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DESCRIPTION OF BLOOD LEAD LEVELS WITH URIC ACID CONCENTRATION REGARDING SMOKING AND PERIOD TIME HABITS OF EXPOSURE BATIK INDUSTRY WORKERS

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ABSTRACT
The use of heavy metals as a mixture in the batik production process is still ongoing today. Increased concentrations of heavy metals cause accumulation in workers' bodies. Lead exposure and poisoning has now become a global concern in the environmental field. Environmental and behavioral factors, especially in terms of smoking habits, are supported by the length of time exposure to pollutants each day. Blood lead levels are a risk factor for gout. This research was conducted with the aim of providing an overview of lead levels and uric acid levels in workers at the Batik Home Industry in Banaran Village based on smoking habits and length of time exposure to pollutants each day. The examination was carried out at the Yogyakarta City Health and Calibration Laboratory Center (BLKK). The research method used was descriptive of workers blood samples. The sampling technique used was purposive sampling. Samples are selected based on predetermined criteria. Samples were analyzed using an Atomic Absorption Spectrophotometer. The results of research on 24 respondents showed that the lowest lead level was 0,030 µg/dL and the highest was 4,896 µg/dL. The lowest range of uric acid levels is 4,0 mg/dL and the highest is 11,8 mg/dL. The average period of time that workers are exposed to pollutants is 8 hours/day and there are 11 respondents who have a smoking habit. Based on these results, it is stated that every worker has lead levels in their blood but it does not cause toxic effects.

Keywords: blood; cigarettes; exposure; workers; uric acid

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INTRODUCTION

The batik industry is an industry that uses synthetic materials containing pollutants that are harmful to the human body. The use of these types of pollutants is carried out with the aim of speeding up the production process. One source of pollutants in this industry is heavy metals. Continuous use of heavy metals will increase the concentration of pollution in the surrounding environment and the human body (Pratiwi, 2023). Pollutants in this industrial sector come from the entire production process. The production process in this industry will produce liquid waste produced from leftover dyes from dyes, water left over from washing cloth, and leftover wax or oil used in making batik (Apriyani, 2018). The use of synthetic dyes in the batik industrial sector has many advantages, due to the favorable characteristics of synthetic materials, namely having a good level of stability. Workers in the batik industry sector will be increasingly vulnerable to exposure to heavy metals because workers are in direct contact with production materials every day.

According to research by Murniati, et al. (2015) the heavy metals found in batik industry wastewater were chromium with a percentage of 99% and lead with a percentage of 92.1%. Lead can accumulate in the blood, lead can enter the human body from various routes such as inhalation, oral, or through the layers of the skin. We need to realize that exposure to lead is deadly and poses a very dangerous threat, whether intentionally or unintentionally, such as being ingested through food, drink, respiratory tract, etc. Lead exposure that may occur in workers is direct exposure through continuous inhalation of lead pollutants or unconscious absorption of lead through the layers of the skin (Jaishankar et al, 2014). Uric acid is produced from purine products. Foods high in purines, especially nuts, shellfish and offal, trigger high levels of uric acid in the blood (Ningsih, 2014). According to research by Choi & Curhan, (2005) consumption of meat and seafood is associated with a higher risk of gout, this association is similar to beliefs regarding risk factors for high-purine eating behavior that causes gout (Perdana, 2014).

The correlation between blood lead levels and gout is illustrated by exposure to lead through inhalation into the body, the entry of lead into the kidney glomerulus and damage to the kidney channels by forming intranuclear inclusion bodies and aminociduria (excess amino acids in the urine), which are examples of the relationship between lead levels. in blood and uric acid. Lead is also a risk factor for gout which can worsen hyperuricemia (Fitri, 2021). Research by Agustiningsih et al. (2021) shows that there are differences in exposure patterns between batik industry workers and other batik industry workers which can be seen from the length of time exposure to pollutants on humans around them.

