

IDENTIFICATION OF CALCIUM OXALATE IN URINE SEDIMENT FOR CONSUMING CAFFEINATED DRINKS AT PAUWO VILLAGE

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ABSTRACT

This study aimed to determine urinary calcium oxalate sediment in men and women who consume caffeinated drinks in the Pauwo Village, Bone Bolango district in 2021. The method in this study used a qualitative approach with the type of research used was descriptive univariate. The type of data used was primary data and secondary data sourced from questionnaires. The sampling technique in this study used a purposive sampling technique using a sample of 30 people consisting of men and women who consumed caffeinated drinks.

The results showed that of the 30 samples of men and women who consumed caffeinated drinks in the Pauwo Village of Bone Bolango district found abnormal urine sediment as many as 21 people from 30 samples and normal urine sediment as many as 9 people from 30 samples which contained calcium oxalate urine sediment in it. The factors that influence the presence of calcium oxalate in men and women include age, gender, and duration of consuming caffeinated drinks.

Keywords: caffeinated drinks, urine sediment, calcium oxalate

INTRODUCTION

Caffeine is basically a natural supplement to balance the body as an effective strategy for maintaining physical and cognitive performance. Based on the percentage results, 80% of the world's population consumes caffeine every day in which this amount is considered relatively high [22].

Drinks or foods that contain caffeine include coffee, tea, energy drinks, and chocolate. From the results of the comparison of daily caffeine consumption, especially coffee, it was found that men consumed more caffeine than women. This is shown by data where men consume caffeine around 3.83 kg/year and women

1.97 kg/year. The benefits of consuming caffeine in normal amounts include increasing alertness, learning ability, physical performance, and improving mood. Meanwhile, consuming large doses of caffeine can cause adverse effects in sensitive people, such as anxiety, increased heart rate, and insomnia that occurs 2-6 hours after drinking caffeinated drinks [18].

Not getting caffeine for a few days and then drinking the equivalent of 2 or 3 cups of caffeine will increase urine production. Three cups per day of caffeine is still a rough estimate and can be considered excessive because a person can consume

caffeine other than coffee such as energy drinks or tea in the same day.

Research conducted by Massey showed that consuming too much caffeine equivalent to two to four cups a day every day for a long time will increase the risk of kidney stone disease (renal calculi). Calcium stones are a type of kidney stone formed and come from a combination of calcium and oxalate crystals, which will result in increased levels of calcium in the urine.

Caffeine is a crystalline xanthine alkaloid compound, and it has a bitter taste that acts as a psychoactive stimulant and mild diuretic. The term “caffeine” refers to a chemical compound in coffee. Caffeine is naturally found in foods such as coffee beans, tea leaves, and cola [8].

It is estimated that caffeine addiction occurs when consuming more than 600mg of caffeine or the equivalent of 5-6 cups per day and consumed within a period of 8-15 consecutive days. Caffeinated drinks are high in oxalate. If consumed in excessive doses, it can cause the formation of calcium oxalate in the kidneys which causes kidney stone disease or nephrolithiasis [26].

Food and Drinks contain Caffeine

The food or drinks ingredients that contain caffeine include:

1) Coffee

Coffee is a dark black drink with a distinctive aroma which is usually made with hot water and is dominated by a bitter taste. Almost everyone likes coffee drinks. The aroma and taste of coffee makes the audience addicted. Coffee has a distinctive taste that is different in each region. The cause of the difference in coffee taste is due to the processing procedures in obtaining high quality coffee [3].

Coffee is the most consumed beverage in the world. Coffee also contains caffeine which plays an important role as a stimulant. Coffee is usually consumed in

the morning before activities, during the day when working in the office, in the afternoon when relaxing, and at night to stay up late or work overtime. A 150 ml of instant coffee contains 40-108 mg of caffeine [13].

2) Drinks containing soda and energy

In addition to coffee, which is the largest source of caffeine, there are also energy drink products that contain almost the same caffeine as coffee. According to The National Agency for Drug and Food Control of Indonesia (BPOM), a soft drink contains 50 mg of caffeine per bottle and is only allowed to be consumed as much as one bottle per day. Meanwhile, energy drinks per sachet usually contain 25 mg of caffeine [8].

3) Tea

Besides water, tea is the most consumed beverage in the world and has health benefits. Tea is also a source of caffeine. The amount of caffeine in tea is equal to half of the caffeine in coffee. Some types of tea, especially black tea, contain more caffeine than other types of tea. Black tea contains 40-100 mg of caffeine per cup. While in other teas, in 100 grams there are 2.5-4-5 mg of caffeine [17].

