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INCREASING LEVELS OF HYPURAT ACID IN URIN SHOES CRAFTSMEN TAMBAK OSO WILANGUN, SURABAYA

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ABSTRACT

Increasing Levels of Hypurat Acid in Urin Shoes Craftsmen Tambak Oso Wilangun, Surabaya. The home industry in the Tambak Oso Wilangun sub-district, Benowo District, Surabaya City was a center for producing shoes in Surabaya. From the entire production process there was a chemical used as a shoe adhesive, namely glue. Toluene contained in the glue used as an adhesive was very volatile so easily inhaled and enters the respiratory tract of workers. The liver and kidneys had an important role in producing toluene metabolites, namely hippuric acid, which were then excreted very quickly into the urine. Urinary hippuric acid is the main metabolite of toluene and has long been considered a biomarker of toluene exposure. The study is based on observational analytical research method while the design uses a cross-sectional study in 2 populations consisting of the exposed group and the unexposed group. The sample size for two groups is 22 people. Measurements of hypuric acid levels using HPLC-UV. The level of hypuric acid in the exposed group had mean value 9,23 mg/g of creatinine was higher than the unexposed group has mean 8,21 mg/g of creatinine. The characteristics respondent related to the levels hypuric acid was the length of work and smoking habits. Conclusion: The level of hypuric acid were higher in the exposed group than the unexposed group.

INTRODUCTION

The shoe industry in Indonesia has, until now, developed both on a large and small scale (the home industry). A home industry refers to a business unit or small-scale company that operates within a specific industrial sector. The home industry only uses one The home industry primarily utilizes one to two houses, which serve as simultaneous production, administrative, and marketing centers [1]. s and the production process are factors that can contribute to occupational health problems in the home industry. The home industry in the Tambak Oso Wilangun sub-district, Benowo District, Surabaya City, is a center for shoe production. The shoe industry's production process can pose health risks to workers due to exposure to hazardous materials contained in the glue solvent used to glue the shoe [3]. The substances contained in the glue are volatile organic compounds (benzene, toluene, and xylene), which belong to the volatile organic compound (VOC) group [4]. Toluene is an organic solvent that is often Toluene, a volatile and toxic organic solvent, is the most prevalent solvent in glue [5]. to be found in gasoline, paint, and thinners. The effects of VOCs on health include respiratory problems, sore throats, eye irritation, nausea, dizziness, and vomiting [6]. The

levels of VOCs have the potential to be quite high indoors, with high levels of exposure compared to outdoors [7].

Toluene at 50 ppm to 200 ppm can cause acute poisoning of the central nervous system with signs of dizziness, headache, and drowsiness. If the use of toluene exceeds a predetermined threshold value for a long time, it will cause health problems and occupational diseases (PAK) [8]. Toluene has typical properties like benzene, which is a colourless, sweet-smelling, pungent, and volatile liquid [9]. The toluene contained in the glue is very volatile, so it is easily inhaled and enters the respiratory tract. Factors such as age, sex, body composition, and health status can affect toluene metabolism when it enters the body [10]. Continuous exposure to toluene can cause dizziness, vertigo, eye irritation, skin irritation, respiratory problems, impaired liver function, impaired kidney function, and central nervous system (CNS) disorders. The central nervous system (CNS) is the main target organ of this compound [11]. Toluene, which is absorbed and metabolised in the human body, will be excreted in the urine as the most dominant metabolite, namely hippuric acid. Toluene enters the body, mainly through inhalation. As much as 20% of toluene inhaled will be excreted from the body via breathing air in its intact form; 80% will undergo metabolism to benzoic acid, then conjugate with glycine in the liver to form hippuric acid, which will be excreted in the urine [9].