Lead poisoning can indeed come from exposure to lead in the workplace, but smoking too often can also be a source of lead exposure, because smoking is one of the factors that can influence the concentration of lead in the blood. The ingredients that make up cigarettes are tobacco, cloves and addictive substances. One of the addictive substances used is lead (Restuaji & Kusuma, 2023). The more a person consumes cigarettes every day, the more lead levels in the blood will increase. One cigarette produces 0.5 µg of lead, so that one pack of cigarettes (± 20 cigarettes) smoked in one day can produce 10 µg of lead (Herawati, 2010 in Harningsih & Wimpy, 2020). About 80% of lead enters the body through the respiratory tract and is then absorbed into the blood vessels of the lungs. There, lead will bind to the blood and then spread throughout the body's tissues and organs (Shinta & Mayaserli, 2020). This research was conducted with the aim of providing an overview of lead levels and uric acid levels in workers at the Batik Home Industry in Banaran Village, Grogol District, Sukoharjo based on smoking habits and length of time exposure to pollutants each day.

METHOD

Data collection was carried out from November 2023 and ended in January 2024. The procedure for measuring levels of lead compounds in blood was carried out at the Yogyakarta City BLKK. The population object in this research is Batik Home Industry workers in Banaran Village, Kec. Grogol, District, Sukoharjo. The sampling process for industrial workers requires the following tools and materials: Point of Care Testing (POCT), autoclick, and lancet for uric acid examination. Then, purple vaccum container, flashback needle, holder, tourniquet, ice box, ice gel, and atomic absorption spectrophotometer to check lead levels. The research process was carried out in stages starting from obtaining research permits, providing education to workers, and conducting interviews with workers. Workers who are willing to become respondents will state their availability and be given a questionnaire regarding the worker's habits when carrying out their work. The EDTA vacuum tube was then prepared, and the sample container was labeled with the following information:

name, sample code, age, time of sampling, and sample type. The blood sample was then digested with HNO3 solution, the sample was analyzed using an Atomic Absorption Spectrophotometer.

RESULTS

Measurement of lead levels in this research was carried out at BBLK Yogyakarta City with a sample of Batik Home Industry workers in Banaran Village, Kec. Grogol, Kab. Sukoharjo. This research began with direct observation at the location for sampling 24 respondents and measuring lead levels using the Atomic Absorption Spectrophotometer instrument.

Table 1.
Measurement Lead in the Blood of Batik Industry Workers

Code	Lead (µg/dL)	Uric acid (mg/dL)	Time Exposure (hour/day)	Smoking habits (cigarete/day)
SP1	1,798	5,3	8	5-10
SP2	0,688	4,4	8	-
SP3	2,324	6,3	8	5-10
SP4	1,272	5,7	8	-
SP5	0,454	6,3	8	-
SP6	1,798	6,3	8	<5
SP7	2,558	4,0	8	5-10
SP8	4,896	4,4	8	<5
SP9	4,078	6,6	8	-
SP10	0,042	5,1	8	<5
SP11	2,441	5,4	8	-
SP12	3,610	4,0	8	-
SP13	1,973	5,3	8	-
SP14	0,103	6,3	8	-
SP15	2,850	4,1	8	-
SP16	1,038	6,5	8	-
SP17	1,623	8,3	8	5-10
SP18	0,037	11,8	8	-
SP19	1,155	5,1	8	10-20
SP20	0,030	5,0	5	-
SP21	0,571	5,7	8	10-20
SP22	2,098	5,3	8	-
SP23	0,030	6,1	8	-
SP24	0,454	4,5	8	<5

Table 2.
Description of Lead Levels and Uric Acid Levels in Workers' Blood Batik Industry

	N	Min	Max	Mean	Std. Deviasi
Lead Level	24	0,03	4,896	1,58004	1,357623
Uric acid	24	4,0	11,8	5,77083	1,633209

DISCUSSION

Table 1 shows the lead levels in Batik Home Industry workers in Banaran Village, Kec. Grogol, Kab. Sukoharjo examined at BLKK Yogyakarta City as many as 24 respondents showed normal results, namely <10 µg/dL (CDC, 2011) and showed the length of time the respondents had worked in Batik Home Industry and the habit of smoking every day. The normal value for uric acid levels in the blood according to the EasyTouch Uric Acid Test Strip Insert Kit in men is 3-7,2 mg/dL and in women 2-6 mg/dL. Uric acid levels of Batik Home Industry workers in Banaran Village, Kec. Grogol, Kab. In Sukoharjo, 19 respondents (79%) had normal uric acid levels and 5 respondents (21%) had uric acid levels more than

normal. The length of working time does not appear to vary much. Most respondents worked 8 hours/day and there was only one different respondent who worked 5 hours/day. Meanwhile, the smoking habit is only owned by 11 respondents out of 24 respondents, and cigarette consumption per day varies greatly.

