The Intervention of Participatory Ergonomics in Repetitive Truck Loading Improvement Activities for Mineral Water Product

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Abstract. This research was conducted at a bottled drinking water company located in Sumatera Utara, Indonesia. Workers loading gallon water bottles into trucks experiencing musculoskeletal complaints (MSDs). Rapid Upper Limb Assessment (RULA) and Job Strain Index (JSI) assessment of the work also shows high-risk work. Participatory ergonomics interventions were conducted to overcome these complaints through two stages of Focussed Group Discussion (FGD). The first stage of the FGD with the workers produced several inputs which became material in the second phase of the FGD with the management. In the second phase of the FGD, approval was obtained for the implementation of the repair solution for 20 working days (4 weeks), namely the provision of Occupational Safety and Health material, the application of gallon water bottle transfer operating procedures to the truck, and the application of Job Control by the supervisor. Every week, ergonomic interventions are evaluated and at the end of the fourth week, there are no complaints of extreme pain in all segments of the worker's body.

1. Introduction
Analysis of field conditions is needed to examine the weaknesses of actual field conditions. An assessment of the weakness of the field conditions cannot fully identify the entire work station, therefore an interview with the worker is needed. The results of the interview indicated that there were complaints from workers in carrying out their duties. After working for some time, a person can experience complaints on parts of his body; starting from the upper neck, shoulders, arms, back, waist and legs. This complaint is usually called a musculoskeletal complaint. In the assessment of musculoskeletal complaints, the number 0 is often used to indicate no complaint, up to a value of 3 which indicates a very sick complaint [1]. Overcoming complaints experienced by workers by improving work methods and conditions can be a way to increase work productivity [2] as well as the application of Participatory Ergonomics [3].

If a person experiences musculoskeletal complaint, it will result in decreased work concentration, the quality of work results will also be affected, it can result in loss of working hours because it takes time for relaxation, and can even lead to work accidents. Complaints in the spine experienced by
workers, if it continues to be left with a great chance of causing dislocation of the spine which causes a feeling of pain and can cause fatal irreversible [4].

Overcoming complaints experienced by workers can be done by creating good working conditions through an in-depth analysis of existing conditions and soliciting input from workers related to work activities they do use SNQ [5-7]. Interviews of six workers in the Gallon Water Bottle (GWB) hauling line and filling in SNQ questionnaires before and after work showed an increase in complaints against body segments after carrying out their duties.

JSI and RULA are tools to assess the risks of work [8]. The assessment uses Job Strain Index (JSI) related to business intensity (estimated effort used to do a job), duration of effort, effort per minute (the amount of energy used per minute or frequency of work per minute), hand or wrist position, work speed, and the duration of work per day gives the number 12, which is the work that was observed to be dangerous. The work posture assessment using the RULA (Rapid Upper Limb Assessment) technique shows that all three working elements of GWB loading require remedial action shortly.

Participatory ergonomics (PE) is one approach the process carried out to carry out ergonomic intervention programs. Participatory Ergonomics is the active participation of employees at all levels to implement program ergonomics in the workplace to improve working environment conditions. Participatory ergonomics is carried out on workers and company management to get the proposed solutions implemented [9,10].

Focus Group Discussion (FGD) is a form of data collection through group interviews and group discussions. To get a more accurate understanding, it may be defined as a method and technique in gathering qualitative data where a group of people discusses a particular problem or topic focus guided by a facilitator or moderator [11]. FGD was held twice. The first FGD was conducted to obtain input from workers related to the improvement of work activities, and the second FGD was conducted with management to discuss input from workers. First, workers are given an understanding of the risks of their work, then input from workers is sought namely a clear job description, the availability of drinking water near the worksite, the availability of electrolyte drinks, the need to be given time off after more than three hours of GWB handling, and the existence of additional teamwork. The results of the FGDs conducted with these workers become material for FGDs with management [12].

2. Method and equipment

This research was conducted at a bottled drinking water company located in Sumatera Utara, Indonesia. The object studied was six workers moving/transporting drinking water in GWB [13]. There are three lines of work, each line consisting of two workers. The first-person transports GWBs from the conveyor onto the transport truck and the second person does the compilation in the truck. Sometimes workers are assigned to help workers in other parts if additional workers are needed. This results in a lack of rest time for the body and causes worker complaints.

The results of identification of employee complaints made using the Standard Nordic Questionnaire (SNQ), Job Strain Index, and RULA are sought for a solution using the Participatory Ergonomics approach through the implementation of the FGD. The first phase of the FGD was conducted and several inputs were obtained from the workers. In this research, the second phase of FGD was conducted with management to discuss proposals from the results of the first stage FGD. Worker input approved by management is tested for one month (20 working days) and evaluated every week.
3. Results and Discussions

3.1. RULA’s result

Assessment of work posture using the RULA method the results can be shown in Table 1. All workers were male and observed workers were first shift workers.

| Respondent | Score | Action                  |
|------------|-------|-------------------------|
| Worker 1 (male) | Holding 2 | Take some time          |
|            | Moving 7  | Action Now              |
|            | Putting 6  | Action in the near future |
| Worker 2 (male) | Holding 6 | Action in the near future |
| Worker 3 (male) | Holding 2 | Take some time          |
|            | Moving 7  | Action Now              |
| Worker 4 (male) | Holding 5 | Action in the near future |
| Worker 5 (male) | Holding 2 | Take some time          |
| Worker 6 (male) | Holding 6 | Action in the near future |

From the six workers, it appears that the posture problem is in moving activities so that almost all need improvement right now, while putting activities are risky for some workers. Holding activities in these activities do not pose a high risk to all workers observed.

