

Conference Abstract

## Training Volume and Altitude Training Are Associated with Power Output and Race Results; a Longitudinal Case Study of an Elite Female Cyclist

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Received: 22 April 2024

Accepted: 6 May 2024

Published: 10 August 2024

### Abstract

**Introduction:** Since the introduction of the UCI Ladies World Tour in 2016, the popularity of female competitive cycling has grown exceptionally. While training characteristics that correlate with power-output and racing results have been fairly well established in male elite cyclists, only little research has investigated these characteristics in female cyclists. However, the distinct nature of racing, with higher intensities and shorter distance covered in females compared to males, the physiological sex differences and the brief history of female cycling urge for sex specific examination of determinants of bike racing performance. Further, previous research investigated professional but not world-class level female cyclists. Thus, the aim of this study was to identify training characteristics that are related to power output and race results in a world-class female cyclist. Moreover, this analysis permitted the identification of key characteristics including length, duration and power outputs of classical races and grand tours where this cyclist excelled.

**Materials and Methods:** Training and racing data were retrieved from a recently retired world-class female cyclist. The participant was born in 1982 and was highly successful from 2012 to 2023 in female professional cycling, obtaining 37 one day victories and 15 stage races at the highest level in cycling. Training characteristics such as the training volume and days spent at altitude were correlated with 5-second, 1- 5- 20-minute power output and critical power as assessed during training and races. In the second part, a detailed overview was given of power output in classic races and grand tour races to investigate what power output was needed to excel in these races.

**Results:** Mean training volume was  $902 \pm 302$  hours per year (range 420-1296 hours, cycling-only). Both training volume and time spent at altitude were significantly correlated with a composite performance measure (ProCyclingStats (PCS) points scored) ( $r = .878$ ,  $p < .001$  and  $r = .913$ ,  $p < .001$  respectively). Additionally, training volume and time spent at altitude correlated significantly with stage race wins ( $r = .806$ ,  $p = .005$  and  $r = .825$ ,  $p = .003$  respectively). Further, fatigue resistance as determined by the critical power after 2000 kJ of work had been performed, correlated strongly with PCS points achieved and stage race wins ( $r = .824$ ,  $p = .003$  and  $r = .862$ ,  $p = .001$ ). Lastly, repeated power outputs of  $5.9 \pm 0.2$  W\*kg<sup>-1</sup> for  $4 \pm 2$  minutes and  $5.5 \pm 0.6$  W\*kg<sup>-1</sup> for  $22 \pm 16$  minutes on decisive climbs were needed to excel in female classic races and grand tours respectively. Retrospective analysis of training and race data of multiple successive years in a multiple world champion female cyclist revealed that training volume and altitude training were positively correlated with power output and race results. Furthermore, a higher fatigue resistance was correlated with race results.



**Conclusions:** In conclusion, high training volumes and altitude training appear to be pivotal training components to excel in professional female cycling.

**Keywords:** UCI World Tour, Race Performance, Fatigue Resistance, Power Output