Table 2 shows blood samples from batik industry workers, which were examined for lead levels. The lowest normal lead level was 0,030 µg/dL, while the highest normal lead level was 4,896 µg/dL. The average lead content was 1,58004 µg/dL, and the standard deviation of the lead content data was 1,357623 µg/dL. Batik industry workers had their blood uric acid levels measured using a Point of Care Testing (POCT) tool. The results showed that the average uric acid level was 5,7 mg/dL, with the lowest uric acid level value being 4,0 mg/dL, the highest uric acid level value being 11,8 mg/dL, while the standard deviation of the acid level data urate was 1,633209 mg/dL Characteristics of primary data obtained from filling out questionnaires for 24 respondents. Consuming foods high in purine amino acids affects blood uric acid levels. The results of filling out a questionnaire regarding the description of consumption of foods high in purine during the last 2 weeks showed that 7 respondents (29%) consumed red meat, 1 respondent (4%) consumed offal and seafood. 4 respondents consumed seafood. Most of the 12 respondents (50%) consumed nuts.

The duration of exposure among respondents was that 23 respondents (95,8%) were exposed to lead pollutants for 8 hours / day, and 1 respondent (4,2%) was exposed to lead pollutants for 5 hours / day. Distribution results from filling out questionnaires regarding the characteristics of respondents' smoking habits, it is known that there are 13 respondents (52%) who do not have a smoking habit, while the other 11 are divided into 5 respondents (20%) who have a smoking habit of 5-10 cigarettes/day, 4 respondents (16%) have a habit of smoking <5 cigarettes/day. and the remaining 2 respondents (12%) appeared to have a habit of smoking 10-20 cigarettes/day. Workers in batik home industry are included in the group of employees at risk of direct exposure to lead. This exposure can come from the work environment. According to Ardillah (2016), the increase in lead levels in workers is caused by prolonged exposure to each individual. The longer a worker is in an area that is at risk of exposure to lead metal, the greater the risk of exposure, so that more lead levels will accumulate in the blood. Workers who work for more than 8 hours will be at greater risk than workers who work the normal time, namely 5-8 hours (Pusparini et al, 2016). Each exposure to heavy metals has a different effect, especially the heavy metal type lead. This is due to the different dosages of materials used and concentrations in each production process such as canting, stamping and dyeing (Oginawati et al, 2022). According to Rosalie et al, (2014) someone who smokes every day is twice as likely to be exposed to lead as those who do not smoke, this is because smoking is a route of lead exposure in the general population.

The results above table 1 show that the lead levels in the respondents bodies were within the normal limit range set by the Center for Disease Control (CDC, 2011), namely <10 µg/dL. The average worker in the Batik Home Industry in Banaran Village, Kec. Grogol, Kab. Sukoharjo has varied smoking habits, of the 24 respondents, it was found that only 11 respondents were active smokers, while the other 13 were non-smokers. On average, they work 8 hours/day. Respondents with sample code SP8 with an exposure time of 8 hours/day and a smoking habit of <5 cigarettes/day had the highest lead levels compared to the other 23 respondents, namely with a lead level of 4.896 µg/dL and the lowest lead levels were found in the 2 samples with the longest exposure time. different exposure, namely in sample codes SP20 and SP23 with the same level, namely 0.030 µg/dL. The SP20 sample code has an

exposure time of 5 hours/day while the SP23 sample code has an exposure time of 8 hours/day, both of which do not have a smoking habit.
Samples with codes SP8 and SP10 have the same smoking habit, namely <5 cigarettes/day, but the results of the examination of the two samples showed different results. It can be seen from the characteristics of the respondents that it is known that respondent SP 8 is 51 years old with a fairly long period of smoking, namely 5-10 years and has worked in the batik industry for 5-10 years, while SP10 is known to be only 21 years old with a smoking period of < 5 years and includes new workers because they have only worked in the batik industry for <5 years. In this case, it can be interpreted that age, length of work, and length of smoking can be factors that can increase lead levels in the respondent's blood apart from the smoking habit itself. The above is in line with research conducted by Huwaida et al (2016), which stated that smoking habits are not necessarily the only factor that can influence blood lead levels. Other factors such as gender, age, work environment, working hours, nutritional status, use of personal protective equipment, physical condition, history of illness can also be trigger factors that can influence blood lead levels. Different physiological states of a person can influence the level and rate of absorption of inorganic lead from the digestive and respiratory systems.

