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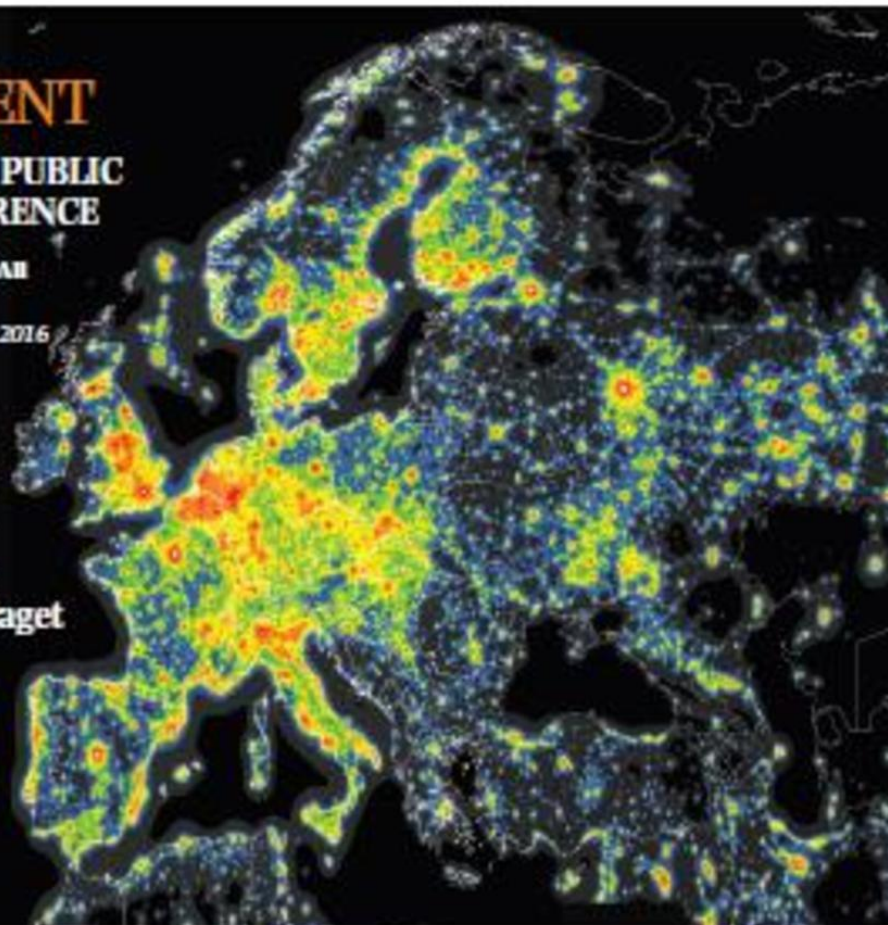
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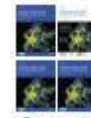
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## Industrial tobacco dusts' exposure chronic impacts on workers' health Rini Riyanti

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## Industrial tobacco dusts' exposure chronic impacts on workers' health

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**Background:** Tobacco industry develops rapidly, employs millions workers worldwide, increasing incident of workers' health problems caused by tobacco dusts' exposure (TDE). TDE may lead to tobaccosis that is difficult to detect due to the prolonged occurrence. The aim of this study was to determine the chronic impacts of TDE. **Methods:** This study used an analytic cross sectional approach, and recruited 108 non-smoking indoor tobacco industry workers at Jember, Indonesia. They were classified into three groups based on TDE length of time; T0 (0–5 years), T1 (6–19 years), and T2 (≥20 years). Data were collected by questionnaire to evaluate workers' health history and vital signs' examination to evaluate workers' general health. As an addition, Ankle-Brachial Index (ABI) and hematological changing were being measured. **Results:** Health history result showed that the problems occurred on the body entrance of tobacco dust, e.g. respiratory, eyes and skin disorder, and these problems were more common in T0 group. General health result showed about half workers had tachypnea and high blood pressure in T1 and T2 group. ABI measurement showed no arterial disease, but it was significantly lower in T1 group compare to T0 group. The Somers' D correlation test between TDE length of time and hematocrit level showed a strong negative correlation value of -0,776 and significance value of 0.000. Low hematocrit level indicated the suppression of bone marrow that was possibly caused by nicotine effect from TDE. Before showing a decline in T2 group, hematocrit level was first incline from 4 years to 10 years' exposure, possibly caused by the compensation ability on extra-medullar hematopoiesis. **Conclusions:** Industrial TDE chronic impacts on workers' health similar to chronic impacts of nicotine exposure and the study of hematological changing pattern is suggested to be developed as screening examination of tobaccosis because it is applicable annually on workers' general health examination.

