BOOK OF ABSTRACTS **Open Access**

The effect of hub design on lower limb muscle activation while riding on different terrain

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Purpose:
In cycling, bike wheels are the direct bike-to-ground object that plays one of the most important roles that keeps the bike moving. However, in all structures that make up a wheel, hub stands the most important part. Yet, whether different hub design would influence lower limb muscle activation or not is currently uncertain.
The aim of this study was to investigate the relationship between different hub designs and terrains to lower limb muscle activation.

Methods:
In this study, we recruited 12 experienced cyclists (average stature: 172.5±5.3 cm, average weight:70.1±8.8 kg). No musculoskeletal and neuromuscular injuries happened in the past 6 months. The study implemented DELSYS EMG to compare lower limb muscle activation by riding same wheel models equipped with 2 different hubs (Figure 1 and 2) at 3 different terrains (Figure 3 and 4) respectively. The EMG were positioned on vastus lateral, vastus medial, rectus femoris, bicep femoris, tibialis anterior and gastrocnemius of the participants' dominate leg with sampling frequency was set as 1000Hz. During the trial, the participants were freed to shift the gears and pedaling cadence to make sure they could finish the lap in the shortest (fastest) time. Differences in muscle activity between 2 hubs and between 3 terrains were determined using two-way repeated measures ANOVA. (α=.05)

Results:
The results showed no interaction effect between hubs and terrains. There were no main effect for different hubs on lower limb muscle activation. However, the main effect for different terrain lower limb muscle activation. Muscle activation observed in vastus lateral, vastus medial, rectus femoris, bicep femoris were higher at uphill and flat road cycling compared to downhill. The gradient would not influence tibialis anterior and gastrocnemius muscle activation (Figure 5). Hubs won't impact the lower limb muscle activation. Thus, no significant differences were found in lap times between same wheel models equipped with different hubs (KSHARP:7.43±0.88 VS KDT240: 7.34±1.33 min).

Conclusion:
Hubs will not vary the lower limb muscle activation as the result showed similarities during uphill and flat road cycling. The possible reason could be contributed to the fraction caused by bearing rolling in the hubs that are not great enough to influence the pedaling performance. Muscle of thigh plays the main role in cycling to which it's activation can be differed depending on the terrain. On the other hand, muscle of calf is responsible for power transmission, therefore, gradient will not affect the calf muscle activation.
The Hubs design could not affect muscle of lower limb. It is similarities lower limb muscle activation at uphill and flat road cycling.
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Figure 1. The Sharp hub

Figure 2. The DT240 hub

Figure 3. Course map

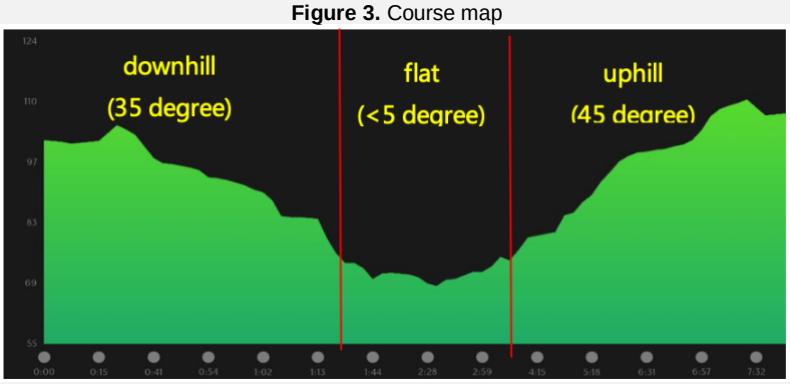

Figure 4. Course Elevation

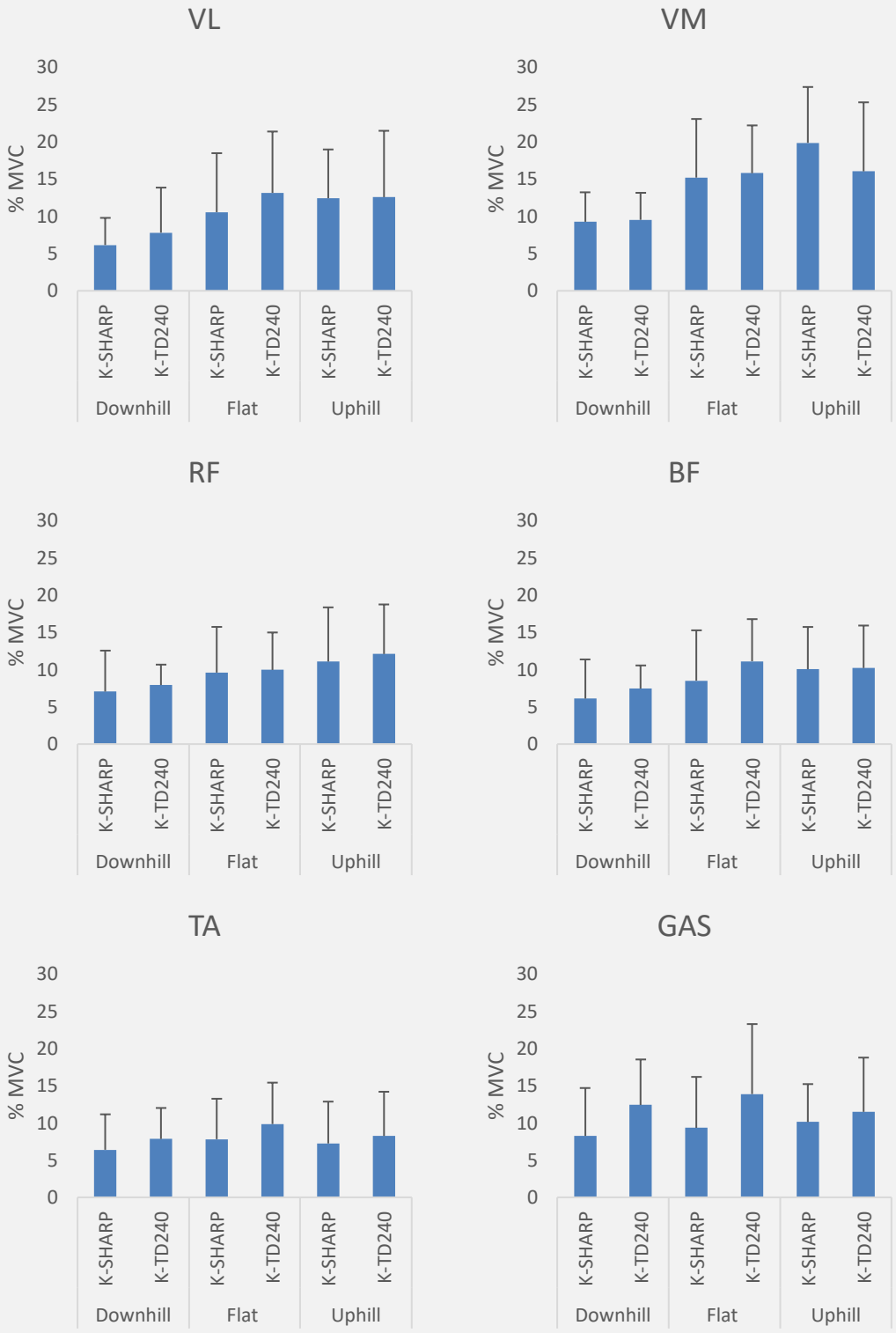

Figure 5. Influence of different hub models and terrains to lower limb muscle activation. VL=Vastus lateral, VM=Vastus medial, BF= Bicep femoris, TA= Tibialis anterior, GAS= Gastrocnemius.