HAPPY GREEN MUSCLE

GROW MUSCLE FASTER THAN YOUR MEAT EATING NEIGHBOR BUT WITHOUT ANIMAL PRODUCTS

SEBASTIAN STEINEMANN, PH.D.

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Dedication

To all pioneers who paved the way for this book

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Foreword

A purely plant-based or vegan diet is becoming increasingly popular. I don't know where exactly you stand, but since you are holding this book in your hands, I suspect at least, curiosity and openness towards plant-based nutrition. People are beginning to see the reasons and evidence for its usefulness.

One reason why this transition progresses slowly is because of conditioning. If you grew up in a modern society like me, the food's central part was mostly of animal origin. Science shows that what you eat from an early age shapes your taste and perception[1],[2], and this is one reason why many people find it difficult to change food items. In addition to intrinsic conditioning, there is also external conditioning. Advertising messages and any source of information spoke and still speak mostly for animal products. We live in an exciting time

because that seems to be changing.

Nevertheless, this conditioning is still following all of us. Milk and cheese be indispensable for the bones. Meat symbolizes enjoyment, prosperity, health, naturalness, and masculinity.

What I've observed: if this conditioning is deeply embedded in the general population, it affects the part of the people interested in muscle building even more. This crowd of people equates animal products with the ability to build muscle. Many see meat as the epitome of masculinity or strength. A purely plant-based diet is considered a necessary evil to get a few vitamins on the side.

It's kind of ironic because people who actively want to build up muscles are usually more concerned with nutrition than the average person. This interest should clarify these dogmas. So far, however, these dogmas have persisted stubbornly. The rigid combination of conditioning, alternative facts, and so-called broscience is evident here. Plant-based nutrition offers opportunities that many people do not realize.

To get you started, here is an example of a *Nature* study from 2020, showing that vegans may have better aerobic endurance than omnivores, and are just as strong[3].

Vegan is on the rise, and the muscle-loving crowd of people has a fondness for meat. That is an excellent reason to accelerate - this is inevitable in the future - the connection between both elements with this book. Besides, there are at least four more reasons for you and me to pay attention to muscle care - and thus, to this book.

Why is muscle building and care important at all?

Muscle building is an exciting field, not only for you but for more and more people. With its firming, vitalizing, and strength-increasing effect, muscle building is not only a purely aesthetic factor, it is increasingly gaining esteem as an essential health component. Four critical points speak for the appreciation of the musculature.

First, our lifestyle is very sedentary and lacks movement. Authors of a study published in

the renowned journal *The Lancet* estimate that 5.3 million deaths worldwide were attributable to lack of exercise in 2008[4]. More and more technical solutions are available to relieve us humans of the grave, physical work: most jobs glue us to the monitor. Technological progress means that what used to happen by itself in everyday life and at work - the use and "training" of our entire body, the cardiovascular system, and the muscles - is steadily decreasing. Due to technical progress, this will jack up in the future. However, excessive sitting and lying down is already strongly evident in many medical conditions today. Too little exercise doubles the risk of cardiovascular diseases, diabetes, and obesity. It makes colon cancer, high blood pressure, lipid metabolism disorders, osteoporosis, and depression more likely. An estimated 60 to 85 % of people worldwide live a sedentary lifestyle[5]. Sedentariness is a significant cause of our diseases of civilization.

The second point is another essential health aspect. Our average energy balance is out of

control. People with a modern dietary pattern consume too much energy in the form of calories. Compared to 1961, Europeans today consume 330 calories more, Americans, over 360 calories more[6]. Higher energy intake, combined with a lack of exercise and a decreasing energy requirement, is a major cause of diseases of civilization, such as cardiovascular diseases and cancer[7]. The muscles are an energy guzzler, counteracting this energetic imbalance.

The third reason is also related to our technical progress. The life expectancy of people is continuously increasing. While Japanese women have a life expectancy of 87 years today, Swedish women held the record of 46 years in 1840[8]. Increased lifetime on earth means that today, but certainly tomorrow, the musculoskeletal system must function for a very long time. Our body, our musculoskeletal system, our muscles are all one. Without muscles, it does not work. But why should this be so important, especially in old age, and why should it become a problem with longer life expectancy? It is quite simply

because of our biology. The human body's ability to form and maintain muscles decreases drastically with increasing age[9]. This loss is due to hormonal changes and begins from the age of thirty, regardless of sex[10].

Muscle loss-associated diseases already play a key role in today's 70-year-olds. In that case, they will play an even more significant role in the future with increasing life expectancy for many 80-year-olds. The care of the musculature from a young age thus takes on a further, important dimension. Because in this way, you can slow down the biological decay of the body[11],[12]. Interestingly, the 2019 published *Guangzhou Nutrition and Health Study* shows that a higher dietary intake of total protein, regardless of the ratio of animal-to-plant protein, is associated with greater skeletal muscle mass in Chinese adults aged 40 to 80[13].

Science also provides the fourth point. Progress in technology and life expectancy is accompanied by increased knowledge of our

physiology. The role of muscles in our general health and well-being is increasingly acknowledged. Muscles are changing from being superficial visual aids, which function purely mechanically, to hormonally active organs, which play a fundamental role in our body[14]. By releasing messenger substances, they regulate inflammatory processes and insulin sensitivity, or can improve cognitive abilities[15]. As a result, the care of muscles is also responsible for the quality of life and health.

The diet of many people is becoming more and more plant-based for various reasons. The global demand for meat-free products grew ten times between 2012 and 2017[16]. The proportion of people who want or even have to build up muscles actively will also increase. The hunt for muscles accompanies the rethinking in the often-conservative world of weight training and bodybuilding. People like you and me, interested in extraordinary muscle building, will find nutritional topics that lead to better health, refined regeneration, and an increase in performance,

despite all eating conditioning.

In summary, vegan muscle building is becoming increasingly important for more and more people. Interested people like you are hobby sportsmen, health-conscious mothers, fathers who want to stay young, young students who like weight training, or older people who must care for their muscle apparatus actively.

Why Happy Green Muscle?

Ideas are much more practical for you to implement and remember, when there is this one fixed point - this method. Wildly swarming instructions, tips, tricks, and articles become a story with a red thread. There is a beginning and an end. The Happy Green Muscle Method (HGMM) identifies a problem, looks for solutions, presents the result to you, and finally culminates in the practical essences vital for your everyday life.

Happy. Happy is the result of the method for your muscles and you. The method provides your body with everything it needs to grow, be healthy, and be in full strength. Not only

nutrition is responsible for happiness. Therefore, the method contains techniques that go beyond food and are essential for muscle building and happiness. You become more independent, and your feeling of having everything you need in your own hands automatically makes you happier.

Green. The plant-based diet is the catalyst for happiness. Green is sustainable, nutritious, healthy, and free from suffering. Green hits the nerve of time, and many people who learn to listen to their hearts.

Muscle. Through this plant-based diet, your muscles and you can thrive optimally. Muscles are a part of your body. But it is not only about muscle fibers and tendons. Your mind is also a part of you. Body and mind are interwoven and influence each other. With the method, both body, and mind are equally supplied.

Happy Green Muscle Method aims at your practicality. It enlightens you and gives you valuable insights on your way. One of them is: this is all you need. You are the forger of your happiness.

Aim of the book

My goal is to strengthen your independence in nutrition, muscle building, and life through a balanced mixture of background information and practical guidance.

It is not only about recipes and plans. It's about a decisive idea.

It's not just about the tools. It's about the holistic context.

It's not just about the everyday struggle. It's about essences that make you successful.

It's not about winning in the short run but winning in the long run.

With Happy Green Muscle, you get a method that is full of tips and tricks. In addition to the method's pillars, the pillars on which the method stands, you get the scientific background as essence, alongside some convenient and applicable instructions, strategies, and even recipe building blocks. Figure 1 depicts the seven pillars of the HGMM.

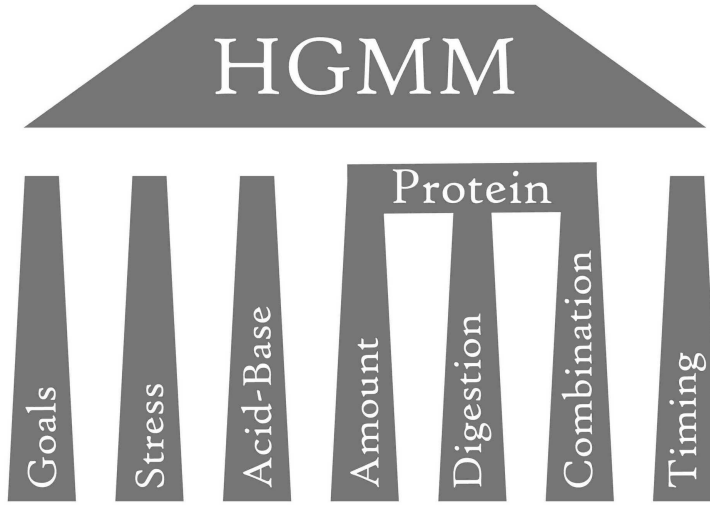

Figure 1 The seven pillars of the happy green muscle method.

However, mediocre plans, food lists, and recipes are a dime a dozen. You don't even have to pay for them. *YouTube*, blogs, and magazines make your life easy. If you want to pay for it, you can easily find an e-book for two dollars and a few crushed ones. It doesn't matter which e-book you take. You can find one in this price category - the depth of the book is usually just as inevitably shallow.

In this book, you shall get new and essential things, which include deep, sustainable and long-term insights that can take your life and

routines to the next level.

I hope you can reach a new state of understanding and consciousness. Only then will you be able to change the way you do things in the long run. With this comes your success. It's important that you know this from the beginning: just as you start things, you continue them. With these thoughts in the foreword, I want to give you a decent start so that you can turn your attention and your curiosity to take the best for yourself.

What is it about exactly? Muscle building, right? Well, let's look a little further into the matter. This book is about the optimal diet to help you get the most out of your vegan muscle growth. That's it? No. That's not it yet. You'll learn exactly why and how the vegan diet can do this. Plant-based equals muscle or health is not always correct. It all depends on how you live your diet, which is generally true for nutrition. Vegan can be unhealthy or super healthy. Paleo can be beneficial or disease-promoting. The same goes for vegetarian and other diets.

The HGMM is about how you can get the

edge with an optimized vegan diet. It can make sure that your already healthy vegan diet also builds up muscles in an optimal way. With HGMM, you will learn how to live an almost unbeatable combination, the scientific fusion of one of the healthiest lifestyles - if lived correctly - and all the essential key points for muscle building.

The principle of the pillars

The key scope just mentioned results in the seven pillars of the method - a handy foundation. To emphasize the grip even more, I do not stop with this combination of plant and musculature. That's where we start because your practical use is absolutely in the foreground. The book creates this direct connection to practice through a rich, applicable part per pillar.

The areas of benefit and action within each pillar allow you to internalize the background and then apply it sustainably. In the first section of each pillar, you will learn all about the pillar’s benefits for your goal. In the second section, you will receive practical

instructions for direct action and implementing the pillar in your everyday life.

On the topics of the importance of vegan nutrition for muscle building or what you need for muscle building and nutrition, we approach the essence of HGMM during the first part of the book. When you encounter the pillars for the first time, you will find some additional preludes and a sequel to give you more hold and grip on the pillars.

In the end, you only need these seven pillars to succeed. That means more success with muscle growth than most people who follow a plant-based or non-plant-based diet. Everything around these pillars, the background knowledge to muscle growth, vegan nutrition, and all tips for the practical conversion is top material to reach your goals at the speed of light.

I am thrilled to introduce you to the Happy Green Muscle Method, simply because I know it works. And because I can picture your face celebrating your success.

Credibility and sources

Before we get started, a word about the origin of all the information in this book. Have you ever wondered where this or that information in magazines, fitness, and health books originates? Few people check every fact for validity and automatically ask for the source. In fact, in our information age, we are often too uncritical and we also like round stories. A protein shake that makes your muscles grow or a powder that doubles your performance fits perfectly into the picture.

But in scientific reality, it is rarely that simple, straightforward, and above all, pictorial. My eyes, stomach, and even heart still hurt when I read something like this. As I just said, not necessarily because of the author of such statements. Instead, because I think of the readers: I can hardly imagine what effect such information has on a willing but inexperienced reader. It merely becomes a subjective reality. And the reader bases his life on this reality. Even if this sounds a bit swollen, nothing else but this happens in many small domains of life. The sum is then already more than a thought or a word.

I don't want to grumble about it as much as I want to explain my motivation for this book to you. These reasons and thoughts make up a large part of the quality of this book. If you like the writing style, if you can or want to get my message, or if you like the cover, I can't do anything about that except to give it my best. But, I can certainly do something for the correctness of the facts - any time, any day.

That is why I used more than 500 references to source all the critical facts in this book. The HGMM is not the gossip press and not just any lifestyle blog that wants to profit from that flood of information. The sources are neutral places of objective analysis, in most cases, scientific peer-reviewed journals. You can see for yourself in the list of references.

I wish you a lot of fun with the book and an exciting reading experience.

Yours,

Sebastian.

HGMM: Intersection Of Vegan Lifestyle And Muscle Building

For many, vegan lifestyle and muscle building is a contradiction. Is that also true for you? Or are you not quite so pessimistic but unsure or insecure about vegan and muscle? If that's so, I don't blame you.

With the predominant information in media, blogs, and magazines, I sometimes wake up confused in the morning. Then, I manically browse through my studies until I have found my faith again. All jokes aside, there is, of course, a lot that can be done wrong in the

vegan diet, especially concerning muscle building and health. But the same applies to any other form of nutrition. Contrary to that, you will learn with this book why primarily vegan food is outstandingly suitable to build up muscles. But, one after the other.

It's all about unleashing your muscle potential. That's the focus. But without health, everything is nothing. Effective muscle building is not possible without attention to a healthy, vegan diet. Not everything you do to build up vegan muscles is a fundamental pillar of health.

On the other hand, not everything that belongs to a healthy, vegan diet leads to immense muscle growth. The goals of health and muscle growth overlap largely, as shown in Figure 2, but they are not entirely congruent. That's why we'll first look at the basis here: a balanced plant-based diet.

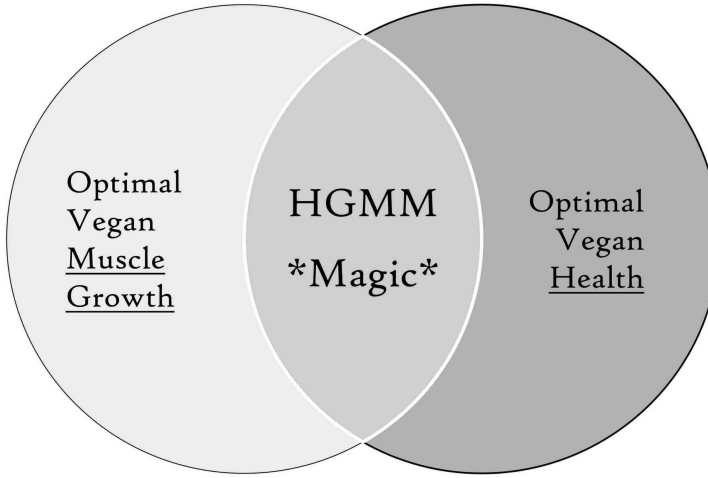

Figure 2 Happy Green Muscle combines healthy vegan nutrition and optimum muscle growth.

By making slight adjustments to a wholesome and healthy vegan diet, you can get the most out of your muscle gain. How do you live? Very health-conscious or as a pudding vegan?

Many people fall into these two categories, to the left and right of the entire spectrum. Both are not necessarily optimal for muscle building and health. But see for yourself:

1. You are a convenience or pudding vegan, whatever you want to call it, you eat what you always liked and what is easy to get. You eat a lot of

ready-made and substitute products and a protein shake at least twice a day. That means you get enough protein and energy, but too much salt and fat and only a few nutrients in total. As a pudding vegan, you have only partially fulfilled the requirements for optimal muscle growth. Due to nutrient deficiency and over-acidification, your regeneration will be poor. With too much energy, you will instead put on fat. Insufficient nutrients, too many calories, and unfavorable fats are, of course, also bad for your health.

2. You are health-conscious and eat mainly wholesome vegan food. You get enough vitamins, minerals, and secondary plant metabolites. However, your protein is not optimized, and your energy intake could sometimes be a bit higher. In the end, you have a plant-based diet that is good for your health but is not optimally designed for muscle building. More of the right protein plus energy and nutrients at the

right time could give you a real boost in muscle growth.

So, what do you need?

On one hand, you need the principles of a healthy, vegan diet as a basis. On the other hand, you need specific optimization and tips for better muscle building on top of this basis. That's why I will give you a small backup for healthy, vegan nutrition at the beginning. I am such a selfless person, and I simply care about your health very much. Well, I must admit, that's true, of course. But, it's not the only reason for this chapter.

My logic is instead: I will explain to you here at the beginning some basics about healthy, vegan nutrition. You can check that off right there. Everything that comes after that in this book is primarily about muscle building. I show you both adjustment screws and how you can best adjust them objectively. Afterwards, it's your turn to adapt your set screws for yourself.

Myths and prejudices

Rumors surround veganism.

Muscle loss and nutrient deficiency are only two prominent examples. Oftentimes, pregnant women and parents are targeted. Vegan be a strange trend of the do-gooders, one hears. Sooner than later, one would be forced by drastic health losses to return to the proper, animal-heavy nutrition.

There are few lifestyle and nutrition magazines or newspapers that have not already brought similar content among us. You can find such assertions frequently. It is hard to imagine conversations with family or colleagues without them.

The truth is that a balanced, vegan diet is far from being as unhealthy as is often claimed. I'm going to show you below. But, that's only half the story. You and I are working multiple tracks here, at least for your profit. The other half, of course, is very sharp information about what a healthy diet means for you. These two points will make you stronger. They will strengthen your conviction and your ability to build vegan muscle.

How do vegans eat in practice?

The amazing thing at the beginning: if you do it like the average vegan next door, you are already well set up. That means, if you eat like this, hard to believe but true, then you have a better setup than the average omnivore.

Surveys that investigate the consumption behavior of vegans indicate that a plant-based lifestyle can be healthy. Vegans consume more fibers, antioxidants, or secondary plant metabolites than the average omnivore[17]. They also supply more vitamins C, E, B1, B5, B7 and even more zinc, potassium, magnesium, or iron[18],[19],[20]. The average vegan also lives healthier by consuming less saturated fat, cholesterol, or sodium[21],[22].

If we look at the current situation, it becomes clear that vegans do not eat unhealthier than omnivores - the opposite is true. My scope, however, is not to lift vegan over everything, no. You should recognize that the care for sufficient nutrient supply is not the exclusive affair of vegans. No matter which form of diet, the correct nutrients in adequate quantity

are always an issue.

Suppose these surveys now say that the average vegan provides itself exceptionally well, does that mean that he is less ill? Our so-called diseases of civilization are shooting through the roof, and there is a lot to investigate. It would be good to know why this is so.

It is now clear that our lifestyle has a lot to do with the so-called diseases of civilization[23]. Lifestyle naturally includes our diet. You can see below how vegan nutrition is related to our most common diseases and whether a decreased risk for diseases accompanies the high intake of many nutrients by the average vegan.

Nutrition and health effects

Many epidemiological studies have looked at the relationship between diet and the occurrence of certain diseases. Through such studies, you can assume that vegans, compared to omnivores, are very likely to have better cards for many predominant diseases of civilization:

Vegans have a reduced risk of coronary heart diseases, cancer, obesity, type 2 diabetes, high blood pressure, stroke, osteoporosis, and metabolic syndrome[24], [25],[26].

Vegans consume more soy products[27]. Soy lowers the prostate cancer risk[28],[29] and increases the survival rate for breast cancer patients[30],[31].

Vegan nutrition not only lowers the risk of diseases, but the change to vegan can even improve existing disease conditions. Vegan nutrition can halt atherosclerosis[32],[33] or reduce unfavorable blood lipids or blood pressure[34].

This information is undoubtedly part of a healthy view of the bigger picture. Vegan life is not automatically beneficial or unhealthy. If you assume the average, then it behaves as follows: vegans are healthier in many ways. They reduce their risk for almost all non-communicable diseases.

Do you want to be the average vegan?

Nevertheless, I have something frightening to tell you: no diet in the world is a self-starter

for health and muscle building - nor is vegan. Because "the vegan" I was referring to before doesn't exist. He is a construct of statistics and data. You and I, on the other hand, exist. What I want to say with that: just because "the average vegan" lives relatively healthy and has good cards doesn't mean that you also have a good hand. Maybe you don't have a deck at all because you don't eat right.

Such studies explore the vegan diet as a general idea and look at how people live it on average. But, you have to implement everything for yourself. I don't want to pull the cheery wave completely from under your board. Stay on top and float with me for a while. With the following practical tips, you will come one step closer to your optimal implementation of a healthy vegan diet; to build, like the average vegan or better, the optimal foundation for vegan muscle growth.

Make the vegan diet healthy for you

Every diet has critical nutrients. Omnivores within the mixed diet must be careful to get certain nutrients. Vegans in a purely plant-

based diet must also be careful to get certain nutrients. For this reason, I recommend you understand this critical point: what nutrients are most likely to be deficient in your diet?

Equalizer processing

The great equalizer is the degree of processing of the food you consume. Whether animal, plant-based, or from the realm of mushrooms, the processing is the superior regulator for your health. How many hands or processing steps the food has seen from its origin to your mouth determines whether your diet is healthy, much more than any other factor[35],[36]. Your key to generally healthy and healthy vegan food is natural and wholesome food. Figure 3 illustrates the relationship between processing and nutrient density.

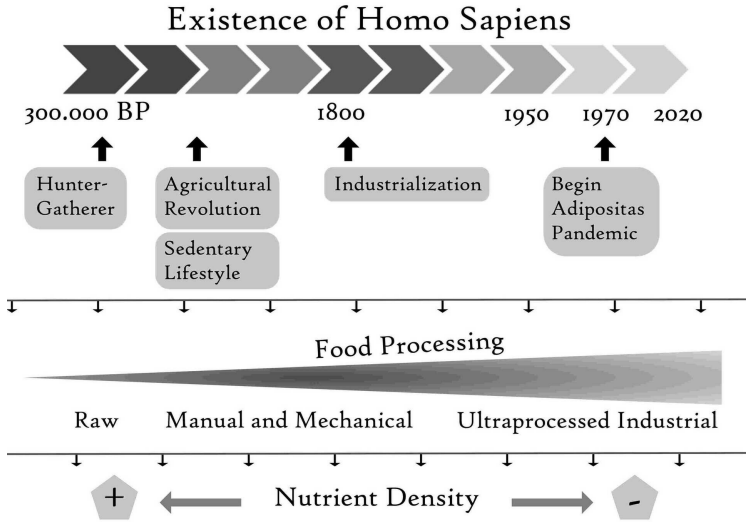

Figure 3 Increase in food processing and accompanied loss of nutrients. Over time, the processing of food intensified while average nutrient density declined. (Modified after Huebbe et al. 2020, doi: 10.3390/foods9081056).

Let me show you what I mean. Since this is about muscle, protein is our currency. Let's say you cover your protein needs once with wholesome, unprocessed food and once through refined and processed food.

In the first unprocessed case, you eat beans, tofu, brown rice, walnuts, wholemeal bread, and linseed within one day. I'm just mentioning the high-protein foods. In the second, processed case, you eat wheat toast bread, spaghetti, Seitan sausages, soy yogurt,

and a protein shake made of soy, hemp, and pea protein.

The first observation: in both cases, you adequately cover your protein requirements. But at second glance, well, you know what I mean? At second glance, in the first, wholesome scenario, the protein comes from complete and unprocessed foods. Beans have a massive amount of minerals. Although tofu is processed, it still contains a lot from the soybean and provides handsome magnesium or calcium amounts; the same applies to brown rice, walnuts, wholemeal bread, and linseed. Each of these foods ends up on your plate and almost no one has tampered with them. The natural nutrient package is intact, and nothing has been cut or sifted out. The consequence is: for one calorie, you get a lot of nutrients.

How does it look in the second case? I think you can guess right now. It's the other way around. You get very little nourishment for one calorie there. Wheat toast bread made from white flour has been refined to remove almost all nutrients and fiber[37], leaving

easily digestible carbohydrates with a very high glycemic index and few of the wheat grain's original components. The same applies to spaghetti. Seitan sausages can be super tasty; otherwise, they don't have much nutritional value, but, they sometimes come with flavor enhancers and preservatives. This pattern continues through the second scenario, which is, of course, no coincidence. So, you cover your protein but not your nutritional needs in the second scenario. In the first scenario, you can assume that your dietary needs are covered.

Don't get lost in the finer details

This insight is no longer new, but people still do not implement it. Any diet that is wholesome and natural has an excellent chance of meeting the nutritional requirements[38]- provided you consume enough calories. In other words, I can advise you to eat foods that are as nutrient-dense and low-energy as possible. We can twist it around any way we want. If you eat mainly natural foods, you will also take in many nutrients in relation to the number of calories.

Wholesome is your most crucial key to a healthy, vegan diet.

It was bound to happen. There's no magic, and there are no tricks, so here's the deal. Real tricks are coming soon in the muscle building section. We're almost done in the health section, because that is the essence.

With this example, I have tried to cover many small interrelations by an encompassing guideline to give you the big picture instead. Nevertheless, I would like to mention four nutrients in detail for you, shown in Figure 4. These four nutrients are available in the mixed diet through quantitatively more food than in the vegan diet. They are considered the critical nutrients that are most likely to be deficient in a purely plant-based diet. Many vegans take up from these four less than the average omnivore.

