

The Hercules Harness – Ergonomic Study Results

Musculoskeletal (MSK) disorders, particularly low back pain, (LBP), are highly prevalent and one of the leading causes of disability in the general population with annual direct health care costs exceeding \$85 billion dollars annually. According to the 2018 Liberty Mutual Workplace Safety Index, injuries related to overexertion, (lifting, pushing, pulling, holding, carrying) were the leading cause of workplace injuries, costing businesses more than \$13.6 billion. Preventing back injuries can be a major challenge for employers. Although no approach has eliminated back injuries, the frequency of injury could be minimized by incorporating an effective lifting device that properly distributes loads in a safe and more ergonomic manner.

The Hercules Harness a wearable, lightweight harness, was conceived to assist in manually moving objects while promoting proper carrying techniques. It is designed to reduce muscle strain and fatigue to the neck, shoulders, arms and back. The easily adjustable harness straps ensure a proper fit for all body types and sizes while properly distributing the weight of heavy objects. The harness' secure closure is safe and easy for a user to put on and take off without assistance.

A subjective and objective ergonomic evaluation study of The Hercules Harness was conducted in February 2023. This study was a comparison of subjects performing a variety of lifting and carrying tasks while wearing The Hercules Harness and without. Surface Electromyography (sEMG) of select muscle groups was used to quantify the muscle activity while wearing the harness, performing a variety of tasks compared to not wearing a carrying aid. Subjects were recruited to participate in the study. Two boxes (12.5" by 12.5" by 16") were filled with sand to 25 and 50 pounds. The boxes were moved and lifted in a variety of ways as sEMG was measured. All subjects were also asked to complete a set of subjective questions upon completion of the sEMG data collection.

The results of the objective muscle testing measurements indicate The Hercules Harness is able to reduce muscle activity when carrying both 25 and 50 lbs. boxes on flat surfaces and up and down stairs. Specifically, The Hercules Harness reduced the average back muscle activity by 51% for the flat carrying task, 56% for a lift and twist task, 60% for the lift and pivot task, and 43% for the stair climbing task not using handrails, and 56% for the stair climbing task using handrails carrying the 25 lbs. box. Task performed with the 50 lbs. box also saw a lesser but significant amount of muscle activity reduction.

Subjectively on the completion questionnaire, a clear preference for wearing the Hercules Harness was noted from all subjects reporting better comfort and increased productivity while wearing the harness and performing the selected tasks.

Overall, the study indicates The Hercules Harness has advantages when performing carrying tasks for all subjects showing a 50% and 39% reduction in back muscle activity for men for the 25 and 50 lbs. box conditions respectfully; and a 12.5% reduction in back muscle activity for women for a 25 lbs. box. Individual differences indicate that body mechanics and proper carrying technique is important. When subjects are familiar with the Hercules Harness and how best to utilize the platform to minimize muscle effort, there was an increased reduction in muscle activity.