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The effect of fatigue on body kinematics during simulated flat water kayak

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Flat-water kayak requires both technical skills and muscle strength. Previous studies conducted during simulated kayaking suggest that different kinematic variables (joints range of motion [RoM], symmetry, paddle position) are related to performance improvements [1,2] and may distinguish athletes of different competitive levels. On the other hand, muscle fatigue negatively affects both upper and lower limbs performance [3], but its effect on kayaking technique and body arrangement has not been analyzed yet. In this study, we examined changes of 3D kinematics through a simulated 500-meter kayak sprint. Ten athletes (7 M, 3 F, mean age 17±2 y) performed on a kayak ergometer: 1) an incremental test (INCR) to detect peak oxygen uptake (O2peak); 2) a 500-meter sprint trial (TT). During TT, besides collecting cardiometabolic response to exercise and blood lactate concentration ([Lapeak]), a motion capture system sampled the 3D coordinates of 40 cutaneous markers. For each athlete, joints RoMs (trunk, pelvis, lower and upper limbs) were obtained together with symmetry indices. Stroke frequency was computed from the wrist landmarks trajectory. To assess the effect of fatigue on kinematics, data obtained at the beginning of TT (11th-20th rowing cycles) were compared with that obtained at the end (last 10 cycles). During INCR, O2peak was 3.36 L/min. TT lasted 130.1±9.2 s, and paddle frequency was 1.1±0.2 s-1. During TT, in all subjects O2 value was higher than 90% of O2peak, whereas [Lapeak] was 10.6±3.1 mM, thus indicating a large contribution of both aerobic and anaerobic energy systems. Fatigue influenced joints RoM, with an increment in lower limbs joints (significant hip rotation, effect size [ES] 0.60), and a decrement in dominant side shoulder (rotation and adduction; ES 0.58). Trunk inclination also increased (ES 0.63). The first part of TT was performed with a higher shoulder rotation asymmetry (larger dominant limb RoM) than the last part. Results suggest that fatigue affects kinematic variables related to technical skills, where increased trunk and lower limb RoMs may compensate reduced upper limb movements and symmetry. If confirmed, these data can provide useful information to optimize training programs.

References

[1] Limonta et al. (2010) Sport Sci Health 6:27–34
[2] Michael et al. (2012) J Sport Sci 30:661–8
[3] Tesch (1983) Can J Appl Spt Sci 8:287-91

Key words

Kayak, fatigue, range of motion, kinematics.