

Ergonomic Risk Assessment in Manual Material Handling Task Among Rice Stores in 4th District of Leyte

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Abstract

This study aimed to assess the ergonomic risks associated with manual material handling (MMH) tasks in rice stores located in the 4th District of Leyte, Philippines specifically in Merida, Isabel, and Palompon. The objective was to identify work-related musculoskeletal symptoms and evaluate risk-prone tasks involving lifting, carrying, pushing, pulling, throwing, and lowering heavy rice sacks. A total of 20 MMH workers from 18 rice stores were purposively selected to participate. Data were collected using the Modified Nordic Questionnaire (MNQ), NIOSH MMH Checklist, Hazard Evaluation Checklist, and the Ovako Working Posture Assessment System (OWAS). MNQ results indicated high prevalence of pain in the shoulders (95%, 80%), upper back (95%, 100%), lower back (80%, 95%), and hips (75%, 100%) in the past 12 months and 7 days, respectively. The NIOSH checklist showed 80.33% of the responses fell within the risk range (60%-100%), while 57.88% of responses to the Hazard Evaluation Checklist indicated conditions that pose a risk of developing low back pain. OWAS analysis revealed that lifting tasks were the most hazardous, falling under Category 4. The findings underscore the need for engineering and administrative interventions and provision of personal protective equipment to reduce musculoskeletal risks and improve the working conditions of rice store laborers.

Keywords: Ergonomic risks; MNQ; NIOSH MMH; OWAS; Musculoskeletal Disorders

Introduction

Manual Material Handling is an important aspect of many industries; however, worker safety is often compromised in MMH, due to various hazards and contributing factors. Manual Material Handling (MMH) tasks are frequently of concern when evaluating job activities for risks that may result in work-related musculoskeletal problems. Ergonomic risk associated with Manual Material Handling (MMH) activities typically involve uncomfortable postures, repetition, excessive force and work-related stress. Around a one-third of all workplace injuries are caused by MMH (Grepo, 2013).

Rice stores are widely recognized for their reliance on manual material handling practices. The manual material handling tasks involved in rice store operations present many ergonomic risks that can impact the physical health and well-being of workers. Manual material handling tasks in rice stores involve various activities, such as lifting, carrying, pushing, pulling, throwing and lowering heavy sacks of rice. The weight of the rice sacks and awkward postures in handling the sacks, combined with bending, twisting, and lifting motions, increase the risk of injuries, such as pain and discomfort in the neck, shoulder and back areas. WMSDs are injuries to ligaments, tendons, muscles, nerves and joints (Eko Nurmianto, 2015). WMSDs have been a major concern in many industries because they affect worker's productivity, absenteeism, turnover, compensation and work quality (Hebbal, 2014). Considering the health issues associated with rice store operations- their far-reaching impact on both employees and organizational performance, it becomes imperative to investigate this area further. Despite the potential risks, there remains a noticeable gap in research, particularly on the prevalence of pain and discomfort related to WMSDs in rice store settings. Thus, given these factors, this study aims to conduct a focus study on rice store operations in 4th District of Leyte to assess the extent of WMSDs and provide a foundation for developing interventions aimed at improving worker safety and operational efficiency through the use of Modified Nordic Questionnaire (MNQ) to identify work-related musculoskeletal disorders (WMSDs), the NIOSH Manual Material Handling (MMH) Checklist, Hazard Evaluation Checklist for Lifting, Carrying, Pushing, or Pulling, and the Ovako Working Posture Assessment System (OWAS) to conduct a thorough examination of manual material handling tasks in rice retail personnel at various rice stores in 4th District of Leyte. Conducting ergonomic risk assessments in rice store operations is important for recognizing potential hazards and developing appropriate control measures.

Methodology

The study utilized a checklist as one of the methods for gathering the necessary data, incorporating the NIOSH Manual Material Handling (MMH) Checklist, Hazard Evaluation Checklist for Lifting, Carrying, Pushing, or Pulling, Ovako Working Posture Assessment System (OWAS), and Modified Nordic Questionnaire (MNQ). The Ergonomic Checklist is a tool used to assess and evaluate ergonomic conditions and factors in the workplace. It helps to identify potential ergonomic issues and provides guidance on how to improve the work environment to enhance comfort, safety, and productivity. The researchers used a checklist to identify the risks associated with manual material handling. Conversely, 2. Ovako Working Posture Assessment System (OWAS) is an observational method, relying on the observation of the worker's posture during task at regular intervals. The method classifies the observed the observed postures based on the worker's back, arms and legs postures and the load being handled.