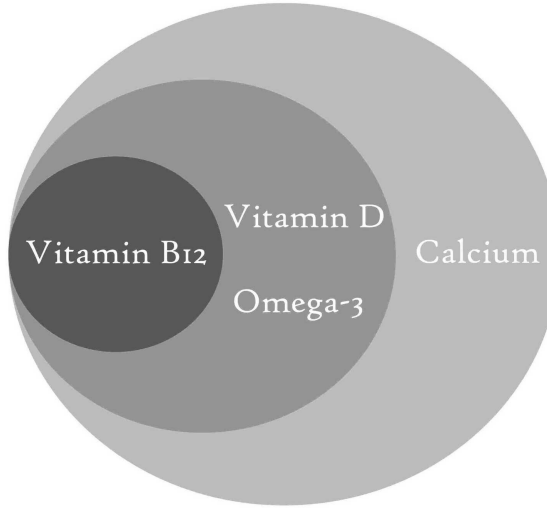

Figure 4 Critical nutrients in plant-based diets.

The most critical nutrient in a purely plant-based diet - vitamin B12

One thing is sure: first and foremost, it is vitamin B12, which you should supplement in a purely plant-based diet[39],[40],[41].

Vitamin B12 belongs to the group of cobalamins produced by microorganisms. Although such microorganisms live in our colon and produce vitamin B12 there, it, unfortunately, is too late from a spatial point of view. The nutrients are absorbed in the intestinal section before the colon[42]. That

spatial partitioning is the case for most animals as well as for humans. After this passage through the colon, no significant absorption of vitamin B12 takes place until excretion.

Ruminants, the stomach system, and own B12.

Ruminants have several stomachs in their stomach system, the rumen. These are home to a large number of microorganisms, which, among other things, make it possible to digest cellulose from the grass. Also, these organisms build vitamin B12 in the rumen of ruminants[43].

Because of these circumstances, we find vitamin B12 almost exclusively in animal foods. Meat and dairy products usually carry larger amounts of vitamin B12[44],[45].

Vitamin B12 occurrence in plant foods

Plant-based sources of B12 that are supposed to be usable are algae like Chlorella. However, whether the quantity and quality of vitamin B12 in plant foods are sufficient is

disputed, and studies so far have mostly answered no[46],[47].

Microorganisms guide fermentation, hence it can enrich foods with vitamin B12. However, resulting quantities are often small or fluctuate too much, depending on the fermentation conditions to ensure a reliable supply[48],[49].

Securing vitamin B12

For vitamin B12, the recommendation is clear. To secure vitamin B12 on a vegan diet and without external supplementation is difficult to impossible. Vegans, therefore, have a high risk of a B12 deficiency. Even though the body's liver storage can last for months or even years, you should not underestimate a B12 deficit. It can lead to severe and irreversible long-term defects. Therefore, every strict vegan should take vitamin B12 in the form of fortified foods or supplements[50].

Conversion or not - omega-3 fatty acids

The three omega-3 fatty acids in question are

alpha-linolenic acid (ALA), eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA). They are indispensable and essential for cardiovascular health, the immune system, or hormone regulation[51].

Omega-3 fatty acids - plant- or animal-based?

You find ALA in plant foods, EPA and DHA are usually only found in animal foods. However, in addition to ALA, plants from the marine algae group like microalgae can also produce DHA[52]. With the starting point microalgae, omega-3 accumulates in the aquatic food chain[53], which is why the high omega-3 content in fish is due to the DHA production of a plant[54].

Plant foods rich in ALA, DHA's precursor, are nuts and seeds such as walnuts, chia, or linseeds. Although the body needs DHA and EPA, it can convert ALA into these two substances[55]. This ability means that you do not necessarily have to consume animal foods such as fish to meet your own omega-3 needs.

Different Omega-3 concentrations in the blood without consequences

But now, back to our question: what about vegan omega-3? How does the supply of vegans compare to the rest? To answer this, we look again into the studies. Some of them find lower levels of DHA and EPA in vegans than in omnivores. EPA and DHA are paramount for cardiovascular health and the development and function of the brain and eyes. Whether this observed lower level in the blood of vegans makes a practical difference is not absolute. For example, vegan children show comparable brain and eye development to omnivorous children. Furthermore, cardiovascular health in vegans is usually substantially better compared to omnivores[56],[57].

Just because there is a little less does not mean it is too little. It always depends on how much you need. Perhaps, vegans who have a healthier lifestyle generally need less omega-3, as it seems to be for calcium, more on that in a moment. Yet, some studies show lower omega-3 levels in vegans.

What you can do to be on the safe side with omega-3 fatty acids

In theory, if you eat enough ALA-containing food, it should be enough. However, this only works because our body can convert ALA into the biologically vital DHA. So, when taking ALA, you should consider how well your body converts it into the required DHA. As of today, the rate of conversion of the ingested ALA to DHA in our body is relatively low. Depending on the source, the conversion rate is a maximum of 5 %[58],[59].

In numbers, that means from 1 g ALA e.g. from walnuts, your body converts a maximum of 50 mg DHA. Due to the low conversion efficiency, your intake of ALA must be many times higher than the recommendations for EPA and DHA.

You can also do something yourself to improve conversion: by reducing your intake of omega-6 fatty acids[60]. Although these are also essential, they compete with ALA for conversion in the body and block an efficient conversion of ALA to DHA[61],[62]. Since the intake of omega-6 in our modern diet is

usually excessive, you can support the supply of omega-3 by reducing omega-6 fatty acid intake[63].

Play it safe

The supply of enough omega-3 fatty acids should not be a problem in a balanced, vegan diet. Twenty grams of linseed contain 4.6 g of ALA[64]. Assuming 5 % conversion rate, the resulting amount of 230 mg DHA covers the recommendations of most nutrition societies[65],[66],[67].

However, it remains uncertain for the moment how well the conversion will work[68], but what is helpful is the knowledge of omega-3 and omega-6 and their relationship to each other. When we humans were still living as hunter-gatherers, the ratio of omega-6 to omega-3 in the diet was about 1:1. Nowadays, with our modern diet, we consume 14-25 times more omega-6 than omega-3[69],[70]. The omega-6 overweight could interfere with our own ALA to DHA conversion. That is why scientists today recommend a maximum omega-6 to omega-3

ratio of 4:1 to keep the conversion functional[71].

A safe way to reduce omega-6 is to look at the sources of fat, and therefore usually the oils you use. Sunflower oil, corn germ oil, or palm oil have high omega-6 content, and you should not use them very often. Linseed oil, hemp oil, walnut oil, olive oil, or rapeseed oil, on the other hand, should be preferred. Linseed and chia seed contain even more omega-3 than omega-6[72].

The conversion of ALA into DHA depends on ingested ALA amounts, intake of omega-6, but also factors as gender, ethnicity, or genetic predisposition[73],[74]. The influence of those factors means that the conversion rate can vary greatly depending on the person. For example, you could take enough ALA but not have a noticeable increase in DHA in the blood[75]. To be on the safe side, some people consider it advisable to supplement DHA via microalgae extract[76]. Recommendations advise supplementation particularly for children, pregnant women, or people with diseases that lead to an increased need for

DHA[77].

Ultimately, this means that vegans get DHA either by amounts of at least four grams of plant-based ALA through natural foods and oils or by eating microalgae extracts enriched with DHA. If you live a purely vegan life, there is no harm in playing it safe with a microalgae preparation. If you want to save yourself money and prefer to eat other plant-based foods such as seeds and nuts, you can play it safe with a blood test of omega-3 fatty acids by a specialist.

The average vegan is at the lower limit of the calcium recommendation

The correct dose of calcium is not easy. The most long-lived people on earth, such as those from Okinawa in Japan, consumed 500 mg of calcium, which is half of what today's recommendations state. Yet, they lived longer than average and were fit. The reasons for this were the very alkaline-forming, potassium-rich, and low-salt diet, which prevented calcium breakdown from the bones, a lot of exercises, and the high

isoflavone content of the diet[78],[79],[80]. Due to their lifestyle, they lived a low-acid life. Calcium, whose main store is our bones, was thus less needed to neutralize the acid.

In contrast to these predominantly or entirely plant-based peoples, today's omnivores consume twice the amount of calcium or more[81],[82],[83],[84]. This high calcium intake is mostly the result of the excessive consumption of animal food. We should view it critically concerning the adverse effects on the environment and animals.

What's more, there is some evidence for the disadvantages of excessive calcium consumption, such as an increased risk of depression, insomnia, anxiety, or hyperexcitability[85]. New meta-studies even show that too much calcium from supplements can be harmful. Not only do calcium supplements do nothing for bone density and susceptibility to hip fractures, but supplementation could also increase the risk of heart attack by 20-40 %[86]. Even and especially with calcium, a lot does not always help a lot.

Calcium intake of vegans

The current calcium recommendation is set in the upper range (1000 mg) to this discussion. Let's look at how the vegan population lives and take these general, relatively high recommendations as a guide. Calcium does seem to be a potentially critical factor. While vegans are generally achieving the recommended daily intake of calcium across studies, some studies find that they are under-consuming calcium.

The EPIC study observed over 65,000 people in the UK. It showed average intakes below this recommendation[87], meaning that vegans do not always manage the recommended dose.

Enough calcium

Even if it is not certain that less calcium in the body is a bad thing or maybe even a good thing within the vegan diet, it is worth keeping an eye on it - particularly if you aim for challenging goals such as the best vegan muscle growth.

To end up in the sweet spot of the calcium

recommendation in vegan diets, I recommend vegetables rich in calcium or calcium-enriched vegetable milk. It is chief that you choose the right foods for it. Spinach and chard have a lot of calcium but much of the so-called oxalic acid[88], which hinders calcium absorption, so it is not very useful. We can absorb calcium from kale up to ten times more efficiently than calcium from spinach[89]. It would help if you chose a different green leaf for calcium.

Just pick some foods that are rich in calcium and incorporate them into your diet. Tofu, for example, has calcium that can be absorbed as well as calcium from milk[90]. And calcium from cabbage family vegetables like pak choy, kale, or broccoli is absorbed twice as efficiently as calcium from milk[91]. Vegetable calcium comes without acidity that the body would have to balance out with its own or food-containing calcium.

Most people have low vitamin D levels

Vitamin D2 from plants is less bioavailable than vitamin D3 from animals[92]. More

animal foods, especially from marine animals, have a high vitamin D content. Nevertheless, vitamin D is not a matter of nutrition.

After all, when it comes to consuming animal foods, the vast majority of people in modern societies are very much at the forefront: the overwhelming majority consumes animal food. But if we look at the vitamin D supply, it becomes clear that most people do not supply adequate amounts of vitamin D.

82 % of men and even 91 % of women in Germany do not reach the recommended daily intake of vitamin D. Most even take in less than 50 % of the vitamin D requirement[93]. Even more important than what we eat is what reaches the body. For the USA, 75 % of the population has insufficient vitamin D blood levels[94],[95]. In Germany, this applies to 60 % of the population[96]. Vitamin D deficiency is a central topic in the entire population, no matter what dietary style.

Vitamin D through radiation

Vitamin D is formed by sunlight[97], and the body can produce it through direct exposure to the skin. However, this requires sufficiently strong radiation. Due to the sun's low altitude in northern latitudes, the body's own vitamin D reserves become scarce, especially at the end of the cold season: firstly, the sun shines too little; secondly, not enough UVB radiation from the sun reaches us to produce vitamin D in the skin effectively[98].

Stable vitamin D levels throughout the year

Vitamin D is cardinal for your health. It interacts with hundreds of genes and is associated with many metabolic processes, such as regulating calcium metabolism or the immune system[99]. Low levels of vitamin D have been linked, for example, to rickets in children and the development and worsening of osteoporosis, cancer, autoimmune diseases, or depressive symptoms[100].

Due to too low vitamin D levels in the population, many nutritional societies advocate taking dietary supplements at least

during the winter months[101],[102]. Besides, you should regularly go out into the fresh air and sun.

Vegan equipment for muscle building

As you can see, after paying attention to a few subtleties, you are well equipped with a wholesome vegan diet to start building muscle right now. If you want to be on the safe side with these nutrients, I recommend a blood test from a specialist. Then you will know how you are and how your lifestyle influences your nutritional level. Blind supplementation can even be harmful like marked for calcium. That's why the safe way is to have a blood test done regularly and readjust your diet.

Muscle building vegan - a unique challenge?

The preceding information is overriding for an optimally, healthy, vegan diet. As I already mentioned, a healthy vegan and a muscle building-optimized vegan diet are not always congruent, but both scenarios share substantial overlap.

A plant-based diet that is not complete and healthy cannot be optimal for muscle building. That sounds quite logical. According to the WHO, health is "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity"[103]. Not to mention the mental and social components that just as understandably shape your health, you see: without complete physical well-being, there is no ideal health.

How is your body supposed to optimally nourish muscles and provide for growth if other parts and dimensions of your body are not well supplied? As you can imagine, this does not work. Because our body, our complete existence, works holistically. Everything is linked and interdependent. So restrictive thoughts lead to heart palpitations. Stress leads to uncoordinated bowel movements. Meditation leads to physical relaxation and mental strength. It is even more apparent regarding muscle building - only a healthy diet leads to extraordinary muscle building.

Is vegan special in terms of health and muscle building?

With the information on critical nutrients, we have put vegan nutrition in perspective regarding health right from the start. You are now up to date on this topic. From now on, we can primarily take care of your optimized muscle growth.

Are there unique problems and challenges in vegan muscle building?

Why should muscles grow worse on a vegan diet? The most commonly cited reason is certainly protein. Is optimal protein a unique challenge in the vegan diet? The answer is yes, and no. It is not a unique challenge because the so dreaded protein deficiency in the vegan diet is nothing more than a misconception. Yes, it is a unique challenge because no diet is optimally aligned to muscle building.

It's easy to get enough protein with a purely plant-based diet. Research shows that most vegans consume sufficient amounts[104]. However, when it comes to efficient muscle

building, protein optimization in the vegan diet looks different from a mixed diet.

What the HGMM is ultimately concerned with is precisely this optimization of vegan nutrition for muscle building. No diet in the world has included such optimization - neither an average mixed diet nor low carb, paleo or vegan diets. But of course, the starting point is different in every type of diet. The goal of the seven pillars of the HGMM is to achieve the best possible muscle growth, specifically within the vegan diet.

What Does It Take To Build Muscle?

In this book, I will show you how to design your plant-based diet for muscle building optimally. Nutrition alone does not make muscles grow. Even training alone does not make for optimal muscle growth. Good regeneration without good training alone does not make for optimal muscle growth either. Everything is connected. The interaction of these three components - nutrition, exercise, and regeneration - is essential for your success. You can start sharpening your holistic mindset right here.

With this book, I'll make it as easy as possible for you. You'll know what's important. With your holistic view, you will understand

beyond nutrition, what the essence of the other areas of training and regeneration are. We are not going to go through a course of studies on muscle fasciae or sleep phases. But you will be able to classify and implement useful things.

How does muscle building work?

This is not a sports dictionary or a physiology book. The main topic is still nutrition. It is primarily about how you can maximize muscle growth within your vegan diet. Nevertheless, you get the most revealing muscle stimulation cornerstones because training, regeneration, and nutrition are your priority for muscle building deluxe. So, why do muscles grow, which stimuli do they need for that, and what is the role of nutrition? These connections are not only essential for ideal muscle growth but also a holistic understanding of the body.

Balance in lifestyle is crucial

It is indispensable that you optimize training, sleep, and nutrition to maximize your muscle gains. Balancing your efforts is essential for

your maximum success. What happens when these three influences that you hold in your hand get out of joint? Nothing good:

1. Suppose you exercise and sleep well, but your *diet* consists of low-quality food. As a result, your nutrients suffer. The nutrients that your muscles and body need are missing[105],[106]. Ultimately, you might be exhausted for longer, and your muscles grow sluggishly, if at all.
2. Suppose you exercise and eat well, but your *sleep* is too short and irregular. As a result, your body does not get enough quality time to recover[107]. A reason for the association of less sleep with less strength might be insufficient regeneration[108]. Without enough sleep, you cannot make optimum use of the valuable preconditions of the right training stimulus and proper nutrients in the bloodstream.
3. Suppose you eat and sleep well, but your *training* is inadequate. As a result, the growth stimulus is missing

because you are not stimulating your muscles sufficiently[109]. You feel energetic and fresh, but your muscles are not growing.

Of course, not everything is as black and white as in these exaggerated examples. Everything is in flux, including the transitions between these three scenarios. But the point here is: you need all three influences to be maximally successful with your muscle building. Here, we look at the training; later, in the central part of the book, the seven pillars, you will get strategies for regeneration and diet.

What difference does gender make?

There are, of course, differences concerning hormone levels[110]. Biologically and evolutionarily, men have a completely different role than women. Women give life and birth; the man is the opposite.

Men also have estrogen, but the level of estrogen is lower in men than in women. There are also significant differences in testosterone, this time the other way around,

the man has higher concentrations than the woman[111]. The critical difference for you is testosterone. It has a powerful anabolic effect[112], and not only for that reason, men have, at least on an absolute level[113], better conditions to build up muscles[114].

Should men and women, therefore, train differently?

The answer is a definite no. Surprised? Let me explain. Suppose a man puts his training together in such a way that he achieves the maximum possible muscle growth, why should it be different for a woman who wants the same thing?

If there is a difference in training, it is because of a different goal. Assume the woman prefers a more pronounced peachy butt and doesn't necessarily want broader shoulders, and the man likes strong shoulders and still wants to fit into his old jeans, the training is different - not because they are two distinct genders, but because the goals are different.

In the end, both men and women should do

the same exercises. If the woman wants to train the buttocks, she can use Romanian deadlifts or hip thrusts; if the man wants to discipline the buttocks, it looks the same. If the man wants to strengthen his shoulders, he does military press - precisely what the woman should do.

If multi-joint or full-body exercises are generally preferable, why is this only for men? The man should do a complete squat, and the woman should only do a quarter squat? Strongly isolated exercises should never be the central part of the workout, at most, the supplement.

What about frequency and volume?

For the same goal, the choice of exercises does not differ between the sexes. Frequency and volume do not vary either. Both parameters depend on many things; gender only plays a minor role. Again, the goal plays a role, the ability to regenerate, the experience in training - but not the gender.

Does a man or woman need longer for regeneration because he or she has a

physically demanding job? Then the training frequency is not quite as high.

Does a woman or man have a lot of training experience because they practiced avid sports for many years? In that case, the intensity is higher due to more volume or frequency because the body is already better adapted than a beginner's body.

How is that with problem zones?

Each sex has different "problem zones" due to the hormonal setup: the fat distribution is modulated by sex steroids[115]. At the same time, cultural factors determine the wish to change that and are the reason we call them problem zones[116]. Specifying that further means that the woman would like to get rid of her thigh's problem zone, the man would like to reduce his belly fat. Therefore, should the woman sit a lot at the adductor machine, and should the man focus on crunches? No and no. Targeted fat loss does not work[117],[118], so the workout does not differ between the sexes.

Women and men have different body fat

levels by nature. That does not mean that you would tackle them differently. A woman wants to look athletic and toned; a man wants to look defined and robust. Ultimately, both want to shift the body fat percentage down a little on their scale, by a few percentage points: the approach is very similar for both genders.

No difference

There are no differences in training that would be based solely on gender. Reasons for a different choice of exercises are rather individual goals. Experience and prerequisites such as genes, physiology, and anatomy also play a role in the workout design.

Sway to the anabolic side

Nutrition alone does not make muscles grow. Even training alone does not make for optimal muscle growth. Proper regeneration without good practice alone doesn't make optimal muscle growth either because everything is connected. The interaction of the three components, nutrition, training, and

regeneration is essential for your success. Now, let's take a look at how training for muscle growth looks like.

How does muscle growth work?

What is the secret to efficiently gain kilo by kilo muscle mass in no time at all? Does such a secret even exist? I would say there is. It's no secret, but oftentimes, one is made of it. It must remain exciting, and the products have to sell well. Essential points of the mystery are healthy and enough food, optimal training, enough sleep, little alcohol, and all this together with a lot of discipline.

Okay, I admit, I know what the question of muscle growth means. You do not want to hear what you hear everywhere; you want something new. You want to look behind the scenes, like with the backstage pass. The question is supposed to be: is there a point to which you can reduce everything? A single thing you should do? If you can and want to look at it that way, we can break down muscle growth to the anabolic milieu thanks to your backstage access.

Anabolic metabolism

Anabolic metabolism has nothing to do with doping. If you look at it closely, it does because anabolic steroids help consumers get into an anabolic metabolism via an artificial route. However, it is far healthier[119] and more sustainable to achieve this anabolic metabolism via natural living conditions.

Anabolic means a state of metabolism that supports growth and development in every way. In an anabolic environment, cells and tissues such as immune cells, skin cells, and muscle cells grow, as depicted in Figure 5. The body and everything that happens is very complicated. There are always hundreds of processes and enzymes involved in such steps. That is why I call it anabolic metabolism. Because many factors, enzymes, and cells pull together to make this happen, like little workers of an ant colony who want to achieve growth together.

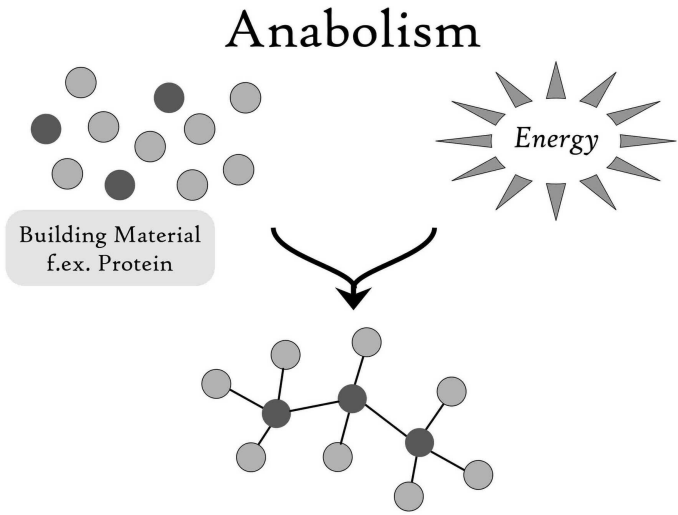

Figure 5 Anabolism uses energy and substrate to build up molecules. That way, the body uses protein and energy to build muscles.

Catabolism is not your enemy

But it cannot always be about growth. The healthy body is in a state of balance - the so-called homeostasis. It cannot ever just grow; that would go very wrong. It also needs the opposite pole: care, a kind of healing, reflection, just like autumn. In summer, everyone runs out and celebrates life. A lot of things are great, but some things fall by the wayside. But then autumn and winter come. They bring more time for reflection; we take

care of ourselves and what we have left behind. It is like a kind of self-healing and regeneration. Just because it's not so warm and connected with shorts and barbecue doesn't necessarily mean it's wrong or doesn't bring anything. It is an essential step in development and life. This autumn of the body is the catabolism; it is the counterweight to anabolism, by definition, the combustion of resources to produce energy[120], as shown in Figure 6.

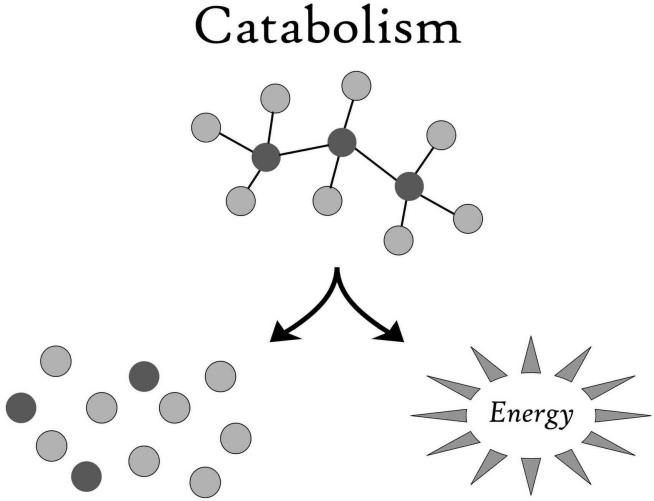

Figure 6 Catabolism degrades molecules to release energy. In the case of muscle catabolism, the body degrades muscle for the release of energy and protein.

Catabolic metabolism means maintenance and is paramount. The body works with inflammation to repair damaged tissue or get rid of invaders. Many immune cells use catabolic pathways to work[121]. Catabolic workers of your organism are necessary for the release of energy reserves. You can store energy in the form of fat or glycogen. Without these catabolic workers, you would not be able to use this stored energy.

With anabolic metabolism, much grows

To align everything towards anabolism can be too much of a good thing. Because anabolism means cell growth and proliferation. However, unwanted cells such as tumor cells or degenerated cells are also made to grow. In particular, a diet heavily based on milk and meat can promote the growth of these cells[122],[123],[124],[125]. By avoiding animal foods, vegan nutrition naturally has fewer problems to keep the balance between anabolic and catabolic in this respect.

As you can see, either state of your

metabolism is important. They are both sides of the same coin, illustrated in Figure 7. You want both states of metabolism to play efficiently with each other, because that precisely is what makes your optimal vegan muscle growth. There are many ways to influence these metabolic states, the most important ones are packed into this book.

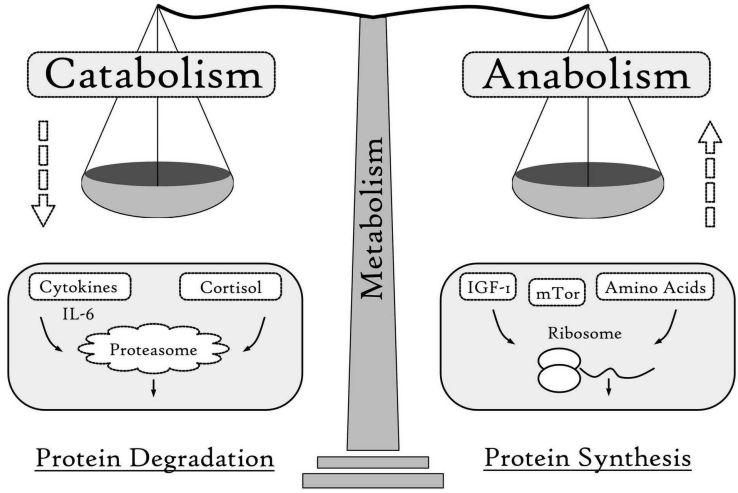

Figure 7 The balance between anabolism and catabolism influences muscle growth. In catabolic metabolism, the messengers cytokine, cortisol and the proteasome work in unison to facilitate muscle protein degradation. In anabolic metabolism, the messengers IGF-1, mTOR, and amino acids work together to increase protein translation with ribosomes and muscle protein synthesis. The balance of the interplay of these two states determines muscle growth or muscle loss.

