	Mean	SD
Systolic Posttest					
Control	18	100	132	118,56	8,76
Intervention	18	99	129	111,0	8,73
Diastolic Posttest					
Control	18	74	89	78,78	4.12
Intervention	18	65	99	76,89	8,56

Table 3 shows that the average post-test systolic blood pressure in the control group is 118.56, and the average of the experimental group is 111. The control group's moderate post-test diastolic blood

pressure is 78.78 mmHg, and the experimental group is 76.89 mmHg. The data in tables 4 and 5 show that during the post-test systolic blood pressure, the minimum (100 mmHg) and average (118.56 mmHg) values were in the normal category, while the maximum value (132 mmHg) was in the prehypertension category. In diastole, the minimum value (74 mmHg) and the average (78.78 mmHg) blood pressure was in the usual type, while the maximum value (89 mmHg) was in the prehypertension category.

Blood pressure is the pressure exerted by the blood against the walls of the arteries. Systolic blood pressure is the pressure when the ventricular muscle of the heart contracts. Diastolic blood pressure is when the atrial heart muscle contracts and blood go to the ventricles (Widyasari & Candrasari, 2013). According to medical criteria, the typical value of blood pressure is that the normal range for systolic blood pressure is <119-86 mmHg, while diastolic is <79-56 mmHg (Muhlisin, n.d.).

Table 4. Cross Tabulation of Characteristics of Respondents with Systolic Blood Pressure Pre-Post Test Control Group and Experiment Group

Characteristic of Respondents	∑	Systolic Blood Pressure (mmHg)								Difference Mean
		Min		Max		SD		Mean		
		Pre	Post	Pre	Post	Pre	Post	Pre	Post	
Control Group										
Male	11	110	100	139	132	9,964	10,649	122,09	120,00	-2,09
Female	7	112	112	124	124	4,348	4,348	116,29	116,29	0
Intervention Group										
Male	6	112	110	129	129	6,178	8,280	118,17	117,83	-0,34
Female	12	110	99	128	119	6,515	6,973	114,42	107,58	-6,84
Control Group										
Smoking	5	110	110	139	130	10,616	8,198	126,20	123,20	-3
Non Smoking	13	110	100	129	132	4,580	4,688	117,38	116,77	-0,61
Intervention Group										
Smoking	2	119	112	120	125	0,707	9,192	119,50	118,50	-1
Non Smoking	16	110	99	129	129	6,735	8,582	115,19	110,06	-5,13

Table 4 describes the average value of pre-test systolic blood pressure in the control group for males 122.09 mmHg for females 116.29 mmHg. In the control group's measurement of post-test systolic blood pressure, the average systolic blood pressure of male respondents was 120.00 mmHg, and female respondents were 116.29 mmHg. The average difference in pre-post test systolic blood pressure in male respondents was -2.09 mmHg, while in women, it was 0 mmHg.

Meanwhile, the average systolic blood pressure pre-test was 118.17 mmHg for men and 114.42 mmHg for women in the experimental group. The post-test systolic blood pressure in the experimental group had a moderate systolic blood pressure of 117.83 mmHg for men and 107.58 mmHg for women. The average difference in pre-post test systolic blood pressure for male respondents was -0.34 mmHg, while for women, it was -6.84 mmHg. Table 6 shows that male and female respondents had a decrease in systolic blood pressure, namely pre (118.17 mmHg) and post (117.83 mmHg) male respondents, while female respondents pre (114.42 mmHg) and post (107. 58 mm Hg). Difference the average pre-post systolic blood pressure of male respondents was -0.34 mmHg, and female respondents were -6.48 mmHg.

The average pre-test systolic blood pressure value in the control group of respondents smoking was 126.20 mmHg, and not smoking was 117.38 mmHg. The post-test systolic blood pressure value of respondents who smoked was 123.20 mmHg, and non-smokers were 116.77 mmHg. The average difference in pre-post test systolic blood pressure in smoking respondents was -3 mmHg, while respondents who did not smoke were -0.61 mmHg.

The average value of pre-test systolic blood pressure in the experimental group of respondents who smoked was 119.50 mmHg, and not smoking was 115.19 mmHg. The average weight of post-test systolic blood pressure in respondents who smoked was 118.50 mmHg, and non-smokers were 110.06 mmHg. The average difference in pre-post test systolic blood pressure for smoking respondents was -1 mmHg, while non-smoking respondents were -5,13 mmHg.

