

Lower Uric Acid Levels in Subjects Consuming Coffee compared to Not Consuming Coffee

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Abstract—Uric acid as the nitrogen compounds produced from catabolism purine from both diet and endogenous nucleic acids (DNA deoxyribonucleic acid). One of the factors that can increase uric acid levels is the factor of excessive purine intake. The habit of consuming coffee can reduce levels of uric acid because the content of polyphenol compounds in coffee such as *chlorogenic acid* can inhibit the activity of the enzyme *xanthine oxidase*, thereby reducing levels of uric acid. The purpose of study was to determine differences in uric acid levels between subjects who consumed coffee and did not consume coffee in the Eastern Puskesmas area in 2018. This study included an analytical study with research design *cross-sectional*. The number of study subjects was 46 subjects aged 45-54 years. Spectrophotometer Rayto measured the level of uric acid in the blood, data on the history of gout and consumption habits were obtained using an observation sheet. Data analysis used test *Mann-Whitney*. There were differences in uric acid levels between subjects who consumed coffee and did not consume coffee in the East Rim Health Center area in 2018, the uric acid level of subjects who consumed coffee was lower than subjects who did not consume coffee (CI 95% 6.20, 7.80 ; $p = 0.001$). Uric acid levels of subjects who consume coffee are lower than subjects who do not consume coffee, and coffee can be used as a non-pharmacological alternative treatment and prevention of Gout.

Keywords: *Uric acid levels, coffee, coffee consumption*

I. INTRODUCTION

Uric acid is the final product of purine metabolism that comes from metabolism in the body or factors *endogenous* (genetic) and comes from outside the body or factors *exogenous* (food sources). Every living thing produces uric acid as a result of cell metabolic processes that function to maintain survival. Uric acid is excreted in the kidneys (70%) and gastrointestinal tract (30%). The level of uric acid in the blood depends on the balance of production and excretion. Purine turnover occurs continuously along with the synthesis and decomposition of RNA and DNA so

that although there is no purine intake, uric acid is still formed in substantial amounts. Excessive increase in uric acid is also caused by the excess formation of uric acid in the body or obstruction of uric acid removal by the body. Increased levels of uric acid in the blood are called hyperuricemia [1].

Hyperuricemia is caused by two things, because of the formation of excessive uric acid or due to a decrease in uric acid secretion. The kidneys work to regulate the stability of uric acid levels in the body where some of the remaining uric acids are removed through urine. Excessive uric acid and the kidney is no longer able to regulate its stability so that uric acid will accumulate in the tissues and joints. High uric acid levels will cause severe pain, especially in the joint area. Hyperuricemia that is not treated causes excessive uric acid in the blood, causing a buildup of uric acid crystals. Uric acid crystals will damage the coronary endothelium (inner lining of blood vessels). If the crystal is in the joint fluid, it will cause Gout [2].

The prevalence of joint disease based on a diagnosis of health workers in Indonesia is 11.9% and based on diagnosis or symptoms 24.7%. The prevalence based on the diagnosis of health workers was highest in Bali (19.3%), followed by Aceh (18.3%), West Java (17.5%), and Papua (15.4%). The prevalence of joint disease based on the diagnosis of health workers or symptoms was highest in East Nusa Tenggara (33.1%), followed by West Java (32.1%), and Bali (30%). Based on data from the Bengkulu City Health Office, the number of arthritis in the city of Bengkulu is quite high and is included in the ten diseases that suffer most from the people of Bengkulu City [3].

Gout disease as a disease of purine metabolic disorders characterized by hyperuricemia and repeated attacks of acute synovitis. The incidence of Gout is 1-2%, especially in the age of 40 years and 20 times more often in men than in women. Gout is indeed many men who are caused by age, diet, decreased kidney function, and other health problems, but after 50 years of age, women are also

at high risk of developing Gout due to reduced estrogen, so uric acid is difficult to pass through urination. This disorder is related to the accumulation of monosodium monohydrate urate crystals and at a later stage joint cartilage degeneration. The limit of serum uric acid saturation in men is 7.0 mg / dL and in women 5.7 mg/dL. According to previous research, increasing uric acid levels in the blood are often related to geographical location, cultural patterns of local people, both those living in coastal areas and highland areas, have high protein and fat eating habits, and habits of consuming alcoholic beverages [4].

