

**TRAINING – RACING FUEL GUIDE** 



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Go Longer.

# WHY?



# Avoid Bonking – Metabolic Flexibility

By training efficient use of fat and carbohydrate fuel sources, athletes can mitigate bonking with stable energy for strong finishes.



# Preserve Glycogen – Finish Stronger

By oxidizing fat at higher and higher intensities, you will preserve glycogen stores, and lower lactate production - to support your strongest finishes.



# Mitigate Gut Distress. Lower Inflammation

Through efficient oxidation of fat for fuel, athletes do NOT need to over-consume sugar in races, mitigating Gut/GI distress and lowering inflammation.





Glycogen preservation



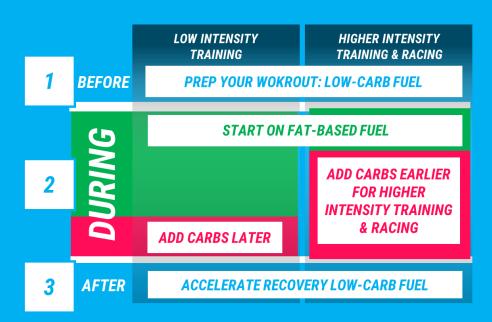
Mitigated gut distress (1)

Lower perceived

exertion



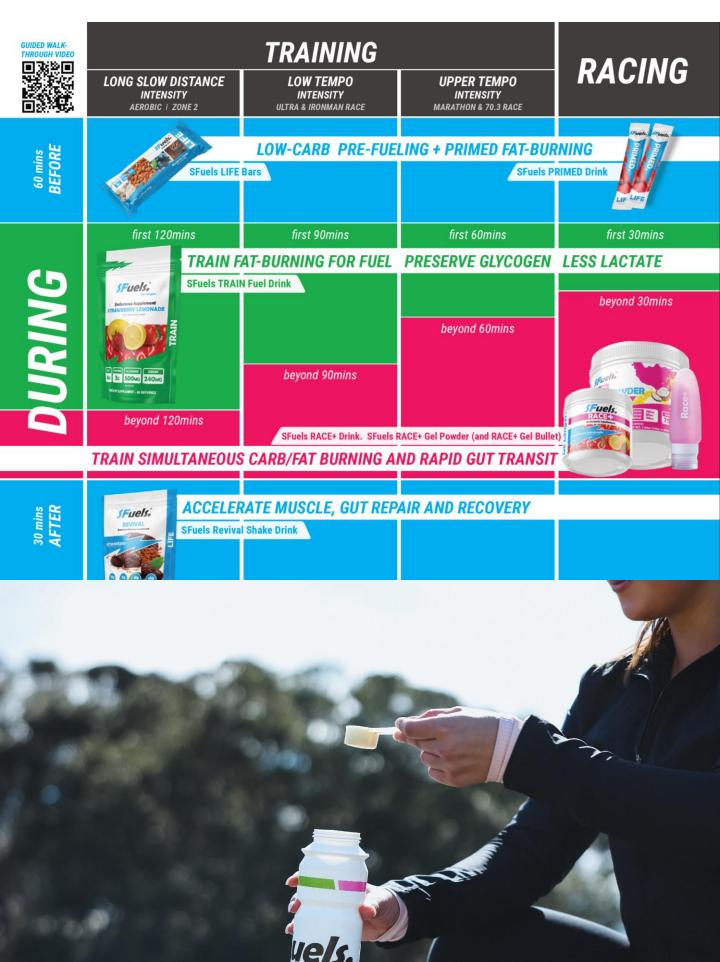
# HOW? ... THE SIMPLE VERSION





**Product Usage Guide: Video Walk-through** Let us walk you through our Product Usage Guide

# HOW TO USE SFUELS PRODUCTS - FULL VERSION: WALL CHART



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# **IN-RACE DOSING**

**RIGHT TIME** 

Pre-Race PRIMER: Prime Fat Burning & Lower Perceived Exertion



Concentrate

3 Serves/Hr

x Hrs on Bike

3 Serves

ner/H

Bullet





## **HOW IT WORKS**

With large energy demands during endurance exercise, efficient access to the 15 times larger fat-based energy pool (than carbohydrate pool) is critical to endurance athletic performance.

Training the body to flexibly use both non-carbohydrate and carbohydrate energy sources is key to extended endurance athletic capacity, lower Gut distress and energy crash-bonk risks.

