

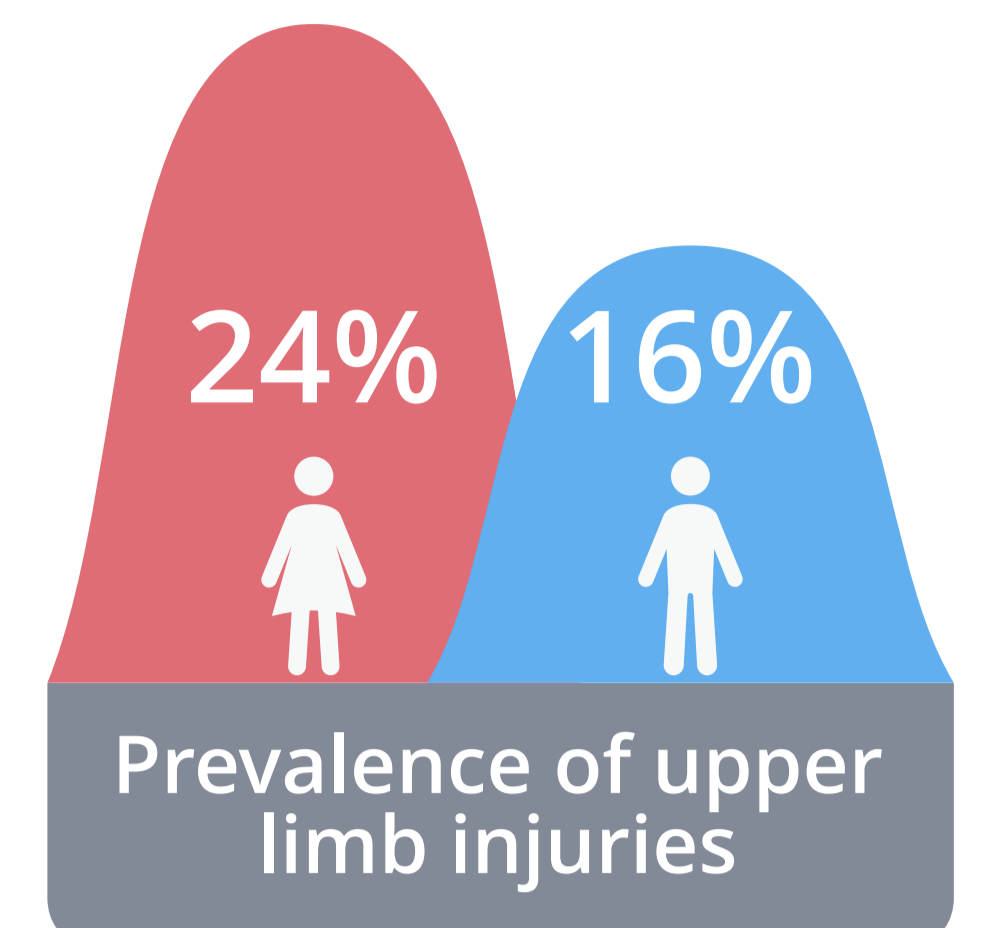
SEX-SPECIFIC SCAPULO-HUMERAL RHYTHM DURING A LIFTING TASK

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Introduction

- Upper limb injuries have been associated with work factors but also with individual risk factors including **sex** [1].
- Sex differences in motor behaviour have been identified [2], but not for **dynamic shoulder movements**.
- The interaction of the shoulder joint during arm elevation is commonly assessed using the **scapulo-humeral rhythm** (SHR).
- This study investigated sex differences in the SHR during a lifting task.



Methods

Population

- **25** women **25** men (*asymptomatics and novices*).

Task

- Participants moved a box between two adjustable shelves located at **hip** (0%) and **eye** level (100%).
- The mass of the box was set at **6** and **12 kg** (*maximum acceptable mass for 90% of female and male, respectively*).



Kinematics

- Kinematics of the upper limb was recorded with *VICON* cameras and a 43 markers set.
- A 25 degrees-of-freedom kinematic model was constructed.

Scapulo-humeral rhythm

- SHR was computed **dynamically** using a 3D approach [3], which includes all rotations of each shoulder joints:

1. Compute the thoraco-humeral elevation (TH_{all});
2. Set the glenohumeral joint to its reference orientation;
3. Compute the thoraco-humeral elevation (TH_{scap});
4. Compute the SHR as $SHR = TH_{all} \div TH_{scap}$

Statistics

- Women's and men's SHR were compared using **statistical parametric mapping**.
- Non-parametric 2-ways ANOVA ($sex \sim mass$, with repeated measures on mass).

