# Evaluation of the Immediate Cardiometabolic Effects of PULSE PEMF Therapy in Healthy Adults.

PNOĒ INC. - 08/06/2025

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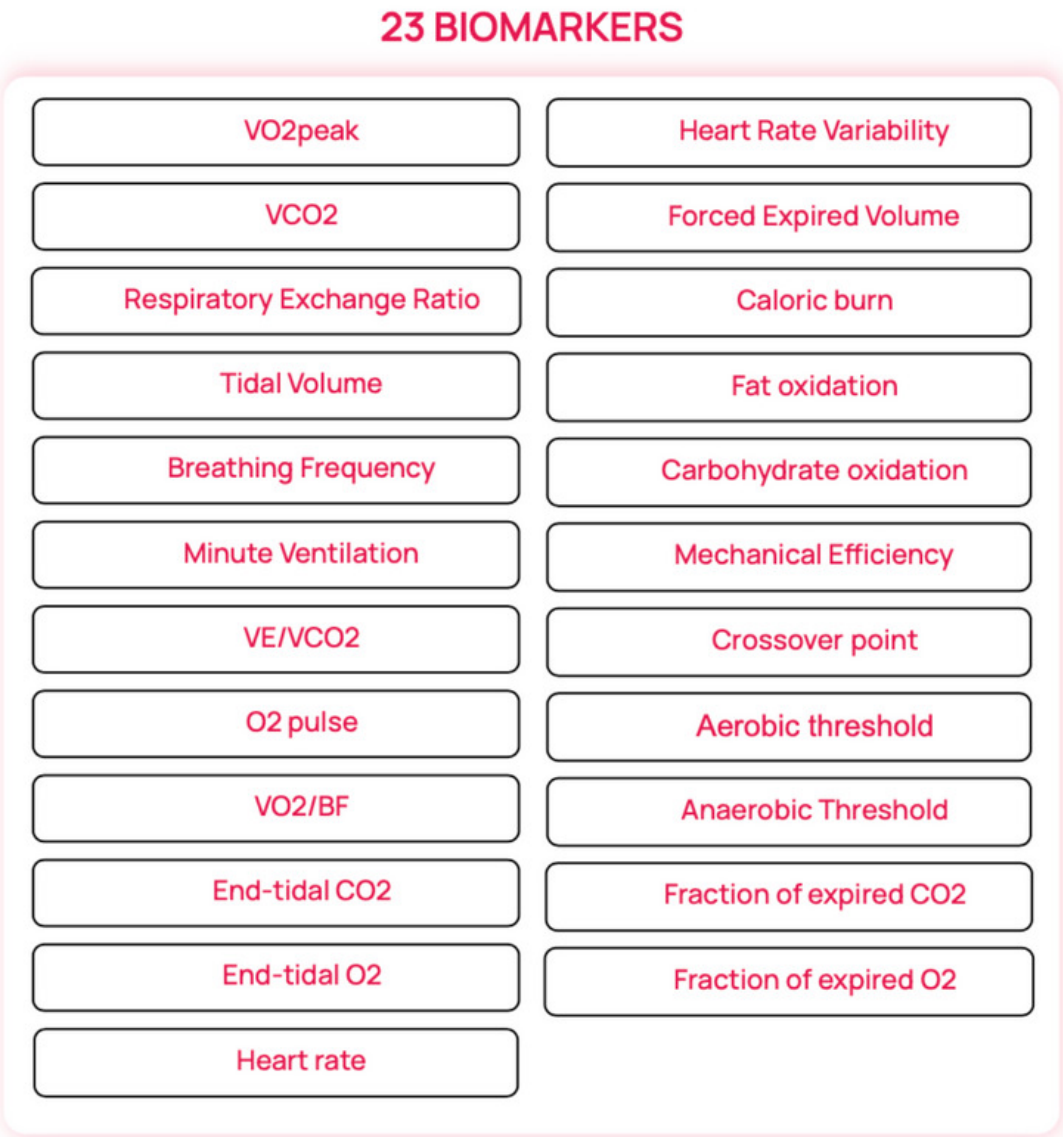
PULSE PEMF

