

## POSTURE IMPROVEMENT AND STRETCHING TREATMENT BASED ON PARTICIPATORY ERGONOMIC DECREASE RISK OF WORK POSTURE AND LOW BACK PAIN INTENSITY ON BRICK WORKERS IN KUPANG, NTT

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**Abstract.** Low Back Pain (LBP) is widely experienced by many brick workers who generally carry out repeated physical activities of lifting-and-carrying with non-ergonomic postures. Such condition can increase the risk of work posture and LBP intensity which if continued can disrupt the continuity of production, increase the risk of injury, and reduce worker productivity. Simultaneous intervention of posture improvement and stretching is conducted with the aim of reducing the risk of work posture and LBP intensity. This research was a quasi-experimental study using pre and post test design. Nineteen males brick workers from the brick production business unit sample in Kupang City who met the eligibility criteria participated in this study. They were determined as samples using purposive sampling technique. Simultaneous improvement of posture and stretching treatment is the selected intervention model agreed upon by researchers, workers and business owners to reduce the risk of work posture and LBP intensity for 5 weeks. The risk of work posture was measured by Rapid Entire Body Assessment (REBA) while LBP intensity was measured using a modified Oswestry questionnaire. Five main activities were measured for LBP intensity i.e. lifting, standing, sitting, walking, social life and sleeping. Measurements the risk level of work posture and LBP intensity were taken before and after the intervention. The data were analyzed by paired t test with a significance level of 5%. The results showed that posture improvement and stretching treatment reduced the risk level of brick workers' work posture from the average score of 9.25 to 5.0 or a decrease of 45.95% and reduced the intensity of LBP from 3.53 to 2.54 or a decrease 28.05%. The highest decrease in the pain intensity was found during sleep i.e. 39.19% and the lowest during lifting activity i.e. 15%. The conclusion is the improvement of posture and stretching treatment base on participatory ergonomic can reduce the risk of work posture and LBP intensity of brick workers.

*Keywords : low back pain; work posture, stretching*

### 1. INTRODUCTION

Brick production business is one of the informal sector businesses that is widely spread in various sub-districts in Kupang City. Its development continues to increase yearly with an average increase of 15%. The increase in the number of the business is in line with increasing demand for bricks by communities, industries and developers that has grown rapidly in the last 10 years [1].

Units of brick production business in Kupang City can be found in the subdistricts of Alak, Kota Raja, Kota Lama, Kelapa Lima, Oebobo, and Maulafa. In general, brick making businesses in the five sub-districts are grouped into 3 categories, i.e. small, medium and large scale. This categorization is based on production system, production level and number of workers [2]. In small-scale units, production is done manually, while in medium and large-scale business production is done semi-automatically. Level of brick production varies for each category

i.e. 1,000 pcs per day, 5,000 pcs per day, and 7,000-10,000 pcs per day for large scale. From the aspect of workers, each respective business unit employs 1-4 people, 5-10 people and 10-20 people or more.

Even though more business units have utilized machines, brick making still done by manual handling. Work that relies on physical exertion includes mixing raw materials, inserting the mix to the machine, pressing, lifting printouts out to drying place and storing and arranging bricks that are ready to sell to storage location. The use of human labor in the production process can increase the risk of work postures on the workers resulting in early fatigue, musculoskeletal complaints, and low back pain [3] - [5]. Therefore, brick making work has very high health risk, while the attention of management or business owners on workers' health and safety is still minimal [6].

Preliminary studies showed that the workers often work with awkward postures such as bending and twisting. The awkward posture is caused both by incompatibility of tools dimension with workers and lack of skills of workers on how to work with neutral posture. Working in a bent position for an extended period will increase pressure on the nerve bearing and can increase the risk of LBP events [7], [8]. Low Back Pain is a phenomenon that is often found in work is done manually. Generally, LBP is felt as discomfort in the lower back [6], does not result in disability, but its effects can reduce concentration, productivity, and quality of work, and increase the risk of accidents [9], [10].

There were 60% of workers often take 'stolen' breaks in the middle of activities, even though they have been given sufficient 'official' break by the management. From the ergonomic point of view, breaks that are often taken in the middle of activities indicate that excessive fatigue or complaints have occurred [11]. The survey also indicated that stolen breaks were taken to reduce back pain felt during and after the activities.

Workers who are exposed to LBP rarely seek medical treatment for reason of expensive medical costs. Efforts that are often done by workers to overcome LBP are through massage, taking painkillers, smearing with massage oil or leaving to heal by itself. This shows that workers, including business owners, lack knowledge and skills to overcome the causes of LBP. Working with bent work postures, twisting with repetitive movements are ergonomic factors that cause LBP that workers rarely know of [12] - [14]. On the other hand, efforts to get used to stretching before and after the activity to strengthen the muscles of the lower back are minimal. These reasons can make handling of LBP complaints workers not optimal.