MATERIALS AND RESEARCH METHODS

This type of research, known as observational analytic research, involves conducting observations within the domestic shoe industry. Meanwhile, this study employed a cross-sectional study design on two populations, as the observations and measurements of research variables were conducted simultaneously. This research was conducted in the shoe home industry in Tambak Oso Wilangun Village, Surabaya City. Residents of the shoe home industry area in Tambak Oso Wilangun Village, Surabaya City, comprised the research population. The exposed group consists of individuals who work as shoe craftsmen. The unexposed group is made up of residents who do not work as shoe craftsmen and are located around the home industry area of Tambak Oso Wilangun Village, Surabaya City. They also have the same characteristics as the exposed group. The research sample was selected by simple random sampling. The sample size for each group, both the exposed group and the unexposed group, was 11 people, or a total of 22 people for both groups. In this study, the exposed and unexposed groups were the independent variables. The amount of hippuric acid is the dependent variable. The confounding variables were age, nutritional status, length of work, years of service, and smoking habits. Urine sampling was carried out by a laboratory health analyst with a urine sample of 50 ml. Hippuric acid levels were measured using the HPLC method at Prodia. The methods used to collect data were interviews, field observations, and documentation. The data is presented in the form of tables and narratives and then analyzed using a statistical test with an alpha value of 0.05. The statistical test used is by:

Shapiro – Wilk for data normality test (sample size less than 50)

1. A parametric test, with an independent sample t-test to see if the data distribution is normal and non-paIf the data distribution is not normal, use the Mann-Whitney test.not normal
2. We conducted a Bivariate Pearson Correlation Analysis to examine the correlation between age, nutritional status, smoking habits, length of work, and years of service with urine hippuric acid levels among the shoe craftsmen in Tambak Oso Wilangun Village, Surabaya City.

RESEARCH RESULTS AND DISCUSSION

Characteristics of Research Respondents

The characteristics of the research respondents on Tambak Oso Wilangun shoe craftsmen include age, length of work, work period, nutritional status, and smoking habits, which will be reviewed in the exposed and non-exposed groups.

Age

Table 1. Two-Free Sample T Test, Age Exposed Group and Non-Exposed Group

Group	Descriptive		Independent t-test	
	Mean	SD	t-value	p
Exposed	50,45	13,05	1,062	0,301
Not Exposed	44,64	12,64		

The mean age of the exposed group was 50,45 years and the unexposed group was 44,64 years.

Length of Work

Table 2. Frequency Distribution of the Length of Work Exposed Group on Tambak Oso Wilangun Shoes Craftsmen in 2019

Length of Work	Amount	%
<7	2	18,2
≥7	9	81,8
Total	11	100

The length of work mean in the exposed group in the Tambak Oso Wilangun shoe craftsmen Surabaya was 8,18 hours/day.

Work Periode

Table 3 Distribution of the Work Periode Exposed Group on Tambak Oso Wilangun Shoes Craftsmen in 2019

Work Periode	Amount	%
≤5	1	9,1
6-10	1	9,1
≥11	9	81,8
Total	11	100

The work periode mean in the exposed group was 32 years.

Nutritional Status

A person's nutritional status can be seen from one of the indicators, namely the body's mass index (BMI). The body's mass index (BMI) can be obtained by measuring height and weight. The BMI results can be classified as the respondent being in the thin category (<18,5), normal (18,5–25,0), or fat (≥ 25,0).

Table 4. Two-Free Sample T Test, Nutritional Status Exposed Group and Non-Exposed Group

Group	Descriptive		Independent t-test	
	Mean	SD	t-value	p
Exposed	26,90	9,07	1,228	0,234
Not Exposed	23,15	4,48		

The nutritional status mean in the exposed group was 26,90 and in the non-exposed groups was 23,15.

Smoking Habits

Table 5 Two-Free Sample T Test, Smoking Habits Exposed Group and Non-Exposed Group

Group	Descriptive		Independent t-test	
	Mean	SD	t-value	p
Exposed	186,55	294,06	0,476	0,639
Not Exposed	133,64	222,09		

The smoking habits mean in the exposed group was 186,55 and in the non-exposed groups was 133,64.

Urine Hypuric Acid Levels in The Exposed Group and Non-Exposed Group

Table 6. Hipuric Acid Levels in The Exposed Group and Non-Exposed Group

No.	Hipuric Acid Levels in Urine	
	Exposed Group (mg/g creatinine)	Non-Exposed Group (mg/g creatinine)
1	0,21	0,62
2	0,30	1,32
3	15,84	10,58
4	17,32	5,51
5	0,27	61,20
6	1,20	0,58
7	9,43	2,30
8	9,88	1,46
9	36,63	1,02
10	9,65	1,00
11	0,79	4,72

The Hypuric Acid mean in the exposed group was 9,23 mg/g creatinine and in the non-exposed groups was 8,21 mg/g creatinine. While the distribution of Hypuric Acid levels in the exposed group and in the non-exposed group shown in table 7.

