

FITNESS PROFILING / CYCLING

Strong on the first climb. Ready for the last.

The rider could lead the group on early climbs and win short sprints. After two hours, power fell sharply. Harder turbo intervals improved fresh efforts but left the late-ride problem intact.

THE ATHLETE

42 years | 75 kg | 8 hours/week | Hilly 160 km sportive | 12-week block

FRESH 20 MIN

315 W

4.20 W/kg

AFTER 2.5 HOURS

255 W

81% of fresh power

FUEL INTAKE

30 g/h

Habitual long-ride intake

THE GOAL

Hold at least 290 W for the final 20-minute climb after 2.5 hours of riding.

Measure the power that survives the ride.

Fresh power hid a durability and execution gap. Metabolic profiling, prolonged-ride testing and strength data pointed to steadier pacing, more endurance work and better fuelling.

+40 W

12-WEEK OUTCOME

More late-ride power | 255 W to 295 W

01 / UNDERSTAND THE CHALLENGE

Too costly early. Too little left late.

Bike-specific gas exchange and lactate tests established sustainable intensity. INSCYD added modelled fuel-use context to explain why early surges deserved attention.

SPIROFIT VO2MAX

60

mL/kg/min

LACTATE LT2

286 W

Upper threshold estimate

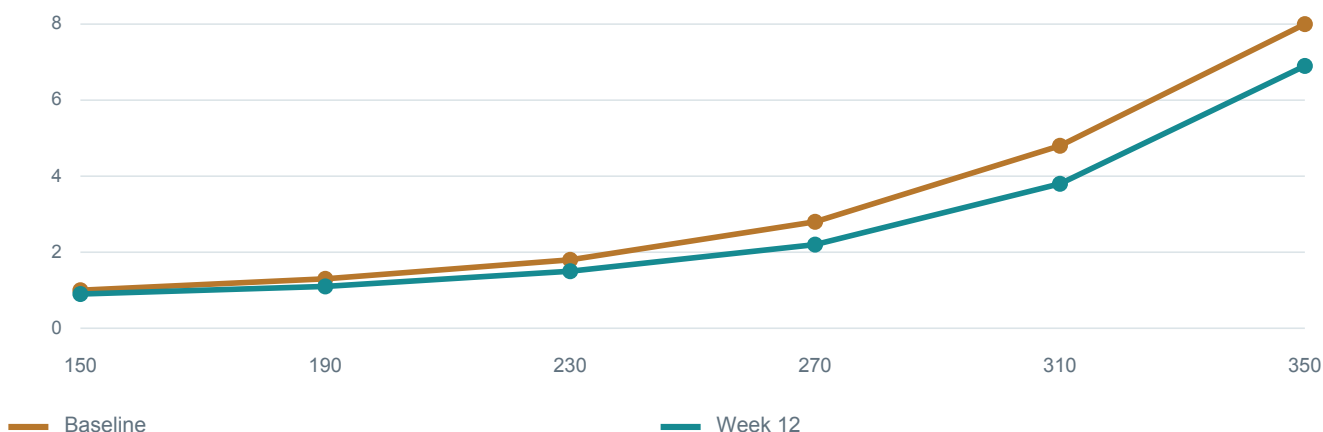
INSCYD VLAMAX

0.61

mmol/L/s | modelled

A lower lactate response at matched power

Blood lactate (mmol/L) | x-axis: cycle ergometer power, watts



THE FUEL-USE CLUE

At 220 W, INSCYD estimated 145 g/h carbohydrate use. Habitual intake of 30 g/h highlighted scope to practise feeding; stored fuel also contributes.

A USEFUL TRADE-OFF

VLamax of 0.61 mmol/L/s fitted the rider's punchy profile. The goal favoured sustainable output; peak sprint power was monitored while training shifted. [2]

THE DECISION

Prioritise power late in the ride. Prescribe endurance and controlled threshold work, limit unnecessary early surges, and train the gut as consistently as the legs.

02 / CONNECT THE MEASUREMENTS

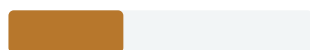
Fatigue changed the rider, not just the watts.

VALD assessed force capacity; Train.Red tracked local recovery. Sweat analysis helped make the long-ride plan specific to the conditions.

Train.Red: local recovery t90

seconds | fixed 3-minute effort | baseline

Fresh



34

After 2.5 h



68

VALD: knee extension after ride

N | DynaMo | baseline after 2.5 h

Left



535

Right



570

ASSESSMENT	BASELINE	WHAT IT ADDED
DynaMo: fresh knee extension L / R	640 / 670 N	Falls to 535 / 570 N late; the change is the main signal.
ForceDecks: IMTP net peak	29.0 N/kg	General strength baseline; not a direct pedal-force measure.
Sweat rate + sodium	1.20 L/h 950 mg/L	Approx. 1,140 mg sodium/h lost in the test conditions.

