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Factory worker jobs and the relationship with cardiovascular risk factor in Indonesia

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Summary. Situation at the workplace, including environment and job type influence health status of workers. This study was conducted to learn the relationship between job types in factory setting with cardiovascular risk in Indonesia. A cross-sectional study was conducted on 111 factory workers in an electronic factory in Yogyakarta, Indonesia. Jobs were classified into three category: officers, operators, and technician. Officers are white-collar employees which have low occupational physical activity, while operators and technician are blue collar employees who have higher physical burden. All the subject were measured the body mass index, waist circumference, percent body fat, and total cholesterol. The mean of percent body fat in officers is lower than operators and technicians. No other relationship was found in BMI, waist circumference, and total cholesterol. In conclusion, we found in our study an association between job type and percentage body fat as a cardiovascular risk factor. White collar employees have lower percent body fat than their blue collar counterparts.

Keywords: occupation, nutritional status, cardiovascular risk, worker, factory

Introduction

According to the Global Burden of Disease Study 2013 (GBD 2013), the mortality rate from non-communicable disease and injuries increased gradually between 1990 and 2013. During this period, there was observed death reduction from communicable disease as well as nutrient deficiencies (1). The age-standardized leading cause of death are cardiovascular diseases with 375.5 per 100.000 (1). This disease was very common mainly in developed world. Currently, there is emerging increase of cardiovascular disease prevalence in low- and middle-income countries. In fact, more than 75% of CVD death take place in these countries (2).

Most people spend the most time of their daily life at workplace. Legal working hours for regular employees in Indonesia, are eight hours per day (five working days) or seven hours per day (six working days) totaling 40 hours per week according to Republic of Indonesia Act no.13 year 2003 (3). Since a significant amount of time is spent at work, working condition should influence the health status of workers.

Workers are prone to several health risk which arises from condition in the workplace. Shift work, for instance, often cannot be avoided by employees. Workers who have shift on non-daytime more than two-thirds of working days showed increased risk of absenteeism due to ill (4). In the factory setting, workers may suffer for instance from shift work-related sleep problems (5), various occupational exposures which result in changes in both hard and soft tissues of oral cavity (6), pulmonary complications (7), hearing loss (8), and unbalance nutrient intake leading to under- (9) or overnutrition (10). Several known contributor to the cardiovascular risk at work including job stress (11), chemical exposure (12), and organizational justice (13), while ethnicity apparently is not an independent risk factor for cardiovascular and all-cause mortality among factory (14).

Several type of jobs compared to others may be associated with cardiovascular risk (15). Therefore, health promotion particularly nutrition should be encouraged to employees with job-associated cardiovascular risk. A study showed that a combination of high demands at work and low job control is associated with 2.2 times cardiovascular mortality risk. The risk of cardiovascular mortality was also increased among employees with effort-reward imbalance, including low salary, lack of social approval, and few career opportunities relative to efforts required at work (16). Blue collar workers who work in manual labor have higher risk of health problems. A study showed that there was increased risk of diabetes mellitus in two-shift—blue collar factory workers compared to white-collar workers (17). In other study, however, no difference in myocardial infarction and cardiovascular events between manual and non-manual metal factory workers (18).

Our study attempted to compare the cardiovascular risk factors, including BMI, percentage of body fat, waist circumference, and blood total cholesterol among different factory worker jobs. Our study was the first to describe cardiovascular disease risk among Indonesian factory worker.

Methods

Subjects

Subjects were recruited from an electronic factory in Yogyakarta, Indonesia specialized in production of lamps. This study was conducted between August-November 2015. A total of 111 factory employees signed the informed consent form, and thus included in this study. Interviews were carried out by the research team member using structured questionnaire to obtain socio-demographic data. Afterwards, anthropometrics measurements and blood drawing procedure were performed on subjects to assess the cardiovascular risk factors including obesity, central obesity, and dyslipidemia among employees with different type of jobs. These jobs are officer, operator, and technician. Officers, the white-collar employees, mainly do administrative task including typing, paper work, and participating in meetings. The others two type of employee, classified as blue-collar employees, do more physical work than the previous one. Operators are factory employees who responsible for lamp production. They generally sit during working hour, but their hands both are very active in assembling and packaging the product. Technician responsible for starting the production machines and fixing any broken tools or instruments. This study was approved by Ethical Committee of Faculty of Medicine, Universitas Gadjah Mada, Indonesia (no. KE/FK/963/EC/2015).

