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CERTIFICATE OF POSTER PRESENTATION

I hereby declare that:

Juan García-López, *Sergio Díez-Leal, Jose Antonio Rodriguez-Marroyo, Josu Larrazabal Arbaiza, Igor González De Galdeano, José Gerardo Villa Vicente*

Participated with a poster entitled

Validity, Reliability And Sensitivity Of The Velodrome Tests To Evaluate Aerodynamic Drag On Aero-Bikes

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Roberto Cejuela
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VALIDITY, RELIABILITY AND SENSITIVITY OF THE VELODROME TESTS TO EVALUATE AERODYNAMIC DRAG ON AERO-BIKES

García-López J[12], Díez-Leal S[1], Rodríguez-Marroyo JA[1], Larrazabal J[2], de Galdeano IG[2], Villa JG[1]
[1]*Faculty of Physical Activity and Sports Sciences, University of León (Spain)*
[2]*Euskaltel-Euskadi Professional Cycling Team, Basque Country (Spain)*

INTRODUCTION

Aerodynamic drag (AD) is relevant to cycling performance, mainly during time-trials (i.e. road cycling and long-distance triathlon). It represents about 80-90% of the total resistive forces at 30-40 km/h, respectively. Different techniques were used to evaluate AD (traction resistance test, lab-to-field extrapolation, simplified deceleration, etc.), and the wind-tunnel was considered the reference method. However, it is very expensive (~2000 € per 1-hour testing) and does not simulate exactly the bicycle conduction (García-López et al., 2008). To solve these problems Martin et al. (1998 y 2006a) compared wind-tunnel *vs* taxiway AD data, but the environment on a taxiway is too unstable. No study compared wind-tunnel *vs* velodrome AD data, which contrasts the extended use of the velodrome tests (Martin et al., 2006b). The aims of this study are to probe the validity, reliability and sensitivity of the velodrome tests to evaluate AD.

Figure 1.-Wind-tunnel tests (www.lswt.com/, San Diego, USA)

METHODS

10 professional cyclists UCI Pro-Tour participated (27.8±2.2 years, 66.5±5.0 kg and 1.79±0.05 m). Two of them were evaluated in a subsonic wind-tunnel (Figure 1) which was used previously (Brownlie et al., 2009). All of them performed two tests in the same velodrome of 285.71 m length, 139.6 m straight and 146.1 m curve, with the same powermeter (SRM Scientific Version) and the same bicycle (aero-bike and wheels) (Figure 2): 1-Progressive test (from 30 to 48 km/h): seven sets of 4 min effort (1-2 min rest), using the original configuration cyclist-bike. 2-Stable test (45 km/h, similar to the wind-tunnel): six sets of 11 complete turns (5 min rest). Two sets were performed by using the same original configuration cyclist-bike (test-retest). Four sets were performed lowering the handlebars by 1-4 cm and advancing the pads (forearm support) by 3-5 cm. The postures used in the two cyclists who were evaluated in the wind-tunnel were reproduced in the velodrome, where drag area (S·Cx) was obtained according to the model of Martin et al. (2006a).

Figure 2.-SRM adjustment and velodrome tests (Anoeta, Basque Country)

RESULTS

Significant correlation (r= 0.88, p<0.001) was found between S·Cx values in the wind-tunnel and the velodrome (stable test, Figure 3 left). S·Cx was lower (p<0.01) in the velodrome than in the wind-tunnel (0.237±0.008 and 0.240±0.007 m^2, respectively). As bike speed increased (progressive test), S·Cx decreased (F= 24.1, p<0.001, Figure 3 right). Velodrome test (stable) showed high test-retest reliability (r= 0.99, p<0.001). S·Cx decreased by 3.7±2.0% (F= 28.7, p<0.001) when modifying the cyclists' posture.

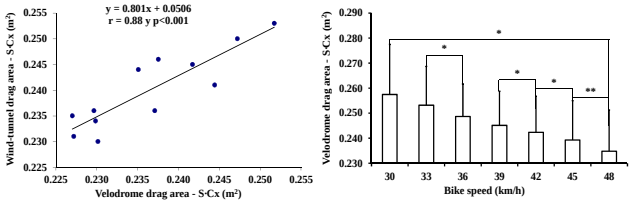

Figure 3.-Drag area (S·Cx) in the wind-tunnel and the velodrome

DISCUSSION and CONCLUSIONS

The evaluation of the AD by means of velodrome tests is a valid and reliable methodology. However, it is very difficult to compare S·Cx values which will be obtained in different velodromes (different straight/curve proportions, different curve inclinations, etc.) or at different bicycle speeds (Olds, 2001). By contrast, if we perform the essays in the same conditions, the velodrome test is sensible to detect small variations in AD (~ 4%, present study), which could be more realistic than those obtained in the wind-tunnel (~15%, García-López et al., 2008).

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