4) Chocolate

Chocolate is made from cacao beans that only grow in the tropics. Consuming a glass of chocolate or a chocolate bar is commonplace for the society. One chocolate bar contains 100 mg of caffeine [4].

Benefits of consuming caffeine

The benefits of consuming caffeine are:

1) Improves Focus & Alertness

Caffeine is a natural stimulant that can increase focus and alertness. In addition, caffeine makes a person feel more energized.

2) Improves Memory And Cognitive Ability

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Consuming caffeine can improve memory. This is evidenced by the fact that people who consume coffee in the morning will find it easier to answer exam questions.

3) Improves exercise performance

Consuming a small amount of caffeine about 1 hour before exercise can increase muscle strength, energy, and endurance during exercise.

Negative effects of consuming caffeine

The negative effects of consuming caffeine are:

1) Leads to gastritis

Chlorogenic acids contained in caffeine can increase the production of stomach acid in the body. This is due to the process of relaxation or weakening of the muscles under the esophageal canal called esophageal sphincter.

2) Increase the risk of kidney stones

Consuming caffeine increases the risk of kidney stone disease. Kidney stones are formed from the combination of calcium crystals and oxalates which result in high calcium levels in the urine.

3) Increases blood flow in the kidneys

Caffeinated drinks stimulate the pacemaker of the heart to be faster causing an increase in blood circulation in the organs including the kidneys which causes the bladder to fill quickly and there is an increase in the production of urine.

Urine

Urine is a waste product that will be excreted by the kidneys as the end product of the metabolic system. The composition of substances in urine varies depending on the food or water consumed [23].

Urinalysis is one of the oldest clinical tests in history. Urinalysis comes from English consisting of the words *urine* and *analysis*. This urinalysis examination consists of chemical, macroscopic and microscopic examinations. Urinalysis provides information about the kidneys and

urinary tract, and even about the physiology of various organs of the body such as the liver, bile ducts, pancreas, and adrenal cortex [6].

Urine Sediment

Urinary sediment is a component of urine that is insoluble in the blood, kidneys, and urinary tract. Therefore, examination of urine sediment is very important to help diagnose and monitor disease progression in kidney and urinary tract disorders [18].

Preparing Urine Sample

Samples must be collected in a closed, clean and dry container. Disposable urine pots must be used to eliminate the possibility of contamination due to improper washing. The urine pot is tightly closed to prevent leakage. The recommended urine pot capacity is 50ml which can accommodate 12ml urine samples for analysis [5].

A good sample for examination of urine sediment is concentrated urine, which has a specific gravity of 1.023 or higher. Concentrated urine is easier to obtain if used morning urine for examination [6].

Calcium

Calcium is the most important element in the body. The amount of calcium in the body is about 1.52 mg by weight of an adult. Even in infants, only a small amount of calcium such as 25-30 grams. However, at the age of 20 years and over, about 1,200 mg of calcium is usually put into the body. Calcium is distributed 99% of the hard bone tissue and teeth. The remainder is widely distributed throughout the body, including intracellular and extracellular fluids.

The greater the amount of calcium consumed, the greater the excretion and increased crystallization of salts in the body. High levels of calcium in the urine is called hypercalciuria [9].

Oxalates

Oxalates often form calcium crystals. Oxalate in urine comes from the body (endogenous), from food eaten that the body converts it into vitamin C. At the same time, the portion of food is only 10% (mostly endogenous) but this amount is considered sufficient even though it is important to avoid eating only foods or drinks rich in oxalate [12].

Calcium Oxalate

Calcium oxalate is a crystal consisting of calcium and oxalate. Calcium oxalate is a common crystal causing urinary stones (70-75%). Calcium is a normal mineral compound excreted by the body [12].

RESEARCH METHOD

This research was included in the type of qualitative descriptive research. The process of collecting data through interviews and observations [6]. The type of qualitative research used was case study research with the aim of collecting data, assuming meaning, gaining an understanding of a case.

This research was carried out in June-July 2021 in Pauwo Village. The sampling location was conducted in Pauwo Kabila Village, Bone Bolango district. The place for the research was carried out at the UPTD Regional Health Laboratory Center of Gorontalo Province.

The type of data used was primary data, namely data that researchers received or collected directly in the field in the form of the results of collecting urine analysis on men and women who consumed caffeinated drinks in the Pauwo village.

Sources of data derived from measurements of urine sediment in men and women who consumed caffeinated drinks with a total of 30 samples were obtained consisting of 15 men and 15 women.

