International Journal of Occupational Safety and Ergonomics

ISSN: 1080-3548 (Print) 2376-9130 (Online) Journal homepage: http://tandfonline.com/loi/tose20

Factors Affecting Musculoskeletal Disorder (MSD) Prevalence among Women Weavers Working With Handlooms in Samarinda, Indonesia

Iwan Muhamad Ramdan, Krishna Purnawan Candra & Alfiani Rahma Fitri

To cite this article: Iwan Muhamad Ramdan, Krishna Purnawan Candra & Alfiani Rahma Fitri (2018): Factors Affecting Musculoskeletal Disorder (MSD) Prevalence among Women Weavers Working With Handlooms in Samarinda, Indonesia, International Journal of Occupational Safety and Ergonomics, DOI: 10.1080/10803548.2018.1481564

To link to this article: https://doi.org/10.1080/10803548.2018.1481564

Accepted author version posted online: 11 Jun 2018.

Submit your article to this journal

Article views: 3

View Crossmark data

Full Terms & Conditions of access and use can be found at
http://tandfonline.com/action/journalInformation?journalCode=tose20

Publisher: Taylor & Francis & Central Institute for Labour Protection – National Research Institute (CIOP-PIB)

Journal: *International Journal of Occupational Safety and Ergnomics*

DOI: 10.1080/10803548.2018.1481564

Check for updates

Factors Affecting Musculoskeletal Disorder (MSD) Prevalence among Women Weavers Working With Handlooms in Samarinda, Indonesia

Iwan Muhamad Ramdan[1,*], Krishna Purnawan Candra[2], Alfiani Rahma Fitri[1]

[1]Dept.Occupational Health and Safety, Fac.Public Health, Mulawarman University, Samarinda, Indonesia, [2]Dept.Agricultural Product Technology, Fac.Agriculture, Mulawarman University, Samarinda, Indonesia

*Coresponding Author: Email: iwanmuhamadramdan@gmail.com

ACCEPTED MANUSCRIPT

Factors Affecting Musculoskeletal Disorder (MSD) Prevalence among Women Weavers Working With Handlooms in Samarinda, Indonesia

Abstract

A cross-sectional study was conducted on 40 women weavers of Samarinda sarongs to identify the prevalence and risk factors of musculoskeletal disorders (MSDs). A Nordic body map, rapid upper limb assessment (RULA), and anthropometric tools were used to plot the MSD severity, work posture, and anthropometric dimensions of the weavers, respectively. The age, education background, working period and prolonged sitting position distributions of the weavers were collected by direct interview. Pearson's product-moment correlation was applied to identify correlations between the MSD prevalence and other parameters. An MSD prevalence of 80.5% was found among the women weavers, with the MSDs categorised as low, moderate, and high in 15.0, 75.0, and 7.5% of the respondents, respectively. The MSD prevalence was significantly correlated with education background (p=0.025), working period (p=0.015), prolonged sitting hours (p=0.032), work posture (p<0.001), and weavers' anthropometry (p<0.001).

Keywords: Samarinda sarong, traditional loom, *gedokan*, work posture, working period, prolonged sitting hours, anthropometry, ergonomic

ACCEPTED MANUSCRIPT

1. INTRODUCTION

Like souvenirs such as *amplang, bateek* with *Dayak* carving designs, *mandau,* and Dayak handicrafts, the Samarinda sarong is an iconic handicraft from Samarinda. This sarong, which has a square design in black and red colours,

is identified with the Samarinda people. Samarinda sarongs have been produced since 1607 by the people of Samarinda [1] and are traded with the neighbouring country of Malaysia. Samarinda sarongs are produced by women weavers using a traditional loom called the *gedokan*, which is constructed from wood. Using a *gedokan*, a weaver needs 15 days to complete one sarong that is 200x80 cm in size (Figure 1.). To date, the Samarinda sarong has been produced manually primarily to maintain its high artistic value.

Insert here Figure 1a and 1b.

The entire weaving process is performed manually, including the fibre colouring, yarn spinning, and washing steps. The loom consists of four parts: the *unuseng* (spinning wheel), *saureng* (design instrument), appraising (yarn inserting instrument) and *pemalu* (yarn roller). The handloom dimensions (cm) are as follows: height (33), foot height of frame (48), length (156), height of frame (114), length of hand range to handloom (57), width of hand grips to handloom (4), height of foot support (50), width of chair (35), thickness of sitting pedestal on chair (5), and length of chair (36).

