Work Posture Analysis Using Rapid Entire Body Assessment on Workers at AR Tailor Denpasar

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Abstract

The business competition of textile companies is getting tighter, so that the companies engaged in the apparel industry will spur their respective companies to produce quality clothing, so the companies will focus on labor so that the goods produced are of high quality. Working as a tailor has a less good work posture. The work posture in question is that the tailor sits in a static position for a long time, the posture of the back and head tends to bend which causes complaints such as pain in the neck. So it is necessary to do preliminary research on work posture of workers at AR Tailor, as an illustration of whether work as a tailor has a risk of experiencing musculoskeletal complaints. Then an initial measurement of the tailor's work posture was carried out using the *Rapid Entire Body Assessment* (REBA). Data collection was carried out by using observation, measurement and interview techniques to two workers at AR Tailor - Denpasar. Measurements taken are analyzing work posture on the job of cutting clothing and sewing using REBA. Data was collected in January 2021. The results of REBA measurements for cutting clothing have a high risk level, while the results of REBA measurements in sewing jobs have a medium risk level. Actions that can be suggested include limiting work time, resting time, providing stretching, socializing appropriate work postures, and designing workstations.

Keywords
Work Attitude, REBA, Tailor

1. Introduction

Currently the competition in the textile company business is getting tougher. Therefore, companies engaged in the apparel industry will spur their respective companies to produce quality clothing and produce clothing in large quantities in order to be profitable for the business. To achieve this goal, the company will focus on human resources or labor so that the goods produced will have high quality (Susanti 2015).

A tailor is a person whose job is to sew pieces of cloth that will be used as clothes, t-shirts, pants, etc. (Susanti 2015). At this stage of sewing, the tailor has job characteristics that require special attention, because it requires high concentration and accuracy in a sitting position with the head and neck tending to bend (Kaergaard & Andersen, 2000) this is because the tailor must pay close attention to the material to be sewn. so that later there will be no mistakes in the process.

Rusni's research (2017) states that working as a tailor has several work postures that tend to be unfavorable. The work posture referred to in this case is the seamstress sitting in a static position for a long time, the posture of the back and the head that tends to bend. This is what can cause complaints such as pain and stiffness in the neck. The posture that tailors usually apply when doing their work can be said to be *bad* posture or it can be said that the work posture is not ergonomic.

Although many industries have used machines in their work processes, in practice they still require human labor for manual handling. However humans have physical limitations. These physical limitations need to be taken into consideration in compiling a work plan because if a certain job requires more energy than the physical capacity of a

human being, this is a risk factor for musculoskeletal disorders. According to data from NIOSH in 1998, in investigating the incidence of musculoskeletal disorders related to work performed by a tailor, it was included in the work process that showed musculoskeletal disorders.

Work posture that is not ergonomic is one of the triggers for the emergence of Occupational Diseases (PAK), one of which is MSD (*Musculoskeletal Disorders*), if workers suffer from MSD it will be detrimental to workers which causes their work productivity to decrease. For this reason, it is necessary to conduct an initial study regarding the work posture of workers in AR Tailor, as an illustration of whether working as a tailor has the risk of MSD in the form of PAK. Therefore, it is necessary to make an initial measurement of the work posture of the tailor in accordance with ergonomic principles using the *Rapid Overall Body Assessment* (REBA) method

2. Literature Review

2.1 Work Posture

Work posture is an action taken by workers in doing their job (Nurmianto 2004). Work posture is a determining point in analyzing the effectiveness of a job. If the work posture carried out by the worker is good and ergonomic, then it can be ascertained that the results obtained by the job will be good. However, if the work posture of the worker is not ergonomic, the job will tire easily. If workers easily experience fatigue, the work done will also decrease and not be as expected (Susihono 2012). If the work posture used by workers is wrong or not ergonomic, workers will tire quickly, their concentration and level of accuracy will decrease, which can result in work accidents, causing several muscle disorders such as musculoskeletal disorders (MSDs) and other disorders that can disrupt the work process (Andrian 2013).

