Effects of anthropometric variables and electrode placement on the SEMG activity of the biceps brachii muscle during submaximal isometric contraction in arm wrestling

Abstract

Surface electromyography (SEMG) has been widely used to analyze the biceps brachii (BB) muscle during voluntary contraction, and the effect of the interelectrode distance has been studied. However, the effect of anthropometric variations and the placement of electrodes on the BB activity during arm wrestling (i.e., during isometric contraction at a submaximal intensity) has seldom been investigated. In this study, the BB strength throughout this type of static contraction was evaluated. The SEMG signals were recorded from three locations on the BB: the muscle belly (M), near proximal (P), and distal tendon (L) regions. Twenty subjects who participated in the experiment were divided into five groups (A, B, C, D, and E). The average SEMG, root mean square, and variability of the signal were calculated using the coefficient of variance. The results indicated that the M region was more active and exhibited increased signal consistency (10.91%) compared with the other two regions (P: 24.47% and L: 19.13%). Significant differences were observed between the L and P regions and between the M and P regions ($p<0.05$); however, there were no differences between the M and L regions ($p>0.05$). The increase in the SEMG value in groups B and C was significant ($p<0.05$), whereas groups A, D, and E did not exhibit a significant increase ($p>0.05$). In addition, muscle size was the strongest predictor of strength compared with body weight and height. The results suggest that the M region displays considerable SEMG effects and signal reliability. Furthermore, the SEMG measurements were found to correlate strongly with the strength of the contractions and the muscle size, and not with weight and height.

Keywords — Anthropometric, arm wrestling, biceps brachii, electrode, electromyography, isometric contraction