# $VLa_{max}$ – glyoclytic power –
# the secret weapon of elite endurance performance coaches

*20% of the difference in performance between cycling amateurs and professionals, can be explained by $VO_{2max}$. 75% of the performance differences in these two groups is accounted for by differences in $VLa_{max}$.*

Glycolytic power – or $VLa_{max}$ – has proven a highly important metric in endurance sports over the past decade. In the highest ranks of sports, such as swimming and cycling, the integration of $VLa_{max}$ as a metric has helped to understand athletic performance. Almost unnoticed in the past decade, VLamax has been a key metric to success for:

- Dr. Olbrecht – advisor to coaches whose athletes won 18 medals in Rio Olympic Games
- STAPS: Europe's most successful testing and coaching business, having Movistar, Katusha-Alpecin, Bora-Hansgrohe, et at. as their customers
- Sebastian Weber – one of cyclings most successful coaches in the past decade, worked with athlete such as: Alban Lakata, Tony Martin, Ivan Basso, André Greipel, Peter Sagan, et al.
- Dan Lorang – former head coach of the german triathlon federation, private coach of Jan Frodeno et al.

A high $VLa_{max}$ allows for high performance in short events such as sprinting. On the other hand, high $VLa_{max}$ causes higher glycolytic flux rate at sub-maximum intensities. This leads to high carbohydrate combustion, slower recovery from lactate accumulation, lower energetic contribution from fatty acids and lower performance at anaerobic threshold.

## Aerobic & Glycolytic power

The maximum aerobic power is commonly measured as $VO_{2max}$ – the maximum oxygen uptake capacity. Why is $VO_{2max}$ important? For each milliliter of oxygen processed in the aerobic metabolism, energy is produced.

In the glycolytic metabolism (glycolysis) lactate (or pyruvate) is produced out of glucose. This anaerobic process (no oxygen is involved) also produces energy. The amount of energy produced per piece of glucose is much less compared to the aerobic metabolism. However, this type of energy is produced at a much faster rate. Therefore, glycolysis is much more important for shorter, high intensity efforts. For such short efforts, a high energy production in a short time is needed. As the amount of energy produced is proportional to the amount of lactate or pyruvate produced, $VLa_{max}$ is a feasible way to measure glycolytic performance. $VLa_{max}$ stands for max production of Lactate.

$VLa_{max}$ hasn't been widely measured until now. Historically, very few, but highly successful coaches and sport scientists have used it. The reason for this? $VLa_{max}$ wasn't easily accessible…yet.

## The role of $VLa_{max}$ in endurance performance

Glycolysis is not only important for sprinters, but has a tremendous effect on endurance performance. Glycolysis is the only way to utilize carbohydrates as a fuel during exercise. High glycolytic rates, enable high rates of utilizations of carbohydrates as a fuel. On the other hand, a high utilization of carbohydrates as fuel, reduces the need for fatty acids as a fuel- thus lowering fat metabolism. Furthermore, the maximum glycolytic power – or $VLa_{max}$ – influences the glycolytic rate at endurance exercises. High $VLa_{max}$ will trigger high lactate production during endurance exercises. This high lactate production lowers power at anaerobic threshold and the ability to recover from lactate accumulation.

Do you wonder what enables high performance at anaerobic threshold? Why do different athletes require different fueling strategies and carbohydrate intake? Why do different athletes encounter different abilities to utilize fatty acids as a fuel – even though those athletes might possess similar performance at anaerobic threshold? What allows certain athletes to change their race rhythm and attack their competition, with bouts of high power/energy output, again and again and again? If these questions are of interest to you – assessing $VLa_{max}$ might – in most cases – be the answer to these questions.

*Higher maximum glycolytic power (higher $VLa_{max}$) triggers higher lactate production rates at sub maximum / endurance exercises*

Lets look at two identical athletes. These athletes share identical body weight and body composition (muscle mass, fat mass, etc.), identical efficiency (energy needed to produce one Watt of power), identical buffering capacity, identical aerobic capacity ($VO_{2max}$), but with two different $VLa_{max}$. The high $VLa_{max}$ triggers higher lactate production rates at all sub maximum intensities. The athlete with the higher $VLa_{max}$ possess a higher lactate production rate, for any given power output, when compared to the athlete with the low $VLa_{max}$.

For the athlete with a higher $VLa_{max}$, this higher lactate production results in a lower intensity at which lactate production equals lactate clearance. This is the mechanism of how a high $VLa_{max}$ lowers anaerobic threshold- as shown below.