Results

Sex ~ mass Interaction

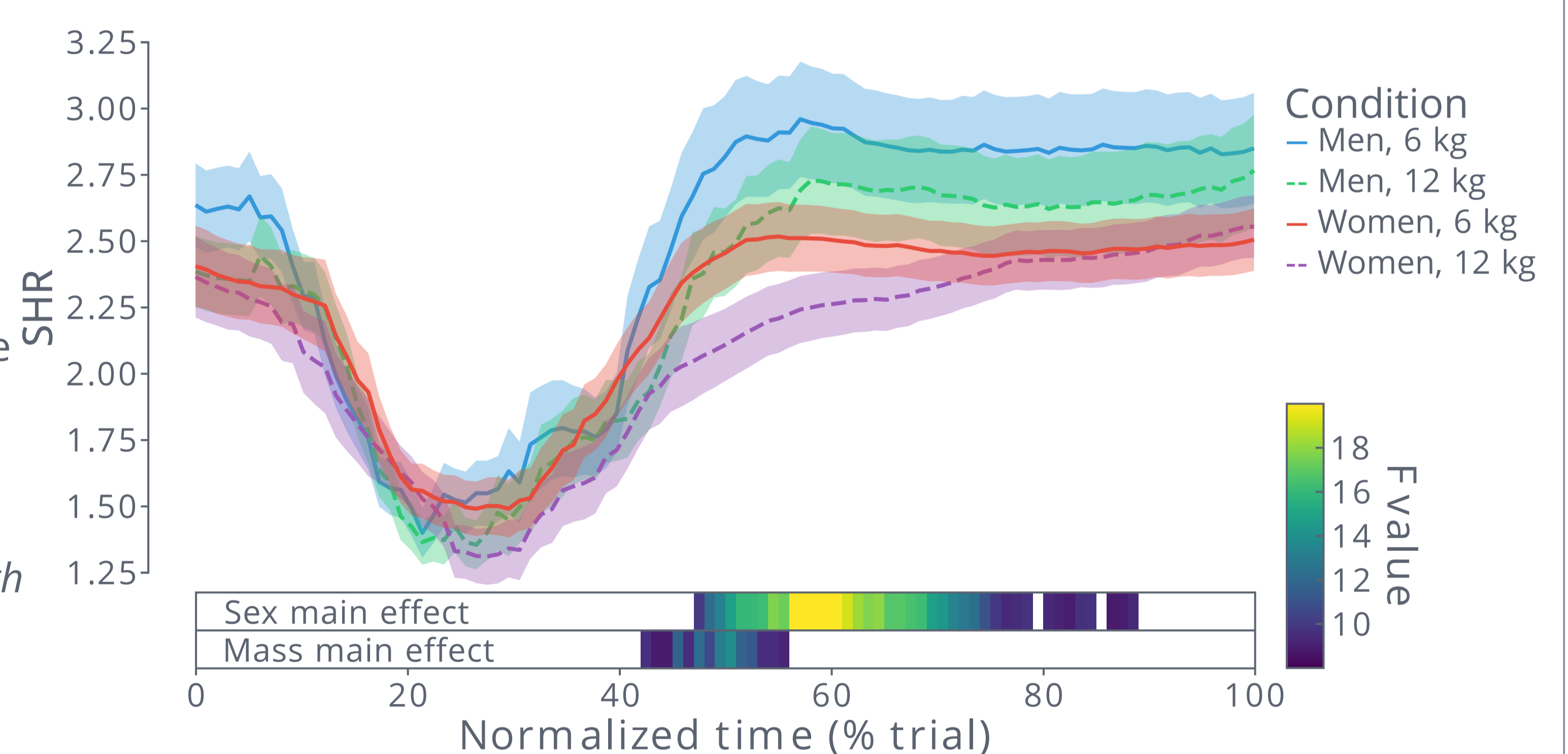
- There was no interaction sex-mass.

Sex main effect

- SHR is systematically higher in men than in women during the last half of the trial.

Mass main effect

- SHR is systematically higher at 6 kg compared to 12 kg (*in both men and women*).



Discussion

- **Men are more likely to use the glenohumeral joint and/or less the scapulo-thoracic joints** to lift a box at eye level at either 6 or 12 kg.

- We can hypothesize that men do not require as much effort as women to lift the box, in accordance with biological differences [2].

- When effort are closer to the maximal capacity, the glenohumeral joint cannot contribute as much and **the arm elevation relies on the scapulo-thoracic joint**.

- This is confirmed by a higher SHR at 6 kg compared to 12 kg.

References

1. Côté, J. N., (2012). *Ergonomics* 55 (2): 173-82 ;
2. Robert-Lachaine, X., et al., (2015). *CMBBE* 18 (3): 249-58 ;
3. Treaster, D., et al., (2004). *Ergonomics* 47 (5): 495-526.