

## Medium Chain Triglycerides (MCTGaia™): A Natural Solution for Optimal Pet Health and Vitality

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Certain components have emerged as promising ingredients with the potential to reshape our understanding of dietary impacts on health and performance. Among these, Medium Chain Triglycerides (MCT) stands out as a captivating subject of study. These unique fatty acids, with their distinct molecular structure and metabolism, have garnered attention from both scientific researchers and health enthusiasts alike.

The term "triglycerides" refers to a kind of dietary fat known as medium-chain triglycerides (MCT), consisting of three fatty acids linked to a glycerol backbone. MCT differs from other fats due to their chemical composition, particularly the length of their carbon chains. MCT is made up of fatty acids with carbon chains comprising from 6 to 12 carbon atoms, in contrast to long chain fatty acids, which have more than 12 carbon atoms. The designation "medium chain" refers to the length of fatty acid chains that make up triglyceride molecules. Common sources of MCT include coconut oil, palm kernel oil and dairy products. Key MCTs include caproic (C6), caprylic (C8), capric (C10) and lauric (C12) acids, each distinguished by the number of carbon atoms in their molecular structures<sup>1</sup>.

This unique structure gives MCT distinct properties that influence how they are metabolized and utilized in the body. In comparison to long-chain triglycerides (LCT), MCT is notably smaller and more readily digestible. Upon consumption, MCT undergoes breakdown into individual medium chain fatty acids, facilitating swift absorption into the bloodstream and providing a rapid surge of energy. Moreover, they are quickly converted into energy or transform into ketones, which have the potential to reach the brain and offer it vital fuel. Due to their shorter carbon chains, MCT possesses several notable characteristics, including rapid absorption, thermogenesis, digestive ease, ketone production and various health benefits.

MCT can be found as constituents in various foods, including coconut oil, palm kernel oil, butter, milk, yogurt and cheese<sup>2</sup>, with coconut and palm oils representing the richest dietary source of MCT<sup>3</sup>.

While MCT has historically been used as emulsifier in various human and veterinary pharmaceutical preparations, as well as in cosmetics, they are now extending their influence into an expanding array of food and dietary supplement applications<sup>4</sup>. Recently,

MCT has emerged as a fascinating and promising addition to the realm of pet nutrition. MCT's unique fatty acids, known for their distinctive structure and rapid metabolism, are making waves due to their potential to enhance the overall well-being of our beloved furry companions. With benefits spanning from energy metabolism to cognitive function, MCT is sparking excitement as a potential nutritional powerhouse in pet diets and pet supplements.



## Enhancing Pet's Brain Health

As dogs age, their ability to efficiently metabolize glucose tends to decline, potentially leading to shifts in their mental and physical energy levels. This metabolic change can have significant implications. One of the prevalent neurological disorders affecting dogs is Idiopathic Epilepsy (IE), which poses a substantial risk to their health and overall well-being. IE has been associated with various physical, cognitive and neurobehavioral complications, and it also increases the likelihood of premature death, as highlighted by Risio *et al.* in 2015<sup>5</sup>.

In recent times, there has been growing recognition of the positive impact of ketogenic diets enriched with MCT for dogs with IE. Studies conducted by Berk *et al.* in 2019<sup>6</sup> and 2020<sup>7</sup>, as well as by García-Belenguer *et al.* in 2023<sup>8</sup> have demonstrated that such diets can effectively reduce both the frequency and severity of seizure activity in dogs suffering from IE. This promising development offers new hope for enhancing the quality of life for dogs affected by this neurological condition.

MCT offers a valuable source of Medium Chain Fatty Acids (MCFAs) and ketones, which act as supplementary sources of energy for the brain. Remarkably, research by Han *et al.* (2021) has demonstrated its potential to alleviate seizures not only in rodent seizure models but also in dogs and humans with epilepsy<sup>9</sup>.

In a pioneering pilot study conducted by Garcia-Belenguer and colleagues, the effects of an MCT-enhanced diet were explored over the course of one month in dogs suffering from IE and



non-epileptic beagles<sup>8</sup>. All dogs in the study were gradually transitioned to a commercially produced ketogenic diet (KD) enriched with MCT over one week. Subsequently, they were fed on a high MCT oil diet (6.5%) for the remaining study period. The results were enlightening, showing a reduction in actinobacteria levels in all dogs and a notable decrease in seizure frequency among those with epilepsy.

In Japan, dogs with IE are often prescribed zonisamide (ZNS), an anti-seizure medication. To investigate the potential synergistic effects of MCT and ZNS, a group of Japanese researchers from Nippon Veterinary and Life Science University in

Tokyo conducted a prospective, randomized, double-blind, placebo-controlled, crossover dietary trial involving dogs with IE<sup>10</sup>. Their findings revealed that combining an MCT-enriched diet with ZNS did not result in adverse effects and did not impact the concentration of ZNS.