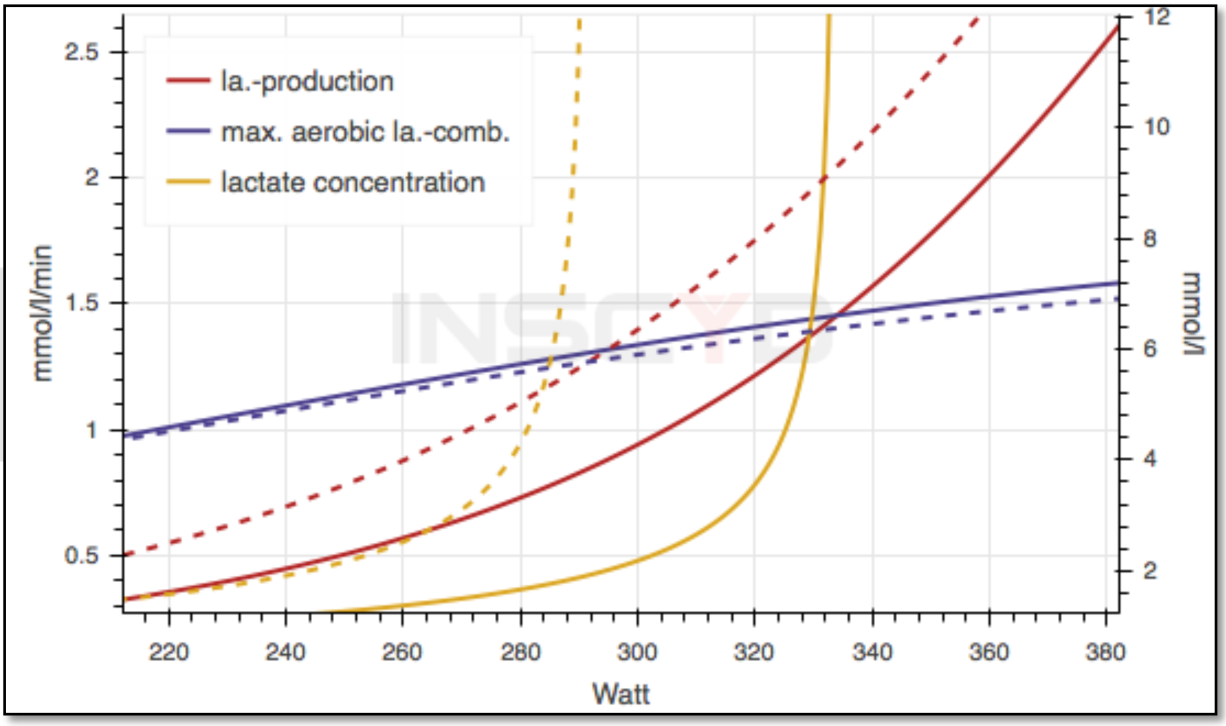


Fig 1: Muscle Metabolism in steady state conditions are shown here. The influence of a high vs. a low $VLa_{max}$ on the lactate production, and anaerobic threshold is noted: all doted lines = high $VLa_{max}$, all solid lines= low $VLa_{max}$. Blue line shows the maximum possible lactate clearance rate by aerobic metabolism. The red line shows the lactate production. The yellow line shows the corresponding lactate concentration – for steady state conditions.

*Higher lactate production rates come with the cost of higher carbohydrate utilization – therefore reducing fatty acid combustion*

Muscles produce lactate using carbohydrates. Therefore, a high lactate production rate consequently results in higher carbohydrate utilization rates.
With a higher amount of energy coming from carbohydrates, as a consequence the fat combustion rate is lower.

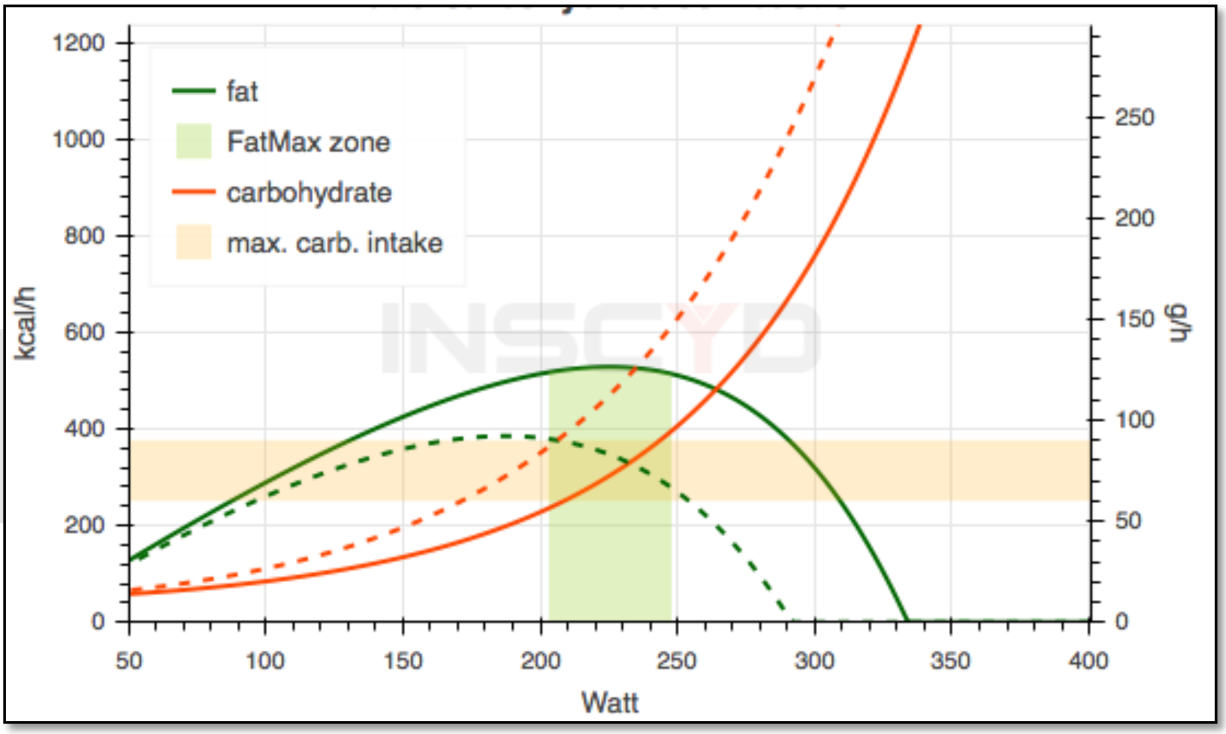


Fig 2: Carbohydrate combustion (red) and fat combustion (green) for a high $VLa_{max}$ (dotted lines) and a low VLamax (solid line)