

## TABLES

**Table 1.** Demographic characteristics of the participants.

|                              | Training Group<br>(n = 17)    | Control Group<br>(n = 17)     | Statistics                   |
|------------------------------|-------------------------------|-------------------------------|------------------------------|
| Age (years)<br><i>95% CI</i> | 24.6 ± 5.4<br>22.7 – 26.5     | 26.3 ± 6.4<br>24.1 – 28.4     | $F_{1,33} = 1.403; p = 0.24$ |
| Gender (%)                   | F: 5 (29.4%)<br>M: 12 (70.6%) | F: 6 (35.3%)<br>M: 11 (64.7%) | Pearson's $\chi^2; p = 0.81$ |
| Weight (kg)<br><i>95% CI</i> | 66.7 ± 9.6<br>61.7 – 71.7     | 68.6 ± 12.9<br>61.2 – 76.1    | $F_{1,33} = 0.228; p = 0.64$ |
| Height (cm)<br><i>95% CI</i> | 170.0 ± 10.5<br>164.7 – 175.4 | 170.6 ± 8.4<br>165.8 – 175.5  | $F_{1,33} = 0.028; p = 0.86$ |

CI = Confidence Interval; F = Females; M = Male

**Table 2.** Reproducibility and responsiveness of maximal strength measurements from the dominant and non-dominant hands.

| Hand         | Motor task | Reproducibility               |                               |                               | Responsiveness |          |
|--------------|------------|-------------------------------|-------------------------------|-------------------------------|----------------|----------|
|              |            | ICC <sub>2,1</sub>            | CV (%)                        | SEM                           | SRD            |          |
|              |            | Session 1 vs. 2<br>(95% C.I.) | Session 1 vs. 2<br>(95% C.I.) | Session 1 vs. 2<br>(95% C.I.) | SRDi           | SRDi (%) |
| Dominant     | Tip        | 0.94<br>(0.81-0.96)           | 6.1                           | ±1.07                         | 4.2            | 23.9     |
|              | Key        | 0.95<br>(0.92-0.97)           | 4.8                           | ±0.92                         | 3.62           | 17.2     |
|              | Tripod     | 0.98<br>(0.97-0.99)           | 3.9                           | ±1.26                         | 4.93           | 14.8     |
|              | Handgrip   | 0.99<br>(0.98-0.99)           | 2.9                           | ±1.09                         | 4.29           | 10.7     |
| Non-dominant | Tip        | 0.94<br>(0.89-0.97)           | 6.4                           | ±1.24                         | 4.86           | 29.8     |
|              | Key        | 0.95<br>(0.90-0.97)           | 5.6                           | ±0.99                         | 3.89           | 19.3     |
|              | Tripod     | 0.99<br>(0.97-0.99)           | 3.1                           | ±1.21                         | 4.73           | 15.2     |
|              | Handgrip   | 0.99<br>(0.98-0.99)           | 3.0                           | ±1.04                         | 4.06           | 10.8     |

ICC, Intraclass Correlation Coefficient; C.I., Confidence Interval; CV, Coefficient of Variation; SEM, Standard Error of Measurement; SRDi, Individual Smallest Real Difference; SRDi%, Individual Smallest Real Difference in percentage. SEM and SRDi absolute values follow the same unit of measurement (Newton) of the relative outcome measure.

