

Effective Workplace Stretching Exercise for Decreasing Musculoskeletal Disorders in Ndao Ika Weavers in Rote Ndao Regency

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Abstract

Musculoskeletal disorders are one of the main health problems found in traditional ice workers in Rote Ndao Regency-NTT. The ika weavers still done it manually with a bent body position accompanied by static and repetitive movements and it caused them to suffer musculoskeletal disorders. This study aimed to determine the effect of work stretching exercise on decreasing musculoskeletal disorders in ika weavers. A total of 18 active ika weavers who are eligible were randomly selected to participate in this study. Work stretching exercises with low until medium levels was given to the participant using a one group pretest-posttest design. Measurement of musculoskeletal disorders using Nordic Body Map and the results were analyzed by paired sample t-test. The results showed that the mean aged of weavers was 41.94 ± 11.05 years, the mean of weaving activity was 8.72 ± 1.36 hours/day and the mean of weaving length was 41.94 ± 11.05 years. The intervention of work stretching exercise reduced musculoskeletal disorders significantly ($p = 0.007$) with a reduction rate of 19.39%. The conclusion is Work Stretching Exercise was effective in reducing musculoskeletal disorders in traditional ika workers.

Keywords

Traditional Ika Workers, Musculoskeletal Disorders, and Workplace Stretching Exercise.

1. Introduction

East Nusa Tenggara has been widely recognized by the people of Indonesia and the world as one of the multi-ethnic provinces that has a variety of local cultural riches. One form of local cultural manifestation that is quite prominent is the handicraft of weaving. almost all districts in NTT have a woven cloth which has a distinctive pattern of motifs and colors. NTT's traditional ika fabrics were originally made to fulfill daily needs as clothing covers and body armor, then developed for traditional needs such as party, ceremony, dance, marriage, death, means of paying traditional fines, medium of exchange/money, and so on. Until now, the traditional ika fabrics are an official and modern clothing material that is designed according to fashion developments, also to meet consumer demands and needs.

The Rotendao district is no exception. Rotendao Regency is an archipelago consisting of Rote Island and Ndao Island, which is located in the southernmost part of the NTT region and is known to have a distinctive weaving product, namely the Ndao ika weaving.



Figure 1. The map of NTT islands

Ika weaving business is done from generation to generation and has become a traditional business. It also become a source of income for the family and the communities around. Many ika weaving businesses are growing and developing in Ndao district. One of the well-known ika weaving business centers in Ndao is in Namodale Village, Lobalain District. The products of Ndao ika weaving consists of three forms i.e. cloth, shawl and blanket (Winaldi et al. 2016).

Generally, weaving activities starting from spinning cotton into yarn, dyeing, and making the cloth. All stages of the activities were done by women, especially housewives, and it is still done in a traditional way as of manual using hands (East Nusa Tenggara Regional National Craft Council, 2020). The weaving tools are based on local wood and bamboo materials which are specially designed. There are issues regarding ergonomics, and it is a challenge to be studied.

Ergonomically, weaving activity is predominantly done in a sitting position, with a bent back, minimal back support, bent legs accompanied by static and repetitive movements. This position of the body is due to the demands of the activity and the workstation. On the other hand, effort to create healthy and safe working conditions in the workplace in the informal sector have not received the attention of workers or job owners. Likewise, the level of skills and knowledge of the health of female workers is still low, which is a determinant of muscle disorders (Adriansyah et al. 2019).

Musculoskeletal Disorders (MSDs) are an increasing occupational health problem in the traditional workplace worldwide. The causes of work-related MSDs are usually multifactorial including physical, ergonomic, and psychosocial (European Agency for Safety and Health at Work 2010). Da Costa and Vieira (2010) stated that MSDs generally happens in workers with excessive repetition, awkward postures, and heavy lifting.