They observed that 42% of the dogs exhibited a reduction in epileptic seizure (ES) frequency of  $\geq 50\%$ , with one dog (14%) achieving complete cessation of seizures. Moreover, a notable elevation in serum  $\beta$ -hydroxybutyric acid concentration was detected at the end of the supplementation period compared to the placebo. Medium-chain triglycerides (MCTs) are metabolized into medium-chain fatty acids (MCFAs), which can swiftly generate ketone bodies, including  $\beta$ -hydroxybutyric acid<sup>11</sup>. Various studies have indicated associations between epilepsy and impairments in brain glucose metabolism across human populations, rodent epilepsy models, and dogs<sup>12-14</sup>.

In such conditions,  $\beta$ -hydroxybutyric acid may serve as an alternative energy source and contribute to mitigating seizure activity<sup>15</sup>. Additionally, some dog owners reported an



improvement in their pets' quality of life while consuming the MCT-enriched diet. These findings underscore the potential safety and efficacy of MCT-enriched diets when used in conjunction with ZNS for the management of idiopathic epilepsy (IE) in dogs, offering a promising avenue for enhancing the management of this condition.

Furthermore, cognitive impairment is a frequently observed issue during the course of epilepsy. The consumption of MCT has been

shown to mitigate behavioural comorbidities and enhance cognitive function in dogs affected by epilepsy. This encouraging line of research holds promise for improving the quality of life for individuals and animals dealing with epilepsy-related cognitive challenges.

Supplementing with MCT has shown remarkable potential in enhancing cognitive performance and preserving the brain structure of elderly dogs. This improvement stems from the fact that MCT provide an alternative source of cerebral energy through the production of ketones without the need to restrict dietary carbohydrates or proteins, as demonstrated in studies by Pan *et al.* (2010 and 2011)<sup>16-17</sup>.

To delve further into this, a study by Berk *et al.* (2021) looked into the role of MCT supplementation in addressing cognitive impairment (CI) related to epilepsy in dogs<sup>18</sup>. This extensive 6-month, multi-center, randomized, controlled, crossover prospective trial involved 29 dogs with epilepsy, with 18 underwent cognitive testing. Two cognitive tasks were conducted during this trial, comparing the effects of MCT oil to a control group. The results were of significant interest. The MCT supplementation phase demonstrated a notable increase in trainability scores, particularly in the realms of spatial working memory and problem-solving skills. These findings suggest that MCT supplementation holds substantial potential for improving cognitive function in dogs experiencing epilepsy-related cognitive impairment.

According to a study conducted by Pan *et al.* (2010), the introduction of MCT supplementation can yield significant cognitive benefits in elderly dogs<sup>16</sup>. In this study, a group of aging Beagle dogs underwent cognitive assessments to establish baseline data, facilitating the formation of two comparable cognitive groups. The MCT supplemented group was provided with a diet enriched with 5.5% MCT, while the control group consumed an isoenergetic diet with equivalent levels of fat, protein and carbohydrates. The results were noteworthy, revealing improved cognitive performance and increased serum ketone levels in the MCT-fed group. The MCT-fed group outperformed the control group in terms of cognitive performance, which was particularly impressive.





These findings underscore the potential of MCT supplementation in mitigating age-related cognitive decline by providing an alternative source of brain energy, partially compensating for the declining energy metabolism associated with aging.

In a separate study by Pan *et al.* (2018), it was found that MCT oil, when combined with Brain Protection Blend (BPB) – a nutrient blend consisting of antioxidants, B vitamins, fish oil and L-arginine, can effectively manage the clinical signs of cognitive dysfunction syndrome in senior dogs, a condition akin to Alzheimer's disease in humans<sup>19</sup>. The study involved 87 dogs categorized into three diet groups: the Control group, the 6.5% MCT oil + BPB group (6.5% MCT diet), and the 9% MCT oil + BPB group (9% MCT diet). This dietary intervention lasted for a duration of 90 days and demonstrated the potential of MCT supplementation as a valuable strategy for addressing cognitive decline in aging dogs.



Beyond cognitive decline, a decrease in the concentration of omega-3 polyunsaturated fatty acids (n-3 PUFA) in the brain can contribute to the deterioration of dogs' cognitive abilities. Research exploring the role of MCT in dog nutrition has shown promise in supporting canine brain health.

One study discovered that dietary supplementation with MCT led to an increased levels of n-3 PUFA and enhanced fatty acid oxidation in the parietal cortex of aged dogs<sup>20</sup>. These findings aligned with a prior study that revealed how a high-fat ketogenic diet could elevate polyunsaturated fatty acid levels in the brains of rats<sup>21</sup>.

