The Modification of Workstation of Lipa Sabbe Weavers as an Effort to Reduce Musculoskeletal Disorders (MSDs)

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Abstract

Work with more loads and equipment design that is not ergonomic results in the use of more energy and risky work postures. Working in a sitting position basically can reduce stress on the feet, energy consumption, and circulation requirements. Ergonomic workstation is an example of the application of ergonomics which aims to create a balance between various aspects of each work system and process carried out as an attempt to create a high quality of work and quality of life, as well as an effort to prevent occupational injuries and diseases. This study aimed at modifying the workstation to reduce MSDs among *lipa sabbe* weavers. This is a quasi-experimental study with one-group pretest-posttest approach to analyze differences in the levels of MSDs before and after the intervention through modification of ergonomic workstation designs. The participant selection technique used purposive sampling. The research instruments used were Nordic Body Map questionnaire, camera, and anthropometric measurement tools. Data were analyzed using Wilcoxon Signed-Rank Test. The result showed that there is a difference in the level of complaints after modification of the work media of *lipa sabbe* weavers. It indicates that modification of work media can reduce MSDs among *lipa sabbe* weavers.

Keywords: *ergonomic workstation, musculoskeletal disorders, weaver, handloom, modification workstation*

Introduction

Wajo Regency is one of the silk-producing areas in Indonesia. The silk produced through the weaving process is a local wisdom that has been passed down from generation to generation. The silk weaving process generally uses three kinds of looms, one of which is *Gedog* or *Tennung Walida* loom. *Tennung Walida* was used by the people of Wajo Regency in the 13th century and developed since the 15th century. In 2012, there have been 5,113 *Tennung Walida*[1]. It is scattered throughout the village and is commonly used by housewives and young girls, and produces silk sarong called *Lipa Sabbe*.

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Data from the Department of Industry and Small and Medium Enterprises of Wajo Regency demonstrate that *lipa sabbe* weavers produce around 99,640 *lipa sabbe* per year which can increase every year[2] . The increasing demand for *lipa sabbe* made silk craftsmen work in longer duration and more frequent intensity. Work with more loads and equipment design that is not ergonomic results in the use of more energy and risky work postures. Moreover, *Tennung Walida* model uses a back-support loom and uses human power in a sitting position. Working in a sitting position basically can reduce stress on the feet, energy consumption, and circulation requirements. However, working in this position for too long can cause abdominal muscles to become elastic, spine curved, and eye muscles that experience more contractions so that the weavers feels tired quickly[3]

In this case, Yusuf discovered that one of the work risks of silk weaving workers is MSDs on the

back, waist, hands and feet when working for a long time and repeatedly[4]. Similar study by Tambun found that there are MSDs on the back waist, right shoulder, left shoulder, buttocks, right upper arm and left calf in weaving workers[5]. These MSDs can be prevented or reduced by improving ergonomic workstation (chairs)[6].

Ergonomic workstation is an example of the application of ergonomics which aims to create a balance between various aspects of each work system and process carried out as an attempt to create a high quality of work and quality of life, as well as an effort to prevent occupational injuries and diseases. A study conducted by Setiawan showed that redesign of the printing workbench can improve work posture[7]. It is supported by Syamsul who found that providing an ergonomic chair can reduce MSDs[8]. Additionally, improved working conditions can increase the productivity and income of metal painting craftsmen[9,10]

Therefore, it is necessary to pay attention to the ergonomic design of the workstation so that the silk craftsmen can work comfortably, safely, and healthily, which indirectly increases their productivity in producing *lipa sabbe* that in turn can increase their economic capacity. This study aimed at modifying the workstation to reduce MSDs among *lipa sabbe* weavers.

Material and Methods

This is a quasi-experimental study with one-group pretest-posttest approach to analyze differences in the levels of MSDs before and after the intervention through modification of ergonomic workstation designs. The participant selection technique used purposive sampling with the following criteria: female, working period > 5 years, work duration ≤ 8 hours/day, 26-45 years old, *lipa sabbe* weavers who use *Tennung Walida*, has personal looms, is working on *lipa sabbe*, and willing to be involved as research participants. The research instruments used were Nordic Body Map questionnaire, camera, and anthropometric measurement tools. Data were analyzed using Wilcoxon Signed-Rank Test.

Findings

The result showed among 16 weavers met in the field, the points of complaint that were often experienced while weaving included (1) lower neck, (2) left shoulder, (3) right shoulder, (5) back, (8) below waist, (9) buttocks , (14) right wrist, (15) left wrist, (18) left thigh, (19) right thigh, (22) left calf and (23) right calf points. There were only 5 *lipa sabbe* weavers who worked until November, while 11 others did not get weaving orders so they could not be the sample of this study. Based on the results of observations, those points experiencing complaints could be because the tools used were not ergonomic, for instance waist rest, seat, and leg rest made of wood without any soft layers. In addition, work posture could also affect these conditions.