Meanwhile, the Modified Nordic Questionnaire (MNQ) can be used to assess body parts with work-related musculoskeletal disorders (WMSDs) problems were distributed to twenty (20) manual material handling workers from eighteen (18) different rice stores. This was done to obtain information on workers perceptions and the level of discomfort experienced y workers. The MNQ was used to identify musculoskeletal symptoms among MMH workers in different rice stores. (Kuorinka et al. 1987). This study used specific steps to gather the necessary data, which involved the following: the researchers composed letters to various rice store owners, seeking permission to approach the workers of the stores and request their voluntary participation in the study; gather data about the demographic characteristics of each worker, including age, sex, years of experience, and number of working hours through personal interviews; identify the prevalence of work-related musculoskeletal disorders using the Modified Nordic Questionnaire (MNQ), assess ergonomic conditions and factors in a workplace through the use of NIOSH Manual Material Handling (MMH) checklist, and assess the level of risk associated with particular tasks within a job by evaluating the worker's posture, the level of force and repetition involved in the task, and other ergonomic factors through the use Ovako Working Posture Assessment System (OWAS).

Sampling Procedure

This study used a purposive sampling technique to select rice stores and participants based on their relevance to the research objectives. Eighteen (18) rice retail stores across Merida, Isabel, and Palompon in the 4th District of Leyte were selected. The inclusion criteria for store selection included: (1) active engagement in manual material handling tasks, and (2) accessibility for researcher observation and data gathering.

From these stores, a total of twenty (20) workers participated in the study. While most stores had one worker, two of the stores employed two workers, making up the total sample size. The inclusion criteria for participants were: (1) currently employed in rice retail operations, (2) directly involved in MMH tasks such as lifting, carrying, pushing, pulling, throwing, or lowering heavy sacks of rice, and (3) willing to participate voluntarily. Workers not directly involved in these tasks or unwilling to participate were excluded from the study.

Results and Discussion

Worker's demographics revealed a predominantly middle-aged, male work-force working long shifts (9-15 hours/day) in physically demanding roles.

As shown in figures 1 and 2, the study revealed a high prevalence of musculoskeletal disorders (MSDs) among rice store workers in Merida, Isabel, and Palompon, Leyte, with significant discomfort reported in the shoulders, upper back, lower back, and hips—over 12 months and the past 7 days. The specific concentration of pain in the shoulders and lower back among rice store workers can be attributed to the repetitive lifting of rice sacks that often weigh up to or more than 50 kg. These results are consistent with findings from similar sectors involving manual material handling. For instance, a 2024 study on lychee-longan harvesters in Northern Thailand reported that 82.2% of workers experienced shoulder pain, while 78.0% reported lower back pain due to frequent lifting and awkward postures (Tuntiseranee et al., 2024). Similarly, rice farmers in West Bengal were found to have a 71.76% prevalence of lower back pain caused by repetitive bending, squatting, and carrying loads (Sarkar et al., 2024).

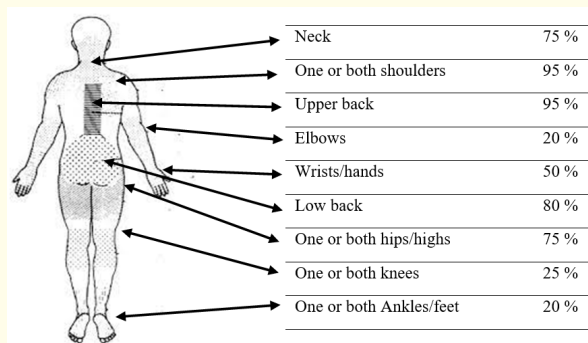


Figure 1: Pain and Discomfort in the past 12 months.