This paper summarizes the findings of the metabolic changes measured through the PNOĒ metabolic analyzer after the exposure of a diverse cohort of seventeen healthy individuals to a 10-minute PULSE session. PULSE is a state-of-the-art Pulsed Electromagnetic Field (PEMF) wellness system that delivers gentle, low-frequency electromagnetic pulses to stimulate cellular function, enhance circulation, support recovery, and promote the body's natural healing processes—all in a non-invasive, drug-free manner.

## About PNOĒ

PNOĒ is an independently validated cardio-metabolic analyzer that assesses.
It is equipped with oxygen, carbon dioxide, and flow sensors and is capable of measuring all 23 biomarkers measured during clinical cardio-metabolic tests, including:



## About Pulse PEMF

Pulse PEMF is a leading provider of advanced PEMF technology, recognized globally for its ability to help the body repair, recover, and recharge at the cellular level. Using ultra-low frequency pulses—typically under 10 Hz—delivered through proprietary coil accessories, Pulse PEMF systems interact with cell membranes to improve nutrient and oxygen uptake, accelerate waste removal, and boost overall cellular performance. The technology has been refined over nearly two decades and is now used in more than 30 countries, with over one million sessions conducted annually. Key benefits include increased energy and vitality, enhanced circulation and oxygenation, reduced pain and inflammation, improved mobility, accelerated recovery, cellular detoxification, and stress relief. Pulse PEMF systems, such as the Pulse XL Pro, also offer user-adjustable intensity settings and solid-state engineering, making them unique in the wellness market.

### Safety & Research

Pulse PEMF is intended for general wellness and should not be used by individuals with implanted electronic devices, during pregnancy, or with certain medical conditions without consulting a healthcare professional. Independent research, including studies from Old Dominion University's Center for Bioelectrics, has shown PEMF can improve blood flow, oxygen utilization, and mitochondrial ATP production, supporting its role as a safe, non-invasive method for enhancing cellular health and recovery.

## Respiratory Exchange Ratio (RER):

RER is the ratio between the volume of CO2 (VCO2) produced by the body and the volume of O2 (VO2) consumed during a metabolic analysis measurement through the PNOĒ device. The device measures both the VCO2 exhaled and the VO2 inhaled through the lungs during respiration. Therefore, RER=VCO2/VO2. RER can take values from 0.7-1.0, where an RER=0.7 demonstrates pure fat oxidation and an RER=1.0 demonstrates pure carbohydrate oxidation. When a mixture of substrates is utilized, RER is typically around 0.8. In other words, a high RER indicates that carbohydrates are predominantly used, whereas a low RER indicates that fats are mainly oxidized for energy production. A high resting RER is predictive of weight gain and body fat accumulation as well as metabolic inflexibility, a metabolic condition where the body cannot easily switch between fat and carbohydrate oxidation. Metabolic inflexibility is associated with metabolic conditions such as obesity, type-2 diabetes, insulin resistance, and fatty liver. On the contrary, a low resting RER demonstrates a high fat-burning efficiency, high metabolic flexibility, and thus protection from severe metabolic abnormalities like those described above. An RER > 1.0 can occur during maximal effort exercise, prolonged starvation, excessive recent energy consumption, as well as metabolic processes, such as de novo lipogenesis.

## VO2max:

Maximal oxygen uptake or maximal aerobic capacity is defined as the maximum rate at which a subject can consume and utilize oxygen during an incremental exercise measurement to exhaustion while running, cycling, or rowing on the respective ergometer. A subject's VO2 max is reached when their oxygen uptake remains constant, although the intensity of the exercise test increases. VO2max is measured through a cardiometabolic analyzer, which very accurately measures the volumes of oxygen and carbon dioxide (VO2 and VCO2), such as the PNOĒ device. It is expressed in L/min or mL/min/kg. A VO2 max test is the gold standard method for assessing cardiovascular and respiratory fitness. According to the American Heart Association (AHA), VO2 max is the strongest predictor of all-cause and disease-specific mortality, thus biological age. Therefore, the fitter an individual is in terms of their cardiorespiratory fitness, meaning the higher their VO2 max, the lower their biological age and the more protected they are from chronic severe health issues, such as cardiovascular disease (CVD).

