Health profile of batik workers in Malon Village Indonesia

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ABSTRACT

Background: The making of batik in Malon Village utilized natural dyes. The process of making batik was done through 7 stages: designing pattern, tracing, outlining, coloring, fixing, masking and rinsing. Those processes were conducted with poor ergonomic working positions and were highly potential to cause injury for the batik workers. This study aimed at finding out the potential health risks that exist for the natural batik workers and the occupational health profiles of batik workers in Malon Village which is an icon for naturally dyed batik.

Method: This study was descriptive quantitative research by using observational design. The data were collected from subjective complaint questionnaires, workplace observation and measurement of Vital Lung Capacity (VLC) of the batik workers.

Results: The results showed that 45.5% of the working tools used poor ergonomic designs. Batik in Malon Village used four chemical irritants: wax, alum, soda ash and lime. All of them could potentially lead to health problems. The result also showed that around 61% of batik workers complained about stinging/burning eyes, 28% watery eyes and 11% red eyes. In addition, 22% of them complained about itchy skin, 6% redness in the skin and 6% pain in the skin. The VLC showed that 50% of respondents had normal VLC, 47% mild restriction and 3% severe restriction.

Conclusion: The area where the batik workers worked had high health and safety risks, but only 22% of respondents used Personal Protective Equipment (PPE) and all of the worn PPE did not meet the standards.

Keywords: batik, health complain, natural dyes.

INTRODUCTION

Batik is one of world heritage from Indonesia which has high demand for domestic or foreign markets. UNESCO recognizes batik as the oral and intangible heritage of humanity from Indonesia which is currently developing into a world-class business. In general, there are two kinds of batik production processes. The first production type uses chemical or synthetic materials and the second one uses natural materials. Currently, people tend to like something that returns to nature, therefore batik with natural dyes becomes the most customers’ favorite and it sells quickly in the markets. Batik Alam Malon is one of the batik centers in Semarang - Indonesia that emphasizes on nature dyes or natural materials for its production. The materials used in the batik production process in Malon Village were HVS papers and stationery, mori/ silk, soda ash, writing/ canting wax (for handwritten batik/ “batik tulis”)/ stamp wax (for stampbatik)/ cold wax (for screen batik printing), some natural dyes such as: “jelawe” (a kind of fruit used to produce brown color), “tingi” (the nark of jackfruit/ teak/ magohany), “tegeran” (a tree trunk), “indigo vera” (blue color) and mangrove wastewater. In Malon Village, textile dye (synthetic) was required only when there was a special order, but it was very rarely used. Other materials used in the batik production process were TRO (Turkish Red Oil) as a cleaning agent, water, and alum/ lime/ ”tunjung” fruit. The tools used were handwriting canting/ stamped canting, “malam” print (a special machine to print pattern which is usually called screen batik printing), big pot to boil cloth, dye fabric container, traditional stove and long wood to stir.

The materials and tools mentioned in the natural batik production process above showed that batik makers still used chemical substances although they claimed that they used natural materials for it. The chemical substances used in the natural batik production process were soda ash, TRO, lime liquid (Ca(OH)2), alum and wax. Surprisingly, most of batik makers admitted that they never received any socialization from the relevant officials about how to use of safe coloring materials for batik.

This study was conducted in The X Natural Batik production center at Mallon Village, Semarang. The number of batik makers in The X Natural Batik at Malon Village was around 40 people, and 85% of them were women. During their work, they were exposed to the chemical irritants. In addition to being exposed to chemical irritants, batik makers also had poor ergonomic working positions, and they also needed to utilize the working tools, i.e: stove which also had potential...
hazards such as heat, radiation and fire. Preliminary studies revealed several health complaints among the batik makers such as cough, eye irritation and muscle problems. The Material Safety Data Sheets (MSDS) document shows that soda ash and alum can cause eye and respiratory tract irritation, while TRO and lime liquid can cause eye and skin irritation. Meanwhile, wax can cause eyes, skin and respiratory tract irritation. Based on this background and circumstances, this study aimed at finding out the potential health risks that exist for the natural batik workers and the occupational health profiles of batik workers in Malon Village which is an icon for naturally dyed batik in Semarang, Indonesia.