The average value of pretest diastolic blood pressure in the control group of male respondents was 78.73 mmHg and women 77.14 mmHg. The average weight of posttest diastolic blood pressure for male respondents was 79.82 mmHg, and female respondents were 77.14 mmHg. The average difference in pre-post test diastolic blood pressure

in male respondents was 1.09 mmHg, while in women, it was 0 mmHg.

Meanwhile, the experimental group's average pretest diastolic blood pressure was 70.50 mmHg for male respondents and 75.08 mmHg for women. While posttest diastolic blood pressure in the experimental group, the moderate diastolic blood pressure of male respondents was 78.00 mmHg, and for women, it was 76.33 mmHg. The average difference in pre-posttest diastolic blood pressure in male respondents was 7.5 mmHg, while in women, it was 1.25 mmHg.

The study results in table 5 show that the pretest systolic and diastolic blood pressure values in men were higher than in women. Kozier (Lilyana, 2008) states that one factor influencing blood pressure is gender, where after puberty, women tend to have a lower blood pressure than men of the same age.

Table 4. Cross Tabulation of Characteristics of Respondents with Diastolic Blood Pressure Pre-Post Test Control Group and Experiment Group

Characteristic of Respondents	∑	Systolic Blood Pressure (mmHg)								
		Min		Max		SD		Min		Difference Mean
		Pre	Post	Pre	Pre	Pre	Post	Pre	Post	
Control Group										
Male	11	72	74	86	89	5,368	4,916	78,73	79,82	1,09
Female	7	72	75	80	79	2,795	1,676	77,14	77,14	0
Intervention Group										
Male	6	60	74	74	83	5,244	2,966	70,50	78,00	7,5
Female	12	71	65	88	99	4,795	10,404	75,08	76,33	1,25
Control Group										
Smoking	5	74	77	86	83	4,848	2,510	78,00	78,60	0,6
Non Smoking	13	72	74	86	89	4,580	4,688	78,15	78,85	0,7
Intervention Group										
Smoking	2	71	74	74	77	2,121	2,121	72,50	72,50	0
Non Smoking	16	60	65	88	89	5,582	9,081	73,69	77,06	3,37

Men suffer from hypertension more than women, with a ratio of about 2.29 for increased systolic blood pressure and 3.76 for an increase in diastolic blood pressure. Men are thought to have a lifestyle that tends to increase blood pressure compared to women. After entering menopause, hypertension in women is higher than that in men caused by hormonal factors (Lilyana, 2008).

Table 5 shows that male and female respondents had an increase in diastolic blood pressure, namely pretest (70.50 mmHg) and post (78 mmHg) male respondents, while female respondents pre (75.08 mmHg) and posttest (76.33 mmHg)). The average difference in pre-post diastolic blood pressure for male respondents was 7.5 mmHg, and for female respondents was 1.25 mmHg.

The results of this study indicate that male pre-test systolic and diastolic blood pressure tend to be higher than women. Arif Muttaqin mentions factors that affect blood pressure, one of which is gender. After puberty, male blood pressure increases; after menopause, women's blood pressure increases due to loss of estrogen hormone protection (Muttaqin, 2010). In addition, neuroscientist Oda Debora also supports the research results that blood pressure in males tends to be higher at puberty than females of the same age (Debora, 2011).

Meanwhile, in diastolic pressure, there is an increase in blood pressure which is not in line with Indrowiyono's study, where the results of the study of blood pressure after drinking young coconut water was 106.65/68.3 mmHg lower than before drinking young coconut water by 115.46/75 mmHg, which the difference was very significant ($p < 0.01$). Conclusion: young coconut water can reduce systolic and diastolic blood pressure in adult men (Indrowiyono, 2010). Research conducted by Setiadi and Iwan showed a decrease in both systolic and diastolic blood pressure after drinking 300 ml of coconut water in female respondents aged 19-23 years (Widyasari & Candrasari, 2013).

Table 5 illustrates that the average value of pretest diastolic blood pressure in respondents who smoked was 78 mmHg in the control group, and those who did not smoke was 78.15 mmHg. The average weight of posttest diastolic blood pressure in respondents who smoked was 78.60 mmHg, and non-smokers were 78.85 mmHg. The difference in the moderate diastolic blood pressure of the Pre-Post Test in respondents who smoked was 0.6, and those who did not smoke were 0.7.

In the experimental group, the average pretest diastolic blood pressure in respondents who smoked was 72.50 mmHg, and those who did not smoke was 73.69 mmHg. The average value of posttest diastolic blood pressure in respondents who smoke is 72.50 mmHg, and those who do not smoke is 77.06 mmHg. The difference in the moderate diastolic blood pressure Pre-Post Test in respondents who smoke 0 and those who do not smoke 3.37.

