WHITEPAPER 2023

THE SCIENCE BEHIND LiFT®

4GOLD

ABSTRACT

LiFT® stands for Lipid Fuel Technology, and is a supplement that has the power and potential to redefine the current old school approach of fueling exercise with solely carbohydrates. LiFT® can deliver fast energy directly to the muscles, like carbohydrates, but with a much higher caloric density. Because of these properties LiFT® can have a significant muscle glycogen sparing effect.

LiFT® leverages all these features by usage of new smartly structured lipids (medium- and long-chain triglycerides or MLCTs). This whitepaper is an attempt to share our knowledge of this highly innovative supplement, so that its potential can be grasped and its use perfectly integrated into current exercise fueling technologies.

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I. Introduction To Lipid Metabolism

Lipids are structured molecules containing 3 fatty acids and a glycerol backbone (hence the name triglycerides). They have a much higher caloric density of 9kcal/g compared to 4kcal/g for carbohydrates and protein. A higher caloric density means more energy is available from one gram of lipids compared to carbohydrates or protein. This should make them the ideal source for fueling exercise. But lipid metabolism is such that energy delivery is slower and longer-lasting compared to carbohydrates.

In order to understand why lipids have not been traditionally used for fueling exercise, a closer look into lipid metabolism is necessary.

A. Post prandial long-chain triglyceride metabolism

Digestion and absorption of fatty acids is affected by the length of their carbon chain. The longer the chain length, the lower the degree of uptake [1]. Long-chain triglycerides (LCTs) are subject to de-esterification in the intestine, resulting in the release of two free long-chain fatty acids (LCFAs) and the formation of an sn-2 monoglyceride. These enter the cells that line the intestine, enterocytes, and once inside, LCFAs and monoglycerides are re-esterified into triglycerides and packed with phospholipids, cholesterol ester, and apolipoproteins into structures called chylomicrons. These chylomicrons are released into the lymphatic system from where they drain into the subclavian vein via the thoracic duct. In this manner, LCTs reach the circulatory system to become available to peripheral tissues and become long-lasting sources of energy.

When these LCFAs reach the peripheral tissues, and muscle cells specifically, they enter the cell via specific transport proteins like CD36 and FATPs (fatty acid transport proteins) and have to build carnitine esters for import into the mitochondrial matrix. So, they need a special transporter to enter the cell and the mitochondria before they can be used as fuel source through a process called β-oxidation. The need for this dual transporter is part of the rate limiting factor that makes LCTs slower as source for fueling exercise.

B. Medium chain-triglyceride metabolism

Medium-chain triglycerides (MCTs) are processed in a completely different manner. In the intestine, they are hydrolyzed into free medium-chain fatty acids (MCFAs) and glycerol. MCFAs diffuse into the enterocytes but are, by and large, not re-esterified. Instead, they continue moving by diffusion into the portal vein where they form complexes with albumin. MCFAs bound to albumin are then directly taken up by the liver. In the liver, MCFAs can rapidly diffuse into the mitochondria, where they are catabolized through β-oxidation to become a fast source of energy. A specific transporter is not necessary for MCFAs to diffuse into cells and translocate through the mitochondrial membrane. Most of this energy becomes available either as longer chain fatty acids synthesized in the liver from these MCFAs, or as ketone bodies.

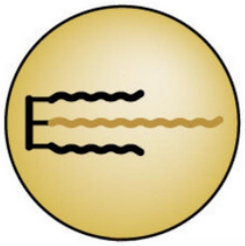
Several studies were done with MCTs for exercise performance. Some showed benefits, others were not able to show benefits. Recently, and on the back of the data showing positive results, supplementation with exogenous ketones have become more popular in endurance sports.

However, on top of inconsistent results, MCTs need conversion into ketone bodies in the liver for them to serve as a source for fueling exercise and this conversion is partially inhibited by the insulin release that occurs when consuming carbohydrates [2,3,4].

Scientists created a solution that combines the best of LCTs and MCTs and negates the downsides of both. Enter LiFT®.