## Resting Metabolic Rate:

Resting Metabolic Rate (RMR) is one of the three components of total daily energy expenditure (TDEE), along with the thermic effect of food (TEF) and activity-induced energy expenditure (AEE). RMR is the energy the body requires to maintain vital physiological functions such as body temperature regulation, respiration, heart rate, etc., at rest while being awake, in a fasted state, and in a thermoneutral environment. It accounts for up to 75% of TDEE and is affected by many factors such as age, sex, body composition, and disease status. The gold standard method for measuring RMR is indirect calorimetry, where a metabolic analyzer, such as the PNOĒ device, precisely measures the volume of carbon dioxide (VCO2) exhaled and the volume of oxygen VO2) inhaled through the lungs during respiration. The Weir equation transforms the volume of gasses (VCO2 and VO2) into the RMR, which is expressed in kcal. RMR can also be determined through predictive equations, such as the Harris-Bennedict and Mifflin equations, which are not as reliable though. The RMR measurement demonstrates whether a subject has a slow or fast metabolism, which is very important for a tailored dietary prescription. Therefore, RMR measured through indirect calorimetry is vital for accurately determining an individual's daily caloric burn and, thus, daily caloric intake. As a result, any weight goal, in terms of weight loss, maintenance, or gain, can more easily and effortlessly be attained through an accurate daily calorie prescription.

## Crossover point:

The crossover point is relevant to an incremental exercise measurement done through a cardiometabolic analyzer, such as the PNOĒ device. It occurs at the exercise intensity where fat and carbohydrate utilization intersect when the subject tested transitions from fat to carbohydrate utilization. Specifically, at low exercise intensities (25%-60% VO2 max), fat is the main substrate that provides adequate energy for exercise. As exercise intensity increases (> 65% VO2max), carbohydrate utilization starts to pick up, and fat utilization starts to fall. The point where the fat and carbohydrate utilization cross, meaning there is an equal (50/50) contribution from both substrates to energy production, is called the crossover point. The crossover point delineates the lower limit of training zone 2, which is the fat-burning zone. Typically, the more trained an individual is, the later the crossover point during the incremental exercise occurs. In other words, the fitter, a person is, the greater their ability to keep burning mainly fat while the exercise intensity increases, thus training for longer periods sparing their valuable glycogen stores.