TRAINING IMPLICATION

Use the final climb as the decision point. Strength work supports force capacity; pacing and fuelling are practised during the longer ride.

SmO2 is a local oxygen supply-demand signal. Use the same device, placement and protocol; a lower value is not automatically worse. Video and force tests support the performance story, not a diagnosis. [3-6]

03 / APPLY THE RIGHT STIMULUS

Train for the final climb.

The block moved from chasing fresh power to keeping power available late. Total time rose only where recovery and daily life allowed.

01 Build the long ride

One weekly ride: 2 to 3.5 hours, mainly 165-200 W initially. Add duration before intensity; every third week reduce volume.

Stimulus: build tolerance to prolonged work and repeat the fuelling routine.

Check: lower late-ride heart-rate drift at fixed 220 W.

02 Accumulate controlled power

One weekly session: 3 x 12 minutes at 255-270 W, 4 minutes easy. Progress to 2 x 25 minutes. In weeks 7-10, occasionally place 2 x 10 minutes late in a long ride.

Stimulus: sustain aerobic power while managing accumulated fatigue.

Check: stable power and controlled effort; no all-out final repetition.

03 Keep force and a little punch

Two 25-minute strength sessions: squat or leg press, hinge and split squat, 3 x 5-6, with 2 reps in reserve. Add 4 x 8-second bike sprints every 7-10 days when fresh.

Stimulus: retain strength and short power as endurance work increases.

Check: stronger DynaMo results without excessive soreness or loss of sprint ability.

04 Fuel before the fade

Build carbohydrate intake from 30 to 60, then 75-90 g/h on long rides using tolerated mixed sources. Start in the first 20 minutes. Trial 0.6-0.9 L/h fluid at 900 mg sodium/L.

Stimulus: improve intake tolerance and reduce preventable late-ride underfuelling.

Check: consistent intake, no gut upset and no body-mass gain from drinking.

Example week: Mon rest; Tue controlled power + strength; Wed easy; Thu endurance; Fri rest; Sat endurance + short strength; Sun long ride. Roughly 8 to 10 hours/week if recovery stays good.

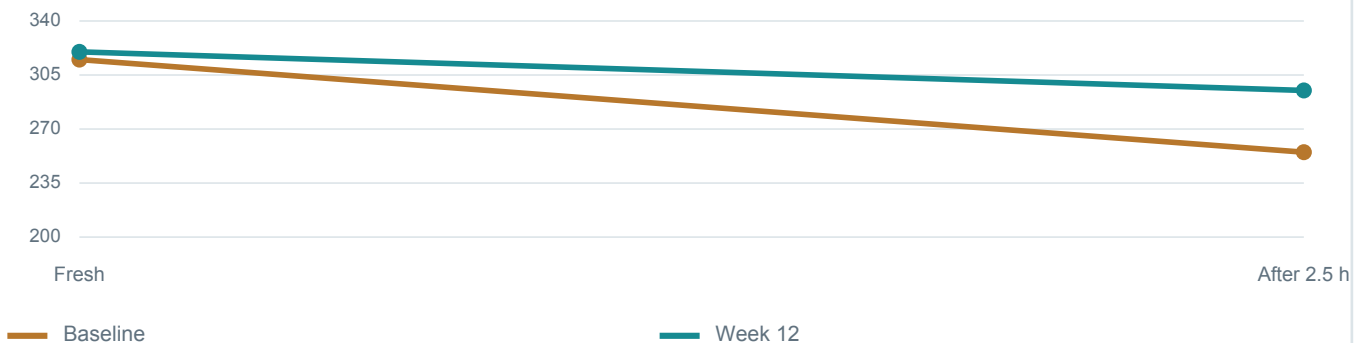
04 / CHECK WHAT CHANGED

The late-ride power gap narrowed.

Week-12 results from matched laboratory rides. Most of the improvement appeared when tired, exactly where the rider needed it.

Fresh versus late-ride 20-minute power

Mean power (W) | identical 2.5-hour preload and lab fuelling



OUTCOME	BASELINE	WEEK 12	WHAT CHANGED
Late-ride 20-minute power	255 W	295 W	+40 W / +15.7%
Fresh 20-minute power	315 W	320 W	+5 W / +1.6%
Late / fresh power retention	81.0%	92.2%	+11.2 percentage points
Heart-rate drift at 220 W	9.2%	4.1%	Less strain at fixed output
Five-second peak power	1,000 W	980 W	Small sprint trade-off
Long-ride carbohydrate intake	30 g/h	80 g/h	Practised outside matched lab tests

WHAT THE PROFILING MADE POSSIBLE

The meaningful gain was 40 watts when tired, with little change in fresh power. The next block would consolidate that gain and watch the sprint trade-off rather than chasing every metric upwards.

APPENDIX A / ASSESSMENT RECORD

The numbers behind the story.