2.2 Rapid Entire Body Assessment (REBA)

The Rapid Entire Body Assessment (REBA) method is a method for quickly assessing the posture of a worker's neck, back, upper arms, forearms, wrists and feet (Restuputri et al. 2017). Rapid Entire Body Assessment or REBA is a method for assessing the risk of work activity postures that result in Musculoskeletal Disorders (MSDs) (Hignett and McAtamney 2000). REBA focuses on a specific job and is assessed by giving a score or number on each part of the assessment. The REBA method aims to determine the level of risk and action level of MSDs based on an assessment of risk postures so that preventive or corrective action can be taken. The REBA concept is suitable for jobs, such as nurses, dentists, domestic workers, cleaning services, waiters, tailors, etc. The work is in accordance with the REBA concept because in their activities they move using all their limbs (head, hands, knees and feet)

The steps for carrying out a risk assessment using the REBA method include: making observations on work activities, determining body posture while working to be assessed, scoring the posture, processing predetermined scores, establishing the REBA score results, confirming action level immediately so that control measures can be taken. In choosing the posture to be assessed, there are several criteria that must be considered, namely: the most frequently performed posture, the posture that has the longest treatment, the posture that requires the most or the greatest muscle activity, a posture that is known to cause discomfort, extreme, unstable, awkward posture, especially accompanied by a great deal of exertion, the posture most likely to intervene.

The calculation method uses the Rapid Entire Body Assessment (REBA) method. In the calculation step, several tables are used (tables A, B, and C) and the format REBA Scoring. The explanation of the use of tables A, B, C and the format REBA Scoring is as follows. Table A is used to provide a score based on the combined scores for the neck, trunk, legs. Table B, is used to provide a score based on a combination of the results of the scores: upper arms, lower arms, wrist. Table C is used to give a C score, where the score is based on a combination of the results of the A score and the B score. The A score is obtained from the sum of the results of the table A score (combination of neck, trunk, legs) with the load or force source score. While the B score is obtained from the sum of table B (a combination of the upper arms, lower arms, wrists) with the score coupling. The Format is REBA Scoring used to add up the scores according to the columns in the format. These scores are the calculation results from tables A, B, and C. To get the final reba score, the method is to add the C score with the score activity. Below is the REBA Scoring that will be used to perform calculations as described above. The results of the scoring will be matched with the table REBA Decision to find out risk levels, action levels, and further assessment of workers. Here in Table 1 is the REBA decision and conclusions based on the results of this table (Osni 2012).

Table 1. REBA score interpretation

REBA Score	Risk Level	Action Level	Action
1	Ignored	0	No Need
2-3	Low	1	May teke
4-7	Medium	2	Need
8-10	High	3	Needsoon
11-15	Very high	4	Now Also

2.3 Musculoskeletal Disorders (MSDs)

According Astuti (2009) complaints *Musculoskeletal Disorders* (MSDs) are complaints that occur in parts of the skeletal muscles that are felt by a person ranging from very mild complaints to very painful. The pain that occurs due to MSDs can be described as stiffness, inflexibility, tingling, numbness, heat or burning, cold and discomfort (Zulfiqor 2010). If the muscles receive static loads repeatedly and for a long time, it can cause complaints in the form of damage to joints, tendons and ligaments. Complaints to this damage are usually termed complaints of *musculoskeletal disorders* (MSDs) or injuries to the system *musculoskeletal*.

Meanwhile, according to Zulfiqor (2010) *musculoskeletal disorders* include swelling and degenerative effects of muscle conditions, joints, tendons, ligaments, peripheral vessels and blood vessels. The major parts of the body involved are those of the upper extremities such as the neck, shoulders, back, hands and forearms, although the lower extremities also need more attention. MSDs levels ranging from the lightest to the most severe can cause fatigue, disrupt concentration at work and ultimately reduce productivity at work (Rahawarin 2011).

According to Peter (2000), explains that there are several factors that cause complaints of the musculoskeletal system, including: excessive muscle stretching, repetitive activity, unnatural work attitudes, secondary factors (pressure, vibration, and microclimate), combined causes (age, gender, smoking habits, physical activity and body size). According to some experts, individual factors such as age, sex, smoking habits, physical activity and body size also cause skeletal muscle complaints. Nala (1994) is static (isometric) in a large number of human body muscle systems and static muscle contraction can result in: (1) the energy required is higher in the same effort; (2) pulse rate increases higher; (3) feeling tired quickly and (4) after working out, muscles need a longer recovery time.