LiFT®

LIPID FUEL TECHNOLOGY



Contains new molecules that combine

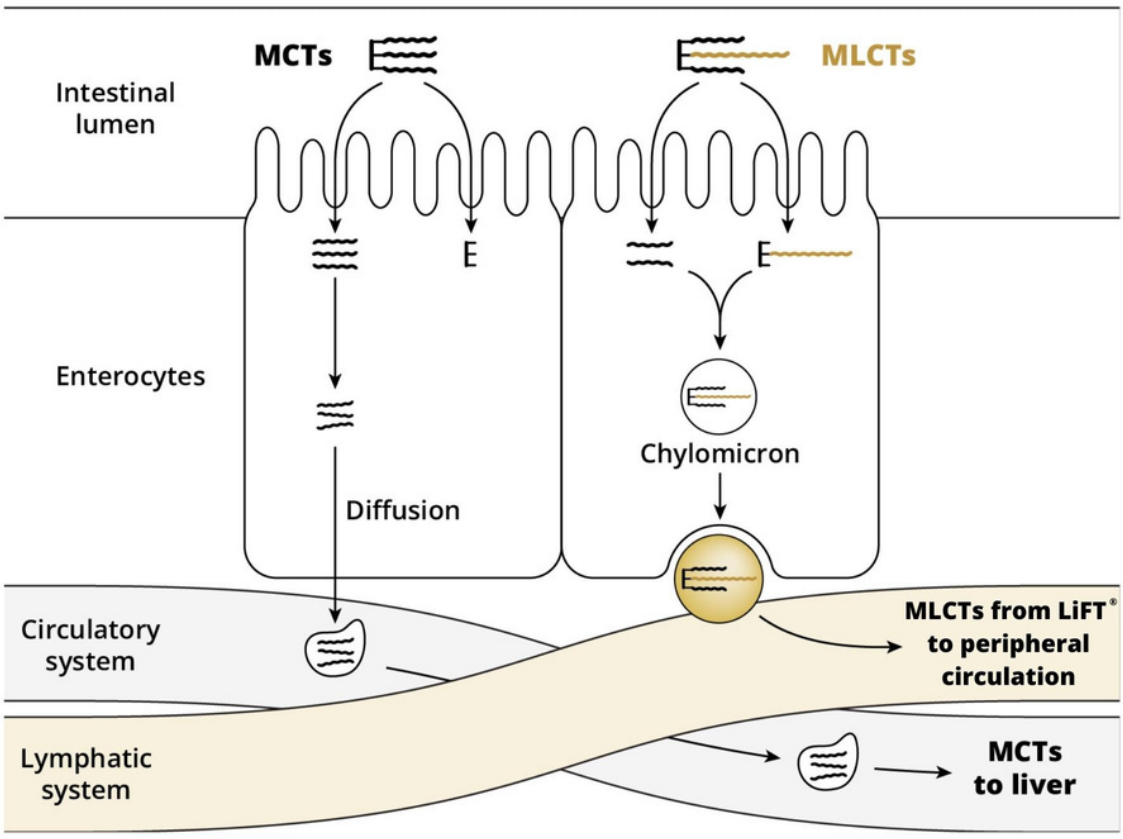
Medium chain fatty acids

Long chain fatty acids

C. LiFT®: a supplement containing NuliGo® structured MLCTs and their highly specialized metabolism

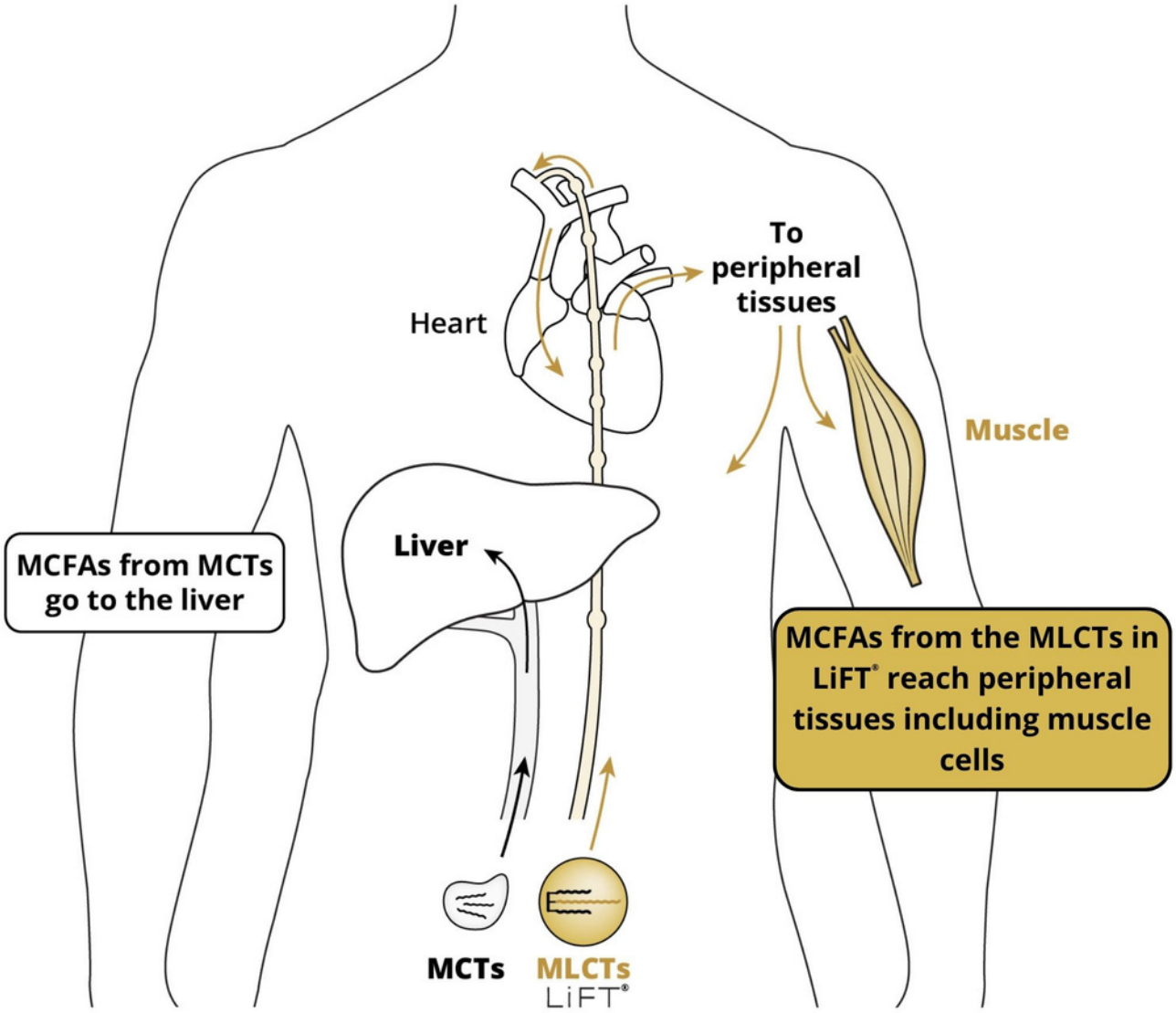
In essence, LiFT® is a lipid solution, based on smartly structured medium- and long-chain triglycerides (NuliGo®), that has the potential to deliver a glycogen sparing effect in endurance performance. This glycogen sparing is crucial for being strong in the last part ("finale") of endurance races like cycling or marathon running. How does LiFT® realize this feat? Before we go into that we first have to explain structured MLCTs.

What are structured MLCTs? Structured MLCTs are the product of interesterification whereby fatty acids of MCTs and LCTs are separated from the glycerol backbone and then recombined to create new structured triglycerides. The newly formed lipid, contains both MCFAs, like caprylic (C8:0) and capric (C10:0) acids, and LCFAs, like oleic (C18:1), linoleic (C18:2), and linolenic (C18:3) acids.



