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2ND INTERNATIONAL SCIENCE,
ENGINEERING AND TECHNOLOGY
COLLOQUIUM



THE POWER OF SCIENTIFIC INNOVATION

INTELLIGENT SOLUTIONS FOR A
SUSTAINABLE WORLD

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(ISETC 2025)**

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PREFACE

Welcome to the 2nd International Science, Engineering and Technology Colloquium 2025 (ISETC 2025)!

It is with great pleasure that we present this year's colloquium, a distinguished gathering of scholars, researchers, and professionals dedicated to the advancement of applied sciences. Held virtually on 9th July 2025, ISETC 2025 serves as a platform to highlight cutting-edge research, foster meaningful networking, encourage collaborations, and explore innovative solutions to global challenges.

This year's theme, "The Power of Scientific Innovation: Intelligent Solutions for a Sustainable World" highlights our shared goal to solve global challenges through applied science. It celebrates innovation as a key to building a more sustainable and resilient future. We're proud to feature keynote speakers and presenters who bring fresh insights, bold ideas, and breakthroughs shaping tomorrow's world.

We would like to extend our heartfelt appreciation to the Faculty of Applied Sciences, Universiti Teknologi MARA, Perak Branch, Tapah Campus, for their outstanding support and assistance throughout the planning and execution of the event. Their dedication has been instrumental to the success of this colloquium. We would like to sincerely thank all participants and researchers for their valuable contributions. We also appreciate the reviewers for their careful evaluations and helpful feedback. Your hard work and support mean a lot to us.

As editors, we are proud to present this collection of proceedings. It is an honour to bring together the interesting and meaningful work of our speakers and authors. We hope the ideas shared will lead to new discoveries, encourage more research, and help solve global challenges through science and innovation.

Warm regards,

Dr. Emi Norzehan Mohamad Mahbob

Dr. Saiyidah Nafisah Hashim

Ms. Lili Widarti Zainuddin

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ISETC 2025 Proceedings Editors

AN EVALUATION OF STORE EMPLOYEES USING NIOSH LIFTING INDEX

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Abstract: Most workers in convenience stores tend to perform tasks using improper techniques, including awkward postures and incorrect methods of lifting heavy loads. This project aimed to evaluate the lifting activities of workers at Lotus's convenience store using the NIOSH Lifting Index (LI) to identify ergonomic risks and recommend practical solutions. Workers in such retail environments frequently engage in manual handling tasks such as lifting heavy boxes and stocking shelves, often without adequate rest or ergonomic support. Seven workers were interviewed and observed as part of the study. Measurements based on the NIOSH LI parameters were collected and analyzed using the NIOSH LI app. The results showed that five workers had LI values below 1.0, indicating a low risk of injury. However, two workers, who were handling heavier items such as sacks of rice and large boxes, recorded LI values above 1.0, suggesting an increased risk of musculoskeletal disorders (MSDs). Poor posture, heavy loads, and lack of support especially during peak working hours contributed to the elevated risk. The findings highlight the importance of safe lifting techniques, teamwork, and better staffing to reduce physical strain. Recommendations include using team-lifting strategies, hiring additional workers during weekends, and providing ergonomic training. Overall, this study demonstrates the usefulness of the NIOSH LI tool in assessing workplace safety and improving manual handling practices in retail settings.

Keywords: *Musculoskeletal disorders (MSDs), Lifting Index, workplace ergonomics*

INTRODUCTION

Workers in convenient stores such as Lotus's always lift heavy boxes and loads every day. Eventually this work has become a routine, and it is not good for their body posture. This is because lack of rest can lead to injuries. For example, their shoulders or lower back will get injured as they have lifted heavy load for a long time and took a long time for recovery. But because of the sake of work, they are required to do it every day even though they are still in recovery condition. Moreover, they also have arranged many products at the top of shelves. Usually for short workers, it became hard for them to reach the top. As a result, workers will stretch their bodies to reach the top.

The main objective of this project is to assess the lifting activities performed by workers using the NIOSH Lifting Index (LI) application and to provide appropriate solutions aimed at reducing the identified LI values. NIOSH developed the mathematical lifting equation to help predict the risk of lifting injuries. The Lifting Equation defines a Lifting Index (LI) based on the Recommended Weight Limit (RWL) for specific lifting tasks that most workers could perform in an eight- hour day without increasing the risk of developing low back pain (National Institute for Occupational Safety and Health, 2024). By evaluating the current lifting practices, the project identifies potential ergonomic risks and recommends safer lifting methods and improvements in work practices to minimize the risk of musculoskeletal disorders and enhance workplace safety.

In Mohd Zubairy's case study, workers were tasked with picking up a 4 kg front car bumper using both hands, then lifting and carrying it to another assembly platform. The body parts mainly involved were the hands, fingers, and neck, while the upper and lower back (torso) were heavily used during the lifting and lowering processes (Shamsudin & Shahid, 2019).

Work-related musculoskeletal disorders (WMSDs) are common health problems caused by repeated physical strain at work. These include tasks involving heavy lifting, repetitive motions, awkward body positions, and forceful

exertions. The study provides strong evidence from many industries showing that such working conditions are linked to pain and injuries in muscles, joints, and other parts of the body. The authors also emphasize that WMSDs can lead to reduced productivity and long-term health issues if not addressed properly (Punnett & Wegman, 2004).

Ergonomics focuses on fitting the job to the worker designing tools, workstations, and tasks for safety, comfort, and efficiency (Occupational Safety and Health Administration [OSHA], n.d.).

