The Implementation of Occupational Health and Safety

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Abstract

Batik is a traditional process of repeatedly applying wax and dye on fabric to produce intricate and colourful patterns. Occupational safety and health issues arise among workers due to improper positioning during the *mencanting* process or exposure to risk factors in the workplace. This community service aims to implement workplace climate measurement using the Wet Bulb Globe Temperature (WBGT) index, work fatigue using a reaction timer test, light intensity with a lux meter in the *mencanting* area, musculoskeletal pain using the Nordic Body Map (NBM) questionnaire, as well as promoting occupational safety and health materials to 8 participants whom are workers at Small and Medium-sized Enterprise (UKM) Sanggar Batik Cirebon. The measurement results showed the average (WBGT) workplace climate index was 28.13 °C; the average work fatigue was 531.48 milliseconds; the average range of light intensity was 45.20 Lux - 85.33 Lux; and the average NBM score was 47.13. During the delivery of the occupational safety and health promotion materials, the participants appeared enthusiastic and motivated.

Keywords: Ergonomic, light intensity, musculoskeletal, work fatigue.

Introduction

Since October 2nd, 2009, batik was recognized by UNESCO as Indonesia's cultural heritage. Since the inauguration, the development of the Indonesian batik industry has grown rapidly. Cirebon has long been known as one of the best centres for batik craftsmen in Indonesia. Trusmi Batik Centre is located in the Plered area, or about 4 kilometres west of Cirebon City. Trusmi Batik Centre itself is a village inhabited by batik craftsmen in Cirebon. Until now, there are more than 3,000 creative industry performers at Trusmi Batik Center (Kemenparekraf, 2021).

The Central Bureau of Statistics for Cirebon Regency recorded the number of batik industry workers who are a leading commodity in Cirebon Regency in 2016 of 4,628 people and in 2020 of 4,679 people (BPS Kabupaten Cirebon, 2021). The process of making batik is a technique for drawing images on the surface of the cloth by covering certain parts using wax or candlewax, *canting* tools and requiring sufficient lighting (Ari, 2011), In line with the review of Heru's research (2008), adequate lighting will have an impact on increasing productivity and make it easier and faster for workers to carry out their work. Adequate lighting standards in rooms, particularly for industrial activities, are stated in the Decree of the Minister of Health of the Republic of Indonesia No.1405/MENKES/XI/2002 concerning Health Requirements for Office and Industrial Work Environments.

Based on the data from the International Labour Organization (ILO) in 2015, around 6,000 work accidents occur every day which result in fatal casualties in the world caused by fatigue (BPJS Ketenagakerjaan, 2017). Another data from Social Security Administrator Agency (BPJS), there had been 14,664 work accidents by the end of 2015 in Indonesia. In West Java, the number of work accidents in 2016 reached 21,296 cases, then there was an increase of accident cases in 2017 becoming 22,878 cases (BPJS Ketenagakerjaan, 2017).

Based on the research conducted by Wiyanti & Martiana (2015) on 20 Batik home industries at Jetis Sidoarjo, it revealed that 9 of them with room lighting measurements of 55% did not fulfil the standards and with results of 45% relevant to the standards of 11 home industries. According to the research carried out by (Sofiati, 2011) lighting measurements applied in the White Jasmine Batik Studio of Jambi at each worker's workplace, it was identified that the measurement results are 65% or as many as 13 points not relevant to the standard, then with a measurement result of 35% or as many as 7 standard points.

Another previous study conducted by Wiyanti & Martiana (2015) on 30 Laweyan written Batik workers in Surakarta, it was found that 25 workers experienced eye fatigue, and 5 people did not experience eye fatigue. Workers who experienced eyestrain in the study were characterized by complaints of several pain symptoms: sore eyes, red eyes, double vision, tension around the eye muscles, so that they feel uncomfortable and not safe during work hours due to insufficient lighting at the workplace.

Based on the research conducted on 20 Jetis Batik workers of Sidoarjo, it found that 10 workers experienced eye fatigue with a measurement result of 50%, and those who did not experience eye fatigue with a result of 50% namely other 10 workers (Marlia, et.al. 2018). Whereas other research which was conducted on 20 Batik workers in the White Jasmine Batik Studio of Jambi, revealed that 14 workers with a measurement result of 70% experienced eye fatigue, and 6 workers with a measurement result of 40% did not experience eye fatigue (Sofiati, 2011).

The unfavourable lighting conditions would affect the batik home industry and the workers themselves, namely decreased income, non-conducive working environmental conditions, fatigue and discomfort for workers which would impact further on lack of work efficiency, mental fatigue which would affect the workers' physical fatigue, complaints of sore eyes and headaches around workers' eyes, and would eventually increase work accidents (Kuswana, 2014).