Through initial observation, musculoskeletal disorders (MSDs) have been detected among women weavers who produce Samarinda sarongs. However, no study has investigated the factors responsible for MSDs among women weavers in Samarinda. Factors such as non-ergonomic facilities and devices [2], high frequency of repetitive motion, high work load, unsuitable working position, vibration exposure, and overwork are responsible for MSDs [3–6]. In Asia, MSDs have been detected in shoe craftsman [7], potato processors [4], sugar cane [8] and palm oil farmers [9], dentists [10], and paramedics [11].

ACCEPTED MANUSCRIPT

This study aims to investigate the prevalence of MSDs in traditional women weavers of Samarinda sarongs, to analyse the influencing factors, and to find a proper way to overcome problems (i.e., MSD prevalence) for weavers based on the rules of ergonomics and the health and safety control hierarchy.

2. METHODS

A cross-sectional study was conducted from May to September 2016 on all weavers (40 women) at the sole sarong producer in Samarinda in the East Kalimantan province of Indonesia. The MSD prevalence of the weavers was measured using a standardised Nordic body map questionnaire [12]. The questions included in the questionnaire were based on nine different anatomical body parts (e.g., neck, shoulder, elbow, wrist/arm, upper back, lower back, hips/thighs, knees, and ankle/leg). The three questions asked were as follows: 1) Have you had any MSD complaints (illness, pain, inconvenience, and insensitivity) within the last 12 months? 2) Have you had any difficulties with daily activities (inside and outside home) within the last 12 months? 3) Have you had any MSDs in your body in the last 7 days?

Anthropometric tools and measurement sheets were used to determine, the anthropometric measurements of the weavers in a sitting position for 13 body dimensions (body height, eye height, elbow height, thigh thickness, thigh length from the buttocks to the knees, knee height, back knee height, shoulder width, hip width, length of elbow to the fingertips, thenar width, wide range of shoulder to the fingertips, and waist width). The weaver anthropometric value is the value obtained from the sum of each body dimension measurement.

ACCEPTED MANUSCRIPT

A rapid upper limb assessment (RULA) [13,14] is used to make a fast judgement on the work posture of the operator musculoskeletal system (OMS). Here, the RULA procedure was divided into three stages. (i) To develop a recording method, the OMS work posture was analysed on two body segments per group (i.e., group A (upper arm, lower arm, wrist and wrist twist) and group B (neck, trunk and legs). The OMS measurements in groups A and B are noted as the A and B scores, respectively. (ii) The C and D scores were based on the use of muscle and force during activities and were obtained from the A and B scores, respectively. Each score was added to the muscle and force scores, respectively. (iii) A grand score was developed by adding the C and D scores. The grand score guides the risk and action levels.

The first action level (low/value 1-2) indicates a negligible risk with no action required. The second action level (medium/value 3-4) indicates a low risk and suggests that change may be needed. The third action level (high/value 5-6) indicates a medium risk that requires further investigation and suggests that a change should occur soon. The fourth action level (very high risk/value 6+) indicates a very high risk and that changes should be implemented immediately.

Pearson's product-moment correlation was applied to determine the correlations between MSDs and independent variables (age, education background, workload, and body size). A normality test was applied prior to the product-moment analysis.

3. RESULTS

The characteristics, working conditions, and MSD prevalence among women weavers of Samarinda sarongs are shown in Table 1.

ACCEPTED MANUSCRIPT

Insert here TABLE 1.

Most weavers were aged 44-50 and 30-36 years (15% and 12.5%, respectively). Elementary school was the dominant education background level of the weavers (52.2%), and 60% of the women weavers had less than 5 years of work experience. The highest proportion of the weavers reported prolonged sitting of less than 4 h (57.5%); however, 52.5% of the weavers had very high-risk working postures. The MSD prevalence was low, moderate, and high for 15.0, 77.5, and 7.5% of the woman weavers, respectively. The Pearson's product-moment correlation analysis showed that all of the characteristics observed for the Samarinda sarong women weavers were significantly associated with MSD prevalence except age (Table 2.).

Insert here TABLE 2.

