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Description of Calcium Oxalate Crystals in Urine Based on Degree of Dehydration

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ABSTRACT

Dehydration is a condition of lack of body fluids because the amount that comes out is more than the amount of fluid that goes in, water output must be balanced with water intake, if there is an imbalance of fluids in the body, dehydration will occur. Reducing fluid consumption means the body will automatically experience dehydration, this dehydration will trigger a constant decrease in urine volume. Urine volume indicates insufficient water in the body dissolving minerals and urine. If there is not enough fluid in the urine, the bound oxalate and calcium will collect and form stones. The formation of stones is directly related to lack of fluid intake in the body. The formation of calcium oxalate crystals can cause kidney stones. Oxalate can precipitate and form calcium oxalate which cannot be absorbed by the body, resulting in insoluble salt deposits forming which cause kidney disease. In the body, oxalate will combine with calcium to form calcium oxalate crystals. To determine the appearance of calcium oxalate crystals in urine, the degree of dehydration. This type of research is qualitative research using the microscopic method. The population in this study were students, etc. Medical laboratory technology, Stikes Panrita Husada Bulukumba. There were 45 samples, 15 samples of mild dehydration, 15 samples of moderate dehydration, and 15 samples of severe dehydration. The sample in this study was a urine sample. Based on the research that has been carried out, results were obtained from 45 samples, 15 samples of mild dehydration, 15 samples of moderate dehydration, and 15 samples of severe dehydration. In severe dehydration, 1 sample was found that obtained a positive result (+) with a percentage of (6.7%).

Keywords: *Dehydration, Calcium Oxalate Crystals*

I. INTRODUCTION

Dehydration is a condition of lack of body fluids because the amount that comes out is more than the amount of fluid that goes in. Water output must be balanced with water intake. If there is an imbalance of fluids in the body, dehydration will occur (Sri, 2020). Calcium oxalate crystals are chemical compounds consisting of calcium ions and oxalate ions. Calcium oxalate crystals are a combination of calcium in urine and substances in food. If these two substances are combined in excessive amounts, they

can form crystals in the urine. If these crystals are continuously present in excessive amounts in the urinary tract, the crystals can settle and accumulate together to form stones in the urinary tract (Qoyyim, 2019). Not drinking enough water causes the body to automatically become dehydrated, this dehydration will trigger a constant decrease in urine volume. Urine volume indicates insufficient water in the body dissolving minerals and urine. If the body does not have enough fluid in the urine, bound oxalate and calcium will collect and form stones. Stone formation is directly related to lack of fluid intake (Dehydration) and is by far one of the common causes of kidney stone formation (Sholihah & Utami, 2022).

According to the World Health Organization (WHO) 2017, the degree of dehydration stated that 2.5 million cases of people experienced dehydration. Dehydration also occurs in Singapore, reaching 49.2%. In Indonesia, it was found that 49.5% of teenagers were dehydrated, this was caused by not consuming enough water (Herman et al., 2021). Judging from the cases that occur, 80% of the composition of stones are often found in the kidneys (Elyana, 2020). The most common symptoms of dehydration are a faster heart rate, dizziness, dry mouth, and smelly urine as well as the risk of urinary tract infections and the formation of kidney stones (Amalia Yunia Rahmawati, 2020). Judging from the data found, the lack of awareness among teenagers about consuming fluids as needed is still an important factor related to dehydration that occurs among teenagers, many teenagers do physical activities which cause faster fluid loss through sweat or exposure to sunlight. Judging from the results of the researchers' initial survey of Medical Laboratory Technology Etc. students, many teenagers were reluctant to drink or consume enough fluids. The impact this has on health, especially that the organs in the body do not receive an adequate supply of oxygen and nutrients (Amari, 2023).

II. METHODS

This research employed laboratory experimental methods. The laboratory experiment method refers to activities conducted within a laboratory setting to observe, measure, or test hypotheses through scientific methods (Akbar et al., 2023). The location of this study was the Clinical Pathology Laboratory of STIKES Panrita Husada Bulukumba, and the research was carried out from April to May. The population of this study included all students of the Medical Laboratory Technology study program at STIKES Panrita Husada Bulukumba. The sample consisted of a portion of these students, selected using probability sampling through a simple random sampling method. A total of 45 samples were selected, categorized according to the degree of dehydration: 15 samples with mild dehydration, 15 samples with moderate dehydration, and 15 samples with severe dehydration. These samples were selected based on specific inclusion criteria.

The inclusion criteria for this study were Health Analyst students, both male and female, who were willing to provide urine samples and were diagnosed with Type 2 Diabetes Mellitus. The exclusion criteria included students during their menstrual period, students who consumed colored beverages prior to sampling, and students who were currently taking medications.

The research procedure comprised several stages: pre-analytical, analytical, and post-analytical. In the pre-analytical stage, preparation of tools and materials, patient preparation, and sample preparation were conducted. Equipment used included clean and dry urine collection containers, glass slides, cover slips, test tubes, test tube racks, centrifuge, dropper pipettes, and a Yazumi microscope. Materials involved random urine samples, tissues, and labels.