Based on the phenomenon above, the Community Service Team (PkM), D-IV Occupational Safety and Health (K3) Study Program, Polytechnic of Manpower (Politeknik Ketenagakerjaan) held a program to implement occupational health and safety for workers at Small and Medium-sized Enterprise (UKM) Trusmi Batik Studio X Cirebon. The program socialized stretching exercises, first aid in accidents, and measuring work climate, lighting, fatigue, and muscle and bone pain complaints.

Method

D-IV Occupational Safety and Health (K3) Study Program, Polytechnic of Manpower (Politeknik Ketenagakerjaan) conducted a series of community service (PkM) programs that carried out several activities (Table 1) in collaboration with the apparatus of UPTD Labour Inspection III Cirebon on September 27th – 30th 2022 at Small and Medium-sized Enterprise (UKM) Sanggar Batik Cirebon.

The participants of this community service were the eight daily workers at the UKM Sanggar Batik Cirebon whom were willing to participate in the service.

Table 1. The Programs of Community Service (PkM) on September 27th – 30th, 2022

Programs	Activities
Measurement of work climate	Measurement of work climate was conducted on 28-30 September 2022 by adopting the procedures of SNI 7061:2019 Measurement and Evaluation of Work Climate.
Measurement of fatigue	Measurement of fatigue used Reaction Timer Test within self-administrative measurement.
~~Lighting~~ Measurement of lighting	Lighting Measurement by adopting the procedures of SNI 7062:2019 Measurement of Lighting Intensity at the Workplaces.
Measurement of Muscle and Skeletal Pain Complaints	Measurement of Muscle and Skeletal Pain Complaints used the Questionnaires of Nordic Body Map (NBM) "4 likert scales" within scale 1 to 4 represented indicator NP (Not Pain), EP (Enough Pain), P (Pain), VP (Very Pain) (Tarwaka, 2014).
Socialization on Occupational Health and Safety	The socialization materials included: • Work Ergonomics • Workplace Environment • Emergency Condition
Socialization of stretching exercises	Socialization of stretching exercises referred to exercise standard from Directorate of Health for Productive Age & Elderly, Ministry of Health RI 2020 with the YouTube link https://youtu.be/60wZ1ns7f7Q

Results

Measurement of Workplace Climate

Based on the result of the measurement of workplace climate, the data obtained were as follows:

Table 2. The Results of the Measurement of Workplace Climate

Date	Location	Heat Sources	WBGT (°C)	Climate
28 September 2022 at 15.03	*Canting*	Stove and Sun (with semi-tin rooftop)	28.6	Sunny
29 September 2022 at 14.04	*Canting*	Stove and Sun (with semi-tin rooftop)	28.1	Sunny
30 September 2022 at 15.03	*Canting*	Stove and Sun (with semi-tin rooftop)	27.7	Cloudy

The results of the measurement of workplace climate using Wet Bulb Globe Temperature (WBGT) in Table 2 adopting SNI 7061-2019 procedures for 3 days were 28.6 °C, 28.1 °C, and 27.7 °C in sunny, sunny, and cloudy weather, respectively.

Measurement of Fatigue

Based on the result of measurement of fatigue, the obtained data were as follows:

Table 3. The Results of Measurement of Fatigue

No	Respondent	Average (millisecond)	Remarks
1	1	457.6	Measurement was conducted after working hours
2	2	646.1	
3	3	430.9	
4	4	546.5	
5	5	471.2	
6	6	810.5	
7	7	464.6	
8	8	424.4	

The results of measurement of work fatigue the Table 3 using the Reaction Timer Test on 8 participants were 457.6 milliseconds, 646.1 milliseconds, 430.9 milliseconds, 546.5 milliseconds, 471.2 milliseconds, 810.5 milliseconds, 464.6 milliseconds and 424.4 milliseconds, respectively.

The participants' characteristics were displayed in the Table 4 below.

Table 4. Participants' Characteristics

No	Characteristic	Data	Frequency	%	Mean
1	Age	24	1	12.5	34
		26	1	12.5	
		28	1	12.5	
		31	2	25.0	
		37	1	12.5	
		46	1	12.5	
		49	1	12.5	
2	*Body Mass Index* (BMI)	17.2	1	12.5	20.95
		18.0	1	12.5	
		19.4	1	12.5	
		19.5	1	12.5	
		21.2	1	12.5	
		21.4	1	12.5	
		22.1	1	12.5	
		28.8	1	12.5	
3	Working Hours	8	8	100	8

Based on Table 4, it can be inferred that the lowest and highest age of the participants 24 (12.5%) and 49 (12.5%), respectively. The mean for body mass index (BMI) of the participants was 20.95. Meanwhile, each participant worked for 8 hours.

