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Natrium dischargement from peripheral blood as a predominant factor influenced by the administration of banana (*Musa paradisiaca*) on elderly female hypertensive patient

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Abstract. Hypertension is more common in elderly female that triggered by diet and lifestyle changes. Bananas were not only useful for the food, but also for hypertension therapy and preserving life. Administration of bananas decreased blood pressure in hypertensive patients. This study aims to identify of factors that influenced by the administration of banana (*Musa paradisiaca*) on elderly female hypertensive patient. Twenty of elderly female patient were divided into 2 respondents group: control (11 patients) and treatment (9 patients). The treatment groups received banana twice a day during 2 weeks, but the control group didn't. Here, we showed the administration of banana significantly decreased blood pressure on elderly female hypertensive patient ($p = 0.00$) in both systole and diastole. There was a significant decrease in sodium levels ($p = 0.037$) in the blood, but potassium levels remained the same. Erythrocyte sedimentation level ($p = 0.136$) and trombocyte count ($p = 0.176$) in treatment group, were not affected by banana administration. Taken together, banana administration on elderly female hypertensive patient decreased the blood pressure significantly, greatly affected by the natrium dischargement from the blood. Thus, our findings contribute to preliminary comprehension of banana effect on hypertension reduction.

3 Introduction

Hypertension or high blood pressure is a health issue that predominantly occurred in some developed countries. Cardiovascular diseases caused 17 million deaths annually, nearly a third of the world population. About 9.4 million deaths annually by cardiovascular disease, caused by hypertension [1]. Hypertension caused due to lifestyle such as diet and lifestyle changes. Changes of lifestyle is not easy to be done, therefore need a comprehensive approaches to achieve the expected results. [2]. Age factor is also one of the hypertension influence risk.

Hypertension is a medical condition which the blood pressure in the artery rises above normal limits [3]. Based on data in 2013 from World Health Organization (WHO), in 2025 there are one billion people that suffering hypertension. Two-thirds of that number will comes from developing countries, including Indonesia. Based on data from WHO World Health Statistics, hypertension accounted for 51% deaths from stroke and 45% deaths from coronary heart disease [1].

The hypertension prevalence in Indonesian was 31.7%, or 1 in 3 persons had hypertension. The prevalence of hypertension decreased from 31.7% (2007) to 25.8% (2013). However, the prevention



and treatment management of hypertension were still needed. As many as 75% of hypertensive patients did not know realized that they had hypertension. They realized if there had been complications. In Indonesia, the threat of hypertension should not be ignored [4]. Government programs related to early disease detection and hypertension complications were desperately needed. Depok City Health Department issued data that showed the number of new cases of hypertension in 2013 as many as 19.275 cases (53,9%). Therefore, hypertension are the highest disease cases in the Depok area. From the 10 diseases of patients hospitalized in Depok City in 2013, hypertension occupies the 2nd position (13,63%) [5]. Most hypertensive patients who comes to the clinic in the Depok City in 2010 are women [6]. Those data showed that hypertension in women has been a serious problem which must be addressed, especially in Depok City.

A wide variety of plants has diuretic and potassium content. Diuretics has an antihypertensive effect by increasing the release of water and natrium. Potassium maintained stable in body through the electrolyte sodium potassium pump, reduced the amount of water and salt in the body, and loosen up blood vessels. The conditions made blood pressure become normal. Potassium intake from fruit were added in the diet of hypertensive patient can decreased of systolic and diastolic blood pressure [7].

A study diet therapy on hypertensive patients blood pressure, proved that bananas decreased high blood pressure due to the high content of potassium. The work mechanism of banana to decrease of hypertension is similar with antihypertensive drug [8,9]. In this study, we collected preliminary information of banana effect on hypertension patient, as well as to identify the factors in the blood and urine, that influenced by banana administration.

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2. Methods

2.1 Time and Place Research

This research was conducted in Posbindu Gandul Village, located Cinere Subdistrict, Depok City, Indonesia from February till May 2016. The blood and urine examination were performed in biology laboratory Department of Biology University of Al Azhar Indonesia.

2.2 Study Design

This study involved 20 hypertensive patients (9 control, 11 treatment) with the inclusion criteria were women aged 45-70 years which has a history of blood pressure $\geq 140 / 90$ mmHg (seen from the records of the Posbindu per month), has no history of other diseases that caused hypertension (diabetes, coronary heart disease, kidney disorders, etc.). Beside that, the respondents were not undergoing drug therapy of hypertension and willing to cooperate in this study. All respondents had knowingly signed informed consent. All examination procedures of blood samples were conducted in Posbindu Gandul Village, located Cinere Subdistrict, Depok City.