In the analytical stage, urine samples were first homogenized. Subsequently, 10 ml of urine was transferred into centrifuge tubes and centrifuged for 5 minutes at a speed of 1500–2000 rpm. After centrifugation, the supernatant (top liquid) was quickly discarded, and the tube was repositioned upright to obtain the urine sediment. The sediment was then gently resuspended by shaking the tube. One to two drops

of the resuspended sediment were placed onto a glass slide using a micropipette and covered with a cover slip. Microscopic examination of the urine sediment was performed initially under a 10x objective lens, referred to as Low Power Field (LPF), to identify epithelial cells and count cylinders, followed by observation under a 40x objective lens, termed High Power Field (HPF), to detect crystals. Observations were systematically recorded. In the post-analytical stage, the findings were categorized as positive (+) if calcium oxalate crystals were observed, or negative (–) if these crystals were absent from the urine sample (Thom & Nadhiroh, 2023). Data analysis involved categorical descriptive statistics, aiming to describe the occurrence of calcium oxalate crystals in urine based on the degree of dehydration. Statistical testing for data analysis was conducted using categorical percentage or proportion tests.

III. RESULTS AND DISCUSSION

a. Research result

This research was conducted at the Stikes Panrita Husada Bulukumba Clinical Pathology Laboratory on April 23 2024. It can be shown in the primary data table of the examination results as follows:

Table 1. Examination Results

No	Sample Code	Age	Gender	Moderate Dehydration	Mild Dehydration	Severe Dehydration
1	MR	22	F	-	-	-
2	AW	21	F	-	-	-
3	RA	22	F	-	-	-
4	WE	20	F	-	-	-
5	NA	21	F	-	-	-
6	AA	21	M	-	-	+
7	WS	22	M	-	-	-
8	AR	21	F	-	-	-
9	AZ	21	F	-	-	-
10	AS	23	F	-	-	-
11	AD	21	F	-	-	-
12	PS	22	F	-	-	-
13	NF	21	F	-	-	-
14	S	21	F	-	-	-
15	AA	22	F	-	-	-

Source: Primary data 2024

In this study, the population was taken from 15 DIII Medical Laboratory Technology students, using a sample of 15 respondents with 45 samples consisting of 15 samples of mild dehydration, 15 samples of moderate dehydration and 15 samples of severe dehydration with the aim of knowing the description of Calcium Oxalate Crystals at the level of dehydration**.**

Table 2 Respondent Characteristics

Jenis kelamin	N	%
Male	2	13
Female	13	86
Amount	15	100

During the research, from 15 samples, it was found that the number of female respondents was greater than male, namely 2 males with a percentage of (13.3%) and 13 females with a percentage of

(86.7%).

	N	Min	Max
Age	15	20	23
Valid N	15		

When the research was conducted, research results were obtained which showed that the characteristics of the respondents were an average of 20-23 years old, there were no respondents who were under 20 years old at the time the research was carried out.

Table 3 *Description of mild dehydration research results*

	N	%
Valid		
Negative	15	100
Total	15	100

Source: Primary data 2024

Based on the table above, it shows the results of the mild dehydration examination with 15 urine samples which showed negative results (-) with a percentage of (100%), which means that no calcium oxalate crystals were found in the mild dehydration urine sediment examination.

Table 4. *Description of research results for moderate dehydration*

	N	%
Valid		
Negative	15	100
Total	15	100

Source: Primary data 2024

Based on the table above, it shows that the results of the moderate dehydration examination with 15 urine samples obtained negative results (-) with a percentage of (100%), which means that no calcium oxalate crystals were found in the moderately dehydrated urine sediment examination.

Table 5. *Description of research results for severe dehydration*

	N	%
Valid		
Negative	14	93,3
Positive	1	6,7
Total	15	100

Source: Primary data 2024

Based on the table above showing the results of a severe dehydration examination with 15 samples, 14 samples obtained negative results (-) with a percentage of (93.3%) and 1 sample obtained positive results (+) with a percentage of (6.7%), which This means that in severe dehydration calcium oxalate crystals are found.

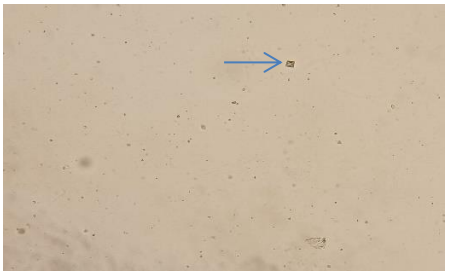

Figure 1. *Calcium Oxalate Crystals in Urine*

b. Discussion

In this study, based on the examination results shown in table 4.1, 45 samples were obtained from the 15 people examined. In Table 4.2 Respondent Characteristics, During the research, from 15 samples, it was found that the number of female respondents was greater than male, namely 2 males with a percentage of (13.3%) and 13 females with a percentage of (86.7%).