**Table 3.** PRE to POST changes in the maximal strength of the hand muscles within- and between-subjects.

| Side       | Strength outcomes   | Training Group               |                              |                                    | Control Group                |                             |                                    | Training vs Controls                |
|------------|---------------------|------------------------------|------------------------------|------------------------------------|------------------------------|-----------------------------|------------------------------------|-------------------------------------|
|            |                     | PRE                          | POST                         | PRE-POST<br><i>Within-subjects</i> | PRE                          | POST                        | PRE-POST<br><i>Within-subjects</i> | PRE-POST<br><i>Between-subjects</i> |
| Right Hand | <i>Key Pinch</i>    | 21.4 ± 4.1<br>(19.3 – 23.5)  | 24.4 ± 4.8<br>(21.9 – 26.9)  | +14.0%**                           | 21.9 ± 4.2<br>(19.8 – 24.0)  | 23.1 ± 5.5<br>(20.3 – 25.9) | +5.5%                              | +8.5%*                              |
|            | <i>Tip Pinch</i>    | 17.9 ± 3.8<br>(16.0 – 19.8)  | 19.2 ± 4.1<br>(17.1 – 21.3)  | +7.3%*                             | 18.3 ± 5.0<br>(15.9 – 20.9)  | 18.4 ± 5.0<br>(15.8 – 20.8) | 0.1%                               | +7.2%*                              |
|            | <i>Tripod Pinch</i> | 35.8 ± 10.1<br>(30.6 – 41.0) | 36.8 ± 9.5<br>(31.7 – 41.7)  | +2.8%                              | 32.7 ± 7.5<br>(28.4 – 35.8)  | 33.2 ± 7.5<br>(29.5 – 36.9) | +1.5%                              | +1.3%                               |
|            | <i>Handgrip</i>     | 42.9 ± 11.6<br>(36.9 – 48.9) | 43.9 ± 11.1<br>(38.2 – 49.6) | +2.3%                              | 38.7 ± 10.2<br>(33.6 – 43.8) | 39.5 ± 9.4<br>(35.0 – 44.4) | +2.1%                              | +0.2%                               |
| Left Hand  | <i>Key Pinch</i>    | 20.6 ± 4.2<br>(18.5 – 22.7)  | 22.2 ± 4.6<br>(19.8 – 24.6)  | +7.8%*                             | 21.1 ± 4.8<br>(19.7 – 23.5)  | 21.4 ± 3.8<br>(19.5 – 23.3) | +1.4%                              | +6.4%*                              |
|            | <i>Tip Pinch</i>    | 16.9 ± 3.9<br>(14.9 – 18.9)  | 18.5 ± 4.1<br>(16.4 – 20.6)  | +9.5%*                             | 16.8 ± 6.1<br>(13.8 – 19.8)  | 17.6 ± 6.3<br>(14.5 – 20.7) | +4.8%                              | +4.7%*                              |
|            | <i>Tripod Pinch</i> | 33.1 ± 8.3<br>(28.8 – 37.4)  | 33.8 ± 8.0<br>(29.7 – 37.9)  | +2.1%                              | 32.3 ± 8.8<br>(26.3 – 35.1)  | 32.7 ± 8.9<br>(28.2 – 37.0) | +0.1%                              | +2.0%                               |
|            | <i>Handgrip</i>     | 40.1 ± 11.0<br>(38.8 – 46.0) | 40.8 ± 11.3<br>(35.0 – 46.6) | +1.7%                              | 36.9 ± 9.7<br>(31.8 – 41.4)  | 37.4 ± 8.8<br>(33.0 – 41.8) | +1.3%                              | +0.4%                               |

The Training Group underwent maximal isometric strength training of the right hand for 4 weeks. The Control group underwent no-intervention between the PRE and POST strength assessments. Contralateral net transfer *between-subjects* calculated by Carroll's equation (Carroll et al. 2006). Absolute values are expressed in Newton; \*Significant for  $p < 0.05$ ; \*\* Significant for  $p < 0.01$ .

**Table 4.** Repeated measures ANOVA analysis of dynamometric parameters measured from the FDI muscles before (PRE) and after (POST) 4 weeks of maximal isometric strength training of the right muscle in the CT group or no-intervention in the CONTROL group.

| OUTCOMES            | Main effect of<br>TIME     | Interaction<br>TIME*GROUP  | Interaction<br>TIME*SIDE | Interaction<br>TIME*GROUP*SIDE |
|---------------------|----------------------------|----------------------------|--------------------------|--------------------------------|
| <i>Key Pinch#</i>   | $F_{1,62}=23.12; p<0.0005$ | $F_{1,62}=16.64; p<0.0005$ | $F_{1,62}=3.74; p=0.06$  | $F_{1,62}=0.05; p<0.82$        |
| <i>Tip Pinch</i>    | $F_{1,62}=4.06; p=0.03$    | $F_{1,62}=15.86; p<0.0005$ | $F_{1,62}=1.10; p<0.30$  | $F_{1,62}=0.33; p<0.56$        |
| <i>Tripod Pinch</i> | $F_{1,62}=12.10; p=0.001$  | $F_{1,62}=0.04; p=0.84$    | $F_{1,62}=1.22; p<0.27$  | $F_{1,62}=1.56; p<0.22$        |
| <i>Handgrip</i>     | $F_{1,62}=8.25; p=0.006$   | $F_{1,62}=0.09; p=0.76$    | $F_{1,62}=0.77; p<0.38$  | $F_{1,62}=0.03; p<0.96$        |

