Physiological characteristics of competitive Brazilian cyclists

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Background: The national cycling calendar in Brazil is extensive with numerous regional and state competitions on a weekly basis. Furthermore, several teams now compete in national, continental and international races throughout the calendar year. In light of Brazil's increasing interest and progression in the world of cycling, we aimed to determine the characteristics of well-trained Brazilian state cyclists also competing at national and international level.

Methods: Thirty-eight well-trained Brazilian cyclists (six professionals and thirty-two amateurs) competing in regional (N = 38), national (N = 14) and international (N = 7) competition attended one laboratory session for the determination of the following characteristics: age, height, body mass, maximal oxygen uptake (VO_{2max}), anaerobic threshold (ANT) and maximal power output (W_{max}). Furthermore, individuals were also required to complete a questionnaire relating to their cycling frequency and history (*ie* hours cycled per week; distance cycled per week; years of experience; level of competition). Individual VO_{2max}, ANT and W_{max} was determined during a cycling capacity test to exhaustion on a cycle ergometer (Lode Excalibur, Germany). The test consisted of four submaximal 4-min stages starting at 75 W, increasing by 50 W each stage until 225 W. Thereafter, workload was increased by 30 W every minute until exhaustion. Ventilatory and gas exchange measurements were recorded using a portable breath-by-breath system (K4 b2, Cosmed, Italy); the highest value averaged over a 30-s period during the test was defined as VO_{2max}. The last completed stage and the fraction of time spent in the final non-completed stage multiplied by 30 W was defined as an individual's W_{max}. Individual ANT was determined using the method described by Okano et al. (2006).

Results:

Table 1. Physical, maximal and submaximal physiological characteristics of Brazilian road cyclists

Characteristic	Mean (SD)	Range	
		Minimum	Maximum

Age (y)		37 (8)	18	55
Height (cm)		1.76 (0.06)	1.60	1.89
Body mass (kg)		74.9 (8.5)	58.9	93.0
Experience (y)		10 (11)	1	40
Weekly training	Duration (h)	11 (5)	4	25
	Distance (km)	297.7 (106.2)	140	500
VO_{2max}	Absolute ($L \cdot min^{-1}$)	3.7 (0.5)	2.8	4.8
	Relative ($ml \cdot kg \cdot min^{-1}$)	50.1 (7.6)	33.6	70.0
HR_{max} ($beats \cdot min^{-1}$)		182 (10)	168	198
W_{max}	Absolute (W)	335.8 (53.1)	181.4	439.0
	Relative ($W \cdot kg^{-1}$)	4.5 (0.8)	2.6	5.7
W_{ANT} (W)		223.1 (57.0)	129.0	345.0
W_{ANT} (%W_{max})		65.9 (14.0)	36.9	90.9
VO_{2ANT} (%VO_{2max})		88.9 (6.0)	68.6	97.3

Discussion: Well-trained Brazilian male cyclists showed a wide range of values for physical and physiological characteristics. Interestingly, VO_{2max} was well below those reported by several studies employing well-trained cyclists (>60 $ml \cdot kg \cdot min^{-1}$; Jeukendrup et al., 2008; Bellinger and Minahan, 2014 & 2015), while the upper-most value shown in our cyclists is equivalent to the lower-end value in professional road cyclists (Mujika and Padilla, 2001). In addition, W_{max} and ANT was also below those shown in reportedly well-trained (Chung et al., 2014; Jeukendrup et al., 2008) and professional (Mujika and Padilla, 2001) cyclists. These results are somewhat surprising considering the trained nature of our participants. All athletes included in this study were of a competitive level, several having secured podium finishes in national and international competition over the previous year, while weekly training loads were similar to, or higher than, those previously reported with well-trained cyclists (Chung et al., 2014; Bellinger et al., 2015). Although several individuals were only competing at state level, there were no differences in physiological measures between them and those competing at national level or higher (data not shown). A significant contributing factor may have been the age of the current individuals, since the average age of a professional road team is 26 years (Mujika and Padilla, 2001). Despite this, the highest individual VO_{2max} in our cohort was achieved by an individual 41 years of age. Further investigation into the physiological characteristics of trained Brazilian cyclists is warranted.

Conclusion: These data suggest that well-trained Brazilian cyclists may be at a lower standard than their international counterparts. Nonetheless, future research should determine the physiological characteristics of Brazilian cyclists using a larger professional cohort.

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