THE CARB-APPROPRIATE REVIEW

THE MCT ISSUE

A MONTHLY RESEARCH REVIEW BY

CLIFF HARVEY PHD

In association with The Holistic Performance Institute

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ABOUT CLIFF

Cliff Harvey PhD is an author, clinician, and researcher. He was one of the first clinical nutritionists to begin working with ketogenic and low-carb diets, way back in the 1990s and is also considered a pioneer in the area of mind-body integrative healthcare.

Cliff's early post-graduate work was in mind-body healthcare, while his master's research focussed on the use of medium-chain triglycerides to mitigate 'keto-flu' and encourage faster induction of nutritional ketosis.

His doctoral thesis continued to investigate keto-flu and ketogenesis, and the effects of different types of low-carbohydrate diets along with the individualisation of dietary prescription and how 'carbohydrate tolerance' varies from person-to-person.

He is a former world champion strength athlete, submission grappler, and author of several best-selling books, including *The Carbohydrate Appropriate Diet*, *Carb-Appropriate 101*, *Time Rich Cash Optional* and *The Credo.*

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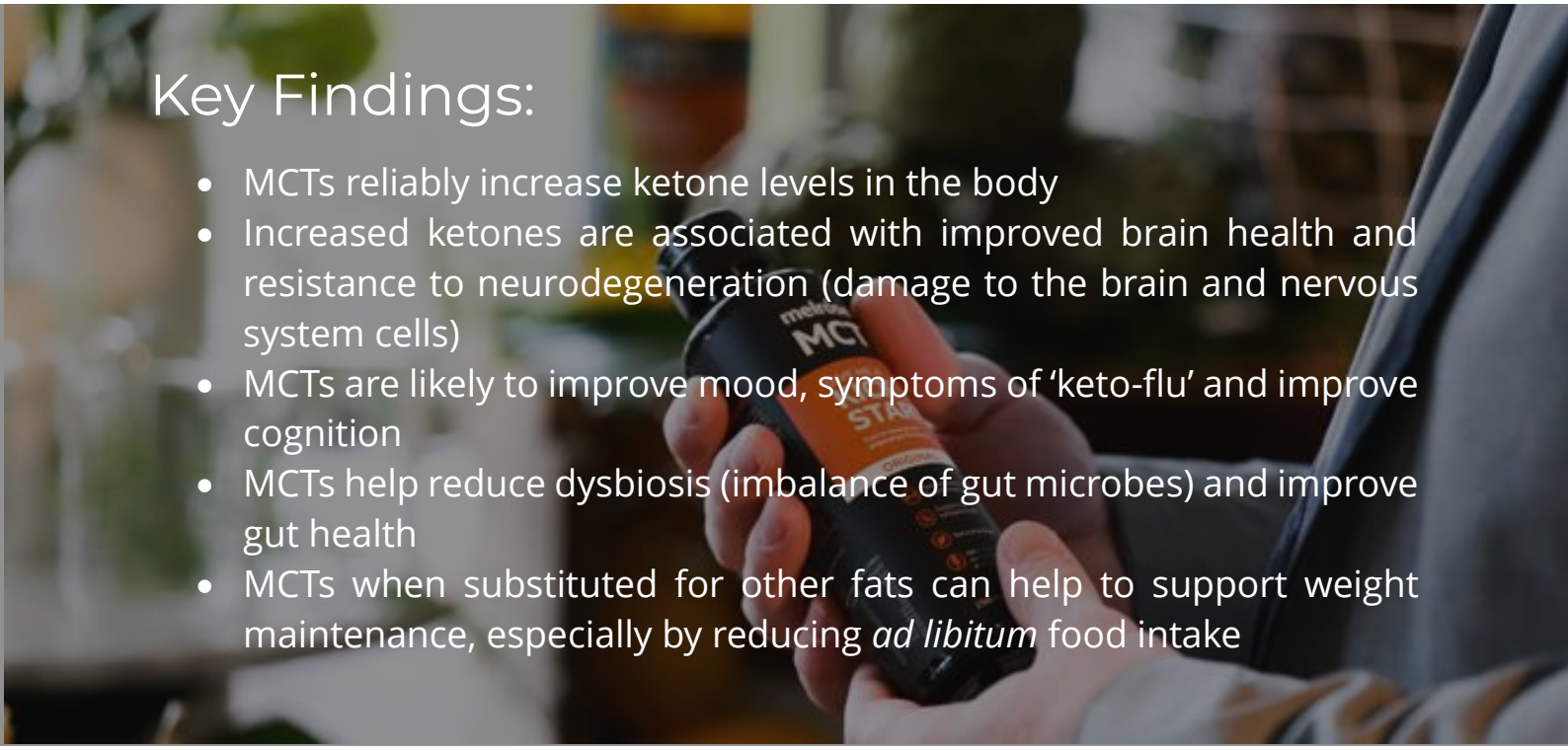
THIS MONTH

ALL ABOUT MEDIUM CHAIN TRIGLYCERIDES



Key Findings:

- MCTs reliably increase ketone levels in the body
- Increased ketones are associated with improved brain health and resistance to neurodegeneration (damage to the brain and nervous system cells)
- MCTs are likely to improve mood, symptoms of 'keto-flu' and improve cognition
- MCTs help reduce dysbiosis (imbalance of gut microbes) and improve gut health
- MCTs when substituted for other fats can help to support weight maintenance, especially by reducing *ad libitum* food intake

Medium chain triglycerides (MCTs) are absorbed directly from the gut and transported to the liver where they can be converted easily to 'ketones'. These ketones are brain- and body-friendly fuels that can:

- Provide a non-sugar fuel source to the brain and nervous system
- Supply non-sugar fuel to working muscles
- Reduce inflammation
- Improve relative relaxation vs over-stimulation of brain and nervous system cells (neurons)

MCTs themselves also help to feed beneficial bacteria in the gut and reduce levels of unwanted bacteria and fungi (like Candida).

What are MCTs?

'Triglycerides' is the fancy name we use for dietary fats. These fats consist of a sweet-tasting compound called glycerol and three fatty acids made up of chains of carbon. Hence, *tri* (three fatty acids) and *glyceride* (the glycerol backbone). Because they are shorter than most of the fats

we consume from our diet (which are mostly 'long-chain' fats greater than 12 carbons in length), MCTs aren't digested in the way longer fats are, and instead are absorbed into the *hepatic portal vein* and transported directly to the liver where they can be converted into ketones easily for use as fuel. MCTs are also directly used by beneficial bacteria in the gut and cells of the intestinal wall, thereby improving gut health.