Based on table 2, it can be seen that the uric acid levels in the blood of batik industry workers in the Batik Home Industry in Banaran Village, Grogol District, Sukoharjo Regency using the POCT (Point of Care Testing) tool found higher uric acid concentrations in SP 18 samples, respondents of any gender. men with uric acid levels of 11.8 mg/dL, more than the normal limit according to the EasyTouch Uric Acid Test Strip Insert Kit, the normal value of uric acid in men is 3-7.2 mg/dL. Samples SP 7 and SP 12 showed the lowest normal results with male respondents also having uric acid levels of 4.0 mg/dL. It is known from the questionnaire data obtained in Figure 1 that 24 respondents (100%) consumed foods high in purines in the last 2 weeks. This research is supported by research conducted by (Riswana & Nunung, 2022) concluding that purine intake is related to uric acid levels, whereas age, gender and BMI are not related to uric acid levels. The consumption pattern of purine-rich foods consumed in this study was not measured in quantities (grams) per day, researchers emphasized asking patients about their food consumption patterns during interviews and filling out questionnaires. Patients in this study who regularly consumed foods high in purine were unable to limit their intake maximally (Kussoy et al., 2019). SP 18 samples were found to have high uric acid levels because the respondents had a habit of consuming foods high in purine frequently which could increase uric acid levels in the blood. Sample SP 18 often consumes foods high in purine, namely nuts. Respondents' food consumption resulted in high purine intake, thereby increasing uric acid levels in the body.

The amount of uric acid in our body naturally should not be too high. The body provides 85% of purine compounds for daily needs, so it can be interpreted that only 15% of purine requirements from food are needed (Artinawati, 2014). The results of this study also showed that 2 respondents (8%) had low, normal uric acid levels due to eating habits high in purine which were rare or still under control. This was proven from the questionnaire data of respondents SP 7 and SP 12 who answered that they consumed foods high in purine such as nuts and seafood in the last 2 weeks. Foods high in purine increase uric acid levels in the blood. Increased blood uric acid is influenced by foods rich in purine. Acid produces nucleotides due to the associated breakdown of enzymes immediately entering the bloodstream increasing uric acid levels. Intestinal kinases print and modify nucleotides into pyrimidine bases. Furthermore, the basic material during the oxidation of uric acid, some of these purines are carried into the blood and some are excreted in the feces. Therefore, limit

intake. A high purine or low purine diet can reduce uric acid levels in the blood (Mubarak & Zulmah, 2022).

Figure 4 which shows the respondents' job divisions, it can be concluded that many of the workers who were respondents in this study worked in the dyeing department, followed by respondents in departments other than production. Parts of work other than production in the research population include fabric cutting and measuring, warehouse, drying and packaging. The results of the questionnaire illustrate that sample code SP 20 has a working period of less than 5 years, works in the dyeing department, does not smoke, but does not wear a mask when working as personal protection. Meanwhile, the SP 23 code has a longer working period, namely 5-10 years, works in the coloring department, does not smoke, but uses a mask as personal protection when carrying out his work. So we can see that the two workers both work in the dyeing section, where this section has a fairly high level of exposure because it is in direct contact with dye materials which are a source of pollutants from exposure to heavy metals. The increase in lead levels in the two samples can also be assumed to be due to workers' disorderly use of personal protection, which can differentiate the pattern of exposure to the heavy metal lead among batik industry workers from one another. According to research by Purwati, et al. (2023) stated that the increase in lead levels in batik industry workers was partly caused by self-protection. Where workers do not pay attention and consider the use of personal protective equipment when carrying out their work and some workers also have unhealthy lifestyles, namely the habit of smoking and even smoking during working hours so that exposure to lead through inhalation in the batik industry environment becomes higher and more vulnerable.

CONCLUSION

The results of the lead examination of all respondents can be concluded that the lead levels in the blood of all respondents (100%) studied were in the normal category, because they were below the threshold and met the standards set by the Center for Disease Control and Prevention (CDC) in 2011, namely <10 µg/dL. 79% of respondents had normal uric acid levels and 21% of respondents had more than normal uric acid levels.

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