## Discussion

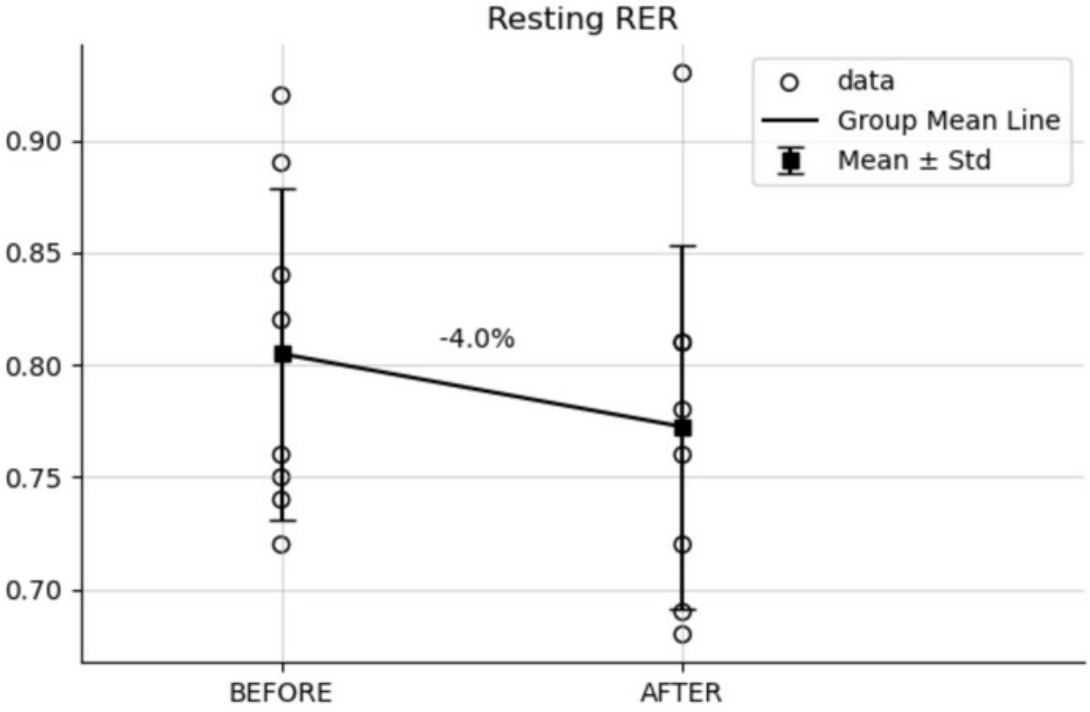
This study demonstrated notable improvements across multiple key cardiometabolic variables following a single 10-minute PULSE oxygen therapy session. Specifically, participants exhibited an increase in maximal oxygen uptake ($VO_2$ max) by 8.1%, a critical indicator of enhanced aerobic fitness and cardiovascular health. An elevation of this magnitude implies greater efficiency in oxygen utilization during peak physical exertion, potentially leading to improved endurance performance and reduced cardiovascular strain during daily activities.

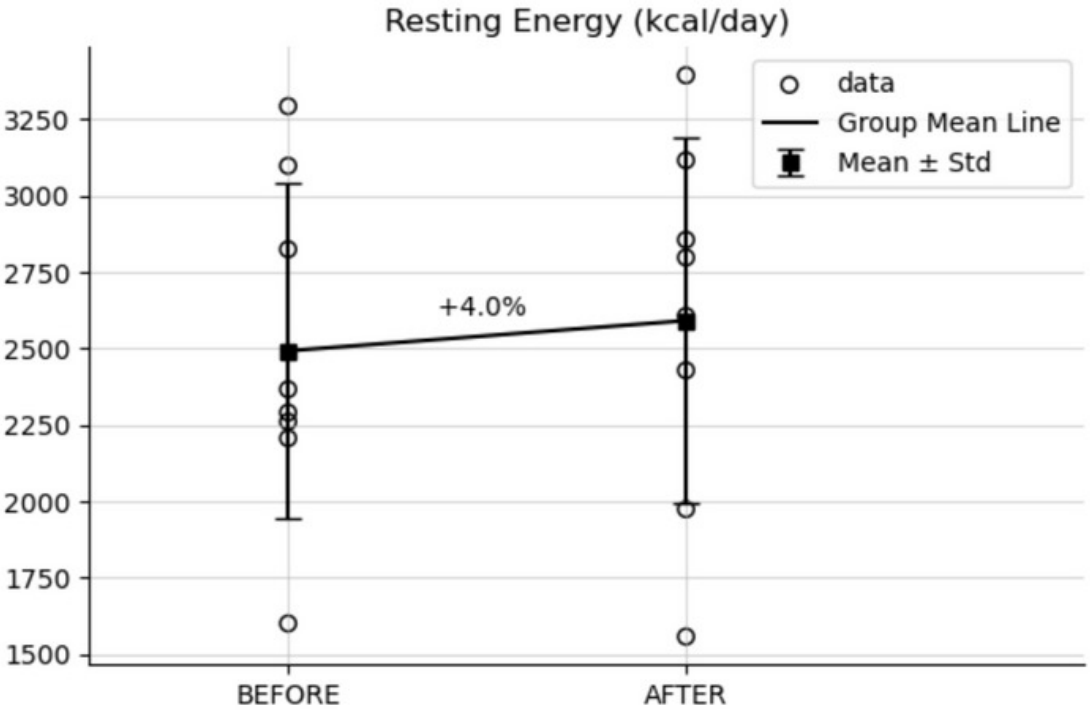
Resting metabolic rate (RMR), reflecting basal caloric expenditure, increased by 4%. This elevation indicates a meaningful enhancement of basal energy requirements, suggesting that participants experienced an acute metabolic activation. Such a change has important implications for energy balance, potentially benefiting weight management and metabolic health by modestly increasing daily calorie consumption without additional physical effort.