(Modified after Kraemer et al. 2020, doi: 10.3389/fendo.2020.00033).

But no matter how much I write here, before muscles grow, you need a growth stimulus. More specifically, you need to set an incentive yourself. In the next section, you will see what is essential to establish this stimulus efficiently. With this stimulus, you give the starting signal for your muscle growth.

Set the initial growth stimulus

Suppose you want to express the principle of muscle growth differently. In that case, you can describe it as follows: interruption of the pleasant all-is-good state. To grow, the muscle needs the signal that it can't go on like this. What it has on the box now, you should make it understand, is not enough. Only if you stand up to it decisively, you can make it understand. Otherwise, it will laugh up his sleeve, lean back, and enjoy the evening program.

So how do you make your muscle understand that it must grow beyond itself? Since your muscle is a bit mouthy, you should do it

practically: let actions speak for themselves. Training is the perfect opportunity to do that. And don't be too fussy. Because in the end, a half-hearted effort is useless. Your muscle doesn't take you seriously and certainly doesn't grow.

In general, you know that there are three things your muscle pays attention to. When you put your muscle[126],[127],[128]:

1. Under tension;
2. Cause damage to it;
3. Expose it to metabolic stress.

Okay, this might sound a bit harsh on this personal level. Let's get real here because it's not so much a punishment of the muscle, but rather a miracle of nature.

Through stimulation, mostly through training stimulus, your body adapts to this stress and reacts with adaptation - muscle growth. To find out which way of communicating with the muscle works best and is most likely to make it grow, let's first look at what happens if you put the muscles under tension.

Muscles under tension

Putting muscles under tension is undoubtedly an excellent way to boost your muscle growth. There are two ways to put your muscles under tension: by actively contracting or by passively stretching them. Both active and passive tension are linked to muscle growth[129],[130].

When you actively contract the muscle, you create tension. This contraction, and thus the tension, stay if the muscle is shortened, lengthened, or remains the same length. Let's assume you do bicep curls. Curls are not the best exercise for total muscle growth, but they are perfect for this example.

In bicep curls, the muscle shortens when you move the bar from bottom to top. It lengthens when you move the bar from top to bottom. Therefore, if you stop the movement somewhere along the way, the muscle will stay the same length, but keep the tension.

Stretch also creates tension

Not only the dynamic tension, but also, the passive stretching should affect muscle

growth[131]. Because even when the muscle is passively stretched, it is still under tension. Interestingly, this passive stretching also seems to give it a stimulus to grow[132], although you do not contract the muscle at all.

In the end, active tension and passive tension can add up - the more stress in sum, the more stimulus for muscle growth. The amount of tension makes a difference; more muscle tension leads to more growth. Ultimately, more weight leads to lower velocity and hence more time under tension in any exercise; consequently, more lifted weight also leads to more muscle growth[133].

However, this only applies up to a certain point, the so-called threshold. The most plausible hypothesis from science, the threshold hypothesis, assumes that you have to reach a certain total tension to set a growth stimulus.

Even if you stand in front of a mirror and flex your muscles, this tension only coming from your force, without using an external load, can lead to stimulation of muscle growth[134].

Metabolic stress

The second way to tell your muscles to "move your butt" is metabolic stress. The meaning of muscle tension seems intuitive and is quite apparent. But, what does metabolic stress mean for the muscle?

It is the accumulation of metabolic products in your muscle tissue. This accumulation of products of biochemical reactions is triggered by training. Can this metabolic stress make your muscles grow?

Everybody knows the slow exhaustion that occurs during workout. Let's look at an exercise. Let's say you do three sets with a weight to move twelve times in the first set. However, in the second set, it becomes harder to achieve these twelve repetitions. And if you have chosen your weight well for this purpose, then in the third set, you can just about manage to do the twelve with great difficulty.

Metabolic products accumulate in your muscle

But what happens from set one to three and

each time from repetition one to twelve? It becomes more strenuous for you, and the speed with which you move the weight slows down. So, it may well be that the initial repetitions are more explosive and the last ones more sluggish. Metabolic stress is strongly associated with this pattern.

This slowing down of the speed that reflects your struggle with weight is caused by metabolic stress. The more the barbell slows down, even though you are fighting against it, the more metabolic stress you create. Metabolic stress can be measured after workout by the concentration of the metabolic products lactate and ammonia in the muscle[135].

Your metabolism produces these substances during workout, they are products of energy supply. Your body needs power and converts materials like glycogen, resulting, among other things, in such byproducts and energy.

Now you know what metabolic stress is. But is it crucial for muscle growth? That is difficult to say because the effects that metabolic stress on the one hand and muscle

tension on the other have or could have on muscle growth are difficult to separate. As you have seen, as soon as the exercise gets strenuous, velocity decreases, time under tension and as well the accumulation of metabolic byproducts in the muscle increase.

During workout, both things happen simultaneously. That makes sense. Because when you put tension on the muscle, it is usually also exhausting and leads to metabolic stress. Overall, however, it is assumed that the lion's share of muscle growth is not triggered by metabolic stress, as tested by blood flow restriction experiments, but by muscle tension[136],[137].

Muscle damage

The third way you can address your muscles to persuade them to change is through muscle damage. You know muscle damage as sore muscles. When you have strained and pushed your muscles to their limit, your muscles carry away those tiny cracks. Small injuries, even if they are only microscopic cracks in the tissue, hurt naturally, especially in

combination with metabolic products like lactate, which can also be caused by metabolic stress during workout.

It is often heard that these muscle damages are indispensable for muscle growth. Only when everything hurts would the muscles grow in no time. That notion would mean that more sore muscles lead to more muscle growth, but this is not valid[138]. A critical study found out that the body does increase muscle protein synthesis after muscle damage. However, this increase in protein formation was not related to an increased size of the muscle, but rather to muscle repair[139], [140].

You also hear that eccentric movements (away from the body) are better than concentric actions (towards the body). Today, it seems eccentric and concentric lead to the same amount of muscle growth. Eccentric movements potentially cause more damage to the muscle, for example, in the form of cracks. But we know now that the effect of muscle damage has only a minimal influence on muscle growth, and that eccentric and

concentric can lead to the same amount of growth[141].

No matter which movement we look at, whether concentric, eccentric or isometric (constant distance from the body), most muscle growth can be explained by the amount of tension under which you place it[142].

Launch your growth with training

After all that has been said, I must state the following: it is not yet clear how exactly muscle growth is stimulated and what is especially important for it. The research is complicated because it is difficult to open the muscle of people who train and look inside. Many effects, such as muscle tension and metabolic stress overlap, and cannot be considered in isolation. Even more interesting, therefore, is what we already know with relative certainty.

It seems that muscle under tension is the key. The focus on metabolic stress and muscle damage does not guarantee the best bang for your buck in practice. Both factors can even

cause you to train less often. After all, with severe muscle soreness and exhaustion, many people either don't exercise at all or perform less once they get to the gym. In the former case, the growth stimulus is absent. In the second case, the sum of the muscle tension is reduced, which can ultimately reduce your success if you do not provide a growth stimulus. Eventually, too much muscle damage could even lead to overtraining[143] or muscle loss[144].

The connection between the three influences - tension, stress, and damage - means that conclusions are premature. However, the effects of metabolic stress on muscle growth can be explained by increased tension due to lower velocity when fatigued. Same way, the association of muscle damage and growth can be explained by more significant loading and hence more mechanical tension. Although we do not know everything, you can use this information to optimize. If you design your training in a way that you maximize the time your muscles spend under tension and focus on this point, then the other two influences

will merge automatically. Too many sore muscles is unfortunate. If you want to whisper to your muscles to get going, then concentrate on time under tension and the tension's intensity - and I guarantee you, that sore muscles will follow.

Golden rules of training

Without training, everything is nothing. Nutrition alone does not make muscles grow. The body does not build muscles just because you additionally eat four tablespoons of soy yogurt a day or quinoa combined with potatoes. The body must be forced towards muscle growth. It must feel that it cannot survive without muscles, because you physically demand so much from it. Therefore, here are some essential tips for practical training. I am sure 95 % of all accomplished athletes can confirm these scientifically-backed facts.

Full-body exercises are the foundation

When I first started weight training, the gym's old hands told me, I couldn't start with bicep curls before I could do twelve, clean pull-ups.

It was weird at the time, but I understand now. If I can have the whole cake, why should I be satisfied with the crumbs?

Full-body exercises, also known as multi-joint movements, allow more weight and load during workout. Since several joints are involved, a much higher number of muscle groups are used. That is why you can move more weight. The added growth stimulus is thus increased. With biceps curls, you use 20 kilos, with pull-ups, your body weight. And the biceps are also heavily involved in the pull-up effort.

Ultimately, you will achieve more moved weight per time and more muscle under tension. Three sets of curls with twelve repetitions and 20 kilos each are 720 kilos of moving weight. Three sets of pull-ups with twelve repetitions each and bodyweight of 75 kilos are 2700 kilos. Total and peak loads are much higher during pull-ups.

Also, you train your whole body in this way in a natural movement pattern. You practice your coordination and the synchronous use of your muscle chains. You improve your

muscle activation and body awareness. In which world do you use only your biceps and no other muscles to manage anything? Most of the time, you depend on the synchronous interaction of many different muscle groups. Almost your entire body is involved in the pull-ups: shoulders, arms, the numerous muscles of your back, your core, your lower back, even your legs stabilize. Biceps curls are biceps, that's it. Although you have higher central nervous system fatigue during the workout with full-body exercises[145], the long-term fatigue after a workout will be lower than with single-joint exercises[146].

Another vital point speaking for whole-body exercises is the signal to the metabolism. Picture yourself in your mind's eye after a set of curls and then after a pull-up set. What is the difference? Your breathing will be different, as well as your oxygen demand, blood flow, and the time you need to pause until the next set. If you have done it right, you need at least one or two minutes to be ready for the next pull-up set. In other words, the systemic strain on your body and nervous

system is entirely different[147].

When you think about sending a signal, a growth stimulus, which scenario is more likely to give your body the call that it needs to adapt, that it needs to change something?

In the end, full-body exercises lead to a systemic adaptation reaction, down to the level of hormones. Compared to the leg press, for example, the squat leads to more testosterone and growth hormone excretion after workout[148]. Through full-body training, you generate a whole-body response that you can never achieve through isolation exercises like curls[149],[150],[151].

Isolation exercises have their justification. They can strengthen the muscle-mind connection or adapt certain muscle groups to the overall aesthetic picture. But, they are not the reason for the meat on your bones. You build up most of the muscles most efficiently with full-body exercises.

In best order

At the beginning of the workout, you are fresh and capable. That potency applies to

your mind, muscles and nervous system. You should take advantage of this fact with your exercise sequence. Research shows, exercises performed later in workout, when central nervous system fatigue has increased, are less likely to induce the same muscle recruitment as they would in the beginning[152].

Countless times, I have seen people in the gym who have just arrived and start their workout with triceps extensions, only to go on to half knee bends with another isolation exercise. Quite apart from the fact that this division of muscle groups for training is nonsense, the exercises' order is not optimal here.

It would be best if you always started with the most demanding exercise. This exercise puts the most strain on your strength and coordination. In theory, this means explosive movements before slow exercises and multi-joint exercises before isolated exercises.

For example, if you are doing back exercises today, the order would be deadlifts, pull-ups, Croc rows, dumbbell rows, rope rows and bicep curls. Once you are more advanced,

you can play with these parameters.

For example, some athletes work with pre-fatigue of a specific muscle group. A prominent case is the pre-fatigue of the triceps during breast training. So, the athlete performs isolated triceps exercises and then bench presses. The reason is simply that the chest muscles must work more because the triceps are already pre-fatigued[153]. That way, you can enhance the breast muscle growth[154].

Two further thoughts are injury susceptibility and goals. If you start with the most demanding exercises, you will minimize your vulnerability to injury. The more exhausted you are, the higher the risk of injury[155],[156], like reported for shoulder dislocations and breast muscle ruptures from bench press or squat injuries. Even if you are completely exhausted and can hardly stand on your feet, you can't do much damage with bicep curls; in contrary to poorly executed deadlifting after a strenuous session.

There are cases where the division is not so clear. Deadlifts, pull-ups and Croc rows are

all multi-joint exercises and demanding good coordination. In such a case, you can decide according to goal or preference. In the first exercise, you are always the freshest and can move the most weights. That is why you will make the most progress in this exercise[157]. If your deadlift performance is excellent right now, but you are not fully satisfied with your pull-up performance, start with pull-ups. You will see that your pull-up performance will improve noticeably. Perhaps, you will not be able to continue your old achievement in the deadlifts. But that does not matter, because now you know why.

Again, you can influence the hormonal response of your workout by this parameter. Research has shown that testosterone output in the body is greater after multi-joint exercises. The subsequently available testosterone can help you improve the strength and performance in following, less complex movements, which would not have been enough to induce testosterone secretion on their own[158].

Number of reps for a maximum of muscle

growth

It's not that your body counts and goes for strength in four repetitions and muscle growth in nine. Instead, you choose your weight so that you will manage a certain number of repetitions with flawless execution. That process triggers specific physiological cascades in your body that promote increased strength or muscle growth.

In general, the reps with the highest motor unit recruitment and slowest contraction velocity exert the most potent stimulus for muscle growth. Naturally, those reps will be the final reps of any set.

Your weight should be so demanding that you can only manage five to 12 repetitions since motor unit recruitment and velocity[159], [160] are optimal here. That is most likely the sweet spot for maximum muscle growth. Untrained lifters cannot train with such a high intensity yet and first need to perfect the movement and adapt their nervous system, so the number of reps might be a little higher for beginners.

Progression is necessary to keep challenging your muscles

I talked about homeostasis - the low-cost balance in which your healthy body is located. You train to throw your muscles out of this comfortable balance. You want to continually tell the muscles that they need to do more and get better.

If you always train with the same weight and do not change any other parameters, your muscles get used to the same load quite quickly. In the beginning, they will be forced to adapt and grow accordingly. But after a short time, this stimulus is history. Your muscle fibers increase in size from workout to workout[161], and hence each fiber manages a decreasing share of the applied force, if you leave the weight the same. Your muscles get bored and make themselves comfortable on the sofa again. Regarding the number of repetitions before, the number of stimulating reps will get smaller this way. To counteract this, you should always think progressively.

So, try to improve yourself in every single workout session in some way. This increase

can take place in different areas. Whether weight, frequency, volume, intensity or muscle-mind connection is not relevant. What is important for continuous muscle growth is the increase.

Quite classical is the increase in load and repetitions. You start an exercise with eight repetitions and work your way up to three sets and twelve repetitions within a few training sessions. Then, you increase the weight slightly and start again with less than twelve repetitions. That is progression.

Maximum range of motion

No matter what exercise you do, make sure you use your full range of motion. Pull-ups offer good educational material in every gym in the world. I bet you that the next time someone does pull-ups in your studio, you will see an insufficient ROM (range of motion). The full ROM means the movement starts with hanging under the bar with arms completely stretched out, and it ends with the chin above the bar. That is not complicated, but you will see very few people train like

this, unless you are lucky enough to visit a gym where many professionals and real athletes train. They know what it's all about and will train with full ROM.

Three significant advantages of full ROM are more effort, healthier exercise and more muscle growth. Exercises with the complete range of motion and hence training at long muscle length often, but not always, lead to more muscle growth than training with short muscle lengths under partial ROM[162].

Your body, joints, tendons and ligaments work on the principle: use it or lose it. If you don't use the movement's outer areas, you will become disproportionately weak and fragile in these spheres. The load on your musculoskeletal system is distributed unevenly. You put too much strain on some areas and not at all on others.

What good are 25 half pull-ups if you have difficulty pulling yourself up from the bottom a few times - functionally, it is worthless. And in the long run, you will develop imbalances that encourage injuries. It's easier to do half pull-ups, and you will do more

repetitions. But do you want to have it easy and show off with your half repetitions or build a healthy, resistant, muscular and functional body?

Warm up to get your juices flowing

The warm-up is there to prepare you physically and mentally for your work sets[163]. The work sets are, for example, the three sets with twelve repetitions each at a certain weight.

Even if you hardly see people doing this, the warm-up is an underestimated routine. It protects you from injury of tendons, ligaments[164] and helps you train in a more focused and ultimately more successful way.

Ligaments and tendons are generally less well supplied with blood than muscles. That is why they take longer to reach operating temperature[165]. Even if your muscles can somehow cope with half a warm-up set, your passive musculoskeletal system cannot. You may not notice a difference in the short term because you are young, and the human body is very forgiving. But in the long run, you

will get into trouble like this and encourage injuries and chronic problems.

Also, the focus should not be underestimated. You come into the gym from your everyday life and immediately want to break your all-time deadlift record. Maybe, but with optimal preparation, you increase the probability immensely. After the warm-up, you are heated, you start sweating, your breathing rate is increased, your body is flooded with oxygen, and your mind is brighter and more focused. In this way, your workout becomes a holistic and efficient experience and nothing you are bored with on the side.

You don't need much to prepare your body and nervous system for the upcoming coordination. A few sets without much break in between is usually enough. For example, when deadlifting, you could start with two times 15 repetitions with the empty bar. Then, you go up to the working weight in more substantial steps. Assuming your working weight today is 100 kilos, you could lift ten times 40, eight times 60 and four times 80 kilos until you start with your

working sets. Some even advocate to go up to 110 with the last warm-up set and lift it for stable one or two times. In that way, you can trick your nervous system into believing, that the actual working weight of 100 kilos is a "lightweight baby" (for reference, check Ronny Coleman). Also, warm-up, including some kind of dynamic stretching routine, is an excellent way to prepare your flexibility to the full range of motion in the following exercises[166],[167].

In terms of warm-up, there is another advantage of a proper exercise sequence. If you start your workout with multi-joint exercises like pull-ups, then muscle groups are already warm for later isolation exercises. You certainly do not need to warm up your biceps after pull-ups.

Which systems make sense?

On this topic alone, you could fill entire libraries. In the end, I realized that this is like many things in life: there is the right time for most things. When the time is right, system x or thought y will bring you something.

If you are not at this point yourself, then system x personally brings you nothing. But system x is the life of the person next to you. This thought is vital so that you achieve a particularly relaxed approach to system decisions.

The prime example is the split plan. Vast crowds of bodybuilding novices have shot their motivation with an ingenious four-way split. Nobody knows where they are living their meagre existence today. Classical split plans like back, chest, arms, and legs make only limited sense for beginners. They are not ready yet - even though many more experienced athletes swear by them and want to convince every newcomer.

But the problem is that the beginner simply cannot apply enough intensity to make the split plan worthwhile. The split is based on the principle of working out one muscle group intensively once a week to have a long recovery time. If the intensity on the workout day is right, then it can work. If the intensity on the workout day is not right, then nothing happens, because the muscle would need a

stimulus again after only two days to be progressively challenged, but the split makes it wait a full seven days. So, it is almost back to the starting point for the next workout. The consequence is minimal to no progress.

For beginners, therefore, whole-body plans are more suitable. Focus on the foundation, on multi-joint exercises and coordination. For example, a program like push and pull can be done four times a week. In this way, each muscle group is fully exercised at least twice a week. Besides, that way, the beginner learns movement and coordination faster. This orchestration of muscles and nerves, in turn, leads to earlier weight gain and a more resilient body.

Another thought to the system is the variety. Someone who trains the whole life with the same system will surely make less progress than someone who changes the system now and then, and avoids monotony[168],[169].

I have tried to give you essences of knowledge and experience with these golden rules rather than a ready-made blueprint, just like generally for the whole HGMM. The

advantage for you is that you can always adapt to your individual needs. You can get information about recipes or training systems everywhere. They are perishable and easy to obtain. I am sure this workout guide could save you some of this trouble and help you to arrange your training for your optimal vegan muscle buildup.

Before we start with the seven pillars of the HGMM, let’s have a look at the energy requirements while you try to build muscle. To be more precise, how much excess calories should you consume to let your muscle grow like mold in the rainy season?

Calorie requirements for efficient muscle growth

Even if many people handle it differently, efficient muscle building has nothing to do with overeating or "bulking"; just as losing weight has nothing to do with hunger.

The same principles apply for either muscle growth or fat loss: the further away from the requirement, the greater the risk of undesirable consequences. If you have too

many calories, you will measurably gain more fat in relation to muscle[170].

Therefore, the standard recommendation for excess calories is between 10 % and 20 % of your total calorie intake[171],[172], as depicted in Figure 8. If you have an absolute requirement of 3000 calories (basal metabolic rate plus performance metabolic rate from exercise and activities), your optimal excess would be 300 to 600 calories.

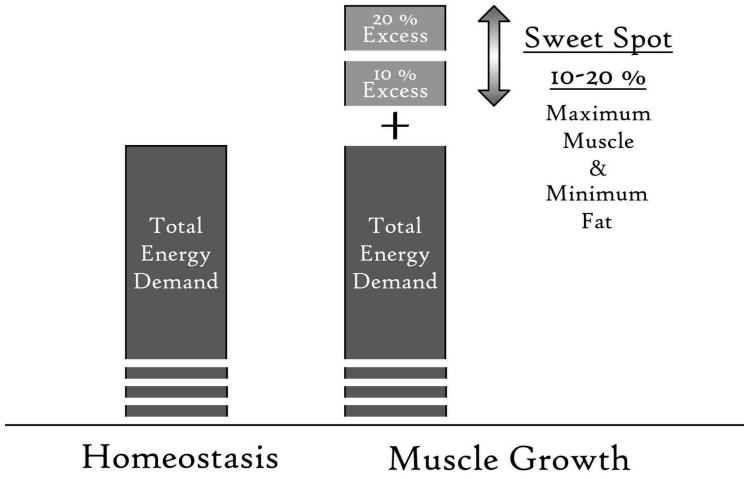

Figure 8 Caloric requirements for efficient muscle growth. A maximum of 20 % calorie surplus guarantees reduced fat gains and maximum lean mass gains. More calories would not increase muscle building potential but fat gains. Fewer calories would further minimize fat gains but hamper

efficient muscle growth.

Mechanisms involved in increasing body weight and musculature

I assume that the ratio of muscle to fat also plays a decisive role in your weight gain. You want to minimize the increase of fat and maximize that of muscle tissue. There is no art to putting on belly fat. Genetic predisposition is involved in this equation to some extent. Still, you can do something to shift this ratio in favor of muscle.

Hence, your goals are:

- minimizing the increase of fat despite excess calories;
- maximizing muscle gain.

Sport is essential

Even though you probably already know this, I would like to emphasize it again. You won't reach your goal without exercise but with excess calories. You will gain fat almost exclusively. To grow muscles, you must set a stimulus. Without an incentive, even a diet alone cannot do anything.

Now, let's advance to the core of the HGMM - the seven pillars.

The center of the pillars is protein optimization. The pillars of protein are framed by a pillar about target finding and tracking so that you can move single-mindedly towards your real target. Also, the pillar for stress reduction to improve your regeneration is part of it. For you to use the potential of the time dimension, finally, the pillar for nutrient timing completes the seven pillars of the HGMM.

Pillar One: Find And Pursue Your Goals

The right mindset is half the battle for everything in life especially when there's resistance coming your way. And in muscle growth, a healthy attitude is crucial for motivation, training, and nutrition.

Set goals. What sounds so logical and meaningful is something very few people do in everyday life. Many do not believe in the power and strength of goals. They lose themselves in dreams and wishes.

Perhaps, this is because many goals seem unrealistic, and therefore they believe that they can never achieve them. Or maybe there is a lack of knowledge about how to set goals effectively? Ultimately, it may be due to a

lack of self-confidence because to actively develop and tackle goals, you must know yourself and, above all, trust yourself[173].

What do you want in the gym and in life?

Many forget what they can achieve over a long time. Logically, you can't build a magazine cover body in a few days or weeks. It looks different if you use months for days and years for weeks. Then suddenly, much more becomes possible - virtually everything. In five years, you can create an entirely new existence; that is if you believe in the power of continuous change. If you want to have a house, you start with the first stone, or by getting a job so that you can afford the stone, or by getting an education so you can get a job.

The cutting point is, it always makes sense to look ahead. Look within yourself, feel your heart and vision of the future, and then think about your immediate goals. By doing this and focusing on your heart, you make sure that all your efforts are pointing in the same direction and that your goal will make you

happy.

Slackline for the self-supporter

In my vision of the future, I am out in nature. I grow large parts of our food supply, such as vegetables and fruit, myself. To do so, I wade in the mud, lift quite a lot here and there, and am usually on my feet from morning to night. I want to be as close as possible to nature, this also requires a good deal of physical work. But now, just as I am writing these words, I am not the youngest anymore. As you may also know, over the years, you usually don't get fitter by yourself (if you do, let me know, we'll write a book together!). So, what does that mean?

The goal on the horizon includes my future lifestyle, vision, and pictures I create for myself. After that, I see how I adapt my current actions to make this vision a reality someday. Based on my example, I have decided to take care of my body. Because with my vision, my body is my capital. Therefore, I engage in various sports and try to keep my body fit and, above all, healthy. I

spread my vision very thin across all days, from now until then, so that I can nibble on it a little bit every day.

Of course, things can always turn out differently than you think, wish, or envision. But that is not the point. Change is the essence of our life; it is the course of things: everything is constantly changing. Suppose something changes, then the vision changes with it. The decisive part is the vision, having a fixed point, and a goal in the distance.

