Acute and chronic effects of training with a fixed gear on pedaling technique

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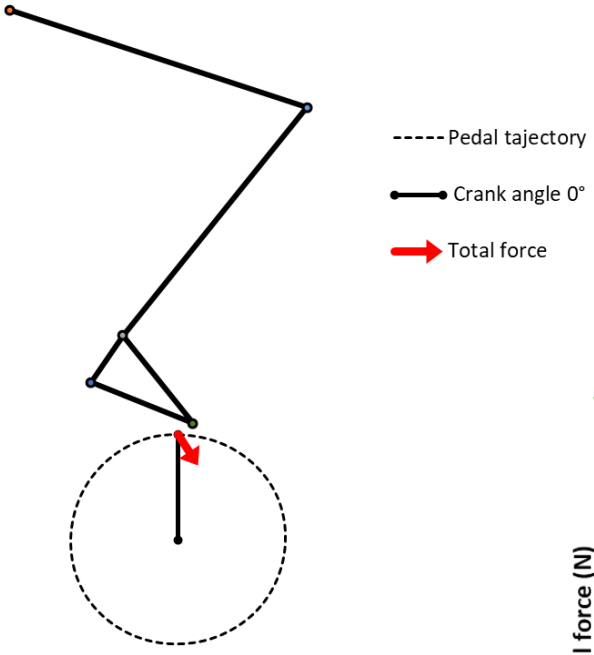
UNIVERSITY OF THE BASQUE COUNTRY

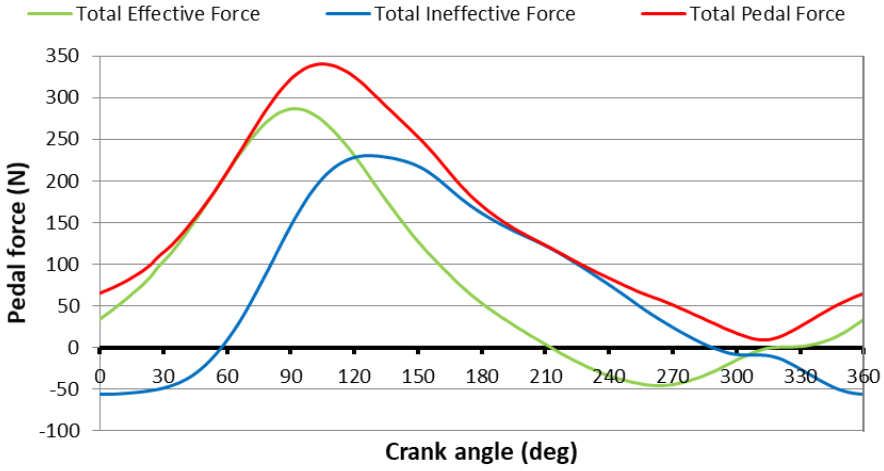
1.
INTRODUCTION

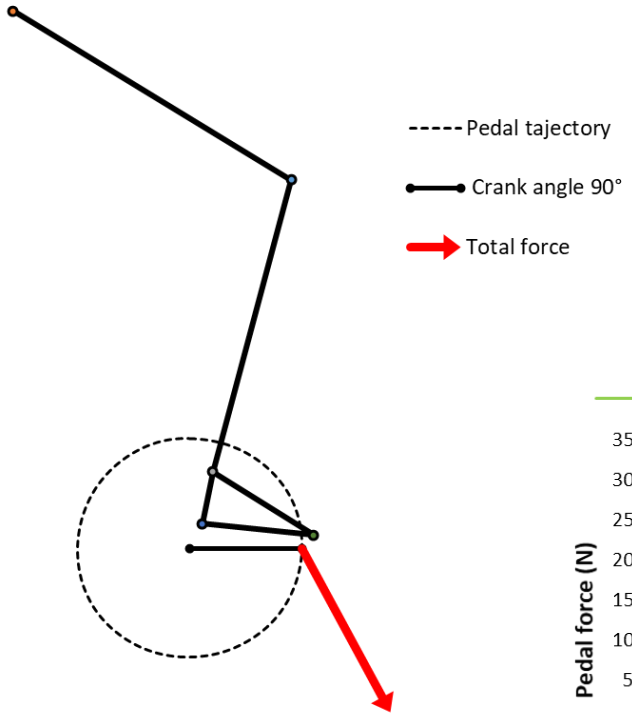
(or why pedaling technique matters)