METHOD

This was a quantitative descriptive research method with an observational design. The quantitative descriptive method was used because this study described the phenomenon as it is, prioritizing objectivity, gave no treatment and had no intention to test any hypothesis. The observational approach was used because the data collection in this study was done through observation. The quantitative data in this study were presented using percentage.

The data in this research were collected from the subjective complaint questionnaires, observation in the working place and measurement of the Vital Capacity of Lung of batik workers in The X Natural Batik at Mallon Village. Subjective complaint questionnaires were used to find subjective symptoms manifesting in the respiratory tract, skin, eye and muscle during the batik production process, including the symptoms related to working environment, tools, materials, or working position. Observation was done to collect data about the working position, tools and materials used. The measurement of Vital Lung Capacity was done using a spirometer to determine the maximum amount of air that can be exhaled from the lungs with maximum force after maximum inhalation.

The samples taken were the total population of the batik workers in The X Natural Batik at Malon Village as many as 40 samples. Any batik workers who were absent during the data collection were excluded. The collected data were analyzed descriptively.

RESULTS

The number of batik workers in Malon Village was 40 workers, but only 36 showed up during the data collection of this study. Of the 36 people who were present, 6 (17%) were male and 30 (83%) were female. In respect to their age, twenty-two (61%) of the workers were ≤ 40 years old and 14 (39%) were > 40 years old. Batik-making process belongs to the informal occupation sector, which is very different from the formal sector. One difference is in the terms of age. In the informal sector there is no age restriction for workers, so in this study we could find a 70 years old respondent who still worked as a batik maker in that village.

According to the data of the working period, a total of 31 workers (86%) had been working as batik makers for less than 5 years whereas 5 workers (14%) had been working for over 5 years. Among these workers, only 4 people (11%) had been working as batik makers in Malon Village for ≥ 5 years while the other 32 workers (89%) had worked as batik makers in Malon Village for less than 5 years.

The employment history description showed that there were 26 people (72 %) who had worked in other sectors other than the batik making industry, those with working periods of ≥ 5 years were 11 people (42%), and < 5 years were 15 people (58%). They used to work in garment, tire factory, supermarket, convection, polyplas (58%). They used to work in garment, tire factory, supermarket, convection, polyplas factory, and stone breaker. This meant that the batik workers in The X Natural Batik at Malon Village had a history of various jobs before working as batik workers. Some of them had worked in areas that involved chemical substances or other materials which could affect the Vital Lung Capacity before they started to work as batik workers in Malon Village.

There were 11 tools used by the workers for making batik in Malon Village, those were pillows, chair, "gawangan", tablecloth, "krenteng", "jlawe", "canting", brush, pan, stove and gas cylinder. Out of the 11 tools mentioned, 5 (45.5%) of them were classified as non-ergonomic and/or encouraged the workers to be in a poor ergonomic working position. Those tools are pillows, chairs, "gawangan", tablecloth and stove. The other 5 (45.5%) tools were still ergonomic enough to be used, and 1 tool (9%) had a standard design by LPG gas cylinder manufacturer.

The results of subjective complaint questionnaires showed that the respondents addressed complaints of pain or stiffness in the muscles of the body, such as aches in the legs as many as 13 respondents or 36%, aches in the waist as many as 26 respondents or 72%, aches in the back as many as 25 respondents or 69%, aches in the neck as many as 20 respondents or 56%, aches in the arm as many as 20 respondents or 56%, aches at the hands as many as 17 respondents or 47%, aches in the wrist as many as 10 respondents or 28% and aches in the fingers as many as 8 respondents or 22%. Meanwhile, other complaints arose including numbness, blurry eyes and dizziness when working.

