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EVALUATION OF ERYTHROCYTE SEDIMENTATION RATE (ESR) OF MOTORCYCLE WORKSHOP WORKER EXPOSED TO BENZENE

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Evaluation of Erythrocyte Sedimentation Rate (ESR) of Motorcycle Workshop Worker Exposed to Benzene

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Abstract

Occupational exposure to benzene from fuel oil in workshop motorcycle workshop causes several health effects, depending upon the level and duration of exposure. Analysis of blood is important to access the status of worker' health. The study aimed to assess the gather basic information required for protecting workers' health and improve working conditions in the works sites by investigating the ESR levels. A comparative cross-sectional study conducted in Surabaya City, East Java-Indonesia, which involved 100 workers. The occupational data collected using a structured questionnaire while blood analysis parameters measured with an automated hematology analyzer. The result showed that leukocytes, erythrocytes, hemoglobin (HGB), hematocrit values (HCT), platelet, MCV, RDW, eosinophil, basophils, neutrophil rods, neutrophil segment, lymphocyte, monocytes were in normal value. Whereas, MCH, MCHC, ESR has shown in abnormal value as average 24.5 pg, 29.18 g/dL and 8.21 mm/h, respectively. Those value, especially in ESR value indicated the increasing concentration plasma viscosity. This is may cause by inflammation in the workers' body. To prevent the hazardous effect of benzene exposure, occupational health should be implemented for workers in order to protect them from exposure to benzene.

Keywords

Motorcycle workshop workers, ESR, Surabaya city, benzene

INTRODUCTION

The level of benzene exposure in the workshop motorcycle workshop during operations may occur. Mechanical workshop sites process various chemical products based on highly volatile and flammable liquid hydrocarbons (1, 2), namely Premium, Pertamax, Solar which are the most widely

used types of fuel oil. It presents many dangers associated with toxic chemical materials, including carcinogens such as benzene. However, recent reports have indicated a link between occupational diseases such as cancer and benzene exposure in workshop site (2). Workers in sites exposure to benzene are more risk in occupational health (1, 3).

Erythrocyte Sedimentation Rate (ESR) is a blood test that measures a "sed rate". This rate is depends on various factors, namely hemoglobin concentration, the ratio of plasma proteins, serum lipid concentration, and plasma pH. It has been a widely used marker for inflammation and indicates disease (5). In the occupational health of fuel oil, ESR determination is an important part of critical and emergent diagnoses Duc as acute and chronic lymphocytic leukemia; non-Hodgkin's lymphoma, multiple myeloma, anemia due to hematopoietic organs dysfunction, malignancy, temporal arteritis, renal disease, collagen vascular disease (6) (7). Furthermore, the role of ESR in the clinical management of various disease (6).

Routine tasks in the workshop motorcycle workshop include such as replacing spark plugs or changing the oil, repair engines and transmissions, removing dents from fenders. Thus, evaluation of the effect of benzene exposure is one of occupational health requirement at workshop motorcycle workshop (8) . This study aims to gather basic information required for protecting workers' health and improve working conditions during works sites by investigating the hematological parameters, especially in the ESR levels.

MATERIALS AND METHODS

Study design

A comparative cross-sectional study of workers conducted at a workshop motorcycle workshop. The study subject involved 100 occupationally workshop motorcycle workers exposed to fuel oil. All worker require hematological parameters evaluation, especially in ESR levels. All workers were asked to give informed consent.

Data collection

Demographic and occupational data were collected using a structured questionnaire, and The subjects Ade interviewed by the researcher. Before the blood collection, resting blood pressure was measured by using sphygmomanometer. Blood samples from worker respondents were taken at the end of the work shift. 4 mL of blood samples were collected using venipuncture techniques into a Vacutainer tube containing potassium EDTA from the antecubital area of participants. The tubes were then placed in a holder or rack and placed/stored undisturbedly inin cold box. All samples were analyzed using an automated hematology analyzer Horiba Type ABX Micros 60 (KX-21N; Sysmex, Kobe, Japan).

Data processing and analysis

All the data were cleaned, double entered into Microsoft Excel spreadsheets and analyzed using Stata software version 13 (StataCorp, College Station, TX, USA).

Ethical considerations

The proposal in this study was approved by the Surabaya occupational safety and health technical implementation unit. all respondents in this study gave written agreements to participate in this study. All respondents were given an explanation of the purpose and results of this study. Laboratory test results were given to respondents in this study.

RESULTS

General characteristics

Personal characteristics of the workshop motorcycle workers are presented in Table 1 They were comparable with regard to age and sex. 91% of workers were males. The average age of the workers was 28 years. Protective measures were poorly followed during work in workshop.

Table 1. Personal Charateristics of Workshop Motorcycle Workers

Age Group	Range	Percentage (%)
Age-group (years)	18-27	55
	28-37	33
	38-53	12
Sex	Female	9
	Male	91

Table 2. Major Activities of The Workshop Motorcycle Workers

Job	Task
Mechanical engineer	1. Dismantle engines and repair or replace defective parts, such as magnetos, carburetors, and generators. 2. Remove cylinder heads, grind valves, and scrape off carbon, and replace defective valves, pistons, cylinders and rings, using hand tools and power tools. 3. Hammer out dents and bends in frames, weld tears and breaks; then reassemble frames and reinstall engines. 4. Repair or replace other parts, such as headlights, horns, handlebar controls, gasoline and oil tanks, starters, and mufflers. 5. Repair and adjust motorcycle subassemblies such as forks, transmissions, brakes, and drive chains, according to specifications.