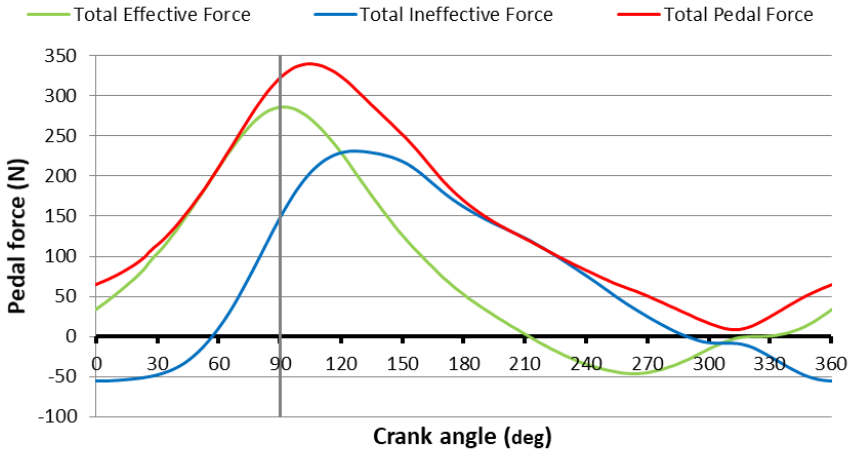
“Training with a fixed gear improves the round pedaling stroke.

Some random coach, 1995 ca.


Pedal tajectory
Crank angle 0°
Total force


Total Effective Force
Total Ineffective Force
Total Pedal Force
Pedal force (N)
350
300
250
200
150
100
50
0
-50
-100
0
30
60
90
120
150
180
210
240
270
300
330
360
Crank angle (deg)


Pedal tajectory
Crank angle 90°
Total force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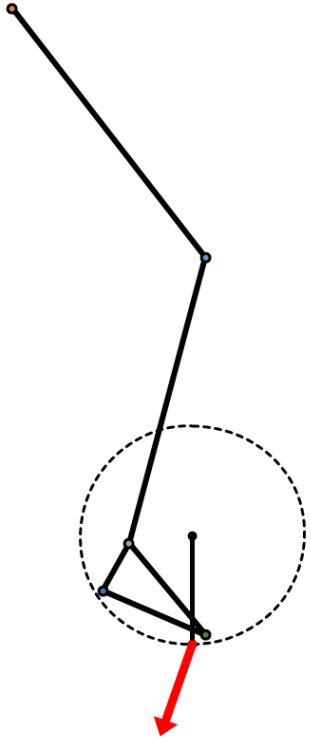
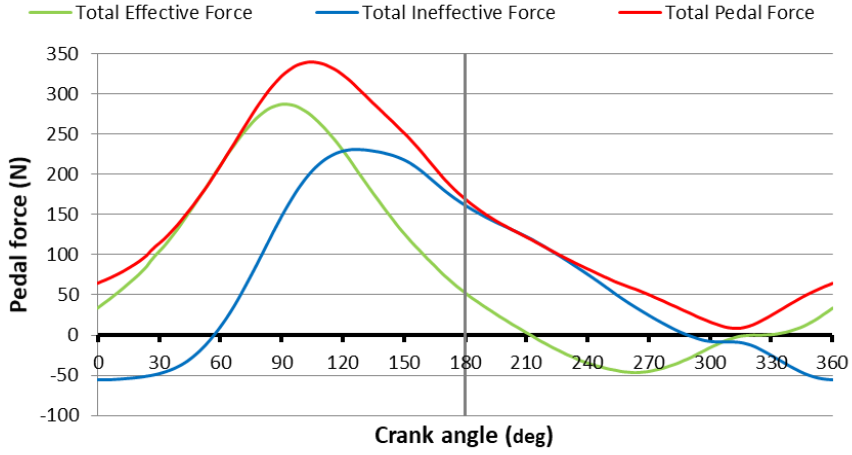
360
Crank angle (deg)

