

INFLUENCE OF THE POSITION ON THE BICYCLE ON THE FRONTAL AREA IN ROAD CYCLISTS.

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INTRODUCTION

The frontal area (FA) of the cyclist and the bicycle is a common parameter used to analyze the aerodynamic efficiency of cyclists [1, 2]. Heil, in a previous study, worked out the FA in different cycling positions and came up with a log-linear regression equation to predict de FA in each cycling position [3]. The aims of this study were to analyze the FA of the cyclists and bicycles in three different positions that usually are adopted by road cyclists, and to compare the results with the Heil's prediction model.

METHODS

Seventeen male subjects took part in the present study. All of them compete in the Spanish Cycling First Division and one of them got into the third place in the Junior Cycling World Championship under-23 in 2008. The riders were photographed on their own bicycles, which were supported by a wind-training device, in three positions:

1) the *stem* position: upright torso position with the hands near the stem of the handlebars, 2) the *brake-hoods* position: the hands resting on the brake hoods and 3) the *drops* position: hands resting on the downturned part of the handlebars. The FA was obtained by computerized planimetry. The photographs were taken with a 6 pixels digital camera (Casio Exilim F1 Pro). The camera was placed at the height and on the center of the handlebar at 4 meters far from the front wheel. A repeated measure ANOVA was used to compare the FA of the cyclists and bicycles in the three different positions. A Student's t test was used to compare the present results with the Heil's prediction model.

RESULTS AND DISCUSSION

No significant differences were observed between the position 1 and 2 (Table 1). This means that the combined FA of the cyclists and bicycle does not significantly change when the cyclists placed their hands on the stem and on the

brake-hoods. On the contrary, significant differences were obtained between position 3 and position 1 ($p<0.02$) and 2 ($p<0.02$); there was a significant reduction of the FA when the hands were placed on the downturned part of the handlebars. Comparing the present FA in the three different positions, with the FA obtained by the Heil's regression equation, it is observed (Table 1) that the FA of the cyclist and bicycle in the stem position was well predicted by Heil's regression equation. However when the hands were placed on the brake-hoods and on the downturned part of the handlebar the FA significantly differed with the results obtained with the Heil's equation.

CONCLUSIONS

Results of the present investigation suggest that the frontal area of the cyclists and bicycles is significantly smaller when the subjects place their hands on the downturned part of the handlebar compared to the brake-hoods and stem positions. The Heil's regression equation predicted the FA of the cyclists and bicycles when the cyclists placed their hands near the stem of the handlebar but not when they were placed on the brake-hoods and on the downturned part of the handlebars.

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REFERENCES

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Table 1. Frontal area of the cyclists and bicycles in the three different positions.

	Frontal area (m ²)		
	Position 1	Position 2	Position 3
Computerized planimetry (mean \pm SD)	0.497 \pm 0.040a	0.502 \pm 0.040b,c	0.482 \pm 0.037 a,b,d
Heil's regression equation (mean \pm SD)	0.500 \pm 0.027	0.537 \pm 0.027c	0.508 \pm 0.022,d

a: significant differences between position 1 and 3 ($p<0.05$).

b: significant differences between position 2 and 3($p<0.05$).

c: significant differences between position 2 obtained in this study and the one predicted by Heil's regression equation ($p<0.05$).

d: significant differences between position 2 obtained in this study and the one predicted by Heil's regression equation ($p<0.05$).