Structured MLCTs combine properties of both MCTs and LCTs. They are de-esterified in the lumen of the intestine and diffuse or get transported into enterocytes as monoglycerides and fatty acids. Inside the enterocyte, the MCFAs, LCFAs, and monoglycerides are mostly re-esterified and follow the chylomicron route to the lymphatic system. These chylomicrons enter the circulation taking MCFAs to peripheral tissues where they can become fast sources of energy while the LCFAs can be stored for use during tissue repair. Remember, MCFAs can deliver fast energy as they do not need a specific transporter to migrate quickly through the mitochondrial membrane.

So, the NuliGo® MLCTs in LiFT® hijack the absorption and distribution mechanism of LCTs, and then benefit from the fast energy potential of MCFAs to fuel muscle cells.



LiFT® is a supplemental lipid that uses long-chain fatty acids absorption and distribution mechanisms for bringing medium-chain fatty acids directly to muscle tissue for fast energy and, hence, a potential glycogen sparing effect.

II. USAGE

As the usage profile differs from traditional carbohydrate supplementation. We will have to dive a little deeper into the science of postprandial lipid absorption in order to clarify the usage profile of LiFT®.

A. Postprandial absorption of lipids in humans – recent insights

In the last decade, two striking and interesting new characteristics of enterocyte-triglyceride processing have been discovered:

- Lipids secreted at the very onset of a meal are those that were consumed in an earlier meal, suggesting the presence of an enterocyte storage pool for triglycerides.
- A cephalic phase release of chylomicron lipoprotein particles tied to oral stimulation by food intake.

This rise in triglycerides that occurs 10-30 min. after the onset of the meal is denoted “the early peak” to separate it from the primary postprandial peak of blood triglycerides which occurs 3-4 h. after meal initiation. This early peak occurs before the absorption of fat from the ongoing meal could have happened, and is more likely when the previous evening's meal was high in fat. Lambert et al. [5] have shown, via utilization of stable isotopes, that 10-12% of triglycerides consumed in the previous evening's meal appear in new chylomicrons, first occurring 15-20 min after the onset of morning food consumption. This observation indicates that the timing of meal triglyceride storage in the intra-enterocyte pool can last for at least 16 h.

Sensory inputs such as sight, smell, taste, and mastication (prior to swallowing) initiate the first phase of pancreatic secretion known as the cephalic phase. The second interesting discovery is connected to that overall cephalic phase response. The early meal-induced rise in chylomicron secretion from enterocytes can occur when fat is only tasted, i.e., not yet fully consumed. The existence of an oral taste sensor for lipids is intriguing and has led to a taste-gut-brain axis hypothesis.

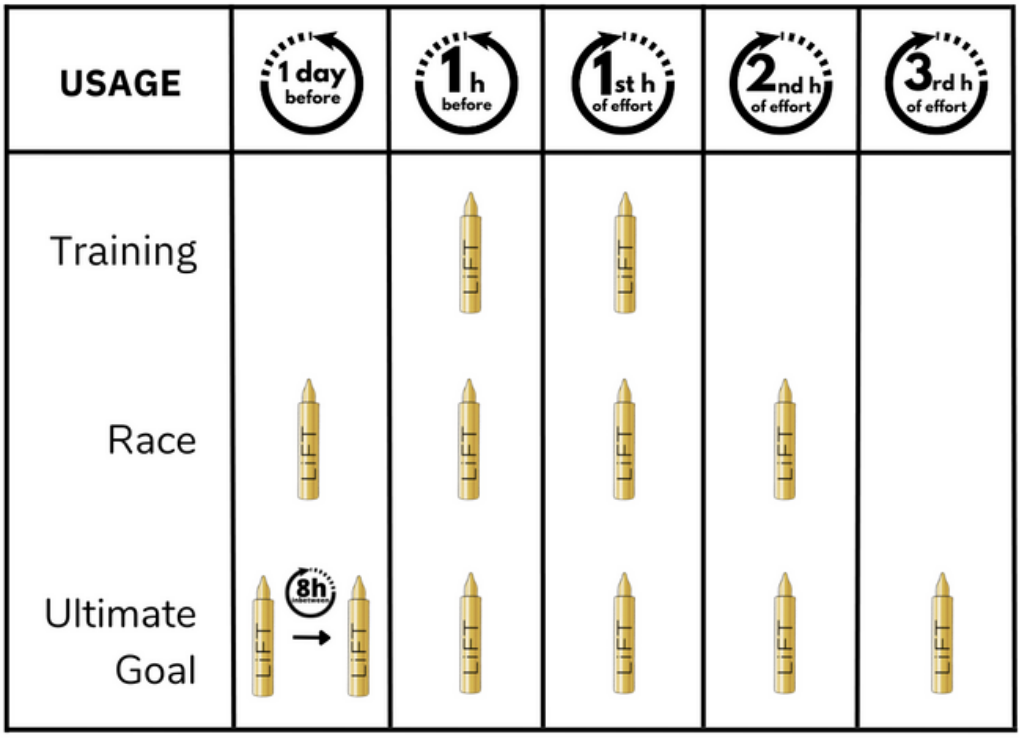
These two new postprandial lipid absorption insights suggest a specific usage profile for LiFT® as a supplement for fueling exercise performance.