How to take MCTs?

MCTs are available as oils and in powders. They can be used to make salad dressings or added to smoothies or hot or cold beverages. The powders, in particular, are easily added to hot drinks and act as a 'coffee creamer'.

How much to take?

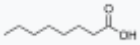
Everyone's tolerance for MCTs is different. Usually, people take around 1 tsp up to a maximum of 2 Tbsp in a drink or with food, 1-3 times per day. Try increasing your dose by 1 tsp per serve until you feel improvements in mental energy or mood. If you feel any uncomfortable feelings in your gut or urgency to go to the bathroom, reduce by 2 tsp.

Note: In a study on ketone levels, lipids, and oxidative stress resulting from the ingestion of MCTs in coffee, it was found that 28g of MCT added to coffee increased blood ketones (BOHB), and HDL-c ('good' cholesterol) while reducing triglycerides, insulin, and markers of oxidative stress. However, 42 g resulted in *increases* in markers of oxidative stress; advanced oxidation protein products and malondialdehyde.[1] So, it might be prudent to limit intake to <30 g per serve, which is typically the maximum tolerable dose anyway.[2]

MCT – IN-DEPTH

Medium-chain triglycerides are dietary fats in which at least two fatty acid chains consist of 6-12 carbon atoms. They are found in the highest quantities in palm kernel and coconut oils and are also found in the milk of ruminants and the common name of the C6 to C10 fatty acids refer to this link, with the root word 'Capra' referring to goats.

The medium-chain fatty acids

Lipid number	Name		Salt/ester name		Formula		Chemical structure
	Common	Systematic	Common	Systematic	Molecular	Structural	
C6:0	Caproic acid	Hexanoic acid	Caproate	Hexanoate	$C_6H_{12}O_2$	$CH_3(CH_2)_4COOH$	
C8:0	Caprylic acid	Octanoic acid	Caprylate	Octanoate	$C_8H_{16}O_2$	$CH_3(CH_2)_6COOH$	
C10:0	Capric acid	Decanoic acid	Caprate	Decanoate	$C_{10}H_{20}O_2$	$CH_3(CH_2)_8COOH$	
C12:0	Lauric acid	Dodecanoic acid	Laurate	Dodecanoate	$C_{12}H_{24}O_2$	$CH_3(CH_2)_{10}COOH$	

MCTs have become popular supplements to provide non-carbohydrate fuel for low-carbohydrate and ketogenic diets but they are also being increasingly used by those following more moderate and even higher carbohydrate diets.

Increased ketogenesis

The main function of MCTs is to increase *ketogenesis*. Ketogenesis is the process, in the body, of producing 'ketone bodies' to use as fuel.[3-6] These 'ketone bodies' (usually just called 'ketones') can be used as a fuel by most tissue in the body, including cells of the brain and nervous system which typically rely almost exclusively on glucose (sugar).

Helping you get into and stay in ketosis

Ketogenic diets were originally used with great success to treat childhood epilepsy and have been used for this purpose since the 1920s.[7-10] Since that time, ketogenic and other low carbohydrate, high fat (LCHF) diets have demonstrated a host of benefits

for many other health conditions, weight and fat-loss, and for improving some sports performance (especially endurance).

When ketogenic diets were first being investigated, they relied heavily on fasting, and on extremely high-fat diets (with up to 80% of calories from fat) to achieve *nutritional ketosis*.[11, 12]

In the 1970s researchers demonstrated that a ketogenic diet could have as little as 60% calories from fat and much more protein and carbs, and still achieve the same levels of blood ketones if the diet included a high proportion of medium-chain MCTs.[13, 14] More recently, my team and I have demonstrated that MCTs significantly 'boost' ketone levels, reduce symptoms of 'keto-flu', and might help induce ketosis more quickly.[2]

> MCTs significantly 'boost' ketone levels, reduce symptoms of 'keto-flu', and might help induce ketosis more quickly

Note: Exercise is also ketogenic, encouraging the creation of ketones for use as fuel. It has been found that combining 30min aerobic exercise with MCT (30 g) is more ketogenic than either exercise of MCT alone.[15]

Sleep

Increased ketones provide a 'relaxing' effect on the brain. This is likely to be due to a combined effect of protection against hypoglycaemia (low blood sugar),[16] increased available adenosine (a relaxing neurotransmitter) and improved GABA-glutamate ratio, reducing over-excitation of neurons.[17] Increased ketones also reduce inflammation,[18] thereby reducing excitotoxicity (protecting neurons from this cytotoxic damage), and improve the structure and function of glial cells of the brain which support other neurons.[19]

> There are plausible reasons why MCT might help to improve sleep

Interestingly, ketones also reduce oxidative stress in the brain and increase brain-derived neurotrophic factor (BDNF),[20] a trigger for improved brain repair and growth of new nerve cells.

So, there are plausible reasons why MCT might help to improve sleep. The effect of MCTs specifically on sleep has been studied in new-borns consuming formula in which 37% of the fat content was from MCTs. The new-borns taking the MCT formula slept on average 52 mins longer than the control oil (a long-chain fat).[21]

Gut health

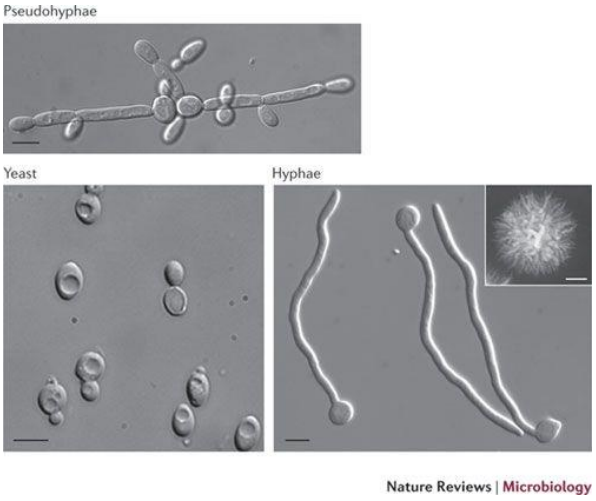
Animal research suggests that medium-chain fatty acids (from MCTs) might help to improve the balance of beneficial to pathogenic (disease-causing) bacteria in the gastrointestinal system,[22] and this effect is likely to occur in humans.[23] A formula containing MCT has also resulted in improved gut-barrier function (i.e. reduced 'leaky-gut'),[24] and they have known anti-fungal activity.

