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# Characterization of cashier shoulder and low back muscle demands

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ABSTRACT

Cashiers commonly report musculoskeletal discomfort in their shoulders, neck, and low back. This may result from excessive loading, awkward postures, insufficient rest, or task repetition. Recently, widespread introduction of reusable, consumer-supplied bags has introduced challenges in assessing exposures in this occupational group. Limited information exists on the physical demands associated with cashier work, particularly in the context of multiple bagging formats; this study was thus designed to generate a novel data set describing standard grocery packaging tasks. Twenty-five experienced cashiers completed 36 grocery packaging tasks consisting of twice performing all combinations of workload intensity (6, 20 items), workstation height (low, medium, high), and packaging type (plastic bags, reusable bags, bins). Surface electromyography (EMG) was measured bilaterally for 5 shoulder and 3 low back muscles and processed to generate integrated muscle demand for each combination evaluated. A mixed effect ANOVA was used to assess the influences of gender, intensity, package type, side, (muscles on the right or left side of the body) and workstation height on individual and total muscular demands. High workload intensity combined with several other factors to increase muscle demands, including using plastic or reusable bags for packaging and increasing workstation height. Gender and side also interacted with workload intensity to influence muscle activity. Encouraging rest breaks, the use of bins for packaging, and decreasing cashier workstation height may help reduce potentially injurious muscular effort for cashiers.



## 1. Introduction

Musculoskeletal injuries of the upper extremity and low back are highly prevalent in grocery cashiers. In 2009 cashiers accounted for 35% of work related injuries among retail workers in Ontario (Health and Safety Ontario, 2011). Forcier et al. (2008) completed a survey including employees from 57 supermarkets and reported that cashiers accounted for 48 of the 140 injuries reported (Forcier et al., 2008). Awkward or static postures, repetitive movements, minimal rest, and excessive manual loads all may contribute to increased muscular demands for the shoulder and low back (Bjelle et al., 1979). However, it is still unknown how modern cashier work environments influence muscular demands of the upper extremity.

Ergonomic interventions exist to limit the exposure to potentially harmful cashier postures and tasks. Current Occupational Safety and Health Administration (OSHA) guidelines suggest that bagging areas should be located at a height of 50.8 cm from the ground (OSHA, 2004). However, a recent analysis concluded that bagging area height was the least compliant area in a grocery store with regard to OSHA guidelines. The mean bagging area height was 108.4 cm from the ground (Shinnar et al., 2004), more than double the recommended height. This discrepancy is especially notable in the context of work by Grant and Habes (1995), in which heights above 114.3 cm caused increased shoulder and elbow demands to lift groceries into packaging containers, putting the cashier in awkward postures 8.7–83% of the time (Grant and Habes, 1995).

