PhysicalSolutions
PHYSIOTHERAPY • TRAINING • EDUCATION

Wattbike : Training with Power to Weight Ratio

This is an extract from Wattbike's Training manual that succinctly explains the relevance of power to weight ratio in cyclist.

The Wattbike measures absolute mechanical power in Watts. The amount of power produced is measured from the sum of all the forces applied to the chain through the cranks. One way to utilise the Wattbike's power data is to determine power to weight ratio [P/Kg] and use this information to optimise performance.

What is power to weight ratio [P/Kg]?

Power to weight [P/Kg] ratio is the relationship between:

- Power (measured is watts [W])
- Weight (measured in kilograms [kg])

For example if a cyclist produces a maximum minute power of 350 W during a cycling ramp test and weighs 70 Kgs the power to weight ratio [P/Kg] is expressed as: **P/Kg = 350/70 = 5 Watts per kilogram of body weight**. A cyclist weighing 90 Kgs achieving the same maximum minute power would have a power to weight ratio [P/Kg] of **P/Kg = 350/90 = 3.89 Watts per kilogram of body weight.**

Wattbike Expert Software (version 2.50.42 upwards) automatically calculates the Power to Weight ratio [P/kg] providing the correct weight, in kilograms has been entered in the cyclist's personal file.

Why measure power to weight ratio [P/Kg]

The purpose of measurement is to optimise power to weight ratio relative to a specific task, for example cycling up a hill or during a sprint of short duration (note also the consideration of drag and rolling road resistance where surface area and weight are equally relevant even on a flat road course).

Optimisation can be done in two ways which can be combined:

- Increasing absolute power
- Decreasing weight

Losing weight as a means of improving the ratio is not recommended unless clearly overweight. Dieting to attain an "ideal" cycling weight can be very counter productive. It's not as simple as losing weight, if lean muscle mass is lost absolute power output will be reduced as the means for producing the power has gone.

The best option is to focus on optimising power whilst balancing diet and weight. It is far simpler to maximise power than control body weight. Weight loss can usually be achieved naturally by a structured training and racing program. By focusing on training to maximise power (increasing lean muscle mass) power and weight ratio can be optimised.

The basic science of power to weight ratio[P/Kg]

The best explanation is to consider hill cycling ability. Assume two cyclists of equal ability and identical equipment riding uphill side-by-side. The first cyclist weighs 85 Kgs and has an average power on the climb of 450 watts. The second cyclist weighs 65 Kgs and has an average power on the climb of 380 watts.

Looking at pure absolute power the natural assumption is that the first cyclist would easily beat the second cyclist on this climb because of the 70 watt power difference.

However, power is not the only variable that cyclists have to contend with whilst climbing. Part of a cyclist's climbing power is used to move horizontally in a forward direction and part to overcome the influence of gravity in moving in an uphill direction (i.e. climbing the hill).

When weight is taken into account in addition to absolute climbing power the result for each cyclist is:

- Cyclist 1 P/Kg= 5.29 W/Kg (450/85)
- Cyclist 2 P/Kg = 5.85 (380/65)

Cyclist 2 in most circumstances would get to the top of the hill first even though cyclist 1 is producing 18% more absolute power than cyclist 2.

What is a typical power to weight ratio

It really depends on the type of cyclist. Sprinters typically have high short duration power output and lower endurance scores whilst endurance cyclists may have low short duration power and high endurance scores. Weight (lean muscle mass) is an advantage for short duration sprint cyclists.

As an example, world class male sprint cyclists typically weigh over 80 Kgs and in some cases over 90 Kgs and are capable of peak power scores in the range 1750-2250 W and max minute power of 360-400W. Conversely world class male endurance cyclists typically weigh closer to 70-75 Kgs and whilst producing lower peak power scores of 1000-1250W have a much higher max minute power score of 420-500W.

World class female sprint cyclists typically weigh 60-65 Kgs with peak power scores of 1000-1500W, world class female endurance cyclist typically weigh well below 60 Kgs with max minute power score of 320-350W

On a Wattbike we have seen scores within these ranges - the highest peak power score, so far is 2300W (male) and 1600W (female). Testing peak power and maximum minute power on a Wattbike is an easy process. A 6 second Peak Power Test is built into the Wattbike Performance Computer and Maximum Minute Power Ramp Test protocols are easy to construct on a Wattbike and analyse using Wattbike Expert Software.

How to improve power to weight ratio [P/Kg]

In the example above cyclist 1 would need to lose 9 Kgs to increase power to weight ratio to equal that of cyclist 2. A rapid reduction in body weight of this magnitude would result in the loss of lean muscle mass responsible for producing the power in the first place. The better choice would be to focus on increasing absolute power using a structured training program.

The advantage of the Wattbike is the control and immediate, accurate feedback on relevant parameters such as gearing (resistance), cadence (see section on Gearing and Cadence), power output, technique (using the unique Polar View facility of the Wattbike Performance Computer and Expert Software) and many other cycling parameters to optimize performance.