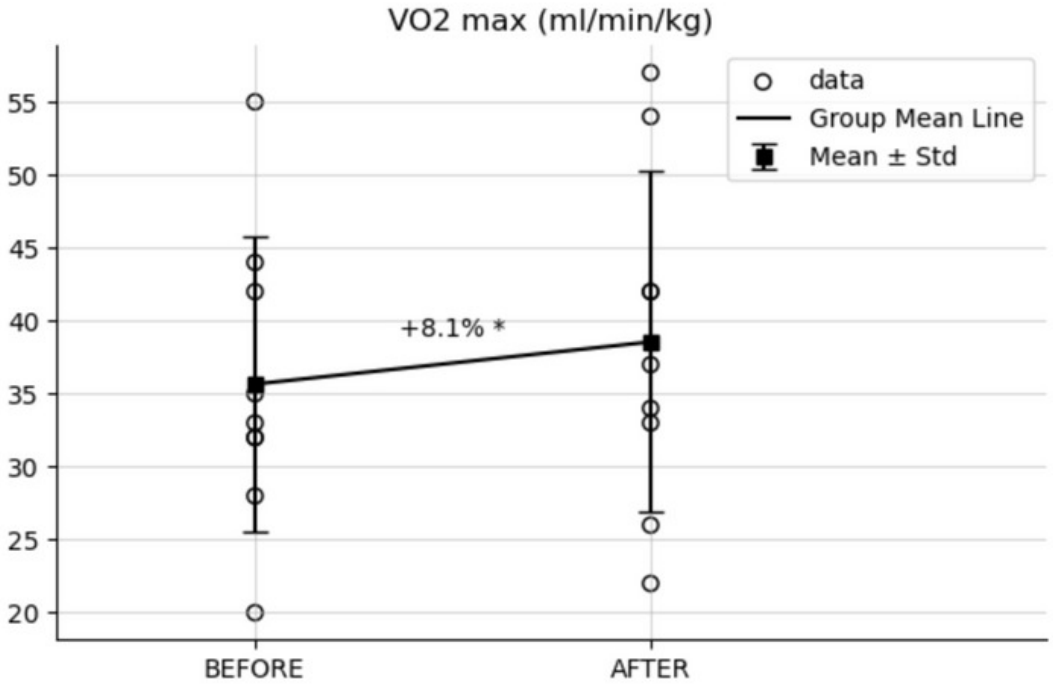
Additionally, resting respiratory exchange ratio (RER) decreased by 4%, signifying a shift toward greater reliance on lipid metabolism at rest. This reduction in resting RER is indicative of enhanced fat oxidation capabilities, a metabolic adaptation highly beneficial for long-term cardiometabolic health. Enhanced lipid utilization at rest may not only improve body composition by facilitating fat loss but also contribute to improved metabolic flexibility, allowing the body to efficiently alternate between fat and carbohydrate sources based on energy availability and physical demands.