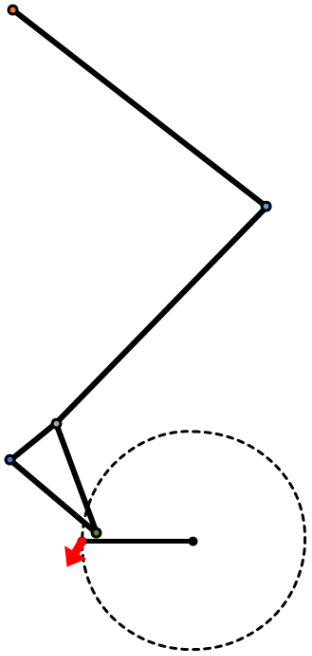


Pedal tajectory

Crank angle 180°

Total force

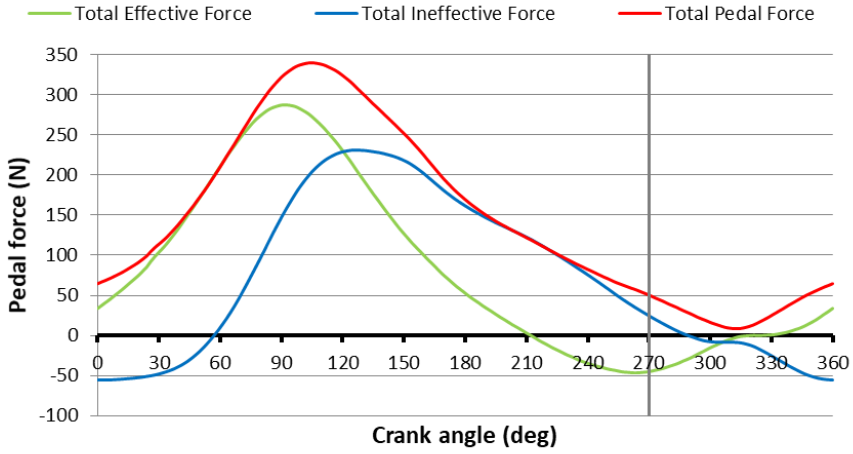




Pedal tajectory

Crank angle 270°

Total force



Open questions:

- Which pedaling technique is more metabolically efficient?

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- Does training with a fixed gear actually modify the pedaling technique?

2.
METHODS

(or how did we do it)

-13 track and 9 road cyclists

-Elite E-motion roller at Low and High intensities

-60, 80 and 100 rpm

-Pedaling kinetics at 1000 Hz for 20'' (PowerForce, O-Tec, Germany)

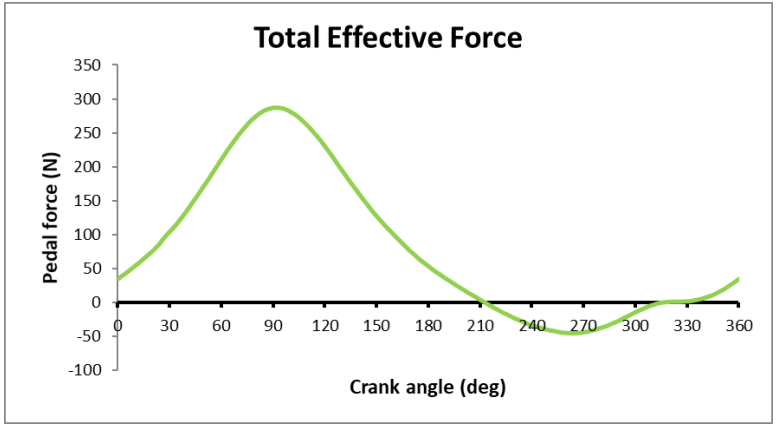
VARIABLES

-Left Power (W)

-Positive (IMP+) and Negative (IMP-) impulses

-Positive Impulse proportion (PIP)

-Index of Effectiveness for the whole pedal stroke (IE_{360}), downstroke ($IE_{0\text{-}180}$) and upstroke ($IE_{180\text{-}360}$).