Improvement of work posture and stretching treatment is one type of Ergo-physiology intervention. Ergo-physiology intervention is a model that combines improvement of work posture and physical physiotherapy in the form of stretching to reduce risk of back troubles [15]. Work posture improvement is intended to minimize the potential risk of LBP and physical training in the form of stretching is intended to strengthen and flexibilities muscles of the lower back i.e. the muscles that reflect the lumbo-sacral spine, especially abdominal muscles and maximus gluteus muscles; and stretch extensor groups in the lower back. Previous studies have shown that combined posture improvement and physiotherapy training can reduce the risk of work posture and LBP [15]. However, improvements to work posture and stretching that have been made need to be redesigned in accordance with task specifications and posture position as well as the level of complaints experienced by workers. At the same time, in order to obtain optimal results, to be needed active participation of workers and other stakeholders. In this study, workers and business owners were involved in the whole process from planning to implementation of interventions. Based on such deliberation, both workers and business owners agreed on the improvement of work posture and the provision of stretching simultaneously as the chosen intervention model to reduce the risk of work posture and LBP of brick workers.

## 2. METHODS

This research was a quasi-experimental study using pre and post test design. A total of 19 males brick workers from the brick production business unit sample in Kupang City who met the eligibility criteria (i.e: perform manual handling tasks as part of their work activity, have history of low back pain within the last three months) participated in this experiment. They were determined as samples using purposive sampling technique. Selected intervention model, i.e: improving work posture and stretching treatment simultaneously was carried out three times a week for 5 weeks. There were 4 (four) stages to this process. The first: Retrieval of employee posture data during the stage of activity (i.e mixing materials, put the materials into the molds, carry out the brick and pull down it on place of drying) using video assistance, determined the angles of the worker's body parts and then it was calculated by REBA value for the relevant posture and LBP assessment were identified. The second, subjects were trained how to work with the ergonomic posture and stretching using the William flexion method. The third was implementation phase for 5 weeks, i.e: subjects worked with ergonomic posture and stretching under the supervision of tim. Stretching treatment was done before and after the activity for the duration of 30 minutes with a frequency of 3 (three) times a week. The last step is the assessment of work posture risk using REBA and LBP using the Oswestry questionnaire which was modified using a four-level scale (not painful, rather painful, painful, and very painful). Five main activities were measured for LBP intensities namely lifting, standing, sitting, walking, social life and sleeping. Data before and after the intervention were analyzed using paired t-test with a significance level of 5%.

### 3. RESULTS AND DISCUSSION

#### 3.1 Characteristics of Subjects

The characteristics of the research subject were explained as follows, their mean age was  $28.03 \pm 7.25$  years, classified as productive ages. Their mean height and weight were  $159.44 \pm 15.25$  cm, and  $51.18 \pm 6.25$  kg, respectively, and their mean body mass index was  $20.05 \pm 3.22$  kg / m<sup>2</sup>. was in a normal nutritional status. The Subjects have a mean work experience as brick worker is  $13.13 \pm 6.45$  years, classified as skilled workers. Most of the subjects (78.50%) had junior high school education.

#### 3.2 Effect of Posture Improvement on Reduction of Work Posture Risk

Work posture is position of body parts when doing activities. Due to physical stress during activities, the body responds by forming certain postures [11],[16], [17]. Based on the agreement with workers and business owners, improvement of work posture was chosen as a form of intervention to reduce the risk level of work posture. Correction of work posture is intended to change and improve the position of worker's body parts when mixing materials, inserting mix into molds, carrying and laying bricks molds to be more natural than the initial condition. The main problem of these forms of activities, however, is not the heavy load on the muscle, but much more the wear and tear on the intervertebral disc. Results of analysis show difference in work posture scores before and after the intervention as shown in Figure 1.

