

# Introducing DC12: The “5th Macronutrient”



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Revolutionary Science in Enhancing  
Metabolic Health, Vitality, and Holistic  
Wellness

# Table of Contents

<b>Introduction</b>	<b>01</b>
<b>Chapter I: DC12 introduction</b>	<b>02</b>
<b>Chapter II: Growing Metabolic Health Concerns</b>	<b>03</b>
<b>Chapter III: Energy That Supports Metabolic Flexibility</b>	<b>04</b>
<b>Chapter IV: Facts about DC12</b>	<b>05</b>
<b>Chapter V. Spotlight Studies</b>	<b>07</b>
<b>Chapter VI. Next steps for Food Formulators</b>	<b>09</b>

## INTRODUCTION

# Hello, I'm your DC12 advocate, Tim Avila.

Welcome, and thank you for downloading this e-book about DC12 (dodecanedioic acid, DDDA) – a generational scientific breakthrough that is on the precipice of completely redefining energy, metabolism, nutrition, and longevity.

Enclosed you'll find a summary of some of the most compelling facts and findings about DC12 from 40+ scientific papers in top journals by pioneering researcher Prof. Geltrude Mingrone (King's College London), a world-leading star in the field of nutrition and metabolic research and a Lancet Commission leader in metabolism, and diabetes and many of her outstanding colleagues.

Considering the alarming long-term trends in chronic metabolic health conditions such as Type 2 diabetes, obesity and cardiovascular disease that are impacting tens of millions of people, rarely in my 20+ years in the nutrition industry have I seen such a direct intersection of an urgent fundamental need and benefits that DC12 can deliver.



From a scientific perspective, the research to date is incredibly compelling and has set the stage for a wide variety of additional large-scale trials.

On the commercialization front, DC12 is soluble in water and easy to integrate in any solid food or formulation, it is a game-changer for sports drinks, meal replacements, and functional nutrition.

I hope you enjoy this information. If you are a researcher or food formulator, please reach out to discuss future collaborations.

*- Tim Avila*

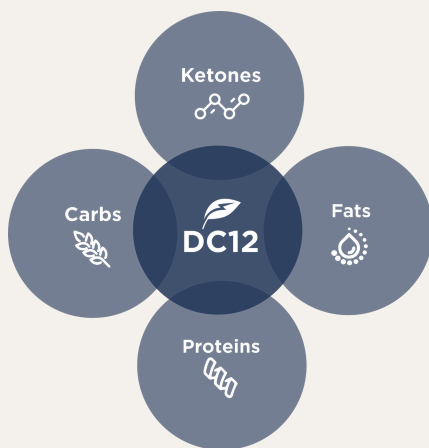
## CHAPTER I

# Introducing DC12: The “5<sup>th</sup> Macronutrient”

**How can we improve both our energy and our metabolic health?**

Macronutrients are nutrients that provide calories or energy and are required in large amounts to maintain body functions and carry out the activities of daily life. Fats, carbohydrates, proteins and now Ketones are considered macronutrients.

DC12 (dodecanedioic acid) belongs to a family of dicarboxylic acids, which are commonly referred to as “DiCarbs”. DC12 is not a protein, fat, carbohydrate or even an exogenous ketone. Rather DC12 is a 5th macronutrient – an entirely unique energy substrate that provides essential metabolic benefits, but without the commonly associated metabolic pitfalls, such as increased insulin production, weight gain and fast crashes.



## CHAPTER 02

# ADDRESSING THE GROWING METABOLIC HEALTH CONCERNS

## The downside of being misinformed

For many years, we have been misinformed and inadequately educated about nutrition and energy.

This has led to an increase in sugar, carbohydrates, unhealthy fats, caffeine, and other harmful additives in our diets. They are fueling a long-term rise in chronic metabolic conditions such as high blood sugar, insulin resistance, type 2 diabetes, obesity, high blood pressure, cardiovascular disease, and more.

## Stats that cause us concern:

88 % In the US are Metabolically Unhealthy

74 % In the US are Overweight or Obese

98 M American adults are living with prediabetes

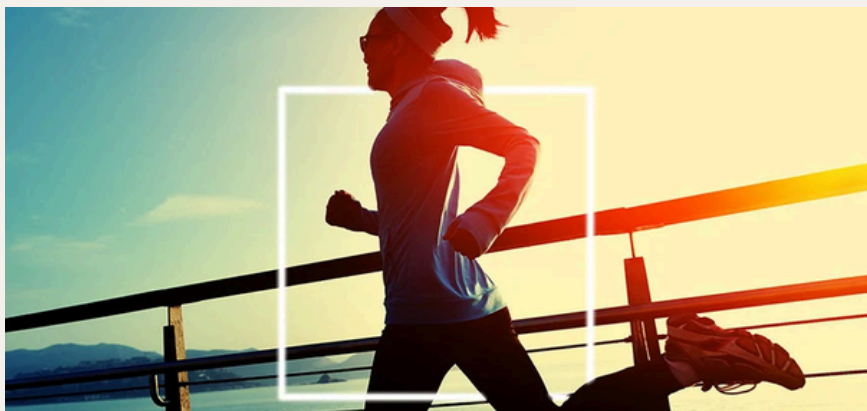
Jemyll's research on dicarboxylic acids started with the objective of helping people with metabolic disorders utilize nutrients other than fatty acids or glucose, since they're unable to process them properly.