3.2. Analysis of FGD Results with Management

The company is the owner of the highest authority who is expected to pay attention to the welfare of workers and help create a good work environment in the future. PE results with workers are bought to management so management expects a feasible solution to be implemented and can overcome all the
problems that are a problem at the transportation station. Conditions are important factors that must be considered in determining solutions. A joint agreement between management states that changes or improvements cannot be carried out on a large scale. In addition to looking at the conditions, time constraints and limitations of the experts involved, it was also the main reason for leaders and management to limit the changes made. The management said that all proposals requiring application time of more than 20 days and matters requiring financing were included in the "category received but postponed" where the proposal was considered but there was no guarantee of application until an unspecified time limit. The results of the FGD with the management decided the implementation was applied to workers 1 and 2 workers on line 1 for 20 working days. The summary of the FGD results with the management of the company can be seen in Table 2.

| No. | Proposal Description                      | Information              |
|-----|-----------------------------------------|--------------------------|
| 1.  | Counseling based on good work, material handling, and MSDs | Agreed                   |
| 2.  | Make a standard Job Description         | Agreed                   |
| 3.  | Limit time to 3 hours                   | Received but postponed   |
| 4.  | Add 1 additional team                   | Reject                   |
| 5.  | Provision of electrolyte drink          | Received but postponed   |
| 6.  | Make appointment procedures             | Agreed                   |

3.3. The Intervention of Proposed Solution

The application of OSH materials to workers aims to educate workers about the risks of work experienced and provide knowledge based on work safety. How to deliver OSH material using paper containing material and explanations is given verbally. Submission of material is carried out by the Safety Health Environment (SHE) section which is responsible for carrying out repairs. Giving material about OSH is given 5 times on Mondays or Wednesdays. Consideration of the selection of days and duration due to Tuesday, Thursday and Friday is the schedule of the arrival of vendors, direct checking of the plant manager and checking trucks. At the beginning of the presentation of the material, it was also conveyed about the Occupational Safety SOP, which is expected by workers to fully understand the application. Giving material in the form of understanding, goals, principles, and handling in the work environment. Implementation of the provision of material to workers, there are obstacles when the implementation is that workers are less focused because workers are less familiar with the delivery of material. On the first and second days, the workers tended to ignore, but after the third meeting onwards workers began to be able to pay attention and understand well. The results of the implementation of the provision of OSH material are workers knowing the importance of OSH in carrying out their activities. Workers have realized that health is the main thing that must be maintained. With the provision of OSH material, workers are considered to have been well educated to determine the risks of the work done so far.

- An SOP is a guideline that contains standard procedures that exist within an organization that is used to ensure every decision, step, action carried out by people in an organization has been running effectively, consistently, standardly, and systematically. Occupational Safety SOPs are prepared by SHE by considering inputs and suggestions. The prepared SOP was then handed over to the HRD Manager so that the SOP got permission to run. Work posture is also the focus of making SOPs create healthy conditions for workers. Initially, the SHE and
supervisor together explained about the SOP and how to implement it. Early education on the application of SOPs is needed to help workers better understand and accelerate the time of adaptation. In its application, workers have difficulty implementing procedures. Workers are confused when implementing it directly in the field. The supervisor's role that guides the implementation process helps workers better understand its application. The supervisor ensures that lifting activities are carried out by established procedures.

- The supervisor applied Job Control and stressed that the main task of the worker was to transport the GWBs to the truck. Supervisors oversee work methods that are carried out when workers carry out appointment activities so that workers always apply operating procedures while working. Supervision is carried out at least 3 times a day to minimize the level of negligence of workers. The results of its application for 20 working days show that no more workers are assigned to the storage area again, so workers are more focused on doing their jobs.

![Diagram](https://example.com/diagram.png)

**Figure 2.** Re-evaluation of workers’ complaints for four weeks: (a) week-0, (b) week-2, (c) week-4
3.4. Re-evaluation of Workers’ Complaints

Implementation of repairs was carried out for 20 working days and a re-assessment of workers’ complaints using the SNQ questionnaire was carried out every week. SNQ results regarding complaints are a measure of the results of implementing proposed solutions that have been made. The results of the re-assessment using SNQ can be seen that in the first week there were no changes regarding the percentage of illness and severity of illness because in the first week there was a period of adaptation where workers did not fully understand the implementation of repairs. The second week saw a reduction in the percentage of severely ill to sick, which can be seen by workers feeling a decrease in complaints. In the third week, there was a decrease in complaints in the upper neck, and the lower neck from very sick to being sick. In the back segment, there is a decrease in the percentage of very sick workers who previously as much as 100% to 50%. At week 4 it can be seen that workers feel a decrease in complaints so that no worker feels very sick in all body segments.

A good work posture in carrying out material handling manuals is to build strength in the lower body. Changes in the support of workers from the skeletal part to the lower body cause complaints of pain in the lower body segments, namely the left thigh, right thigh, left knee, and right knee. This complaint arises because the posture when carrying out its activities the body’s attitude is unstable.

4. Conclusions

From the first phase of the FGD with workers, several inputs were obtained which became the material of the FGD with the management. These inputs have been approved, rejected, or approved with a time delay. The agreed proposal is counseling based on good work, manual material handling, and MSDs; make a standard job description and make good appointment procedures, try out for 20 working days (4 weeks) and evaluate every week. Evaluation results show a decrease in MSDs from week to week, so at the end of the fourth week in all segments of the body no longer found complaints of very sick.

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