3. Methods

This research is a preliminary study, to assess the work posture of tailors at AR tailor- Denpasar. The method used is observation, measuring work posture using a *Rapid Entire Body Assessment* (REBA) and interviews.

4. Data Collection

Where data collection is done by observation, measurement and interview techniques to two workers at AR Tailor - Denpasar. Measurements taken are analyzing work posture in the job of cutting clothing patterns and sewing using the *Rapid Entire Body Assessment* (REBA). Data collection was carried out in January 2021

5. Results and Discussion

5.1 Work Posture Analysis Using a *Rapid Entire Body Assessment* (REBA)

a. REBA measurement for cutting clothing patterns

From Figure 1 it can be seen how the body postures of workers cut clothing patterns. We already know that the work of making patterns and cutting is a work that is static in nature because the work position tends to be stationary at its pivot point with only hand movements. From the picture it is also seen that workers cut while standing on their legs, even though there is often a change in the fulcrums of the legs. This is done to create a sense of comfort and in accordance with the state of the part of the garment to be cut.

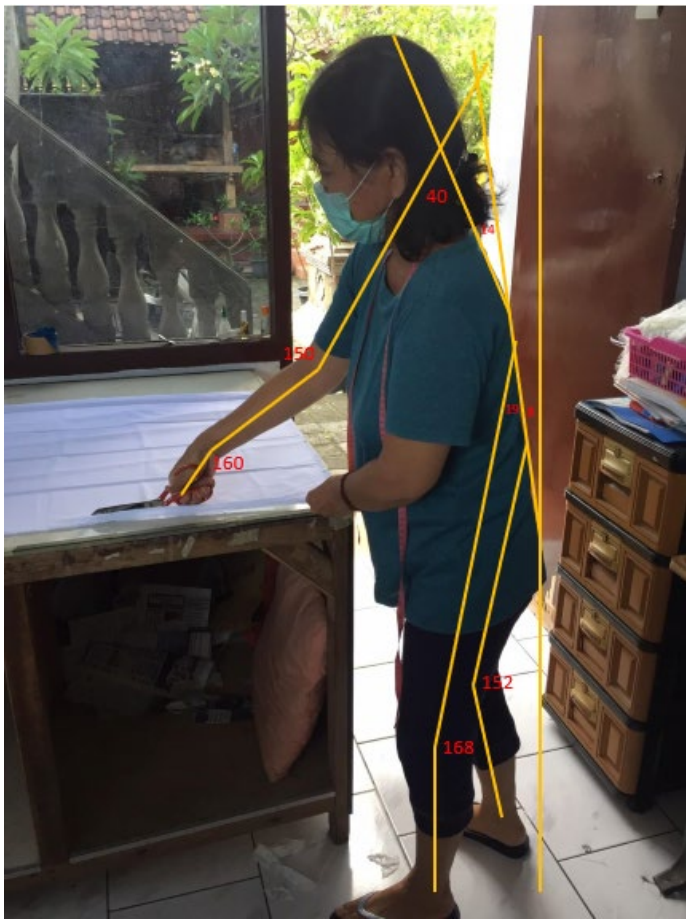

Figure 1. Body posture of workers who do work on cutting clothing patterns

The results of the *Rapid Entire Body Assessment* (REBA) are:

1. Assessment of neck posture.
   Neck posture of work performed by workers when cutting clothing patterns using scissors above forms an angle of 14°. The neck posture that occurs is that workers bow their heads to see the position of the fabric that will be formed and the pattern will be cut. In accordance with the REBA assessment sheet, the neck posture performed by the worker above gets a score of +1.
2. Assessment of trunk.
   Trunk in the work of cutting the pattern done by the worker above forms an angle of 8 ° to the normal line of the body. This is done to be able to see optimally when doing his job and also so that the hand position is right for holding and cutting clothing patterns. According to the REBA scoring sheet, this back posture scores +2. When cutting clothing patterns, the back posture performs a circular or sideways movement so that it gets an additional score of +1

