

Abstract

# Biomechanics of lower extremities and the bike handlebar reach

Jose Pablo Rodríguez Samaca, Rodrigo E. Argothy Jenner R. Cubides, Sergio Cruz Leon

<sup>1</sup> Study Centre for the Physical Activity Measures (CEMA) Universidad del Rosario, Biometrics Lab- Science Center of Sports (COLDEPORTES), Military School of Cadets "General José María Córdoba", Bogotá (Colombia).

<sup>2</sup> Colombian School of Engineering: Julio Garavito, Bogotá, Colombia.

<sup>3</sup> Max Planck Institute of Biophysics, Frankfurt, Germany.

\* Correspondence: Jose Pablo Rodríguez Samaca. [josepablrodriguez@hotmail.com](mailto:josepablrodriguez@hotmail.com)

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## 1. Abstract

The cyclist position on the bicycle is essential to prevent injuries and to improve the performance. The reach adjustment of the handlebar may have similar or opposite effects to the horizontal adjustment of the saddle. The backward position of the saddle generates a reduction of the hip angle; a greater activation of the hamstring muscles and the ankle plantarflexors; and a greater tibiofemoral shear strength. On the other hand, the forward position of the saddle produces an increase of the hip and the knee angle, a reduction of the activation of the hamstrings and the cuadriceps force increment which may produce patellofemoral pain.

## 2. Purpose

To relate the variations of muscular activity and the joint range of the lower extremities in the pedalling cycle with the reach distance change of the handlebar, by varying the stem length of the handlebar for enthusiastic cyclists.

## 3. Methods

Electromyography of the surface, bilateral joint angles in 3D and the adjustment of their bicycles were measured on eight male cyclists with right predominance. Two stress tests were carried out:

one on maximum power incremental load and the other on steady load to the 57% of the maximum power at 90 rpm in three different handlebar reach lengths: 1. Preferred. 2. Forward (preferred + 3 centimetres) and 3. Backward (preferred - 3 centimetres). Data about the biceps femoral muscle, lateral gastrocnemio, the Medial and Lateral Vastus and the angles of the sagittal plane in the hip, knee and ankle bilateral joints was registered for 30 seconds.

## 4. Results

An analysis of variance (ANOVA) was carried out to compare the muscle activation means with the lower extremity joint angles according to the handlebar reach length: significant differences were found in the left hip angle at 120° and 150° of the pedalling cycle, in the forward position against the backward position (89.378581363 vs 94.169073073 and 96.642240341 vs 101.207447638 respectively,  $P = 0.05$ , Tukey test).

## 5. Discussion

The variation in the handlebar reach of the bicycle from the forward position to the backward position produces an increment of the left hip angle. This modification is observed at



120° and 150° of the pedalling cycling in the transition from maximum power to inferior death point and the non-significant reduction of the lateral left and right gastrocnemio muscle activation.

## **6. Conclusion**

Modifications related to the handlebar reach of the bicycle increase the left hip angle and reduce the lateral gastrocnemio activation in the non-dominant leg at backward position, and in the dominant leg in the forward position.

**Keywords:** Electromyography, joint angles, lower extremity, cycling, bike handlebar reach.