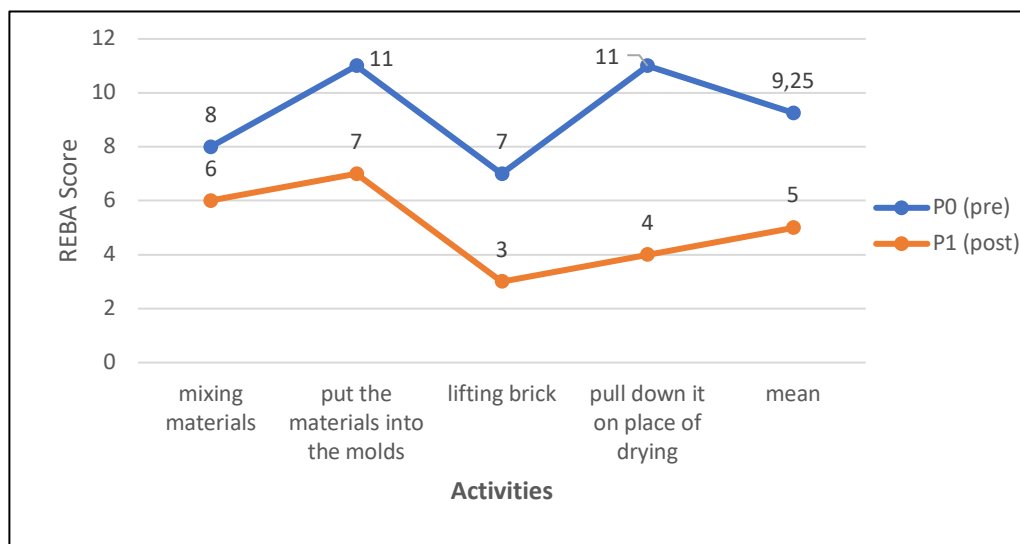


Figure 1. Risk Level of Work Posture Period P0 (pre) dan P1(post)

Results showed that in Period P0 the average work posture score was at 9.25 which is categorized as high level of risk [18]. This was due to working in a bent and squatting position. Such positions may help finish the task faster but typically requires more energy. A prolonged bending position can increase muscle tension and further effects cause fatigue and muscle aches more quickly [17], [19]. Back position when bending exceeded the normal elevation angle of 20°. The high elevation angle will increase the risk score. The highest score occurred in the sub-activity of inserting material into a mold and pressing, and carrying the printed bricks into a drying area with the score of 11, i.e. very high-risk level [18]. Working in a bent position can increase resting pulses and reduce work productivity [20]. To make matters worse, works do a lots of sideway turning (left or right, or toward the back) while bowing/bending. Working with this posture can increase lumbar lordosis and kyphosis in the upper back (thorax) [21]. The presence of back hyperextension and hyperflexion interferes with the nucleus pulposus on the Intervertebral discs, thereby increasing the risk of back injury [22].

After improvement of posture, the risk level of work posture decreased significantly ( $p = 0.001$ ). Decrease of work posture risk was at the level 5.0 (medium level) or 45.95%. This reduced level of posture risk was greater than in a previous study which found a reduction of LBP in red soil excavation workers after ergo-physiological intervention by 34.56% [15]. Interventions with a participatory ergonomic approach can change the position of the body, especially the position of the back and neck so that it can perform activities in a more natural/ergonomic position. Results also presented a reduction in the bending motion of the back by 30°-35° and neck flexion movements of 10°-15° when carrying and placing printouts to the drying area. The greatest decrease in risk level occurred in the sub-activity of carrying printouts to the drying area which was 7 points or 63.64%, followed by the activity of bringing the printouts down by 4 points or 57.14%, and putting the material into the mold and pressing

by 4 points or 36.36%. Improved work posture characterized by a reduced level of risk of posture can reduce fatigue and musculoskeletal complaints [12], [15], [17].

### 3.3 Effect of Work Posture Improvement and Stretching Treatment on Decrease of LBP

Low Back Pain is a feeling of pain and discomfort that is localized in the lower back region i.e. below the last rib angle (costal margin) and above the lower buttocks (gluteal inferior fold) with or without pain in the legs [9], [22]. Based on the agreement with both workers and business owners stretching training was set as the chosen intervention model to reduce LBP. The effect of correcting work posture and stretching on LBP can be seen in Figure 2.