II. METHODS

This study uses study design *cross-sectional* - involving subjects collected according to the inclusion and exclusion criteria to be determined as research subjects. Inclusion criteria or characteristics that need to be fulfilled by each member of the population that can be taken as a sample in this study, namely (1) Having arthritis, (2) Not taking gout medicine; (3) Having the habit of drinking black coffee (Robusta) which is dissolved in 3 cups of hot water per day; (4) Respondents aged between 45-54 years. Of the population, 223 people met the inclusion criteria and taken 20% so that the number of samples in this study was 46 samples.

Uric Acid levels were analyzed by spectrophotometer (*Rayto*®), The tools used in this study were cuvette, blue and yellow tip, 1000 µL and 20 µL micropipette, beaker glass (*Pyrex*®), red lid vacutainer tube, centrifuge, centrifuge tube, tissue, 3 mL syringe, tourniquet, cotton, plaster, handscoon, mask. Sampling is done, namely (1) Tourniquet mounted on the patient's arm (3 fingers above the elbow fold); (2) The patient's arm is placed on the bearing; (3) The area of veins to be removed is cleaned with 70% alcohol cotton; (4) 2 mL of venous blood is sucked using a syringe; (5) The venous blood is inserted into the red lid vacutainer tube. The principle of checking uric acid levels is uric acid was oxidized by Uricase to become Allatoin and H₂O₂ in the presence of Peroxidase to produce chromogens colored measured with a wavelength of 500 nm which is proportional to the level of uric acid in the sample. Normal value of male uric acid 2.5-7.0 mg / dL, female 1.5-6.0 mg / dL. Work procedures (1) Tools and materials to be used are prepared; (2) Making serum from venous blood that has been taken is centrifuge for 15 minutes at a speed of 3000 rpm; (3) dilution of the working reagent was carried out by mixing reagent 1: reagent 2 (4: 1); (4) Work reagents are piped 1000 µL into 3 cuvettes; cuvette 1 (blank); kuvet 2 (standard); kuvet 3 (sample); (5) Reagent 3 is piped 20 µL into kuvet 2 (standard);

(6) Serum piped 20 µL into cuvette 3 (sample); (7) The cuvettes are homogenized respectively; (8) Incubated at room temperature (37°C) for 5 minutes; (9) Read on a 500 nm spectrophotometer and all used devices are cleaned.

III. RESULTS

Table I. shows the frequency distribution of uric acid levels of people who consume coffee and do not consume coffee. The number of respondents in this study was 46 subjects with arthritis in the East Rim City Health Center area of Bengkulu.

TABLE I. DISTRIBUTION OF FREQUENCY OF URIC ACID LEVELS BASED ON GENDER CHARACTERISTICS

	AU levels Coffee consumption				n	AU levels not Coffee consumption				n
	Normal		High			Normal		High		
	F	%	F	%		F	%	F	%	
P	8	57.14	6	42,85	14	2	11.1	16	88.88	18
L	8	88.88	1	11.11	9	1	20	4	80	5

V: Variable, L: Male, P: Female

Based on Table I shows the results of the frequency distribution of female uric acid levels that consumed mostly normal coffee as many as eight people (57.14%), and the frequency distribution of male uric acid levels consumed almost all normal coffee is eight people (88.88%). The results of the normality test analysis of data obtained from 46 respondents using the *Kolmogorov-Smirnov* and *Shapiro-Wilk tests* were not normally distributed seen from *p-value* <0.05, so no unpaired t-test was performed and an unpaired alternative t-test, the test *Mann-Whitney*.

Table 2. shows the results there are differences in uric acid levels between people who consumed coffee and did not consume coffee in the East Rim Health Center in 2018 (CI 95% 6.20, 7.80; *p* =0.001).

TABLE II. DIFFERENCES IN URIC ACID LEVELS OF SUBJECTS WHO CONSUMED COFFEE AND DID NOT CONSUME COFFEE

	Median (Min-Max)	<i>p</i>
Coffee consumption	6.20 (4-8)	0.001
No coffee consumption	7.80 (5-15)	

IV. DISCUSSION

Research on differences in levels uric acid people who consume coffee and do not consume coffee in the Bengkulu City Lingkar Timur Health

Center area was carried out on 23 respondents consuming coffee and 23 not consuming coffee. The method used spectrophotometry *Rayto*.