> Medium-chain fatty acids might help to improve the balance of beneficial to pathogenic bacteria in the gastrointestinal system

Anti-candida activity

Lauric acid from coconut oil (C12),[25, 26] capric acid (C10) and caprylic acid (C8) help to combat candida (a pathogenic yeast) by reducing activity, adhesion, and biofilm formation of the yeast.

Research has shown that capric acid and caprylic acid affect the yeast-to-hyphal progression (the development of yeast into a more mature mycelium, which is more virulent) of candida. This research suggests that all of the MCTs may be effective in treating Candida yeast infections.[27]



Yeast, hyphae, and pseudohyphae of *Candida albicans*.[28]

From: https://www.nature.com/articles/nrmicro2636

In human research, preterm infants supplemented with MCT oil experienced a significant reduction in candida load over a 3-week period, and candida significantly increased after supplementation was stopped. Thus, supplementation with MCT may be an effective method to reduce candida colonisation of the gut.[29]

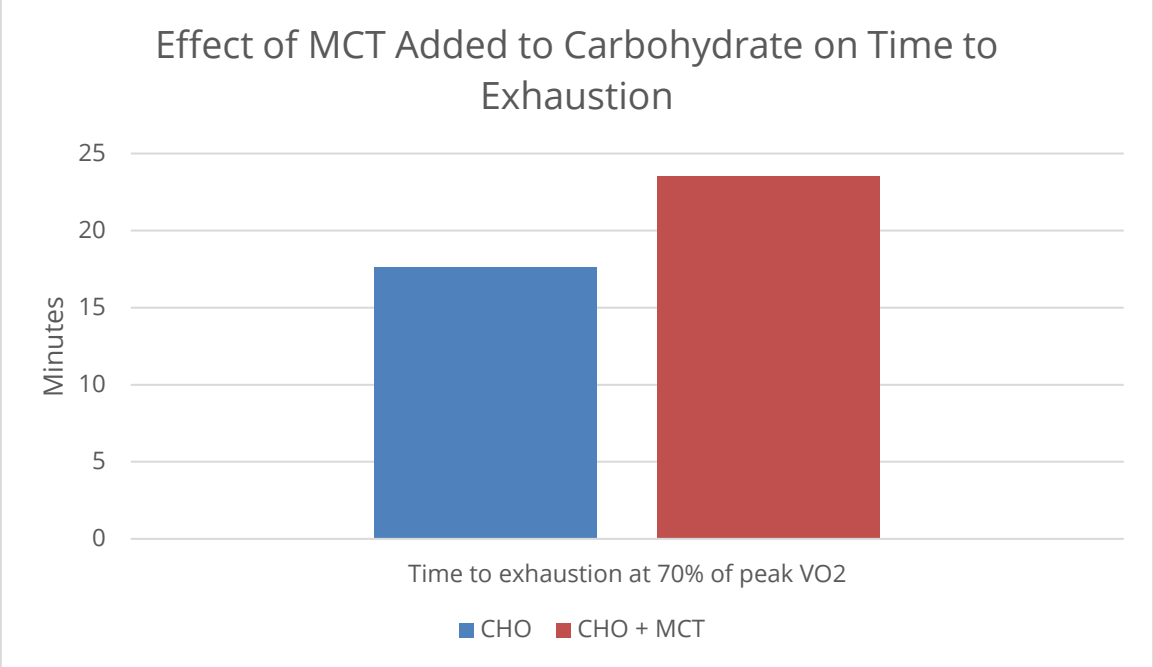
> MCTs may be effective for treating Candida yeast infections

Improved physical performance

MCTs are useful for increasing fat utilisation during exercise. While the effects on performance have been somewhat equivocal, there are likely to be benefits to performance when MCTs can both provide fuel *and* improve fuel utilisation.

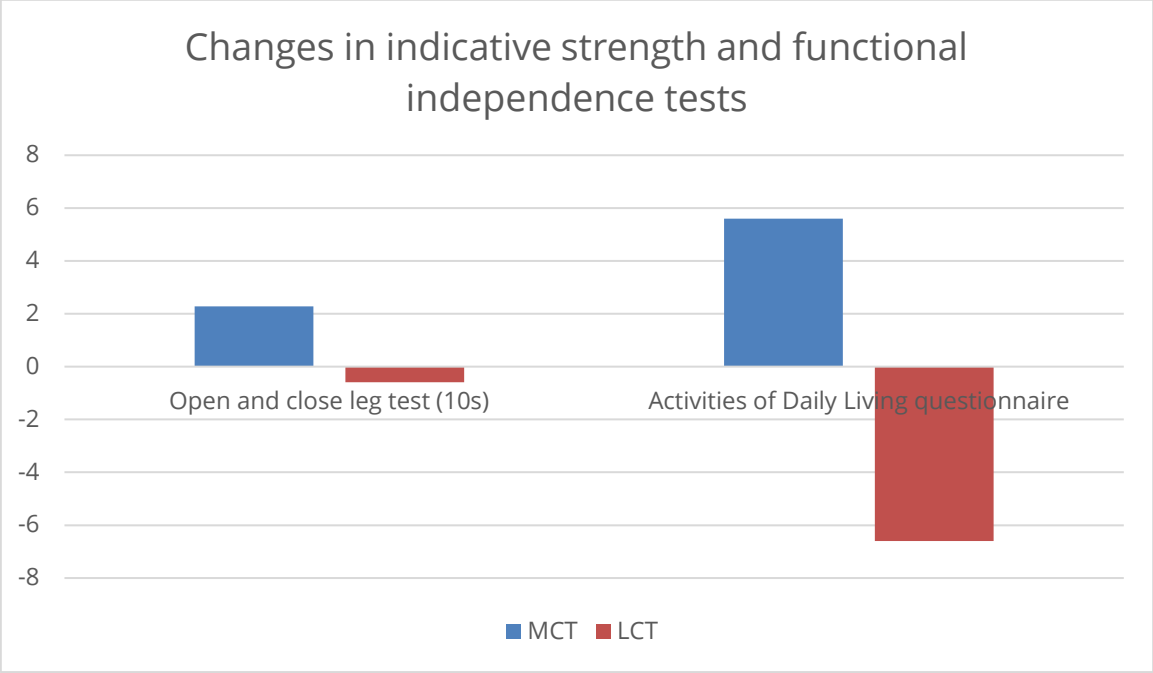
A 2018 study compared the effect of 6 g of MCT consumed along with carbohydrate (maltodextrin), compared to a carbohydrate only meal providing the same amount of energy, for two weeks, on moderate-intensity (50% peak $V\dot{o}_2$) and high-intensity (70% peak $V\dot{o}_2$) exercise. Fat oxidation was significantly increased in the MCT + carbohydrate trial during moderate-intensity exercise, and the duration of subsequent high-intensity exercise was extended significantly, compared with that observed in the carbohydrate-only trial. The authors concluded that *continuous ingestion of 6 g MCT with maltodextrin could increase fat oxidation during moderate-intensity exercise and extend the duration of subsequent high-intensity exercise in recreational athletes, compared with the ingestion of isoenergic maltodextrin alone.*[30]