3. Assessment of leg posture.
   Foot posture when cutting the pattern of clothing to be sewn is in a standing position and is unstable where the legs support the body's weight and always change movements during work activities to cut the clothing pattern. So based on the REBA assessment sheet, the leg posture scores +2. The angle formed between the thigh and calf leg forms an angle of 168 ° on the left foot and 152° on the right leg, where the angular posture on the leg that is formed is more than 60 ° so that it gets an additional value of +2.
4. Assessment of the upper arm posture.
   Upper arm posture of the worker when cutting the cloth as shown above forms an angle of 40°, then according to the REBA assessment sheet, if the angle is 20° - 45° then the value obtained is +2.
5. Assessment of the lower arm posture.
   Lower arm posture experienced by the worker above forms an angle of 150° and this is at a position> 100 ° so that based on the REBA assessment sheet, the value given when the position above is +2
6. Assessment of wrist posture
   Posture When the worker performs his work activities, it forms an angle of 0° for palmar motion and dorsiflexion so that based on the REBA scoring sheet, the worker's wrist posture scores +1. And in carrying out their activities, the workers above make a movement away from the center line so that they get an additional value of +1
7. Assessment of workload
   Cutting the fabric as shown above does not have a heavy load that exceeds 11 lbs so there is no need to add value.
8. Assessment of hand position while working
   Hand position (*coupling)* when cutting cloth has a poor grip to support the hand while working so that based on the REBA assessment sheet it gets a +2
9. Assessment of the duration and work activity
   The sewing cutting cloth requires that several parts of the body continue moves and changes in position are large, so based on the REBA scoring sheet, this activity gets an assessment of +1.
10. Final REBA assessment
    The value of each of the above body postures is then entered into the REBA scoring mechanism (REBA *Scoring*) to produce a final score of 9, as shown in Figure 2.

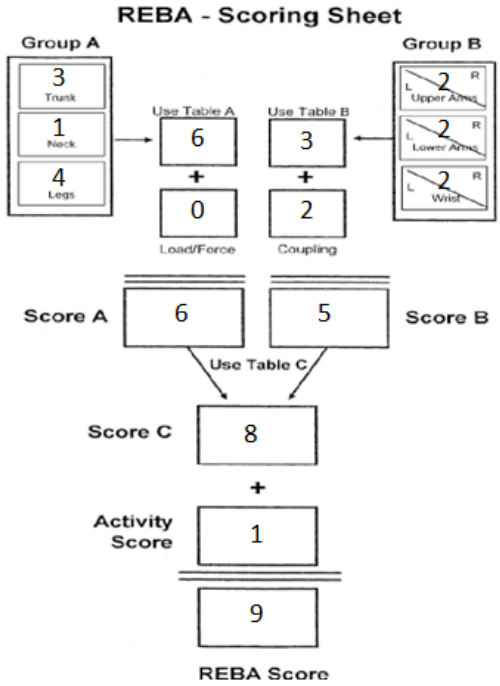

Figure 2. REBA results *scoring* for workers in the cutting and cutting of clothing patterns using scissors

11. Ergonomic Risk Analysis
    Final value of REBA which is carried out on tailors in the position of cutting or cutting cloth is 9 which means that the level or level of risk of cutting activities carried out by workers has a high level of risk. This high level of risk requires immediate action. This high level of risk also really requires the attention of workers to try to change their posture during work or take preventive and other interventions such as stretching and resting at least every one or two hours of work which is useful to reduce the risk of *musculoskeletal disorders* (MSDs).

b. REBA measurement in sewing work

From Figure 3, it can be seen how the tailor's body posture when doing work activities at the time of sewing. From the picture, it can be seen that the chairs used by workers for sewing are plastic chairs with backs and the machine used is a new type of machine that has been equipped with a large engine dynamo.