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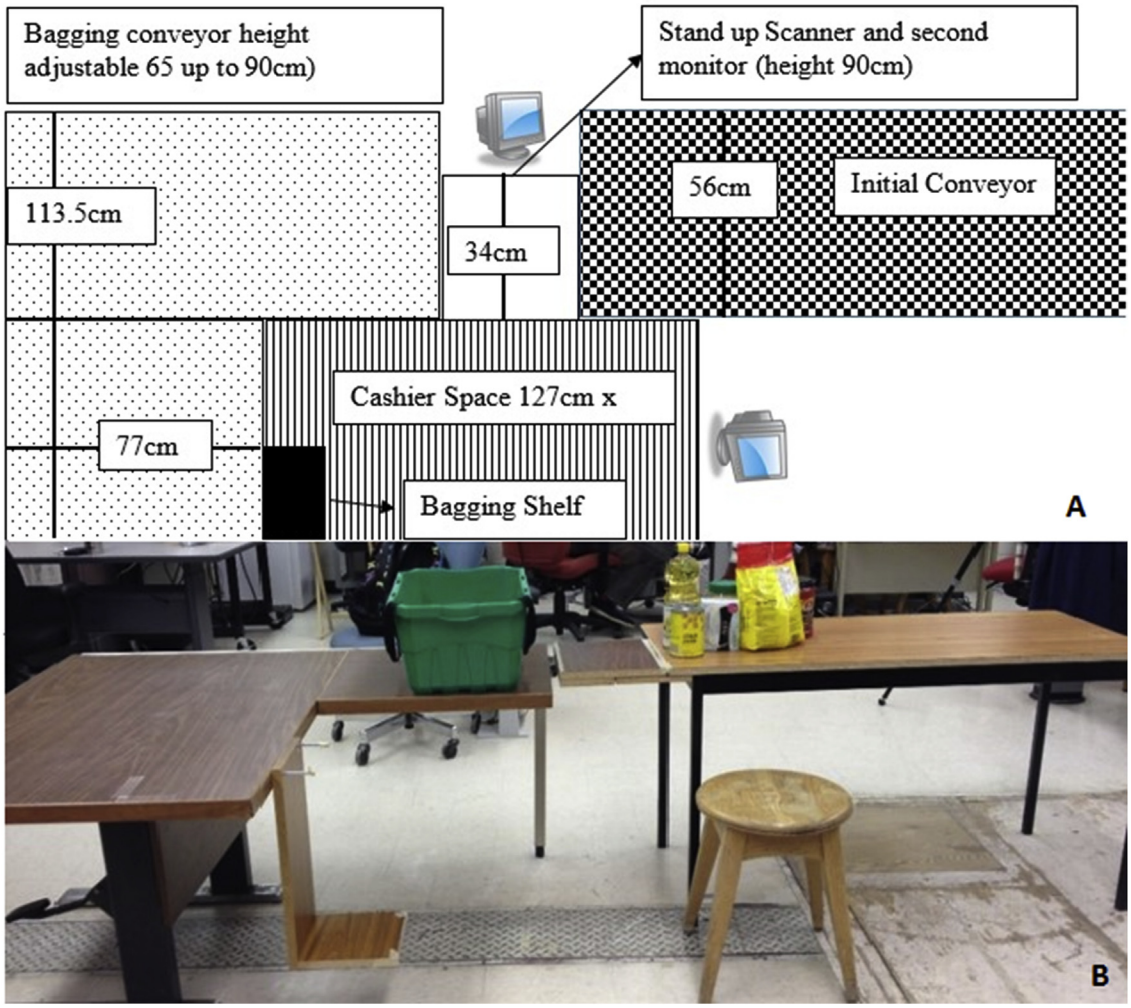


**Fig. 1.** A schematic of the experimental setup (A) and the laboratory setup (B).

Recently, many customers have adopted enviropackaging, which includes reusable bags and bins, rather than disposable plastic bags. Since the introduction of enviropackaging, the average grocery package weight has increased from 4.5 kg (10lbs) to approximately 12.7–17.2 kg (28–38lbs) (Health and Safety Ontario, 2011). This increase in weight likely also increases the demand on cashiers, as they are now frequently required to move heavier loads. Although the adoption of enviropackaging has environmental motivations, its effect on the musculoskeletal exposures of cashiers is not immediately evident. The effect of bins on cashier musculoskeletal demand has been relatively unstudied; this type of packaging has decreased height compared to reusable bags, which may enhance packing ease. Additionally, the rigidity of the bins permits placement of items within the packaging without the need to use the contralateral limb to hold the package open. Characterization of the individual and combined effects of enviropackaging and workstation dimension on cashier musculoskeletal demand would allow ergonomists to implement changes to existing workstations and work tasks to reduce musculoskeletal demands for the cashier population.

The purpose of this study was to evaluate the influence of workstation height, packaging type, and workload intensity to determine which individual or combined factors have the strongest influence on muscular demand in a group of cashiers. It was hypothesized that a reduction in overall muscular demand would coincide with the use of lower workstation areas, bins, and lower intensity trials. The lower workstation height may reduce the muscular effort of the shoulder; as lower arm elevations would be needed to lift items into the package. Similarly, the lower height of the bins compared to plastic or reusable bags reduces total lifting distance to move items from the workstation into the package, and the rigid sides of the bin may eliminate the need for stabilization of the package. Finally, lower intensity trials intuitively require a smaller overall demand because fewer items are handled and packaged.

## 2. Methods

### 2.1. Participants

Twenty-five experienced cashiers (10 male, 15 female; age = 21.5 ± 1.9 years, height = 1.72 ± 0.08 m, body mass = 69.7 ± 10.9 kg, experience = 2.0 ± 1.3 years) participated. Exclusion criteria included self-reported upper extremity or back discomfort or injury within the past year. The study protocol was approved by the University of Waterloo Research Ethics Board and all participants provided written informed consent.