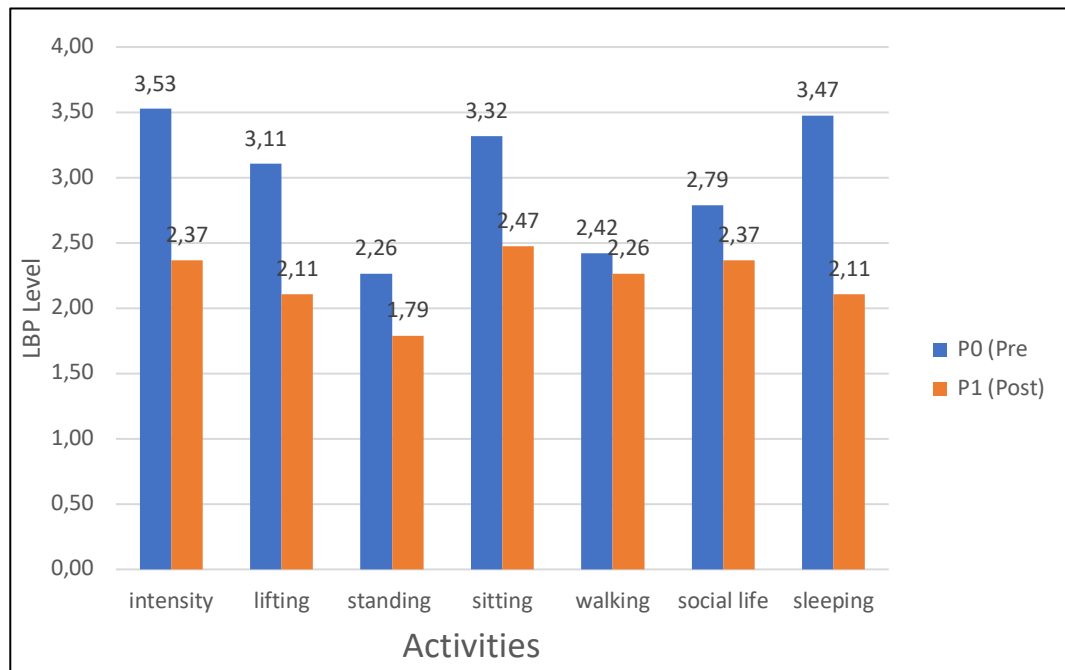


Figure 2. Difference in Intensity of LBP Before and After Intervention

The results showed that subjects had had a history of LBP before, and it classified as chronic pain. Chronic pain is a type of pain caused by a prolonged non-ergonomic way of work [22], [23] and lasts for a longer duration of 1-3 months or even more [7], [16]. Measurements using the Oswestry questionnaire found that the average LBP intensity of was 3.35 (very painful) with a range of categories from mildly to very painful. LBP experienced by subjects is mostly related to lifting and moving materials manually with odd work positions [23], [24] - [27]. LBP intensity was felt when the workers performed activities such as lifting weights, standing, sitting, walking, doing social activities and sleeping. The pain intensity was felt to be higher when the subjects slept (sleeping activity) with the pain score of 3.47 (very painful), followed by sitting activity with score of 3.22 and lifting activity 3.11.

Analysis showed that work posture correction and stretching administration could significantly reduce LBP ( $p = 0.02$ ). Decrease of LBP intensity after intervention was 2.54 or 28.05%. Decrease in the intensity of complaints also occurred when subjects performed lifting, standing, sitting, walking, doing social activities and sleeping. The highest decrease in LBP intensity occurred during sleep activity, i.e. 1.36 (39.19%), lifting activity i.e. 1.0 (32.15%), sitting activity i.e. 0.85 (23.29%) and the lowest during walking activity with the score of 0.18 (6.61%).

Simultaneous provision of posture improvement and stretching is an effort to eliminate the main causes of pain (casual) or relieve pain (symptomatic). Improvement of posture become neutral can reduce the compression load on the lower back when over-flexing and over-extending due to demanding tasks. Reducing the compression load will prevent excess pressure on the lumbar intervertebral disc including the nucleus pulposus and the annulus fibrosis and ligament that are the sources of pain [22], [28]. Correction of work posture to be more ergonomic can prevent the use of excessive muscle strength and muscle tension. Correcting posture by reducing the angle of back elevation when lifting or lowering the load can minimize low back pain [29], [30].

Stretching is effective in reducing LBP [15], [31], [32]. It can stretch the abdominal and back muscles so as to smooth the lymph system and circulation system, activate the parasympathetic system and will indirectly reduce stress level in the lower back region. Stretching exercises can reduce the impact of shock due to static load on the back [16], [30]. *William Flexion Exercise* adequately can increase the flexibility of lower back muscles which is characterized by increased joint motion in the lumbar region [31]. Improvement of range of motion in the lumbar will stimulate the Golgi tendon so that relaxation on related muscles occurs [32], [33]. Strength and

flexibility of the back muscles are increased so as to minimize pain and stress on the spine. Stretching can also improve the muscle pump which results in increase in blood circulation in the back-muscle tissue. Thus, supply of food and oxygen in the muscle tissue gets better and the pain caused by spasm will decrease [33] - [35]. Previous studies have also shown that conducting regular physiotherapy training in the form of stretching with the frequency of 3-5 times a week can reduce the risk of low back pain [15].

#### 4. CONCLUSION

Improvement of work posture and stretching treatment base-on participatory ergonomic could decrease the risk of work posture and LBP intensity on brick workers as compared to conditions before the intervention. The acquired reduction of work posture risk level is by 45.95% and LBP intensity by 28.05%. It is necessary to redesign equipment used in brick press especially the material mix and the pressing equipment so the decrease of posture risk level and LBP intensity more effectiveness.

#### 5. REFERENCES

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