B. Postprandial absorption of lipids in humans – implications for LiFT® usage

The presence of an enterocyte storage pool for triglycerides, and the cephalic phase release of chylomicrons linked to these stores, imply that preloading of the enterocyte storage pool is necessary for immediate use of NuliGo® lipids from LiFT® during exercise. Furthermore, intramuscular fatty acid composition is influenced by dietary triglyceride intake. Combined, these facts suggest that several days preloading of LiFT® would lead to maximal NuliGo® lipids availability during high-energy, demanding athletic performance. A three-day loading phase is put forward as a strategy consistent with the latest science on postprandial lipid absorption.

Additionally, the use of LiFT® during the initial period of endurance exercise or performance (e.g., first 2 hours) also capitalizes on the cephalic phase response, leading to an initial fast release of chylomicron lipoprotein particles, with preloaded NuliGo® lipids, into the lymphatic system.

The traditional or preferred approach with carbohydrates to fuel performance can be maintained as LiFT® can be added on top of the existing approach with carbohydrates (loading, pre-workout meal/supplement, and certain grams per hour during activity), while keeping total supplemented calories constant.



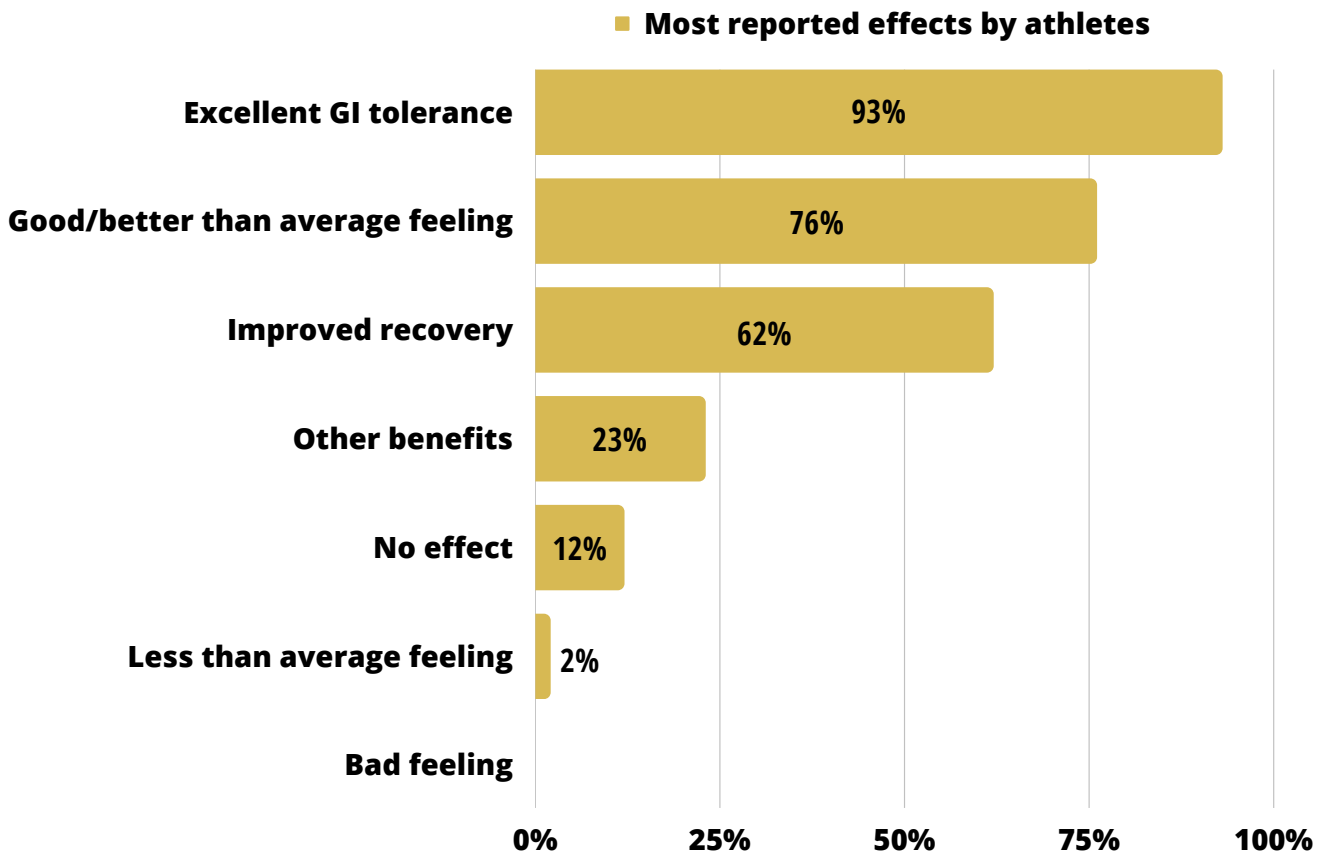
III. LIFT LAB AND FIELD-TESTING RESULTS

A. Field testing

Many athletes in different kinds of endurance and interval-specific sports have been rigorously and thoroughly testing LiFT® for an extensive period. All athletes that participated in our field tests were unaware of the possible or expected effects of LiFT® in order to minimize a possible placebo effect.

Some key elements from the outcome of all this field testing:

- Cycling: 16 of 22 tested cyclists reported having “good legs” that day and 3 of the 22 reported having “extremely good” legs. All 22 cyclists reported excellent GI tolerance and no side effects.