And when the research was conducted, research results were obtained which showed that the characteristics of the respondents were an average of 20-23 years old, there were no respondents who were under 20 years old at the time the research was carried out.

Results were obtained in table 4.3, mild dehydration examination with 15 urine samples obtained negative results with a percentage (100%), in table 4.4, moderate dehydration examination with 15 urine samples obtained negative results with a percentage (100%), and in table 4.5, examination of severe dehydration with 15 urine samples found 14 samples which obtained negative results with a percentage (93.3%) and 1 sample obtained positive results with a percentage (6 .7%) which means calcium oxalate crystals were found. Calcium oxalate crystals are a form of mineral deposits that form in the urinary tract which are usually found in the pelvis and renal calyces (Elyana, 2020).

The metabolism of calcium oxalate crystal formation is related to the concentration of various salts in the urine which is related to the metabolism of food and fluids as well as the impact of changes that occur in the urine. Before urine is excreted through the final channel of the urethra, the urine is first filtered by the gromerulus (a small network of blood vessels which is the cleaning unit in the kidneys), useful substances will return to the blood, while unused substances will be excreted through the vessels to the kidneys, then flow through tubes called ureters, then to the bladder. If the kidneys lack fluid during the excretion process, turbidity will occur, over time it will crystallize and become a crust like stone (Sri, 2020). (Sholihah & Utami, 2022).

Deposits occur due to the concentrated salt content in the urine in the kidneys. If these stones come down from the kidneys with urine and become lodged, they are called bladder stones. Crystals are formed by the deposition of dissolved substances in the urine, including inorganic salts, organic compounds and iantrogenic compounds. Precipitation depends on changes in temperature, concentration, solute, and pH, which affect solubility.

Kidney stones occur when a person has hard deposits resembling stones in the kidney. Deposits are formed from minerals and salts in the body. The main cause of the formation of precipitate in urine is because it contains too much salt or salts that are not dissolved or dissolve little. Precipitate occurs due to lack of water intake (Sholihah & Utami, 2022).

Lack of fluids occurs because the environmental temperature is hot when carrying

out activities, causing the volume of urine to decrease, causing the deposition of dissolved substances, resulting in the collection of stones in the kidneys and the formation of crystals.

If the body experiences a loss of a lot of fluid, dehydration will occur, the fluid in the body will carry out its function as a heat regulator. Water will release excess heat through sweat during activities. The water released through sweat is not only water produced through metabolic processes but also water obtained through fluid consumption, so that if the process of reducing fluids in the body during activities is left for a long period of time and If this is not balanced with adequate fluid consumption, the body will experience dehydration (Mongan et al., 2017).

Reducing fluid consumption means the body will automatically experience dehydration, this dehydration will trigger a constant decrease in urine volume. Urine volume indicates water in the body dissolving minerals and insufficient urine. If there is not enough fluid in the urine, the bound oxalate and calcium will collect and form stones. The formation of stones is directly related to lack of fluid intake in the body. The formation of calcium oxalate crystals can cause kidney stones which are excruciatingly painful. Oxalate can precipitate calcium and form calcium oxalate which cannot be absorbed by the body, resulting in insoluble salt deposits forming which cause kidney disease. In the body, oxalate will combine with calcium to form calcium oxalate crystals. These crystals will settle and collect and enlarge to form kidney stones, kidney stones are formed due to lack of fluids. Dehydration occurs due to the body losing a lot of fluids which come out through sweat as compensation for releasing heat in the body. Heavy activity will reduce the condition of the body, and will not meet the need or adequacy of fluids in the body (Hadibrata & Suharmanto, 2022).

Very hot environmental temperatures and intense activity can cause dehydration or will affect the release of body fluids which will have an impact on body fluid balance. If the amount of body fluid ingested is not enough then urine production will decrease and urine sensitivity will increase. This situation persists and can trigger the formation of calcium oxalate crystals in the urinary tract (Sunarmi et al., 2022).

Based on the results of research that has been carried out on the degree of dehydration, the examination for severe dehydration obtained positive results, which means that in severe dehydration there are calcium oxalate crystals. Based on research conducted by (Dhea et al., 2019) it is stated that consuming less fluid will make the body dehydrated. Based on the results of research conducted by (Sri, 2020), there is a relationship between dehydration and the formation of calcium oxalate crystals. Based on the results of research conducted by (Hadibrata & Suharmanto, 2022) it is stated that environmental temperatures that are too hot will affect the release of fluids in the body which will result in inadequate fluid balance which, if it lasts for a long time, will cause crystals to form in the urinary tract.

IV. CONCLUSION

Based on the research that has been carried out, results were obtained from 45 samples, 15 samples of mild dehydration, 15 samples of moderate dehydration, and 15 samples of severe dehydration. In severe dehydration, 1 sample was found to have a positive (+) result with a percentage of (6.7%), which means there were calcium oxalate crystals.

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