Now, our mission is to create superior energy sources with profound metabolic benefits and no associated pitfalls of traditional western diets.



## CHAPTER III

# FACTS ABOUT DC12 & DICARBS

**DC12 Delivers Energy That Supports Metabolic Flexibility**

Key amongst its many benefits, DC12 helps the body switch from burning carbohydrates to burning fat.

This is known as metabolic flexibility, and it makes DC12 extraordinarily unique because only actual ketosis has been known to do that. Ketones like beta-hydroxybutyrate (BHB) or acetoacetate do not burn fatty acids – only dietary ketosis does. And most people cannot maintain dietary ketosis; so, DC12 is an excellent next step in weight management after a weight-bearing exercise regimen and good nutrition.

And unlike glucose, DC12 supports normal insulin sensitivity and blood sugar levels. These characteristics are crucial to maintaining a healthy metabolism and weight.

## CHAPTER III

# FACTS ABOUT DC12 & DICARBS



## 1. A NATURAL SOURCE OF "CLEAN" ENERGY

DiCarbs are known to be a good source of energy with physical-chemical characteristics intermediate between carbohydrates and fatty acids. They are oxidized like fatty acids but, like glucose, their salts are soluble in water. Their end product of oxidation, succinic acid, provides an indispensable substrate for glucose metabolism.



## 2. SUPPORTING INSULIN SENSITIVITY

DiCarbs do not require insulin, nor do they stimulate insulin secretion, while increasing fatty acid oxidation, therefore they are a useful energy substrate for obese and diabetic subjects. In fact, insulin is a hormone which stimulates fat accumulation and therefore promotes obesity.



## 3. DELIVERS NEARLY 2X THE ENERGY OF CARBS

Carbohydrates provide 4 calories per gram while fat provides 9 calories per gram. DC12 provides 7.2 calories per gram without increasing fat mass as do fatty acids.

## CHAPTER III

# FACTS ABOUT DC12 & DICARBS

## 4.BIOAVAILABILITY



DC12 is water soluble and good at being used by both mitochondria and peroxisomes in the liver and kidney. A recent study found that DC12 avoids first pass liver metabolism so it can be quickly consumed as energy, and was utilized by many tissues – with DC12-specific breakdown products in the liver, kidney, muscle, heart and brain.

## 5. FAT BURN, WEIGHT LOSS & T2D CONTROL



DiCarbs not only provide energy to the body but also improve insulin resistance and glucose utilization in diabetic patients. Therefore, DiCarbs support weight loss and improves type 2 diabetes control. Given the high-caloric, low-fat characteristics of DiCarbs, they have been shown to be a strong energy substrate during exercise, reducing muscle fatigue and increasing muscle strength (Salinari et al., 2006; Am J Physiol Endocrinol Metab ;291:E1051–8).DiCarbs

## 6.EXERCISE PERFORMANCE & HYDRATION



DC12 is a source of fuel during exercise and helps preserve muscle glycogen stores. This is crucial to anyone interested in being their best during while exercising for extended periods of time. DC12 provides fuel to muscle immediately, without the limitations that medium and long chain fats have.



## CHAPTER IV

## A RICH HISTORY OF SCIENTIFIC DISCOVERIES BUILT ON DECADES OF RESEARCH

Jemyl's Chief Science Officer, Professor Geltrude Mingrone, has pushed forward the boundaries of metabolic medicine for 20+ years and is widely regarded as among the most recognized researchers in metabolic medicine of our time. Starting in the 1990s, she has led teams of biomathematicians, biologists, and bioengineers to advance research on DiCarbs and DC12 to address metabolic disorders through innovative energy substrates.

Today, there are over 30 peer-reviewed studies, establishing the scientific foundation of our understanding about the impact of DiCarbs and DC12 on energy, metabolism, weight management and more. New studies will continue to expand on this rich legacy to continue to explore DC12's potential to impact human longevity, exercise performance, cognitive health, and chronic diseases.