Table 2 shows the distribution of MSD prevalence for each body section. On average, 40.0, 17.5, 35.0, and 7.5% of the women had low, moderate, high, and very high overall prevalence rates, respectively. Low MSD prevalence rates were reported for the elbow, ankle, arm, knee, wrist, buttocks, leg, lower hand, upper hand, bottom, thigh, and shoulder (100, 77.3, 65.0, 57.5, 52.5, 37.5, 25.0, 22.5, 20.0, 17.5, 12.5, and 7.5%, respectively). Moderate MSD prevalence rates were reported for the upper hand, wrist, neck, ankle, thigh, back/buttocks/knee, leg, shoulder, waist, and bottom/calf (30.0, 25.0, 22.5, 21.3, 20.0, 17.5, 15.0, 12.5, 10.0, and 7.5%, respectively). High MSD prevalence rates were reported for the calf, shoulder, waist, thigh, lower hand, back, bottom, upper hand, leg, neck, and wrist (72.5, 62.5, 60.0, 55.0, 47.5, 47.5, 45.0, 37.5, 30.0, 29.8, and 17.5%, respectively). Very high MSD prevalence rates were reported for the bottom,

ACCEPTED MANUSCRIPT

waist, calf, back/shoulder, upper hand/lower neck/thigh, buttock/knee, and leg (27.5, 22.5, 20.0, 12.5, 7.5, 5.0, and 2.5%, respectively).

Pearson's product-moment correlation analysis for the association of anthropometric size with MSD prevalence is shown in Table 3. All variables were significantly associated with MSDs except the eye and elbow height, sitting position, thighs, high knee, and distance range from shoulder to fingertips.

Insert here TABLE 3.

4. DISCUSSION

4.1. MSD Prevalence

The MSD complaint prevalence was relatively high among women weavers of Samarinda sarongs (85%) and was dominated by moderate-level MSDs (75%). Complaints of very painful (4 based on a score of 1-4) musculoskeletal issues were mostly found for the bottom, waist, and calf. Complaints of musculoskeletal pain (score 3) were mostly found for the shoulders, waist, thighs, calves, and legs. Complaints of moderate musculoskeletal pain (score 2) were found for the bottom neck, upper hands, wrist, thighs, and ankle.

These results indicated that the MSDs experienced by women weavers of Samarinda sarongs were very serious and required immediate intervention. Weavers who experience MSDs may have low productivity. Similarly, Daneshmandi et al [15] showed that MSDs were correlated with work fatigue and work productivity. All of the weavers in this study are housewives, and their MSD experiences may result in more severe injuries and interfere with their

ACCEPTED MANUSCRIPT

household management activities. MSDs have been correlated with work-life conflict [15] and broadly affect daily job activities [16].

In this study, MSDs were measured subjectively using the Nordic Body Map questionnaire. Although these measurements are considered highly sensitive [17], are acceptable for MSD assessments [18], and are the most commonly used tool for MSD evaluations [19], advanced research using objective measurements, such as medical examinations, is needed to justify the MSD experiences among these weavers.

4.2. Factors that Affected MSD Prevalence

4.2.1. Age of the women weavers

The age distribution of the women weavers in this study was dominated by the 44-64-year-old age group (42.5%), followed by the 37-43-year-old (35%) and 23-36-year-old age groups (22.5%). In this study, we showed that the age of the women weavers was not associated with MSD prevalence. This observation indicated that neither work experience nor the strength and resiliency of muscles affected MSD prevalence among women weavers of Samarinda sarongs. This MSD prevalence is contradicted by nature, because MSDs are more often found in the elderly due to the decrease in muscle strength and resiliency [20]. These results also contradict some reports about the association between the age distribution and MSDs [4,7,21,22]. This phenomenon is very interesting and should be proven by observing other communities of women weavers in other districts. Indonesia includes more than 8 districts, each of which has a unique linen weaving motif created by women weavers using a handloom.

ACCEPTED MANUSCRIPT

This study showed that age was not associated with MSD prevalence in Samarinda sarong women weavers. This lack of an association may be due to the other four factors (education background, working experience, prolonged sitting, and anthropometric size), which all affected MSD prevalence among the women weavers. People are thought to be more susceptible to severe MSDs in old age due to a physiological function decline. Okunribido and Wynn [23] reported that MSDs often occurred in old age due to differences in job demands and workers' physical workloads.

Therefore, determining the correlation between age and MSD prevalence in women weavers will be interesting when the other four factors are eliminated by activities, such as ergonomic training.

4.2.2. Education Background

The education levels of the women weavers included the following: did not graduate elementary school, graduated elementary school (6th grade), graduated junior high school (9th grade), and graduated senior high school (12th grade). The women weavers' education backgrounds were dominated by the elementary school level (graduated 6th grade, 52.5%). In this study, we showed that education background was associated with MSD prevalence. Other studies have also reported that education background is associated with MSD prevalence [20,22]. These data support the consistency of the association between education level and health [24].

Better education can lead individuals to think more logically and rationally, and thus, people tend to accept and implement new knowledge or experiences [25]. This finding will be a very interesting topic for investigation in the case of

ACCEPTED MANUSCRIPT

Samarinda sarong women weavers by introducing training to increase awareness about MSD prevalence. Indeed, previous studies [26–28] found that ergonomic training programmes for workers could prevent and manage MSDs.