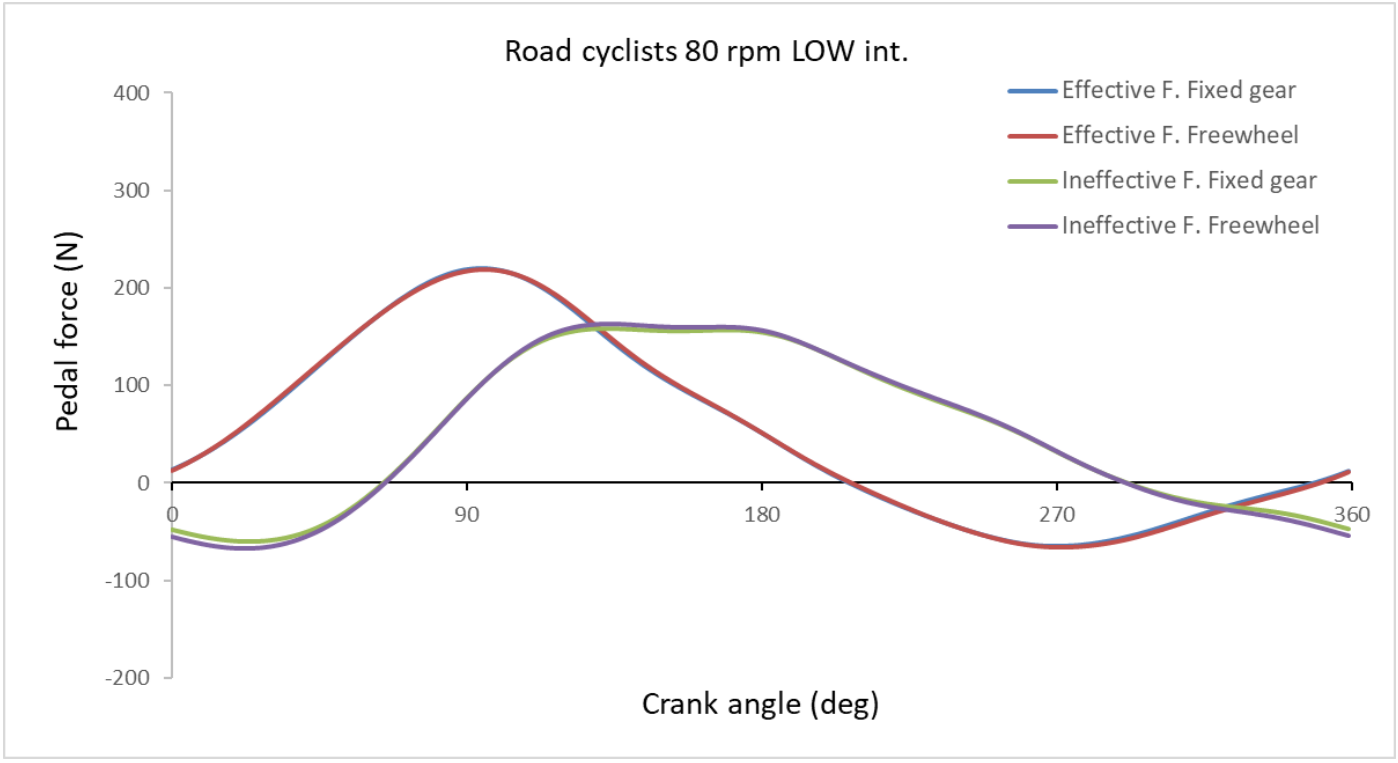
3.
RESULTS

(or what interesting things we found)