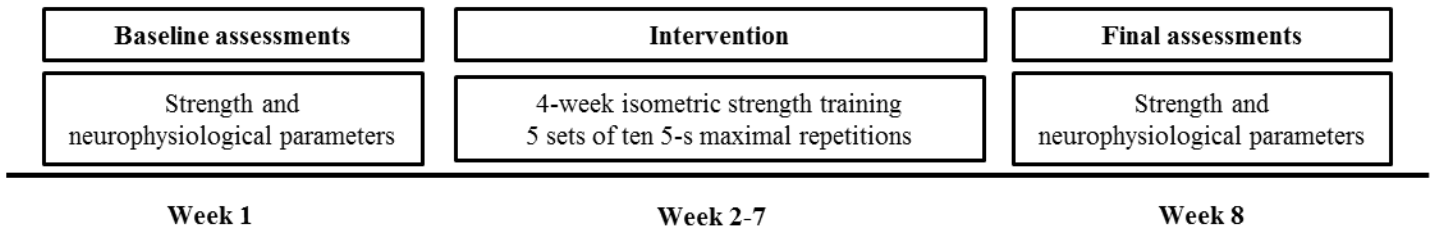
TIME, PRE *versus* POST; GROUP, CT group *versus* Control group; SIDE, trained (dominant) *versus* untrained (non-dominant). #, Motor task employed during the 4-week training; significance set at  $p < 0.05$

**Table 5.** Repeated measures AVOVA analysis of neurophysiological parameters measured from the FDI muscles before (PRE) and after (POST) 4 weeks of maximal isometric strength training of the right muscle in the CT group or no-intervention in the CONTROL group.

