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Urea Level, Urine Crystallization, and Related Factors in Tahu Workers

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ABSTRACT

Background & Objective: The process of making tahu which generates a heat source, causes workers to affect the crystallization level of urine and the level of urea of the worker. This study was to analyze the factors associated with urinary crystallization and urea levels. **Materials and methods**: This study is an analytical study with a cross-sectional design. The independent variables in this study were age, gender, water consumption, clothing use, physical activity, heat stress, urine pH, BMI, and dehydration status. The dependent variable is urine crystallization and urea levels—the analysis used in univariate and bivariate analyses. **Results**: Based on the chi-square test, it was found that age, years of service, heat stress, dehydration level, BMI, and water consumption were related to urine crystallization levels. Meanwhile, age, years of service, urine pH, heat pressure, dehydration level, BMI, and water consumption were related to urea levels. **Conclusion**: Of the ten types of variables studied, six variables had a statistically significant relationship with urine crystallization, namely age, years of service, heat stress, level of dehydration, BMI, and water consumption. Meanwhile, age, years of service, urine pH, heat pressure, dehydration level, BMI, and water consumption, seven variables related to urea levels. However, the water consumption pattern of respondents with abnormal heat pressure in the work area should get more attention because the measurement results of water consumption are less.

KEYWORDS: Urinary crystallization level, urea level, heat exposure, tahu factory

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1. INTRODUCTION

Tahu manufacturing plants have risks that can endanger health, namely the hot working climate[1]. The hot working climate comes from the production process, which uses a furnace to cook or boil soybeans. Hot-working climatic conditions outside the health standard limits can cause increased body fluids through sweat so that dehydration can occur[2],[3]. Dehydration causes a decrease in extracellular volume, which will lead to reduced tissue perfusion. It can trigger disruption of the function of body organs, one of which is a decrease in kidney function[2],[3]. In addition, a relatively high lack of sweat fluid will affect the balance and concentration of body fluids so that that body fluid will decrease (experience dehydration) followed by concentration and formation of urine crystals[4],[5].

Chronic kidney disorders occur in several farmers in the world, including Central America[6], [7], Sri lanka[8], and the United States[9]. More than 60,000 deaths from kidney failure (41% in those younger than 60) occurred in Central America between 1997 and 2013[10]. The 2013 Basic Health Research Report (Riskesdas) shows that the prevalence of chronic kidney failure in Indonesia is around 0.2%, increases with age. It increased sharply in the 35-44 years age group (0.3%), followed by 45-54 years (0.4%), and 55-74 years (0.5%), the highest was in the ≥75 years age group (0.6%). In addition, it is known that the prevalence in the male sex (0.3%) is higher than the prevalence in women (0.2%)[11].

Decreased kidney function in workers exposed to a work climate, a combination of the worker's metabolic heat with the work environment heat generated by the use of a furnace as a production process, will cause heat stress to increase creatinine and urea levels[12]. Creatinine is a metabolic product of creatine and phosphocreatine,

constantly produced and filtered by the kidneys[13]. In comparison, Urea is Urea a waste product from protein digested by the body[14].

The increase in creatinine and urea levels is more influenced by increasing age accompanied by excessive physical activity every day, and electrolytes released through sweat are not matched by consuming enough drinking water, which will affect blood pressure and decrease blood pressure pulse becomes faster. Another danger due to excessive fluid excretion will affect urine production, increasing urine concentration (hyper saturation/supersaturation). This situation lasts long enough to encourage the formation of, among others, uric acid crystals and stones in the urinary tract[15][16].

2. MATERIALS AND METHODS

This research is an analytical study with a cross-sectional design or design. The independent variables in this study were age, gender, water consumption, clothing use, physical activity, heat stress, urine pH, BMI, and dehydration status. The dependent variable is urea level and urine crystallization.

The research instrument used interviews with a questionnaire for age, gender, water consumption, clothing use, years of service, and the Global Physical Activity Questionnaire (GPAQ) questionnaire for physical activity variables. Measurement with a heat stress meter to find out the heat pressure in the tahu factory. BMI is known by measuring height with a microtoa and body weight using a weight scale then calculating the Body Mass Index (BMI). A Ph meter is used to determine the ph of workers' urine. The urine color is used to determine the level of dehydration of workers in the tahu factory in Tandang Village, Semarang. Urine crystallization is identified by microscopic urine laboratory examination.

The data obtained are interpreted in three parts, namely univariate and bivariate. Chi-square analysis was used to determine the relationship between the independent and dependent variables for the bivariate test and the multivariate test using multiple logistic regression to determine the most dominant influencing variable.

3. RESULTS

3.1 Univariate Results

Table. 1 Respondents Frequency Distribution Based on Water Consumption

Variables	Category	Water consumption				Total	
		Enough		Less			
		f	%	f	%	f	%
Age	<30	12	92,3	1	7,7	13	100,0
	≥30	7	36,8	12	63,2	19	100,0
Gender	male	4	66,7	2	33,3	6	100,0
	female	15	57,7	11	42,3	26	100,0
Working period	≤4 th	14	82,4	3	17,6	15	100,0
	>4 th	7	41,2	10	58,8	17	100,0
Physical activity	high	5	62,5	3	37,5	8	100,0
	moderate	8	57,1	6	42,9	14	100,0
	low	6	60,0	4	40,0	10	100,0
Use of clothes	No	12	63,2	7	36,8	19	100,0
	Yes	7	53,8	6	46,2	13	100,0
pH	>5	9	47,4	10	52,6	19	100,0
	≤5	10	76,9	3	23,1	13	100,0
Heat stress	Normal	14	87,5	2	12,5	16	100,0
	Abnormal	5	31,3	11	68,8	16	100,0
Dehydration level	Normal	16	88,9	2	11,1	18	100,0
	Abnormal	3	21,4	11	78,6	14	100,0
BMI	Normal	12	80,0	3	20,0	15	100,0
	Abnormal	7	41,2	10	58,8	17	100,0