MCT with maltodextrin could increase fat oxidation during exercise and extend the duration of high-intensity exercise



Reduced effects of ageing

Elderly patients given just 6 g per day of MCT (C8 and C10 blend) had significantly improved strength and functional independence (ability to perform daily activities) [i] compared to those taking a control oil.[31]



Brain health

The ketones we create when we take MCT oils increase 'mitochondrial efficiency' (how efficiently we use fuels, especially fat-for-fuel) and help to supplement the brain's normal reliance on glucose.[32] Impaired use of glucose by neurons is also a hallmark of Alzheimer's disease and cognitive decline, and MCTs, which indirectly provide ketones (especially BOHB) can offset the effects of a glucose-deficient brain.

MCTs also show neuroprotective properties and there is evidence that they help to reduce the risk of Alzheimer's and cognitive decline.[33]

MCT oils increase 'mitochondrial efficiency'

[ii] Measured by *Functional Independence Measure score*

For example, MCT supplemented diets improve mental performance and memory in those with Alzheimer's Disease and other age-related cognitive declines .[34-36]

A recent placebo-controlled trial has also shown a significant improvement in the cognitive scores [ii] of mild to moderate severity Alzheimer's patients taking 17 g of MCT per day.[37] There were also significant increase in cholesterol and HDL-c, BOHB, and androstenedione (a precursor to testosterone) and significant reductions in several fatty acids in the blood.[iii]

In a study of 6 g MCT per day (with L-leucine and vitamin D) mental status scores in the MCT group improved by over 30% whereas, in the leucine + vitamin D + long-chain fat, and control groups, these measures were *decreased* (by 11.2% and 26.1% respectively).[38] This suggests that even relatively low doses of MCT improve brain health and mental performance.

> Even relatively low doses of MCT improve brain health and mental performance

A 2020 meta-analysis of the available research showed that MCTs induce mild ketosis and improve cognition in people with Alzheimer's disease.[39]

MCTs have also been shown to aid cognition and protect against the effects of hypoglycaemia (low blood sugar) in diabetics.[40]

Improved oxygen delivery

The addition of MCT to ghrelin treatment improved the aerobic capacity of underweight patients with chronic obstructive pulmonary disease.[41]

Support for weight management

Diets rich in MCTs promote greater fat-utilisation and weight/fat-loss than those containing the same amount of standard dietary fat.[42, 43]

> Diets rich in MCTs promote greater fat-utilisation and weight/fat-loss than those containing the same amount of standard dietary fat

[iiii] Alzheimer's Disease Assessment Scale–Cognitive Subscale

[iii] LysoPC (18:0), palmitic acid, linoleic acid, oleic acid, and 7,12-dimethylbenz[a]anthracene

They have been shown to have a particularly positive effect on fat in and around the midsection (internal and external 'belly fat'),[44] which we know to be a risk factor for cardiovascular disease and is an indicator of increased risk of metabolic syndrome (pre-diabetes).

MCTs could also help us to stick to a healthy diet more easily, by reducing voluntary food intake,[45] increasing the desired time between meals, and improving portion control.[46] Even relatively low intakes of MCT (as little as 15 g per day or 1 Tbsp.) as part of the diet, enhance how many calories we burn day-to-day.[47]

MCTs could help us to stick to a healthy diet by reducing voluntary food intake

Improved cardiometabolic health

Consistently high triglycerides (fats in the blood) reading are a key indicator of heart disease and stroke risk and are a key marker for insulin resistance, prediabetes and carbohydrate tolerance. MCTs increase serum triglycerides less than standard dietary fats.[48, 49]

MCTs increase fats in the blood less than standard dietary fats

Experimental studies demonstrate that dietary MCTs reduce fat deposition, increase thermogenic rate (calories burned) and fat burning. Additionally, several reports suggest that MCTs help preserve *insulin sensitivity*, both in animal models and patients with type 2 diabetes.[50]

Greater muscle retention post-injury and while dieting

Due to the easily used nature of MCTs, they can help to reduce muscle and other tissue breakdown after injury or trauma,[51] and improve fat-loss while helping to preserve muscle while dieting.[52]

Resistance to corticosteroid-induced damage

Corticosteroids are catabolic hormones that break down tissue. They are used to treat many inflammatory disorders and are extremely beneficial to these conditions but long-term use results in insulin resistance, obesity and cytotoxicity (damage to cells).

In a study of the effects of MCTs on glucocorticoid-treated children with leukaemia, it was found that those supplemented with MCT were more resistant to middle weight-gain compared

to the control group.[53] This suggests a benefit to abdominal adiposity, a key marker of metabolic disorders and a risk factor for future health problems.

WHICH MCFAS INCREASE KETONES THE MOST?

