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GENDER DIFFERENCES IN TRUNK MUSCLES RESPONSE DURING LOWERING TASKS OF LIQUIDS

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SUMMARY
The revised NIOSH lifting equation is a widespread risk assessment tool that it is used in the decision-making process of designing a job that contains repeated lifting tasks. A limitation of the equation is that it does not include unpredicted factors like unstable loads.

INTRODUCTION
Several ergonomic assessment tools can be used to make useful inferences about an individual working on a given job in order to identify potential precursors of developing Work Related Musculoskeletal Disorders (WRMSDs) before workers develop symptoms severe enough to require medical treatment and to lead to *work absenteeism* and *work disability*. If these tools cannot be used preventively, when a workstation is designed, they have to be used in-situ during the work process in order to determine which specific jobs or worker characteristics are most likely to be the cause of the WRMSDs or worker performance problems and therefore redesign ergonomically unacceptable workstations. The basic idea behind every ergonomic assessment tool is that job physical demands should not exceed the worker physical capacities, because any mismatch of human physical capacities and human manual performance requirements in industry may produce, or aggravate, WRMSDs [1, 2]. The revised NIOSH lifting equation is a widespread risk assessment tool that it is used in the decision-making process of designing a job that contains repeated lifting tasks [3]. A limitation of the equation is that it does not include unpredicted factors like unstable loads.
Therefore, the aim of this study was to determine the effect of unstable load and its interaction with the NIOSH equation multiplier factors on the trunk musculature during lowering tasks. Moreover, it was investigated whether these differences were consistence between males and females.

METHODS
A split-plot experimental design with repeated measurements on experimental units was used in this study in order to investigate the main effects of four subject-normalized factors: Load (liquid or solid, weight = 67 N),

Vertical (knee or hip) and Horizontal distance (near or far) and Asymmetry (0º or 45º, left turn) and their interactions, on the control of voluntary trunk movements during lowering tasks (3 lift cycles, 30 lifts/sec) for 7 males and 7 females participants. Therefore, each participant was considered as block and repeated measurements made on each block under factorial treatment structure. The response variable was the RMS of the EMG amplitude of each of the 10 studied muscles, left and right: erector spinae, rectus abdominis, external and internal obliques and latissimus dorsi. The myoelectric signals were registered using the active sEMG sensors DE-2.3 (Delsys Inc., Boston MA) and digitized at a rate of 1 KHz using the Myomonitor IV (Delsys Inc., Boston, MA) portable EMG 16-ch system (16 bits, range ± 5 V). Once ECG artefacts removed [4], the EMG signal was filtered (4th - order Butterworth, 20 - 450 Hz) [5], demeaned and stored in ASCII files.

Figure 1: Experimental set up showing a subject during the lowering task.

RESULTS AND DISCUSSION
The results of the mixed ANOVA revealed that the gender interacted in some way with the combined effect of the within-subjects independent variables indicating that unstable load influence different the muscle intervention between males and females (Figure 2). Further investiga-

tion is needed to understand how unstable loads influence muscle intervention and consequently internal loads on tissues and anatomical structures.
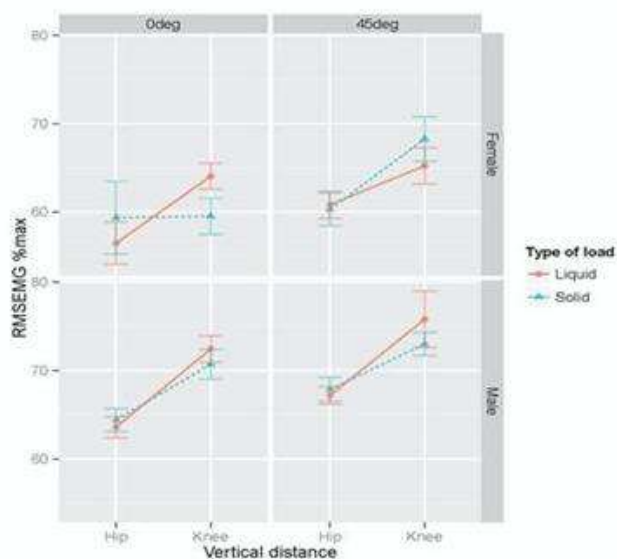

Figure 2: Mean RMSEMG (%max) of the Gender×Asymmetry×Load×Vertical interaction term for the right rectus abdominis muscle.

CONCLUSIONS
Manipulating unstable loads was investigated during lowering tasks in order to determine its effect on the musculoskeletal effort and motor control between males and females. Differences have found.

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