#### CARBOHYDRATE CENTRIC FUELING

The four major problems with high and exclusive use of carbohydrate-sugar based fueling includes:

BLUNT AEROBIC DEVELOPMENT: With rapid spikes in blood glucose and insulin, fat oxidation is blunted(1), driving an even greater dependency on carbohydrates for fuel. Additionally, consistent use fructose in fueling formulas, has shown to suppress glucose transporter proteins (in muscle cells) specifically Glut4 (3), limiting efficient carbohydrate flow into muscle cells, and blunting the training effect of aerobic exercise (2, 4).

**GUT/GI DISTRESS:** In longer-duration exercise, heat and higher carb/fructose consumption (>60gram/hour) has been shown to trigger chaotic GI distress, with symptoms of bloating, belching, diarrhea and vomiting. Fructose (and sucrose) has the additional negative side-effect of disrupting the GI/Gut membrane integrity, raising systemic inflammation. (5, 6, 7)

**RISK OF BONK/CRASH:** Taking in simple carbohydrates creates an absolute reliance for routine feeding of these fuels during extending training and racing. As commonly seen in most endurance events, this swinging of high-low blood sugar and energy levels dramatically raises the risk of bonking/crashing/hitting the wall.

**CHRONIC INFLAMMATION:** The longer-term adoption of prolonger higher blood sugar levels has consistently shown to be associated with more chronic inflammatory based diseases – including cardiovascular disease, diabetes, rheumatic diseases. (8,9, 11, 12, 13)

#### **RIGHT TIME RIGHT FUEL**

Fat oxidation efficiency is a key tenant for stabilizing energy, spared muscle glycogen, mitigated Gut/GI distress, and reducing inflammation allowing endurance athletes to train, race and recover optimally.

FAT OXIDATION OPTIMIZATION: By improving Fat-Oxidation efficiency, athletes can preserve precious muscle-liver glycogen stores. Day to day dietary (including during training) intake of quality fats and timed carbohydrate/protein, begins to shift and train, the metabolism and muscles to become less reliant on carbohydrate as fuel. Lipolytic and oxidative enzymes that breakdown fat can be trained (like muscles) through diet, training-fuel and exercise (14), with lab results showing cases of 2-3 times improvement in fat oxidation efficiency.

**ENHANCED ENDURANCE:** By timed use of carbohydrates, research is showing enhanced endurance performance, namely through a lower carbohydrate for aerobic/zone 2 workouts, and higher carbohydrate for threshold/anerobic-zone 4-5 workouts (15). By training both fat and carbohydrate oxidation efficiency, the endurance athlete can better preserve glycogen stores, access flexible-simultaneous energy from fat and carbohydrates, thereby reducing carbohydrate dependency and high intake risks (bonk/crash, gut, inflammation etc.) – noted earlier.

MITOCHONDRIA & MUSCLE SYNTHESIS: Researchers (16) conclude that train-low (carbohydrate), and higher leucine (17) approaches can best trigger exercise induced mitochondrial biogenesis, and muscle protein synthesis.



Fat oxidation efficiency enables more stable, flexible (fat / carb) simultaneous fuels for enhanced endurance training and racing.

Through reduced carbohydrate dependency/intake – risks of energy-crash/bonking and Gut/GI risks are mitigated.

Fat oxidation has a lower inflammatory load - supporting more consistent, higher volume training and racing blocks.



RIGHT/TIME

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# THE SCIENCE OF HOW TO IMPROVE FAT OXIDATION

Lab testing and race results are showing that the right timing, and the right type of fuel, has significant efficiency impact on fuel (substrate) oxidation and endurance.

Analyses of over 434 studies(1) on athlete's substrate (Fat/Carb) oxidation, has shown that the most influential factors effecting substrate (fuel) oxidation outcomes are, exercise duration (and intensity), dietary intake (during and outside of exercise) and sex.