The production of batik required 2 main raw materials, i.e. fabric (the most used was mori type) and dye. The X Natural Batik at Malon Village used natural dyes, such as tree bark for yellow dye and fruit peel for brown dye. To avoid the monotonous color, The X Natural Batik mix-matched them with other dyes such as: mango leaves, jenitri fruit, indigo, jelawe fruit, jengkol skin and others. But in practice, The X Natural Batik also used 4 additional synthetic chemical materials which were: wax, alum, soda ash and lime. All of them (100%) were irritant materials that had the potential to cause health problems such as skin, eyes, and respiratory tract irritations according to the MSDS. Results of subjective complaints showed that the respondents had skin problems, such as itchy skin, redness on their skin and sore skin. Out of the 36 respondents, 8 respondents (22%) complained of itchy skin, 2 respondents (6%) skin redness and 2 respondents (6%) complained of skin sore/pain when working and interacting with colorants.

The results of the PPE usage in this study revealed that from 36 respondents, only 8 respondents (22%) used a PPE in which 7 (19%) of them used regular cloth masks and 1 (3%) only covered his nose with a regular cloth. It can be concluded
that the PPE used by batik workers The X Natural Batik at Malon Village did not meet the standards of Occupational Safety and Health (OSH), because the chemical additives used in the process of batik making could still be inhaled by the workers especially during the process of coloring and rinsing. Furthermore, the duration of PPE usage by the batik workers was not for the whole time of working but only at arbitrary times/ when they wanted to. This was caused by the inadequate level of knowledge about the importance of using masks as Personal Protective Equipment and there was no monitoring regarding the use of PPE from the business owners or government authorities. The data from the questionnaires showed that one respondent (3%) used PPE in less than 2 days, 2 respondents (6%) used PPE within 2-4 days and only 5 respondents (14%) used it within 5-6 working days in a week. This showed that the PPE they used was far from the standards.

The data from the subjective complaints questionnaire results also showed the history of lung disease suffered by the batik workers in The X Natural Batik at Malon Village was. From 36 respondents, 5 respondents (14%) suffered from shortness of breath, 4 respondents (11%) had chest pain, 3 respondents (8%) was diagnosed with asthma, one of the respondents (3%) was diagnosed with bronchitis, 2 respondents (6%) was diagnosed with pneumonia, 3 respondents (8%) suffered from cough with phlegm and 5 respondents (14%) suffered from cough without phlegm. Moreover, the batik craftsmen Vital Lung Capacity (VLP) was measured with the Pony FX Cosmed Type Spirometry tool. From 36 respondents, 18 (50%) had normal VLP result in which the VLP was ≥ 80%, 17 respondents (47%) had mild restriction result in which the VLP was 60-79% and 1 respondent (3%) had severe restriction result in which the VLP was ≤ 50%. The severe restriction result came from the oldest respondent (70 years old).

Nutritional status of batik craftsmen of Malon Village in this study was represented only by calculating the Body Mass Index (BMI), after height and weight data of the batik craftsmen were obtained. We classified the BMI into three categories: underweight if (BMI < 17.0 to 18.4), normal (BMI > 18.5 to 25.0) and obese (BMI 25.1 - > 27.0). BMI was calculated by the formula of weight (kg) divided by height (m)^2. From the 36 respondents, 3 respondents (8%) were categorized as underweight, 14 people (39%) were normal and 19 people (53%) were obese (> 25.0). Therefore, we could conclude that most batik craftsmen were in the BMI category of obese. The obesity condition could be influenced by batik craftsmen work activities, especially in the process of outlining batik. This process tended to be monotonous in which they had to stay in sitting position for hours, days even up to weeks, depending on the complexity of the batik pattern itself, especially if the product was hand written batik/ “batik tulis”. This was one factor that made calories burnt by physical activity in batik craftsmen very low.

Overall health complaints of batik craftsmen were on the respiratory tract, eyes, skin and muscle. From the subjective complaints questionnaire results, we found that respondents experienced eye complaints such as pain, red and watery eyes, and 61% respondents experienced sore eyes while working, 28% respondents experienced watery eyes and 11% respondents experienced eyes redness when working and interacting with color.