Fig 1. Partial view of working practice in of the workshop motorcycle. Workers are engaged in routine activities without proper personal protective equipment (mask and gloves)

Based on this study, the possible routes of chemical entry into the body trough inhalation. It has shown in Figure 1 that the workers did not wear a mask during workpractice

Table 3. Blood Analysis and Hematological Parameters of Workshop Motorcycle Workers

Parameters	Average value	Normal (%)	Abnormal (%)
Leukocytes	8.53 x10^3/mm^3	80	20
Erythrocytes	5.07 x 10^6/mm^3	93	7
Hemoglobin (HGB)	12.51 g/dL	96	4
Hematocrit values (HCT)	43.26 %	98	2
Platelet	298.96	91	9
MCV	84.36 μm^3	86	14
MCH	24.5 pg	11	89
MCHC	29.18 g/dL	7	93
RDW	13.62 %	96	4
Eosinofil	1 %	100	0
Basophils	0 %	100	0
Natrofil rod	0.65 %	100	0
Neutrophil Segment	63.94 %	95	5
Lymphocyte	30.99 %	98	2
Monocytes	3.44 %	35	65
ESR	8.21 mm/h	8	92

MCV (Mean Corpuscular Volume); MCH (Mean Corpuscular Hemoglobin); MCHC (Mean Corpuscular Hemoglobin Concentration); RDW (RBC Distribution Width); ESR (Erythrocyte Sedimentation Rate).

DISCUSSION

The results presented here are based on the study in workshop motorcycle worker to evaluate the ESR value during benzene exposure in their worksites. Workshop motorcycle workers are exposed to different chemicals of fuel oil in their workshop. Studies have found that they can be exposed to numerous types of heavy metals Duc as lead, chromium, and cadmium, including carcinogens such as benzena (1, 9). Benzene was induced poisoning occurs almost entirely by inhalation of benzene vapors in the air.

Workshop motorcycle workers in our study exposed to benzene showed mean RBCs (average value is 5.07 10^6/mm^3) and

hemoglobin (12.5 g/dL) were in the normal range. RBC indicates MCV, MCH and MCHC which are calculated from hemoglobin, hematocrit, and erythrocytes count. Normal MCV indicates normocytic (normal average RBC size). Mean cell hemoglobin concentration (MCHC) refers to the average concentration of hemoglobin in the RBCs contained within the sample. Abnormally low MCHC in workshop motorcycle workers is called hypochromic. Mean cell hemoglobin (MCH) refers to the average weight of hemoglobin in the RBCs in the sample (units are picograms (pg/cell).

Among workshop motorcycle worker, the ESR abnormal rate is as much as 92%. It is suggested that some inflammation reaction in the body (9). The ESR value indicated the increasing concentration of fibrinogen, the main clotting protein and alpha globulin (10). It leads to plasma viscosity increased and red blood cell start to aggregate (10, 11).

We assumed that raised ESR is observed in workshop motorcycle workers caused by benzene in fuel oil exposure. It is well known that benzene causes haematological toxins, such as aplastic anemia and leukemia. Recent studies demonstrated that low-level of benzene exposure (<1 ppm) has potential in hepatotoxicity (12).

Benzene is slightly soluble in water. Hence, this is easy to circulating blood enters the tissue and fat tissue. The primary route of benzene exposure is entering the body from inhalation (13). This is caused by benzena which is very easy to evaporate into the air very quickly. Benzene will enter into the bloodstream, and travel into the entire organ. In temporally, benzene can be stored in the bone marrow and fat. The metabolism benzene includes in oxidations of the benzene rings by cytochrome P450 monooxygenase. This enzyme is primarily produced in liver cells. Therefore, accumulation of benzene in long periodic could affect liver function. Normally, benzene is degraded into phenol (14). Further, phenol is absorbed into the blood and distributed to other tissue.

Short term exposure to fuel oil, especially in benzene results in neurotoxic, irritatory, reproductive and developmental effects (15). Long-term exposure to benzene may cause a hazardous effect on health, such as hematopoietic cancer.

Evaluation of hematological parameters, including ESR is useful for monitoring the exposure of workshop motorcycle workers. This exposure carries a serious risk. Therefore, it is important to keel fuel oil securely from motorcycle workshop workers.

This study has some limitations. We evaluated the hematological parameters, namely ESR in workshop motorcycle workers exposed to fuel oil. We did not measure the specific chemicals to which the workshop motorcycle workers were exposed. It would be better to explore the effect of types of occupational chemical exposure on

health in future studies.

CONCLUSIONS

Benzene contamination in the air may cause reduced MCH and MCHC level and ESR. It was possible that the workers' exposure to benzene in fuel oil during work. The advice that can be given in this research is to reduce benzene exposure should install exhaust ventilation and workers using personal protective equipment such as gas masks and gloves.

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CONFLICT OF INTEREST

There are no conflicts of interest.

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