4.2.3. Working Experience

The Samarinda sarong woman weavers were divided primarily into two different categories (i.e., weavers with <5 years (25%) and ≥5 years (75%) of working experience). Working experience was associated with MSD prevalence. More working experience significantly lowered the MSD prevalence (p=0.025). This finding is similar to the effect of the education background of the weavers described above. To reduce more severe MSDs due to an increased working period, the workload and working hours should be reduced, and the weavers should receive adequate rest and proper work conditions [29].

4.2.4. Prolonged Sitting

In this study, we showed that prolonged sitting by women weavers was associated with MSD prevalence. The handloom is not equipped with an adjustable chair. Prolonged sitting (in an uncomfortable sitting posture) was also associated with MSD prevalence among office workers in Qom Province, Iran [30], who also had no access to adjustable desks. To overcome this risk, stretching exercises are suggested to reduce the MSD severity in women weavers. Da costa and Vieira [6] showed that stretching exercises had several beneficial effects on preventing work-related MSDs, whereas Gasibat et al. [31] reported that regular stretching exercises contributed to a reduction in discomfort/pain and an increased range of motion (ROM).

ACCEPTED MANUSCRIPT

4.2.5. Anthropometry

Anthropometry is a body size dimension that is connected to the physical anthropology sub-category, body movement, and muscle strength. Anthropometric data are used as a basic tool to design ergonomic work stations, equipment, furniture, and clothing [5,21,32]. In this study, we found that the anthropometric measurements of the women weavers were associated with MSDs. The handloom work station used by Samarinda sarong women weavers is equipped with a fixed chair of the same dimensions, whereas the weavers have different body sizes (Figure 1). This condition forces the women weavers to adjust their body sizes to the size of the chair. Weavers with taller or shorter bodies than the chair need additional effort to adjust to the handloom chairs, which contributes to the MSD prevalence among the Samarinda sarong woman weavers. The same conclusion was reported by Sadeghi [5] for public transport drivers, for whom the discrepancy in furniture dimensions was also associated with MSDs [32].

We recommend the establishment of standard operational procedures, including with regard to work time, the provision of training on MSDs, and the provision of ergonomic weaving equipment based on weavers' anthropometry to address the prevalence of MSDs among weavers.

4.2.6. Work Posture

The work postures of the women weavers in this study were significantly associated with MSD prevalence (p<0.001). The weavers' activities are monotonous movements that require lifting weights, twisting, and bending. These data confirmed previous reports showing that work posture was

ACCEPTED MANUSCRIPT

significantly associated with MSD prevalence in Iranian hand weavers of shoe soles [7], Iranian hand-sewn shoe workers [33], white-collar workers in a Portuguese company [34], Iranian sugar-producing factory workers [3], and sand core-making workers in West Bengal [32]. A work posture involving lifting weights while twisting or bending can increase the MSD prevalence for the lower back, especially when the work is performed in a confined space [29].

This finding implies that construction of an ergonomic handloom based on the anthropometric measurements of a woman weaver's body is highly required to prevent adverse effects on the weaver's musculoskeletal system.

5. CONCLUSIONS

The MSD prevalence of women weavers of Samarinda sarongs is approximately 85% and is categorised as low, moderate, and high for 15.0, 7.5, and 77.5% of the weavers, respectively. Skeletal muscle pain was detected mostly in the lower neck, shoulders, upper hand, bottom, waist, thigh, calf, and ankle. These MSDs were associated with the education level, work experience, prolonged sitting, work posture and body anthropometry of the weavers. The handloom should be redesigned based on the anthropometry of the weavers, standard operational procedures should be developed, and regular training should be provided to improve knowledge about MSDs and skill in using the handloom.

REFERENCES

[1] Purwadi. Kajian sarung samarinda dari prespektif pemangku kepentingan [Study of sarong Samarinda from the perspective of stakeholders]. Kinerja.

ACCEPTED MANUSCRIPT

2015;2(2):89–101. Indonesian.

[2] Feng Q, Liu S, Yang L, et al. The prevalence of and risk factors associated with musculoskeletal disorders among sonographers in central China: A cross-sectional study. PLoS One. 2016;11(10):e0163903;(18p.). DOI:10.1371/journal.pone.0163903

[3] Choobineh A, Tabatabaee S, and Behzadi M. Musculoskeletal problems among workers of an Iranian sugar-producing factory. Int. J. Occup. Saf. Ergon. 2009;15(4):419-424.