Baseline and week-12 values are simulated. Direct observations, calculated results and model estimates are separated so the numbers can be interpreted properly.

MEASURE / SOURCE	BASELINE	WEEK 12	UNIT / INTERPRETATION
SpiroFit: VO2max	60	61	mL/kg/min; cycle gas exchange
SpiroFit: VT1 / VT2	202 / 290	216 / 305	W; ventilatory estimates
Blood lactate: LT1 / LT2	205 / 286	220 / 301	W; curve-based estimates
INSCYD: VLamax	0.61	0.49	mmol/L/s; model estimate
INSCYD: FatMax / peak fat	175 / 0.48	200 / 0.64	W and g/min; modelled
INSCYD: carbs at 220 W	145	120	g/h; modelled total use
ForceDecks: IMTP net peak	29.0	31.0	N/kg; body weight subtracted
DynaMo: knee extension fresh L / R	640 / 670	690 / 710	N; fixed knee angle and lever arm
DynaMo: knee extension late L / R	535 / 570	635 / 655	N; after matched 2.5-hour ride
Train.Red: recovery t90 fresh / late	34 / 68	33 / 45	s; same sensor site and recovery
Sweat rate / sodium	1.20 / 950	Plan retained	L/h and mg/L; condition-specific
Ochy running analysis	Not used	Not used	Running analysis; not a bike-fit tool

LT1/LT2: lower/upper blood-lactate threshold estimates. VT1/VT2: ventilatory thresholds. These are related markers, not identical measurements. VLamax and fuel-use values shown here are modelled, not direct instrument readings.

APPENDIX B / REPEAT THE RIGHT TEST

A result is only useful if it is comparable.

The protocol links the finding to the goal. These case-study protocols span several visits, including follow-up; they are not all delivered inside one three-hour appointment.

BIKE-SPECIFIC PROFILING

Four-minute ergometer stages with end-stage capillary lactate, plus maximal gas-exchange assessment. Same bike fit, calibration and cadence target. INSCYD values are simulated examples of model outputs from an appropriate valid cycling profile. A 20-minute mean power is not labelled FTP.

DURABILITY PROTOCOL

Fresh and fatigued 20-minute efforts on separate rested days. Fatigued trial follows 150 minutes at 200 W, with brief 220 W observation windows for heart-rate drift. Retest at the same absolute load. Both visits use 60 g carbohydrate/h and 0.75 L fluid/h; improved habitual intake is assessed separately.

FORCE, OXYGEN AND SWEAT

Force and NIRS assessments use a separate repeated preload to avoid maximal efforts contaminating recovery measures. NIRS probe on the same marked right vastus lateralis; 3 minutes at 300 W, then 100 W recovery, before and after preload. Sweat assessed at 20 C / 50% RH with fixed fan; mass balance plus wearable sodium estimate.

HOW TO READ THE EVIDENCE

Across visits: same time of day, food and caffeine routine, equipment and warm-up; avoid hard training for 48 hours. Repeat key tests after familiarisation. Small changes may sit within measurement variation. The results describe this athlete; they do not establish injury-risk cut-offs or rankings.

Sweat rate = (pre-exercise mass - post-exercise mass + drinks - urine) / duration, approximating 1 kg as 1 L. Sodium loss estimate = sweat rate x sweat sodium. Regional wearable readings are estimates; confirm unexpected values. Intake is adapted to comfort and conditions, not automatic 100% replacement.

Training response in this worked example: follow-up changes are internally consistent examples, not causal proof or guaranteed outcomes. Thresholds and training doses require individual review.

APPENDIX C / SUPPORTING READING

The methods, in context.

Sources support the assessment approach and general training principles. They do not validate the invented athlete values or the example improvement shown in this document.

1. SpiroFit: measured gas exchange and ventilatory thresholds

<https://spirofit.de/frequently-asked-questions/>

2. INSCYD: interpretation and estimation of VLamax

<https://inscyd.com/wp-content/uploads/2021/11/INSCYD-Whitepaper-VLamax.pdf>

3. VALD: strength and running assessment rationale

<https://valdhealth.com/news/optimizing-endurance-running-performance-and-rehabilitation-a-q-and-a-with>

4. Ochy: video-derived running metrics

<https://www.ochy.io/science>

5. Train.Red: running assessment and muscle oxygen context

<https://train.red/blogs/news/running-assessment>

6. Sweat measurement: fluid loss and body-mass method

<https://www.precisionhydration.com/performance-advice/hydration/how-to-measure-your-sweat-rate/>

7. Durability: test design and control of fatigue protocols

<https://pubmed.ncbi.nlm.nih.gov/40150840/>

8. Strength training and running economy: systematic review

<https://pubmed.ncbi.nlm.nih.gov/38165636/>

9. ACSM / Academy / Dietitians of Canada: sports nutrition

<https://pubmed.ncbi.nlm.nih.gov/26920240/>