Table 4 shows that the systolic blood pressure of respondents who smoked pre (126.2 mmHg), post (123.2 mmHg) was higher than those who did not smoke pretest (117.4 mmHg), posttest (116.8 mmHg) although blood pressure was still in the normal category. Likewise, the diastolic blood pressure of respondents who smoked pretest (78 mmHg), posttest (78.60 mmHg) was higher than those who did not smoke pre (78.15 mmHg), posttest (78.85 mmHg).

Smoking can increase blood pressure because cigarettes contain nicotine which stimulates the sympathetic nervous system to release the stress hormone norepinephrine and bind to the alpha receptor hormone. This hormone flows in blood vessels throughout the body. Therefore, the heart will beat faster, and the blood vessels will constrict. So that blood vessels narrow, which can increase blood volume, so hydrostatic pressure in the vascular will increase and cause an increase in blood pressure (Kurniati, 2012).

The study results support the WHO theory; individuals who continuously use tobacco tend to increase the risk of hypertension due to the cumulative consumption of tobacco use. These results are in line with Kurniati's research which shows that the more cigarettes smoked each day, the higher the systolic and diastolic blood pressure (Wahyudi, 2010).

Kurniati's research, in line with a study conducted by Anggara & Prayitno, found a significant relationship between smoking habits and blood pressure (p = 0.000), was in line with research conducted by Siburain (2004). According to the literature, nicotine and carbon dioxide contained in cigarettes will damage the endothelial lining of the arteries, reduce the elasticity of blood vessels, causing blood pressure to increase (Wahyudi, 2010).

Table 4 shows the average value of systolic blood pressure in respondents who smoked pre (119.5 mmHg), post (118.5 mmHg), while respondents who did not smoke pre (115.4 mmHg), posttest (110.8 mmHg). The diastolic blood pressure of respondents who smoked did not change pre-post (72.50 mmHg), respondents who did not smoke pre (73.69 mmHg), post (77.06 mmHg).

From table 5, it is known that the average difference in pre-post test systolic blood pressure in smoking respondents is -1 mmHg, non-smokers -5.13 mmHg. While the difference in the moderate diastolic blood pressure pre-post test in women is 3.37 mmHg. This means that the pre-post test systolic blood pressure of smoking and non-smoking respondents decreased blood pressure while smoking respondents' pre-post diastolic blood pressure did not change and did not smoke an increase.

Smoking affects blood pressure that can increase blood pressure. Supported by the WHO theory, individuals who continuously use tobacco tend to increase the risk of hypertension due to the cumulative consumption of tobacco use. These results align with Kurniati's research which shows that the more cigarettes smoked every day, the higher the systolic and diastolic blood pressure (Muttaqin, 2010).

Table 6 shows the control group's pretest and posttest systolic blood pressure, p-value 0.121 > 0.05, so H0 was rejected. This means that there is no significant difference in systolic blood pressure between the pretest and posttest in the control group. The difference between the average posttest and pretest blood pressure values is -1.278 mmHg. Pre-posttest in the control group obtained p-value 0.149> 0.05, so H0 is rejected. This means that there is no significant difference in systolic blood pressure between the pretest and posttest in the control group.

Table 6. Blood Pressure Pretest and Posttets in Students

Blood Pressure (mmHg)	**Min**	**Max**	**Mean**	**Difference Mean**	***p-value***
Systolic Control Group					
Pretest	110	139	119,83	-	0,121
Posttest	100	132	118,56	1,278	
Diastolic Control Group					
Pretest	72	86	78,11	0,667	0,361
Posttest	74	89	78,78		
Systolic Intervention Group					
Pretest	110	129	115,67	-4,666	0,03
Posttest	99	129	111		
Diastolic Intervention Group					
Pretest	60	88	73,56	3,333	0,194
Posttest	65	99	76,89		

The average difference between pretest and posttest diastolic blood pressure values is 0.6667 mmHg, the average difference between pretest and posttest systolic blood pressure values is -1.278 mmHg. This shows no significant difference in systolic and diastolic blood pressure pre-post test in the control group. There was no significant difference because, in this study, the control group was not given any treatment. The results of pretest and posttest blood pressure measurements tended to remain unchanged.

The results of the study support Kozier's theory that factors that affect blood pressure can be influenced by age, exercise, stress, gender, race, medication, diurnal variations, disease processes, and obesity (Vita, 2016). Meanwhile, according to Sudarta's theory, the factors that influence blood pressure are cardiac output, vascular resistance, volume, viscosity, and elasticity of blood vessel walls. In this study, several factors were not controlled by the researcher so that they could

affect changes in blood pressure in respondents (Kozier, 2015).