[4] Das B, Gangopadhyay S. Prevalence of musculoskeletal disorders and physiological stress among adult, male potato cultivators of West Bengal, India. Asia Pacific J. Public Heal. 2015; 27(2)1669-1682.

[5] Sadeghi N, Habibi E, Sajjadi S. The relationships between musculoskeletal disorders and anthropometric indices in public vehicle. Int. J. Collab. Res. Intern. Med. Public Heal. 2012;4(6):1173-1184.

[6] Da Costa BR, Vieira ER. Risk factors for work-related musculoskeletal disorders: A systematic review of recent longitudinal studies. Am. J. Ind. Med. 2010;53(3):285–323.

[7] Veisi H, Choobineh A, Ghaem H. Musculoskeletal problems iniranian hand-woven shoe-sole making operation and developing guidelinesfor workstation design. Int. J. Occup. Enviromental Med. 2016;7(2):87–97.

[8] Phajan T, Nilvarangkul K, Settheetham D et al. Work-related musculoskeletal disorders among sugarcane farmers in North-Eastern Thailand. Asia Pacific J. Public Heal. 2014;26(3):320–327.

[9] Henry LJ, Jafarzadeh AE, Ramli AI et al. Patterns of work-related musculoskeletal disorders among workers in palm plantation occupation.

ACCEPTED MANUSCRIPT

Asia Pacific J. Public Heal. 2015; 27(2):1785-1792.

[10] Pargali N, Jowkar N. Prevalence of musculoskeletal pain among dentists in Shiraz, Southern Iran. Int. J. Occup. Environ. Med. 2010;1(2):69–74.

[11] Shafiezadeh KR. Prevalence of musculoskeletal disorders among paramedics working in a large hospital in Ahwaz, southwestern Iran in 2010. Int. J. Occup. Environ. Med. 2011;2(3):157–165.

[12] Kuorinka I, Jonsson B, Kilbom A, et al. et al. Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms. Appl. Ergon. 1987;18(3):233–237.

[13] Mcatamney L, Corlett EN. RULA: a survey method for the investigation of world-related upper limb disorders. Appl. Ergon. 1993;24(2):91–99.

[14] Habibi E, Mohammadi Z, Sartang E. Ergonomic assessment of musculoskeletal disorders risk among the computer users by Rapid Upper Limb Assessment method. Int. J. Environ. Health Eng. 2016;5(2);(4 p.). DOI: 10.4103/2277-9183.190641

[15] Hämmig O, Knecht M, Läubli T, et al. Work-life conflict and musculoskeletal disorders : a cross-sectional study of an unexplored association. BMC Musculoskelet. Disord. 2011;12(1):60;(12p.). DOI:10.1186/1471-2472-12-60

[16] Odebiyi O, Akanle O, Akinbo S, et al. Prevalence and impact of work-related musculoskeletal disorders on job performance of call center operators in Nigeria. Int J Occup Env. Med. 2016;7(2):98-106.

[17] Descatha A, Roquelaure Y, Chastang JF. Validity of Nordic-style questionnaires in the surveillance of upper-limb work-related musculoskeletal disorders. Scand. J. Work. Environ. Health.

ACCEPTED MANUSCRIPT

2007;33(1):58–65.

[18] Crawford JO. The Nordic musculoskeletal questionnaire. Occup. Med. (Chic. Ill). 2007;57:300–301.

[19] LAragon LL, Liria RL, Ferre A. Applications of the standardized Nordic questionnaire : A Review. Sustainbility. 2017;9:1–42.

[20] Guo HR, Chang YC, Yeh WY, et al. Prevalence of musculoskeletal disorder among workers in Taiwan: A nationwide study. J. Occup. Health. 2004; 46(1):26–36.

[21] Dianat I, Salimi A. Working conditions of Iranian hand-sewn shoe workers and associations with musculoskeletal symptoms. Ergonomics. 2014;57(4):602-611.

[22] Wang PC, Rempel DM, Harrison RJ, et al. Work-organisational and personal factors associated with upper body musculoskeletal disorders among sewing machine operators. Occup. Environ. Med. 2007;64(12):806–813.

[23] Okunribido O, Wynn T. Ageing and work-related musculoskeletal disorders: A review of the recent literature. Norwich: Health and Safety Executive; 2010. (RR799).

[24] Laflamme L, Engstrom K, Moller J, et al. Is perceived failure in school performance a trigger of physical injury? A case-crossover study of children in Stockholm County. J. Epidemiol. Community Heal. 2004;58(5):407–411.