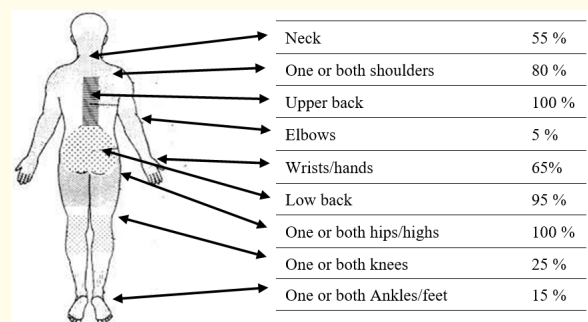
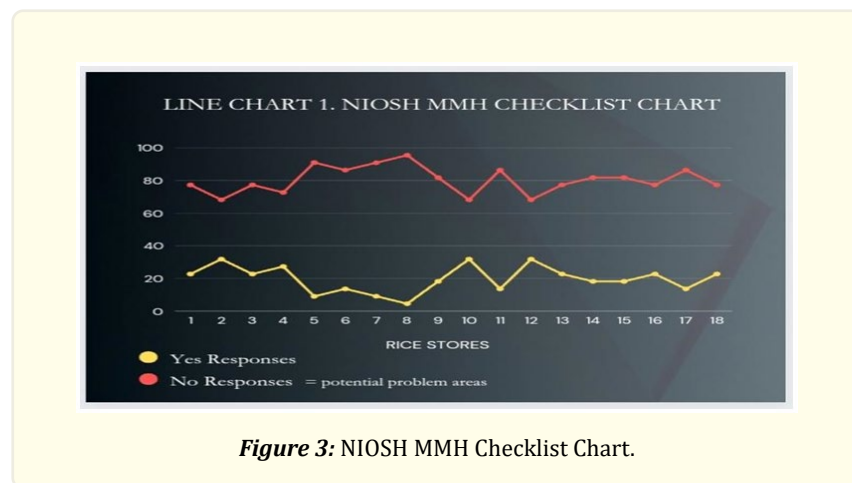


Figure 2: Pain and Discomfort in the past 7 days.

The analysis using the NIOSH Manual Material Handling (MMH) Checklist in this study revealed that 80.3% of the evaluated conditions posed ergonomic risks to rice store workers in Merida, Isabel, and Palompon, Leyte, as shown in figure 3. This high percentage underscores the significant exposure of these workers to factors that can lead to musculoskeletal disorders (MSDs).

Comparatively, similar studies in various industries have reported analogous findings. For instance, a study conducted in an automotive manufacturing company found that workers performing repetitive lifting and lowering tasks exhibited high ergonomic risks, with the NIOSH Lifting Equation indicating a Lifting Index (LI) value of 0.73, suggesting a moderate risk level (Nur Hidayah Abd Hamid & Siti Maisarah Roslin, 2017).

Another study in the animal feed industry in East Java, Indonesia, reported LI values ranging from 3.054 to 3.470 for manual lifting tasks, categorizing these activities as high risk for causing musculoskeletal complaints (Adellian Nugraha & Noeroel Widajati, 2024).



The Hazard Evaluation Checklist in this study revealed that 57.88% of the assessed work conditions in rice stores posed significant risks for developing lower back pain (LBP), as represented in Figure 4. This finding underscores the substantial ergonomic challenges faced by workers engaged in manual material handling (MMH) tasks, particularly in small-scale retail settings. Comparative analyses with recent studies highlight similar concerns across various occupational groups. For instance, a comprehensive survey conducted in Germany reported that 66.5% of workers frequently exposed to manual handling of heavy loads experienced LBP, compared to 47.3% among those with no such exposure (Seidler et al., 2021). This indicates a strong association between frequent heavy lifting and the prevalence of low back pain.

Figure 5 presents a summary of OWAS (Ovako Working Posture Assessment System) risk levels associated with various manual material handling (MMH) tasks performed by rice store workers in the 4th District of Leyte. The analysis reveals that lifting poses the highest ergonomic risk, falling under OWAS Category 4, which indicates extremely harmful postures that require immediate corrective action. The task of lowering or throwing rice sacks is classified under OWAS Category 3, suggesting that these postures are harmful and necessitate corrective measures as soon as possible. These findings are consistent with the results of Álvarez Sánchez et al. (2022) and Sarkar et al. (2016), both of which utilized OWAS assessments and consistently identified lifting and lowering of heavy loads as high-risk activities requiring prompt ergonomic intervention.