The results of this study indicate that coffee can reduce uric acid levels in the blood through the *chlorogenic acid* contained in it. *Chlorogenic acid* has the effect of inhibiting the enzyme activity of *xanthine oxidase*. The main content of coffee other than caffeine is a compound of polyphenols, the most polyphenol content in coffee is a *chlorogenic acid* which has the effect of inhibiting the enzyme *xanthine oxidase* thereby reducing serum uric acid levels [5]. The content of *chlorogenic acid* in coffee also has a diuretic effect that accelerates the excretion of uric acid in the urine, thereby reducing serum uric acid levels. *Chlorogenic acid* is one of the potent antioxidants from phenolic compounds capable of inhibiting the activity of the enzyme *xanthine oxidase* to reduce serum uric acid levels [6].

Consuming coffee can reduce the incidence of various types of diseases including diabetes mellitus, cardiovascular, cancer, and reduce levels of uric acid because coffee contains polyphenol compounds which are antioxidants around 200-550 mg of coffee. When the body consumes coffee with the content of polyphenol compounds, the body will get these antioxidants while still considering the process of processing and serving coffee. Coffee content (polyphenols) that has been identified as an antioxidant is *chlorogenic acid*, a compound that is formed during roasting. *Chlorogenic acid* acts to inhibit the activity of *xanthine oxidase* so that uric acid levels decrease. Polyphenols (*chlorogenic acid*) are also diuretic, so uric acid will dissolve and be wasted with urine [7].

Polyphenol (compound *chlorogenic acid* coffee) can inhibit the action of enzymes *xanthine oxidase* because the mechanism of inhibition is likely due to the similarity of the chemical structure of polyphenol compounds with derivatives *xanthin* derived from caffeine degradation and the body's metabolism. So that the biological activity of polyphenols can inhibit *xanthine oxidase*, like the way allopurinol works in reducing uric acid levels by using the inhibitory pathway of the enzyme *xanthine oxidase* [8].

The habit of consuming coffee can reduce the risk of gout due to the inhibition of the enzyme *xanthine oxidase* which is a catalyst for the change of hypoxanthine to xanthine and from xanthin back in the catalyst by the enzyme *xanthine oxidase* to uric acid [2]. If the work of the enzyme *xanthin oxidase* is inhibited, the formation of uric acid in the body will decrease. The work inhibitory mechanism of the enzyme is *xanthine oxidase* almost the same as the work of blood uric acid-lowering drugs (Allopurinol). One of the ingredients in coffee is that caffeine a crystal-shaped compound. The main constituents are

protein derivatives called xanthine purines. These compounds in normal body conditions do have some properties, among others, are analgesic drugs that can reduce uric acid levels, reduce pain and reduce fever [7]. Allopurinol is a chemical structure analogous to *hypoxanthine*, allopurinol as an analog substrate for the enzyme *xanthine oxidase*. The function of allopurinol as an analog substrate will occupy the active side of the enzyme *xanthine oxidase*, which is usually occupied by *hypoxanthine*. Allopurinol inhibits enzyme activity *irreversibly* by reducing the formation of *xanthine oxidase* which inhibits the formation of uric acid. The workings of polyphenols (*chlorogenic acid*) in a coffee can inhibit the formation of uric acid similar to the way allopurinol works. *Chlorogenic acid* which is one of the potent antioxidants from phenolic compounds was able to inhibit *xanthine oxidase* activity [8].

Whereas according to the results of the study. Antioxidants will capture free radicals and prevent chain reactions from free radicals. Uric acid is one of the secondary antioxidants inside the body. It means that at normal levels, uric acid will be able to ward off free radicals that are in the body, but in excessive amounts will harm the body. The coffee content that has been identified as an antioxidant is *chlorogenic acid* and is a significant contributor of antioxidants [7]. That the intake of high intake of coffee is not a risk factor with a decrease in uric acid levels, this study refers to the results of a study that showed that there was a decrease in uric acid levels after treatment in the group that obtained it coffee solution 0.72 mL/ day and 2.16 mL/ day. Phenol compounds have biological activities as potent antioxidants in vitro so they can protect DNA, lipids, and proteins by fighting damaging free radicals in vivo, to reduce the risk the occurrence of chronic diseases. Polyphenol compounds are also diuretics, so uric acid will dissolve and be wasted with urine [10].