The ergonomic approach at work has been widely used to prevent and overcome musculoskeletal disorders due to work, including improving work posture, redesigning workstations, and muscle stretching exercises (Ratu 2020). Muscle stretching training at work is one of the alternatives to prevent musculoskeletal disorders since it is considered cheap, easy, and had been proved to avoid worse musculoskeletal disorders (Ulfah and Aji 2017, Ratu 2018). The Workplace Stretching Exercise (WSE) is designed with the principle of the stretching movement, namely the muscle relaxation movement (Sands et al. 2013, Rovitri et al. 2015). WSE which is usually done between work times can improve blood circulation which will help to relax nervous tension and train muscles to be stronger, so they don't get tired easily while working (Utami 2017). WSE is one of the Indonesian Ministry of Health's programs to improve the health status of workers in the workplace (Syuhada et al. 2018). The result of researches that have been conducted show that WSE intervention treatment in the workplace is effective in reducing back pain (Ratu 2020).

The results of a preliminary survey of seven weavers of Ndao ika weavers found that all weavers experienced musculoskeletal disorders, with varying degrees of severity. Four out of seven weavers had moderate disorders, and the rest had mild disorders. The major of complaints were pain in the neck, right shoulder, back and buttocks.

Musculoskeletal disorders to weavers are due to the un-ergonomic position of the body and the static work for a long time. The focus of this research is to introduce the muscle tensile training method to see its effect on the quality of musculoskeletal disorders.

The purpose of this research is to analyze the prevalence rate of musculoskeletal disorders in Ndao Ika weaving workers, and the effect of WSE on reducing musculoskeletal Disorders in Ndao Ika weaving workers

2. Literature Review

2.1 Overview of Ndao Traditional Ika Weaving

Weaving is a handicraft in the form of cloth from materials made of threads (cotton, silk, etc.) by inserting the material crosswise into the warp, and also spinning certain materials that can be made into threads which are then made cloth or sarong using the technique. Weaving ties are Indonesian weaving works in the form of cloth woven from strands of weft or warp threads that were previously tied and dipped in natural dyes. The tools made from wood or bamboo called “aju mane nu”. (figure 2). Beside could be sewn get clothes, the products can get upholstery for furniture and home interior decoration (Budiono 2008). The role of woven products for the Rotendao community is very strategic. The main function and role of woven cloth is as a main source of livelihood, a means of custom, especially in marriage, as a means of economic improvement, as a symbol of tribal identity, and as a wrapping for corpses. traditional (Winaldhy et al. 2016, East Nusa Tenggara Regional National Craft Council 2020). Ika weaving produced in the Rote community consists of three forms of weaving, namely cloth, shawl, and blanket. The woven sarong and blanket can be used to cover the body at night. Sarongs, blankets and scarves are used at traditional parties or weddings. Sarongs are used by women and blankets are worn by men, and shawls are worn by the shoulders of men and women. Another function is a blanket worn by men when a person dies and as a cover for a corpse. Blankets are usually worn by men at parties, and when working in the garden. Blankets were also used to wrap bodies that had died



Figure 2. Ika weaving' tools from wood and bamboo (*aju mane nu*)

2.2 Musculoskeletal Disorders

Musculoskeletal disorders are disorders that has been related to ligaments, muscle tissue tendons, nervous system, cartilage, bone structure and blood vessels. Symptoms of musculoskeletal disorders are aching pain, numbness, tingling, swelling, stiffness, shaking, sleep disturbances and burning (OSHA, 2007). Musculoskeletal diseases caused by work that is done repeatedly and continuously, for a long time, work with abnormal or awkward postures that are sick with symptoms that can be felt at work or when not doing these work activities (Charles et al, 2018, Luan et al, 2018). It is often difficult to determine the severity of the disease since symptoms of MSDs are often accompanied by subjective complaints. Musculoskeletal disorders have a multifactorial etiology that is affected by a complex interaction between physical and psychosocial factors in the working environment (Gatchel et al, 2007, Wilkie and Pranksy, 2012, Pincus et al, 2013). Individuals with high demanding physical work such as lifting, pulling, pushing, standing, walking, bending, and forceful or fast repetitive task are prone to MSD and the pain can make it hard to perform the tasks. It has been easily found the MSD in several working sectors and industries such as transportation and warehousing, manufacturing and goods producing, health care and social assistance, agriculture/forestry/fishing/hunting, construction, services, and art/entertainment/recreation providing (Dunning et

al, 2010, Da Costa and Vieira, 2010). Nordic Body Map (NBM) is a subjective measurement instrument for measuring musculoskeletal disorders in workers. The Nordic Body Map questionnaire is the questionnaire most often used to find out workers' discomfort because it is standardized and neatly arranged. It can identify the body parts of the workers frequently undergoing the complaints and the result of measuring the Nordic body map get recommended for administration and work posture improvement (Setyanto et al. 2015).