Population

According to Masturoh and Nauri (2018), the population is the entire object under study or the object to be studied. Population is defined as each element that is the object of investigation. This population element is usually used as a unit of analysis in research. The population of this study were all men and women who consumed caffeinated drinks in Pauwo Village.

Sampling

Masturoh and Nauri (2018) state that the sample is part of the research target population. In determining or taking a population sample there is a rule that the sample represents the population. The sampling technique used in this study was purposive sampling with samples from men and women who consumed caffeinated drinks in Pauwo Village.

Data Collection Method

The data collection method used in this study is Informed Consent which is an ethical aspect in a study. Respondents were asked to fill out a research informed consent form. If the respondent refused, the researcher would not force them for human rights reasons. If the respondent agreed with the research, they should sign a statement of consent.

Further data collection was obtained from the research questionnaire. Questionnaire is a research instrument to obtain data and find out information about respondents' attitudes such as beliefs, behaviors, and their characteristics. Furthermore, laboratory examination of urine samples from respondents was carried out.

Data analysis was performed using descriptive univariate by looking at the presentation of urine sediment in men and women who consumed caffeinated drinks.

The results are presented in tabular form and assessed descriptively.

Data Validation

The validity of the data used in a study is a credibility test with extended observations, increased persistence in research, triangulation of discussions with colleagues, negative case analysis, and member checks.

In this study, the credibility of the data was obtained through triangulation. Triangulation is defined as checking data from various sources. This is done to check or compare the research data carried out so that the information obtained is correct [12].

1. Credibility

Credibility test is a test of the truth of research data submitted by researchers so that the results of the research are not in doubt as scientific papers.

Additional research time is needed to build a trusting relationship with the respondents. It is expected that with a good relationship, respondents will become more open and trust the researcher. In addition, in-depth observations are carried out to verify the adequacy and correctness of the data obtained. The extension of the observation period can be stopped when the data verification in the field has been completed.

Observations made carefully and continuously will get maximum research results. In addition, researchers need to read various references such as books, articles, and journals to support the results of the research carried out.

Triangulation is the verification of data from different sources and at different times. Triangulation consists of 3 types, namely source triangulation, data acquisition techniques, and time.

Negative case analysis is a researcher looking for data that is not the same or even contradicts using data that has been found. If the data obtained are in sync with the

research conducted, then the data found are declared reliable.

There is a need for supporting references to show the data found by researchers. In addition, in the research report, it is recommended to present data documentation along with photographs, so that the research can be trusted.

Member checks are re-checking the extent to which the data collected matches the information provided by the respondent. Therefore, the purpose of member checks is to ensure that the research results are consistent with the data and sources of information provided by the respondents.

2 Transferability

Transferability is an external validity testing technique in qualitative research. This test can show the level of accuracy of the research results obtained. Transferability test in research aims to provide a detailed, clear and systematic description of research results.

3. Dependability

Dependability in qualitative research is achieved by auditing the entire research process. Next, the researcher conducts an examination in such a way and reviews the entire research process. At this stage the researcher can consult with the supervisor to reduce errors in the presentation of research results and in the process during research.

4. Confirmability

Confirmability is a test of objectivity in qualitative research. Research can be said to be objective if this research has been approved by many people. In this study, the data were obtained from urine sediment results in men and women who consumed caffeinated drinks in the working area of the Health Center.

RESULTS

Factors Affecting the Presence of Calcium Oxalate

The factors that affect the presence of calcium oxalate were age, gender, and duration of consuming caffeinated drinks.

Characteristic of Samples

Based on the results of data processing, it was found that the characteristics of urine sediment samples of men and women who consumed caffeinated drinks in the Pauwo village included the distribution of caffeinated drinks consumption by age group, gender, duration of consumption.

Age

Table 4.3

Distribution based on age

No	Ages	Frequenc y	Percentag e
1	21-24	5	16,67
2	25-29	5	16,67
3	30-38	8	26,67
4	40-47	5	16,67
5	50-58	4	13,33
6	60-64	3	10
Total		30	100

Table 4.3 shows that men and women who have urinary calcium oxalate sediment with the highest number are in the age group of 30-38 years as many as 8 people (26.67%) and the age group of 60-64 years (10%) as many as 4 people where the age group this is the lowest number.

Gender

Table 4.4

Distribution based on gender

No	Gender	Frequenc y	Percentag e
1	Men	17	56,67%
2	Wome n	13	43,33%
Total		30	100

Table 4.4 shows that the percentage of urine sediment in men is higher than in women. The number of men as many as 17

people (56.67%) and the number of women as many as 13 people (43.33%).