Do you know slacklines? Or have you ever balanced on a rope, cable, or ledge somewhere? What happens if you try to balance but only look at your own feet? Right, the balance is terrible. You wobble, sway, and find it hard to stay on top at all. But as soon as you look further into the distance, your stand becomes miraculously more stable. The body aligns itself; the balance improves, and everything seems lighter - that's the same with goals.

Specific and measurable objectives are the key

There are many examples that goals or objectives work[174]. The reason is, goals steer attention in a consciously chosen direction. By doing so, you increase your effort, and ultimately, you are persistent, persevering and increasing the likelihood of success, as simplified in Figure 9.

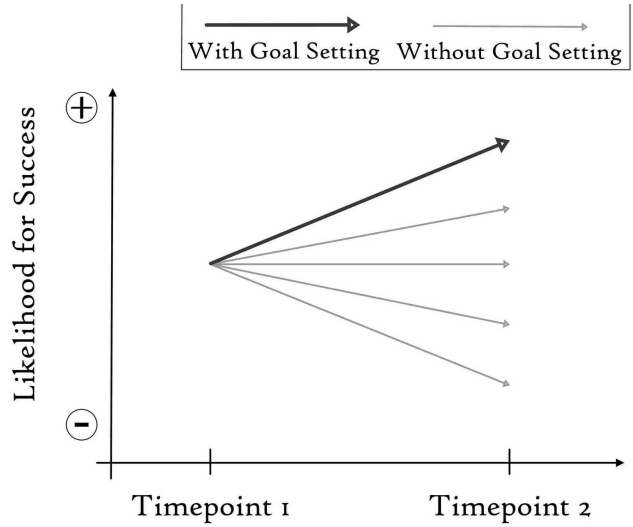

Figure 9 Goal setting techniques increase the likelihood of success.

Once you have set a goal, it also fires up your desire to develop a solid strategy. Your goals are more likely to see the light of day if you consider the following points[175],[176]:

- Specific is better than non-specific;

- Writing it down is more effective than just thinking about it;
- Challenging is better than easy;
- Measurability and feedback on progress are important;
- Small rewards motivate under challenging times;
- A time-frame for achievement increases the focus.

Perhaps, you have already been playing with one or the other of your goals or wishes while reading. You can apply this way of thinking and attitude to the gym and all aspects of your life.

Of course, we want to apply this objective here to your maximum vegan muscle building. Now let me give you tips on how to integrate your goals for vegan muscle building into your everyday life.

Goals are individual and always right

The radiant influence that this goal has on your path is called the lighthouse effect. Let's build the lighthouse to muscle. What is your

personal goal here? Do you want to be the strongest in the gym? Or the one with the firmest butt? All dreams are right and meaningful, as long as you stand fully behind them, as long as your heart says, that's what I want!

For best effectiveness, you should go through the following considerations for yourself at least once now and then.

What is the goal?

As inspiration, you will get a brief list here from which areas your goal can come. You may already know it. Possibly, when reading one of the impulses, a spark is transferred to you, and the thought pleasantly tickles you. Or perhaps you don't have any idea yet, but you can use the list to get a little closer and take the first steps towards your goal.

<u>These are the areas:</u>

- *Power*: moving a certain weight during a particular exercise;
- One, ten, a hundred pull-ups;
- *Endurance*: completing an exercise, a

distance, or a set of practices in a given time;

- *Circumferences*: minimize the circumference of your waist or maximize the circumference of your biceps;
- *Bodyweight*: does not say much, and I do not recommend it. At most as a supplement to other goals in this list;
- *Mirror image*: the mirror image integrates much of the information here. That's why it is usually "most honest;
- *Feel good*: your journey begins with the desire to feel good about your body. Well-being is a good goal, but you have to substantiate for success;
- *Nutrition*: do the HGMM over the next four weeks and see what happens.

Measurability - celebrate or adapt

An essential point for achieving your goals is measurability[177]. Feeling good as a goal is much more abstract than the concrete, measurable extent of the biceps. How else do you know that you have already arrived? Or if you are miles away from it and are sailing

somewhere else? There are dangers involved.

Suppose your goal is to feel good, and you feel like you do a lot in terms of sports and nutrition, but still, you do not feel well - that situation can be depressing because you do things about it but see no effect. The problem is not that it didn't work. The situation becomes so unsatisfactory because you did not break down your desire for well-being into smaller chunks. These chunks must be measurable, then you can see the progress yourself. Think of chunks like fitting into your old trousers, changing your reflection for yourself positively, or smiling spontaneously at someone more often. By determining the measurability, you can celebrate or adapt.

The advantage of measurability is: frustration can turn into strong motivation. Suppose you want to let your strength grow. Strength is easy to measure, at least in a gym environment, because weights are labeled with numbers and therefore measurable. So, if you measure (see) that you have increased your strength, it means celebration and

motivation. But if you measure (see) that your power has remained the same or decreased, then you know where you stand. Because you have a fixed reference, the weight, you can start from this point again, and you are motivated to adjust what is necessary for your goal. Measurability is not only relevant for celebrating your success and motivation but especially for adapting, so that you arrive at some point.

Let's say that you can see that your strength has decreased by the inscription on the weights. At least on this one day, the measurability allows you to reflect, look around, and see why your strength was less. Then you realize that it was probably because of your night out drinking. No problem, next time will be better. Or you may find that it's not so convenient for you to eat almost nothing all day and only eat the majority of your food after workout.

What if the weights were not labeled and your weight was not measurable? Then you would have simply lifted something that day, not wondering and not noticing that a

different eating rhythm suits you better.

Measurable goals can trigger a wide variety of mechanisms in you. Most of them are useful and desirable for your maximum muscle growth.

How do you measure correctly?

Your measurements are best repeatable and objective. Suppose you are not mathematically impaired by lack of oxygen in your brain after an all-out deadlift set: the weight is the same every time. In that case, the sum of the numbers is also repeatable and objective. The same applies to all number games.

The important thing here is to be honest with yourself. Otherwise, you'll end up sabotaging yourself. Because if you assess your shape or weight too positively, then you are happy for the moment. But next time, it will be challenging to reach this point again or even exceed it, leading to frustration and dwindling motivation. If you try to be honest and objective with yourself, you will have more in the long run.

At first glance, some targets are not easily measurable. Such as well-being. However, in most cases, you can think about which intermediate goals are measurable or which sub-goals exist, becoming the big goal. What do you need to get there? Every time you make progress on the way to this intermediate goal, you automatically take a step towards your big goal on the horizon.

The mirror image is tricky to put into numbers. It can also look quite different depending on the time of day, water balance, sleep deficit, or mood swings. Reasonable adjustments that you can make to get repeatable and objective measurements are as follows.

Take the image from the mirror every time:

- at the same daytime;
- in the same light;
- in the same mirror and;
- with the same clothes (or without).

If you then look at a week or two of pictures, you will know pretty quickly what you like and what you don't like. Another advantage is

that you can ignore short-term fluctuations because you know where they evolve. This way, you can measure the image in the mirror.

Documentation is important

The measurability also includes documentation. Because why should you measure something if you forget it afterward? What is a measurement without the chance to compare and look back, to reflect and analyze? Documentation is important. You can get a motivation note or your motivation book. Or you can get a medium-sized whiteboard, put it on the wall of your room, and write your goal and data in big letters on it. Documentation is paramount to stay on the ball and to have something of measurability. The same applies to a workout diary. It should be clear that it is an essential pillar for your sustainable success. As a result, use some form of written tracking, either analog or digital.

It starts with your thoughts, but pictures and emotions take you to your destination

Another significant point that you might already have felt here is the effect these pictures can have on you. What do you think happens when you see your whiteboard on the wall every morning right after getting up? Or when you open the fridge and find your goal on it because you have immortalized it with a pen? Right, whether you like it or not at that moment, the target finds its way into your consciousness. And precisely this point is essential and a cog on which many world-class athletes and performers like to turn[178], [179].

Think about the goal. Write your goal strikingly on the whiteboard or a piece of paper in the mirror. Paint your dream wonderfully. All these processes have one thing in common: the project becomes a bit more of a reality - your reality; and therefore, much more likely to be achieved.

The reason it works that way is: our attention. Something to which we direct our attention automatically becomes stronger. It is like when attention distributes and passes on life force. When you give your attention to

thoughts or emotions, you boost their energy and strength. With our focus, we can bring things to life: first, in us and then around us. Or, as we should perhaps do even more often in our information society, we can make them disappear back to where they came by withdrawing attention.

Attention distributes life force

An example of how well this works is negative emotions or beliefs. Many people are very good at this. Because often we focus too much on negative things. On fears, worries, or oppressive thoughts. If you do this regularly, then you program yourself and fill your life with precisely these things. With those things that you bring to life through your attention, you give more and more power through your focus.

The more often you do this, the better you become at it. Because just like everything you do regularly, there is a practice effect. You become better at amplifying the bad. Very often, this happens not even consciously, but undetected by yourself and therefore

unconsciously. It is a self-reinforcing mechanism for joyous but also negative thoughts and emotions.

Perhaps you know people who, to their sorrow, often clumsily play out these connections. Or maybe you know this from yourself, and you discover yourself in the upper section. The most important thing is how this comes about and what you can do to improve something. Because what chance is there of seeing through this self-reinforcing mechanism? You could even use it for something positive!

Fortunately, you have it entirely in your own hands. You can bring unconscious programming to light and use it in a targeted manner - in such a way that you can finally leave your fears and uncertainties behind. You not only let your self-limiting thoughts and actions shrink and deprive them of their nourishment, at the same time, you give more nourishment to your goal and motivation in the form of attention.

One means that helps you to put this into practice are the affirmations. It is no hocus-

pocus, but a way of practical goal setting. It puts the last paragraphs written here into a practical method that makes this self-reinforcing mechanism easy to use.

Affirmations make it your reality

Affirmations help to rewrite old and obstructive belief patterns and transform them into new, potentially positive ones. There are two prerequisites for it to work. One of them you are fulfilling while reading this: it is the active awareness of these connections. You read this text, reflect, look at yourself, and make yourself aware. Becoming aware is always the first and most crucial step. Congratulations on taking this step for yourself and mastering it.

The second prerequisite for you to benefit massively from the affirmations is to repeat the new affirmations you have chosen actively. This repetition makes it possible for you to make your desires, characteristics, or emotions become a reality. Repeating these affirmations may sound like hocus-pocus again, but it is just the way it is.

Imagine you are a ship on the open sea. There are lighthouses along the coast. These are your wishes, fears, good and bad emotions. What happens if you, like a ship on the open sea, observe a specific lighthouse more often than others? You will inevitably move towards the tower, as illustrated in Figure 10. Even if the lighthouse is very far away, you will still sail in that direction. With affirmations, you will turn off the light of the lighthouses you do not want to have in your life. But you don't turn them off actively, like the light switch. Instead, you give the desired lighthouses so much light that they outshine the other, unwanted towers with their bright, white, and directional appearance.

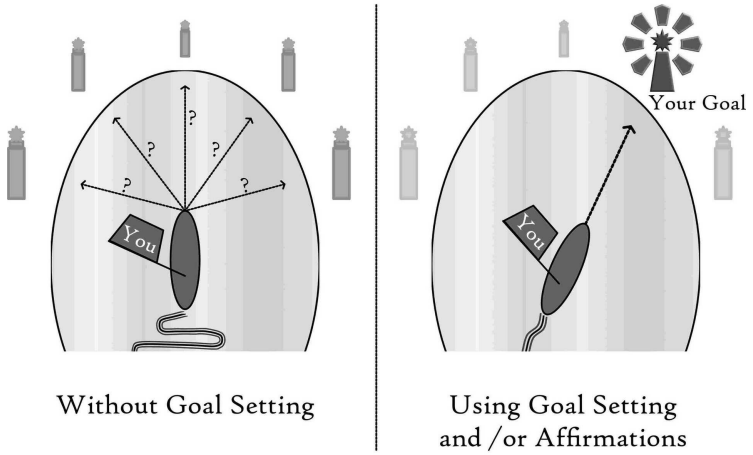

Figure 10 The lighthouse effect. Goal setting strengthens the focus on desired outcomes, while distractive thoughts and emotions naturally fall behind.

Through enough repetition of the affirmation, the lighthouse's essence will gradually seep into your subconscious[180],[181]. At first, you would not have thought it possible to even think of such a foolhardy wish. Then, you would think it bold to pursue such a lofty goal; but you see how the goal has already become part of your everyday life. You realize that the dream has become your reality. You have brought your goal into your existence.

The following affirmations have already taken me a step forward and helped me to form my own desired reality:

- Life is short. People from my environment are continually falling ill and dying. That's why I want to live free and grateful;

or

- I give everything to keep my body functional and healthy so that I can live a free and healthy life in nature;

or

- Always remember, no matter what mood or view you cultivate in your mind, they become your reality.

Shortcut to get your affirmations

It is straightforward to create your own beliefs or affirmations. You can orient yourself by these four steps:

1. What are you striving for? What does your heart say? What does your intuition say?
2. Your affirmation, at best, precisely expresses what your ideal goal looks

like. The statement of faith can be as short as three words. It can also be a sentence or a whole paragraph. It is, of course, logical that more straightforward affirmations are catchier. They are easier to memorize and, therefore, more practical. I have had the best experience with sharp, precise statements that express the core.

3. Be aware that it takes something to go this way, namely your own energy and your drive. With your power, you can create your reality.
4. According to points one and three, what skills do you need to make your affirmation come true? What regular activities or tasks do you want to master to become a reflection of your affirmation?

Affirmations for muscle growth

You can use this method everywhere. Of course, this also applies to muscle building. You can build your affirmation as a counter

draft to something that influences you negatively. You can even start with your personal goal.

Let's run through both options once for muscle building. Let's start with the first option. Is there something that sometimes holds you back in training? Or a doubt that often leads you to negative thoughts?

Are you sometimes demotivated in training, feel weak, and would rather be on the sofa? Then build your affirmation: I am in training because I want to reach 40 cm biceps circumference (or X) and give absolutely everything when I am here.

Do you sometimes doubt whether your diet is right for your goal? Do you have the feeling that your plant-based diet is holding you back or making you feel uncomfortable?

Then, build up your affirmation: "I know that an excellent plant-based diet is the best thing I can do for myself and therefore also for muscle building. Or, better still:

"With the HGGM, I can drive my muscle building into absolute top spheres".

Even if you come from your goal, it is simple and effective.

Let's say your goal is to put 30 kg more on your bench press within a year. Then you can ask yourself, what does it take? Since you probably can't win with the affirmation "today I press 30 kg more on the bench", but most likely only hurt yourself, it's good to divide some big goals into smaller ones. What does it take for these 30 kilos? You have to train regularly, you have to eat well, and you should increase steadily, i.e., train progressively. Well, then say it like that! Your affirmations could be: "I train three times a week, and I am confident that I will reach my goal", or "If I do my best in every workout and progress in some way, I will reach my goal easily", or "The great plant-based food I eat contributes excellently to my extraordinary muscle growth". With these affirmations, you will have success.

Tips for affirmations and goals

Besides, a few other things are handy to give more emphasis to your affirmations.

- It is useful to fill goals and affirmations with as much life as possible. That is, pack in everything you can. Get all the emotions from the bottom of your heart as you speak the words or let them go through your mind. Try to keep the emerging emotions inside you as long as possible to make your affirmation stronger.
- Use all your senses in your imagination[182]. Imagine what it feels like to reach your goal. What do you see, hear, feel, smell, and taste at that moment of victory? How does your body feel? Imagine it in the first-person view as if it already happened!
- You can use the parable "motion = emotion" for yourself. Do something active while you go through your affirmations. Go for a walk or jog, do yoga, a breathing exercise, or just look deep into your eyes in the mirror and see for yourself.
- In the morning, I am especially receptive to such routines and many people I know, too. At the early hour, preferably right after getting up, your head is usually still bright. You are closer to your subconscious than

during the day when your brain is flooded with to-dos, impressions, and communication with others. That's why it has a resounding effect if you apply your affirmations in the morning. Moreover, the confidence, positivity, and motivation you gain from this will radiate right into the new day.

- You can read the affirmation to yourself out loud. Once you mastered it, you speak it freely. You can also simply walk through it in your thoughts. However, I have made the experience that speaking aloud gives it a little more emphasis. It is like a sign to yourself. Why should you hide this important sentence quietly inside you? Provoke it out and let the whole world know (metaphorically, if you wish) who you are and what you want.
- Enhance the skill through repetition. The more you think about your goal and play your images, the better you get. It is similar to the training effect you get from physical practice.

There are periods where you realize it's time

for something new. For example, when the affirmation seems to work, and you have the feeling that it is no longer necessary to use it because you have already internalized it so much. Or because your priorities have changed. Then maybe there are other more mattering things.

Last but not least, you should note that the regularity of execution determines success. The more often you use the affirmations, the more they seep into your subconscious and become your reality. Just build them into your daily routine, like brushing your teeth or going to the toilet.

If you give this practice a chance, you will see what power is within. It shows you what you are capable of, makes you feel that you are in control of your life (which is so), and gives you confidence. This practice gives you a lot of strength to live the life you strive for from the bottom of your heart.

Look at every top athlete from any discipline. I know it from Michael Phelps (Swimmer), Emily Cook (Freestyle Skier), or Lindsey Vonn (Alpine Skier)[183]. I'm sure they all use

some affirmation for mental fitness.

Pillar Two: Minimize Stress

Our body functions on a systemic and holistic level: mind and body are connected[184]. You can get stomach ache (physically) from a thought (mentally); or get depressed (mentally) because you are sick (physically). Everything is connected. That is why it is so paramount for you to minimize stress. It is not only meant for muscle building but your whole life.

Stress directly influences catabolic and anabolic states in your body

Stress can affect the balance between catabolic and anabolic processes in your body. Of course, we have to take a closer look at this. But, before we do, let's have a summary of what catabolic and anabolic means in your body[185].

- Catabolic and anabolic processes always co-occur in your body.
- There is not just one or the other; it is not black or white.
- Anabolism is not the only reason for your muscles to grow. Catabolism is essential for it.
- Catabolic processes keep you healthy and clean up so that ultimately the build-up of new muscle protein becomes possible in the first place.
- If both workings are balanced, this is a good prerequisite for health and muscle building.

What does all this have to do with stress? Stress is complex. Many influences cause it, and it affects many areas, mentally as well as physically[186]. The stress hormone cortisol is a central component of the stress reaction. It has a robust catabolic effect, which is why too much of it is terrible. The consequences of too much persisting cortisol and other stress hormones are a reduction in your well-being and, above all, a reduction in your ability to build up muscles and train

efficiently.

Stress triggers hormonal response

The three best-known, so-called stress hormones are adrenaline, noradrenaline and cortisol. You probably know adrenaline from colloquial speech. Phrases like "the adrenaline shoots into your bloodstream" describe in a convenient way how adrenaline works: mostly during short-term stress. Triggers can be a fright, noise, physical exertion or mental stress like fear.

Cortisol belongs to a group of stress hormones that have a relatively long-term effect. It increases, for example, also in the morning[187] or directly after workout[188]. But, the impact of such transient, immediately measurable stress reactions is not adverse and might even guarantee sufficient supply of amino acids. Research showed that an increase of cortisol related to workout was associated with increased gains in lean body mass and muscle fiber cross-sectional area[189]. Study participants with higher cortisol levels throughout the study were

more likely to grow muscle.

That is the reason why, if you want to use cortisol as an indicator of the body's condition, you have to look at the chronic changes in the resting levels of the hormones[190],[191]. The increase over normal resting levels is decisive. In unfortunate cases, cortisol increases continuously. The result would be a sustained, elevated blood level. As you will see in a moment, this scenario is hugely unfavorable in terms of muscle growth and health.

Why does cortisol exist and how is it produced?

The adrenal cortex produces cortisol as a stress hormone. Among other things, its task is to release energy so that your body is more efficient. But, it is also responsible for the functioning of the immune system and a very potent anti-inflammatory hormone[192].

In the course of our evolution, cortisol, as well as other stress hormones, have been particularly crucial when it comes to life or death. It is a tool of short-term stress

management, supplying the body with quick energy and aiding to reduce processes that waste energy in the eye of the tiger[193]. Then, we had to be ready to escape or battle, within fractions of a second.

In such situations, adrenaline or cortisol release a lot of energy in one go and get you prepared for whatever you need to do. In modern times, such circumstances are almost non-existent. However, the release of stress hormones due to situations subjectively perceived as stress happens the same way. The trigger has simply changed. Today, it is less the saber-toothed tiger that threatens us. In the equivalent, it is things like the upcoming deadline for the completion of a project or the traffic jam on the way home.

If you feel that the deadline for your project is approaching relentlessly and mercilessly, you are releasing stress hormones[194]. Your brain does not distinguish between the saber-toothed tiger and the timeline. Both are life-threatening situations for it. For example, the stress reaction leads to the release of glucose through muscle or liver tissue or the

conversion of protein[195]; your muscles are better supplied with blood and are under tension[196]. Because then you are forceful and ready to fight or flee through the well-known escape reflex quickly. But, flee from what? Right, nothing. At least, not a physical threat, but a purely imaginative, mental one.

Unfavorable symptoms of too much cortisol

Often, the dose makes the poison. Too much cortisol makes you sick. And this is especially important for muscle building. Because if your cortisol goes through the roof, your muscles melt faster than you can say "plum dumplings"[197]. Figure 11 depicts the influence of cortisol on muscle and other tissues.

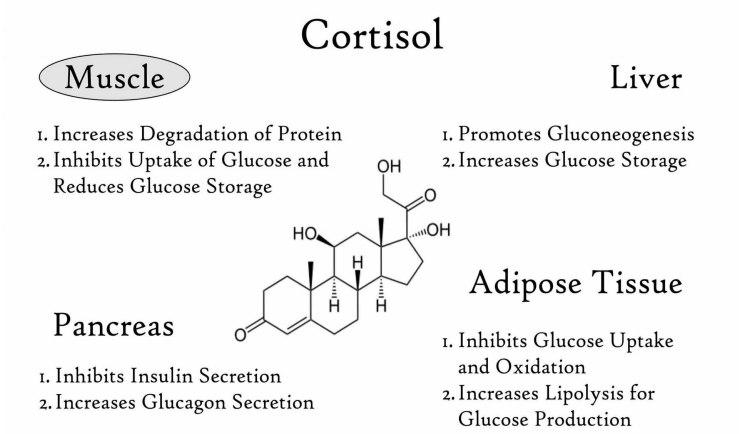

Figure 11 Impact of cortisol on muscle performance and metabolism. Cortisol leads to catabolic situations, supports insulin suppression, glucagon secretion, and muscle protein and fat degradation. The breakdown products are used to build glucose and produce energy.

The problem arises when this state of stress becomes constant. Chronic stress means that the level of stress hormones in the blood is always excessive, although there is no dangerous situation. In this case, many adverse reactions occur. These almost always affect body and mind equally. The symptoms of too much cortisol are manifold. We are looking here primarily at the effect on the muscles.

Cortisol triggers the body's sympathetic nervous system (the fight or flight reaction),

causing an increase in muscle tension. Cortisol makes the muscles tense and contract[198]. So, they are ready to react. However, if this goes beyond an acute situation and happens over a more extended period, overstimulation or cramping occurs. The muscles thrive on a balance of tension and relaxation. This way, it can regenerate, and you can function healthily. You may know a permanently increased muscle tone from your everyday life. Increased tonicity is often manifested by a stiff, aching neck or tense jaw and facial muscles around the eyes[199]. The effects of chronically increased stress or cortisol levels are manifold:

1. Since the muscle is permanently tense, it also becomes less elastic. Thus, it loses mobility and the potential to contract or stretch during movements. Your ROM decreases. The constant activation of your muscle fibers prevents free movement. As a result, you are less mobile and also more prone to injuries, especially if you train ambitiously.

2. Another disadvantage of chronically excessive muscle tone is *reduced blood circulation*. During relaxation, the muscle is better supplied with blood, and thus, your body can care for it. Optimized blood circulation means that superfluous substances and tissue are broken down and removed. In the best case, muscle tissue can be built up. With lousy blood circulation, this does not work so well.
3. Another of the many points that are relevant to your body and muscles is *breathing*. Due to stress and tension, the chest tightens up. All the large and small muscles involved in raising and lowering the thorax during breathing are affected, leading to increased shortness of breath and rapid, shallow breathing. The result is a low oxygen supply and higher CO_2 concentrations in the blood, which could mean even more stress[200].
4. *Oxygen* is, of course, fundamental for many processes within us. In our

context, less oxygen leads to reduced regeneration and inefficient use of the muscles. Too little oxygen affects the entire metabolism. Lack of oxygen has consequences for muscle building and ultimately, your health[201],[202].

5. In emergencies, cortisol helps in the short term to improve blood circulation in many parts of the body employing increased heartbeat and blood flow to the heart. The *blood pressure* rises[203]. What is advantageous for a short time becomes a problem for more extended periods. Due to high cortisol levels, the heartbeat is continually excessive: the risk of high blood pressure, heart attack or stroke increases. These effects influence your complete balance and therefore, also your muscle growth.
6. The stress level has a massive influence on your *digestive tract*, and thus on your digestion and ability to regenerate after workout and exertion. Stress and cortisol can cause you to eat

more or less than you need[204]. By eating hastily and chewing little, you swallow a lot of air and poorly pre-digested food pulp. The consequences are abdominal pain, poor digestion, bloating and flatulence. Stress can cause abnormal intestinal peristalsis or diarrhea[205]. Stress also affects your intestinal microbiome, which returns this to your body in the form of a negative feedback loop. One stress-related condition the microbiome is involved in is the irritable bowel syndrome[206].

7. *Testosterone* is an essential anabolic hormone, which induces hypertrophy in muscle fibers. Chronic stress can affect your production of testosterone to such an extent that your libido comes to a standstill[207],[208],[209],[210]. Whether man or woman, a hormonal imbalance is not desirable for the body's balance. A lack of testosterone is unfortunate for muscle building and the regulation of body composition[211].