[25] Ismaila SO, Musa A, Adejuyigbe S, et al. Anthropometric design of furniture for use in tertiary institutions in Abeokuta, South-Western Nigeria. Eng. Rev. 2013;33(3):179–192.

[26] Van Eerd D, Munhall C, Irvin E, et al. Effectiveness of workplace

ACCEPTED MANUSCRIPT

interventions in the prevention of upper extremity musculoskeletal disorders and symptoms : an update of the evidence. Occup Env. Med. Published online November 8, 2015;0;(9 p.). DOI:10.113/oemed-2015-102992.

[27] Motamedzade M. Ergonomics Intervention in an Iranian Tire Manufacturing Industry Ergonomics Intervention in an Iranian Tire Manufacturing Industry. Int. J. Occup. Saf. Ergon. 2015;19(3):475–484.

[28] Robertson MM, O'Neill MJ. Reducing musculoskeletal discomfort: effects of an office ergonomics workplace and training intervention. Int. J. Occup. Saf. Ergon. 2015;9(4):491–502.

[29] Luttmann A, Jager MA, Griefahn B, et al. Preventing musculoskeletal disorders in the workplace. Geneva: WHO; 2003.

[30] Alavi SS, Abbasi M, Mehrdad R. Risk factors for upper extremity musculoskeletal disorders among office workers in Qom province, Iran. Iran Red Crescent Med J. 2016;18(10):e29518.

[31] Gasibat Q, Bin Simbak N, Aziz AA. Stretching exercises to prevent work-related musculoskeletal disorders. Am. J. Sport. Sci. Med. 2017;5(2):27–37.

[32] Gangopadhyay S, Ghosh T, Das T, et al. Effect of working posture on occurrence of musculoskeletal disorders among the sand core making workers of West Bengal. Cent. Eur. J. Public Health. 2010;18(1):38–42.

[33] Dianat I, Salimi A. Working conditions of Iranian hand-sewn shoe workers and associations with musculoskeletal symptoms. Ergonomics. 2014; 57(4):602–611.

[34] Macedo AC, Azenha CF, Brito AP. A case study of ergonomics encompassing white-collar workers: anthropometry, furniture

ACCEPTED MANUSCRIPT

dimensions, working posture and musculoskeletal disorders. Int. J. Work. Cond. 2014;8:32–43.

ACCEPTED MANUSCRIPT

Figure/TABLE legends

Figure 1a. Women weaver with handloom

Figure 1b. Handloom to produce Samarinda sarongs

TABLE 1. Characteristics of Samarinda Sarong Women Weavers (*N*=40) and the Associations between the Variables and the MSD prevalence

TABLE 2. Musculoskeletal Disorder (MSD) Prevalence Levels of Women Weavers Working with Traditional Looms to Produce Samarinda Sarongs

TABLE 3. Association between anthropometric size dimensions and musculoskeletal disorders (MSDs)

ACCEPTED MANUSCRIPT

TABLE 1.

Variable	Number	(%)	*r**	*p**
Age (years)			0.226	0.160
23 – 29	4	(10.0)		
30 – 36	5	(12.5)		
37 – 43	14	(35.0)		
44 – 50	7	(17.5)		
51 – 57	6	(15.0)		
58 – 64	4	(10.0)		
Education background			0.608	0.025
Never went to school (Elementary school, did not graduate)	6	(15.0)		
Elementary school (graduated 6th grade)	21	(52.5)		
Secondary high school (graduated 9th grade)	9	(22.5)		
Senior high school (graduated 12th grade)	4	(10.0)		
Working experience (years)			0.511	0.025
<5	10	(25.0)		
≥5	30	(75.0)		
Prolonged sitting (hours)			0.904	0.032
<4	23	(57.5)		
≥4	17	(42.5)		
Anthropometric size			0.721	<0.001
Risk level based on work posture			0.663	<0.001
Negligible risk	0	-		
Low risk	0	-		
Medium risk	19	(47.5)		
Very high risk	21	(52.5)		
MSDs				
No MSDs	0	-		
Low	6	(15.0)		
Moderate	31	(77.5)		
High	3	(7.5)		

*) Pearson's product-moment correlation coefficient, the data were normally distributed (Shapiro-Wilk test, p=0.814), MSDs=Musculoskeletal disorders

ACCEPTED MANUSCRIPT

TABLE 2.