Based on the existing animal and human research, it's probably fair to say that the shorter the chain length (of the fatty acid), the more easily the fatty acids are transported into the hepatic portal vein and carried to the liver for conversion to ketones.[54-57]

> The shorter the chain length of the fatty acid, the more easily it is converted to ketones

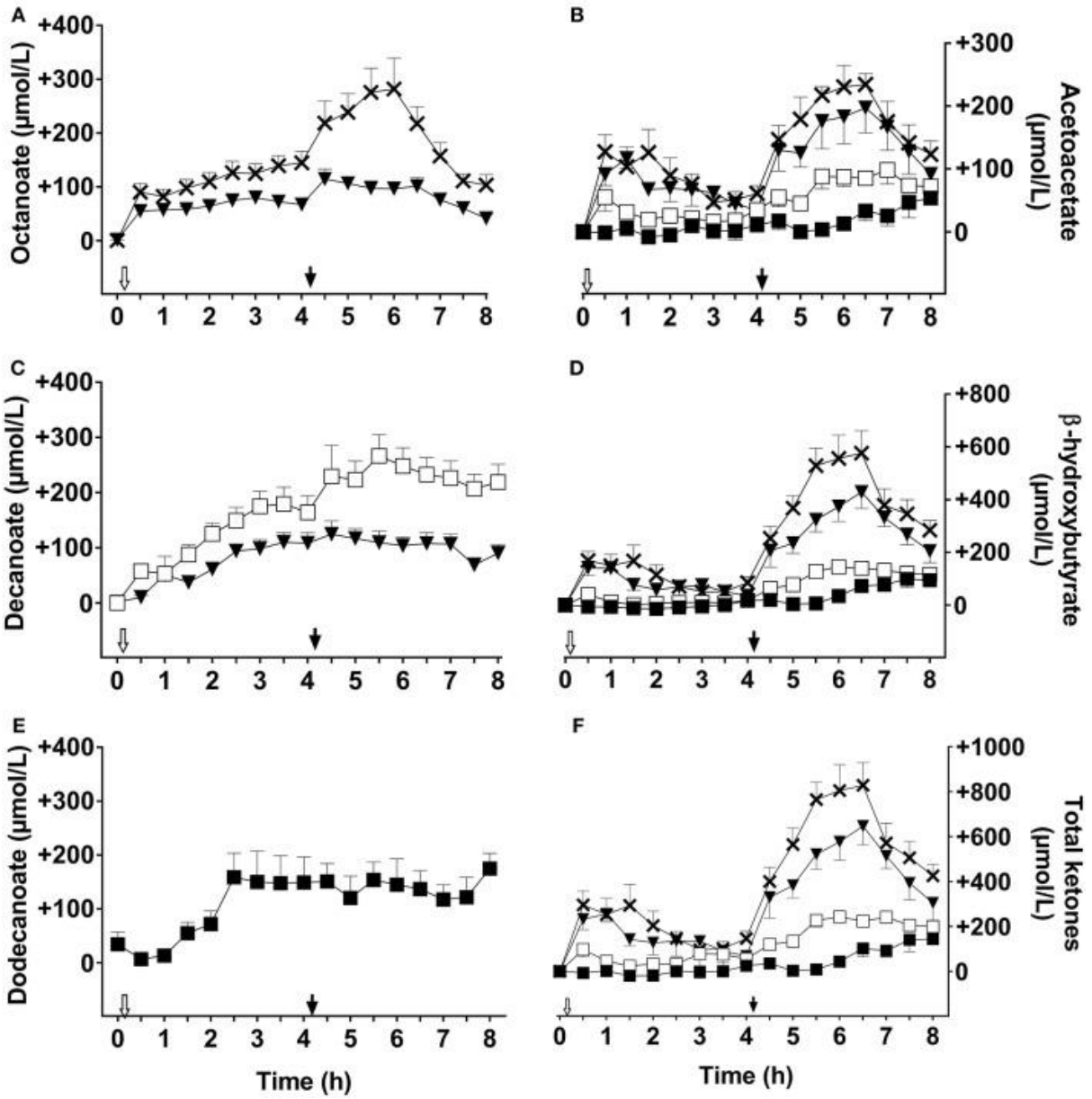
The actual ketogenic effect of the various medium-chain fatty acids from caproic (C6) to caprylic (C8), capric (C10) and lauric acids (C12) in humans has not been well studied.

In a recent study, it was found that the increase in total ketones [iv] wasn't significantly different between C8 and a mixture of C8 and C10 fatty acids. Both C8 and C8-10 increased plasma BOHB by around 5-fold (first half of the day) to 1.5-fold (second half of the day of administration). Compared to C10, the area under the curve for BOHB was 62-fold lower during the 0–4-hour period and 1.5-fold lower during the 4–8-hour period.