Table1. Differences in the Levels of MSDs Before and After the Intervention

Responden	The Value of MSDs		P value
	Pre-test	post-test	
MG	57	44	0.042
TN	53	43	
RP	56	47	
ST	55	47	
TS	52	44	
Rata-rata	54.6	45	

Based on table 1, the average NBM result before the intervention was 54.6 and decreased to 45. The difference test results obtained P value of 0.042, which was smaller than the α value (0.05). Accordingly, it could be concluded that there were significant differences in the levels of MSDs after the intervention.

Existing	Modified
 **Figure 1. Waist rest without soft pad**	 **Figure 2. Waist rest covered with soft pads according to waist height**
 **Figure 3. Backrest without soft pad**	 **Figure 4. Backrest made of soft foam according to the height of the back**
 **Figure 5. No pillow for buttocks, No soft layer of workstation for thighs and calves**	 **Figure 6. Seat covered with soft foam**

Discussion

Based on the results of the Nordic Body Map questionnaire, it was found that many points of complaint experienced by respondents including lower neck, left shoulder, right shoulder, back, lower waist, buttocks, right wrist, left wrist, left thigh, right thigh, left calf and right calf points. It is in accordance with Koiri who affirmed that more than 250 respondents in his study experienced health problems in the form of MSDs[11]. Importantly, a study conducted by Sangeeta and Debkumar also concluded that the upper body areas that experience many complaints among weavers of Assam Industry in Guwahati, India were neck, back, and hands[12].

In this study, prior to administering the chair to the intervened skeletal muscle, MSDs averaged over 2 or were categorized as having complaints. The condition of the 12 skeletal muscles was due to a static work position, in which the work was carried out for more than 8 hours without any adequate work station conditions. Static work positions and inadequate workstations can result in complaints of muscles and bones[13].

The results of field observations before the intervention found the following less ergonomic workstation:

1. The waist rest which was also a tool for loosening and tightening the weave was made of wood without soft padding.

2. There was no backrest, making the back bend.

3. There was no pillow for buttocks that cause cramps or pain during work.

4. Straight legs to push at the waist when tensing and loosening the weave were static for long periods of time.

5. There was no soft layer of workstation for thighs and calves.

6. There was no armrest so the hands were hanging on while weaving.

7. No stretching was done before and after two hours of sitting down to work.

Considering the conditions of the *lipa sabbe* weavers above, the researchers engineered their workstation. The workstation changes included the provision of waist rest covered with soft pads according to waist height, backrest made of soft foam according to the height of the back, seat covered with soft foam, and provision of thigh and calf rests which are also covered with foam. Thus, the size of the workstation for each weaver varies due to the their different body postures.

There were some designs that were not changed, for example a design to prevent the legs in an always straight position and the provision of armrests, since the samples refused and considered that too many changes would make them uncomfortable in working. On the other hand, the loom used was not permanent in that place because it was usually moved; weaving was carried out outdoors during the day, and indoors at night. Consequently, it was difficult to make design changes to the legs. In addition, researchers also did not add armrests because hands were very active during weaving so that the provision of armrests could hamper the weaving process. The suggestion for these two conditions is to always stretch before and every two hours of working as recommended by the Surakarta City Health Office[14].

More importantly, after the intervention, it was found that the average MSDs in the skeletal muscles decreased, especially in the parts of the muscles that were given foam support to each respondent. The decrease in the level of MSDs was due to the provision of support at the right point according to the anthropometry and also a layer of foam so that the muscles and nerves at that point were not easily pinched[15]. Based on the results of statistical tests, it can be concluded that there are differences in the level of complaints after the provision of the workstation design for *lipa sabbe* weavers. The provision of ergonomic workstation in this study can reduce MSDs among *lipa sabbe* weavers. It supports a study finding that providing an ergonomic chair can reduce the level of MSDs[16,17]. Additionally, a study conducted by Sangeeta dan Debkumar also condirmed that after the modification intervention, respondents felt comfortable with the new design which then reduced the aches and pains complained[12].

Conclision

The points of complaint that are often experienced

by *lipa sabbe* weavers while weaving include the lower neck, left shoulder, right shoulder, back, lower waist, buttocks, right wrist, left wrist, left thigh, right thigh, left calf and right calf points. In addition, it is found that there is a difference in the level of complaints after modification of the work media of *lipa sabbe* weavers. It indicates that modification of work media can reduce MSDs among *lipa sabbe* weavers.

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