Anthropometric measurements

Anthropometric instruments used in this study was validated prior to use in a Metrology Agency in Yogyakarta. Body weight were measured while subjects wore minimal clothing. Subjects were asked to empty their pocket and stand still on the weighing scale while measurer record the measurement from the display to the nearest 0.1 kg. Height were measured with the subject wear no head accessory and/or footwear. Wall-mounted microtoise was placed 2 meters from the base and used to measure the subjects' height. During measurement, subject stand still with back of the head, scapula, hip, and ankle against the wall while the head lies in the Frankfort horizontal plane. The measurement results was recorded to the nearest 0.5 cm. Body mass index (BMI) was calculated by dividing weight in kilogram by squared height in meter. Each subjects was categorized based on BMI as follow: BMI of <18.5 is considered underweight, 18.5-22.9 is normal, 23-24.9 is overweight, and ≥25 is obese. Waist circumference was measured using non-stretchable measuring tape placed around the abdomen horizontally via midpoint of the lowest rib and iliac crest. In the case of central obesity, measuring tape was placed on the abdomen with the largest circumference. The result was recorded to the nearest 0.1 cm. Central obesity was defined as waist circumference of ≥102 cm and ≥88 cm for male and female, respectively.

Blood total cholesterol level

Blood was drawn from each subject using finger-prick technique. The first blood flow from puncture site was wiped and the next coming blood is applied to a cholesterol test kit (EasyTouch® GCU Multi-Function Monitoring System, Bioptik Technology, Inc, Taiwan). Blood total cholesterol of higher than 200 mg/dL was considered hypercholesterolemia.

Statistical analysis

Data in the subjects' characteristics are presented in mean±SD and number (percentage). Comparison of each cardiovascular risk factor (BMI, body fat percentage, waist circumference, and total cholesterol level) among type of jobs was analyzed using General Linear Model, with adjustment for age and sex. The result was considered statistically significant if $p<0.05$.

Result

In this study, 111 factory workers were participating. Majority of the participants (69%) were females. The average age was 46.27±4.73 years. Mean body mass index of the subjects was 24.91±3.24 kg/m^2. According to the BMI cut-off that was set for Asian population, 80 out of 111 workers had body weight above normal: 31.5% are overweight and 42.3% are obese. Among men, 3% had waist circumference above normal, while the proportion of women with this condition was over 8 times higher (26%). Moreover, there was a very large proportion of high total cholesterol level in this population, reaching 75% of all workers participated in this study. Most of the participants worked as an operator (76 persons, 69%), while persons who worked in the office contribute to the least number of subjects (9 persons, 8%). Operators were dominated by female workers, while most technician are males. Seventy-five percent of workers graduated from senior high school (Table 1).

There was no different BMI across three jobs in the factory. However, measurement using bio-impedance analysis technique showed that officers had significantly lower percentage body fat to operators and technicians (21.76±4.87 vs. 31.43±6.05 and 25.00±5.72; $p<0.05$). No different of body fatness between operators and technicians. There was also no difference found in waist circumference measurement. Total cholesterol was also similar among jobs. Analysis was performed with adjustment for age and sex (Table 2).

Discussion

This study showed that the nutrition problem in Indonesian factory workers mainly is overnutrition. There is only one person out of 111 who was underweight while 74% workers have body weight beyond normal. Moreover, female workers has more prevalence of general and central obesity in this factory (47% vs. 31% and 26% vs. 3%, respectively). Our study participants are mostly female, which contribute to 69% of all participants. Female workers dominated the operator job, while the more vigorous job like technician mostly done by men.

In this study, we found that officers, who have the lowest physical demand in the job has the lowest percentage body fat compared to other jobs ($p<0.05$ vs. operators and technician). Generally, increased of physical activity has been advised to reduce risk of obesity, metabolic syndrome, and in the long-term—non-communicable diseases (19). In work setting, however, several studies showed that high physical demand in the job related to the high risk of metabolic syndrome/non-communicable disease. A systematic review showed that workers with job strain have higher chance to have diabetes (OR 1.29; 95% CI: 1.11–1.51), and increased Framingham risk score (OR 1.13; 95% CI: 1.03–1.25) (20). This may partly explain why we found workers with the lowest physical burden (officers) have lower percentage body fat.

Another study in workers showed that cardiorespiratory fitness reduced risk of cardiovascular mortality, and workers with high self-reported occupational physical activity have higher risk of CVD mortalities compared to those with low category (21). Recent study suggest that occupational and leisure time physical activity has different effect on cardiovascular disease risk. A study conducted in Denmark showed that while leisure time physical activity protects against risk of myocardial infarction and all-cause mortality, occupational physical activity was shown to increase the risk. Moreover, workers with high occupational physical activity have lower risk of all-cause mortality if they also involve in high leisure time physical activity (22). Workers with high job strain associated with leisure-time physical inactivity according to a study in London (23) while the Danish study did not show any tendency (22). Low leisure-time physical activity is also observed in less skilled workers, which have risk of cardiovascular disease (24).