The body accommodates all these effects of cortisol, but only for a short time. Over a more extended period, there are many adverse effects like the ones mentioned here. Too much cortisol leads to the opposite of optimized muscle growth and a healthy body. Additionally, it is associated with insulin resistance, elevated blood glucose levels and a higher risk for diabetes[212].

With the HGMM, you can naturally switch between anabolic and catabolic states through diet, exercise and regeneration and make muscle growth stress-free.

How can you control cortisol?

As you can see, when you look at the situations of origin, your cortisol level can be influenced. Through food, behavior or even thoughts and emotions. So, what are conditions that can trigger this kind of stress in you and lead to the release of cortisol?

Take care of your sleep

I guess everyone knows how important sleep is. Ultimately, it is of such importance since a

lack of sleep increases cortisol, fatigue and confusion and decreases testosterone levels and vigor[213],[214]. Yet, many people are not aware of what good sleep or sleep quality is and how to have a lasting influence on it. Adjusting things to good sleep is also called sleep hygiene. If you feel that your rest requires improvement, or if you think that one or more of the following points apply to you, then take advantage of the opportunity to improve your sleep hygiene. Or start getting one.

Noise

Sounds and noise can have a substantial impact on sleep quality. If the bedroom cannot be made entirely soundless, you could use comfortable earplugs for a quiet night's sleep. The so-called white noise, a desired monotonous sound carpet in the background, which is usually not consciously perceived, can also help. Many people find binaural beats, rain, sea noise, jungle sounds or meditation music useful - just try it out. The important thing is to set it as quiet as possible.

Light

Avoid bright or blue light in the last two hours before going to bed, at best from sundown. Keeping down blue light helps to preserve light-sensitive melatonin[215], which is secreted at night and functions as sleep hormone[216]. Screens and televisions play a predominant role. You could use blue light blocker glasses. The blue light filter for smartphones and modern televisions can also help. Such software reduce the blue components of the screen light, which is responsible for melatonin inhibition. The best thing, of course, is to do something analogue, like reading a book. Even a completely dark bedroom can help. If you are having a bad night's sleep, it can also help a lot to try out a sleep mask.

Sleeping mask

Even though you may find it funny, a sleep mask can block light and give you a pleasant feeling on your eyelids.

Heat

Warmth or heat can worsen sleep quality and delay falling asleep[217] because when falling asleep, the distal to proximal temperature gradient increases and the body core temperature decreases[218]. That is why many people naturally stick out their limbs from the blanket, and a cooled room can help you to shorten the time it takes to reach deep sleep stages[219],[220].

Caffeine

Caffeine is safe for healthy people and can be useful[221]. It is not without reason that many people use it as a stimulant. But even if the coffee no longer has a stimulating effect, it can affect your sleep[222]. The affected person may not feel it, but the caffeine in the body can impair sleep quality and lead to shallow sleep. That is why it is recommended not to drink coffee for at least six hours before going to rest[223]. If sleep is a big problem, it can also be worthwhile to try not to drink coffee at all.

Alcohol

Alcohol seems to make it easier to fall asleep. However, to improve sleep with liquor is a fallacy because it has a negative influence on the quality and length of sleep. Besides, the effect of falling asleep faster diminishes after a few days of alcohol consumption[224]. It may be better to abstain from alcohol before going to bed or not to drink alcohol at all.

Uniform sleep rhythm

Going to bed at about the same time every night helps you fall asleep faster and sleep better[225]. A good night routine is very beneficial here. It can prepare the body for sleep; the habit should be soothing rather than stimulating. It should be more meditation than computer games. Include a short walk, a breathing exercise or beautiful thoughts. The main thing is that it gives structure and a pleasant feeling before going to bed. Just as many people maintain such a strategy after awakening, you can implement a sleep routine. It can be your own, with things that are good for you and work for you. The goal is to create a kind of buffer. A buffer between the bright, hectic and active day and the quiet,

relaxed and dark night - physically and mentally. Start your sleep routine 60 to 90 minutes before going to bed. You can fill the routine with one or more points from these explanations.

Sport

Physical exercise during the day leads to better sleep at night[226],[227]. However, later or night-time exercise can cause some people to disturb their internal biological clock and can lead to an elevated heart rate during the first hours of sleep[228]. But, most of the research does not support an adverse effect of late evening or night workout for sleep quality or onset[229].

Melatonin

The absence of blue light signals the body to produce melatonin, which in turn signals the body that it is time to sleep[230]. For this reason, it is vital to avoid blue light in the two hours before going to bed. Oral melatonin can improve not only the ability to fall asleep but also the quality of sleep. However, it is not a

panacea and is recommended for certain severe conditions[231].

Magnesium

Magnesium deficiency can affect sleep[232]. You can take magnesium via supplements, and in case you are deficient, it will help[233]. If there is already enough magnesium in the body, supplementation with more magnesium will not improve sleep. However, since magnesium resides in many plant foods, you can easily supply it via magnesium-rich food items. You might want to prefer the natural way.

Lavender

When stress or anxiety interferes with sleep, lavender can help, as can magnesium when the body doesn't have enough of it. It promotes relaxation, reduces insomnia and improves sleep quality[234],[235],[236]. The use of aroma, as well as oral ingestion, are possible and can be useful. Just try out what you prefer.

Mattress

A suitable mattress. You should feel good and fit the next morning, not tense and tired[237],[238]. Test your new mattress, if possible, before you commit to it for an extended time. Some suppliers or shops provide the mattress for test nights, and you can return it if you don't like it. Even if this means a lot of effort, always remember how long you spend on your mattress, every single day. It doesn't make sense to skimp on the mattress but spend money big time every weekend in the club.

Switch off

Actively let go of thoughts from your everyday life, such as to-do lists or review things. Active relaxation helps you fall asleep better and improves the quality of your sleep. You can use many different tools, like reading something or deep, mental relaxation. Relaxing music can also help you to relax and get into a sleeping mood.

Sleep duration

Aim for sleep duration of seven to nine hours.

Everybody is different; you can also go outside this guideline to feel good. But, it is a good starting point.

Tracking

If those are your shoes, you can track your sleep. Meanwhile, there are pretty accurate tools, such as the Oura ring. With this, you can determine and adjust your sleep quality over time.

Care for stress-free nutrition

Here, it depends on what you eat and also how you eat. A lack of nutrients or energy can cause stress to your body[239]. Some amino acids or carbohydrates reduce cortisol secretion[240]. Make sure you eat a balanced, wholesome and natural, plant-based diet and you have the very best conditions for low stress.

In our fast-food culture, we have disrupted our eating habits. Our disturbed awareness of food and eating it leads to many consequences. These include increased stress levels, digestive disorders and discomfort

after eating the food[241].

Around the meal and during eating itself, you can do a lot for your relaxation. You can use the preparation of your meal for recreation instead of running around frantically. Find a place to eat that relaxes you, pay attention to your surroundings. If you consciously take every bite while eating and reduce distraction from TV and smartphone, you will relax more and reduce stress[242]. You can actively try not to think about stressful thoughts and plans while eating, but simply be there with your food and enjoy it. With this, you can create a vast oasis of peace and stress reduction for every meal of the day[243].

Improve your social life

Man is an animal with strong social mechanisms. We are not loners, but pack animals with a strong social structure. If you live differently than we have always lived the last 15 million years[244], this has strong potential to cause stress and depression in you[245]. So, if you want to minimize your stress, take a look at your social life.

Do you ever feel lonely or alone?

If yes, this is a definite sign that you should be looking for contacts. A sports club or gym is an excellent place to meet like-minded people on the side and have a casual conversation. Or just call your old acquaintance again, or your colleague you haven't heard from for a few weeks.

Maybe some people are not healthy for you

No matter how you twist it, not all people fit together perfectly. Sometimes, it helps to identify the social contacts that are good for you. You can try to strengthen and cultivate them. On the other hand, there may be contacts that wear you out and stress you out. It may be helpful for you to identify them and think about how you can reduce stress. You can do that by limiting the time you spend together.

<u>Let go and be grateful</u>

Fortunately, there are a few things you can do to relieve emotional stress.

Meditation

Meditation seems like a mysterious technique of the monks to many, but you can reap the fruits of meditation, too. Everyone can benefit from meditation within a short time[246]. Meditation can have an incredible influence on the physical and mental sensation of a person. Especially on stress, fear and focus[247],[248],[249]. So, what is meditation, and how can you use it?

Meditation is nothing more than introspection. You observe yourself and understand that you are sitting in the here and now and not somewhere else. It is exercise. The founder of mindfulness-based stress reduction, Jon Kabat-Zinn, describes mindfulness as paying attention, on purpose, to the present moment, curiously and non-judgmentally.

With meditation, you practice not flying away with thoughts or emotions, into the past or future, but staying here in the present. You learn to understand that your thoughts and feelings will never run dry. They will come again and again, in different strength and

frequency. You will find it challenging to turn this part off. What you can do is practice dealing with it.

If you just want to get started, a pragmatic approach is enough. This does not need to be explained for long. Sit upright and pay attention to your breathing. If you drift away with your thoughts, come back to your breath. That's it. Sounds easy, doesn't it?

You pay attention to your breathing in different ways. You can pay attention to the up and down of your belly, the airflow on your nostrils, or the fullness through the air inside you. All that matters is your focus on this one thing. I can guarantee you will drift off very quickly. Something from yesterday or tomorrow will surely steal your attention. You have to come in with your active focus. You'll perceive your distraction and refocus your attention actively on your breathing. This effect of redirecting your attention from thoughts and feelings to one thing in the here and now, to your breath, is what you practice with meditation. In the medium or long term, regular meditation is an absolute miracle

weapon against stress and depression.

Gratitude

You may wonder what gratitude has to do with muscle growth. I have found that the moment gratitude floods my body, stress and anxiety disappear entirely. Research confirms this mechanism[250],[251]. It is like there is no room for the emotion stress because thankfulness positively takes everything. How do you do it? Of course, you are thankful for a lot of things, but you still feel stressed, you might think now. This tool is about visualizing your gratitude actively and bringing it directly before your eyes - the more concrete, multi-faceted and colorful, the better; same as with the affirmations above.

A trick, in the beginning, is to start with something obvious. Start with something fundamental to you - your friends, your family, your favorite hobby. Imagine the person or hobby and visualize what you are grateful for. This exercise does not take long. Two minutes a day is excellent for a start! Within these two minutes, you try to keep

this feeling of gratitude within yourself. When you think about this person or your hobby, you will find out how it feels, probably warm and comfortable in your chest. You may even smile slightly[252] and look quite friendly while you think about it. Try to hold these feelings, these impressions, all that the gratitude triggers in you, as best you can at this moment.

If gratitude for such apparent things is more natural for you, then you can switch to any other object: your coffee cup, your breath, or even your bad boss. With practice, you will find it easy to be thankful for many things, even the tiny things that seem perfectly natural. Thankfulness is guaranteed to put a damper on your stress level.

Your three successes of the day

Think about your two or three significant achievements of the day. It doesn't have to be a promotion; it can be merely calming down in a stressful situation or a smile that you shared with another person.

Journaling

Various ready-made journals contain the upper element of gratitude and more applications with similar positive effects on your stress level. I can recommend that you just try it out.

Create a relaxation or positivity routine

Combine applications from this section here with other applications above, like the affirmations. Take it easy, try some for a few days and keep what works for you. You can string together two or three of the things you do for yourself in the morning or evening into a routine. Or you can build this little pool of handy applications and pick one every day to do for you at your appointed time. The harder you plan to do this at a particular time or moment and the more regularly you do it - preferably every day - the more the routine becomes natural for you and you will even miss it.

Diet is a sure way to decrease the level of cortisol and its influence in your body. The next five pillars of the HGMM show you exactly how that works.

Pillar Three: Optimize The Acid-Base Balance

The third pillar is all about your acid-base balance. But stop! Please do not slam the book shut and dismiss it as alternative nonsense. Acid-base homeostasis is not a term you may only use if you grew up in the forest or if you can distinguish real chamomile from field chamomile (FYI: *Matricaria chamomilla* versus *Matricaria inodora*).

You may even have come into contact with the term here and there - rightly so. At least, purely in terms of touch. This balance is a holistic principle that encompasses your

entire body, therefore, it is prime for your health and your performance. Knowledge about the acid-base homeostasis has been used in alternative medicine for a long time. But more and more modern research confirms the old observations.

For this reason, the balance of acid and alkaline also occupies a place in the Happy Green Muscle method as a pillar. Whether you eat acidic or alkaline foods has a decisive influence on your metabolism[253].

The pH value expresses the acidic or alkaline action of an aqueous solution in a concise number. It ranges from 0 - very acidic, to 14 - very alkaline. Vinegar, for example, has an acidic effect. It has a pH value of about 3, while tap water is in the range of 7 to 8.5 and thus has a neutral or slightly alkaline effect. The pH value plays a decisive role in all areas of biochemistry. That means, in all biological systems like the sea, the soil and of course our body[254].

The pH of the sea has dropped from 8.2 to 8.1 in the last 100 years[255], which means it has become slightly more acidic. The human

input of carbon dioxide into the atmosphere and the sea acidifies the environment. Even this small change has a huge and lasting impact on life in the ocean. The seemingly tiny 0.1-point alteration contributes to the predominant coral death.

Plants are the basis of life on earth. The pH in the soil is fundamental for the absorption of nutrients by plants. If the pH tends too much in one direction, the plant can absorb less or almost no nutrients from the soil. For example, with a pH value below 5.5 or above 8.0, the availability of the valuable plant nutrients phosphate and nitrogen is significantly reduced[256]. The exact opposite is true for many heavy metals, which are absorbed preferentially when the pH is acidic but are seldom absorbed above 8.0. Without the right pH value in the soil, plants grow poorly or not at all, because they receive too few nutrients or too many toxic heavy metals.

Through this relationship between pH value and nutrient uptake, the pH in soil determines how much nutrients are in the plant after harvesting. In turn, it determines how much

nutrients we can absorb by eating a particular plant[257]. With extreme pH, our basis of life on earth would be destroyed. By the way, this also means that when you buy a plant, you can determine how much nutrients the plant contains via its origin (soil, growing conditions, fertilizers)[258].

Same way, the pH value of your blood must also be kept stable under all circumstances so that your body can continue to function. The pH value of human blood serum stays in the narrow range from 7.35 to 7.4[259].

Why is this range so limited? Well, this is the narrow window in which the biological processes run optimally, it is part of homeostasis. Every process and every procedure in your body needs a particular environmental condition. In addition to the pH value, this includes temperature, water content and other accompanying substances or building blocks. Your body can only work and function optimally within this narrow window of all conditions. The workers who need these prerequisites are usually enzymes and microorganisms.

A vivid example of these changing conditions is fever. The body raises its temperature to make it difficult for the disease-causing invaders to grow. The growth of the pathogens thrives best at our body temperature, i.e. at 36.5° to 37° C. However, as soon as it reaches 39° C or 40° C, although this seems to be only a minimal difference at first, it looks worse for the intruders[260].

The point is, your body functions in an ingenious balance of acids and bases. It must continuously adjust the pH value to ensure optimal functioning. Many functions in the body are limited to a certain, spatial niche. Therefore, the pH value of these regions is also unique. Gastric juice is 1.3 to 3.5 because it has to break down protein and other food components. The pH of the skin is 4 to 6.5 to shield us from bacteria and fungi. The same applies to the pH of the vaginal fluid, which is below 5, or the acidic pH of urine[261],[262].

Despite the considerable differences between organs and tissues, the pH inside a tissue ranges within a narrow window. The diet-

induced, low-grade metabolic acidosis, the tendency to "over-acidification", which prevails in our society due to excessive consumption of meat, dairy products and eggs, affects places within cells or even between cells and disturbs as many functions of the body like insulin sensitivity or enzyme functions[263],[264]. Some effects of diet-induced low-grade metabolic acidosis on bones, pancreas, kidneys and muscles are highlighted in Figure 12.

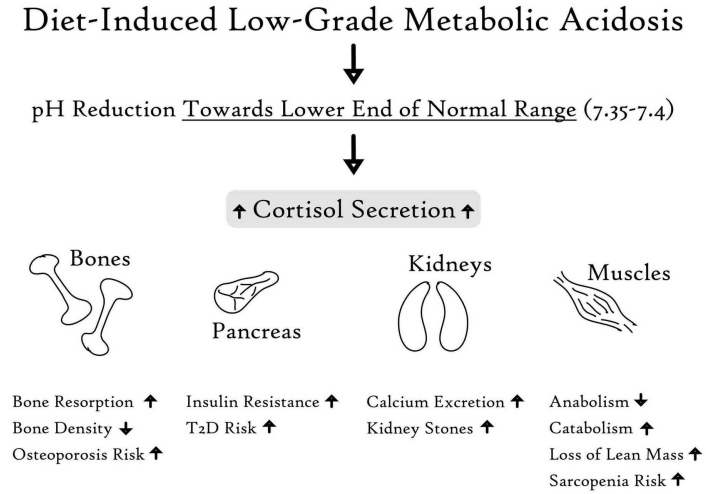

Figure 12 Impact of diet-induced low-grade metabolic acidosis on health and muscle building potential. The low-grade metabolic acidosis increases cortisol secretion. Cortisol, in turn, acts catabolic, lowers bone density, muscle

gains, or insulin sensitivity. (Modified after Osuna-Padilla et al. 2019, doi: 10.1016/j.nefroe.2019.08.001).

The pH value is important for our body

But, is the pH value also crucial for your muscle building? The more important question we have to ask is, can you influence the pH-value of your body by yourself? You probably already know the answer to this question. Because otherwise, the acid-base homeostasis would certainly not be one of the seven pillars of HGMM.

You can influence the pH of tissues and cell types. The influence that nutrition has on this becomes apparent when comparing eating habits. Compared to omnivores, vegans show less calcium excretion in the urine and a higher, more alkaline pH of the urine. Such observations are closely related to the acid load of the diet, which is increased in omnivores compared to vegans, due to many animal products[265].

Your diet is, therefore, a major factor and determines precisely where the pH settles in the range of the tight regulation of your body. At the lower limit of this range, at a blood pH

of 7.35, scientists speak of a latent, low-grade metabolic acidosis. In this context, to see how food affects this acid-base homeostasis, the potential renal acid load (PRAL) can be calculated for each food item. This value expresses the potential acid load of a food item for the body[266].

Here comes an important point for your diet and action. There are foods with high acid load and foods with a low acid load. In general, plant-based foods have a lower acid load or even appear alkaline. Many animal products, especially dairy products, act very acidic. Fruits and vegetables have the most substantial alkaline effect[267]. From this, you can see how the vegan diet is optimal to keep your body in a healthy balance. Figure 13 illustrates the acid burden from animal foods.

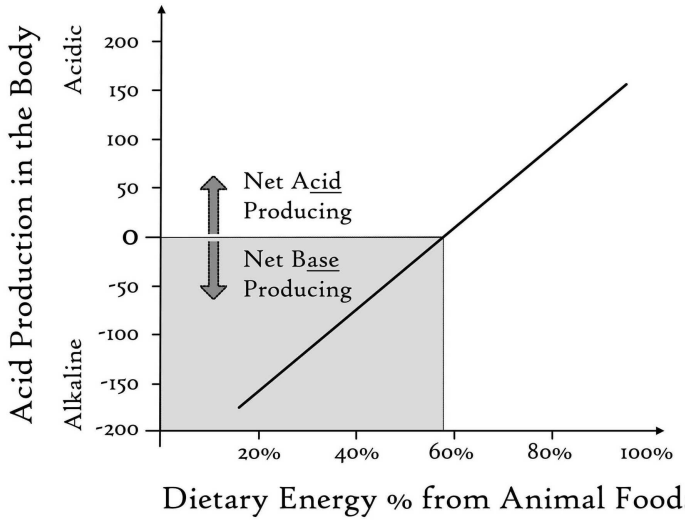

Figure 13 Ratio of plant to animal food determines acid load. The acid load increases with the consumption of more animal foods. (Modified after Ströhle et al. 2010, doi: 10.3945/ajcn.2009.28637).

What you eat is influential, whether you tend to over-acidify your metabolism or the opposite is true. Our modern diet is too heavily based on animal products. The majority of people, therefore, eat too many acid-forming foods[268]. So often, exciting findings are hidden in our development. The problem with today's modern diet and also the chance you have with this pillar lies in our evolution.

Our ancestors ate in an entirely opposite acid-

base balance. In their diet, the value of acid produced by food was -88 (mEq/d), meaning that this diet produces bases that act alkaline, whereas the standard American diet (SAD) is +48 (mEq/d), indicating a diet that acts acidic[269], as shown in Figure 14.

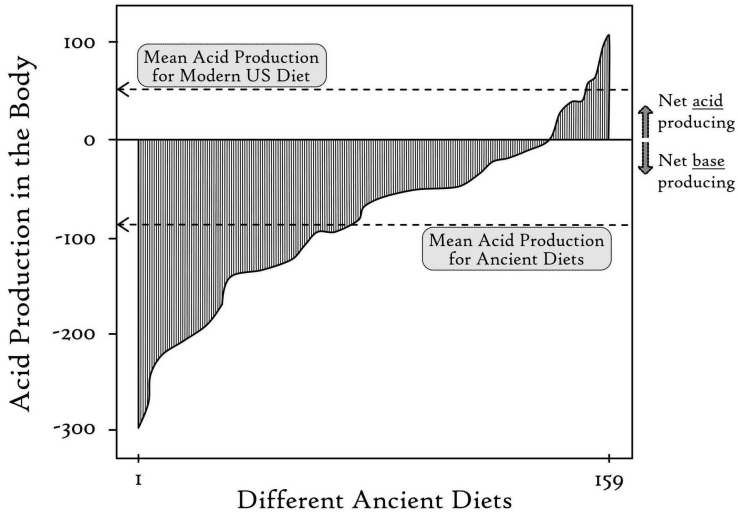

Figure 14 Comparison of ancient diets with the modern US diet for metabolic acid production. The majority of ancient diets were net base producing, while the standard American diet is net acid-producing. Average acid production from all ancient diets was -88 (which is net base producing), while the standard American diet is net acid-producing with +48. (Modified after Sebastian et al. 2002, doi: 10.1093/ajcn/76.6.1308).

In addition to the imbalance between plant and animal foods just mentioned, the sodium-

potassium balance of SAD is also responsible for the acid load. Concerning these two minerals, we are feeding upside down today. At first glance, sodium and potassium have nothing to do with acid. But, they are two key nutrients when it comes to acid and base. Simply put, sodium leads to acidification and potassium balances the acid. But we have adapted to a diet rich in potassium and low in sodium[270].

The problem that we have created with our modern diet since those prehistoric times is the relationship between these vital nutrients. The ratio of potassium to sodium has changed a lot since domestication about 10,000 years ago and especially since industrialization[271], [272]. In the past, we used to consume ten times more potassium than sodium; today, we consume three times more sodium than potassium[273], as illustrated in Figure 15.

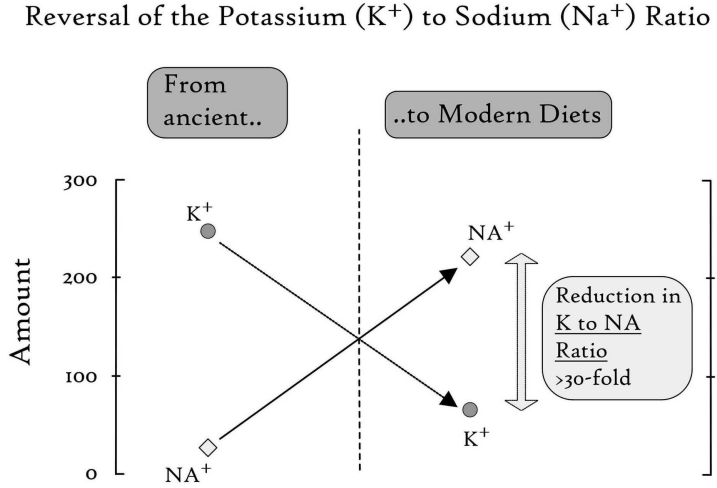

Figure 15 Potassium and sodium intake in ancient and modern diets. Today we consume much more sodium and less potassium. (Modified after Frassetto et al. 2001, doi: 10.1007/s394-001-8347-4).

Now, think about the short evolutionary time in which this change took place. Our body and our genome (*Homo Sapiens*) developed over 300,000 years; if you take the ancestors of *Homo Sapiens* into account, our evolution extends over one million years[274]. But, when you get right down to it, the severe change in our nutrition happened only in the last 100 or even 50 years[275].

From an evolutionary point of view, this is like the blink of an eye and is the reason why

we are firmly inclined to over-acidify our metabolism today. The consequence can be observed in studies. Most people in modern society live with a latent, low-grade metabolic acidosis[276]. Due to the buffering of the body, the pH settles in the narrow normal range, but the high acid load of the diet makes it drop at the lower limit of the spectrum. Even this small change towards the lower limit (7.35) affects your metabolism, risks for diseases and ultimately your ability to build muscle - because of all the things your body has to do to stay in that regulatory window. Hence, the pH value of the blood may appear normal, even though there is an overconcentration of acidic metabolites in little niches and areas of your body.

Our modern diet consists of too many saturated fats and processed carbohydrates[277]. Our so-called foods contain too much sodium and chloride and too little magnesium, potassium and fiber[278]. This change means that the body has to deal with more acidic molecules because the systemic acid load increases. But, our body is

not designed for acidification[279],[280].

High blood pressure is promoted by hyperacidity. The probability of cardiovascular disease is increased, the metabolic syndrome is promoted[281], as well as cancer[282],[283] and kidney damage[284]. The influence of acidosis is often underestimated because the body adapts well to the stress and balances it out. But over a long time, we experience excessive wear and tear. Constant strain ultimately leads to irreversible damage and impairment[285], such as increased morbidity[286].

Now it is crystal clear that your diet can have a decisive influence on how much acid your body has to process. Next, I will show you how the acid-base homeostasis influences your muscles.

Why is a latent, low-grade metabolic acidosis terrible for the body and your muscle growth? Why does it have so much potential to optimize your muscle growth, you may ask? It should not matter if you are a little sour, should it? The body compensates for it, as ingenious as it works with everything. That is

true, but not entirely.