**DISCUSSION**

Age is related with the aging process and aging is related with progressive decrease in lung function. In addition, age is also associated with lower back pain in batik craftsmen. Energy substance requirement continues to increase until it reaches its peak at the age of 40 and it starts to decrease after it. The declining energy demand happens due to the decrease of physical strength. Under normal circumstances, age also affects the respiratory rate and lung capacity. Adult normal respiratory rate is between 16-18 times per minutes, for children it is around 24 times per minutes and for infants it is around 30 times per minutes. Even though the adult respiratory rate is less than that of children and infants, the adult Vital Lung Capacity (VLC) is bigger than them. The result of > 80% seen on the spirometer indicates a normal VLC, 60-79% indicates a mild restriction, 30-59% indicates moderate restriction, and < 30% indicates severe restriction.

The previous studies showed that there was correlation between working period and the incidence of carpal tunnel syndrome and complaints of lower back pain in batik craftsmen. Batik workers with a working period of more than 2 years, both written and printed batik workers, have a higher concentration of Urinary Hippuric Acid (uHA) than non-batik workers. uHA is one of the biomonitoring parameters for exposure to toxic organic matters, such as toluene, where repeated exposure to low concentrations of toluene can cause chronic effects such as damage to the central nervous system.

A poor ergonomic work attitude will lead workers to have high risks. This was shown in a previous study by Agustini (2012) which resulted that among the 14 respondents who were at high risk of work attitude, there were 9 people (64.3%) who suffered from carpal tunnel syndrome. Previous research conducted in Pusaka Beruang Lasem company also showed that there was a relationship between work attitude and the incidence of carpal tunnel syndrome to batik workers. Organs with the highest frequency of health complaint were hands. Ergonomic changes in work attitudes will affect the level of comfort and complaints of musculoskeletal disorders. One of the ergonomic changes in working is by redesigning work chairs to become more ergonomic body posture. A study on working-position assessment with Rapid Upper Limb Assessment (RULA) conducted by Ilva also showed that 22 subjects (84.62%) were at medium risk and 4 other subjects (15.38%) were at high risk working positions. This result was reinforced by the assessment of complaints of the musculoskeletal system according to the Nordic Body Map which showed that most complaint felt by batik workers were from waist down with a percentage of 57.7%. Workload, work posture and low back pain affect work productivity, therefore they need to get high attention in the workplace, including for batik workers.

Chemical irritants are chemical substances that can directly damage the skin which is in direct contact with them.
The inflammatory process that occurs is not mediated by the body’s immunological system.16 Signs of irritant contact are skin redness (erythema), swelling (edema) and cracked skin after contact with irritant materials.23 The irritant materials can be soap, detergent, acid, alkali, cement and phenol. Irritants can also be a solvent that was widely used in industry, for example: turpentine, acetone, carbon dioxide and can even come from plants, such as capsaicin. Factors that can affect irritant contact dermatitis are those chemical irritants mentioned earlier, employment/working history, age, duration of contact, length of employment, Personal Protective Equipment (PPE) usage, history of previous skin diseases, and personal hygiene and knowledge.18

In fact, cloth masks are the most important personal protective equipment in the batik process.19 It was in accordance with previous research by Sari et al., (2014), which stated that from the exposure group, 44.8% had a bad habit, 31% had a moderate habit and only 24.1% of respondents in exposure group had a good habit in the use of PPE.20 Some workers chose not to use PPE because they felt less comfortable if they had to wear gloves or masks since it would complicate the process of their works.1,16 In contrast, the use of personal protective equipment such as protective masks is highly important and its use must meet standards such as Registration, Evaluation, Authorization, and Restriction of Chemicals (REACH) requirements.21

Previous research showed that exposure of substances in batik dyeing processes caused 13 times greater risk to developing chronic cough and chronic phlegm complaints, and there was a significant relationship (p = 0.001) between exposure of substance in batik making process to the risk of clinical abnormalities of the lungs. This result showed the strength of the substance exposure relationship in the process of dyeing in batik making and clinical abnormalities of the lung.20