#### RIGHT TIME: THE BEST TIME TO IMPROVE FAT OXIDATION.

- Studies (18) suggest that a diet including Medium-Chain fats and carbohydrate for 6 weeks <u>prior</u> to an endurance capacity test, can increase (>20%) key enzyme activities of the Krebs cycle (cellular energy production) and ketone utilization/oxidation. In these controlled animal tests, endurance capacity was extended by ~11%, and muscle glycogen concentration was 20% greater than control animals.
- Further studies (19) involving <u>pre-feeding</u> of Medium-Chain fats have also shown improvements (two-fold) in endurance running capacity, specifically in higher (32-36C) temperature environments. The study revealed, that key enzymes-markers of skeletal muscle mitochondrial biogenesis and the respiratory chain, were notably upregulated by the consumption of Medium-chain Fats. It is also worth noting, that negative signaling (for mitochondrial biogenesis) was inhibited by Medium-chain fats. All in all, MCT would seem to offer some protective effect against heat-impairment to exercise endurance-capacity.

#### **RIGHT FUEL: BEST FATS TO IMPROVE EFFIENCY AND PERFORMANCE.**

- Cycling studies (20), had subjects ride for 2hrs at 60% Vo2Max, then followed with a 40km time-trial study. Athletes adding Medium-chain fats to carbohydrate fuels, had improved performances. Furthermore, on finishing the time-trial, athletes had higher plasma fatty acid (and ketone) levels, and either direct/indirect (via lactate) reduction in oxidized glycogen suggestive of a glycogen sparing effect.
- In cross-country skiers, researchers (21) reconfirmed that while long-chain fat oxidation was suppressed in highintensity exercise, medium-chain fat oxidation was not. At loads of 80% VO2max, serum levels of medium-chain fats increased. This is thought to occur since, medium-chain fats like C10 (and C8) can traverse membranes without 'carriers' – as required by long-chain fats. Other studies (22) have also shown the increased speed of oxidation of medium chain fats, compared to long chain fats (mono and poly-unsaturated).
- 5. In a meta-analysis (26) on the acute use of caffeine (~3mg/Kg),researchers showed a significant increase in fat oxidation.
- 6. In addition to endurance performance, high-intensity performance, researchers (23) have also shown that when medium-chain fats are added to a carbohydrate-drink, gastric emptying time of the carbohydrate-drink can be accelerated.
- 7. In a rigorous controlled study, researchers showed that even for very high-intensity exercise (=>85% Vo2 Max) there was no performance benefit for high-carb athletes vs. low-carb high-fat nutrition based athletes. Notably low-carb high fat athletes had fat oxidation rates >1.58gr/min even at intensities >85% Vo2Max. (28)
- 8. Researchers (27) have shown that pre-exercise carbohydrate consumption, blunts fat-oxidation efficiency while showing no improvement to high-intensity average power (on bike). Athletes' perceived exertion and hunger was no different between carb-consuming athletes, and non-carb/fasted athletes.
- 9. Researchers (24) demonstrated that in only 15 days of <u>high long-chain fat feeding</u>, animals showed evidence of impaired exercise capacity notably their oxidative capacity. Conversely, animals in the same study feeding on medium chain fats did NOT show evidence of altered oxidation efficiency or impaired exercise performance. Similar animal studies (25) are showing that high fat LCT diets cause mitochondrial derangement (through UCP3), with results showing anywhere from 35%, to 55% lower-less running endurance capacity (24).

## **KEY TAKEAWAYS**

- Increase fat (and lower carbohydrates) in diet and training (>6-8 weeks prior to racing) to best leverage the efficiency and benefit of improved fat oxidation. Caffeine will further raise fat-oxidation, and pre-exercise carbohydrate consumption will reduce fat oxidation.
- 2. Medium-Chain Triglyceride (fats) like C8, C10, C12 included as an exercise fuel, has shown most promise in improved endurance performance, glycogen sparing capacity, and accelerated gastric emptying of carbohydrate fuel drinks.
- 3. High (over) consumption of long-chain fats, may impair oxidation efficiency of carbohydrates.



RIGHT TIME



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# SFuels. TRAIN

# BLUEPRINT

## Add to cart

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RIGHT TIME



Add 1 scoop of SFuels TRAIN Endurance Powder to 16oz of cold water and mix/shake thoroughly. Consume 1 serving for every 30 minutes of sustained activity. Test in training

# **SFuels.** RACE+ Drink

## **BLUEPRINT**

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#### Add to cart

RIGHT TIME



#### Efficient Carbohydrate Digestion Assimilation and Mitigated Gut Distress

Race+ starch (HBCD) has been predigested with enzymes creating a branched carbohydrate for rapid transit through the stomach. Researchers have highlighted HBCD having 30% faster rise of blood glucose, when compared to a glucose-only fluid.

sugar-alcohols are used to avoid Gut/GI irritation and distress.