### Helping Pets Achieve Their Ideal Weight and Energy Levels

The inclusion of MCT in the diet can lead to a range of favourable effects on energy metabolism and body weight regulation. MCT has been shown to promote higher energy expenditure and increased thermogenesis, meaning the body burns more calories for energy. Additionally, MCT consumption tends to reduce overall food intake while increasing feelings of satiety, ultimately contributing to a reduction in body weight<sup>22</sup>.

Animal studies, conducted on various species such as rats and chickens, have revealed that MCTs have a distinct impact on the body weight of these animals when compared to those fed diets containing Long Chain Triglycerides (LCTs). This effect is believed to be associated with the heightened levels of  $\beta$ -hydroxybutyrate, a ketone body that arises as a result of ketosis, which is more prevalent in MCT metabolism. Ketosis is a metabolic state where the body predominantly utilizes fat for energy instead of carbohydrates, and this shift in energy utilization may contribute to the observed changes in body weight and metabolism in animals fed MCT-containing diets<sup>23</sup>.

### MCTs and Their Impact on Lipid Metabolism

In a noteworthy comparative study published in *Nutrients* (2018), researchers delved into the impact of substituting soybean oil with MCT oil on lipid metabolism in a group of 32 rats afflicted with type 2 diabetes mellitus. These rats were thoughtfully assigned to one of four

dietary groups, namely the low-fat diet + soybean oil (LS), low-fat diet + MCT oil (LM), high-fat diet + soybean oil (HS), and high-fat diet + MCT oil (HM) groups. After an 8-week period, the study yielded some noteworthy findings.

In the high-fat diet context, the introduction of MCT oil had significant benefits. It led to a reduction in serum low-density lipoprotein cholesterol (LDL-C) levels, non-esterified fatty acids, and total cholesterol concentrations in the liver, all while elevating serum high-density lipoprotein cholesterol (HDL-C) concentrations and the HDL-C/LDL-C ratio when compared to soybean oil.

Conversely, in the low-fat diet setting, MCT oil exhibited different yet equally noteworthy effects. It resulted in a lower body weight and less reproductive white adipose tissue compared to the HS groups. Additionally, it increased hepatic acyl-CoA oxidase activities, a key enzyme in peroxisomal beta-oxidation, compared to the LS group. These findings collectively demonstrate that MCT can enhance blood lipid profiles, reduce hepatic total cholesterol, and offer beneficial effects on cardiovascular health<sup>24</sup>.

A team of researchers from Texas A&M University conducted a study aimed at assessing diet preferences and examining lipid and lipoprotein changes in cats fed diets enriched with MCT. This study involved 19 clinically healthy adult female cats divided into two groups and fed specialized diets over a nine-week period. The results revealed that parameters such as food intake, body weight, body condition score, and metabolizable energy components remained unchanged regardless of the diet.



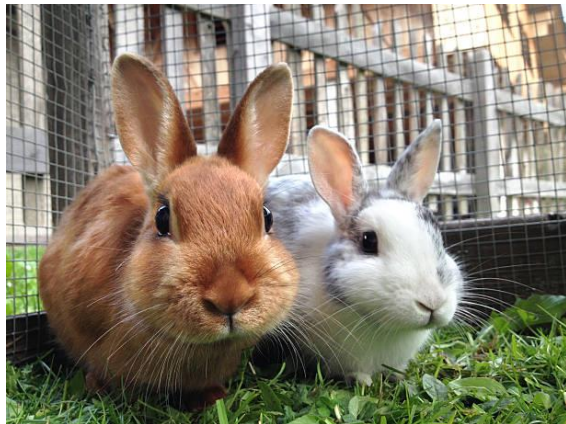
These findings suggest that such dietary interventions could prove beneficial for both clinically healthy cats and those suffering from metabolic disorders. This study, published in the *American Journal of Veterinary Research*, suggests that MCT oils may play a positive role in feline metabolism and can serve as a beneficial nutritional component for cats<sup>25</sup>.

### Strengthening Pet Immunity

Finding practical ways to strengthen our beloved pets' immune systems is a goal that is of the utmost significance in the field of animal nutrition and health. Recent scientific research has focused on how MCT can serve as a powerful ally in this effort.

In a recent study, Wang and his colleagues studied the effects of varying MCT doses on growth performance, immune functions and intestinal health in weaned rabbits<sup>26</sup>. The study enlisted the participation of 600 rabbits, who were randomly divided into five groups. The control group received soybean oil, while the experimental groups were treated with MCT at different dosage levels. This comprehensive research spanned a period of 48 days.