The study performed in four stages; banana administration, daily nutritional intake documentation, daily blood pressure examination, blood and urine samples examination. The administration of banana gave to treatment group only at a dose twice a day (morning and afternoon) during 2 weeks. Blood pressure of both respondents (control and treatment group) checked routinely during 2 weeks using digital sphygmomanometer. The blood pressure was checked using digital sphygmomanometer. Daily nutritional intake data was recorded as additional reference data. Blood and urine tests conducted to all respondents from day 0 (before study) and day 14 (after study).

Blood examination parameters were erythrocyte sedimentation rate (ESR), number of thrombocyte, and electrolyte concentration (potassium, natrium and chlorin). Urine examination parameter were leucocyte, nitrit, urobilinogen, protein, pH, blood content, specific gravity (SG), keton, bilirubin, and glucose level. The urine data transformed into score data from 0 (negative) to 6 (highest expression), respectively. The score data from urine was averaged to facilitate analysis.

The study involving two groups: the control group and the treatment group. The patients were taken in accordance with the inclusion criteria. Data were analyzed using bivariate analysis independent T test. As a normality prerequisite test on systolic and diastolic, we transformed the data into a logarithm due to abnormality data distribution, then continued with Mann Whitney U test.

3. Result and Discussion

3.1 Result

During two weeks of the study, blood pressure values of all respondents were fluctuated (figure 1). The trendline data showed decreased in systolic and diastolic treatment group, while the systolic and diastolic trendline of control remain increased in value. Both, systolic and diastolic value daily were fluctuated. The average decline of blood pressure was 6.8/6.3 mmHg per day. Banana administration during 2 weeks at a dose of twice a day had able reduced the systolic ($p = 0.00$) and diastolic ($p = 0.00$) of blood pressure significantly. This was confirmed by Mariani (2007) which proved that the fruits are high in potassium (including bananas) maintained homeostasis diastolic blood pressure [5]. In other hand, erythrocyte sedimentation rate and thrombocyte count were not influenced by banana administration (figure 2).

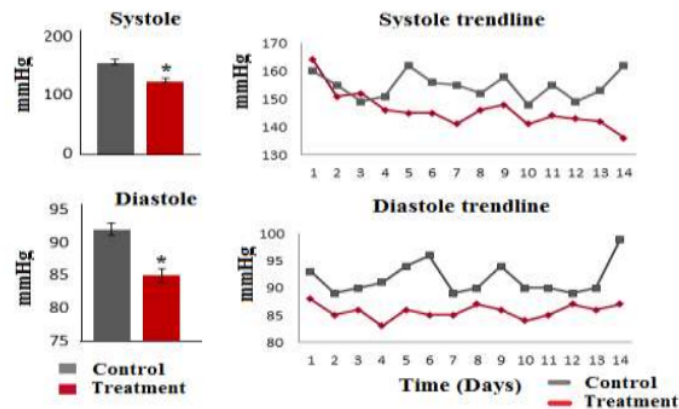


Figure 1. Blood pressure average and trendline from systole and diastole.

Banana administration reduced systolic and diastolic level daily. (A-B) Systole data showed significant reduction of blood pressure ($p = 0.00$). The systole trendline showed the treatment group was decreased daily, compared to control group. (C-D) Diastole data showed significant reduction of blood pressure ($p = 0.00$). The diastole trendline showed the treatment group was decreased daily, compared to control group. Data A and C represent means \pm SD and are derived from two times independent experiments (*, $P < 0.05$).

Banana administration did not affected ESR and thrombocyte count significantly. (A) ESR data showed reduction, but the alteration was not significant ($p = 0.136$). (C) Thrombocyte count data showed reduction, but the alteration was not significant ($p = 0.176$). Data represent means \pm SD and are derived from two times independent experiments (*, $P < 0.05$).

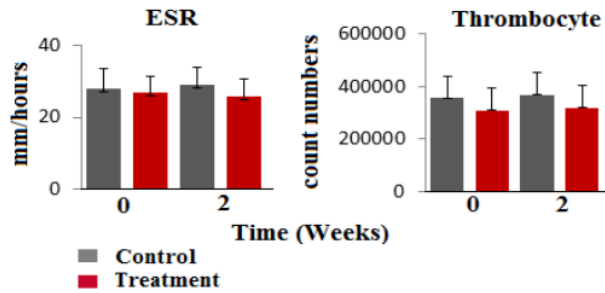


Figure 2. ESR and thrombocyte count average in the peripheral blood.

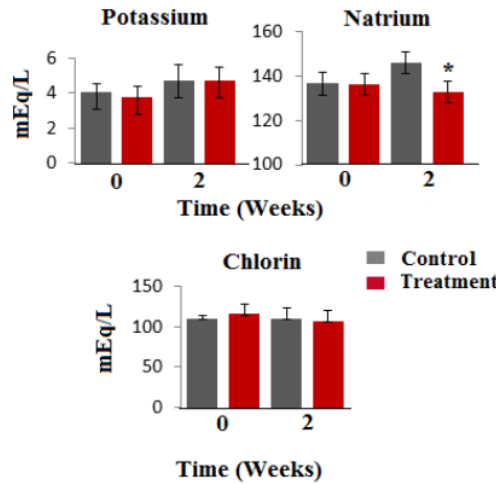


Figure 3. Potassium, natrium and chlorin average in the peripheral blood.