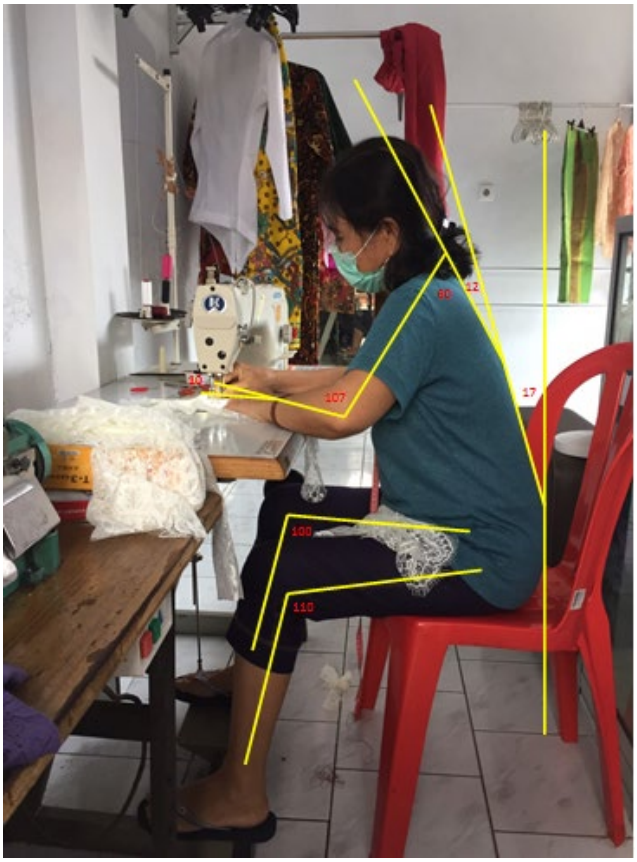

Figure 3. Body posture of workers doing sewing work

The results of the *Rapid Entire Body Assessment* (REBA) are:

1. Assessment of neck posture
   The tailor's posture forms an angle of 12^0. The neck posture that occurs is that of a tailor bowing the head to see the position of the cloth being sewn. Corresponding with the REBA scoring sheet, the neck postures performed by the tailor above got a score of +1. When sewing clothes, the neck is always fixed and does not require movement such as turning or shaking his head. So that no score was added.
2. Assessment of trunk posture.
   The tailor's trunk posture forms an angle of 17^0 to the normal line of the body. This is done to be able to see optimally when doing the job and also so that the hand position is right to hold and move the clothes that are sewn. According to the REBA scoring sheet, this back posture scores +2. When sewing clothes, the back posture is always still and fixed and there is no need to make circular or sideways movements so that there is no added value for this.

3. Assessment of leg posture.
   Foot posture when sewing is seated and tends to slightly move the legs. So according to the REBA scoring sheet, this leg posture gets a value of +1. For the angle formed between the upper and lower limbs forming an angle of 100^0 and an angle of 110^0, both of which are more than 60^0 , the score is added +2.
4. Assessment of workload
   Sewing jobs like the picture above do not have a heavy load exceeding 11 lbs so there is no need to add value.
5. Assessment of the upper arm posture
   The tailor's upper arm posture forms an angle of 60^0 so according to the REBA scoring sheet, if the angle formed is between 45–90^0 then the value obtained is +3. When sewing, the upper arm is in an abduction position so that it gets an additional +1 and the worker's arms are placed on the table or get a buffer so that it fits the assessment sheet REBA, the value gets an additional -1.
6. Assessment of the lower arm posture
   The forearm posture of the tailor above forms an angle of 107^0 and this is at a position> 100^0 so that based on the REBA scoring sheet, the value given during the position as above is +2.
7. Assessment of wrist posture
   The posture of the tailor above forms an angle of 10^0 so that based on the REBA scoring sheet, the wrist posture above gets a +1 rating and in carrying out its activities, the tailor above does not turn away from the center line so there is no need to get additional score.
8. Assessment of hand position while working.
   The hand position (*coupling*) when sewing has a good enough grip to support the hand while working so there is no need to get an added value based on the REBA scoring sheet.
9. Assessment of the duration and activity of the work
   Sewing work is a series of work activities carried out in a fixed body position for long intervals. Some parts of the body that are fixed or static include the neck, back and left leg / leg. This silence is also more than one minute, so based on the REBA scoring sheet, this activity gets an assessment of +1. This sewing activity also provides repetition of movements on the right hand and leg. The repetition of the hand occurs when the tailor moves the fabric while sewing while the right foot experiences a repetitive motion when stepping on the electric pedal (electric dynamo) to move the sewing machine. This activity is repeated more than 4 times in one minute so that it gets an additional value of +1.
10. Final REBA assessment
    The value of each of the above body postures is then entered into the REBA calculation mechanism (REBA *Scoring*) to produce a final score of 6, as shown in Figure 4.