### Introduction

Tobacco industry is one of the biggest industry that provides millions job vacancies (Likke, et al., 2000). The amount of labor needed by the tobacco industry may increase the incidence of

the negative impact of inhalation of tobacco dust as an industrial pollutant (Zarima, 2011) due to the largest content of tobacco dust is nicotine (Triakunakornwong, et al., 2009). The average concentration of nicotine in the tobacco dust is within the range of 0.047 to 0.154 mg/m<sup>3</sup>.

Nicotine in the form of sedative narcotic alkaloid has effects as emetic, cardiac depressant and anti-spasmodic (Dorland, 2010). All disease that is caused by exposure of tobacco dust working environment is often known as tobaccosis. According to data compiled by Inchem in 2015, people will undergo a tobaccosis after 15-20 years of exposure. However, hematological changes will occur earlier at 3-5 years of initial exposure to nicotine (Asif, et al., 2013).

Most of the research related to tobaccosis has always make smokers exposed to nicotine as research subjects. Based on data from Cancer Research UK in 2010, the prevalence of tobaccosis age more than 16 years in the UK were 23% in men and 20% in women. In Indonesia there is no research that collects data on the incidence of tobaccosis especially in the working environment so that the effect of exposure to dust containing nicotine tobacco on the health of workers is not yet known and studied. Problems from this industry is also not simple to solve because it is often related to people's welfare, government policy and sometimes political influence. Therefore, it is necessary to conduct this research.

Tobacco dust exposure (TDE) may lead to tobaccosis that is difficult to detect due to the prolonged occurrence. Therefore, the aim of this study was to determine the chronic impacts of TDE on workers' health by investigating health history, general health examination and including some blood parameter examination by comparing the duration of working. While searching method for early detection and early prevention. We hope that this study can be used to improve the quality of health, safety and security of the tobacco industrial workers.

### **Materials and methods**

This research is an observational survey research using a cross sectional method. The study subjects were non-smoker tobacco industry workers in one of the biggest tobacco industry in

Jember, Indonesia that employing thousand workers and has been certified international standard.

Inclusion criteria in this study were healthy women aged at least 26 years old, with non-smoker status, actively working indoor as sorting labor for 8 hours per day within 6 working days during the week. Research exclusion criteria were workers who develop diarrhea, fever, known by the examination of body temperature with an axial thermometer, anemic known by hemoglobin examination using cupric-sulfate method, edema with pitting edema inspection and capillary blood sampling were delayed for the workers who were still in menstrual period.

The sample size is determined by the binomial proportion with a significant value of 0.05 and a significance degree of 95%, therefore, this research obtain 108 people as a subject, divided into three groups based on the duration of working, i.e. K0 (0-5 years), K1 (6-19 years) and K2 ( $\geq 20$  years). The sampling technique in this research is a simple proportional random sampling. Proportion based on age strata 26-30 years, 30-40 years, 40-50 years and more than 50 years, to eliminate the confounding factor of age.

The research instruments were questionnaire to evaluate workers' health history and medical vital signs' examination equipment to evaluate workers' general health. As an addition, Ankle-Brachial Index (ABI) and hematological changing were being measured using Omron digital tensimeter and hematocrit examination kits by microhematocrit method. ABI, then being calculated and interpreted by AHA guideline.

The present study was approved by the Ethics Committee for human research study at University of Jember, which is standardized to the Indonesian National guideline for human research study ethical clearance. Data were analyzed using appropriate statistic tools and

hematology data were analyzed using correlation Somer's D with SPSS version 21.