Body section	Low f (%)	Moderate f (%)	High f (%)	Very high f (%)
Neck				
upper	24 (60.5)	7 (17.5)	9 (22.5)	0 (0.0)
lower	11 (27.5)	11 (27.5)	15 (37.5)	3 (7.5)
Shoulder				
left	5 (12.5)	5 (12.5)	25 (62.5)	5 (12.5)
right	5 (12.5)	5 (12.5)	25 (62.5)	5 (12.5)
Hand				
upper left	10 25.0)	12 (30.0)	15 37.5)	3 (7.5)
upper right	10 (25.0)	12 (30.0)	15 (37.5)	3 (7.5)
lower left	15 (37.5)	6 (15.0)	19 (47.5)	0 (0.0)
lower right	15 (37.5)	6 (15.0)	19 (47.5)	0 (0.0)
Elbow				
left	40 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)
right	40 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)
Hand wrist				
left	23 (57.5)	10 (25.0)	7 (17.5)	0 (0.0)
right	23 (57.5)	10 (25.0)	7 (17.5)	0 (0.0)
Arm				
right	26 (65.0)	6 (15.0)	8 (20.0)	0 (0.0)
left	26 (65.0)	6 (15.0)	8 (20.0)	0 (0.0)
Back	9 (22.5)	7 (17.5)	19 (47.5)	5 (12.5)
Waist	3 (7.5)	4 (10.0)	24 (60.0)	9 (22.5)
Buttocks	21 (52.5)	7 (17.5)	10 (25.0)	2 (5.0)
Bottom	8 (20.0)	3 (7.5)	18 (45.0)	11 (27.5)
Leg				
left	21 (52.5)	6 (15.0)	12 (30.0)	1 (2.5)
right	21 (52.5)	6 (15.0)	12 (30.0)	1 (2.5)
Thigh				
left	7 (17.5)	8 (20.0)	22 (55.0)	3 (7.5)
right	7 (17.5)	8 (20.0)	22 (55.0)	3 (7.5)
Knee				
left	23 (57.5)	7 (17.5)	8 20.0)	2 (5.0)
right	23 (57.5)	7 (17.5)	8 (20.0)	2 (5.0)
Calf				
left	0 (0.0)	3 (7.5)	29 (72.5)	8 (20.0)
right	0 (0.0)	3 (7.5)	29 (72.5)	8 (20.0)
Ankle				
left	32 (80.0)	8 (20.0)	0 (0.0)	0 (0.0)
right	31 (77.5)	9 (22.5)	0 (0.0)	0 (0.0)
Mean	16 (40.0)	7 (17.5)	14 (35.0)	3 (7.5)

Note: MSDs=Musculoskeletal disorders, N=40 women weavers, f=frequency of sample with specific MSD type

