Abstract

**Introduction.** Upper limb and back injury caused by Manual Material Handling (MMH) in construction context are a significant risk among workers and productivity. Ergonomic research in this context raises methodological challenges, owing to its labor dynamics and heterogeneity of movements realized during the workday. These elements influence the quantitative and quality characteristics of load in the workstation. For instance, the techniques selected to realize each task defines kinematics of each limb, determining the energy necessary executed by the musculoskeletal system of each workers during the tasks. The increase of musculoskeletal requirements of workers increases their risk to develop Work-related Musculoskeletal Disorders (WMSDs). Therefore, selecting appropriate techniques of MMH influences performances and health of workers, avoiding decreases in productivity and welfare of organizations. The aim of this work was compare each techniques of dynamic-asymmetric manual handling over upper limbs and trunk biomechanics.

**Subjects and method.** An analytic, non-experimental and transversal study was realized, with a convenience sampling of one hundred healthy university students in work-age from Chile. Subjects performed a manual handling of a weight (15 pounds). Five techniques was evaluated: a) Weight lifting with an elbow flexion of 90 degrees; b) Weight lifting over arms level (symmetrical); c) Asymmetrical Weight lifting, with a hand over arm, and other at level of hip; d) Weight lifting with both hand at level of hips; e) Weight lifting with dominant upper limb. The data was obtained in the Laboratory of Analysis of Movement of Universidad de Chile, using a BTS bioengineering system and a surface and wireless electromyography (EMG) system to obtain kinematic and electrophysiological data (superior trapezius, inferior trapezius and Spinal erector of each side). This information was processed using the system 3DSSPP (University of Michigan), obtaining the kinetic information of each techniques (upper limb and L5/S1 joint moment and compression force of L5/S1). Additionally, the scale CR-10 about effort perception was applied to the participants. IBM SPSS Statistics software (SPSS v.20, IBM Corporation,) was used for all statistical analyses.

**Results.** There is no differences between man or women in the most of variables analyzed (except in CR-10). Univariate ANOVA and Kruskall-Wallis results (depending of distribution of variables) demonstrated that upper limb moment and EMG activity are significantly affected by techniques used (p < 0,001). Nevertheless, trunk moment and force of compression was not affected by the strategy selected (p value of 0,39 and 0,139 respectively). Using a post-hoc test (Scheffe), we found differences between techniques. The asymmetric technique of MMH and the upper arms MMH are the most demanding. There is a significant and important correlation between every muscular group (0,6, p<0,001).

**Discussion.** These findings suggest that handling loads in a lower position could work as a protective strategy during sudden loading, especially avoid techniques similar to asymmetrical and symmetrical over arms techniques. The human body uses all the elements possible to realize each tasks, therefore contralateral elements will be necessaries to achieve the techniques, acting like a synergy.