Table 1. General information and health history of subject

	Subject (n=108)			Total
	K0	K1	K2	
<b>Age :</b>				
26-30 years	5	2	0	7
31-40 years	15	18	3	36
41-50 years	9	13	23	45
> 50 years	7	3	10	20
<b>Education status :</b>				
Illiterate	8	2	10	20
Elementary	20	27	23	70
Junior high	5	4	3	12
Senior high	3	3	0	6
<b>Smoker status :</b>				
Side-stream smoker	27	28	19	74
Non-side-stream smoker	9	8	17	34
<b>Respiratory problems :</b>				
Anemia	12	23	22	57
Short breath	6	6	5	16
Cough	7	13	5	25
Sneezing	3	6	4	13
Sore Throat	10	14	5	29
<b>Nervous problems :</b>				
Dizzy	15	15	18	48
Paresthesia	15	19	15	49
Tremor	11	13	6	39
<b>Eye problems :</b>				
Get something in the eye	11	10	15	36
Eye burn	3	6	14	23
Hyperemia	5	6	14	25
Sandy eye	5	9	14	28
Epistrophe	5	8	13	26
<b>Skin problems :</b>				
Itch	5	9	7	21
Redness	3	10	7	20

### Result and Discussion

Mainly women who were subject in this research were age 41-50 years and they start to work in this profession at an early age. About % of this

women are educated until elementary school only. Side-stream smoker or passive smokers are exposed to secondhand smoke from active smokers as many as 74 women, while non side-stream smoker is a term for a non-active smoker and not exposed to smoke (table 1).

Table 2. General health of subject

	Subject (n=108)			Total
	K0	K1	K2	
<b>HTN classification :</b>				
Normal	7	7	4	18
Pre-HTN	15	11	13	39
HTN stage I	6	14	8	28
HTN stage II	8	4	11	23
<b>Heart rate :</b>				
Bradycardia	0	0	1	1
Normal	33	32	29	94
Tachycardia	3	4	6	13
<b>Respiration Rate :</b>				
Brachypnea	0	0	0	0
Normal	19	18	16	53
Tachypnea	17	18	20	55

HTN : hypertension

### Health history

Health history result showed that the problems occurred on the body entrance of tobacco dust, e.g. respiratory, eyes and skin disorder, and these problems were more common in T0 group (table 1) probably due to adaptation process has already start from T1 group. This result is relevant to research by Yasmin, Afroz and Hayat (2010) in the beedi workers where about 55.8% of them having respiration problem.

### General health

General health result showed about half workers had tachypnea and high blood pressure in T1 and T2 group (table 2). High blood pressure occurs in 74% of the workers similar with the explanation Purves et al. in his book entitled Neuroscience 3rd edition, i.e. an increase in blood pressure caused by activation of nAChR and vasopressin by nicotine induction.



**Ankle-Brachial Index (ABI)**

ABI measurement showed no risk of arterial disease in all group, but it was significantly lower in T1 or T2 group compare to T0 group (figure 1). Only about 10% of the subjects were having

abnormal ABI and this showed that tobacco dust exposure did not affecting much in peripheral arteries.

