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Factors Causing Musculoskeletal Complaints in Batik Workers at Kraton District

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Background: Musculoskeletal disorders (MSDs) are a major occupational health problem worldwide. Batik workers are considered a high-risk group due to exposure to static work postures, repetitive movements, and long working hours. Purpose: This study aimed to identify the factors contributing to musculoskeletal complaints among batik workers in the Keraton district. Methods: A descriptive mixed-methods design was employed. Qualitative data were collected through in-depth interviews with three batik workers and analyzed using content analysis with the assistance of OpenCode software. Quantitative data were obtained through work posture observation using the Rapid Entire Body Assessment (REBA) method to assess ergonomic risk levels. Results: Interviews revealed complaints of pain in the shoulders, arms, knees, calves, thighs, ankles, neck, right elbow, waist, and back. Identified risk factors included age, duration of work, physical activity, overtime, and insufficient rest. REBA analysis showed scores of 7–9, indicating high risk requiring immediate intervention. Integration of qualitative and quantitative findings reinforced that batik activities impose repetitive strain on the musculoskeletal system.. Conclusion: Batik workers face a high risk of musculoskeletal disorders without adequate occupational health protection. Ergonomics-based interventions, occupational health education, and improvements in the work environment should be implemented promptly
Keywords: Musculoskeletal disorders; Batik workers Ergonomy; Mixed methods; Occupational health

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1. Introduction

Musculoskeletal disorders (MSDs) remain a major global health burden, with a high prevalence across countries.[1,2] The Global Burden of Disease (GBD) Study 2019 reported that the number of incident MSD cases reached 322.75 million worldwide, with low back pain being the leading contributor to Disability-Adjusted Life Years (DALYs).[3] Globally, the burden of MSDs is influenced by several factors, including age, sex, lifestyle, and occupational risk exposure.

In Indonesia, findings from the National Basic Health Research (Riset Kesehatan Dasar) indicate a relatively high prevalence of musculoskeletal complaints among informal sector workers, including those in the batik industry. Batik workers, particularly in the Kraton District one of the main centers of batik production in Yogyakarta are exposed to substantial physical workloads. The batik-making process involves prolonged static sitting, repetitive movements of the wrists, neck, and back, as well as the use of non-ergonomic equipment. These working conditions may lead to various musculoskeletal complaints that adversely affect workers' health and productivity.[4–7]

However, research examining musculoskeletal risk factors among batik workers in Indonesia remains very limited. Therefore, this study aims to identify factors contributing to musculoskeletal complaints among batik workers in the Kraton District using a mixed-methods approach that combines in-depth interviews and ergonomic observations assessed using the Rapid Entire Body Assessment (REBA).

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2. Method

This study employed a descriptive mixed-methods design combining qualitative and quantitative approaches. The research was conducted in Yogyakarta, specifically in the Kraton District, during July–August 2024. The study population comprised all batik workers in the area. A total of three participants were selected using purposive sampling, with inclusion criteria consisting of batik workers who had more than five years of work experience, reported musculoskeletal disorder (MSD) complaints, and had a history of work-related accidents.

Data collection was conducted in two stages. Quantitative data were obtained first through observation of working postures using the Rapid Entire Body Assessment (REBA) method. Subsequently, qualitative data were collected through in-depth interviews using a semi-structured interview guide to explore workers' experiences of musculoskeletal complaints. The instruments used included an audio recording device, REBA observation sheets, and OpenCode software to support qualitative data analysis.

Interview data were analyzed using inductive content analysis to identify major themes, while observational data were analyzed by calculating REBA scores according to standard guidelines to determine ergonomic risk levels. Data presentation was carried out narratively by integrating qualitative and quantitative findings. To ensure the trustworthiness of qualitative data, source and method triangulation were applied, along with member checking with the participants.

3. Results and Discussion

Based on the sample characteristics, three batik workers with more than five years of work experience who reported MSD complaints and had a history of work-related accidents were included in the study. These informants were asked to complete the REBA assessment to identify the location and severity of MSDs experienced during work activities. The mean REBA score among batik workers was 8, indicating a high-risk category that requires immediate intervention.

Table 1. REBA Scores

Respondent	Main Activity	REBA Score	Risk Category	Interpretation
R1	Batik-making in a static sitting position with forward bending posture for approximately 6 hours	8	High	Immediate intervention required
R2	Batik-making in a standing position with repetitive fabric lifting	7	Moderate–High	Changes required in the near future
R3	Batik-making while sitting cross-legged, reaching far with prolonged duration	9	High	Immediate intervention required

REBA observations showed scores ranging from 7 to 9, which fall within the high-risk category, indicating the need for immediate corrective actions. Following the REBA assessment, in-depth interviews were conducted to explore work habits and factors contributing to MSD complaints. Qualitative analysis of the in-depth interviews identified several major themes describing workers' experiences related to musculoskeletal complaints. These themes included factors contributing to MSDs, body parts affected, and types of interventions undertaken. Each theme was further developed into subthemes and codes reflecting variations in participants' responses. A summary of the content analysis results is presented in Table 2.