Acidosis and the influence on your muscle growth

That is what we are all about, what I want to open up for you here. Even though many people know that a lot of salt and little vegetables are unhealthy, beyond that, there is rarely a more in-depth insight. Why is the acid-base homeostasis important for the muscles? Why should you pay attention to the content of acid and base formers in the food you consume? Here are the notable points as an overview:

The metabolism of nitrogen

The nitrogen balance is a measure that describes nitrogen intake and absorption. We absorb our nitrogen primarily via protein since every amino acid contains at least one nitrogen molecule. It is, therefore, eminently important for the balance of muscle breakdown and growth. Acidosis affects this metabolism of nitrogen, which is so vital for the maintenance of our muscles and favors a negative nitrogen balance[287],[288]. In other

words, the bottom line is that you lose nitrogen. Figure 16 indicates increased nitrogen wasting on an acid-producing diet.

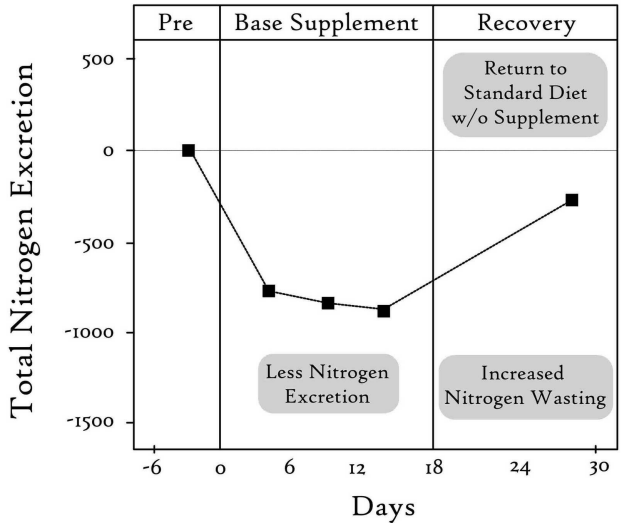

Figure 16 Impact of intake of a base supplement on nitrogen retention. The intake of a base supplement neutralized the net acid excretion and led to increased nitrogen retention. After return to the standard, acid-producing diet, nitrogen wasting increased again. (Modified after Frassetto et al. 2001, doi: 10.1007/s394-001-8347-4).

Muscle loss

Acidosis leads to protein catabolism, the breakdown of protein. Since protein is mainly present in your skeletal muscles, acidosis, therefore, leads directly to muscle

breakdown[289],[290],[291],[292], as illustrated in Figure 17.

In connection with hyperacidity, stress hormones such as cortisol[293],[294], which are also involved in muscle catabolism, are increasingly released. The consequence is the breakdown of your biceps, latissimus or quadriceps. A study even shows that muscle mass increases with an increasing proportion of alkaline food, regardless of protein consumption or physical activity[295]. Despite the importance of protein for muscle growth, the consumption of fruit and vegetables that have an alkaline effect is also eminent for the muscles.

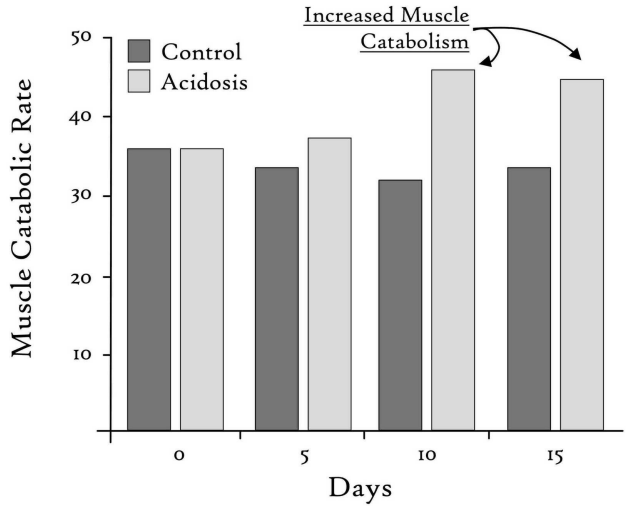

Figure 17 Impact of chronic metabolic acidosis on muscle catabolic rate. Sustained metabolic acidosis leads to increased muscle protein breakdown in acidotic rats. (Modified after Williams et al. 1991, doi: 10.1042/cs0800457).

Bone care as a prerequisite for muscle building

Bones are the most extensive, internal reservoir of the body for bases, i.e. the material that can balance acids. The minimal reduction of the extracellular pH of 0.1 points is sufficient to cause a doubling of the calcium breakdown from the bones[296], because the body has to balance the acid. The

effects of acidosis on bones can be summarized briefly and concisely: poor bone growth in children and reduced bone mass in adults[297],[298].

Figure 18 depicts the influence of animal protein on hip fracture incidence and Figure 19 illustrates that dietary intake of bases had a dramatic effect on bone mass density. Acidosis in contrast dramatically increases the risk of osteoporosis[299],[300]. But strong bones are a prerequisite for a healthy musculoskeletal system and muscles.

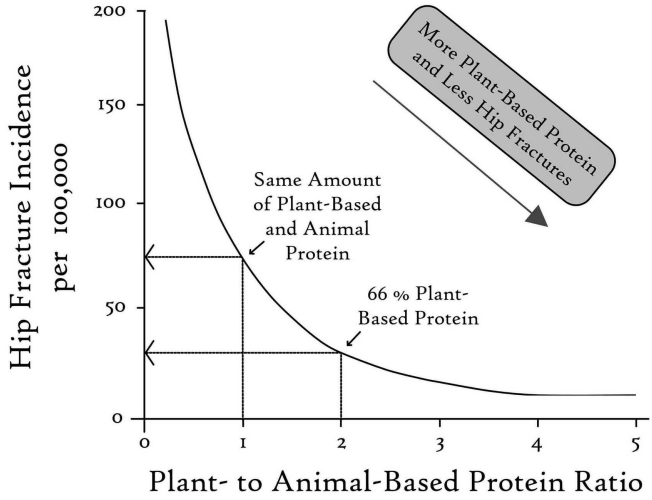

Figure 18 Influence of plant-based protein intake on hip fracture incidence in women from 33 countries. The intake of

more plant-based protein is associated with a lower rate of hip fractures. (Modified after Frassetto et al. 2001, doi: 10.1007/s394-001-8347-4).

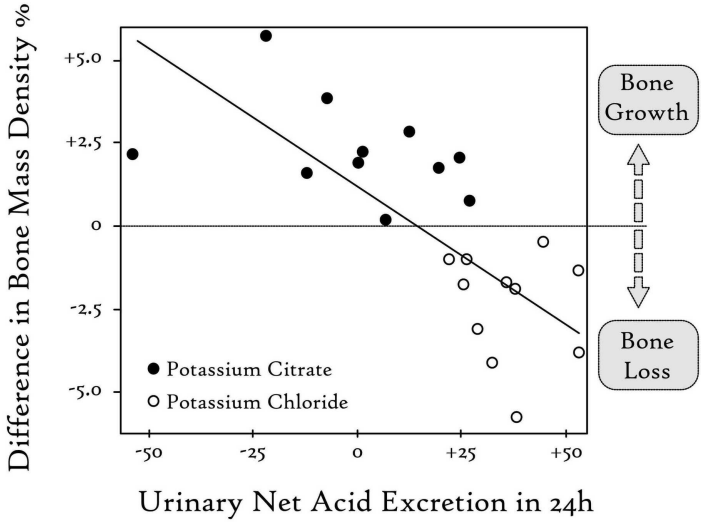

Figure 19 Influence of 12-month base intake on bone mass density in women. The base supplement providing potential bases through bicarbonate increased bone mass density after 12 months compared to a control treatment without bicarbonate. (Modified after Jehle et al. 2006, doi: 10.1681/ASN.2006030233).

Growth hormone acts anabolic

In the case of hyperacidity, the metabolism of our growth hormone (HGH) is negatively affected[301]. In particular, receptors for the growth hormone become more resistant in the body, i.e. less signal is passed on[302],[303], as

shown in Figure 20. That's bad because just like testosterone, growth hormone has an anabolic effect and is crucial for (muscle) growth[304]. It ensures an increased absorption of amino acids in the intestine and therefore more building material for the muscles[305].

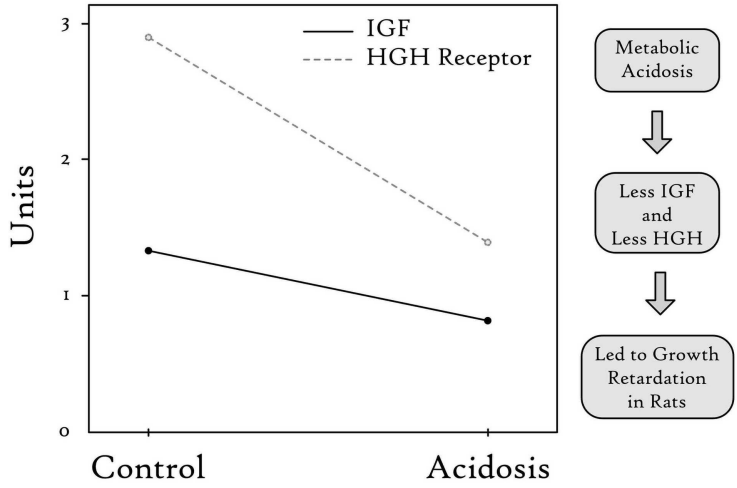

Figure 20 Influence of acidosis on growth hormone and IGF in rats. A relatively short acidosis of 8 days already lowers levels of IGF and HGH receptors. These measurements were accompanied by growth retardation in the acidotic rats. (Data from Challa et al. 1994, doi: 10.1007/BF00856518).

Figure 21 illustrates the influence of growth hormone on amino acid fluxes towards skeletal muscle. The consequences of too little growth hormone are drastic. A lack of

growth hormone leads to dwarfism, and adults with low growth hormone levels have high body fat, less muscle mass and increased mortality[306].

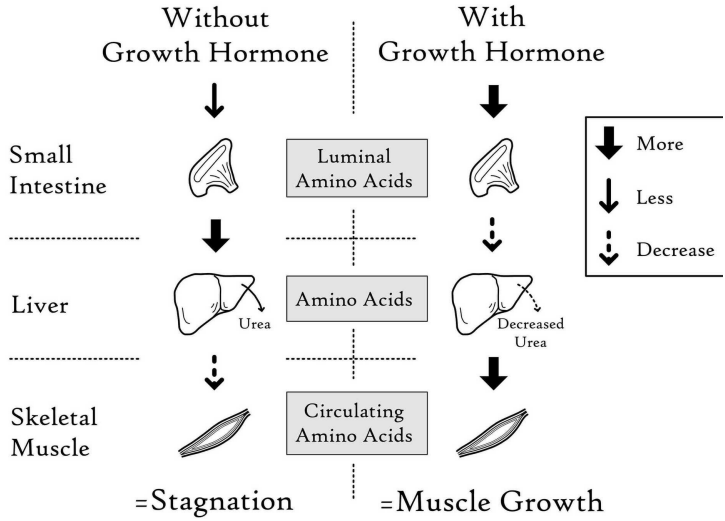

Figure 21 Comparison of amino acid flow with and without growth hormone treatment. The treatment with growth hormone increased the flow of amino acids towards intestines and muscle tissue. In parallel, it reduced the degradation of amino acids in the liver. Growth hormone provides additional amino acids for protein synthesis. (Modified after Inoue et al. 1994, doi: 10.1097/00000658-199406000-00016).

Salt leads to muscle and bone atrophy

Researchers have found that a high intake of sodium chloride, our table salt, can lead to

increased loss of bone and muscle protein[307]. The loss of muscle protein was observed in cases where the musculoskeletal system was not used to its fullest extent. In such cases, there can be a loss due to non-use, exacerbated by too much salt as shown in Figure 22. Bone substance and muscles in particular, then have to suffer.

Such level of non-utilization can happen, for example, when the patient lies down for a long time due to illness or age-related bedriddenness. With our current lifestyle, the so-called sedentary lifestyle, this can also occur in healthy parts of the population. A lot of sodium and chloride from table salt in the diet and the food we consume can support muscle loss.

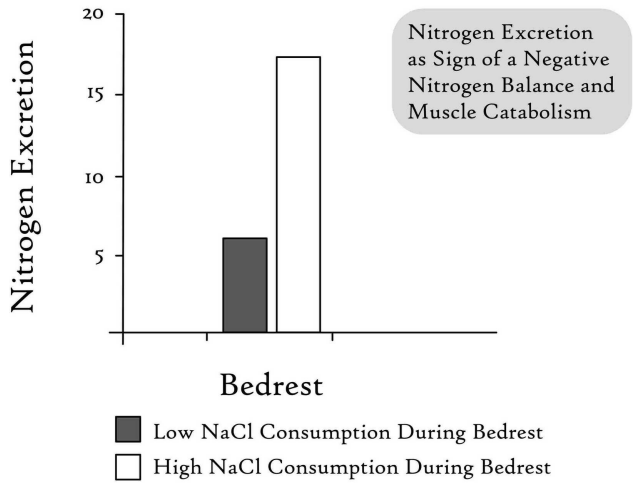

Figure 22 Impact of high salt intake during bed rest on nitrogen balance. Nitrogen excretion increased after 14 days of bed rest compared to 14 days of free movement. Salt can support muscle degradation during bed rest. (Modified after Frings-Meuthen et al. 2011, doi: 10.1152/japplphysiol.00454.2011).

Workout performance needs potassium

Intramuscular potassium concentration is the amount of potassium in your muscles. It is essential for the transmission of stimuli in the muscle and therefore, for contraction during workout[308]. Since the concentration of potassium is also determined by the diet and the acid-base balance, unfavorable diets such as SAD and other diets that increase the acid

load can affect your ability to train intensively[309].

What can you do to turn sour into sweet success?

Due to these influences, an acid-rich diet - as it is usually followed in modern societies - impairs your ability to build and maintain muscle. The exciting thing is that you can apply these mechanisms to your benefit through straightforward interventions.

With plant-based nutrition, you have a huge lever that you can apply. From the somewhat alkaline effect of most plant foods, you can see that you are already super equipped with the vegan diet for optimal muscle building. Nevertheless, there are also plant foods that can act slightly acidic. To help you balance your acid-base homeostasis, you will now receive practical instructions on which foods you can use in your daily life to support your body in health and muscle building.

Change your acid-base balance practically

Eat like our ancestors and reverse the diet-

induced, low-grade metabolic acidosis you may be living in. Optimize your pH level. Simple interventions can influence and improve the mild acidosis that is prevalent in our society. By doing so, you reverse the effects of the latent, low-grade metabolic acidosis, such as reduced growth hormone release, protein catabolism, increased bone loss, increased blood pressure, calcium loss through urine or increased cortisol excretion, as demonstrated in Figure 23.

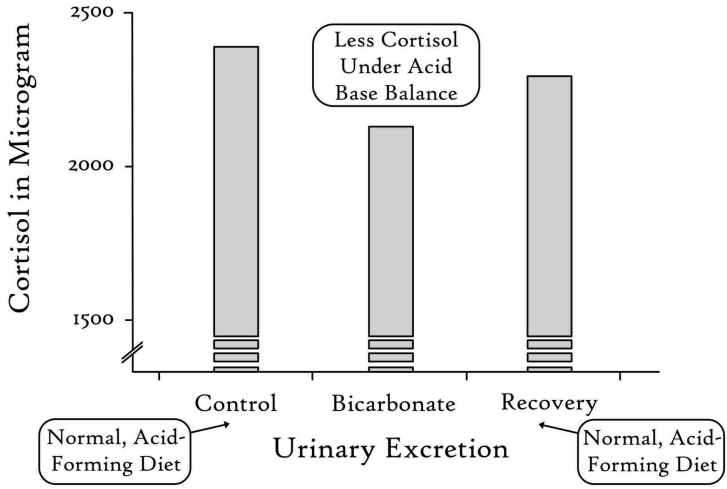

Figure 23 Influence of base supplement on body cortisol levels after nine days of supplementation. Investigators administered a bicarbonate treatment to neutralize the body's acid production. The balanced acid-base state led to

reduced cortisol secretion. It showed that a regular, modern diet could lead to acidification and increased cortisol secretion in humans. (Modified after Maurer et al. 2003, doi: 10.1152/ajprenal.00212.2002).

Better still, eat according to the HGMM and live healthy like a juicy caveman at the prime of our evolution. Use modern scientific knowledge to create optimal conditions for your muscle growth.

Muscle care with alkaline food

More vegetables and fruits in your diet improve the sodium to potassium ratio and prevent potential muscle loss[310],[311]. How much more does that mean? It is best to increase the proportion of alkaline potassium compounds up to the level in our ancestors' diets.

A diet rich in potassium, vegetables and fruits helps to maintain muscle mass, even up to higher age[312]. This way, you limit muscle loss and normalize catabolism[313],[314],[315].

Since acidosis can also mean loss of nitrogen, an alkaline diet helps to improve the nitrogen balance and thus to maintain your muscles. In simple terms, you protect your muscles

against breakdown and create better conditions for growth. This was indicated by investigation of a large sample of female twins in the UK, where a higher intake of plant in relation to animal foods was associated with increased fat free muscle mass, depicted in Figure 24.

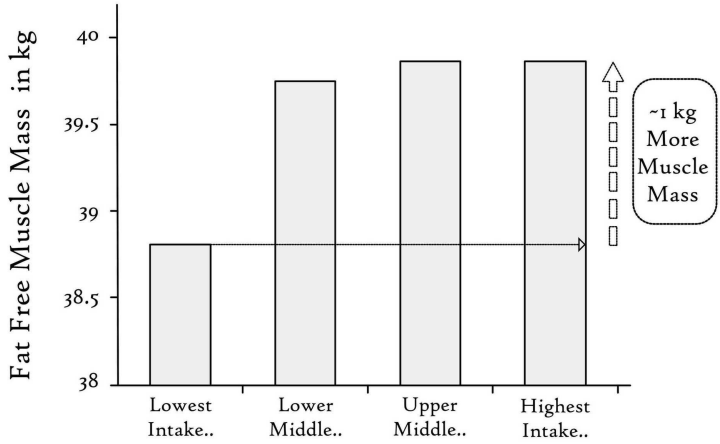

Figure 24 Alkaline diet and its influence on muscle mass in twins. Analyzing data from 2689 female twins from the Twins UK Registry showed an increase of fat-free muscle mass with more plant foods in relation to animal foods. The study suggests that base producing foods like vegetables and fruits are relevant to muscle maintenance and protein. (Modified after Welch et al. 2013, doi: 10.1007/s00198-012-2203-7).

Boosting growth hormone

The use of bicarbonate and potassium citrate, i.e. food or substances with an alkaline effect, can improve growth hormone levels and hence growth[316],[317], which helps to improve body composition. You promote the reduction of the ratio of fat to muscle. But it also has an impact on your health, because this change reduces the risk of cardiovascular diseases[318]. Ultimately, growth hormone metabolism stabilized by an alkaline diet can lead to better muscle growth and increased cardiovascular health and cognition.

Many other areas that serve your goal

Another effect of a sufficiently alkaline diet is that it makes more magnesium available in your cells. One consequence is an improved vitamin D metabolism[319], an area that is involved in almost all central processes in our body. Vitamin D itself can switch on individual genes or, conversely, ensure that a gene is switched off. It is also essential in the regulation of calcium homeostasis and bone structure, so it is easy to imagine that a change in vitamin D metabolism has far-reaching consequences.

Potassium is the key

Many of these positive observations can be achieved simply by increasing potassium and without reducing sodium or table salt. It does not mean that you should ignore your salt intake. Sodium and chloride, which make up salt, are only healthy in moderation[320]. So, this whole pillar hopefully shows you the opposite, that you should keep an eye on sodium. The fact that more potassium alone can make a big difference is to show you that every step count. The diet does not have to be that of a Stone Age angel overnight. Not only perfectionism will bring you to your goal. Every effort is right for you.

Practical tips to lower your acid load

How much potassium exactly?

During the most prolonged period of our evolution, as hunter-gatherers, we took in more than four times the amount of potassium as we do today[321]. To optimize your mineral balance, you should aim for a potassium intake of about 5 g per day[322],[323],

[324], and always prefer natural foods. Supplements are useful to change an acute situation quickly. Nevertheless, wholefoods still have the complete nutrient package and also work better.

How strongly reduce the sodium?

Our ancestors consumed five to ten times less sodium than we did[325], which in absolute terms corresponds to about 600 mg of sodium per day. Even if the difference seems large, it is not at all challenging to bring sodium to low levels, provided the food is natural and not processed. Most of the sodium we take in comes from salt in processed products and preservatives. The WHO recommends a maximum sodium intake of 2 g per day[326], which corresponds to 5 g of salt. If you aim for 1.5 g of sodium per day, which corresponds to 3.75 g of salt, you are well set[327]. Salt alternatives and less processed products are one way.

Care for a natural spectrum of minerals

Do it just as your body has been used to since

evolutionary times. Your diet should include many foods from the categories vegetables, fruits and herbs. These foods contain many organic, alkaline substances with a lot of potassium, little sodium and an optimal ratio of magnesium to calcium of two to three.

Preferably use these foods with a lot of citrate

Fruits like pomegranates, melons, passion fruits, oranges and other citrus fruits have exceptionally high levels of citrates[328].

If you can, prefer food from healthy soil

The soil supplies the plant. This connection influences the mineral balance of our food. Prefer food from cultivation methods that are as close to nature as possible, for example organic, dynamic-biological or from permaculture projects.

Drink enough

Water and drinks without sugar or calories such as herbal tea dilute the acids and help your body do its job.

Plant-based diet

As you are reading this book, I assume that you are already eating a plant-based diet or are about to do so - or maybe you want to go deeper into the purely vegan diet and get the most out of it. On average, plant-based foods seem much less acidic or mostly alkaline, unlike with animal foods, especially if you consider that the PRAL value represents plant food worse and animal food better than it is. We'd have more on this in a moment. Figure 25 illustrates popular foods and their acid-base potential.

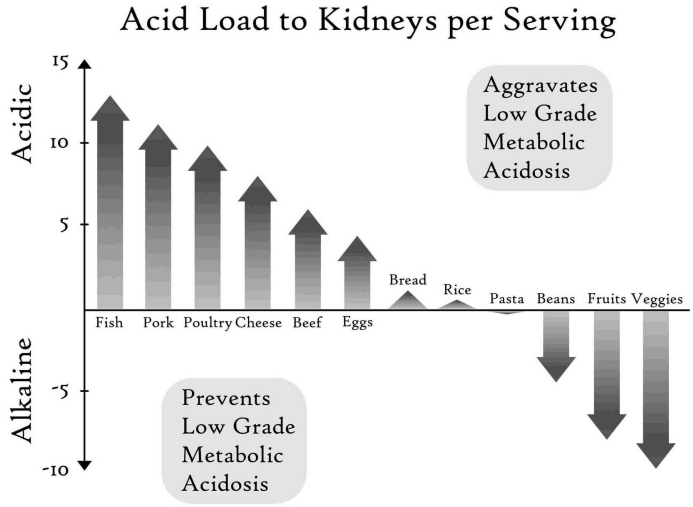

Figure 25 Impact of animal and plant-based foods on the

development of low-grade metabolic acidosis. Animal-based food acts acidic, and most plant-based food acts neutral or alkaline. (Modified after Greger 2016, How Not to Die from Kidney Disease).

Other obvious measures you can take are preferring plant proteins to animal proteins and reducing meat and dairy products and eggs. As you can see, you have a massive advantage with vegan nutrition and the HGMM here. On the subject of protein, you will learn more in the next three pillars.

Top 5 base-boosting food items with PRAL values

The PRAL is a measure that reflects the acid load of food. The PRAL is calculated according to Remer and Manz, considering the nutrients in the food[329]. Due to the chemical effect of food-contained molecules, the ratio is critical, as you have seen for potassium and sodium.

For the calculation of the PRAL, five points are decisive[330],[331]:

- The composition of the food regarding protein, chlorine, phosphate, sodium, potassium, magnesium and calcium

content;

- The absorption rate of the nutrient;
- The formation of sulfur by sulfur-containing amino acids;
- How phosphate behaves in the body;
- The chemical charge of calcium and magnesium.
- For the most alkaline PRAL is essential:
- High potassium to sodium ratio;
- A ratio of magnesium to calcium close to two to three;
- A low amount of sulfur-containing amino acids;
- A low proportion of the amino acids methionine to cysteine.

Table 1 shows popular food items, their content of decisive nutrients and the resulting PRAL.

Table 1 Potential renal acid load (PRAL) of different food items and 5 base-booster foods.

Food Item Unit	Potassium mg / 100 g	Sodium mg / 100 g	Magnesium mg / 100 g	Calcium mg / 100 g	Chloride mg / 100 g	Phosphate mg / 100 g	Methionine mg / 100 g	Cysteine mg / 100 g	PRAL
Human breast milk	46	12	3,1	29	40	15	24	24	0,9
Dairy products									
Cow's milk	157	48	12	120	102	92	90	28	3,9
Gouda	76	512	28	820	788	443	740	190	18,6
Mozzarella	44	206	14	416	292	310	550	88	39,2
Egg	147	144	11	51	180	210	450	310	10,4
Meat									
Beef	296	50	19	3,8	147	165	580	270	21,4
Pork	292	72	21	9	68	172	730	300	20
Chicken breast	264	66	27	14	80	210	644	322	19
Fish									
Tuna	407	37	34	29	140	222	594	286	21,7
Wild salmon	371	51	29	13	59	266	478	184	10
Cereals									
Oats	355	8,4	129	80	119	342	191	323	9,1
Wheat	380	7,7	97	33	55	342	220	290	12
Legumes									
Lentils	837	7	129	65	84	408	220	250	3,1
White bean	1337	3,5	140	113	47	414	260	230	1,5
Tofu	375	7	50	159	10	109	205	126	3,5
Vegetables									
Sweet potato	360	4	18	22	46	39	28	25	-1,8
Irish potato	417	2,7	21	6,2	50	50	30	20	-1,7
5 Base boosters									
Apricots	280	2	9	16	1	21	4	2	-4,8
Celery	344	132	12	80	130	48	18	12	-5,2
Banana	393	1	36	9	109	28	9	2	-5,2
Pomegranate	290	7	3	8	40	17	7	4	-8,1
Yam	393	10	21	25	36	44	26	22	-15

Data from Ziegler 1990, doi: 10.1016/s0022-3476(05)80002-2; Carnauba et al. 2017, doi: 10.3390/nu9060538; Souci, Fachmann and Kraut 2000, ISBN: 3887630769; Max Rubner-Institute: Nutrient data.