MATERIALS AND METHODS

The method used in this project was entirely based on the NIOSH Lifting Index (LI) guidelines. This approach was selected to address the identified problem, where workers at Lotus's are required to lift and arrange loads continuously throughout the day. To ensure their physical well-being, the NIOSH LI app was used to calculate the Lifting Index values. Data collection involved interviewing seven workers, asking relevant questions such as their daily working hours and the weight of loads they typically handle. The responses were recorded in a table.

Simultaneously, on-site observations were conducted to assess whether the workers performed their tasks using proper lifting techniques. All necessary measurements were taken according to the NIOSH LI parameters, originally in inches but later converted into meters for the purpose of this project. After calculating the LI values using the app, appropriate advice was given to each worker—either to continue their current practices if the LI was within a safe range or to adopt safer lifting techniques if the risk was deemed high.

RESULTS AND DISCUSSION

All seven workers involved in the project were evaluated using the NIOSH Lifting Index (LI). The results showed that most workers handled loads below 5 kg, leading to LI values under 1.0, indicating a low risk of injury. However, two individuals, Worker E and F, scored LI values above 1.0. These higher values were due to their tasks involving heavier loads such as carrying sacks of rice and large boxes. These workers are more exposed to potential musculoskeletal disorders (MSDs), especially due to the weight and frequency of their lifting tasks. In general, most of the workers reported working between 6 to 8 hours per day, which increases their exposure time to lifting tasks but not necessarily their injury risk if the load is within a safe range.



Figure 1. Improper Worker Postures During Lifting Tasks

As shown in Figure 1, workers demonstrated varying lifting techniques, significantly influencing their Lifting Index (LI) values. A proper posture, such as bending the knees while keeping the back straight, resulted in a low LI value of 0.1, indicating minimal risk. In contrast, improper posture characterized by keeping the load far from the body and bending the back, increased the horizontal multiplier in the LI calculation, contributing to higher risk levels.

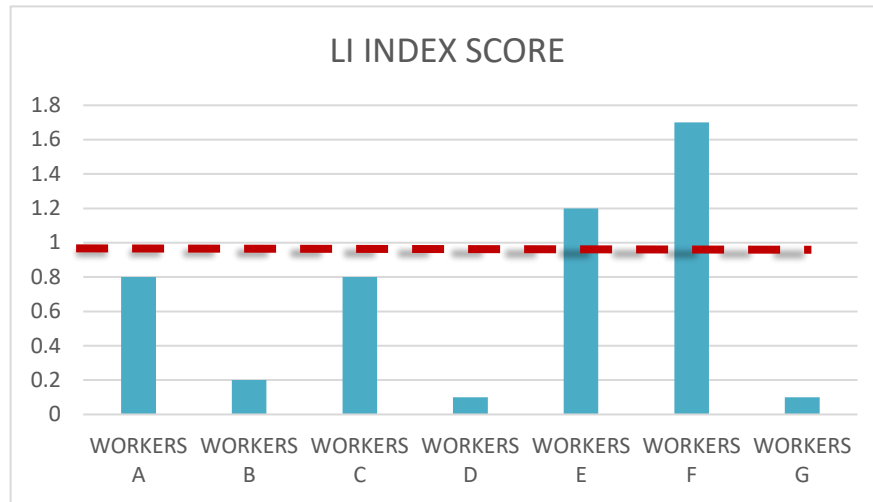


Figure 2. LI Index Score for 7 Workers

The results of the LI assessments for all seven workers are summarized in Figure 2. While the majority recorded LI values below 1.0, indicating low ergonomic risk, two workers identified as Worker E and Worker F exceeded this threshold. These elevated values were primarily due to heavier load handling and poor lifting techniques, underscoring the need for targeted ergonomic interventions.

One worker with a low LI value of 0.1 demonstrated a safe lifting posture by bending the knees and keeping the back straight while lifting. This approach helps reduce strain on the back and is considered safe when handling lighter loads. Repetitive lifting using this method does not significantly increase injury risk, as the posture minimizes awkward movements. On the other hand, a worker with an LI value of 1.2 was found to be lifting in an improper way, mainly due to poor body posture and keeping the load too far from the body. This increased the horizontal multiplier in the LI calculation, leading to a higher overall risk. Repeated lifting in this position can lead to back injuries and other forms of MSD.

The highest LI value observed was for a female worker tasked with lifting heavy sacks of rice during a weekend shift, when fewer workers were available. Due to the excessive load and lack of support, she struggled to complete the task safely. A recommended solution is to assign such tasks to two workers at a time to distribute the load, reducing strain on a single person. Additionally, the employer should consider hiring more workers, especially for high-demand periods like weekends, to improve task distribution and enhance workplace safety.

CONCLUSIONS

This project successfully evaluated the lifting activities of workers at Lotus's using the NIOSH Lifting Index (LI) as a guideline. The findings revealed that while most workers operated within a safe lifting range ($LI < 1.0$), two workers exceeded the recommended threshold, indicating an increased risk for musculoskeletal disorders (MSDs). These cases were linked to improper lifting posture and handling of heavy loads, particularly during understaffed periods such as weekends. The project emphasizes the importance of proper lifting techniques, workload distribution, and ergonomic awareness in minimizing injury risks. By identifying hazardous practices and proposing simple interventions such as team lifting, hiring additional staff, and training on body mechanics, this study demonstrates how the NIOSH LI tool can be effectively used to enhance worker safety and reduce physical strain in retail environments. Employers are encouraged to implement these findings to promote a safer, more supportive workplace.

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Tarikh : 20 Januari 2023



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Sekian, terima kasih.

"BERKHIDMAT UNTUK NEGARA"

Saya yang menjalankan amanah,

Setuju.

27.1.2023

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Timbalan Ketua Pustakawan

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