Measurement of Light Intensity

The measurement of light intensity was conducted in the *mencanting* area. There are 2 white 18-watt light bulbs between points 1 and 2, and between points 4 and 5. The results of the measurement were in the Table 5 below.

Table 5. The Result of Measurement of Light Intensity

Date	Measurement Point	Measurement Result (Lux)			Average (Lux)	Climate
		1	2	3		
27 September 22	1	86.8	103.3	106.1	98.73	Sunny
	2	76.8	77.1	78.0	77.30	
	3	47.7	45.5	46.1	46.43	
	4	82.3	70.5	73.4	75.40	
	5	68.0	66.1	68.0	67.37	
29 September 22	1	91.5	90.5	93.5	91.83	Sunny
	2	74.7	72.7	66.1	71.17	
	3	45.4	44.9	45.2	45.17	
	4	73.2	70.5	71.8	71.83	
	5	62.7	62.2	66.7	63.87	
30 September 22	1	69.7	64.6	62.0	65.43	Cloudy
	2	64.7	59.9	66.5	63.70	
	3	43.8	43.0	45.2	44.00	
	4	55.0	48.1	57.0	53.37	
	5	41.0	49.7	44.3	45.00	

The results of measurement of light intensity in Table 4 adopting SNI 7062:2019 procedures at 5 measurement points for 3 days with average values were day 1 (point 1: 98.73 Lux; point 2: 77.30 Lux; point 3: 46.43 Lux; point 4: 75.40 Lux; and point 5: 67.37 Lux); day 2 (point 1: 91.83 Lux; point 2: 71.17 Lux; point 3: 45.17 Lux; point 4: 71.83 Lux; point 5: 63.87 Lux); and day 3 (point 1: 65.43 Lux; point 2: 63.70 Lux; point 3: 44.00 Lux; point 4: 53.37 Lux; point 5: Lux). The weather for day 1, 2, and 3 were sunny, sunny, and cloudy, respectively.

Measurement of Musculoskeletal Pain

The following Table 6 displayed the results of the measurement of musculoskeletal pain.

Table 6. The Result of Measurement of Musculoskeletal Pain

Participant	No Pain	Mild Pain	Moderate Pain	Severe Pain	Score
1	14	22	9	0	45
2	8	0	57	4	69
3	15	26	0	0	41
4	17	20	3	0	40
5	15	20	9	0	44
6	7	12	42	4	65
7	20	14	3	0	37
8	20	16	0	0	36

The results of measurement of musculoskeletal pain in Table 6 using the 4-likert scale Nordic Body Map (NPM) questionnaire. The scale 1 to 4 were the indicators of no pain (1), mild pain (2), moderate pain (3), and severe pain (4), which were felt in 28 parts of the body. The total score of pain obtained from each participant were 45, 69, 41, 40, 44, 65, 37 and 36, respectively.

The Description of Workload

Based on the observation, it was identified that workload at Small and Medium-sized Enterprise (UKM) Batik Studio X Cirebon was light in the *mencanting* area of batik cloth.

Socialization on Occupational Health and Safety

Socialization on Occupational Health and Safety was followed by all participants enthusiastically. The socialization materials were presented by the Lecturers team of D-IV Occupational Health and Safety (K3), Polytechnic of Manpower:

- Socialization on Work Ergonomics by apt. Nico Linggi Pongmasangka, S.Farm., M.M on 28 September 2022;
- Socialization on Workplace Environment by Ida Umarul Mufidah, S.T., M.Si on 29 September 2022;
- Socialization on Emergency Condition by M. Islam Nasution, S.T., M.Kes on 30 September 2022

The documentary evidence of the program as follows:

Figure 1. Socialization on Work Ergonomics

Figure 2. Socialization on Workplace Environment

Figure 3. Socialization on Emergency Condition

Socialization of Stretching Exercises

Socialization of stretching exercises presented by all lecturers, educational staffs, and students' representatives from D-IV Occupational Health and Safety (K3), Polytechnic of Manpower (Politeknik Ketenagakerjaan) with the apparatus of UPTD Labour Inspection III Cirebon. The documentary evidence of the Stretching Exercises program as follows:

Figure 4. Socialization of Stretching Exercises

Discussion

Based on the result of the Community Service Program held by PkM Team of D-IV Occupational Health and Safety (K3), Polytechnic of Manpower, it revealed that ISBB value on the Table 2. The Result of Work Climate Measurement for 3 days, thus the ISBB average value of 28.13 ºC at the *mencanting* area. Meanwhile the observation of work load conducted at Small and Medium-sized Enterprise (UKM) Batik Studio X Cirebon was identified as moderate work load. To gain light work load so the workers can work optimally, thus they are highly recommended to work on ISBB (ºC) under 31.0ºC. The analysis of work climate at the *mencanting* area can be concluded as the result did not exceed the threshold value that has been set.