2.3 Workplace Stretching Exercise (WSE)

Stretching has been known as a training part for athletes worldwide. This stretching movement is very simple and easy to do. Anderson (2010) developed stretching can be done almost anywhere and anytime, does not require special equipment, does not require special clothing and does not require special skills. It defined as the application of force to musculotendinous structures in order to achieve a change in their length, usually for the purposes of improving joint range of motion (ROM), reducing stiffness or soreness, or preparing for physical activity (Da Costa and Vieira 2008, Armiger and Martyn 2010). Now, Stretching use more workers in workplace. Stretching as a preparatory activity for increased flexibility to enhance stretch tolerance by relatively extreme body positions which causes by ergonomics problems in the workplace. Workplace stretching exercise is a workout stretching exercise are designed according to the principle of stretching the muscles which aim to extend the muscles, so they become relaxed and supple (Atjo et al. 2020). Stretching to reduce stiffness and soreness which cause by working is a therapeutic aspect of stretching muscle (Sands et al. 2013, Park et al. 2018). The benefits of stretching in the workplace for workers are i.e. to improve your flexibility, to improve muscle performance, to promote better circulation, to reduce the chance of muscular injuries, to help prevent muscular stiffness and soreness and to help reduce tension and to encourage relaxation., and to help workers develop better awareness of their bodies. It also could reduce low back pain (Maksuk and Syafitri 2021), low productivity, and health outcomes in workforce (Lowe and Dick 2014, Andersen et.al. 2015, White et al. 2016).

3. Methods

The experimental design with a one-group pretest-posttest design was carried out on 18 active female weaving weavers come from Namodale Village, Lobalain District, Rote Ndao Regency. The subjects have met the of eligibility criteria selected as subjects randomly. Namodale village was chosen as the sample area because of the location have weaving center which is quite broad area so that the implementation of the intervention could apply the protocol of covid-19. Intervention Workplace Stretching Exercise is carried out in between activities involving 20 movements in stages with each stretching motion for 10 counts/10 seconds with light to moderate intensity. The stretching movement is focused on the part of tissue that is under pressure physical load.

4. Data Collection

Musculoskeletal disorders in weaving workers were measured by the Nordic Body Map using a likert scale. Measurements were made before activity and after activity in the P0 period (before WSE) and the P1 period (after WSE). The prevalence rate of musculoskeletal disorders was analyzed descriptively quantitatively, while the mean complaint data before and after the treatment was analyzed by paired t-test. This research has passed the ethical review by the Ethics Committee of the Faculty of Public Health, Nusa Cendana university with Ethical Approval number 2020194-KEPK. Research subjects who were asked for their participation were asked for approval by signing the informed consent.

5. Result and Discussion

5.1 Characteristics of Respondents

This study involved 18 active female weavers with a participation rate of up to 100%. The characteristics of the subjects were being observed were ages, working hours and years of work. Table 1 shows that the mean age of respondents 41.94 ± 11.05 years. More than 72% of respondents aged less than 40 years and 27.8% over 40 years of age. In facts, muscle strength and quality have decreased rapidly after people have over 40 years old (Radaelli et al. 2019).

Table 1. Distribution of Characteristics on Ndao Weaving Weaving Weavers

Characteristics	frequency (n=18)	proportion (%)	mean
ages			
< 40 years	13	72,2	41.94±11.05
≥ 40 years	5	27,8	
Working hours/day			
< 8	2	11,1	8.72±1.36
≥ 8	16	88,9	
Work period			
< 6 years	3	16,7	12.67±6.04
6-10 years	1	5,6	
> 10 years	14	77,7	

Increasing age will be accompanied by a lack of work ability due to changes in body functions and this is always associated with physiological conditions, namely fatigue and experiencing musculoskeletal disorders. Amalia et al. (2014) and Tambuwun et al. (2020) states that there is a relationship with increasing age with an increase in musculoskeletal disorders.