Table 2. Content Analysis Result

Theme	Subtheme	Codes
	Working hours	6 hours, no days off, daily

Theme	Subtheme	Codes
Factors Contributing to MSDs	Work experience	Since childhood, 46 years, decades, since adolescence
	Physical activity	Walking, exercising
	Overtime work	Work taken home, meeting deadlines
	Duration of production process	Several months, several days depending on motif
	Rest periods	During customer visits, lunch breaks
	Work process	All stages, following motifs, drawing patterns
MSDs	Affected body parts	Ankles, lower back, neck, right shoulder, hips
	Causes of pain	Accidents, walking, prolonged batik-making
	Physical sensations	Calf cramps, dizziness, eye strain
Interventions	Self-management	Massage
	Intention to stop working	No plan
	Reasons for continuing work	Enjoyment of batik, economic necessity

The findings indicate that musculoskeletal complaints among batik workers are associated with prolonged working hours without rest days, long work tenure beginning at a young age, and additional physical activities outside work. Overtime work and lengthy batik production processes further contribute to physical workload. Pain was most commonly reported in the ankles, lower back, neck, right shoulder, and hips. Respondents associated these complaints with static working postures, prolonged batik-making duration, and minor work-related accidents. Despite these issues, intervention strategies were largely limited to self-treatment such as massage, and most workers had no plans to stop working due to economic reasons or intrinsic motivation, such as enjoyment of batik-making. These findings highlight limited occupational health protection and the need for more systematic ergonomic interventions.

Integration of qualitative and quantitative findings demonstrates that pain complaints experienced by batik workers particularly in the lower back, neck, shoulders, and ankles are closely related to REBA observation results, which yielded scores of 7–9, indicating high risk and the need for immediate intervention. Qualitative findings further emphasize that prolonged working hours, decades-long work experience, additional physical activities, overtime, and minimal rest periods are key contributors to musculoskeletal complaints. These conditions align with ergonomic assessment results showing repetitive strain on the musculoskeletal system due to static postures and repetitive movements. Overall, the integration of findings strengthens evidence that batik work places workers at serious risk of MSDs, underscoring the need for ergonomic interventions, work-hour regulation, and improved occupational health awareness

Discussion

This study reveals that batik workers in the Kraton District experience musculoskeletal disorders (MSDs) affecting various body parts, including the shoulders, back, lower back, knees, arms, and ankles. The dominant risk factors include prolonged working hours, repetitive physical activities, non-ergonomic body postures, overtime work, and insufficient rest periods. These findings are consistent with global reports indicating that MSDs remain one of the leading causes of disability worldwide, with prevalence trends continuously increasing since 1990.[1-3]

Low back pain has been identified as the largest contributor to Disability-Adjusted Life Years (DALYs) related to MSDs globally.[1,4] This condition was also evident among batik workers in the present study. One respondent stated, “When I sit for too long, my lower back and calves often cramp” (R2). Prolonged static

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postures combined with repetitive movements during batik motif drawing closely align with epidemiological evidence identifying static postures and repetitive work as major risk factors for MSDs.[7,8]

Beyond postural factors, gender also plays an important role. Global studies indicate that MSD prevalence is higher among women than men, particularly for conditions such as rheumatoid arthritis and osteoarthritis.[1,7] In this study, female batik workers reported more frequent complaints. One female respondent noted, "I have been making batik since adolescence, and now I often experience pain in my shoulders and hips" (R1). This finding is consistent with literature linking gender differences in MSD prevalence to hormonal factors, anatomical differences, and the double burden of occupational and domestic work.[8]

From a work-context perspective, the informal sector environment in which batik workers operate further exacerbates health risks. Numerous studies in informal sectors within developing countries highlight weak implementation of occupational safety and health (OSH) standards, increasing vulnerability to musculoskeletal complaints.[9,10] One respondent stated, "I make batik from morning until evening with almost no days off" (R1). Limited access to health services and financial constraints further worsen workers' conditions, leading them to tolerate pain and continue working.[11]

REBA analysis in this study reinforces qualitative findings. Scores ranging from 7 to 9 indicate high ergonomic risk requiring immediate intervention. The integration of quantitative and qualitative results confirms that batik-making activities impose repetitive strain on the musculoskeletal system. While interviews capture workers' subjective experiences, observational assessments provide objective evidence of high ergonomic risk. This aligns with the triangulation principle in mixed-methods research, which allows multiple data sources to complement each other and produce a more comprehensive understanding.[6,12]
Regarding coping strategies, most workers relied on traditional self-care methods such as massage or topical ointments. One respondent stated, "When I feel pain, I usually just get a massage or apply ointment" (B3). However, such self-managed interventions are insufficient to mitigate long-term risks. Previous studies suggest that systematic ergonomic approaches, routine stretching programs, job rotation, and regulated working hours are more effective in preventing MSDs.[12-14]

Community-based interventions are also considered crucial. Research indicates that community-based occupational health programs in informal sectors can increase workers' awareness of proper working postures, use of simple ergonomic tools, and effective rest-time management.[15,16] In line with this, International Labour Organization (ILO) guidelines emphasize the importance of system-based OSH management frameworks that can also be adapted to informal sectors.[20]

4. Conslusion

Batik workers in the Kraton District are at high risk of musculoskeletal disorders, as evidenced by reported complaints and REBA observation scores ranging from 7 to 9. The combination of qualitative interviews and posture observations provides a comprehensive understanding of the risk factors faced by these workers, including prolonged working hours, static postures, repetitive activities, and insufficient rest. It is recommended that ergonomic interventions be implemented through posture improvement, modification of tools and workstations, and job rotation. Additionally, community-based occupational health education and simple stretching training should be introduced to batik workers. Local governments, health authorities, and batik associations play a vital role in providing support, including access to occupational health services and the development of protective regulations for informal sector workers. With structured interventions in place, musculoskeletal complaints may be reduced, workers' quality of life improved, and the sustainability of the batik industry maintained

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