UPPER LIMB CRANKING ASYMMETRY DURING A WINGATE ANAEROBIC TEST IN WHEELCHAIR BASKETBALL PLAYERS.

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Introduction

Interlimb asymmetry of strength and/or motor coordination could limit the performance of wheelchair athletes or increase their risk of injury. Studies of the lower limbs have shown high between-subject variability in interlimb asymmetry that does not depend on the side of dominance and that does not change with fatigue [1]. Upper limb asymmetry is particularly large in highly classed manual wheelchair athletes [2]. The aim of this study was to evaluate the interlimb asymmetry of forces developed during a 30-s anaerobic Wingate arm test, the effects of fatigue on the force, and differences between high- and low-point players (HP versus LP). We hypothesized that asymmetry would not increase during the exercise and that asymmetry would be larger in HP than in LP players and larger in men than women players.

Methods

25 wheelchair basketball players (13 females and 12 males) performed a 30-s Wingate test on an arm ergometer. Participants were classified into two functional categories, high-point (n=12) and low-point (n=13), according to the International Wheelchair Basketball Federation classification. Data were collected with an arm ergometer (Lode Brachumera, Nederland). Left and right arm forces were measured during the pushing and pulling phases at peak power (A_PP), at 10 sec of onset (A_10s), and at the end of the 30-s test (A_30s). We calculated total force asymmetry (SItot) using equation 1[3].

$$SItot = \frac{|LFtot - RFtot|}{0.5 * (LFtot + RFtot)} * 100 \qquad (1)$$

Results

Asymmetry changed during time exercise at each phase, significantly between A_PP and A_10s. In average, force asymmetry increases between A_PP and A_10s (12.5 ± 10.5% A_PP vs.17.1 ± 14.8 A_10s; *p=0.028*) and tend to decrease after A_10s (14.5 ± 12.1 at A_30s; *NS*). No significant difference between functional categories was founded but tended to be greater in high-point players (13.7 ± 11% in HP vs. 10.8 ± 7.9% in LP; *p=0.078*) *(Table 1)*. Asymmetry tended to be greater in the women, with significant differences between the men and women in the push phase (respectively, 9 ± 7% vs. 18.5 ± 10.1%; *p=0.014*).

Discussion

Inter-subject variability was high, but forces were asymmetric for most participants, especially women. It seems that differences in classification alone do not explain the tendency for higher force asymmetry in HP players. The bilateral asymmetry is higher at A_10s, which could show a link between the onset of fatigue and the peak of muscular imbalance. In literature, a commonly used threshold for studies on lower limbs is 10% [4]. A measurement above this threshold would be considered abnormal. However, when studying upper limbs, care should be taken when using this threshold, as upper limb asymmetries could be more prevalent due to the diverse range of tasks they can perform daily. The Wingate anaerobic test could reveal asymmetries that may affect sports performance or daily life.

SI (%)	HP M ± SD	LP M ± SD	*p-value*
Total Force	13.7 ± 11	10.8 ± 7.9	*.078*
Push Force	14.3 ± 10.8	13.5 ± 9.3	*.225*
Pull Force	14.0 ± 12.3	12.5 ± 11.6	*.060*

Table 1: Comparison of mean symmetry index (SI %) all along the WanT_30s of the total force, push force, and pull force between high points players (HP) and low points players (LP). M: mean, SD: Standard deviation, SI: Symmetry Index.

References

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