Banana administration did not affected to potassium and chlorin level significantly, but affected to natrium level in the blood significantly. (A) Potassium level showed no alteration ($p = 0.621$). (B) Natrium level showed significant reduction ($p = 0.037$). (C) Chlorin level showed no alteration ($p = 0.518$). Data represent means \pm SD and are derived from two times independent experiments (*, $P < 0.05$). The average value of blood potassium content showed no difference between control group and treatment group, either on weeks 0 or weeks 2. It means that potassium content in the blood were not influenced by banana administration (figure 3). It's the same case as potassium blood, the chlorin content in the blood showed no difference between control and treatment group, either on weeks 0 or weeks 2. In the other hand, blood natrium content on treatments group showed significant decline. On weeks 2, the blood natrium content of treatment group (132.81 mEq / L) compare to control group (146.06 mEq / L), was decreased significantly ($p = 0.037$, $p < 0.05$). The natrium blood content of control group was only small exceeding normal limits on weeks 2 (figure 3). For adult, the normal range of natrium content in the blood was between 135-145 mEq / L [6]. This occurred because a very high content of potassium in bananas can depleted natrium in extracellular space and increased natrium excretion in the urine (natriuresis) [10]. Detailed mechanism needs further investigation.

Not all of the urine analysis data showed difference (supplementary). The urine analysis data showed that there was a decrease in urine leukocyte esterase in treatment group at week 0 and week two. This result were in line with study in interstitial cystitis patient which showed that a subset patient with positive PST/ Potassium Sensitivity Test, were caused by abnormal epithelial permeability showed that potassium administration would lead to epithelial permeability improvement, reduced the leukocyte esterase level and urinary infection level [11].

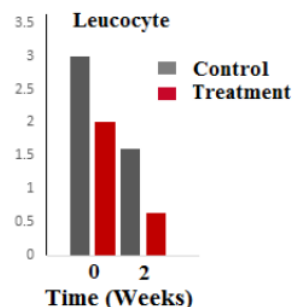


Figure 4. Average score for leucocyte esterase in urine on week 0 and week 2.

3.2 Discussion

Bananas administration to elderly female at a dose of 2 times a day during 2 weeks shown to decreased of blood pressure based on the results of statistical tests that had been carried out. This was also confirmed by the results of research conducted by Amran et al. (2010), which has been reported that the nutritional intake of fruits (not limited to bananas) for 2 weeks in the elderly can lowered blood pressure significantly [12]. Another study proved that the combination of banana juice and coconut water effectively lowered blood pressure in 25 elderly people in a nursing home within 5 days [7].

The mechanism of banana fruit in lowering blood pressure associated with one of dominant component in banana, which is potassium. The concentration of potassium in the banana fruit is estimated at 422 mg or 10% of daily potassium requirement for adults [13]. Potassium homeostasis levels are influenced by the kidneys that work to filter, reabsorption and excreted it under the influence of aldosterone [14]. Mechanism action of potassium to reducing blood pressure have been widely studied by researchers. Some researchers inferred that potassium works in several ways, which are affects the central nervous system and peripheral, change the activity of the renin-angiotensin and aldosterone, change directly peripheral resistance and has diuretic properties as well as the relationship physiological reciprocal with sodium, potassium can act as natriuresis [15].

Potassium affects the activity of the renin-angiotensin with working like ACE-inhibitor, which is an enzyme that may inhibit angiotensin II causes vasoconstriction of the blood vessels thus increasing blood pressure. Some researchers in India found the ACE-inhibitor in 6 different types of bananas [16]. In addition, potassium which administered either acute or chronic can suppressed the level of secretion or renin activity. Arteriolar smooth muscle response against angiotensin II and III could be reduced in animals when the diet is high of potassium. The increasing of potassium intake resulting of decrease in angiotensin circulation in the vascular [17].

In other hand, potassium can also initiate the process of diuretics and natriuresis in the body. One of study reported that dose of potassium to lead natriuresis ie with up to 300 mM per day which give for 4 days. In spite of initiation and diuretic natriuresis occurs due to potassium intake, sodium balance are generally returned to normal in the first week. The study that conducted by Meneely support the natriuretic effect of potassium which revealed total body sodium levels declined during the administration of a combination of high-potassium salt diet in rats. This indicates that under these

conditions, potassium effectively leading diuretic, minimal in the short term and even though the effect on the volume of body fluids is not clear, the mechanism is possible which can cause changes in blood pressure [15].

4. Conclusion

Banana administration to elderly female hypertensive patient decreased the blood pressure significantly. The sodium blood levels were greatly affected by banana administration. Our findings contribute to preliminary comprehension of banana effect on hypertension reduction.

Acknowledgement

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