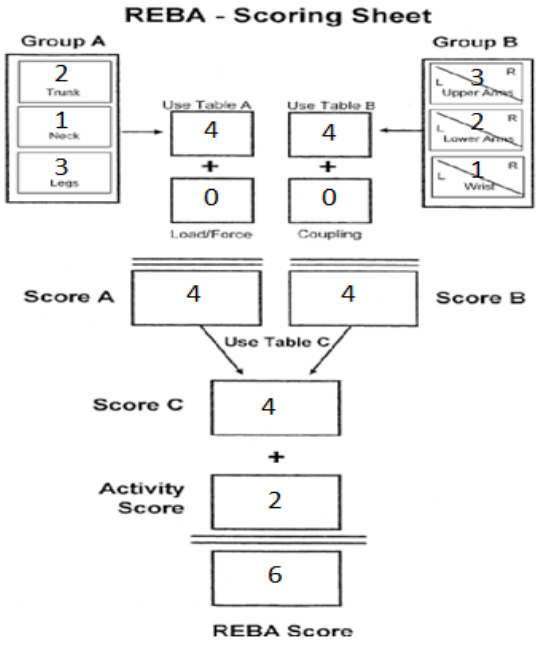

Figure 4. REBA results *scoring* for sewing workers

11. Ergonomic Risk Analysis
    In assessing the REBA method, it is known that work carried out with a static body posture and repetition of movements in several parts of the body that occur more than 4 times a minute contributes to a fairly large risk value. By getting a final REBA score of 6 which means that the level or level of risk from sewing activities carried out by workers has a medium level of risk. This intermediate risk level requires further action as well as further assessment. This level of moderate or medium risk also requires the attention of workers to try to change their posture while working or take preventive and other interventions such as stretching and resting at least every one or two hours of work which is useful to reduce the risk of *musculoskeletal disorders* (MSDs).

The results of this preliminary study are in line with the research conducted by Polat and Kalayci (2016) showing the work posture analysis of the garment industry activities in Turkey. The final REBA score is 9, which is a high level of risk that can cause physical disruption to I-3 so that it requires corrective work posture, job rotation and machine redesign. Research conducted by Joanda and Suhardi (2017) shows that the REBA score of the binding operator activity of PT Solo Murni in Surakarta, Central Java, obtaining a score of 9 is included in the high risk level of causing musculoskeletal disorders. There is a need for action to reduce risk. injury i.e. elevating the chair for operator binding. Research conducted by Yuliarty and Soegiyanto (2017) shows that the work posture analysis of employee activities in the PT X car assembly industry in Indonesia is at a very high risk level with a final REBA score of 11 so that repairs must be made as soon as possible. Actions that must be taken are providing training on work posture when lifting heavy loads and redesigning the work table in accordance with the dimensions of the worker's body. From these results, further research will be carried out in the form of giving intervention to prevent the risk of musculoskeletal complaints that are felt by workers.

6. Conclusion

The results of work posture analysis using the *Rapid Entire Body Assessment* (REBA) on the job of cutting clothing patterns have a high level of risk so that it requires special attention so that workers do not experience *musculoskeletal disorders* (MSDs). The results of work posture analysis using the *Rapid Entire Body Assessment* (REBA) on sewing work have a medium risk level, which also needs attention so that workers can take preventive measures to reduce the risk of musculoskeletal disorders.

Based on the results of the analysis, actions that can be taken refer to the *American Conference of Governmental Industrial Hygienists* (ACGIH) which include administrative *controls* in the form of limiting sewing work time, rest time, providing stretching or relaxation education, socializing good and correct work postures. and providing engineering *controls* such as designing the cutting table height and chair height, as well as providing a soft backrest for relaxation.