The greater the BMI value of a person, the greater the workforce generated. BMI was influenced by body weight and height, so that people who have bigger bodies will also be stronger than those who are thinner.22,23 If they work in the correct position, presumably there will be no excessive muscle stretching and eventually reducing low back pain incidences.24,25 However, if people are overweight, then they will tend to be more easily tired during work hour thus the work hours length will be shorter than those of people with normal BMI. In addition, these conditions will cause workers to have a more frequent break in about 2–3 times than others during one working day.19,26 High BMI also means higher risk of musculoskeletal disorders. People who are fat or obese, will tend to be more prone to musculoskeletal disorders,27 because high BMI will increase the load on the spine, thereby increasing the compression and can cause a tear in the spinal structures. Previous research suggested that individuals who had a BMI above normal or overweight had more fat in his body than the general average individuals. Above average body fat is a risk factor for lower back pain.28 In addition, BMI above normal could also cause chronic inflammation.29

Contact allergens could be caused by several things, such as metal salts and antibiotics or dyes from plant products. Allergens could occur because of contact with jewelry, personal care products, topical medications, plants, home remedies, as well as some chemical substances.30 Workers who were in contact with chemical substances at their workplace, would be more at risk of irritations rather than those with no contact. Irritants are substances that can cause inflammation on the body surface they come in contact with. Hazardous irritants can be divided into those that cause irritation together with contact dermatitis and those that cause upper respiratory symptoms. The US Occupational Safety and Health Administration (OSHA) states that an irritant toxic chemical occurs when the skin or other organ systems experience irreversible damage after application of the test substance for up to 4 hours.31 There are three types of specific irritation based on the location and type of reversible damage, namely: skin irritation (the production of reversible damage to the skin after the application of the test substance for up to 4 hours); eye irritation (the production of changes in the eye after application of the test substance to the anterior (front) surface of the eye, which is completely reversible within 21 days after application); and respiratory tract irritation.32

In the production process of batik, especially batik made with synthetic dyes, chemical intervention was absolutely necessary for the dyes, because the materials of the dye could be abrasive, so the exposed batik craftsmen would highly experience irritation. Irritants include paints, plants and grains, detergents, wet work, cleaners, fibers and bleaching agents.31 Therefore, the use of Personal Protective Equipment such as goggles, aprons, dust masks and rubber or plastic gloves is needed for any workers when they interact with chemical substances from the preparation to the finishing stage of the works.19,32

**CONCLUSION**

We argue that the ergonomic working position of Malon Village batik craftsmen in this study was poor. These poor conditions could potentially lead to musculoskeletal disorder. All of the working process in crafting batik could potentially cause injury. Five out of 11 working tools (45.5%) were considered to have non-ergonomic design and/or encouraged workers to have poor ergonomic working positions which were cushions, chairs, cloth standing, tablecloths and stove. There were 4 irritant chemicals used in the production process, namely wax, alum, soda ash and chalk, where all of the materials could potentially cause health problems such as skin and eye irritation. Six out of 7 (86%) processes involving chemicals were identified to cause skin, eye and respiratory tract irritation. Based on the health complaints, we found that there were respondents who suffered from shortness of breath, chest pain, asthma, bronchitis, pneumonia, cough with phlegm and without phlegm, but all respondents did not meet the standards of Occupational Safety and Health in respect to the use of PPE.

Therefore, the measurement and supervision of the work environment, regular medical check-ups and health surveillance must be carried out by the local Health Office/Service (Dinas Kesehatan) either through the Public Health Centres (Puskesmas) or health units to ensure that the working environment is safe and all
workers are healthy, safe and productive. Further research related to the similar issue should focus on the preparation of a more adequate Occupational Health and Safety effort because batik workers are included in the informal sector which has not been able to implement the Occupational Safety and Health program properly.

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CONFLICT OF INTEREST
None.

AUTHORS’ CONTRIBUTION
EW responsible for concepts, design of the study, definition of intellectual content, data analysis, statistical analysis, and guarantor. ARK and WHC responsible for data acquisition, data analysis, statistical analysis. YY and YAM responsible for literature search, manuscript preparation, and manuscript editing. PL and MK responsible for literature search, manuscript preparation, and manuscript review.

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