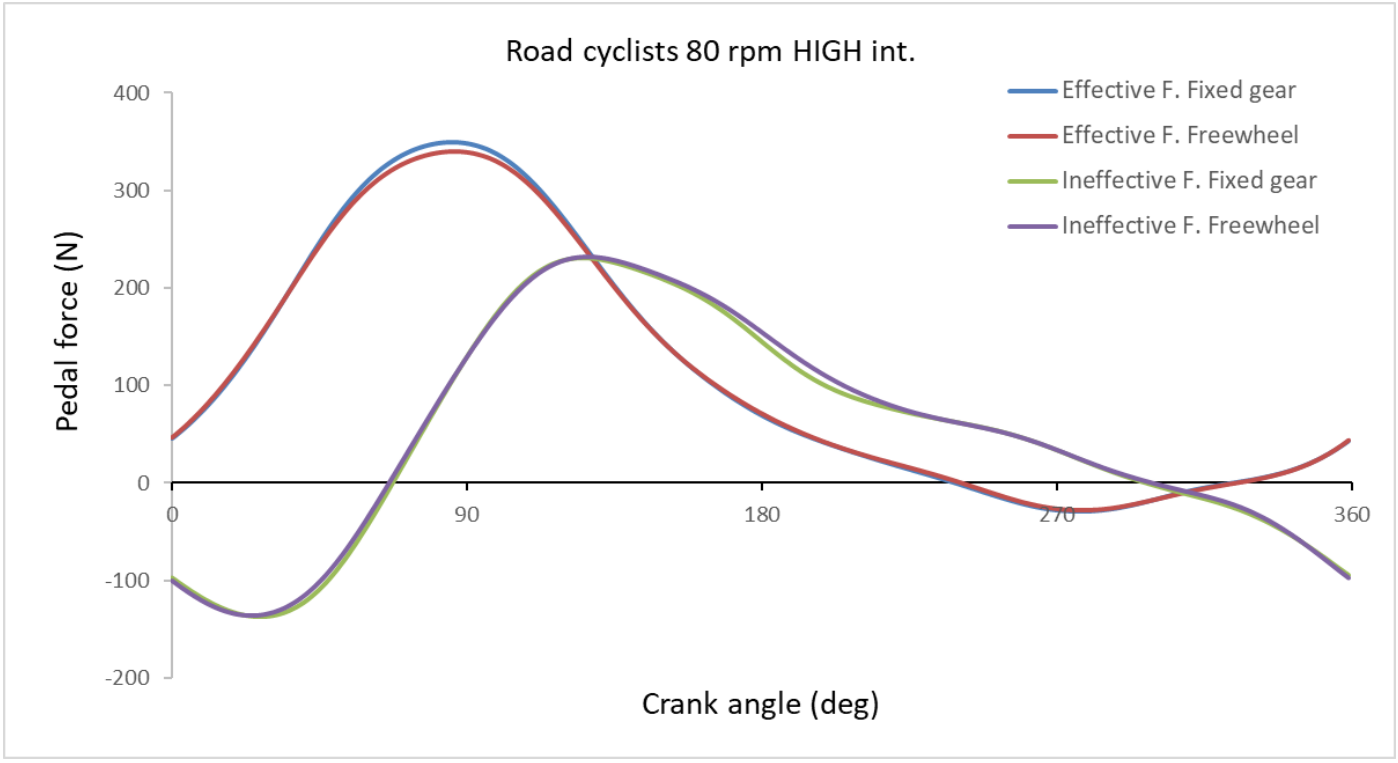
ACUTE EFFECTS

ROAD cyclists	80 rpm, LOW resistance		80 rpm, HIGH resistance	
	Fixed gear	Freewheel	Fixed gear	Freewheel
Left power (W)	76.7 ± 5.6	76.9 ± 4.8	161.8 ± 6.1	159.4 ± 5.9
IMP+ (N·s)	51.13 ± 5.2	51.81 ± 4.1	87.84 ± 4.1	86.63 ± 3.1
IMP- (N·s)	-11.44 ± 3.2	-11.73 ± 3.1	-3.82 ± 3.1	-3.69 ± 3.2
PIP (%)	81.7	81.5	95.8	95.9
IE_{360}	0.43 ± 0.1	0.42 ± 0.1	0.66 ± 0.1	0.66 ± 0.1
IE_{0-180}	0.76 ± 0.0	0.76 ± 0.0	0.79 ± 0.0	0.79 ± 0.0
$IE_{180-360}$	-0.32 ± 0.1	-0.33 ± 0.1	0.12 ± 0.2	0.14 ± 0.2