You have experienced that plant foods are more alkaline than animal foods on the average, especially fruit and vegetables. But, if you take it seriously, then the difference is still glossed over by the PRAL. Animal food would have to rank more acidic, plant food however more alkaline. The reason for it lies in the computation of these values.

Phosphate is found in animal and plant foods and has an “acidic” effect on the body. The PRAL assumes that our body absorbs phosphate from plant and animal sources

equally well. But this is not the case; the bioavailability of individual nutrients differs from food to food[332]. Although the phosphate absorption can vary drastically between plant and animal foods, the value for phosphate absorption was averaged over plant and animal foods to calculate the PRAL. An absorption efficiency of 63 % was assumed, but, for meat and milk, the absorption rate of phosphate is over 70 %[333]. In cereals, on the other hand, phosphate is found in the form of phytic acid, which is hardly absorbed by the body. Whole-grain cereals contain phosphate in the form of poorly digestible phytic acid and are thus classified as more acidic than they are. Consequently, animal food would usually rank more acidic and plant food more alkaline, than in the PRAL represented.

Another point is sulfur-containing amino acids. Sulfur-containing amino acids are one reason, protein acts acidic. For the PRAL calculation, Remer and Manz assumed an average content of 2.4 % methionine and 2.0 % cysteine, i.e. 4.4 % of sulfur-containing

amino acids in all foods. But here too, these average values gloss over the difference between plant and animal foods. Plant protein contains significantly fewer of those amino acids that have an acidic effect. Cereal grains or pulses contain just half, with 2.2 % to 2.5 % of sulfur-containing amino acids[334],[335]. Ultimately, the proportion of sulfur-containing amino acids in plant foods is set too high, that in animal foods is too low. The result is a whitewashing of the acid load of animal foods and an overestimation of the acid load in plant foods.

In practice, this means that the PRAL values apply well to omnivores who consume mainly animal foods. However, this is not the case for predominantly plant-based or vegan food. If you eat like this, the PRAL will slightly overestimate your acid load.

More practical alkalization

- *Breathing* is the secret most vegans do not already have exclusively contained in their diet. Deep breathing and breathing techniques get the oxygen supply going and

help to dispose of CO_2! Breathing has the potential to stop and reverse acidification[336]. A little practice and attention to breathing can work wonders. I can recommend techniques such as deep abdominal breathing.

- *Lactic acid* supports the metabolism. Lactic acid helps to create an acidic intestinal environment through the formation of butyrate in the colon[337]. Unlike many other tissues of the body, however, sour is desirable here. Too high an alkaline pH value in the colon increases the risk of colon cancer[338]. An acidic pH in the colon, on the other hand, ensures natural, healthy intestinal activity and helps the body get rid of harmful metabolic products such as ammonia. Aforementioned, in turn, relieves the liver and kidneys, which deacidify and ensure a healthy acid-base balance.
- *Prebiotic* dietary fibers also promote a healthy intestinal flora and lead to the formation of the anti-inflammatory butyrate[339]. The formation of the fatty acid

butyrate acidifies the intestine, which in turn facilitates the excretion of the toxic decomposition product ammonia.

Next step: the protein pillars

As you have seen, protein is not only crucial for muscle building but also responsible for creating the acid load for your body. The problem of modern nutrition is the very high proportion of animal proteins and foods and the omission of foods that act alkaline. Most people do not eat enough vegetables and fruits and too many processed and refined products that are only poor sources of potassium and magnesium.

These correlations make it clear why HGMM is so well suited for muscle building. Due to its amino acid composition, plant protein appears less acidic than its animal counterpart. Also, the diversity and quantity of eaten plant foods provide enough base formers to balance the protein's acid potential. So, the HGMM unites both worlds. Optimized protein intake and balanced acid-base homeostasis.

For you to know exactly how to optimize protein, the following three pillars deal with the optimization of plant protein. First, I will give you an overview of protein, followed by a competition between plant and animal protein for eleven points. This competition is the reason for the three subsequent protein pillars of the HGMM - pillars four, five and six.

Prelude: Macronutrient Protein

Protein, just like carbohydrate, provides 4.1 kcal of energy per gram. One of the best-known functions of protein in the body is the formation of the contractile proteins: actin and myosin. These enable the muscles to contract. Ergo, protein is the building block par excellence for your muscle tissue. It is therefore evident that you can optimize your muscle growth by smart consumption of plant protein.

Protein is the same as amino acids. However, the term protein is often used in the language in a completely different context than amino acids, as if they were two different nutrients. But, precisely the opposite is the case. Amino

acids are nothing more than the building material of proteins. These amino acids are called proteinogenic because we humans use them to build proteins in our bodies.

The 21 proteinogenic amino acids are divided into dispensable ones, which the body can produce itself, and indispensable ones, which you have to take with food. For adults, there are eight indispensable amino acids: valine, methionine, leucine, isoleucine, phenylalanine, tryptophan, threonine and lysine. Histidine would be the ninth; it is indispensable for infants. In the following, I often use the term essential amino acids, or EAAs, to refer to this group of eight protein building blocks.

What does protein have to do with muscle building?

Workout and optimized protein work together to build muscle; they add up[340], as illustrated in Figure 26. Above, you learned about the role of training in building muscle. It is the initial stimulus. During workout, everything starts. You shake your muscles awake and

make them understand that it can't go on like this. Through exercise, you put your metabolism into an anabolic state so that your muscles grow. Logically, the building material of your muscles is also vital for this growth. Without building material, there is no house.

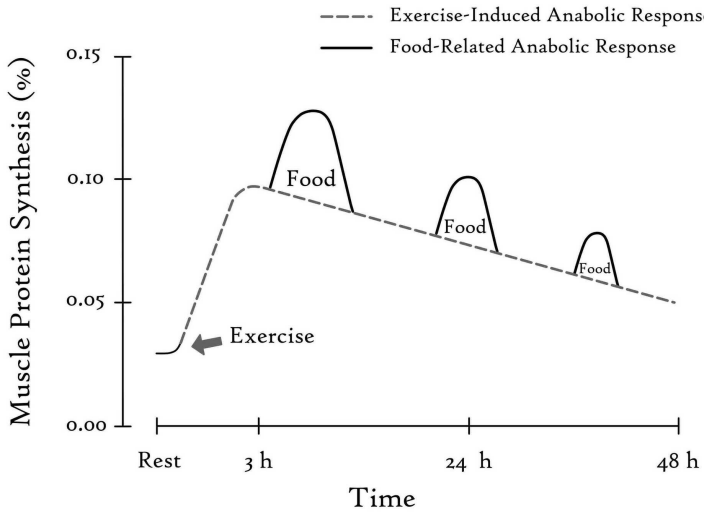

Figure 26 Depiction of the additive effect of exercise and food intake on muscle protein synthesis. The effect of exercise lasts approximately 48 h, while the anabolic food effect lasts three to five hours. Anabolic responses of exercise and food add up to increase muscle synthesis. (Modified after Churchward-Venne et al 2012, doi: 10.1186/1743-7075-9-40).

If you want to get the most out of your

muscle building, you should pay attention to the amount and type of protein you eat[341], [342]. A diet optimized for the amount and type of protein increases the anabolic effect of the workout[343],[344].

As if that wasn't enough, there is another thing protein does for your muscles. Not only does it provide for a more significant muscle synthesis, but it also suppresses muscle breakdown. Figure 27 provides an overview of factors that positively or negatively influence muscle growth.

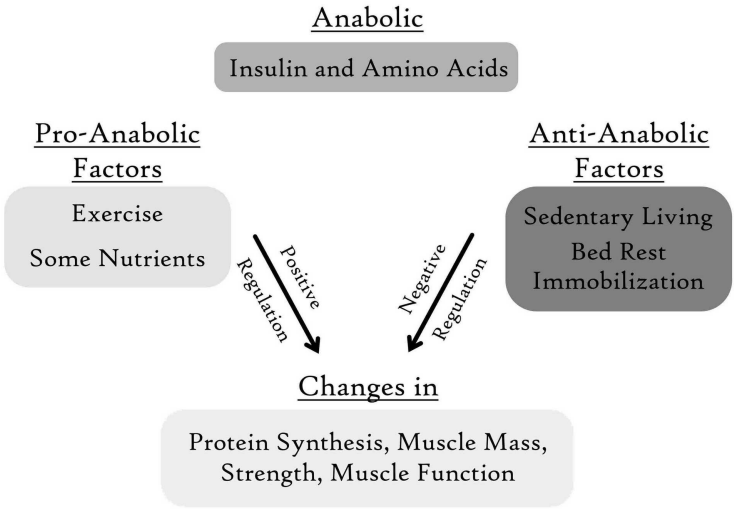

Figure 27 Illustration of anabolic and anti-anabolic factors and their influence on muscle and strength.

Indispensable amino acids are fundamental

Amino acids are the individual building blocks of proteins; they are like amino acid beads on the protein string. Amino acids are the carpet patches of the magnificent muscle carpet. Each amino acid has different properties that it brings to the muscle carpet. Some are especially good in the middle to keep everything tightly together. Some are good as an outer piece because they have beautiful fringes. It's not only the type of amino acids that counts but also the quantity. For example, the muscle carpet has more inner patches than outer pieces, and of the very colorful patches, only a few are enough for the accent. A protein formed in this way takes on a 3D configuration in your body. Only in this way can it be physiologically functional. Proteins can reach the necessary, final shape because of the different roles of the amino acids[345].

All amino acids are irreplaceable in this context, because if even a single amino acid is missing, your body may scrap to build up the protein[346]. The protein may not reach its

final configuration. A patch is missing, and the carpet does not hold together. Each amino acid is concrete and irreplaceable when it comes to its function in your body. Therefore, the amount and type of amino acids you take in plays a role. As shown in Figure 28, the fact that the scarcest amino acid determines protein synthesis can be illustrated by the Liebig law of the minimum.

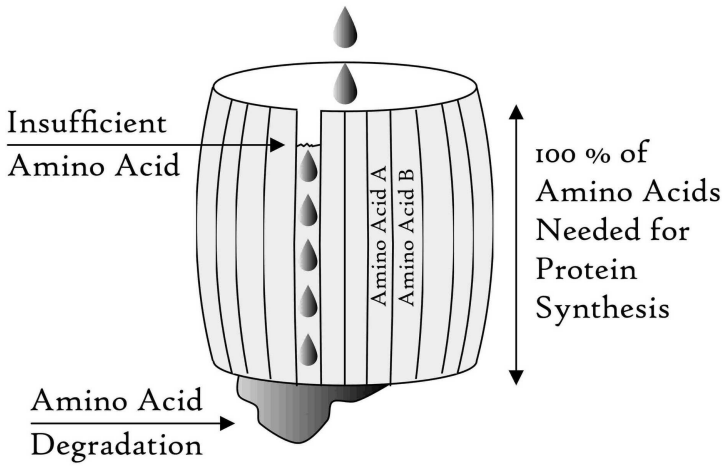

Figure 28 Depiction of the Liebig law of the minimum. Growth is restricted by the scarcest resource, not by the absolute amount of available resources. Hence, one amino acid in sub-optimal concentration can hinder muscle protein synthesis.

In terms of anabolism, muscle building and

muscle maintenance, the EAAs are particularly important. As the name suggests, the others are dispensable, because your body can produce these amino acids itself - provided that there is enough amino acid building material available[347]. From a purely functional point of view, almost all amino acids are indispensable, because otherwise no others can be built from them.

The essence of the following three pillars of HGMM is how you weave your perfectly shimmering muscle carpet with the help of plant protein. With the use of the pillars, you can easily supply yourself with the right amino acids of plant origin. But before, let’s have a look at protein and its health effects.

Is protein unhealthy for the kidneys?

Protein is dangerous; this statement is often heard. There are few components in the food around which so many claims and prejudices entwine. Therefore, we will take a closer look at another central cliché about protein. I can tell you one thing at the beginning: it makes a difference what the source of your protein is -

it depends on whether the protein you consume is of plant or animal origin[348].

The kidneys are usually a prime example when it comes to the allegedly harmful effects of protein. That's why I'll show you what's going on using the kidneys as an example.

Healthwise, sulfur-containing amino acids - cysteine, homocysteine, methionine and taurine - challenge your kidneys the most. These sulfur compounds have an acidic effect on your body, as you learned in pillar 3. The kidney is our rod on the rope stretched over the abyss. It helps us keep our balance. Without kidneys, we would crash. They and the liver keep the pH of our body and various tissues within the necessary range. The kidneys dispose of the excess acidic components to maintain the acid-base homeostasis. To do this, they excrete ammonia[349].

If your kidneys are healthy, they can increase the filtration rate of the blood with increased protein consumption and more inflowing sulfur compounds[350]. Both average and high

protein consumption are therefore considered safe for healthy kidneys.

However, if there are kidney problems, the filtration function of the kidneys may be limited[351]. In this particular case, protein intake must be monitored[352]. Because the kidneys do not work correctly, there may be an accumulation of uremic toxins. That is why the first measure to be taken in case of existing kidney problems is to reduce the protein intake. If protein consumption is not controlled, previously damaged kidneys may continue to suffer from short-term increased albuminuria, and long-term increased renal fibrosis.

Nevertheless, there are promising nutritional science approaches for such cases. In this case, the protein consumption of kidney patients will be drastically reduced[353], but the supply of sufficient EAAs should still be ensured. After all, protein is cardinal even in chronic kidney disease. Otherwise, malnutrition and an increased probability of death will result[354].

So, if you already have kidney problems,

protein can make things worse. The circular reasoning, however, does not hold. Just because the reduction of protein is recommended for people with kidney problems, a lot of protein is not automatically harmful to healthy kidneys.

Protein always works acidic, however, less so for plant protein

There is no evidence for the association of a plus in protein with kidney disease[355]. Still, protein plays a definitive role in the acid-base homeostasis as described in pillar 3. Your kidneys, the key organs in the deacidification of your body, have a lot to do.

Several long-term studies observed increases in glomerular filtration rate and hyperfiltration for animal protein as compared to plant protein. An increased filtration rate contributes to kidney injury and is an indicator of the diet's negative impact on kidney function[356],[357],[358],[359].

There is a positive synergistic effect of plant protein and other plant food molecules on renal function. The National Kidney

Foundation recommends a plant-based protein diet to support kidney health[360]. Authors of a recent study even recommend such diet for patients with chronic kidney disease[361].

In conclusion, it shows that plant foods and the protein from them do not make your healthy kidneys sick. They support the activity of your kidneys through less input of acidifiers and more base formers. A plant-based diet, therefore, offers good chances to keep your kidneys healthy and fight existing kidney disease[362].

However, there is tangible evidence to justify the recommendation to avoid diets high in animal protein for obese or diabetic patients or those with prior cardiovascular diseases or a solitary kidney[363].

Are accompanying substances unhealthy?

Imagine the following scenario. Someone barbecues a bell pepper until it is black and then eats it with pleasure. However, after a short time, the person gets an unpleasant stomach ache and almost writhes in pain. To

your amazement, the person now blames the peppers for the pain and points out that even as a child, he did not like bell peppers and should instead stop eating them. Like all outsiders, you might think now that the cause of the stomach pain was probably more the charred on the bell pepper than the bell pepper itself.

The aforementioned is also valid with protein. Not only the protein itself, influences the body, but also what is inevitably consumed together with the protein. It is not quite right to always point your finger at "the protein" alone. Instead, we need to look at the proteins' origin and what else comes with the food.

Plant protein is superior to animal protein in this respect

Protein comes to you as food in a so-called nutrition matrix. In the animal case, this nutrition matrix usually contains a lot of saturated fat, cholesterol and other substances of animal origin. The consequence is, if you eat much animal protein, then you consume a

lot of saturated fat, cholesterol and other factors of risk for some diseases of civilization like diabetes[364]. Thus, the connection of protein and unhealthy is naturally no longer far.

If animal protein related to the health benefits of the nutrition matrix is the class clown, then plant protein is the superior class leader. If you rely on protein from pure plant sources, you have complete nutrient packages that are good for your health[365]. People who consume a lot of plant protein are automatically supplied with excellent quantity and quality of nutrients due to the high nutrient density. This connection of protein and healthy nutrition discovered by scientists does not exist for animal protein[366].

Before we come to the three pillars of protein - quantity, protein digestibility and combinations - I would like to take a very close look at protein from plant foods. In the next section, I will make the big comparison. How does plant protein compare to animal protein?

Prelude: Animal Versus Plant Protein

To make this clear, I will go into detail here and compare plant and animal protein directly. This topic is particularly central for nutrition-conscious people and athletes. Still, in the coming years, it will also become increasingly crucial for the general population. You will see the reason right away.

Also, this section is important for your mindset with the goal of vegan muscle building. Only the real facts allow you to make considerable decisions and give lasting motivation.

You see the fight of plant- and animal-based protein for eleven points from eleven

categories in the following. The winner of each category gets one point.

Here we go.

Amino acid composition

Animal protein is complete. The composition of the amino acids corresponds to that of our muscles[367].

In contrast, grains have less lysine to other amino acids they contain[368]; pulses have less methionine. The combination of grains and pulses, bread with hummus, for example, results in a complete amino acid composition.

Animal proteins are, therefore, usually given a higher biological valence. That is why this point goes to animal protein. However, as you will soon see, this evaluation will have little practical relevance for you.

Point goes to animal protein.

Anabolic potential

In isolation and short-term, because most of the research looks at periods of only several days or weeks, animal protein like whey is

more anabolic. But there is a substantial body of evidence that intake of an equal quantity of plant proteins like pea[369],[370] or rice[371],[372] over study periods of more than six weeks leads to the same increase in strength and muscle growth as whey. Acute muscle protein synthesis and long-term lean muscle gain are two different things.

Nevertheless, an amino acid that is usually found more in animal protein is leucine. Leucine is considered the most anabolic amino acid[373],[374]. Hence, animal protein seems to have more anabolic power when considered in isolation[375].

If you consider the protein pillar strategies to build vegan muscle, the leucine advantage disappears entirely.

Point goes to animal protein.

Digestibility

A food item provides other nutrients besides protein. Secondary plant metabolites in plant foods can reduce digestibility. Impeded digestion means that in the end, fewer amino acids are absorbed from the food pulp than

are available. Your body excretes the remainder.

If you compare untreated plant foods with animal foods, the latter have higher digestibility. However, as soon as plant foods are prepared appropriately, using soaking, cooking or germinating, the digestibility is almost the same.

Again, as with the anabolic effect of animal protein, there are two sides to the coin. Secondary plant metabolites are essential for your health[376].

Point goes to animal protein.

Acidic versus alkaline

Animal protein sources usually contain a higher sodium-potassium ratio than plant-based sources, less magnesium to calcium, and more of, as well as an unfavorable ratio of the sulfur-containing amino acids methionine and cysteine.

On average, the opposite is true for plant-based protein. It contains more potassium, less sodium, more magnesium, less calcium,

and a methionine to cysteine ratio that is more similar to that of human breast milk. Cow's milk, on the other hand, represents an animal protein and contains three times as much methionine as cysteine.

Now you know the differences, but why am I telling you this? Simply because plant-based protein is gentler on the detoxification organs, kidneys and liver, and on the whole organism.

Point goes to plant-based protein.

Cancer

The excess of an anabolic metabolic environment could contribute to a higher risk of cancer[377]. These properties may make animal protein generally problematic for health[378],[379],[380].

Due to its anabolic properties, animal protein, like that from milk, has a strong effect on insulin release and other growth factors (e.g., IGF-1)[381]. Such messenger substances support cell division and proliferation of good and bad cells[382]: excessive signaling for growth can promote the development of

cancer[383],[384].

In the assessment "Carcinogenic effect of eating red meat and processed meat"[385], the WHO describes why meat and processed meat can be carcinogenic. There is a close relationship between red meat intake, fecal ammonia production, and increased colon cancer risk[386].

Substituting plant protein for animal protein may be a strategy to lower the risk of colon cancer in individuals with specific gene variants for fatty acid metabolism[387].

Point goes to plant-based protein.

Insulin response

Protein-rich animal foods such as fish, beef, or cheese contain very little or no carbohydrates. Yet, they have a similar insulin index to plant-based protein sources such as lentils, pasta, or brown rice. Gram for gram, beef and cheese produce more insulin than brown rice or lentils[388].

Since high insulin production can lead to increased insulin resistance and

cardiovascular disease[389], animal protein is more critical in this respect than plant-based protein[390]. However, insulin also has an anabolic effect, which is desirable for your muscle development. For this reason, there is a draw here.

Draw.

Weight gain and metabolic syndrome

Increasing plant protein as a substitute for animal protein can decrease the risk of obesity in adolescents[391]. The insulin effect likely contributes to the fact that animal protein is associated with weight gain[392] and higher body mass index[393]. In contrast, the intake of plant-based protein leads to a balanced body mass index. Contrary to animal protein, you can use plant-based protein to prevent insulin resistance, disturbed fat metabolism and hence the metabolic syndrome[394].

Point goes to plant-based protein.

Diabetes

While animal protein increases insulin

resistance and damages insulin sensitivity[395], plant-based protein increases insulin sensitivity[396],[397]. The effect on insulin is one reason why animal protein can more than double the risk of developing diabetes[398],[399]. In contrast, plant-based protein can reduce the risk of diabetes[400], and physicians even recommend a plant-based diet to treat diabetes[401],[402],[403]. In another investigation, replacing only 5 % of the energy intake from animal protein for vegetable protein was associated with a 23 % reduced risk of type 2 diabetes[404].

Point goes to plant-based protein.

Cardiovascular health

Cardiovascular diseases such as heart attack or stroke are the number one causes of death and common diseases of civilization that have become increasingly prevalent in the last 40 years.

Animal protein can raise blood cholesterol levels[405],[406], plant-based protein acts neutral, or lowers cholesterol[407],[408],[409]. You can reduce the cardiovascular diseases risk

factors LDL and total cholesterol by replacing animal protein with plant-based protein[410],[411].

Point goes to plant-based protein.

Mortality

The same applies to overall mortality[412],[413]. Consuming less animal protein can be just as effective in prolonging life as reducing the energy supplied by food[414],[415],[416].

People who cover their protein requirements mainly with pulses live longer than average[417],[418], contrasting to people who meet their protein demand mostly from animal sources.

One study following more than 600 000 people over 16 years reported that substituting only 3 % of animal protein for plant protein led to a 10 % reduction in mortality[419]. Another recent meta-study confirmed that substituting plant protein for animal protein is beneficial regarding longevity and mortality[420].

Point goes to plant-based protein.

Climate change

Animals have a poor conversion efficiency of the feed. The result of the pre-digestion of the plant-based protein is an immense loss of energy. Out of 100 calories that the animal eats, only three to eight calories reach us, humans, depending on the animal[421]. The consumption of mainly animal protein results in the massive demand for arable land and fodder and, ultimately, in the deforestation of the rainforest[422].

The demand for animal protein increases greenhouse gas emissions. The production of beef alone is responsible for an incredible 36 % of the greenhouse gas emissions of the entire food sector in the USA[423].

A selection of the many consequences of eating animal protein is deforestation, unprecedented mass extinction of species, waste of fresh water, and pollution of the environment. Human-made destruction happens in such a tremendous magnitude that humans are the reason for the sixth mass extinction on earth, the Anthropocene extinction[424].

Point goes to plant-based protein.

The result

A clear winner: Plant-based protein wins seven to three (one draw).

Now you know how plant-based protein and animal-based protein compare. This knowledge should give you some motivation in advance. However, I also understand if you are insecure about the anabolic potential. After all, this is important for you to build up excellent muscles.

There are three categories in which animal protein scores: digestibility, amino acid composition, and anabolic potential. At a second glance, the differences in these areas become blurred because it is possible to obtain these favorable properties from plant-based protein as well, but without disadvantages for your health, ethics and the environment.

Therefore, with the next three pillars of the HGMM, you will get the three strategies to raise your muscle potential above that of

animal protein, with plant-based protein consumption.

These three strategies will help you move from the insecurity and problems of vegan protein consumption to a diet brimming with nutrients, digestibility, and anabolic power.

These strategies are the consequence of the three comparisons with animal protein, which plant-based protein lost in the last section.

The strategies are:

Pillar four: you adjust the amount of protein.

Pillar five: you improve digestibility.

Pillar six: you complete by combining.

Pillar Four: Adjust The Amount Of Protein

Protein is the prime building material in your body and the building material for your muscles. Proteins are composed of different amino acids that in turn, have various tasks in your body.

All amino acids are essential for the protein structure because if only one is missing, the whole protein cannot be built. Therefore, the EAAs are especially important. You cannot produce them yourself, so you have to take them in with your food. Also, EAAs - especially leucine - have a meaningful, additional function for your muscle

building[425], so you can build muscle efficiently and in the long term.

Through the optimized amount of protein, you support the growth and maintenance of your muscles. To optimize your protein amount efficiently, you need information about the total amount per day, protein per meal and the resulting number of meals in one day.

Amount of essential amino acids

There is knowledge about the theoretically optimal amount of protein. It says that a meal containing about 10 g of EAAs, of which about 2-2.5 g of leucine, provides the maximum anabolic response after eating[426], [427]. Figure 29 and Figure 30 give an overview of EAA and leucine content in popular food items.