"THIS IS GROUNDBREAKING SCIENCE THAT  
REPRESENTS A SEISMIC SHIFT IN BOOSTING  
METABOLIC HEALTH, ENERGY AND OVERALL  
WELLNESS"

- DR. GELTRUDE MINGRONE

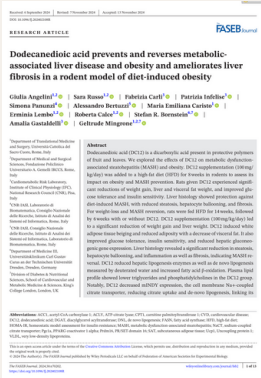


## CLICK TO SEE VIDEOS

Dr. Mingrone is Professor of Diabetes and Metabolic Disease at King's College, Director of the Centre for Obesity related pathologies at the Catholic University of Rome, and the pioneering scientist in the study of dicarboxylic acids

CHAPTER IV CONTINUED

SPOTLIGHT  
STUDY #1



Dicarboxylic Acids Counteract The Metabolic Effects Of A Western Diet By Boosting Energy Expenditure

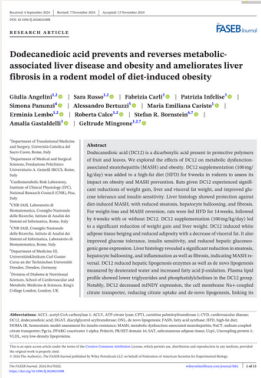
Lidia Castagneto-Gissey, Stefan R. Bornstein, and Geltrude Mingrone  
The Journal of Clinical Investigation. 2024 Jun 6;134(12).

ABSTRACT

Obesity has reached pandemic proportion not only in the West but also in other countries around the world; it is now one of the leading causes of death worldwide. A Western diet is rich in saturated fats and provides more calories than necessary, contributing to the rise of the obesity rate. It also promotes the development of liver steatosis, insulin resistance, hyperglycemia, and hyperlipidemia. In this issue of the JCI, Goetzman and colleagues describe the effects of consuming dicarboxylic acids (DAs) as an alternative source of dietary fat. The 12-carbon dicarboxylic acid (DC12) was administered to mice at 20% of their daily caloric intake for nine weeks in place of triglycerides. Notably, the change in diet increased the metabolic rate, reduced body fat, reduced liver fat, and improved glucose tolerance. These findings highlight DAs as useful energy nutrients for combatting obesity and treating various metabolic disorders.

CHAPTER IV CONTINUED

SPOTLIGHT  
STUDY #2



Dodecanedioic acid prevents and reverses metabolic-associated liver disease and obesity and ameliorates liver fibrosis in a rodent model of diet-induced obesity

Giulia Angelini, Sara Russo, Fabrizia Carli, Patrizia Infelise, Simona Panunzi, Alessandro Bertuzzi, Maria Emiliana Caristo, Erminia Lembo, Roberta Calce, Stefan R. Bornstein, Amalia Gastaldelli, Geltrude Mingrone

The FASEB Journal. 2024 Nov 30;38(22):e70202.

ABSTRACT

Dodecanedioic acid (DC12) is a dicarboxylic acid present in protective polymers of fruit and leaves. We explored the effects of DC12 on metabolic dysfunction-associated steatohepatitis (MASH) and obesity. DC12 supplementation (100 mg/kg/day) was added to a high-fat diet (HFD) for 8 weeks in rodents to assess its impact on obesity and MASH prevention. Rats given DC12 experienced significant reduction of weight gain (32% less than HFD-only rats), reduced liver and visceral fat weight, and improved glucose tolerance and insulin sensitivity. Liver histology showed protection against diet-induced MASH, with reduced steatosis, hepatocyte ballooning and fibrosis. For weight-loss and MASH reversion, rats were fed HFD for 14 weeks, followed by 6 weeks with or without DC12. DC12 supplementation (100 mg/kg/day) led to 46% weight loss and significantly lower liver and visceral fat weight. It also improved glucose tolerance, insulin sensitivity, and reduced hepatic gluconeogenic gene expression. Liver histology revealed a significant reduction in steatosis, hepatocyte ballooning and inflammation as well as fibrosis, indicating MASH reversal. DC12 reduced hepatic lipogenesis enzymes as well as de novo lipogenesis measured by deuterated water -oxidation. Plasma lipid profile showed lower triglycerides and phosphatidylcholines in the DC12 group. Notably, DC12 decreased mINDY expression, the cell membrane Na<sup>+</sup>-coupled citrate transporter, reducing citrate uptake and de-novo lipogenesis, linking its effects to improved lipid metabolism and reduced steatosis.

## CONCLUSION

# COMMERCIAL APPLICATIONS

Jemyll has discovered a novel method of producing nutritional products rich in DiCarbs and low in cholesterol, by means of hydroponic harvesting and animal breeding. These two methods allow us to produce any food or drink that derives from plants cultivated or animals fed with DiCarbs, and tailor them to meet the needs of a broad spectrum of consumers, including those depicted below.

We partner with formulators who have a passion for developing breakthrough new food and beverage solutions.

To inquire about partnership opportunities, please contact us at [www.dc12science.com](http://www.dc12science.com).