Race+ avoids the use of fructose to mitigate the risk of interfering with GLUT-4 (glucose) muscle-cell

Race+ includes Glutamine to further support fuel-oxidative (energy) heat-triggered subsequent higher inflammatory loads.



#### High Caloric Load & Improved Carbohydrate Absorption

Race+ increases overall caloric fuel load (9cals/gram) through using C8 and C10 MCTs which are rapidly intensity workloads.

MCTs improve the speed and rate of carbohydrate absorption.

#### **Electrolyte Balance**

Calcium and Potassium, and higher race-level dosages of Sodium.

Glycinate form of Magnesium to enable higher dosage with no Gut-GI irritation (common to other Magnesium

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#### SUGGESTED USAGE

Add 1-4 (15-60gr/Hr. CHO) scoops of SFuels Race+ (typically to 16oz of cold water) per hour depending on exercise intensity and heat-humidity. SFuels recommends testing Race+ fueling in training at race intensity conditions (heat/humidity/elevation) – in optimizing your Race+ fluid/per hour.

# SFuels. RACE+ Gel

## **BLUEPRINT**

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Add 1-3 (22-66gr/Hr. CHO) scoops of SFuels Race+ (typically to 16oz of cold water) per hour - depending on exercise intensity and heat-humidity. SFuels recommends testing Race+ fueling in training at race intensity conditions (heat/humidity/elevation) – in optimizing your Race+ fluid/per hour.

# SFuels. LIFE BARS •

## **BLUEPRINT**

through the digestive process, thereby minimizing increased blood-sugar levels, while helping to support gut health

and production/assimilation of healthy Short Chain Fatty

### Add to cart

**RIGHT TIME** 



#### No Sugar, or sugar Alcohols Added.

SFuels LIFE Endurance Bars are very low in sugar. To minimize blood sugar spikes - we use NO added sugar/sucrose, dextrose, dried fruits, rice or cane syrups, fructose, or maltodextrin.

SFuels LIFE Endurance bars use no sugar alcohols like Maltitol, which research increasingly highlights interfere with the gut microbiome.



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#### SUGGESTED USAGE Take ½ to bar upto an our before training sessions, or take 1 bar within 30mins post workout/training session.

# **SFuels. PRIMED**

### **BLUEPRINT**

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#### Sugar or sugar alcohols are avoided in SFuels PRIMED to mitigate insulin trigged blunting of fat oxidation.



#### B3/B6/B12

Key B-vitamins are essential in the process of extracting energy from consumed food substrates.

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#### SUGGESTED USAGE

Bodyweight ~Kg	<b>Prior (Serves)</b> ~1Hr	During (Serves) 1 <sup>st</sup> 2Hrs
55-65		1
70-90	1	2
95-120		3

# **SFuels. REVIVAL**

## **BLUEPRINT**

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RIGHT TIME



Maintain favorable gut bacteria, by avoiding the use of all sugar alcohols like sucralose, that have shown to disrupt the gut microbiome.

glucose,

fructose,

sucrose,

maltodextrins.

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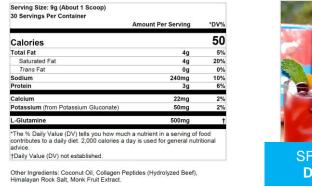
#### SUGGESTED USAGE

Drink SFuels REVIVAL within 30minutes of exercise, workouts. Add 1-2 scoops to 16oz of cold water, or to 14oz cold water and 10oz of crème or your dairy-milk choice.

# SFuels. TRANSFORM EVERYDAY FAT OX

## **BLUEPRINT**

Transform every-day high-carb meals, snacks and drinks to low-carb high-fat, foods to minimize heightened-sustained blood glucose and insulin levels.



MIX WITH Food/Drink Recipes



#### SFUELS LIFE RECIPE GUIDE DOWNLOAD: CLICK HERE

SWEETNESS Mild Sweet / Salty. FLAVOR Enhances Flavor of recipe-foods

#### **Replace Calories – Quality Fat**

TEXTURE

Unnoticeable to

SFuels LIFE - TRANSFORM provides Medium Chain Triglycerides (MCT) bound to collagen as a source of quality fat based calories which can be added to every-day foods – including breakfasts, snacks, drinks and meals. With quality fat added to meals and recipes, carbohydrate ingredients – like grains, starches, sugars, sweeteners, syrups can be replaced.