Based on table 1, most of the respondents who are less than 30 years old consume sufficient water (92.3%), while those who are more than 30 years old primarily consume less water (63.2%). Male (66.7%) and females (57.7%) mostly drank sufficient total water. Respondents with a working period of fewer than four years (82.4%) consumed more

water than those with more than four years (41.2%). Respondents with high activity drank more water (62.5%), as respondents who did not wear clothes consumed more water (63.2%). Respondents with urine pH ≤5 (76.9%) were sufficient in drinking water compared to pH> 5 (47.4%). Respondents consumed adequate drinking water at normal heat pressure (87.5%), while at abnormal heat pressure was less likely to drink enough drinking water (31.3%). Normal dehydration levels consume more water (88.9%) than abnormal dehydration levels (21.4%). The results of regular BMI measurements are sufficient to drink water, then BMI is not normal. Bivariate results.

3.2 Bivariate Results

Table . 2The results of the bivariate analysis

Variable	Crystallization of urine	Urea levels
	p-value	p-value
Age	0,028	0,036
Gender	0,059	0,178
Periode of work	0,010	0,001
Physical Activity	0,969	0,587
Use of clothes	0,720	0,720
pH	0,471	0,036
Heat stress	0,003	0,032
Dehydration levels	0,028	0,000
BMI	0,005	0,042
Water consumption	0,000	0,000

Based on the chi-square test, it is known that age, years of service, heat stress, level of dehydration, BMI, and water consumption are related to the level of urine crystallization. Meanwhile, age, years of service, urine pH, heat pressure, dehydration level, BMI, and water consumption were related to urea levels.

4. DISCUSSION

Based on the correlation test, it is known that there is a relationship between age and urine crystallization levels with a p-value of 0.028 and urea levels with a p-value of 0.036. This is because there were 19 people whose age group was ≥ 30 years. When humans reach old age, all organ functions will decline, including kidney function[17]. As a person gets older, the kidneys are dysfunctional [18]. There is a relationship between tenure and urine crystallization levels with a p-value of 0.010 and urea levels with a p-value of 0.001. Most of the workers in making tahu have a service life of> 4 years. He shows that the longer you are exposed to hot temperatures in the work environment, the body temperature will increase, so the body excretes excess fluid in the form of sweat to lower body temperature[19]. It can have an impact on the occurrence of dehydration in workers. If it is not balanced with fluid intake, it causes decreased urine production, resulting in urine crystallization. The working period of many years can impact workers' health, which can also lead to reduced function of vital parts of the body such as kidney function[20], [21].

The test results explained a relationship between heat stress and urine crystallization levels with a p-value of 0.003 and urea levels with a p-value of 0.032. Heat pressure limits a person's body in receiving heat loads from air temperature, humidity, and wind speed related to body metabolism and clotting factors[22]. The measurement of heat stress on workers is abnormal or has exceeded the threshold value. Exposure to high air temperatures causes the hypothalamus to stimulate the sweat glands, causing sweat to occur and causing the body to experience a lack of fluids[23]. With this condition, the body will lose many mineral salts, causing the body to become dehydrated[24].

Based on the research results, the level of dehydration of a person is related to the level of urine crystallization with a p-value of 0.028 and urea levels with a p-value of 0.000 because making tahu produces a source of heat in the work environment. The heat source that is exposed to workers can cause excessive sweating by workers so that it affects the total body fluids and electrolytes[25]. Then, the study results explained a relationship between water consumption and urine crystallization levels with a p-value of 0,000 and urea levels of workers with a p-value of 0,000. In this tahu-making factory, some workers consume less water. In a hot work environment, especially in a tahu-making factory, workers are encouraged to drink drinking water regularly, both when they are thirsty and when they are not thirsty. This is because the need for fluids in workers who work in hot places requires more fluid intake, and water intake prevents urine from becoming dark and colored[26],[27].

The formation of crystals is related to the concentration of various salts in urine which are related to food metabolism and fluid intake, as well as the impact of changes that occur in urine, such as changes in pH and temperature, which change the solubility of salt in urine to produce crystal formation[28]. Excess weight in workers means a layer of fat in workers that inhibits the ability to transfer heat from the muscles to the skin[22]. People who have a thick layer of fat will more easily increase their body temperature. Serum creatinine and urea levels were found to have a significant positive correlation with BMI only at ≥45 years of age in both men (p = 0.0098, p = 0.0489) and women (p = 0.0149, p = 0 , 0487) respectively[29]. The test results indicated a relationship between BMI or body mass index with urine crystallization levels with a p-value of 0.005 and urea levels with a p-value of 0.042. The BMI of tahu-making workers is largely abnormal. Based on the study results, it was stated that urine pH was related to urea levels with a p-value of 0.036. For chronically dehydrated people, urine pH tends to fall[30].

5. CONCLUSION

Of the ten variables studied, six variables had a statistically significant relationship with urine crystallization, namely age, years of service, heat stress, degree of dehydration, BMI, and water consumption. Meanwhile, age, years of service, urine pH, heat pressure, dehydration level, BMI, and water consumption, seven variables related to urea levels. However, the water consumption pattern of respondents with abnormal heat pressure in the work area should get more attention because the measurement results of water consumption are less.

6. ETHICAL APPROVAL

This research has received proper ethics from the KEPK FKM UNIMUS number 379 / KEPK-FKM / UNIMUS / 2020.

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8. CONFLICT OF INTEREST

The authors declare no conflict of interest

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