Duration of consuming caffeine

Table 4.5

Distribution based on the duration of consuming caffeine

No	Durati on (years)	Frequenc y	Percentag e
1	1-5	6	20
2	6-10	17	56,67
3	11-20	7	23,33
Total		30	100

Table 4.5 shows that the longest duration of respondents consuming caffeine is 6-10 years (56.67%) and the shortest duration of consuming caffeine is 1-5 years (20%).

Urine Sediment Examination Results in Men and Women

Table 4.6

No	Levels	Frequenc y	Percenta ge
1	normal	9	30%
2	abnorma l	21	70%
Total		30	100

Table 4.7 shows that urine sediment in men and women who consumed caffeinated drinks with normal levels is 9 people (30%), and abnormal levels is 21 people (70%). This indicates a high percentage of abnormal urine sediment compared to the percentage of normal urine sediment.

DISCUSSION

Based on the results of research using microscopic methods in the laboratory of the UPTD Regional Health Laboratory of Gorontalo Province on 30 samples in Pauwo Village, Bone Bolango district, in 2021, the results of the identification of calcium oxalate in the urine sediment were 21 respondents (70%) of men who

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consumed caffeine had abnormal urine sediment.

Based on the results of the study, the abnormal urine sediment found was calcium oxalate urine sediment. Consuming drinks containing caffeine can cause calcium oxalate to form in the urine and can increase the risk of kidney stones. Kidney stones are formed from a combination of calcium and oxalate.

These results are in line with research conducted by Ni Made (2020) which states that consuming caffeine drinks such as coffee, tea, and energy drinks can form calcium oxalate in the kidneys or bladder. As the nucleus forms, the crystal size continues to increase until it reaches its maximum. When crystals are unable to grow and develop, they will combine with other crystals to produce particles that are larger than their previous size.

Kidney stones can cause hydronephrosis. Hydronephrosis is an enlargement of the kidneys caused by the inability of urine to flow. This can cause a blockage in the urinary tract that causes symptoms such as back pain that radiates to the groin, pain when urinating, gritty urine with blood, fever, nausea, and vomiting.

Age

Based on the research results obtained, the formation of calcium oxalate urine sediment in the urine of men and women who consume caffeine mostly occurs in men and women who are >30 years old (26.67%) which can be seen in table 4.3. Ages over 30 years are susceptible to urinary tract stones because the age factor is related to the body's metabolic processes. The older a person gets, the less immune system one has and being more vulnerable to disease, especially in fighting bacterial infections, viruses, toxins, etc.

These results are in line with research conducted by Akmal, (2013) stating that the occurrence of urinary tract stones is most often found at the age of 30-50 years

because of risk factors that can affect the form of crystallization where the addition of stone size increases with age. The mineral calcium oxalate in the human body will make compounds that are insoluble and cannot be absorbed by the body. Calcium oxalate stones cause about 80% of kidney stones in adults between the ages of 30 and 60 years.

Gender

Based on gender characteristics, the results showed that cases in men were more than in women, which can be seen in table 4.4. Men had abnormal calcium oxalate levels of 56.67% and in women of 43.33%. Men are at risk for urinary tract stones because in men's genitalia there are higher levels of calcium oxalate inside and man has hormone testosterone in their body which can increase oxalate production [13].

These results are in line with research conducted by Raggi (2018) stating that calcium oxalate urine sediment causes a lot of urinary tract stone disease, which is around 70-75% and is two times more common in men than in women. Calcium oxalate stones occur due to multifactors, one of which is hypercalciuria (excess calcium). Excess calcium can be determined based on caffeine consumption. Caffeine can form calcium stones resulting in high levels of calcium in the urine.

Duration of consuming caffeine

Based on the length of time consuming caffeinated drinks, it was found that the longest duration respondent consumed caffeine was 6-10 years (56.67%) and the shortest duration was 1-5 years (20%). Consuming caffeine for more than 1 year is at risk of causing calcium oxalate sediment in the urine. This is because caffeine tends to inhibit the work of the hormone adenosine, which is responsible for dilating blood vessels. If

the action of the hormone adenosine is inhibited, narrowing of the blood vessels can occur so that blood pressure rises which causes hypertension. Prolonged hypertension makes the heart work harder and slowly blocks blood vessels in certain body parts.

CONCLUSION

Based on the results of research and discussion, it can be concluded as follows:

1. Factors that affect the presence of calcium oxalate in men and women who consume caffeinated drinks are age, gender and duration of consuming caffeinated drinks..
2. The results of the examination found the presence of calcium oxalate in the urine of 30 men and women who consumed caffeine. Urine sediments with abnormal levels were more commonly found in men, as many as 21 people (70%). In women as many as 9 people have urine sediment with normal levels (30%).

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