Table 7. The Distribution of Hipuric Acid Levels in The Exposed Group and Non-Exposed Group

Category of Hipuric Acid	Group			
	Exposed Group		Non-Exposed Group	
	n	%	n	%
< 1,6 mg/g creatinine	6	54,5	5	45,5
≥1,6 mg/g creatinine	5	45,5	6	54,5
Total	11	100	11	100

The Difference of Hypuric Acid Levels in The Exposed Group and Non-Exposed Group

Table 8. Mann-Whitney Test of Hipuric Acid Levels in The Exposed Group and Non-Exposed Group on Tambak Oso Wilangun Shoes Craftsmen in 2019

Group	Descriptive	Mann-Whitney Test
	Mean Rank	P-Value
Exposed Group	11,73	0,870
Non-Exposed Group	11,27	

According to the Mann-Whitney test in Table 8, the mean hypuric acid levels in the exposed group were 11.73 mg/g creatinine and 11.27 mg/g creatinine in the non-exposed group. While the p-value of hypuric acid levels was 0,870 ($p > 0.05$), that means there is no difference between the exposed group and the non-exposed group.

The Relationship Between Age, Length of Work, Working Period, Nutritional Status and Smoking Habits with Hypuric Acid Levels

Table 9 . The Characteristics Respondent that Associated with Hypuric Acid Levels in The Exposed Group on Tambak Oso Wilangun Shoes Craftsmen in 2019

Variable	Pearson Correlation	Sig (2-tailed)
Working Period	-0,534	0,091
Smoking Habits	0,680	0,021
Age	0,219	0,518
Length of Work	-0,613	0,045
Nutritional Status	-0,268	0,426

Based on the analysis in Table 9, we know that the respondent's characteristics (age, length of work, working period, nutritional status, and smoking habits) were associated with the hyaluronic acid levels, specifically the length of work (Sig (2-Tailed) = 0,045) and smoking habits (Sig (2-Tailed) = 0,021).

Characteristics of Research Respondents

Age

The Tambak Oso Wilangun shoe craftsmen are mostly in the age range of 41–59 years because this is a productive age for work. Based on sAccording to similar research, the average age of shoe craftsmen in Mojokerto is typically between 31 and 50 years old, which is considered the most productive age for work [12]. tive age group has a range between 15 and 64 years; this is in accordance with the opinion of the Central Statistics Agency in 2018. The population's economically productive age range is 15–64 years [13].

Length of Work

Shoe craftsmen at Tambak Oso Wilangun do not have a standard working time because they follow the amount of production according to consumer orders. If the number of orders from consumers is large, the shoe craftsmen will spend more time working. The length of work refers to RI Law Number 13 of 2003 concerning manpower, which is 7 working hours per day for 6 working days. According to the data obtained, some shoemakers work more than 7 hours. Physical work that is carried out continuously for a long time will affect the mechanisms in the body (circulatory, digestive, muscle, nervous, and respiratory systems). In this state, fatigue occurs due to the accumulation of waste products in the muscles and blood circulation, which limit muscle activity continuity [14].

Work Periode

The working period is the length of time the shoe craftsmen work in years. The shoemakers for Tambak Oso Wilangun are artisans who have been passed down from the previous family business. Based on the average working period of those who have worked for 20,1 years, by looking at the data, the average age of craftsmen is 50,45 years, meaning they started working at the age of 30. This research is consistent with previous research, which states that there is a significant relationship between work experience and worker productivity; workers with more than 3 years of work experience are more productive than workers with less than 3 years [15].

Nutritional Status

According to the Minister of Health of the Republic of Indonesia's 2011 findings, BMI results can be classified into the categories of very thin (<17,0), thin (17,0-18,5), normal (18,5-25,0), fat (25,0-27,0), and very fat (>27The observations of the nutritional status of the Tambak Oso Wilangun shoe craftsmen revealed a body mass index (BMI) of > 27,0, indicating their classification as very fat. fat. Obesity is the accumulation of fat in the body due to a decreased metabolic rate. In line with the same research, most of the artisans wearing Lacosta Desta shoes have shown that there is a relationship between nutritional status and work fatigue. This condition causes the metabolic process to be incomplete, and if it occurs in the eye area of the ciliary muscle, it will cause pain and fatigue more quickly [16]. Workers who have appropriate nutritional status will be able to have a more active, productive, and comprehensive performance [17].