- Triathletes: 3 of 4 reported feeling fresher after long training. All reported excellent GI tolerance as well.
- Runners: 6 of 9 reported better than average feeling.
- Motocross: 4 of 5 reported less arm pump.



B. Lab testing

Two preliminary studies are ongoing with triathletes and cyclists. These are carried out as as double-blind, placebo-controlled crossover trials. Double blind implies that the athletes and lab technicians were unaware what they were taking (placebo or LiFT®) and cross over design means that they did a test with both the placebo and LiFT® in random order, with less than 10 days between the two tests.

These preliminary studies are being conducted with different supplementation protocols. The main goal of this pretesting is to calculate dosage for an upcoming clinical trial with academic partners.

Preliminarily, our pretesting is showing a trend towards lower lactate levels for the same power output and a muscle glycogen sparing effect that translates into better performance in a time-trial after a few hours of pre-exhaustion at 55% of FTP.

A larger clinical trial will commence imminently. While our clinical program continues, we don't want to keep this highly innovative supplement out of reach from those athletes who want to go 4GOLD.

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THE PARTNERSHIP BEHIND LiFT®

LiFT® is a revolutionary creation resulting from the synergistic partnership between 4GOLD and Bunge Nutrition, a global leader in nutritional lipids.

Together, they leveraged the latest science in lipid metabolism and focused it in athletic performance and endurance. LiFT® is the result of extensive research and development driven by a passion for innovation.

CONTACT US

If you have any questions, feedback or just want to say hi,
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