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PROGRAM & ABSTRACT BOOK プログラムとアブストラクトの本



IN SITU VALIDATION OF POWER QUANTIFICATION FOR DYNAMIC WHEELCHAIR SPORTS

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INTRODUCTION

Wheelchair racing is accessible to athletes who have impairments and are classified according to their level of impairment defined by the International Paralympic Committee (from T51 to T54). For such race, the acceleration phase is an important component of performance and has been directly linked to the ability of the athletes to apply high amounts of horizontal force and power [1]. This is well known to be the phase during which the maximum power is produced by the athletes. In Paralympics disciplines, it has been shown that more powerful athletes could achieve better results in speed tests [2]. A macroscopic method made it possible to calculate various biomechanical variables during able-bodied sprint running on the field [1]. Hence the objective of this study was to propose a protocol for estimating the power developed by the athletes during a wheelchair sprint.

METHODS

Five para-athletes of the national French para-athletics team and two former para-athletes volunteered for this study (EudraCT / IDRCB n° 2020-A02919-30). After a specific warm-up, the athletes performed two sprints of 50 m with 0 N, 10 N, 20 N and 30 N resistances. The 1080 Motion Sprint was used to apply in the field the resistances and collect horizontal velocity at 333 Hz. Photocells (WITTY, Microgate, USA) were used to measure time in the non-resistance sprints (0N). Using the 1080 Sprint and photocells raw data, maximal velocity (V_{max}), estimated time to 100 m, maximal horizontal force (F_{max}), and maximal power (P_{max}) were calculated (Table 1). Horizontal propulsion force (F_h) was calculated using the mass of the athletes and the wheelchair (m), the horizontal acceleration (a_h), the drag resistance (F_{aero}), the rolling resistance (F_{roll}), and the 1080 Sprint resistive force (F_{1080}):

$$F_h(t) = ma_h(t) + F_{aero} + F_{1080} + F_{roll}$$

RESULTS AND DISCUSSION

For all participants, increasing the resistance increased

their estimated time to 100 m, while it decreased their maximal speed and power. Maximal force remained constant despite increasing resistance (Table 1). Force-velocity and power-velocity profiles differed between the subjects, and the highest maximal power was achieved by the S1, an athlete classified as T54, and the lowest was achieved by the athlete classified as T52 (Figure 1). Depending on the classification and sport specialty, the maximum power output varied, and the addition of resistance had different impact.

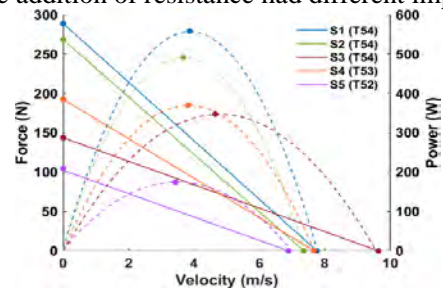


Figure 1 Force-velocity and power-velocity (dashed line) relationship of French para-athletes with 10 N resistance.

CONCLUSIONS

This study proposed a novel method to compute power developed by wheelchair athletes in the field. The protocol developed can be used by athletes for their training, as it can provide the power generated during a sprint and allow them to draw their force-velocity profile and track their progress. Both parameters are of great interest for both athletes and their coaches.

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- [2] Loturco I et al. *Adap Phys Act Q.* **37**: 508-17, 2020

Table 1: Mean and standard deviation of the maximal values of each parameter for all conditions.

	0 N	10 N	20 N	30 N
Time 100 m (s)	16.6 ± 2.4	20.2 ± 3.4	23.5 ± 5.2	26.1 ± 5.8
V_{max} (m/s)	7.3 ± 0.9	6.5 ± 1.1	5.5 ± 1.0	4.9 ± 1.0
F_{max} (N)	187.1 ± 28.2	161.7 ± 72.7	162.3 ± 63.5	162 ± 56.9
P_{max} (W)	359.3 ± 81.7	321 ± 122.6	317 ± 124	300 ± 105.9