ACUTE EFFECTS



ACUTE EFFECTS

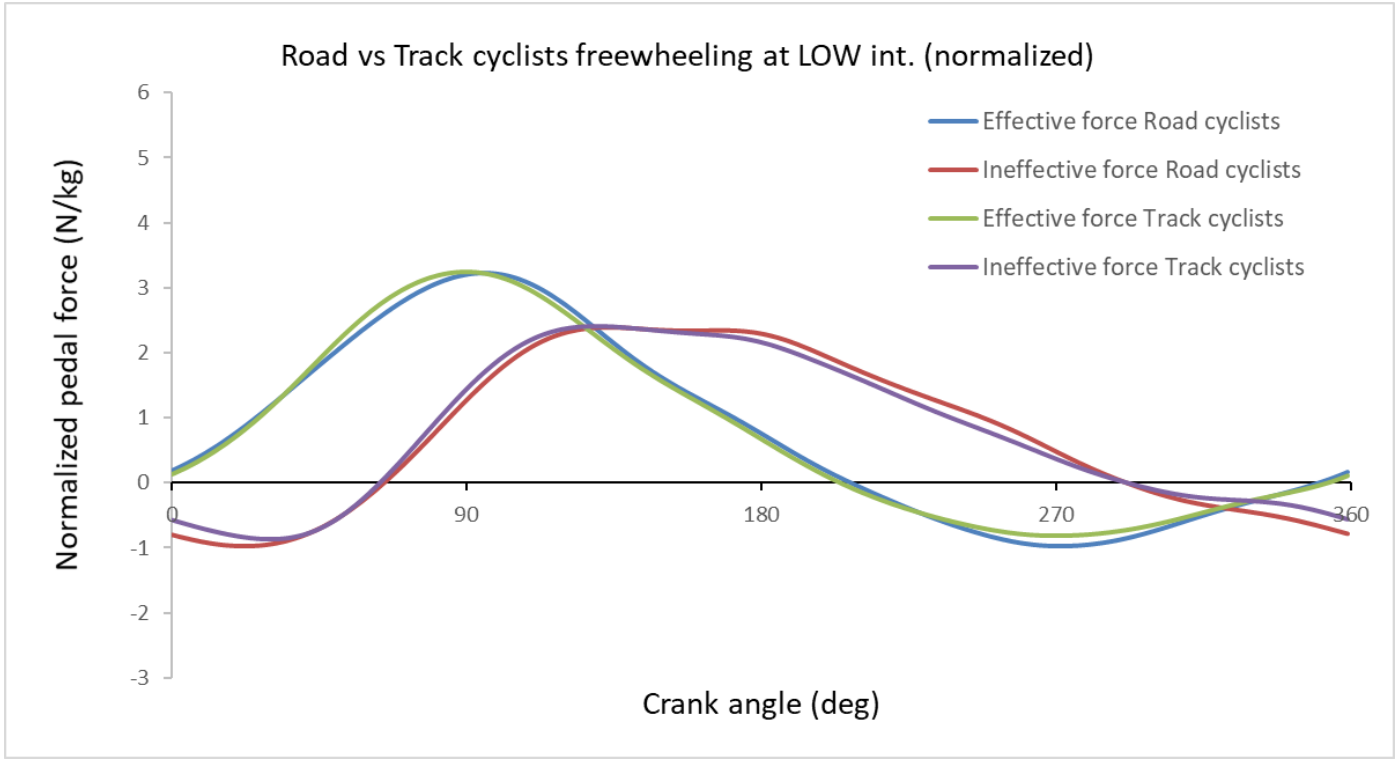


CHRONIC EFFECTS (on freewheel)

	80 rpm, LOW resistance		80 rpm, HIGH resistance	
	Road cyclists	Track cyclists	Road cyclists	Track cyclists
Left power (W)	76.9 ± 4.8	* 87.3 ± 7.6	159.4 ± 5.9	163.5 ± 10.9
IMP+ (N·s)	51.81 ± 4.1	* 56.59 ± 5.2	86.63 ± 3.1	89.51 ± 5.9
IMP- (N·s)	-11.73 ± 3.1	-11.92 ± 2.6	-3.69 ± 3.2	-4.85 ± 2
PIP (%)	81.5	82.6	95.9	94.9
IE_{360}	0.42 ± 0.1	0.44 ± 0	0.66 ± 0.1	0.64 ± 0
IE_{0-180}	0.76 ± 0	0.76 ± 0	0.79 ± 0	0.78 ± 0
$IE_{180-360}$	-0.33 ± 0.1	-0.36 ± 0.1	0.14 ± 0.2	-0.02 ± 0.1

* Statistically significant between track and road cyclists ($p < 0.05$).