The evidences are still conflicting whether occupational physical activity promotes or protects against

Table 1. Subjects Characteristics (n=111)

Characteristics	All		Male		Female	
	Mean±SD	N (%)	Mean±SD	N (%)	Mean±SD	N (%)
N		111 (100)		35 (31)		76 (69)
Age (years)	46.27±4.73		46.29±5.37		46.26±4.44	
Weight (kg)	60.43±9.26		66.71±8.02		57.54±8.3	
Height (cm)	155.69±7.79		165.03±4.19		151.38±4.60	
BMI (kg/m^2)	24.91±3.24		24.51±2.96		25.1±3.36	
Nutritional status						
Underweight		1 (1)		0 (0)		1 (1)
Normal		28 (25)		10 (29)		18 (24)
Overweight		35 (32)		14 (40)		21 (28)
Obese		47 (42)		11 (31)		36 (47)
Waist circumference (cm)	84.34±8.87		85.94±8.56		83.60±9.00	
Normal		90 (81)		34 (97)		56 (74)
Central obesity*		21 (19)		1 (3)		20 (26)
Cholesterol level (mg/dL)	233.22±51.90		253.11±52.86		224.05±49.13	
Normal ≤200 mg/dL		28 (25)		6 (17)		22 (29)
Hypercholesterolemia >200 mg/dL		83 (75)		29 (83)		54 (71)
Type of occupation						
Officer		9 (8)		7 (20)		2 (3)
Operator		76 (69)		8 (23)		68 (89)
Technician		26 (23)		20 (57)		6 (8)
Education						
Elementary school		2 (2)		0 (0)		2 (3)
Junior high school		26 (23)		6 (17)		20 (26)
Senior high school		83 (75)		29 (83)		54 (71)

**(Waist circumference: female ≥88 cm; male ≥102 cm)*

Table 2. Comparison of cardiovascular risk factor profile among different type of jobs

	Officers	Operators	Technicians
BMI (kg/m^2)	25.21±2.85^a	25.09±3.40^a	24.31±2.90^a
Body fat percentage (%)	21.76±4.87^a	31.43±6.05^b	25.00±5.72^b
Waist circumference (cm)	84.72±5.06^a	83.82±9.29^a	85.73±8.72^a
Total cholesterol (mg/dL)	236.00±40.51^a	224.57±50.88^a	257.54±52.09^a

Numbers in the same row with different superscript alphabet are statistically significant ($p<0.05$); adjusted for age and sex.

obesity. According to Whitehall II cohort in London, there was a dose-response relationship between job strain and the risk of general and central obesity (25). In another study, the increase of cardiovascular disease risk in workers with high occupational physical activity probably not related to adiposity as this type of activity still has protective effect against obesity (26). In addition, occupational physical activity reduce risk of abdominal obesity (27).

We found significant difference in our study regarding the body fat percentage of officers vs. operators and technician, although we did not find difference in BMI and waist circumference. BMI is an indirect method to assess adiposity. Therefore, it is probably not surprising to see this association was not seen using BMI but rather with bio-impedance analysis method to predict percentage body fat. Care must be taken when using BMI to compare the degree of fatness among people because many factor may influence it, including sex, age, and race (28). BMI of Asians correspondent to higher body fat percentage compared to white people with the same BMI (29). In large sample adult study, it was shown that BMI was a poor indicator of fatness, particularly in men with BMI of less than 25 kg/m^2 (30).

Our finding on high proportion of obese and dyslipidemic among factory workers deserve more attention from the state policy makers and business owners. Nutrition interventions should be implemented to employees with risk of health deteriorations because of working condition. Several intervention approaches has shown to reduce cardiovascular risk in workers. A five-year interventions of Worksite Intervention Project from Isfahan Healthy Heart Program, which contain intervention for nutrition, physical activity and smoking as well as hypertension and obesity screening systems resulted in decreased of hypercholesterolemia, hypertriglyceridemia and central obesity (31).

Although this problem has been neglected by Indonesian government, currently there is policy focused on prevention of non-communicable diseases (NCDs). These diseases started to gain attention from state government with increase of NCDs contribution to cause of death from 37 at 1990 to 57% in 2015 (32). Indonesian Ministry of Health (IMoH) actively enforce new program called *Posbindu PTM* (Integrated Development Post for Non-Communicable Diseases) to tackle NCDs by encouraging small community-level monitoring of risk factors such as lifestyle-related factors, body mass index, blood glucose and lipid profile, followed by education, exercise, and referral to the health care facilities. IMoH argues that the concept of *Posbindu PTM* can be implemented within any kind of community, including in the workplace (33).

Several factors are not under investigation in our study. As we focus more on the type of job, we did not measure the workers physical activity both in occupational or leisure setting. Moreover, no nutrient intake was recorded which may modify the findings of our study.

Conclusion

Our study showed that there is high prevalence of obesity in Indonesian factory workers. We also found that employees working in administration settings have lower percent body fat compared to their peers. Administration job performed with less physical activity compared to other type of job, therefore, our finding might challenge the current believe that high physical activity protects against obesity. While most study elucidated role of work-associated factors such as work strain and work shifts on risk of cardiovascular diseases, we suggest more study to be conducted to identify other types of job and associated risk. Information will be valuable to set specific policy on different types of job in to prevent work-related diseases.

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