In table 2. The results of the Fatigue Measurement show that the average value obtained from 8 respondents was 531.48 (milliseconds), meaning that worker fatigue is categorized as moderate work fatigue. As stated by Tarwaka (2014), physical work that requires continuous concentration can cause physiological fatigue, thus physiological changes and decreased desire occurred to perform a work activity caused by psychological fatigue. The heavier a person's workload, the shorter the work time that is carried out to work without experiencing fatigue and other physiological disturbances. However, if the workload that a person receives exceeds

his capacity, it will cause fatigue and physiological disturbances such as disorders of the cardiovascular system (Tarwaka, 2014).

The results of lighting measurements at five points in the batik cloth painting section in table 4, obtained the mean for each point, namely: point 1 (85.33 Lux); point 2 (70.72 Lux); point 3 (45.20 Lux); point 4 (66.87 Lux); point 5 (58.75 Lux). Based on the lighting standards in the Regulation of the Minister of Manpower of the Republic of Indonesia No. 5 of 2018, the *mencanting* activity is a work of distinguishing fine items with moderate contrast for a long time with a light intensity of 500 - 1000 Lux. However, from the measurement results it is found that the lighting on the part of the hand-drawn batik cloth does not fulfil the standard. Inadequate lighting is an additional burden for workers; thus, it can cause disruption to work performance which can ultimately have an impact on occupational health and safety. (Departemen Tenaga Kerja dan Transmigrasi, 2001) Poor lighting can result in eye fatigue and reduced work efficiency, mental fatigue, complaints of sore eyes and headaches around the eyes, damage to vision devices and increased accidents. (Sakai, 2009). Good lighting is lighting that allows workers to see the objects which they are working on clearly, quickly and without unnecessary effort (Richa et.al, 2009).

Low-intensity lighting can cause eye fatigue, eye strain, and complaints of soreness around the eyes. Nevertheless, if the lighting intensity is high, this can also cause glare which can interfere with work. Therefore, efforts must be made to provide sufficient and adequate lighting intensity, which is not too low or too high (Santoso, 2004).

The results of the Nordic Body Map measurements in table 5 interpret that the mean NBM score is 47.13, the NBM minimal score is 36.00, and the NBM maximal score is 69.00, so it can be concluded that the average complaint level is not pain and no action is needed. Nevertheless, further study is required for workers who get an NBM score of 69.00 which includes the level of mildly ill complaints so that action may be necessary. When viewed from age, the respondents who obtained the NBM score with the level of mildly ill complaints were 49 years old and 46 years old. A person's age is identified as factor which might affect the occurrence of musculoskeletal disorders (MSDs). The older we get, the more we often experience back pain (Waluyo et.al, 2010). In addition, the older a person is, the body's immune system will decrease. Therefore, old age is more susceptible to disease than young people (Nadesul, 2009). In several studies, it was also stated that there was a significant relationship between age and MSDs complaints (Pratama et.al, 2017; Heiden et.al, 2013).

During the socialization session on occupational health and safety, as well as stretching exercises, the participants looked excited and enthusiastic. The measurement results should be taken into account as the basis on providing outreach program for workers.

Conclusion

The implementation of occupational health and safety at Small and Medium-sized (UKM) Batik Studio X Cirebon has been carried out in collaboration with the Community Services Team (PkM) of D-IV Occupational Health and Safety Study Program (K3), Polytechnic of Manpower together with the apparatus of UPTD Labour Inspection Region III Cirebon, and the community represented by workers of UKM Batik Studio X Cirebon. Based on the results of the measurement analysis, it was found that the working climate was relevant to the standards, the work fatigue was in the moderate category, the light intensity in the *mencanting* area was below standard, and the average level of complaints of muscle and bone pain was not painful so no action was required. Workers do not understand well regarding work ergonomics, handling the work environment and its impacts, and the procedures that must be carried out in an emergency condition.

In order to increase workers' awareness and comprehension on the importance of work ergonomics, work environment, and emergency procedures, educational socialization is held in the form of interactive outreach to workers. Based on direct observation, workers participated and involved actively and enthusiastically in the program.

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