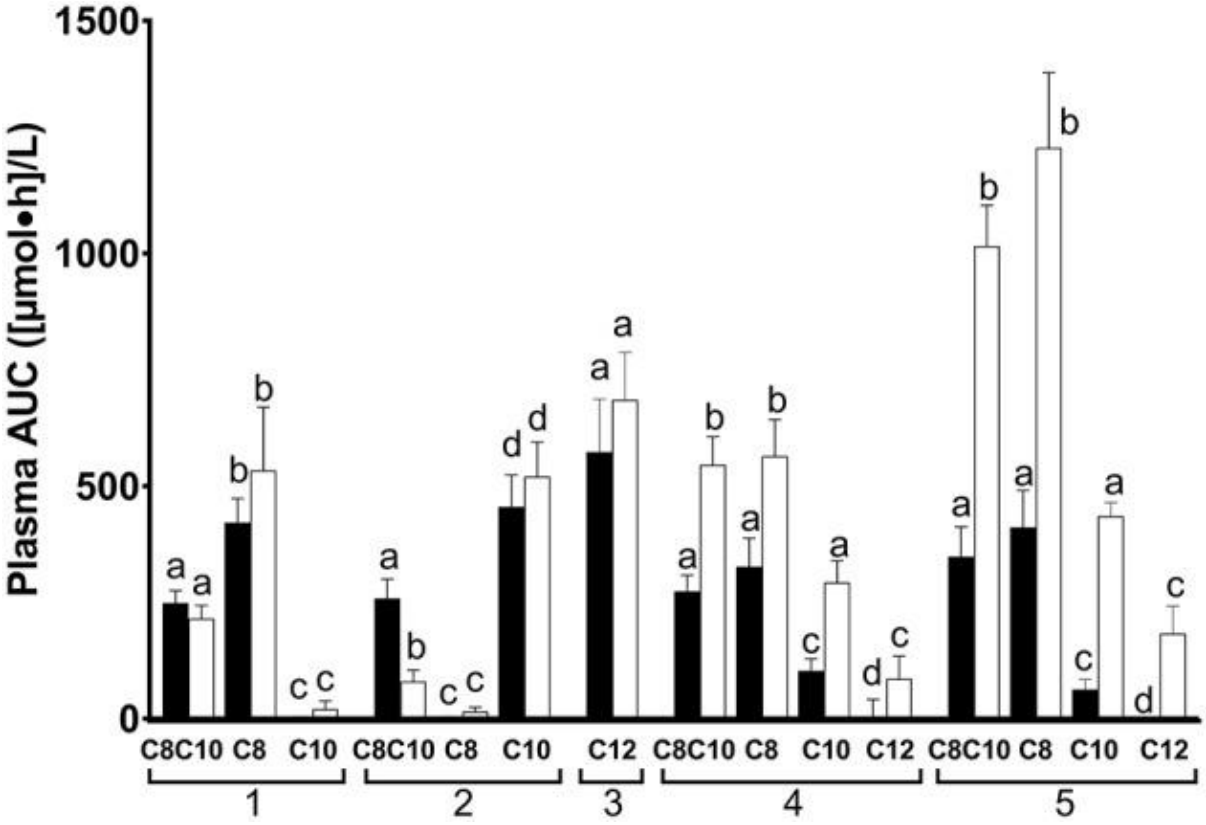
This supports the idea that shorter chain lengths promote faster and greater increases in ketones. However, there is a 'longer' (albeit smaller) effect of longer MCFA chains. The shorter chains also have a stronger dose-effect. For example, at 400 µM of each MCFA in plasma total lipids, plasma ketones were about three times higher after C8 than after C10 and two times higher after C10 than C12. So, C8 is considered a very ketogenic MCFA with diminishing effects for the longer chains of C10 and C12.[58] While lauric acid (C12) does increase ketones over a time-frame of several hours because the total elevation in ketones is not as much as the shorter chain fats, there is debate about whether lauric acid is functionally ketogenic.

> There is debate about whether lauric acid is functionally ketogenic

[iv] Area under the curve (AUC)



Plasma octanoate **(A)**, acetoacetate **(B)**, decanoate **(C)**, β-hydroxybutyrate **(D)**, dodecanoate **(E)**, and total ketones **(F)** throughout the 8 h metabolic study day during which two 20 ml doses of the following test substances were consumed: tricaprylin (C8,×), tricaprin(C10,□), medium-chain triglyceride (C8C10, ▾), or trilaurin (C12, ■). Plasma acetoacetate, β-hydroxybutyrate, and total ketones values were normalized to T0, and control day values were subtracted prior to graphing the results. Plasma octanoate, decanoate, and dodecanoate were extracted from plasma total lipids. The white arrow (⇩) indicates the time at which breakfast plus the dose of test oil was consumed; the black arrow (🡻) indicates when the dose of test oil alone was consumed at midday (without a meal). Data are the mean ± SEM for *n* = 8–9 participants/point.



Area-under-the-curve (AUC) of plasma octanoate (1), decanoate (2), dodecanoate (3), acetoacetate (4), and β-hydroxybutyrate (5) during the metabolic study day on which the doses of medium-chain triglyceride (C8C10), tricaprylin (C8), tricaprin (C10), or trilaurin (C12) were tested. Plasma MCFA were extracted from total plasma lipids. AUC data are shown in pairs of bars: the left-hand bar of each pair represents the data for the 0–4 h AUC while the right-hand bar represents the 4–8 h AUC. Bars are the mean ± SEM for n = 8–9. For each metabolite shown, the 0–4 h AUC was significantly different from the 4–8 h AUC where letters are different ($P < 0.05$).

IN-DEPTH: WHAT ARE MCTS?

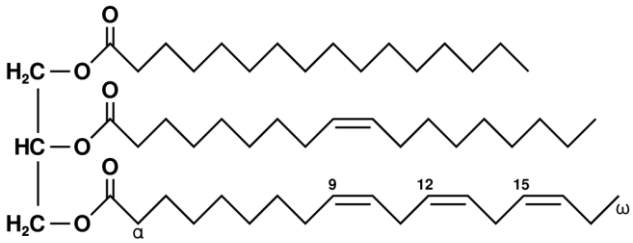
- Structurally, MCTs are lipids with fatty acids between 6 and 12 carbon chains in length
- There is debate as to whether *lauric acid* (C12) in particular is *functionally* an MCFA
- The most active MCTs are those containing 6-10 chain length fatty acids (caproic, caprylic, and capric acids) with the greatest ketogenic effect likely from the shortest MCFAs (C6 and C8)
- They can be transported directly to the liver, from the gut, to be converted into ketones
- Ketones provide a glucose-sparing fuel for the brain and central nervous system and most tissue throughout the body

Medium Chain Triglycerides (MCTs) are a particular type of dietary fat (or 'lipid'). 'Fat' itself is the term lay-term we use for a 'triglyceride'.

A triglyceride consists of a glycerol 'backbone' with three 'fatty acids' attached to it.