In contrast, the task of carrying was found to fall under OWAS Category 2, indicating postures with potential to cause harm and requiring action in the near future. Finally, pulling or pushing tasks were categorized under OWAS Category 1, signifying normal and acceptable postures that do not require corrective measures. These findings reaffirm that lifting and lowering heavy sacks are the most ergonomically hazardous tasks in rice store operations and should be prioritized in any ergonomic re-design or intervention plan.



Figure 4: Hazard Evaluation Checklist Chart.

Supporting this, Sarkar et al. (2016) reported that carrying loads on the shoulder or overhead is particularly dangerous, with 83% of observed postures requiring immediate intervention. These high-risk tasks are strongly associated with the prevalence of musculoskeletal disorders (MSDs), as reflected in this study, where 95% of workers reported symptoms in at least one body part. Contributing factors include the weight of the load, frequency of handling, awkward body positions, and poor coupling or grip during the task (Adhaye & Jolhe, 2023). Previous studies emphasize the need for ergonomic interventions such as task redesign, use of mechanical aids or auxiliary devices, and training in proper handling techniques (Adhaye & Jolhe, 2023; Dempsey & Maynard, 2005).

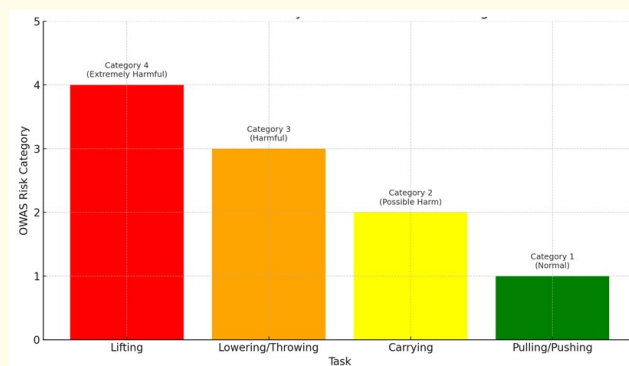


Figure 5: OWAS Risk Levels by Manual Material Handling Task.

Research suggests that ergonomic interventions such as mechanical aids, task rotation, and training programs significantly reduce these risks. In a randomized controlled trial published in 2025, ergonomic training combined with targeted exercises led to measurable reductions in pain across the upper and lower back among manual laborers (Kraiwong & Chiradejnant, 2025).

Conclusion

This study set out to (1) identify the demographic profile of rice store workers in Merida, Isabel, and Palompon; (2) determine the prevalence of work-related musculoskeletal symptoms using the Modified Nordic Questionnaire (MNQ); (3) pin-point high-risk tasks

via the NIOSH MMH and Hazard Evaluation Checklists; and (4) assess postural hazards with the Ovako Working Posture Assessment System (OWAS).

Based from the results, demographics revealed a predominantly middle-aged, male workforce working long shifts (9 - 15 hours/day) in physically demanding roles. MNQ findings showed very high rates of discomfort up to 100% in the upper back and hips over 12 months and the past 7 days. Checklist analyses flagged 80.3% of conditions as ergonomically risky (NIOSH) and 57.9% as low-back pain hazards (Hazard Evaluation). OWAS evaluation identified lifting tasks as Category 4 ("immediate corrective action required"), with carrying and lowering tasks also demanding near-term interventions.

The high prevalence of musculoskeletal disorders documented here under-scores an urgent need to prioritize ergonomics even in low-resource settings. Left un-addressed, these injuries reduce productivity, inflate healthcare costs, and jeopardize workers' livelihoods. Employers should implement ergonomic improvements such as mechanical aids, provide training on proper lifting techniques, and enforce work-rest cycles to reduce fatigue. Policymakers and local authorities are encouraged to support these initiatives through targeted health and safety programs, promoting a safer and more sustainable working environment in community-based industries.

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