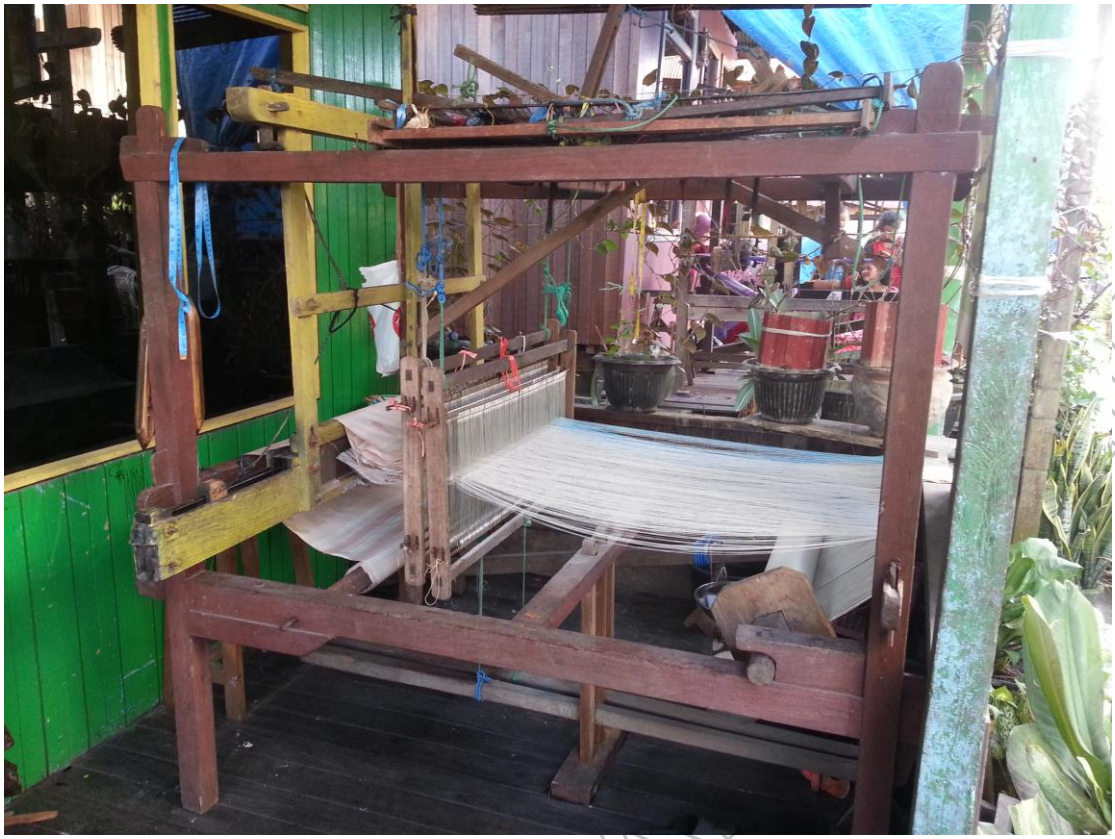
ACCEPTED MANUSCRIPT

TABLE 3.

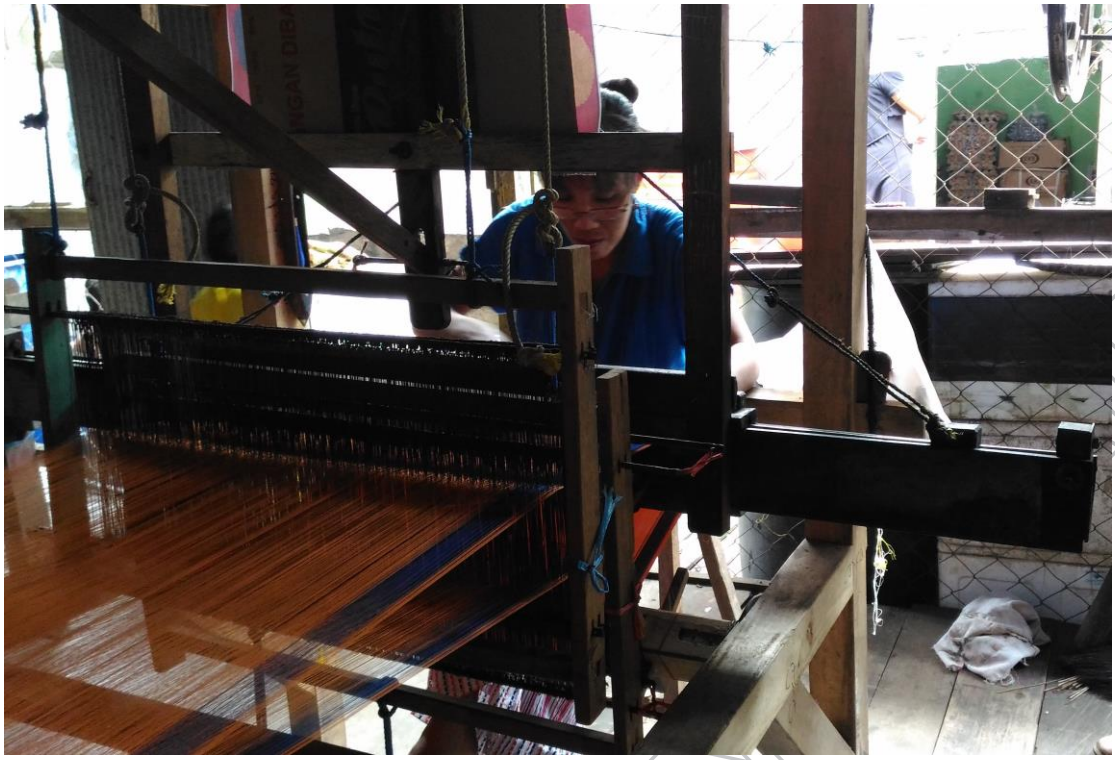
Variable	*r**	*p**
Body height in a sitting position	0.382	0.015
Eye height in a sitting position	0.271	0.091
Shoulder height in a sitting position	0.282	0.071
Elbow height in a sitting position	0.072	0.660
Thighs	0.080	0.622
Length of the thighs from the buttocks to the knees	0.278	0.082
High knee	0.205	0.205
High folding knees	0.975	0.005
Shoulder width	0.405	0.010
Hip width	0.453	0.003
Elbow length to fingertips	0.373	0.018
Wide palms	0.314	0.048
Distance range from shoulder to fingertips	0.302	0.058
Waist width	0.508	0.001

*) Pearson's product-moment correlation; data were normally distributed (Shapiro-Wilk test, p=0.702).

ACCEPTED MANUSCRIPT



ACCEPTED MANUSCRIPT



ACCEPTED MANUSCRIPT