Smoking Habits

According to the Brinkman Index, the category of cigarettes smokers (stubs/year) consists of 3 categories: light smokers (0–200 cigarettes/year), moderate smokers (201–600 cigarettes/year), and heavy smokers (> 600 stems/year). The Tambak Oso Wilangun shoe craftsman group has 45.5% smoking habits. Based on similar research, it is known that the smoking habits of workers are 60%; the frequency of smoking in a person will affect the level of haemoglobin in the body so that it will increase the risk of anaemia [18].

Urine Hypuric Acid Levels in The Exposed Group and Non-Exposed Group

The study found that the amount of hippuric acid in the urine of 22 people, both those who were exposed and those who were not, was higher than the normal limit set by ACGIH in 2014, which was 1.6 mg/g creatinine. Lack of ventilation is one of the reasons for high toluene concentrations in the work environment, which leads to increased levels of hippuric acid in the urine. This study is in line with similar research, which states that there are three people experiencing respiratory disorders due to inadequate ventilation in a room. Ventilation is essential to maintain indoor air quality. The mechanically ventilated class has better indoor air quality than the window-ventilated class [19]. The high levels of hippuric acid in the exposed group could be caused by several things, such as the number of shoes produced. The amount of production produced is directly proportional to the amount of glue used because the more shoes are produced, the more glue is used.

The Difference of Hypuric Acid Levels in The Exposed Group and Non-Exposed Group

Toluene that is absorbed into the human body will be distributed throughout the body through the blood circulation system and will then be metabolised by the body. The results showed that toluene-based products can cause health problems with long-term use [20]. The results of this study are in line with similar studies that state that if toluene is inhaled continuously, it can cause serious health problems. Workers who are always exposed to toluene are at high risk of experiencing health problems [21]. Toluene is mostly broken down in the body through oxidation, which is helped along by the cytochrome P-450 enzymes alcohol dehydrogenase and aldehyde dehydrogenase. This process turns toluene into benzoic acid. Benzoic acid, after conjugation with glycine, will produce hippuric acid, which is the main metabolite in urine [22]. High levels of urine hippuric acid in the body are not only influenced by toluene levels in the room but can also be influenced by several factors such as age, gender, caffeine consumption, education level, and smoking habit. Urinary hippuric acid, which is the result of toluene exposure metabolism, is most commonly found in urine [23]. The results showed that the average urine hippuric acid concentration in the exposed group was 9.23 g/g creatinine. This value exceeds the normal limit set by ACGIH 2014 with the IDX (Biological Exposure Indices) of 1,6 g/g creatinine.

Analysis the Relationship Between Age, Length of Work, Working Period, Nutritional Status and Smoking Habits with Hypuric Acid Levels

Hippuric acid is a biomarker for toluene [24]. Hippuric acid levels are influenced by several factors, one of which is the respondent's characteristic. Based on the same research, it is known that the longer a person works, the higher the exposure to pollutants that person gets, so workers who have a longer working period will have higher levels of urine hippuric acid. Someone who consumes caffeine can increase their hippuric acid levels. Workers who have been working for more than 2 years have significantly higher hippuric acid levels than someone who has worked for less than 2 years. Working periods are linked to repeated exposure and toluene accumulation [23]. It is kThe main factors that can influence and determine the specific classification of exposure are the chemicals used, their chemical composition, and their physical state. These factors also include the route of entry, duration of exposure, and dose of exposure, all of which can determine the health impactAccording to the World Health Organization, smoking can increase the body's elimination of toluene and hippuric acid. Hippuric acid excretion is correlated with toluene concentration during shift work [24].

CONCLUSIONS AND RECOMMENDATIONS

The research's conclusion is as follows:
1. The exposed group had higher hippuric acid levels than the non-exposed group
2. There was no difference in hippuric acid levels between the exposed and unexposed groups
3. Respondents' work periods and smoking habits are related to hippuric acid levels.

The suggestions for shoe craftsmen are:
1. Shoe craftsmen should add an exhaust fan to help circulate air in the room
2. Wear personal protective equipment (PPE) when glueing shoes, such as N95 masks
3. Shoemakers should reduce exposure time (frequency and working hours).

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