Fatmax and its Importance in long duration efforts

Fatmax is a fundamental concept in exercise physiology, defining the specific training intensity at which the body reaches its maximal fat oxidation rate (expressed in grams per minute or calories per hour).

For distance and ultra distance runners, training precisely in this zone is of great importance to improve metabolic efficiency, increase mitochondrial density, and optimize muscle glycogen "sparing."

By raising the Fatmax threshold, an endurance athlete can run at faster competitive paces while predominantly utilizing lipids as fuel.

This prevents the premature depletion of the body's limited carbohydrate stores, which would otherwise lead to what is popularly known un the marathon as "hitting the wall".

The predominant metabolic pathway the body relies on when exercising at this threshold is the beta oxidation of fatty acids (the chemical process by which cells break down fats to convert them into energy), working in synergy with the Krebs' cycle and mitochondrial oxidative phosphorylation, where the body uses oxygen to produce ATP inside the mitochondria.

At the cellular level, free fatty acids are transported into the mitochondria via the enzymes carnitine palmitoyltransferases (CPT1 and CPT2) for energy degradation. Internationally renowned researchers like Dr. Iñigo San Millán highlight that this intensity stimulates maximal cellular health by coupling lipid oxidation with lactate clearance capacity.

If intensity rises excessively, glycolytic flux skyrockets, producing pyruvate and lactate; the latter acts by inhibiting fat transporters and blocking beta oxidation.

The Fatmax zone is typically located within an intensity range of 60% to 65% of VO2 Max in moderately trained endurance athletes, although this spectrum exhibits marked individual variability.

In well-trained runners, this optimal metabolic point can extend up to 70% or 75% of VO2 Max, closely coinciding with the first lactate threshold or aerobic threshold (VT1/LT1).

Research with endurance athletes establishes the average for trained subjects at 63% to 64% of VO2 Max; beyond this percentage, carbohydrate utilization becomes the priority energy source, and the fat oxidation rate drops dramatically.

There is a thin but clear line differentiating Fatmax from recovery pace (or regenerative running).

Recovery pace is executed at extremely low metabolic intensities, usually below 50-55% of VO2 Max or in the so called Zone 1, and its goal is to use blood flow to achieve greater removal of metabolic byproducts without adding neuromuscular fatigue or central stress.

In contrast, Fatmax demands a more metabolically challenging effort located in Zone 2.

In this zone, the oxidative stimulus and the volume of oxygen consumed per minute are substantially higher, requiring prolonged sessions designed to trigger chronic structural adaptations and real training of metabolic flexibility.

Studies conducted by Dr. Iñigo San Millán and published in 2018 alongside George Brooks, titled "Assessment of Metabolic Flexibility by Means of Measuring Blood Lactate and Oxygen Consumption," demonstrated that blood lactate levels are directly and mathematically related to fat burning capacity (metabolic flexibility) and mitochondrial health.

These findings allowed for the creation of performance protocols to measure a person's metabolic health simply by analyzing their lactate curves.