Weaving activity requires a long working time. The average activity of weaving was 8.72 ± 1.36 hours / day which 88.9% of respondents work more than 8 hours a day reaching. Additional hours worked above normal time are known as overtime hours. The application of overtime working hours to complete work can reduce work productivity actually. Previous research has found that the addition of 2 hours of overtime per day reduces productivity by about 10% (Sumarningsih 2014). Thus, the increase in working time beyond normal working time could not be accompanied by increased efficiency, effectiveness and optimal work productivity, but it tends to increase fatigue and musculoskeletal disorders in weavers. Weaving workers have quite a long work experience and this is always associated with work skills. The analysis showed that the average working period as weavers was 12.67 ± 6.04 years with 77.7% of respondents having worked as weavers for more than 10 years. A long period of work will form habits at work, potentially form awkward postures (Figure 2).



Figure 3. Posture when weaving



Figure 4. posture when dyeing woven

Awkward posture may increase the physical load of the tissue and/or reduce its load tolerance by changing the physiological conditions of the tissue (Leunda et al. 2018). For example, when the hand and arm are in an awkward posture in an overhead position, the load in the shoulder is substantially increased and the blood flow in the handwear system is reduced (figure 4). This position quickly results in fatigue of the shoulder arm hand system even when the operation may only last a few minutes.

5.2 The Prevalence of Musculoskeletal Disorders on Ndao Ika Weavers in Rotendao Regency

An overview of the prevalence of musculoskeletal disorders in Ndao ika weavers (table 2). Table 2 shows that the level of musculoskeletal disorders among weavers is in the mild to moderate category. Respondents who experienced moderate musculoskeletal disorders in the period before the intervention (pre-test) were 77.8%. This is different in the period after the WSE intervention. The percentage of respondents who experienced mild musculoskeletal disorders was higher. This shows that there is a decrease in the complaint score after the WSE intervention.

Table 2. The prevalence of disorders of musculoskeletal disorders among Ndao Ika weavers

No	criteria	Musculoskeletal Disorders			
		Pre-test		Post-test	
		n	%	n	%
1.	low	4	22,2	12	66,7
2.	moderate	14	77,8	6	33,3
3.	high	0	0	0	0
4.	Very high	0	0	0	0
Total		18	100	18	100

The difference in the level of disorders is due to differences in disorders in the parts of the muscles that are observed. The results of the analysis showed that there was a decrease in disorders in every muscle part that was observed. It turned out that giving WSE to weavers was effective in reducing the level of disorders in all parts of the muscles observed (figure 5).