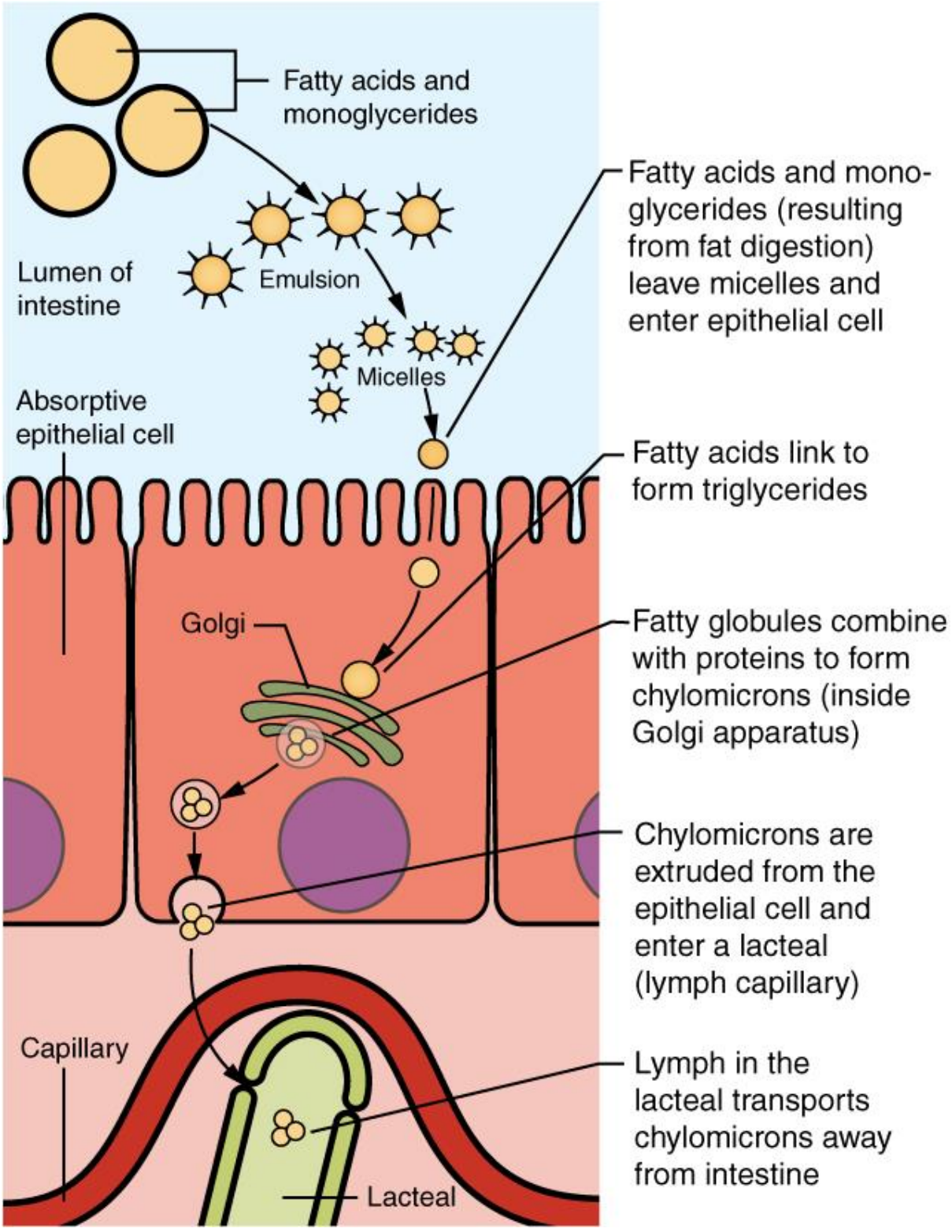
> A triglyceride consists of a glycerol 'backbone' with three 'fatty acids' attached to it

Dietary fats that we eat are almost always triglycerides, but most contain long fatty-acid chains (greater than twelve carbons in length). MCTs are rarer in the diet and are found in small amounts in dairy foods and in palm and coconut oils. Coconut oils are especially rich in a medium-chain fatty acid called 'lauric acid' that is 12 carbons in length. The other medium-chain fatty acids (MCFA) are fatty acids comprised of 6–10 carbons in the chain. These MCTs are: caproic (C6), caprylic (C8), and capric (C10) acids.[59]



Example of an unsaturated fat triglyceride ($C_{55}H_{98}O_6$). Left part: glycerol; right part, from top to bottom: palmitic acid, oleic acid, alpha-linolenic acid.

Long-chain fats, which include most of the dietary fats that we eat, require the action of bile and phospholipids in the gut to break up the fat into smaller 'packets' for digestion and once they have been absorbed into the intestinal wall they are bundled up into *chylomicrons* (a protein transport molecule) so that they can be delivered to the body via the lymphatic system.



Long-chain triglyceride digestion from
https://upload.wikimedia.org/wikipedia/commons/1/15/2431_Lipid_Absorption.jpg

Medium Chain Triglycerides do not require the actions of bile, and rather than the standard absorption and transport pathways, they are instead absorbed into the hepatic portal vein and transported directly to the liver for conversion into bio-available ketone fuels.

> Medium Chain Triglycerides do not require the actions of bile and are absorbed into the hepatic portal vein and transported directly to the liver for conversion into ketones

Early animal studies demonstrated the ketogenic (ketone producing) effect of MCTs and indicated an approximately nine-fold increase in ketone body production after ingestion of MCT versus LCT,[60, 61] and it is well known that MCTs promote both an immediate boost in ketones *and* encourage the creation of ketones from other fat types in both animals [60, 61] and in humans.[62]

What are ketone bodies?

The ketone bodies that we produce when on a ketogenic diet, when fasting, or when taking MCTs, are an alternate, brain- and body-friendly fuel derived from fatty acids and some amino acids.

The ketone bodies are acetoacetate, ß-hydroxybutyric acid (BOHB) and acetone. These ketone bodies are produced through a process called 'ketogenesis' in the liver. Acetoacetate is the primary ketone body, and this is converted to BOHB, which functions as the main ketone 'fuel'.[v] BOHB can be used by most tissue in the body and most importantly is easily used by heart tissue as a preferred fuel, muscle tissue, and the brain and central nervous system (which usually relies on glucose for fuel.) A restriction of carbohydrate results in reduced insulin levels and reduced lipogenesis (the creation of fats). When liver glycogen (your stored carb reserve) becomes insufficient to supply the glucose necessary for normal fat oxidation and for the supply of glucose to the CNS, an alternative fuel source is needed.

The CNS typically doesn't use fat for fuel for two reasons:

1. The common dietary fats (consisting of long-chain fatty acids) are usually bound to a protein called 'albumin'

[v] Technically BOHB is not a ketone body as the ketone moiety has been reduced to a hydroxyl group

and can't cross the blood-brain barrier.

2. Use of fats in the brain demands more oxygen than using glucose, which can starve brain cells of oxygen. This results in oxidative damage and impaired fuel provision to those neurons.[63]

Some dietary fats such as short-chain fatty acids like butyrate, medium-chain triglycerides, and ketones, are able to easily cross the blood-brain barrier (because they are not bound to albumin) and they do not promote the same raft of problems usually resulting from fat metabolism in the brain.[63]

> Short-chain fatty acids, medium-chain triglycerides, and ketones are able to easily cross the blood-brain barrier

Is coconut oil an MCT?