The noteworthy outcomes revealed that supplementing with 2400 mg/kg of MCT led to significant improvements in weaning survival rates, the digestibility of crude fat, serum immunoglobulin levels and overall antioxidant capability.



Furthermore, it positively influenced critical parameters such as villus height, crypt depth, and bacterial abundance in both the 1800 mg/kg and 2400 mg/kg MCT groups. In summary, the substitution of soybean oil with 1800 mg/kg and 2400 mg/kg of MCT in the diet of weaned rabbits was found to be an effective strategy for enhancing growth performance and reinforcing the integrity of the intestinal barrier. This study highlights the potential of MCT as an important dietary component for improving the immunity and general health of our cherished animal companions.

Nair *et al.* (2005) reported that caprylic acid C8 in MCT exhibits potent antibacterial properties that contribute to infection prevention and bolstering the immune system<sup>27</sup>. When administered orally, the antifungal caprylic acid can aid animals with systemic yeast problems by killing fungi and yeast. Furthermore, when capric acid is ingested, it undergoes conversion into monocaprin, which possesses antiviral characteristics. Conversely, monoglyceride monolaurin, formed through the conversion of lauric acid, demonstrates antibacterial effects. As per findings reported by Batovska *et al.*, 2009, in their research, lauric acid (C12) stands out as the most effective medium-chain fatty acid (MCFA) for eradicating gram-positive bacteria, including *Listeria monocytogenes*, *Streptococcus pyogenes*, *Clostridium diphtheriae*, and *Staphylococcus aureus*<sup>28</sup>.

In another research conducted by Skrivanova and colleagues in 2009, rabbits were fed with diets ranging from 0% to 5% C8 and 1% C8+C10, and subsequently exposed to artificial *E. coli* O128 infection<sup>29</sup>. It was observed that diets containing MCFA were notably more effective in preventing colibacillosis. Meanwhile, the findings of a study carried out by Dhakal and Aldrich propose that the inclusion of MCFAs such as caproic (C6), caprylic (C8), and capric (C10) in canine nutrition might aid in the prevention of *Salmonella* and *E. coli* infections within the animals' gastrointestinal tracts<sup>30</sup>. Additionally, this could contribute to curbing cross-contamination during the production and storage of kibble.

## Conclusion

The world of pet nutrition has witnessed a surge in interest regarding the use of natural compounds to enhance the overall well-being of our beloved furry companions. The exploration of MCT in pet nutrition presents a promising frontier in enhancing the well-being of our cherished companions. In essence, MCTs represent more than just a supplement ingredient; they represent a key to unlocking the full potential of our pets' health and vitality. As we continue to uncover the potential of MCTs in pet nutrition, we pave the way for a future where our beloved companions can thrive and live their best lives.

## MCTGaia™

PhytoGaia has developed a natural palm medium-chain triglycerides containing predominantly caprylic acid (C8) and capric acid (C10) with the tradename - MCTGaia™. MCTGaia™, a groundbreaking innovation poised to make a significant impact in the realm of pet nutrition. MCTGaia™, with its unique Medium Chain Triglycerides (MCT), is not just another supplement ingredient. It is a game-changer for pet health. These MCT have been proven to provide a myriad of benefits, from boosting brain cognitive function to strengthening the immune system and promoting holistic well-being in pets.

It is naturally extracted from sustainably-sourced palm kernel oil/palm fruits (*Elaeis guineensis*). MCTGaia™ exemplifies a commitment to sustainable production practices and adheres to stringent sustainability standards. MCTGaia™ is available either in oil suspension or in powder form, catering to a diverse range of applications. The unique combination of these medium chain triglycerides in its natural proportion and their synergistic effects are responsible for the many beneficial health effects associated with MCT.

Much like its counterpart PetGaia™, MCTGaia™ leverages the power of nature to enhance the lives of our four-legged friends. By incorporating MCTGaia™ into a pet's dietary regimen, it's not just offering them a supplement; but providing them with a key to unlocking their full potential.

With the scientific evidence and quality attributes backing MCTGaia™, it offers a cutting-edge solution for pet supplement companies, enabling the formulation of pet nutraceuticals and foods that cater to the rapidly expanding market for pet health products. MCTGaia™ stands as a beacon of innovation in the crowded pet nutrition landscape, offering a unique pathway to elevate pet's health and vitality.

### Take Home Messages:

- i) MCTGaia™ predominantly contains caprylic acid (C8) and capric acid (C10), two of the most studied medium chain triglycerides.
- ii) MCTGaia™ has a significant and compelling scientific foundation, particularly in supporting cognitive function, immune health, weight management and promoting holistic wellbeing for pets.
- iii) MCTGaia™ is sustainably-produced and supports the production of sustainable palm oil.

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