CHRONIC EFFECTS (on freewheel)



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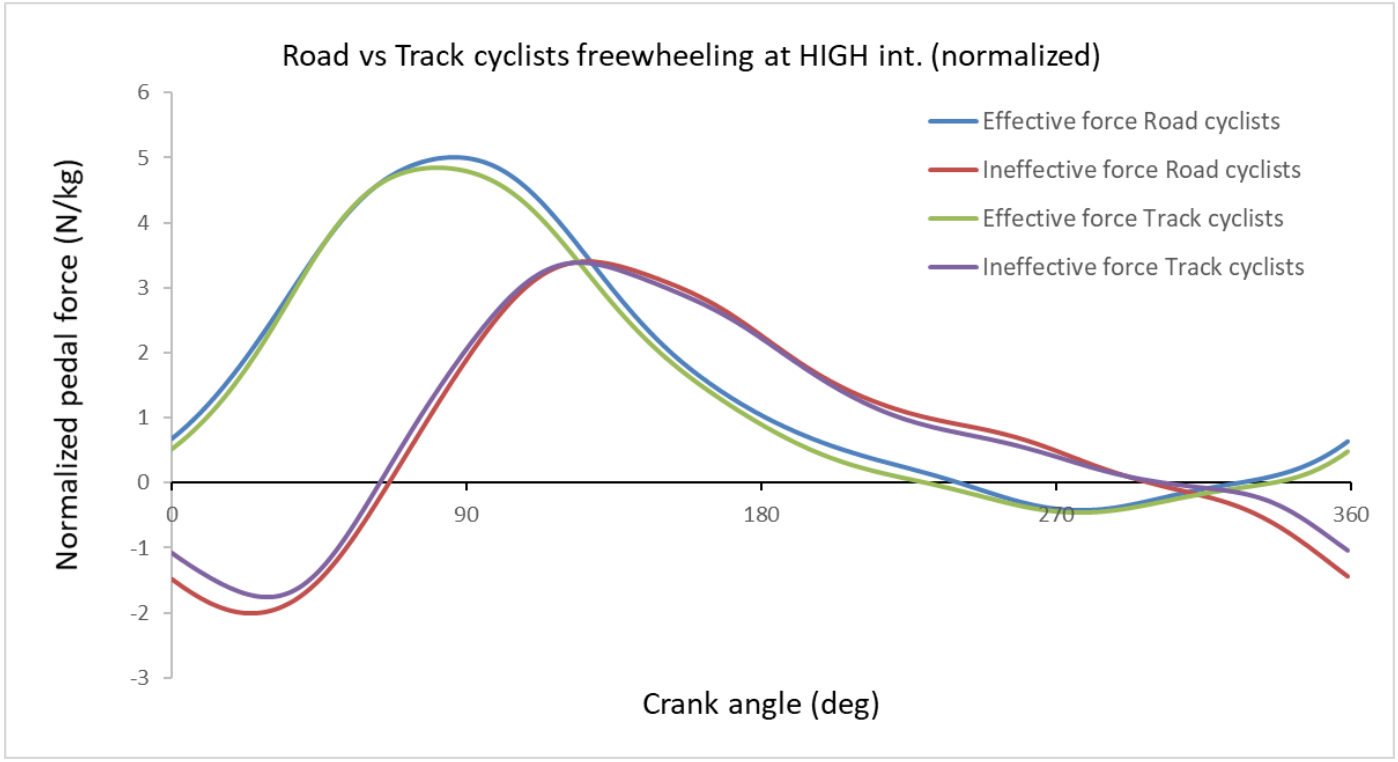
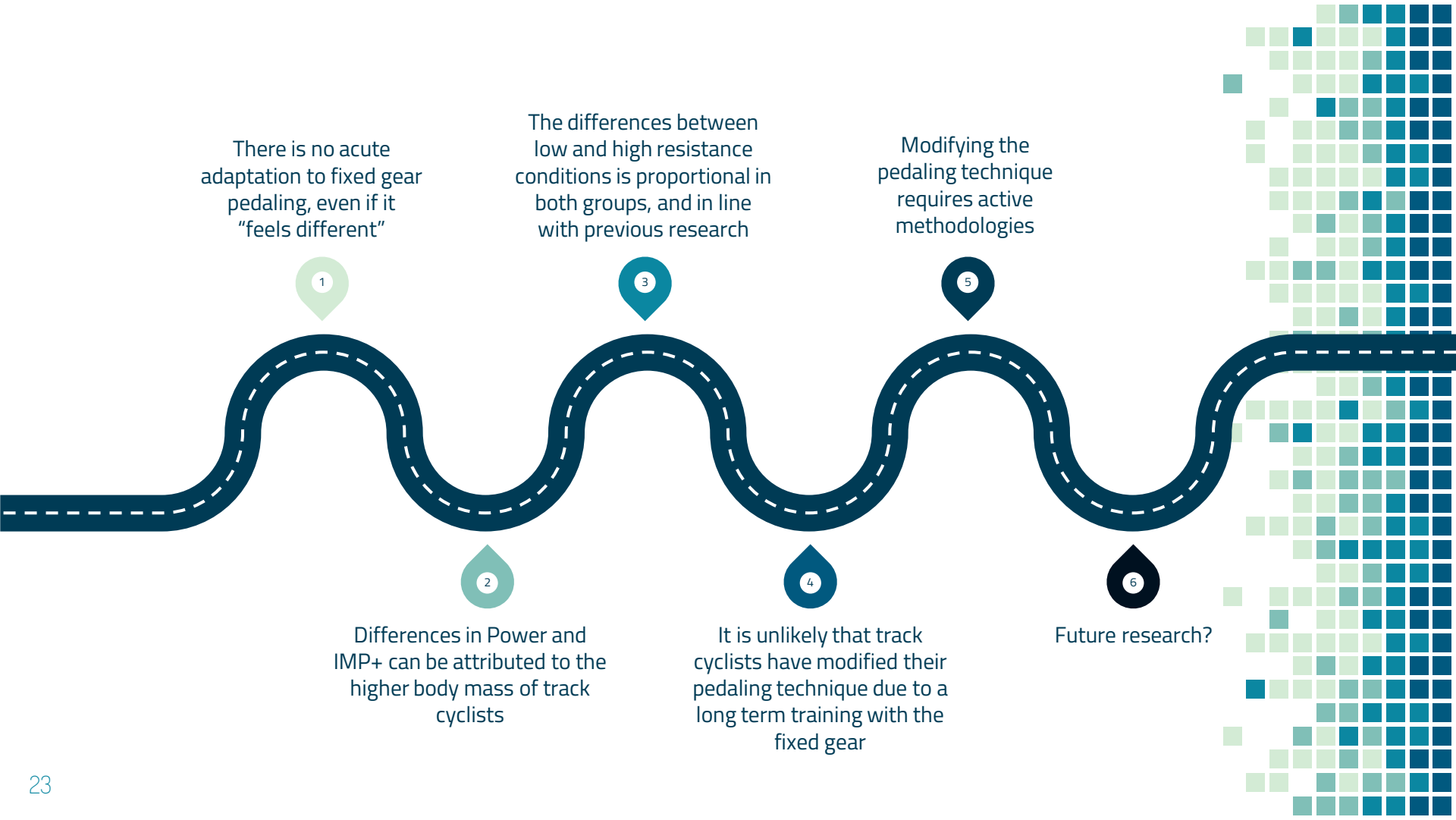


4.

DISCUSION

(or what does it all mean)


There is no acute adaptation to fixed gear pedaling, even if it "feels different"
1
Differences in Power and IMP+ can be attributed to the higher body mass of track cyclists
2
The differences between low and high resistance conditions is proportional in both groups, and in line with previous research
3
It is unlikely that track cyclists have modified their pedaling technique due to a long term training with the fixed gear
4
Modifying the pedaling technique requires active methodologies
5
Future research?
6

THANKS!

Any questions?