

# The effect of time trial position on physiological variables in elite cycling.

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## Purpose:

Improving time trial performance can be achieved by cycling with an optimized aerodynamic position<sup>1</sup>. However, although reducing the cyclist's frontal area will reduce the air resistance that must be overcome, a time trial position has significant flexibility requirements and some positions can potentially impair the ability to produce external power<sup>2</sup>. Physiological effects of using an aerodynamic position compared to an upright one, such as increased oxygen cost, have been shown in recreational cyclists<sup>2</sup>. In competitive cyclists, on the other hand, no difference between using the drops compared to an upright position has been shown<sup>3</sup>. However, less is known about the effect of these position changes in cyclists at the highest level, as well as the effect of using a too low position. Therefore, the purpose of the present pilot study was to investigate the effect of different time trial positions on physiological variables in elite competitive cyclists.

## Methods:

Three male junior elite cyclists participated in the study. All participants were competitive at the national level and participated in the national championships. Three positions on the bike were used: a high and low time trial position and an upright position with straight arms holding on the base bars. Each bout lasted 5 minutes, was separated by 4 minutes of rest and the work rate was set relative to the individual level of each cyclist, at ~90% of their 20-min peak power. All cycling was done at freely chosen cadences on a time trial specific bike mounted on a trainer (Computrainer Lab™, Race Mate, Seattle, WA, USA).

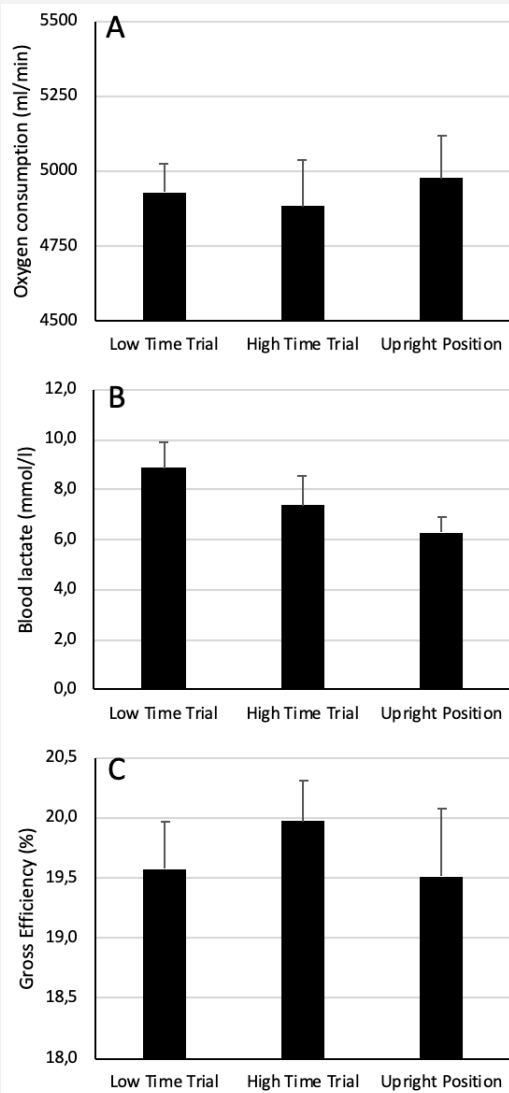
## Results:

Average work rate during the cycling bouts was  $339 \pm 16$  W ( $4.7 \pm 0.2$  W/kg). The physiological response of cycling in the three positions is presented in Figure 1. The lowest time trial position resulted in higher blood lactate levels, higher oxygen consumption and lower gross efficiency compared to the high time trial position. For the upright position, oxygen consumption and gross efficiency were comparable to the lowest time trial position. However, blood lactate during the upright position was the lowest measured across all conditions.

## Discussion:

The main finding of the present study was that using a very low time trial position led to decreased gross efficiency and increased oxygen consumption and blood lactate compared to the high time trial position. The upright position led to an increased oxygen consumption compared to the time trial positions, but blood lactate was lower, which could indicate an increased energetic cost of maintaining an upright position with the arms. The reduced gross efficiency and increased blood lactate further indicate that in elite level junior cyclists, having a too low time trial position may be physiologically unfavourable.





**Figure 1.** Oxygen consumption (A), blood lactate (B) and gross efficiency (C) from cycling in three different positions (n=3).

**References:**

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2. Ashe MC et al. (2003) *Br J Sports Med.* 37: 441-444.
3. Grappe F et al. (1998) *Int j Sports Med.* 19(5): 336-41.

**Key words:** Power Output, Exercise intensity control mechanisms, Performance monitoring, Professional cyclists, Record Power Profile.