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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 of maximal voluntary contraction (MVC) and maximal rate of force development (MRFD) in women and men during handgrip exercise performed following three different instructions: Oral instruction (OI): Started with audible tripping and accompanied 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 with OI were higher than SI. No significant difference has been found between instructions in men. Our results suggested that women are more sensitive to the instruction effect compared to men. Further explanations will be proposed using surface EMG and fMRI measurements.

Key words: Instruction, gender, MVC, MRFD, handgrip

INTRODUCTION

Force production depends on central and peripheral nervous system. Maximal voluntary contraction (MVC) and Maximal rate of force development (MRFD) are defined as peripheral measures of neuromuscular performance during isometric contractions (Blackburn and al., 2009). Many studies have demonstrated that performances during isometric contraction is influenced by the type of instruction given to the subject (Hard and Fast, Slow and gradual, Fast) (Bemben et al., 1990; Sahaly et al., 2001). Furthermore, MVC and MRFD are higher in men than in women (Häkkinen et al., 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 prospective difference 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 adults participated in the study: 12 women (30.4 ± 7.6 years, 61.5 ± 8.3 kg) and 11 men (29.4 ± 3.9 years, 84.0 ± 14.4 kg). The subjects performed 5 maximal voluntary contractionsof 4.4 s each, with 44-s recovery between exercises at each instruction: i) Oral instruction (OI), an audible signal at the beginning of the contraction followed by pre-recorded vocal encouragement. ii) Triggered instruction (TI), same as oral 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 best values of MVC and MRFD were averaged and included in the statistical treatment of data. MVC and MRFD were expressed in absolute units (kg and kg·s⁻¹), reported to body mass (kg·kg⁻¹ and kg·s⁻¹·kg⁻¹) and reported to body mass⁻⁰·⁶⁷ (kg·kg⁻⁰·⁶⁷ and kg·s⁻¹·kg⁻⁰·⁶⁷).

The instruction effect was tested using a one-way ANOVA with repeated measures in men and women separately.

RESULTS

In women’s MVC results, the one-way ANOVA with repeated measures showed a significant effect of instruction whatever the expression of results [in kg (P= 0.023), in kg·kg⁻¹ (P= 0.016) and in kg·kg⁻⁰·⁶⁷ (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=0.015, P=0.017, for MVC in kg, kg·kg⁻¹ and kg·kg⁻⁰·⁶⁷, respectively). There was also a trend of superiority of the TI
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of hamstring neuromechanical properties between healthy males and females and the
Blackburn, JT., Bell, DR., Norcross, MF., Hudson, JD. &Engstrom,
magnetic resonance imaging

study was

DISCUSSION
In men, whatever the expression of data [inkg.s⁻¹ (P = 0.010), in kg.s⁻¹.kg⁻¹ (P = 0.011)], the post-hoc Bonferroni t-test showed that MRFD was higher with OI instruction compared to SI instruction (P≤ 0.021). In addition, MRFD was higher with TI instruction compared to SI instruction (P≤0.046).

In men, whatever the expression of data, there was neither effect of instruction on MVC nor on MRFD (P > 0.05).

![Figure 1: Means ± standard errors of MVC and MRFD expressed in absolute units (A), values reported per body mass (B), and values reported per body mass to the power of (0.67) (C) in men and women.](image)

**Figure 1**: Means ± standard errors of MVC and MRFD expressed in absolute units (A), values reported per body mass (B), and values reported per body mass to the power of (0.67) (C) in men and women.

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BIBLIOGRAPHY