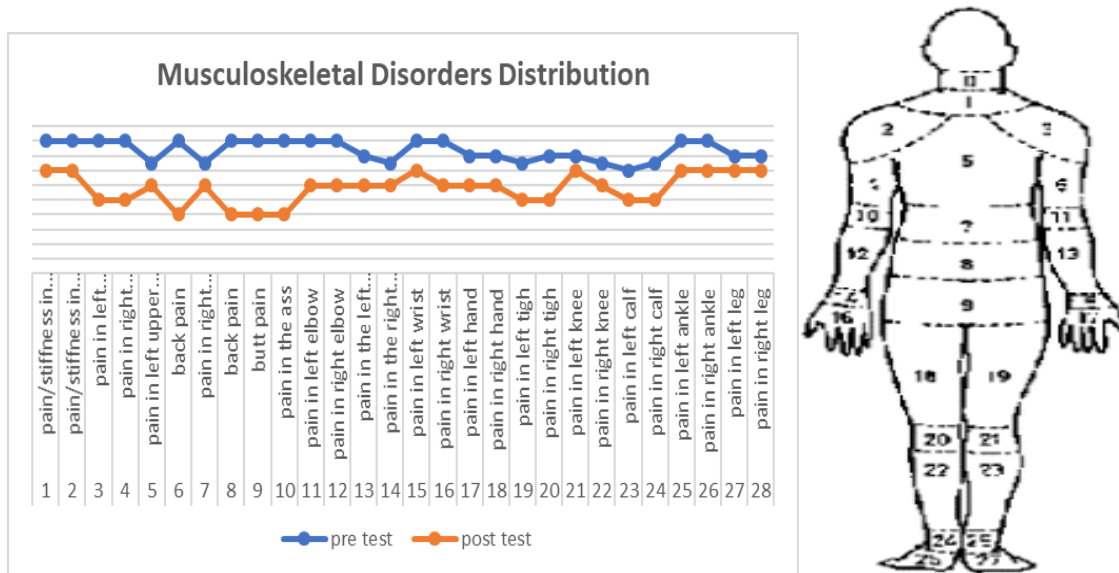


Figure 5. The difference in the level of disorders in different parts of the body

5.3 Effect of WSE on the Reduction of Musculoskeletal Disorders

Different test results showed a difference in musculoskeletal discharge between before and after the WSE intervention on table 3.

Table 3. The Effect of WSE on Musculoskeletal Disorders Ndao Weaving Weavers

Variable	Groups	Mean	Difference	p value
MSD's	Pre-test (18)	50,94±16.52	9,88	0.007
	Post-test (18)	41.06±11.15		

Many risk factors cause musculoskeletal disorders, including heavy physical function, smoking, high body mass index, high psychosocial job demands, and the presence of comorbidities. The most commonly reported biomechanical risk factors with at least reasonable proof for causing WMSDs include extreme repetition, awkward postures, and heavy lifting. While It is important that work-related MSD prevention interventions have to focus on the minimize or elimination of the job task-specific ergonomic risk factors, which could be accomplished with a comprehensive ergonomic program including a combination of engineering and administrative controls, training, management and employee support and sufficient resources (Amick et al. 2009). It can be found that the majority of the review cannot fully explain that stretching at work will prevent work-related musculoskeletal injuries. Stretching programs in the workplace may benefit employees by increasing flexibility and potentially preventing WMSDs.

The result of the study showed that there was a difference in the level of musculoskeletal disorders before and after the workplace stretching exercise intervention ($p = 0.007$). Reduction in musculoskeletal disorders after intervention was 9.88 points or 19.40%. The stretching movement performed is a movement that focuses on the part of bodies which aims to reduce the sensation of pain by increasing blood flow so that oxygen and nutrient intake can be met and stiff muscles and tense nerves can be relaxed. Stretching improve the muscle pump which results in increase in blood circulation in the muscle tissue. Thus, the supply of food and oxygen in the muscle tissue gets better and on the other hand, the accumulation of lactic acid decreased and removed from the muscles so the pain will decrease (Da Costa and Vieira 2008). Berg (2011) stated that the principle of stretching was to extend the muscles, so they become relaxed and supple, so that, stretching can help workers feel pain better. The intervention was carried out in a pleasant atmosphere so that all participating weaving workers felt a more positive impact on their bodies. The exercise can do in a pleasant situation can improve health-related physical fitness and those innovative programs might be of utmost importance for healthy lifestyle promotion (Todorovic et al. 2020). The stretching in the workplace get improving work posture, improving coordination, relieving stress, increasing flexibility, and preventing injury (Park et al. 2018). Previous studies showed that Stretching exercises are effective in reducing MSDs (Sa'adah 2013, Kusuma and Setiowati 2015, Ratu 2018, Ramdan dan Azahra 2020). As a part of physical activity, stretching at the workplace appears to be an effective way to enhance the levels of activity, increase productivity and promote health (Conn 2012, Andersen et al. 2015). This study supports the previous finding. The finding proved that there are differences MSDs Pain between the control group and the treatment group. The ergonomic exercise is given to reduce MSDs pain complaints in the treatment group (Harwanti et al. 2017). In this studied, it was also stated that the control group experienced an increase in MSDs pain due to not being given any intervention.

6. Conclusion

The level of musculoskeletal disorders felt by the weavers before the WSE intervention was in the moderate category and after the intervention decreased to low category. The reduction in disorders occurred in all observed muscle parts and WSE intervention was effective in reducing musculoskeletal disorders by 19.40%. For this reason, weaving workers are advised to carry out workplace stretching exercises (WSE) every day between weaving activities to keep the level of disorders as low as possible.

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