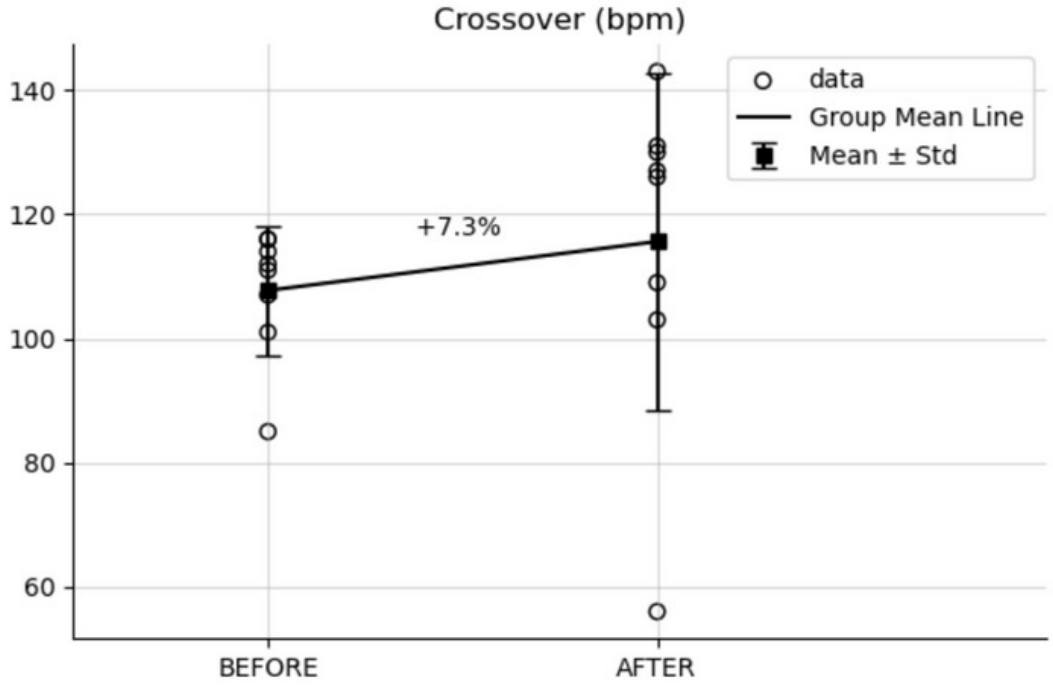
Moreover, the crossover point, defined as the exercise intensity at which energy metabolism shifts predominantly from fats to carbohydrates, occurred at a heart rate that was 7.3% higher post-therapy. This upward shift of the crossover point represents improved metabolic flexibility during exercise, allowing individuals to rely more extensively on fat oxidation at higher intensities. Such a change suggests enhanced endurance capabilities and reduced dependency on carbohydrate metabolism, potentially delaying fatigue during prolonged exercise bouts.

Taken together, these numerical improvements in $VO_2$ max, resting metabolic rate, resting RER, and crossover heart rate collectively indicate that the PULSE therapy induces favorable acute metabolic adaptations. The coordinated enhancement across these parameters highlights a comprehensive improvement in cardiometabolic efficiency and flexibility. These findings collectively suggest a metabolically younger physiological profile, potentially leading to improved health outcomes, reduced disease risk, and greater overall physical performance capacity following repeated exposure to this therapy. Future research should explore the sustained benefits of chronic therapy sessions to further validate these acute positive adaptations and evaluate their impact on long-term health markers.


Resting RER
data
Group Mean Line
Mean ± Std
0.90
0.85
0.80
0.75
0.70
-4.0%
BEFORE
AFTER


Resting Energy (kcal/day)
data
Group Mean Line
Mean ± Std
3250
3000
2750
2500
2250
2000
1750
1500
+4.0%
BEFORE
AFTER


VO2 max (ml/min/kg)
data
Group Mean Line
Mean ± Std
+8.1% *
55
50
45
40
35
30
25
20
BEFORE
AFTER


Crossover (bpm)
data
Group Mean Line
Mean ± Std
+7.3%
140
120
100
80
60
BEFORE
AFTER

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