

Muscle loading and psychophysical effects of obesity during vertical handling tasks

Colim¹, A., Arezes¹, P., Flores², P., Monteiro³, P. & Mesquita³, I.

¹ Research Centre for Industrial Technology Management, University of Minho

² Centre for Mechanical and Materials Technologies, University of Minho

³ Centre of Movement Studies and Human Activity, Superior School of Technology of Health of Porto

1. Relevance of the work:

- **Obese** subjects represent a **growing fraction of the workforce**.
- **Obesity** is associated with **physical problems**, including work-related musculoskeletal disorders (**WRMSD**).
- **Vertical handling tasks** are very **common** in a wide variety of **workplaces** and represent one of the principals **WRMSD** risk factors.
- It is needed a more complete understanding of **obesity effects** on work performance.

2. Objective: To study the **obesity effect** on **physical loading** during manual lifting.

3. Materials and Method:

3.1. Individuals' Categorization

%Body Fat Mass (BFM)
Bioelectrical impedance

Obesity Levels:

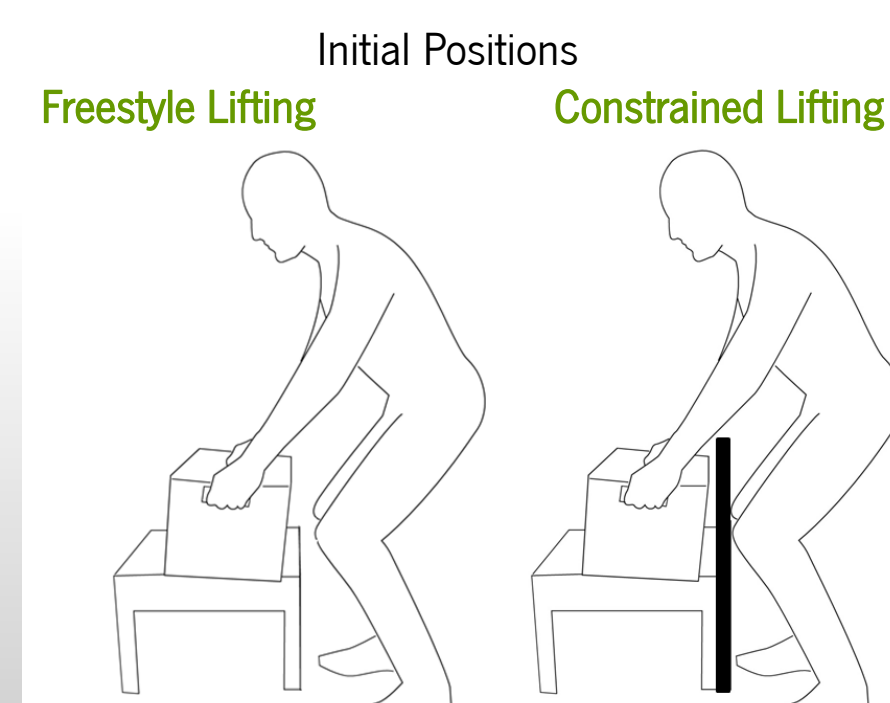
- Normal** - 5 subjects
- High** - 4 subjects
- Too High** - 5 subjects



Body Fat Monitor
OMRON BF306

3.2. Experimental Trials

- Subjects **lift** (and replace) the box between their **knees and shoulders** height.
- **6 lifting trials** = **3 loads** (5, 10 and 15 kg) x **2 styles** (free and constrained with a high barrier).



3.3. Surface Electromyography (EMG) and Psychophysical data

EMG → A portable surface electromyography system (PLUX wireless biosignals) was used while the subjects performed the manual lifting tasks.

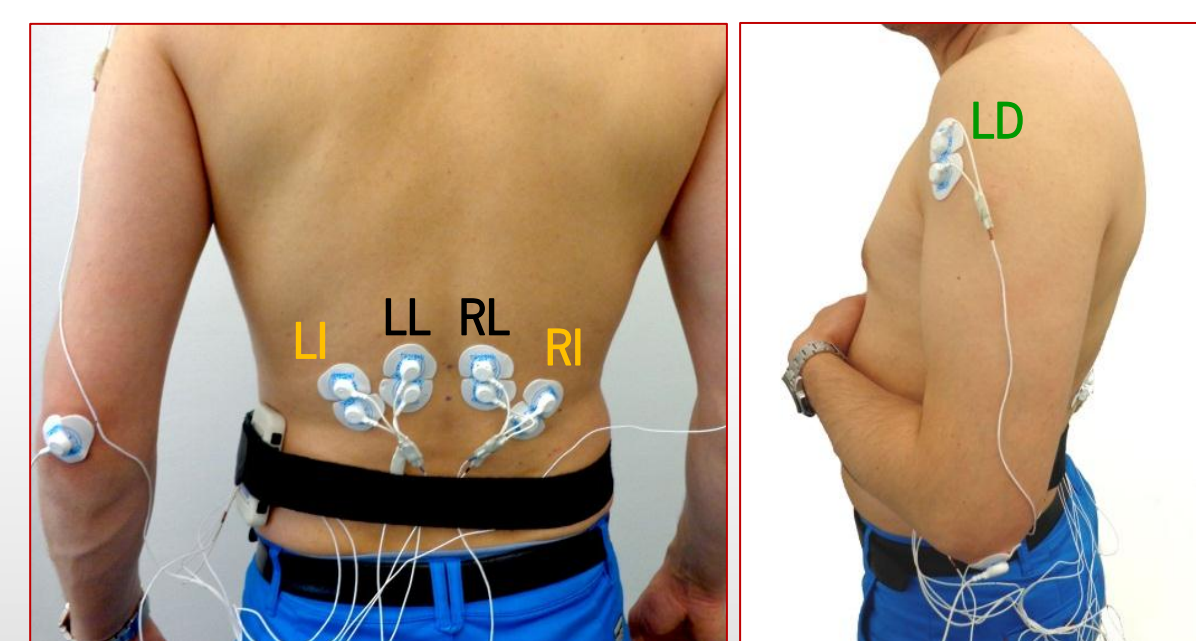
Muscles studied:

- Left and Right *Erector spinae (Longissimus)* at L1 (LL, RL);
- Left and Right *Erector spinae (Iliocostalis)* at L2 (LI, RI);
- Left and Right *Deltoideus Anterior* (LD, RD).



Psychop. → After each trial, the subjects reported their physical effort – **Borg' Rating Perceived Exertion (RPE)**.

Rate of Perceived Exertion, Borg's CR-10 scale	
10	Extremely Strong
7-8-9	Very Strong
4-5-6	Strong
3	Moderate
2	Weak
1	Very weak



EMG data were normalized to peak value – **Maximum Contraction during the task (%MCT)**.

4. Results and Conclusions:

- Positive statistical association between **%BFM** and **%MCT** is established for different muscles studied ($p < 0.05 / p < 0.01$ by Pearson correlation test).
- Using **%BFM** as an indicator of the obesity level, it seems that the **obesity** seems to originate an **increasing muscle loading** during manual lifting tasks and it is, most likely, a contributor to **WRMSD** appearance.
- **Obesity** does not seem to influence the psychophysics data.
- A **kinematics study** will be developed to achieve a better understanding of the obesity effects on individual lifting capability.
- Globally, these results may highlight the importance to consider the workers' anthropometric variability in workplaces, including those with obesity.