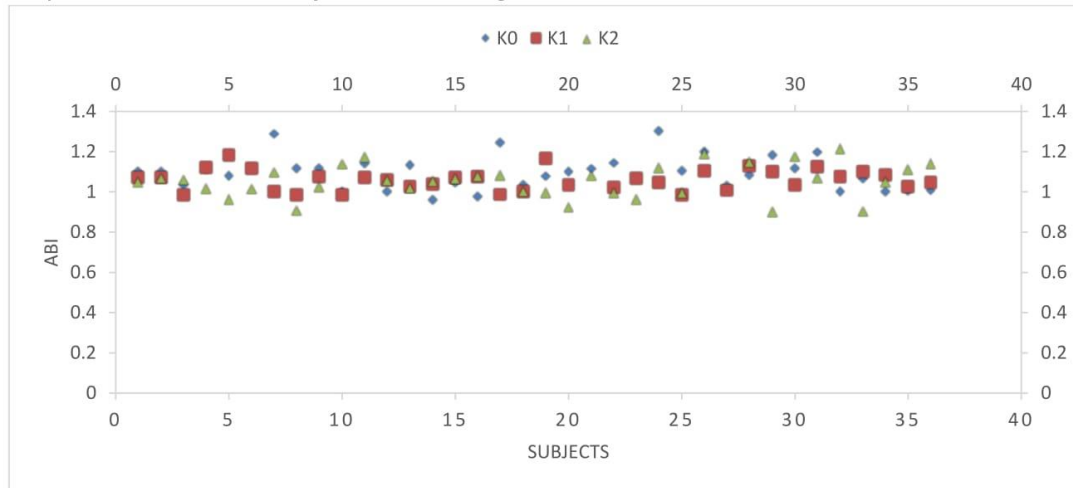


Figure 1. Ankle-brachial index distribution among groups

**Hematocrit examination**

Tabel 3. Relation of hematocrit and duration of working

Hematocrit level	Subyek (n=108) or (100%)		
	K0 (n=36)	K1 (n=36)	K2 (n=36)
Low	0	18 (50%)	36 (100%)
Normal	19 (52,8%)	15(41,7%)	0
High	17 (47,2%)	3 (8,3%)	0

Based on table 3 data we can conclude that a low hematocrit levels dominate hematocrit tobacco industry workers. This is consistent with results from Kholdayamidi et al. (2001) study. The study proves that the decline in CD-44 may occur due to exposure to nicotine. CD-44 is an inducer of signal changes comitted hemopoietic stem cells into stem cells or CFU-E, the parent of the mature erythrocytes. The decline in CD-44 led to

a decrease in production of mature erythrocytes which manifests as a decrease in hematocrit levels.

This study relates between long exposure to tobacco dust with hematocrit levels of tobacco industry non-smokers workers. Duration of exposure grouped into three groups: 0-5 years, 6-19 years and ≥ 20 years. In the group of workers who had been exposed for 0-5 years, it was dominated by the normal hematocrit levels that mostly occurred in workers exposed for 0-3 years. This is relevant with research conducted by Asif et al where the 0-3 years of exposure showed no change in hematocrit.

Abnormal changes taking place start from 4 years of exposure. From exposure of 4-6 years there were increased levels of hematocrit. Asif et al. and Pandit et al. in his journal explained that abnormal increases occurred due compensation of extramedullary hematopoiesis in the spleen due to suppression of hematopoiesis in bone marrow. Hematopoiesis in bone marrow suppression caused by the induction of nicotine

(Mendelson, et al., 2005) that affects the expression of CD-44. CD-44 is a cell surface molecule or Hemopoietic Stromal Stem Cell (HSC). The expression of CD-44, an inducer of differentiation HSC to be committed stem cells such as CFU-E which is the parent of the mature erythrocytes. This was stated by Siggins et al. and Pandit et al in their research.

Suppression constantly in the bone marrow can not be compensated by extramedullary hematopoiesis started from the 11 years of exposure to tobacco dust. On the subject of this study, the compensation of extramedullary hematopoiesis can only occur up to 10 years of exposure. Thus, the workers who have been exposed in a minimum period of 11 years has decreased hematocrit. This decline seems more meaningful in workers exposed at least 20 years old (K2). This is relevant with research conducted by Yasmin, Afroz and Hyat regarding exposure to tobacco in the beedi rollers.

In conclusion, low hematocrit level indicated the suppression of bone marrow that was possibly caused by nicotine effect from TDE. Before showing a decline in T2 group, hematocrit level was first incline from 4 years to 10 years' exposure, possibly caused by the compensation ability on extra-medullar hematopoiesis. Industrial TDE chronic impacts on workers' health similar to chronic impacts of nicotine exposure and the study of hematological changing pattern is suggested to be developed as screening examination of tobaccosis because it is applicable annually on workers' general health examination.

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