SFuels LIFE - TRANSFORM uses the C8 (and C10) form of MCTs which is digested and then transported rapidly into the muscle cell mitochondria efficiently – similarly to carbohydrates.

No carbohydrates, sugar, sucrose, glucose, fructose have been added to SFuels LIFE - TRANSFORM to mitigate insulin stimulation.

SFuels LIFE - TRANSFORM avoids the use of artificial sweeteners and sugar alcohols. SFuels LIFE -TRANSFORM uses natural monk fruit to provide a non-carbohydrate sweetness to foods it is added to.

#### **Rebalanced Electrolytes**

SFuels LIFE – TRANSFORM is formulated with added sodium and potassium for supplementing foods-recipes that it is added to.



#### **Gut Membrane Health**

Glutamine is consistently used for rapid repair of gut membrane integrity, to minimize endotoxin leakage from the gut into the systemic circulation, thereby mitigating associated inflammation.



RIGHT TIME





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## REFERENCES

- 1. Jefrey A. Rothschild, Andrew E. Kilding, Tom Stewart, Daniel J. Plews. Factors Infuencing Substrate Oxidation During Submaximal Cycling:
- 2. A Modelling Analysis. Sports Medicine 2022 Jul.

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- 3. Natalia Gomes Gonçalves, Stephanie Heffer Cavaletti, Carlos Augusto Pasqualucci, Milton Arruda Martins, Chin Jia Lin. Fructose ingestion impairs expression of genes involved in skeletal muscle's adaptive response to aerobic exercise. Genes Nutr. 2017 Dec
- 4. Veeraj Goyaram, Tertius A Kohn, Edward O Ojuka. Suppression of the GLUT4 adaptive response to exercise in fructose-fed rats. Am J Physiol Endocrinol Metab. 2014 Feb
- K-A Lê, D Faeh, R Stettler, C Debard, E Loizon, H Vidal, C Boesch, E Ravussin, L Tappy. Effects of four-week high-fructose diet on gene expression in skeletal muscle of healthy men. Diabetes Metab. 2008 Feb
- Young-Eun Cho, Do-Kyun Kim, Wonhyo Seo, Bin Gao, Seong-Ho Yoo, Byoung-Joon Song. Fructose Promotes Leaky Gut, Endotoxemia, and Liver Fibrosis Through Ethanol-Inducible Cytochrome P450-2E1-Mediated Oxidative and Nitrative Stress. Hepatology. 2021 Jun
- 7. R J S Costa, R M J Snipe, C M Kitic, P R Gibson. Systematic review: exerciseinduced gastrointestinal syndrome-implications for health and intestinal disease. Aliment Pharmacol Ther. 2017 Aug
- 8. Nicole Vargas, Frank Marino. Heat stress, gastrointestinal permeability and interleukin-6 signaling Implications for exercise performance and fatigue. Temperature (Austin). 2016 Apr
- Elizabeth L.M. Barr, Paul Z. Zimmet, Timothy A. Welborn, Damien Jolley, Dianna J. Magliano, David W. Dunstan et al. Risk of Cardiovascular and All-Cause Mortality in Individuals With Diabetes Mellitus, Impaired Fasting Glucose, and Impaired Glucose Tolerance. Circulation. 2007 Jun.
- 10. Hui Pi, Haotong Zhou, Huan Jin, Yaogui Ning, Youlian Wang. Abnormal Glucose Metabolism in Rheumatoid Arthritis. Biomed Res Int. 2017 Apr.
- 11. Plews. D, Phillips. L. Coaches and Athletes Metabolic Flexibility Support Program. https://youtu.be/LOV3d3p7Aws 2019 Jul.
- 12. Allison Clark, Núria Mach. Exercise-induced stress behavior, gut-microbiotabrain axis and diet: a systematic review for athletes. J Int Soc Sports Nutr. 2016 Nov.
- 13. Reetta Satokari. High Intake of Sugar and the Balance between Pro- and Anti-Inflammatory Gut Bacteria. Nutrients. 2020 May.
- Yong Wang , Wentao Qi , Ge Song, Shaojie Pang, Zhenzhen Peng, Yong Li, Panli Wang. High-Fructose Diet Increases Inflammatory Cytokines and Alters Gut Microbiota Composition in Rats. 2020 Nov.
- 15. Daniel Plews. Right Fuel, Right Time Carbohydrate Manipulation to Make Every Session Count! <u>Endure.IQ.</u> 2022 August.



