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# Does the instruction influence voluntary force production regardless of gender during a handgrip exercise?

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The aim of this study was to compare the results ofmaximal voluntary contraction (MVC) and maximal rate of force development (MRFD) in women andmen during handgrip exercise performed following three different instructions:Oral instruction (OI):Started with audible tripping andaccompanied by encouragement during the whole muscle contraction. Triggered instruction (TI): Same as oral instruction, but without encouragement. Self-initiated instruction (SI): The subject himself decided to start and to stop the contraction. Women's MVC and MRFD withOI were higherthan SI. No significant differencehas been found between instructions in men. Our results suggested that women are more sensitive to the instructioneffect compared to men. Further explanations will be proposed using surface EMG and fMRI measurements. **Key words:**Instruction, gender, MVC, MRFD, handgrip

#### INTRODUCTION

Forceproductiondepends on centralandperipheral nervous system.Maximal voluntary contraction (MVC) and Maximal rate of force development (MRFD)are defined as peripheralmeasures of neuromuscular performanced uring isometric contractions(Blackburn andal., 2009).Many studies have demonstrated that performanceduring isometric contraction is influenced by the type of instruction given to the subject (Hard and Fast, Slow and gradual, Fast) (Bembenetal., 1990;Sahaly et al., 2001). Furthermore, MVC and MRFD are higher in men than in women(Häkkinenetal., 1991). This gender effect is explained by anatomical (cross-sectional area of muscle), physiological (muscle type), cognitive difference, etc.To our knowledge, no study has examined the possible prospectivedifference in the treatment of cerebral information associated with muscle response between men and women, and the influence of the instruction during muscle contraction.The aim of the present study was to compare the response of men and womento instruction during maximal handgrip contraction.

#### **METHOD**

23 right-handed adult participated in the study: 12 women  $(30.4 \pm 7.6 \text{ years}, 61.5 \pm 8.3 \text{ kg})$ and 11 men  $(29.4 \pm 3.9 \text{ years}, 84.0 \pm 14.4 \text{ kg})$ . The subjects performed 5 maximal voluntary contractions of 4.4 seach, with 44-srecovery between exercises at each instruction: i)Oralinstruction(OI), an audible signalat the beginning of the contraction followed by a prerecorded vocalencouragement. ii) Triggered instruction (TI), same asoral instruction, but without encouragement. iii) Self-initiated instruction (SI), the start and the stop of the contraction initiated by the subject himself. At each instruction, the 3 bestvalues of MVC and MRFD were averaged and included in the statistical treatment of data. MVC and MRFD were expressed in absolute units (kgandkg.s<sup>-1</sup>), reported to body mass (kg.kg<sup>-1</sup> and kg.s<sup>-1</sup>.kg<sup>-1</sup>) and reported to body mass<sup>0.67</sup> (kg.kg<sup>-0.67</sup> and kg.s<sup>-1</sup>.kg<sup>-0.67</sup>).

The instruction effect was tested using aone-way ANOVA with repeated measures inmen and women separately.

#### RESULTS

In women's MVC results, theone-way ANOVA with repeated measuresshowed a significant effect of instruction whatever the expression of results [in kg (P= 0.023), in kg.kg<sup>-1</sup> (P= 0.016) and in kg.kg<sup>-0.67</sup>, (P= 0.018)]. The post-hoc Bonferroni t-test showed that MVC was higher with OI instruction compared with SI instruction (P=0.023, P=0.015P=0.017, for MVC in kg, kg.kg<sup>-1</sup> and kg.kg<sup>-0.67</sup>, respectively. There was also a trend of superiority of the TI instruction compared to the SI instruction, whatever the expression of MVC (kg, kg.kg<sup>-1</sup> and kg.kg<sup>-0.67</sup>) (P < 0.1).

Inwomen'sMRFD results, theone-way ANOVA with repeated measuresshowed a significant effect of instruction whatever the expression of data [inkg.s<sup>-1</sup> (P= 0.013), in kg.s<sup>-1</sup>.kg<sup>-1</sup> (P = 0.010) and inkg.s<sup>-1</sup>.kg<sup>-0.67</sup> (P= 0.011)]. The post-hocBonferroni t-test showed that MRFD was higher with Olinstruction compared to SI instruction(P $\leq$  0.021). In addition, MRFD was higher withTI instruction compared to SI instruction (P $\leq$ 0.046).

In men, whatever the expression of data, there was neither effect of instruction on MVC noron MRFD (P > 0.05).



#### DISCUSSION

In accordance with ourhypothesis, this preliminary studyindicated that the impact of instructionwasgreater inwomen than inmen, especially with Olinstruction compared toSI instruction. This finding could be explained by muscleor ganization and differences incognitive strategy between menand women.

That's what we intend to highlightby the analysis of the recorded data during the present study of the agonist and antagonist muscles EMGs ignals and the brain activity using functional magnetic resonance imaging (fMRI).

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