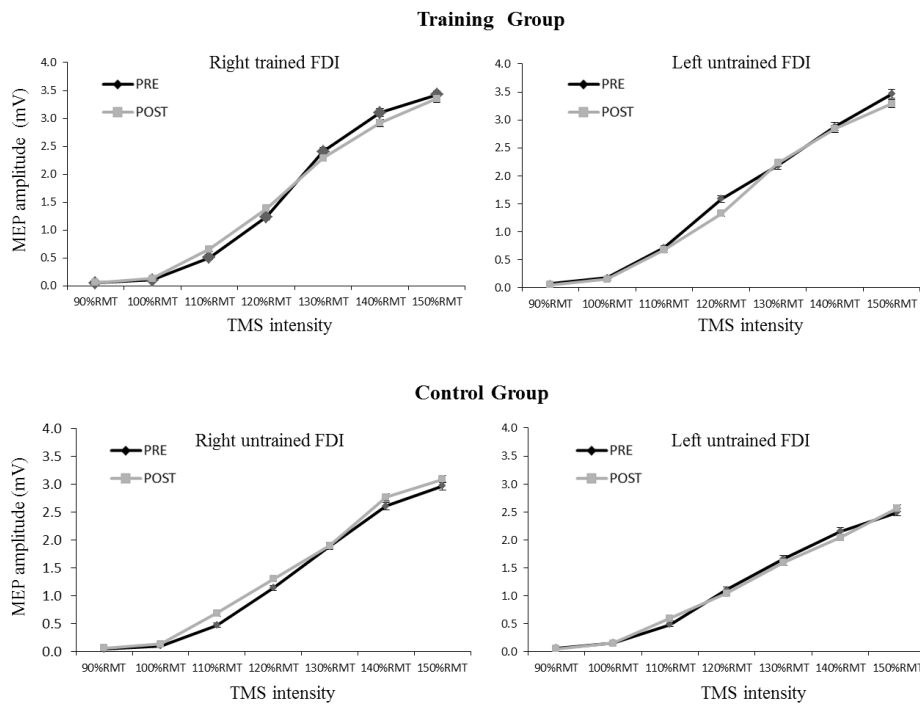
| TMS Protocols             | OUTCOMES | Main effect of TIME         | Main effect of GROUP        | Interaction TIME*GROUP      |
|---------------------------|----------|-----------------------------|-----------------------------|-----------------------------|
| Single Pulse TMS          | RMT      | $F_{1,64}=2.633$ ; $p=0.11$ | $F_{1,64}=0.252$ ; $p=0.62$ | $F_{1,64}=0.520$ ; $p=0.47$ |
|                           | AMT      | $F_{1,64}=5.107$ ; $p=0.03$ | $F_{1,64}=2.307$ ; $p=0.13$ | $F_{1,64}=0.319$ ; $p=0.57$ |
|                           | 1mVMEP   | $F_{1,64}=3.016$ ; $p=0.09$ | $F_{1,64}=0.771$ ; $p=0.38$ | $F_{1,64}=0.001$ $p=0.99$   |
|                           | CMCT     | $F_{1,64}=2.672$ ; $p=0.11$ | $F_{1,64}=1.221$ ; $p=0.27$ | $F_{1,64}=4.357$ ; $p=0.04$ |
|                           | RC       | $F_{1,64}=0.336$ ; $p=0.56$ | $F_{1,64}=1.323$ ; $p=0.25$ | $F_{1,64}=0.423$ ; $p=0.52$ |
| Paired Pulse TMS          | SICI     | $F_{1,64}=0.136$ ; $p=0.71$ | $F_{1,64}=0.100$ ; $p=0.75$ | $F_{1,64}=0.646$ ; $p=0.42$ |
|                           | ICF      | $F_{1,64}=0.764$ ; $p=0.38$ | $F_{1,64}=0.085$ ; $p=0.77$ | $F_{1,64}=0.039$ ; $p=0.84$ |
|                           | SICF     | $F_{1,64}=0.789$ ; $p=0.38$ | $F_{1,64}=0.156$ ; $p=0.69$ | $F_{1,64}=0.650$ ; $p=0.42$ |
|                           | LICI 100 | $F_{1,64}=0.175$ ; $p=0.68$ | $F_{1,64}=0.001$ ; $p=0.98$ | $F_{1,64}=0.517$ ; $p=0.47$ |
|                           | LICI 200 | $F_{1,64}=0.034$ ; $p=0.31$ | $F_{1,64}=0.032$ ; $p=0.85$ | $F_{1,64}=0.568$ ; $p=0.45$ |
|                           | SIHI     | $F_{1,64}=0.005$ ; $p=0.95$ | $F_{1,64}=0.018$ ; $p=0.89$ | $F_{1,64}=0.285$ ; $p=0.95$ |
|                           | LIHI     | $F_{1,64}=0.146$ ; $p=0.70$ | $F_{1,64}=0.150$ ; $p=0.90$ | $F_{1,64}=0.618$ ; $p=0.43$ |
| Sensory-Motor integration | SAI      | $F_{1,64}=0.262$ ; $p=0.61$ | $F_{1,64}=1.680$ ; $p=0.20$ | $F_{1,64}=0.404$ ; $p=0.53$ |
|                           | LAI      | $F_{1,64}=0.020$ ; $p=0.89$ | $F_{1,64}=0.212$ ; $p=0.64$ | $F_{1,64}=0.001$ ; $p=0.99$ |

RMT, Resting Motor Threshold; AMT, Active Motor Threshold; 1mV MEP, TMS intensity to evoke a MEP of 1mV amplitude; SICI, short-interval intracortical inhibition; ICF, intracortical facilitation; (SICF), short-interval intracortical facilitation; LICI 100 and LICI 200, long-interval intracortical inhibition at 100 and 200 ms inter-stimulus interval, respectively; SIHI and LIHI, short- and long-interval interhemispheric inhibition, respectively; SAI and LAI, short- and long afferent inhibition, respectively; TIME, PRE *versus* POST; GROUP, CT group *versus* Control group.