Based on Table 6, it is known that the pretest and posttest diastolic blood pressure in the control group obtained a p-value of 0.361> 0.05, so that H0 was rejected. This means no difference in diastolic blood pressure between the pretest and posttest in the control group. The average difference between the pretest and posttest blood pressure values was 0.6667 mmHg. Table 11 shows the pretest and posttest diastolic blood pressure in the control group, p-value 0.361> 0.05, so H0 was rejected. This means no difference in diastolic blood pressure between the pretest and posttest in the control group.

Table 6 shows the experimental group's pretest and posttest systolic blood pressure, p-value 0.030 <0.05, so H0 is accepted. This means a significant effect of coconut water consumption on pretest and posttest blood pressure in the experimental group. The difference between the average blood pressure values between the posttest and pretest is -4.6667 mmHg. The experimental group's pretest and posttest diastolic blood pressure obtained a p-value of 0.194 > 0.05, so H0 was rejected. This means that there is no significant effect of coconut water consumption on diastolic blood pressure between the pretest and posttest in the experimental group. The average difference in blood pressure values between the posttest and pretest was 3.333 mmHg.

Table 6 shows a significant effect on coconut water consumption on systolic blood pressure pretest and posttest in the experimental group. In contrast, the diastole pretest and posttest have no considerable impact. And also, in Table 6, it is known that the average difference between the pretest and posttest diastolic blood pressure values in the experimental group is 3.333 mmHg. While Table 6 shows the average difference between the pretest and posttest systolic blood pressure values is -4.6667 mmHg. This means that there is a decrease in systolic blood pressure pretest and posttest

Table 7. Differences in Systolic and Diastolic Blood Pressure Posttest Experiment Group and Control Group

Blood Pressure (mmHg)	Min	Max	Mean	Difference Mean	*p-value*
Systolic Blood Pressure					
Control	110	139	119,83	-4,16	0,021
Intervention	110	129	115,67		
Diastolic Blood Pressure					
Control	74	89	78,78	-1,89	0,371
Intervention	65	99	76,89		

Based on Table 7, posttest systolic blood pressure in the experimental and control groups obtained a p-value of 0.021 <0.05, so H0 was accepted. This means that there is a significant difference in posttest blood pressure in the control group and the experimental group. The difference in the average posttest blood pressure values is -4.16mmHg. Posttest systolic blood pressure in the experimental and control groups showed a significant difference in posttest blood pressure in the control and experimental groups. The difference in the average posttest blood pressure value was -4.16 mmHg, meaning that the posttest systolic blood pressure in the experimental group was lower than the control group.

The results of the study are supported by research conducted by Fahriza entitled "The Effect of Young Coconut Water Herbal Therapy on Lowering Blood Pressure in Hypertension Patients in Addrejo Village, Bandar District, Batang Regency", the results of the study in the adult category did not affect reducing blood pressure with a systolic p-value of 0.389 and diastole p-value 0.738 (Fahriza & Maryati, 2014). Because in the study only systolic blood pressure, there was a decrease in blood pressure, while in diastolic, there was an increase in blood pressure. Meanwhile, in a study conducted by Setiadi and Iwan, entitled "The Effect of Coconut Water (Cocos Nucifera L.) on Lowering Blood Pressure", the results showed a decrease in blood pressure both systolic and diastole after drinking 300 ml of coconut water (Setiadi & Budiman, 2013). The study was not in line because in the survey, only systolic blood pressure, there was a decrease in blood pressure, while in diastolic, there was an increase in blood pressure.

Based on Table 7 post-test diastolic blood pressure in the experimental and control groups, the p-value was 0.371 > 0.05, so H0 was rejected. This means that there is no significant difference in post-test blood pressure in the control and experimental groups. Post-test diastolic blood pressure in the experimental and control groups showed no significant difference in post-test blood pressure in the control and experimental groups. The difference in the average post-test blood pressure value is -1.89 mmHg, meaning that the post-test diastolic blood pressure in the experimental group is lower than the control group.

4. Conclusion

The results showed that young coconut water effectively lowered systolic blood pressure but not diastolic pressure. There was a difference between posttest systolic blood pressure in the control group compared to the intervention group. Systolic and

diastolic blood pressure in the intervention group was lower than in the control group.

5. Suggestion

The study results can be used as a basis for the use of herbs in the form of coconut water to maintain optimal blood pressure.

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