Coffee is one drink that is very popular with the people of Indonesia and in other countries in the world. Studies that examine the effects of coffee consumption on a variety of certain medical conditions. The positive effects of consuming coffee include reducing the risk of Alzheimer's disease, Parkinson's, type 2 diabetes mellitus, liver cirrhosis, and reducing blood uric acid. The results of a study in Japan showed that drinkers of 3 glasses or more coffee per day had lower uric acid levels compared to drinkers of 1 cup or less coffee per day. Research in Canada shows that uric acid levels decrease with increasing consumption of robusta black coffee every day. Based on previous research, uric acid levels of mice with high doses of coffee decreased when compared with the group with low doses of coffee [5]. Taxonomically, coffee includes the Rubiaceae family, genus coffee. There are two species, namely *Coffea arabica*

(arabica) and *Coffea canephora* (robusta). Coffee is an alternative beverage choice that is very popular with Indonesian and other countries. The hobby of consuming coffee has been done for generations since the days of our ancestors, even in every banquet of both formal and non-formal events, coffee offers are rarely forgotten.

In some studies, coffee can reduce uric acid levels in the blood. The glucose concentration in plasma will decrease by the presence of chlorogenic acid in coffee. One of the ingredients in coffee, caffeine, is a crystalline compound. The main constituent is a protein derivative called purine xanthine. These compounds in normal body conditions do have several benefits, including analgesic drugs that can reduce uric acid levels, reduce pain and reduce fever [10]. Coffee is one of the results of plantation commodities that have high economic value among other plantation crops and play an essential role as a source of foreign exchange. Some of the compounds in coffee are polyphenols (chlorogenic acid) and caffeine. These compounds in normal body conditions do have some properties, including analgesic drugs that can reduce pain and reduce fever [11].

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V. CONCLUSION

From the results of this study concluded that uric acid levels of people who consume coffee are lower than those who do not consume coffee.

REFERENCES

- [1] Kanbara, A. *et al.* Urine Alkalization facilitates uric Acid Excretion, *Nutritional Journal* 2010, 9: 45 doi 10.1186 / 1475-289145.
- [2] Dahlia, M. 2010. Effect of Drinking Coffee against Diabetes and Gout in Men in Semarang City. *Health Journal of Indonesian Islamic University*. 12-14.
- [3] RISKESDAS. (2013). Basic Health Research. Health Research and Development Agency. *RI Ministry of Health*.
- [4] Anticipated. (2013). Ervi Diantari, Aryu Candra *). Effect of Purine and Liquid Intake on Female Uric Acid Levels of 50-60 Years in Gajah Mungkur District, Semarang. *Diponegoro University*, 2, 44–49.
- [5] Koto *et al.* (2014). Research Article Effect of Instant Oral Coffee on Uric Acid Levels on Wistar Rats. *UNAND*.
- [6] Dahlia, M. 2010. Effect of Drinking Coffee against Diabetes and Gout in Men in Semarang City. *Health Journal of Indonesian Islamic University*. 12-14.
- [7] Lelyana, Rosa. (2008). Effect of Coffee on Blood Uric Acid Level Experimental Study on Rattus Norwegicus Rat Galur Wistar. Post Graduate Program in Master of Biomedical Sciences. Semarang: Diponegoro University.
- [8] Arwangga, Aryans. *et al.* (2016). Analysis of Caffeine Content in Coffee in Sesaot Narmada Village using Uv-Vis Spectrophotometry. Bali: *Udayana University*.
- [9] Hermawati, Eka. (2015a). The relationship between Caffeine Intake and Uric Acid Levels at Banjarnegara Health Center, 1–19.
- [10] Pratama, RI (2016). Effect of Coffee Consumption on Decreasing Blood Uric Acid Levels of the Effect of Coffee Consumption in Lowering Blood Uric Acid Level. *University of Lampung*, 5.
- [11] Wahyuono, S., & Widyarini, S. (2016). Mentah Dari Perkebunan Merapi Daerah Istimewa Yogyakarta