References

Andrian, D., Pengukuran tingkat resiko ergonomi secara biomekanika pada pekerja pengangkutan semen (studi kasus: pt. semen baturaja), *Practical Work Report* (unpublished), Faculty of Engineering, Binadarma University, 2013.

Astuti, S. E. B., Gambaran faktor risiko pekerjaan dan keluhan gejala musculoskeletal disorders (MSDs) pada tubuh bagian atas pekerja di sektor informal butik lamode, depok lama tahun 2009, *Undergraduate Thesis* (unpublished), Faculty of Public health, University of Indonesia, 2009.

Hignett, S., and Mcatamney, L., Rapid entire body assessment (REBA), *Applied Ergonomics*. vol. 31, no. 2, pp. 201-205, 2000.

Joanda, A. D., dan Suhardi, B., Analisis postur kerja dengan metode reba untuk mengurangi risiko cedera pada operator mesin binding di pt. solo murni boyolali, *Seminar dan Konferensi Nasional IDEC,* pp. 72-76, 2017.

Kaergaard and Andersen., Muscukuloskeletal disorders of the neck and shoulders in female sewing machine operators: prevalence, incidence,and prognosis, *Occup Environment med.,* vol. 57, no. 8, pp. 528-534, 2000.

Nurmianto, E., *Ergonomi: Konsep Dasar dan Aplikasinya*, 2nd edition, Surabaya: Guna Widya, 2004.

Osni, M., Gambaran faktor risiko ergonomi dan keluhan subjektif terhadap gangguan musculoskeletal disorders (MSDs) pada penjahit sektor informal di kawasan home industry rw 6, kelurahan cipadu, kecamatan larangan, kota tanggerang pada tahun 2012, *Undergraduate Thesis* (unpublished), Faculty of Public health, University of Indonesia, 2012.

Peter, V., Musculoskeletal disorders. Available: http://www.csao.org/uploadfiles/magazine/vol11no3/musculo.html, Accessed on June 12, 2013.

Polat, O., and Kalayci, C. B., Ergonomic risk assessment of workers in garment industry, *Textile Science and Economy VIII 8th International Scientific-Professional Conference May 16-19st,* pp. 124-129, 2016.

Rahawarin, M. I. U., Gambaran Keluhan Muskuloskeletal pada Karyawan Swalayan Hypermart Makasar Periode 2008-2009, *Clinical Clerkship Duties*, Faculty of Public health, Hasanudin University, 2011.

Restuputri, D. P., Lukman, M. dan Wibisono. Metode REBA pencegahan musculoskeletal disorder tenaga kerja, *Journal of Industrial Engineering,* vol. 18, no. 1, pp. 19-28, 2017.

Rusni, N., Tirtayasa, K., and Muliarta, I., workplace stretching exercise and giving sweet tea improve physiological response and increase the productivity among tailors in pt. fussion hawai, *The Indonesian Journal of Ergonomic,* vol. 3, no. 1, pp. 1-10, 2017.

Susanti, L., Gambaran keluhan musculoskeletal disorders (MSDs) pada penjahit di kota denpasar, bali 2014. *Undergraduate Thesis*, Department of Public health, Faculty of Medical science, Udayana University, 2015.

Susihono, W., and Prasetyo, W., Perbaikan postur kerja untuk mengurangi keluhan musculoskeletal dengan pendekatan metode owas (studi kasus di ud. rizki ragil jaya - kota cilegon), *Spektrum Industri,* vol. 10, no. 1, pp. 69-81, 2012.

Yuliarty, P., and Soegiyanto, S., Chassis and tire dengan metode rapid entire body assessment (REBA) di departemen assembly frame pt. x (industri perakitan mobil), *Seminar Nasional Sains Dan Teknologi*, pp. 1-11, 2017.

Zulfiqor, M. T., Faktor-faktor yang berhubungan dengan keluhan muskuloskeletal disorders pada welder di bagian fabrikasi pt. caterpillar indonesia tahun 2010, *Undergraduate Thesis*, Department of Public health, Faculty of Medical science and health, Syarif Hidayatullah State Islamic University, Jakarta, 2010.

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