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# REFERENCES

SFuels

- 15. Laurie-Anne Marquet, Jeanick Brisswalter, Julien Louis, Eve Tiollier, Louise M Burke, John A Hawley, Christophe Hausswirth. Enhanced Endurance Performance by Periodization of Carbohydrate Intake: "Sleep Low" Strategy. Med Sci Sports Exercise. 2016 Apr
- 16. Samuel G. Impey, Kelly M. Hammond, Sam O. Shepherd, Adam P. Sharples, Claire Stewart, Marie Limb, Kenneth Smith, Andrew Philp, Stewart Jeromson, D. Lee Hamilton, Graeme L. Close, James P. Morton. Fuel for the work required: a practical approach to amalgamating train-low paradigms for endurance athletes. Physiological Reports. 2016 May
- 17. Samuel G Impey, Kelly M Hammond, Robert Naughton, Carl Langan-Evans, Sam O Shepherd, Adam P Sharples, Jessica Cegielski, Kenneth Smith, Stewart Jeromson, David L Hamilton, Graeme L Close, James P Morton. Whey Protein Augments Leucinemia and Postexercise p70S6K1 Activity Compared With a Hydrolyzed Collagen Blend When in Recovery From Training With Low Carbohydrate Availability. Int J Sport Nutr Exerc Metab. 2018 Nov
- 18. Fushiki T et al. Swimming endurance capacity of mice is increased by chronic consumption of medium-chain triglycerides. J Nutr. 1995 Mar
- 19. Wang Y et al. Medium Chain Triglycerides enhances exercise endurance through the increased mitochondrial biogenesis and metabolism. PLoS One. 2018 Feb
- 20. Van Zyl C G et al. Effects of medium-chain triglyceride ingestion on fuel metabolism and cycling performance. J Appl Physiol (1985) 1996 Jun
- 21. A. Yu. Lyudinina, G. E. Ivankova & E. R. Bojko . Priority use of medium-chain fatty acids during high-intensity exercise in cross-country skiers. Journal of the International Society of Sports Nutrition. 2018 Dec
- 22. J P DeLany, M Delaney Windhauser, C M Champagne, G A Bray. Differential oxidation of individual dietary fatty acids in humans. Am J Clin Nutr. 2000 Oct
- E J Beckers, A E Jeukendrup, F Brouns, A J Wagenmakers, W H Saris. Gastric emptying of carbohydrate--medium chain triglyceride suspensions at rest. Int J Sports Med. 1992 Nov
- 24. Andrew J Murray, Nicholas S Knight, Sarah E Little, Lowri E Cochlin, Mary Clements, Kieran Clarke. Dietary long-chain, but not medium-chain, triglycerides impair exercise performance and uncouple cardiac mitochondria in rats. 2011 Aug
- Andrew J Murray, Nicholas S Knight, Lowri E Cochlin, Sara McAleese, Robert M J Deacon, J Nicholas P Rawlins, Kieran Clarke. Deterioration of physical performance and cognitive function in rats with short-term high-fat feeding. FASEB J. 2009 Dec
- 26. Daniel Collado-Mateo, Ana Myriam Lavín-Pérez, Eugenio Merellano-Navarro, and Juan Del Coso. Effect of Acute Caffeine Intake on the Fat Oxidation Rate during Exercise: A Systematic Review and Meta-Analysis. Nutrients. 2020 Dec
- Jeffrey A. Rothschild, Andrew E. Kilding, Sophie C. Broome, Tom Stewart, John B. Cronin, Daniel J. Plews. Pre-Exercise Carbohydrate or Protein Ingestion Influences Substrate Oxidation but Not Performance or Hunger Compared with Cycling in the Fasted State. Nutrients. 2021 Apr
- 28. Philip J. Prins, Timothy D. Noakes, Alex Buga, Dominic P. D'Agostino, Jeff S. Volek et al. Low and high carbohydrate isocaloric diets on performance, fat oxidation, glucose and cardiometabolic health in middle age males. Frontiers. 2023 Feb.



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