Coconut oil (CO) is the expressed oil from the flesh of the mature coconut. Coconut Oil contains medium-chain fatty acids from 6-12 chains in length and premium MCT oils are typically sourced from coconut oil (mainly due to the negative ecological impact of Palm Oil). However, most of the fat content of whole coconut oil comes from the C12 fatty acid, *lauric acid.*

> Most of the fat content of whole coconut oil comes from the C12 fatty acid, *lauric acid.*

Coconut oil and *lauric acid* itself has many health benefits including improved HDL ("good") cholesterol and reduced midsection fat,[64-66] but because of the slightly longer chain-length of lauric acid, less is transported directly to the liver when compared to the other MCTs. Animal studies have suggested that some (perhaps ~18%) of lauric acid *can* escape lymphatic digestion (and thus, enter the liver for conversion to ketones).[55] Later human research has shown that the effects of C12 on ketone production is small but there are temporal effects and there is an elevation of up to ~0.2 mmol/L up to 8 hours after ingestion of 20 ml of MCT containing only lauric acid.[58]

How to use MCTs

General guidelines:

- Build up slowly to find your own tolerance level
- Start with 1 tsp. and build up by 1 tsp. per serve until you are taking somewhere between 1 and 2 Tbsp (3-6 tsp.), 1-3 times per day
- If you experience any stomach discomfort, cut the dose back by 1 tsp.

Ideas for use

In your morning coffee or tea

A great brain-boosting way to take your ketones is in your morning coffee or tea. Try a Tbsp. of MCT or MCT powder, with a dash of full-fat milk, cream, or coconut cream, in your coffee or tea. Give it a quick whizz with a hand blender for a creamy, latte-like consistency and add collagen protein if desired.

In smoothies

Adding MCTs to your smoothie is a great way to add MCTs to your day. Make sure that your smoothie also includes a good protein source, berries, and veggies for full 'meal in a glass' that will help to satisfy you and provide nutrient density.

On salads and veggies

MCTs can be used as a base for salad and veggie dressings. They are light and almost tasteless. Try adding a Tbsp. of MCT oil to olive oil, lemon juice or vinegar of your choice, and salt and pepper, for an easy, convenient, salad dressing that's packed with nutrients and brain- and body-friendly fats. Adding some healthy fats to veggies will also improve the absorption of fat-soluble vitamins and carotenoids.

Goal-specific use

For general use

Take 1-2 Tbsp., 1-3 times per day in coffee, tea, or a smoothie.

For performance

To improve fuelling for performance, take MCTs, according to your tolerance level, before training sessions or events *with your standard pre-training meal or drink.* If you are doing long events you can take small amounts of MCTs during the event as well. Be aware of your own tolerance levels so that you don't develop 'thunder pants'!

For focus, mood and cognition

To improve focus, mood, and cognition through the day, and to help preserve brain health and function as you age, take 1-2 Tbsp in a drink or with a protein shake. This can be taken whenever you feel that your mental energy is dropping, or if you are experiencing 'brain fog'.

To help with sleep

Ketones can modulate the GABA-Glutamate ratio in the brain and increase relative adenosine levels, which is a science-nerdy way of saying that they can help the brain to relax and therefore help you to sleep better. Try taking a Tbsp. of MCTs around 30-60 min before bed to see if it helps *you* to drift off to sleep better. Again, this could be with a protein drink, fish oil, or sleep-aiding

supplements like magnesium, or herbal teas like passionflower, chamomile, valerian etc.

To aid weight management and body composition

MCTs won't magically strip fat from your body!

BUT the evidence does show us that MCTs can help us to reduce our energy intake (because we choose to eat less without realising it) and increase the calories we burn (for no other input from us) and reduce fat, maintain weight more effectively, and help us to reduce abdominal fat ***when substituted for other fats.***

In other words, taking some MCTs can help you to lose weight and body fat if it helps you to eat less, or if you sub out some other fat (especially industrial seed oils) for MCT. BUT if you simply add energy (in the form of MCT) without eating any less and without changing anything else, thermodynamics tells us that you won't lose any fat!

You can use MCTs in smoothies (according to your desired macro intake), or in hot drinks as a fat-fuel that can be used in place of meals to help you to maintain a fasting window.

For muscle gain

Some recent research suggests that increased ketones after training might help to stimulate muscle growth when taken with protein. So, you could try adding a Tbsp. or so of MCTs to your post-workout protein drink.

For health conditions

A range of health conditions can benefit from MCTs including mental and mood disorders, neurodegenerative disorders, autoimmune and inflammatory conditions and cardiometabolic conditions.

If you have a condition, make sure that you consult with a qualified, registered health practitioner *who is well versed in the research behind ketosis, ketogenesis, and MCTs,* as well as your health condition, and take as directed.

Shameless plug: I am a registered clinical nutritionist with over two decades of experience using ketogenic diets and MCTs with clients. Oh yeah...I also did my masters and doctoral research in MCTs and ketogenesis 😉

HOW DO / USE MCTS?

A lot of my readers and clients email me asking how I use MCTs, and supplements in general.

My current meal and supplement regimen looks like this:

Time	Food and Water	Supplement
On arising (around 6 am)	2 glasses of water Coffee with a dash of milk (I sometimes include collagen and MCT powder in this if I am training hard and/or feel I need additional calories)	1 serve Vita Biosa 2 caps Resveracel
Training (around 11 am)	Water during training,	Sometimes a combo of ketones, Lion's Mane and Cordyceps tinctures before or training for an extra 'kick'
After training (12 pm)	Water with smoothie →	4 Tbsp. Clean Lean Protein, 1 scoop Good Green Stuff, 1 Tbsp. Melrose DHA+MCT Various mushroom powders
Meal #1 – Lunch (1-3 pm)	Meat, vegetables, olive oil or avocado (plus nuts, seeds, sprouts etc.)	
After work shake (Around 4-5 pm)	4 Tbsp. Clean Lean Protein, 1 scoop Good Green Stuff, 1 Tbsp. Melrose Original or Pro-Rapid MCT Various mushroom powders	
Meal #2 – Dinner Around 6-7 pm	Meat, vegetables, olive oil or avocado (plus nuts, seeds, sprouts etc.)	

READER SPECIAL

Get 20% off your next purchase of MCTs from Nutrition Store Online by going to the following link: https://www.nutritionstore.online/discount/CARR-MCT or use code **CARR-MCT**

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