## FIGURES

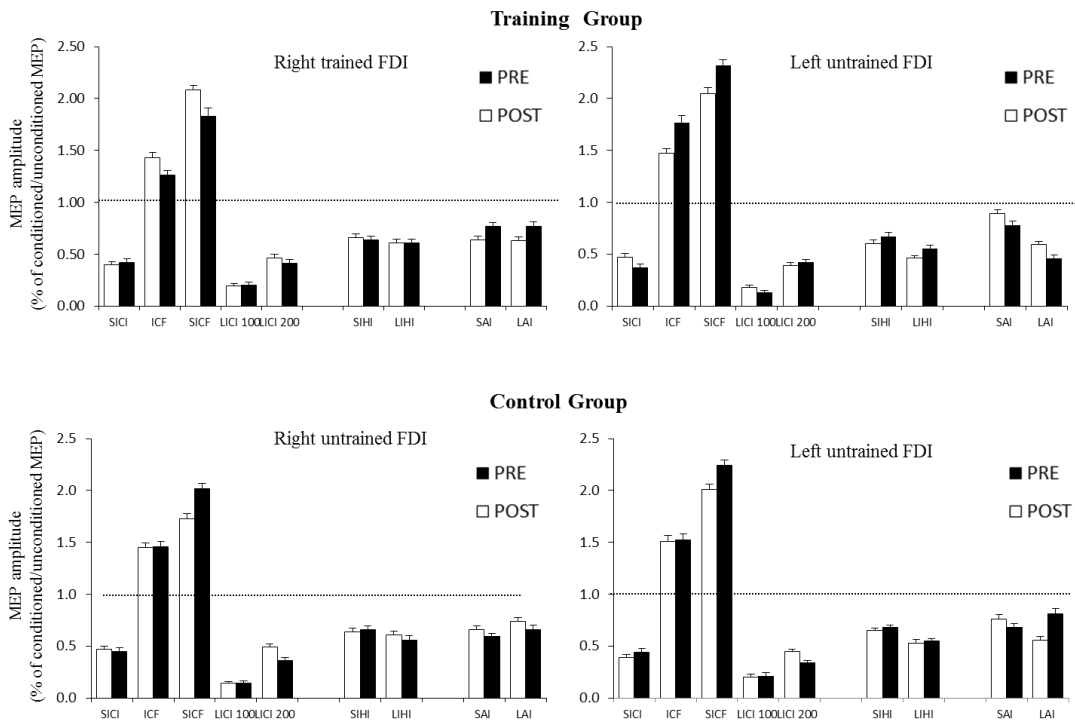


**Fig. 1** Schematic representation of the experimental design with outcomes measured before and after 4 weeks of maximal unilateral isometric training of right first dorsal interosseus muscles.



**Figure 2. Recruitment curves obtained from both the training and control groups are reported for each first dorsal interosseous muscle (FDI).**

Recruitment curves acquired at the baseline (PRE, black line) and after 4-week maximal intensity isometric training of the right FDI in the training group or after a 4-week period of no intervention in the control group (POST, grey line) are superimposed. The ordinates indicate mean MEP amplitude and abscissa indicates transcranial magnetic stimulation (TMS) intensities (in % of the Resting Motor Threshold, RMT). The error bars represent standard error.



**Figure 3. Effects of maximal isometric strength training and of no-intervention on intracortical and interhemispheric excitability and on sensory motor integration at cortical level.**

Histograms report short-interval intracortical inhibition (SICI), intracortical facilitation (ICF), short-interval intracortical facilitation (SICF), long-interval intracortical inhibition at 100 and 200 ms inter-stimulus interval (LICI100 and LICI200, respectively), short- and long-interval interhemispheric inhibition (SIHI and LIHI, respectively), short- and long afferent inhibition measured bilaterally from the FDI muscle before (white columns) and after (black columns) a 4-week period of maximal isometric strength training of the right FDI (training group) or no intervention (control group). Ordinates indicate MEP amplitude, expressed as a mean  $\pm$  SEM percentage value of the unconditioned MEP, induced by single pulse TMS, taken as 100% (dotted horizontal line). In both the training and control groups all parameters of intra- and intercortical excitability and of cortical sensory-motor integration appeared substantially unchanged after the training and the no-intervention period, respectively.