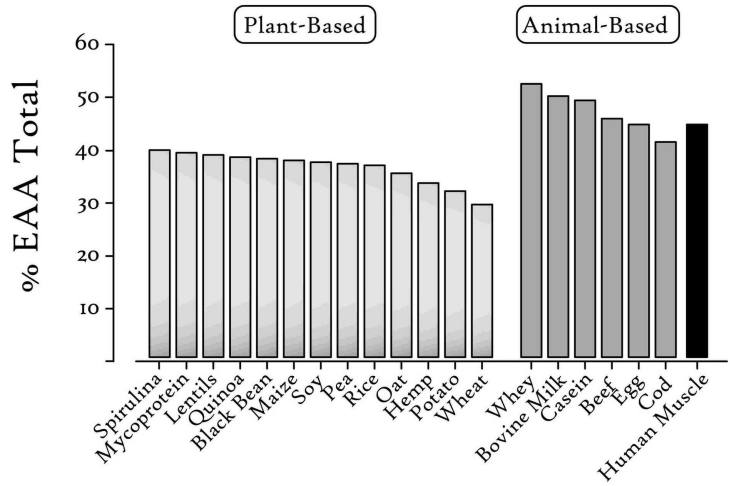

Figure 29 Essential amino acid content of plant- and animal-based food. (Modified after van Vliet et al. 2015, doi: 10.3945/jn.114.204305).

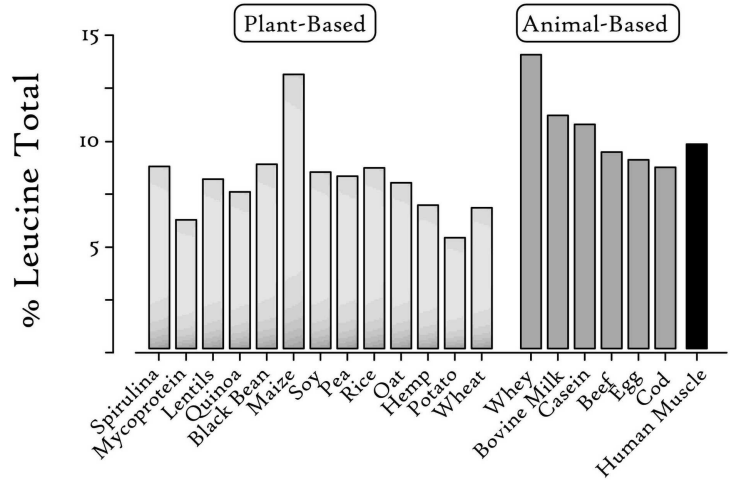

Figure 30 Leucine content of plant- and animal-based food. (Modified after van Vliet et al. 2015, doi: 10.3945/jn.114.204305).

Why Leucine?

Well, this indispensable amino acid plays a central role for our body as a signal to switch to growth[428]. Leucine initiates the assembly process of the muscle growth machinery, the biological complex needed to produce proteins. Once this complex is built, your body can initiate muscle protein synthesis. That is why there is the leucine threshold. A certain amount is necessary to create this complex. Consequently, more leucine does not increase the effect[429],[430].

These above quantities of protein building blocks, 10 g EAAs and 2.5 g leucine, theoretically bring the maximum effect for your muscle building. These values serve as a reference for optimal stimulation of muscle protein synthesis. All right, next chapter.

No, not quite. I do not want to leave it at that. This book and this method should leave you more enlightened and capable of acting than ever before. That's why you will learn all the

background information about the HGMM here and not just get some random facts.

Make differences in the amino acid composition practically disappear

Ultimately, you can achieve these just mentioned amounts of EAAs or leucine with the plant protein you ingest within one meal. To get the critical portion is the prerequisite for you to reach the maximum potential for muscle growth[431]. Animal protein usually contains more of the amino acid leucine. But, this does not necessarily have to be a disadvantage. With the HGMM, we turn this apparent disadvantage into your superpower in a plant-based and natural way!

Total protein quantity is important to reach the threshold value

The required amount of leucine for maximum muscle growth is often called the threshold value. As soon as you hit this point, a domino effect results. Further processes in the metabolism are triggered, which promote the muscle growth[432]. No additional positive change can be determined beyond this

threshold value[433]. That means that as soon as you reach this point, you have eaten out the maximum[434].

What does this have to do with the total amount of plant protein eaten? Well, if it takes 20 to 25 g of animal protein to reach this threshold[435],[436], then you need a little more plant protein to reach this threshold as well.

Imagine you take either little animal or little plant protein in this brief example. With this small amount of added protein, the difference in the amino acid composition gets more pronounced. Then, it is possible that you only get over the leucine threshold with animal protein, but not with the same, small amount of plant protein. But, what happens as soon as you add more protein? Can you make the difference in terms of muscle protein build-up disappear? In addition to that, can you profit through the plant nutrients synergistically contained in the food item?

Researchers could show this in a study when the amount of protein was increased. They looked at how specific amounts of plant and

animal protein affect muscle building. The minimum recommended daily allowance (RDA) according to the WHO and many nutritional societies, give 0.8 g of protein per kilo of body weight per day (g per kg BW per day)[437],[438],[439]. With this RDA of 0.8 g of protein, the researchers observed a difference in potential muscle growth when they compared plant and animal protein.

But more interestingly, they increased the total protein intake from 0.8 to 1.2 grams with the presumed result, which supports the leucine threshold theory: there were no more differences between plant and animal protein regarding muscle building[440],[441].

In numbers, another study determined that vegetarian athletes would need to consume an additional 10 g of protein daily to compensate for the lower content of EAAs compared to omnivorous athletes[442].

An investigation from 2020 confirmed that muscle growth and strength development are similar for soy and whey protein when matched for the leucine content[443].

Figure 31 further illustrates the compensating

effect of increased protein intake on muscle protein synthesis.

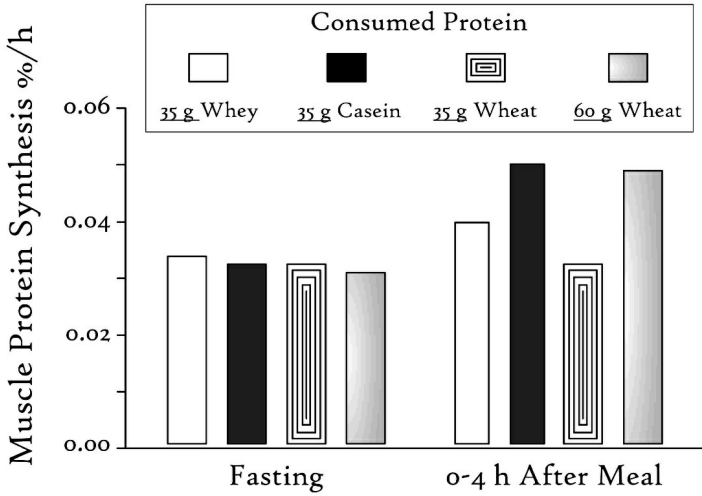

Figure 31 Impact of protein source and quantity on muscle protein synthesis after a meal. An increase in the amount of plant-based protein (wheat) leads to critical improvement of the anabolic potential. It demonstrates that an incomplete amino acid composition can be balanced out by increased protein quantity for a single protein source. (Modified after Gorissen et al. 2018, doi: 10.1017/S002966511700194X).

With HGM, you can take advantage of this fact. As soon as you take in enough protein, the differences in amino acid composition get balanced out. Previously limiting EAAs exceed the minimum and are no longer limiting[444].

The essence is that with a sufficiently high intake of total protein, you can easily reach the threshold for maximum stimulation of muscle building. In the more complex context, this means that the higher your total protein intake, as well as your protein intake within a meal, the less the isolated quality of a single protein source counts in your diet plan.

The recommended amount of total protein

To optimize your muscle growth, the total amount of protein you should take lies in the range of 1.6 g to 2.6 g per kg BW per day[445], [446],[447]. This recommendation is in line with the idea of a range, depending on individual requirements and goals.

The Happy Green Muscle Method could also indicate the range in the manner of an acceptable macronutrient distribution range (AMDR), as defined by the National Academy of Medicine in the USA[448], which recommends a protein intake of 10 % to 35 % of total calories per day.

Protein as a percentage of total daily calories

is more accurate because the total calories you consume are based on your unique body composition, the percentage of fat and muscle mass in your body weight and your physical activity during the day. This information is not included when the protein requirement is given solely based on undifferentiated body weight. Nevertheless, the exact, absolute information per kilogram of body weight is more practical.

Brief exemplary calculation

A man with a bodyweight of 75 kilos consumes an average of 2500 calories per day. He does some exercise three times a week. The AMDR would give a daily protein amount of 61 g (at 10 % of total energy) to 213 g (at 35 % of total energy).

If we take the figure per kilogram of body weight and day, the RDA, then it would be 120 g protein (1.6 g per kg BW) to 195 g protein (at 2.6 g per kg BW).

But, if the 75-kilo man drastically increases his sports workload, his calorie consumption will also increase. Ergo, the amount of

protein per day rises if it is calculated as a percentage according to the AMDR range. Depending on body weight, however, the protein recommendation of the RDA remains the same.

This should show two things:

1. The figure of 1.6 to 2.6 g per kg BW per day is within the range defined by the National Academy of Medicine in the USA;
2. The indication as grams of protein per kg BW is imprecise but more practicable.

It is, therefore, challenging to have a one-size-fits-all solution. That makes sense because everybody functions differently and has different needs.

However, with the specification of 1.6 to 2.6 g, you are optimally positioned to get off to a good start. The more experienced you are with training and muscle growth, the more you will benefit from moving your protein quantity upwards in this range, i.e. towards 2.6 g per kg BW per day.

Why this range? Many institutions recommend these or similar amounts for athletes of many sports. Someone who wants to promote muscle building actively will inevitably arrive in the upper region of the recommended range. Two further reasons are: the increase in fat could be suppressed with protein intake of 1.6 g or higher, and above the 2.6 g per kg BW per day, no additional positive influence on muscle building was observed.

Protein per meal

Since there is always a heated discussion about how much protein per meal we can consume, I would like to devote myself to this topic. You may have heard that more than 20 or 30 g of protein per meal makes no sense because the body would excrete anything above this amount. There is confusion in this statement. As you have just seen, the maximum effect on muscle building is covered by this amount of protein - what the body can absorb is another story.

The percentage of protein that is absorbed is

over 90 %[449],[450],[451] for a typical meal containing 10 to 50 g protein, and the hourly absorption rate fluctuates and changes depending on what else is in the gastrointestinal tract and the source of the protein. For example, protein from a full meal containing fat, fiber and many other ingredients is absorbed more slowly than protein from a protein shake[452]. Protein is absorbed in the small intestine[453]. What remains is fermented in the large intestine by our microbiome[454]. Figure 32 illustrates how the additional intake of either fat or sucrose influences the protein uptake velocity in the small intestine.

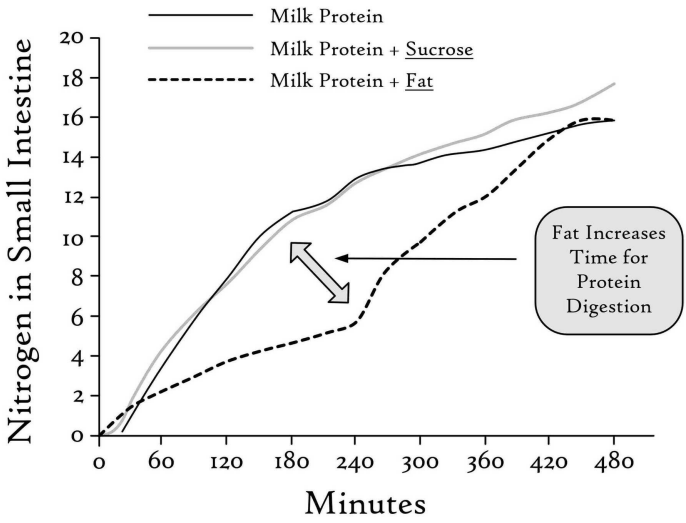

Figure 32 Influence of sucrose and fat intake on digestion of milk protein. Fat increased the time until protein reached the small intestine, compared to sucrose or milk protein alone. The total amount of absorbed amino acids was similar with or without fat. (Modified after Gaudichon et al. 1999, doi: 10.1093/jn/129.4.890).

The question often asked is: can one take too much protein per meal and is the protein then "wasted", i.e. excreted again? Do you simply pee off too much protein? That is not the case. Throughout evolution, your body has developed specific mechanisms that ensure the absorption of the vital nutrient protein.

From an evolutionary point of view alone, anything else would probably have been fatal.

Imagine if, back then, between the cave and the fireplace, you finally got something real and a lot of it between your teeth after a long time. But then, you had to leave a large part of it unused. You would have survived the next fasting period with such difficulty.

So, how does your body do this? Your body refines protein absorption by releasing digestive hormones. These are messenger substances that are released in response to food and individual food components. They regulate your appetite and satiety. Naturally, some of them are released in increased quantities to reduce your appetite and increase your satiety during your meal[455].

Protein ultimately controls the secretion of such hormones as cholecystokinin, thereby slowing down digestive speed[456],[457]: the time that the food pulp stays in your gastrointestinal tract is increased. Your body will have more time to absorb all the protein it has been given, so as not to waste any of this valuable raw material. The hourly absorption rate can be between 5 g and 10 g of protein. The protein from a meal with, for

example, 50 g protein is still absorbed by your body after five hours.

Another fascinating mechanism that ensures that you get all the protein you need from your meal goes through your intestinal roommates, the microbiome. They are also keen on the amino acids, and it is estimated that they can take up about half of your eaten amino acids[458]. This is of course, to your advantage, since their protein-hunger enables them to absorb amino acids for a short time and then rerelease them. Hence, you have a temporary amino acid storage that is spontaneously available when your body needs it[459].

Now that we have cleared that up, back to your optimum. The body avoids waste through sophisticated digestive mechanisms. Therefore, you can take in more protein than the optimal threshold amount for muscle building. With this, I wanted to take away the worry that you are wasting your laboriously chewed protein. Most of the protein is absorbed and serves the supply of your body.

But now, back to the interesting question of

how much protein per meal is optimal to maximize your muscle building.

The amount per meal should break through the threshold

The following applies to the muscle growth triggered by one meal for up to five hours. The intake of:

- 10 g of EAAs including;
- 2.5 g Leucine;

in one meal is optimal for stimulating your muscle building[460],[461],[462].

With these amounts, you reach the threshold that triggers a maximum anabolic response. But, studies are complex, and we humans are complicated. The exact, optimal dose of total protein supplied per meal depends on many factors, such as age, training experience or the amino acid composition in the protein consumed.

Nevertheless, there is a broad range you can implement with the HGMM. Your optimal protein content of a meal in absolute numbers is 20 g to 40 g protein. Depending on the

protein composition, you get the amino acids you need.

Now you know how much protein a day and how much protein per meal is your optimum. The result is the number of meals in one day to push your anabolic metabolic response and thus, the muscle growth to the maximum.

Optimal meal frequency

After we have explored the optimal amount of protein per meal, I will now turn to the question of how many such protein-optimized meals per day would make sense for you.

Through research, we know today that the anabolic effect of a meal decreases again after a few hours. The anabolic effect of amino acids on muscle building lasts for a maximum of three to five hours after the intake of food[463]. Consequently, your meal frequency should be accordingly tight; often and small, before rare and large. Figure 33 shows that peak muscle tissue leucine concentration is already reached two hours after consumption of 40 g of milk protein.

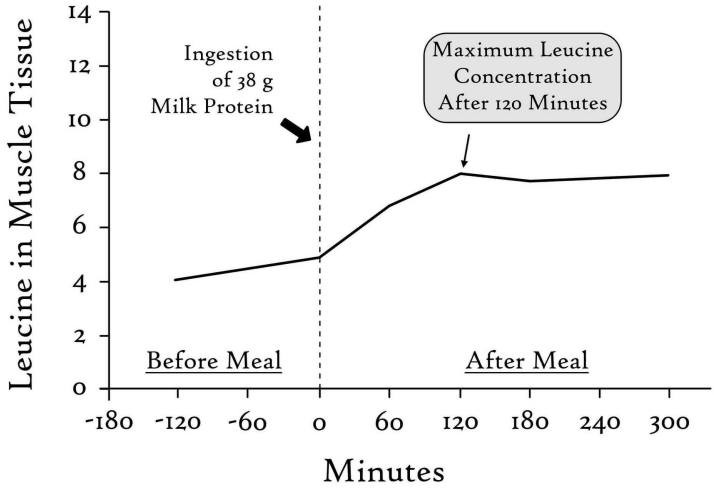

Figure 33 Digestion time and related muscle tissue leucine concentration after milk protein intake. The intake of 38 g of milk protein peaked in leucine concentration two hours after consumption. (Modified after Van Vliet et al. 2019, doi: 10.1152/japplphysiol.00608.2019).

From the domain of weight training, you surely know the following approach based on these findings: athletes eat protein-rich meals frequently, but in smaller portions. That pattern is to keep the supply of protein and amino acids at a constant high level and ensure that the anabolic response after eating is triggered as often as possible.

Applied studies have also confirmed this. In one study, the researchers observed two

interesting groups. In one group of the study, participants got protein mostly in the evening, but less over the day. The other group of the study participants, however, got protein evenly distributed over all meals. The volunteer guinea pigs with the protein evenly distributed over morning, noon and evening showed a better muscle effect than the other group. When the protein was evenly distributed throughout the day, the muscle synthesis was increased by 30 %, as depicted in Figure 34. The muscle synthesis directly after the high-protein breakfast was even 40 % higher than in the group with low-protein breakfast[464].

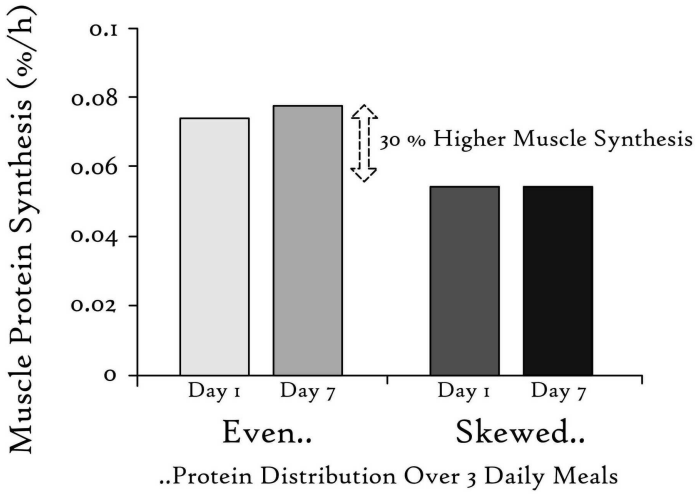

Figure 34 Comparison of the effect of even or skewed protein meal distribution on muscle protein synthesis. Even protein distribution over three daily meals led to higher muscle synthesis than low-protein breakfast and high-protein dinner. For even distribution, the breakfast contained 30 g of protein; for skewed distribution, it had 10 g of protein. (Modified after Mamerow et al. 2014, doi: 10.3945/jn.113.19880).

The study provides additional, practical insight for you. Interestingly enough, many people, perhaps including you, actually consume most of the protein in the evening. In the morning, however, people generally eat little protein. According to the study, this alone has excellent potential.

An image that many athletes have in mind is

the disintegrating muscle. The fear that all progress and muscle growth will disappear after a meal that is omitted or low in protein. Like the balloon after a needle sting. It is certainly not quite so drastic. The body has sufficient buffer mechanisms to compensate for daily fluctuations, as you can see in the example of the absorption and release of amino acids by your intestinal microbiome. But, even a buffer is exhausted at some point, especially if you do not consume enough protein with the required amino acid composition. You do not need to go crazy over a meal. For success, the majority of your meals should simply balance the constant anabolic and catabolic processes.

At intervals of four hours

So, your protein intake is at best evenly distributed throughout the day and structured to trigger a positive, anabolic response as often as possible. Theoretically, the measurable anabolic response after a meal lasts 3-5 h[465],[466]. The classic meal distribution of breakfast, lunch and dinner means consuming less frequent meals with

more protein per meal. If you want to maximize the anabolic effect of protein after meals, you should do it differently than the classic and consume a full meal with sufficient protein every 3-4 h[467].

For practical or personal reasons, you might also prefer another rhythm, like every 4-5 hours. For example, you could then consume three large main meals a day and crunch two delicious snacks.

Example calculation!

Finally, I will show you a sample calculation to illustrate the meal distribution.

A woman with 80 kg of body weight decides for a total protein intake of 1.8 g per kg BW per day. Thus, she aims for an optimized protein intake of 144 g per day. From the daily plan, it fits her best if there are four meals.

That could then be four meals with 36 g of protein each. With an interval of four hours per meal, it is very feasible for her to distribute this number of meals over the day.

Now, she has an optimal approximation for

every day, without having to record individual steps with a stopwatch and calculator. This division is established once and thus guarantees a constant availability of required amino acids in the future.

Of course, the total amount of protein per meal does not necessarily tell how much EAAs and leucine are contained. Assuming that the meals described here have protein from various plant sources, you can be sure that you will reach the thresholds for EAAs (10 g) and leucine (2.5 g) in this way. I will explain the planning and optimization of the individual meals in more detail below in the section System Protein Optimization.

Prelude: Antinutrients

Antinutrients are an important topic to understand the evaluation of plant foods, especially plant protein sources. This knowledge allows you to optimize your protein consumption and thus, your muscle growth. The facts about antinutrients finally lead to the fifth pillar of the HGMM - the improved protein digestibility.

Problems with antinutrients?

Natural plant foods that should be used frequently in the vegan diet, such as lenses or linseed, are high in secondary plant metabolites. Some of these substances are called antinutrients because they can reduce digestibility. Among other things, because of these plant substances, vegan is often mentioned in one go with terms like

malnutrition or unhealthy, particularly if it concerns children or pregnant women.

What are these antinutrients anyway?

Antinutrients are nothing more than phytochemicals or secondary plant metabolites that are found in the plant cell. As such, they perform vital tasks in the plant. They help, for example, to store nutrients in the seed[468], so that the seed can immediately pick from an embarrassment of riches when it sprouts and establish a new plantlet. Some of these plant substances also prevent predators from destroying the precious seed and thus wiping out the offspring[469].

Antinutrients are pro

These plant substances are therefore rather pro than anti; pro life, for example. The neutral term "secondary plant metabolites" would represent this group of substances more appropriately, following their valuable role in nature.

Secondary plant metabolites are concentrated in seeds of all kinds because that is where

they do their job. Thus, they are contained in pulses, cereal grains or other botanical seeds. As soon as the seed germinates, the secondary plant metabolites release the nutrients. This power enables the plant embryo to grow up from the seed coat and become a small seedling.

The "anti" results from this biological function of the substance group in the seed. What these substances do in the seed, they also do in your stomach - if you let them[470]. These secondary plant substances can also bind nutrients in the digestive tract. What helps in the seed to provide many nutrients at the right time can hinder the absorption of nutrients in our body.

Phytic acid embraces phosphorus

One example is phytic acid. It is the phosphorus storage of the plant embryo in seeds. Phytic acid is converted by germination; hence the embryo can use the mineral phosphorus. Without germination, the plant metabolite does what it is supposed to do: it binds to nutrients. Phytic acid can

also cling to minerals in our body, just as it was its handy ability in seeds. In the seed, therefore, it releases minerals that it has clasped. In us, it can bind minerals such as calcium, magnesium, iron or zinc, if we do not prepare the food properly[471]. The action of phytic acid is illustrated in Figure 35.

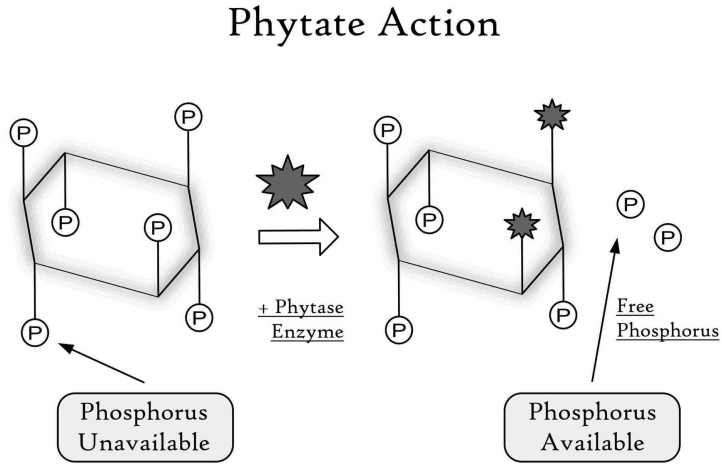

Figure 35 Phytate binds phosphate. Phytate or phytic acid releases phosphorus upon reaction with the enzyme phytase. During germination, the seed mobilizes phosphate through phytase activity to grow.

What other substances are there and what are they doing?

Important plant substances that may play a

role in your diet are[472],[473],[474]:

- Phytic acids are found in cereal grains and oilseeds;
- Polyphenols in pulses;
- Glucosinolates in mustard and canola;
- Protease, trypsin and amylase inhibitors are found in pulses, for example.

Many secondary plant metabolites have a similar predisposition. They can sabotage your digestion by hindering the absorption of nutrients such as amino acids and minerals. Some, such as protease inhibitors, can interfere with the breakdown of protein[475].

All these substances have the potential to interfere with your digestion and food intake. But, despite everything that is said and written about them, it is not a big problem. The body is a wonder of nature and almost always manages to get what it needs. It might look different when you crunch one kilo of raw beans. But, who is going to get it down, who does that anyway?

You may have already thought about it, but we both take it not as a problem, but as an

opportunity: it is an opportunity to further optimize your intake of nutrients and protein for your muscle building. In the following pillar five, we will take a closer look at how you can turn the potentially detrimental effects of secondary plant metabolites into a stable pillar of your diet.

Already, when I write this, it feels as if I am doing these phytochemicals wrong. Plant food is healthy, very healthy even, and these "anti" nutrients have a considerable share in it. This benefit is so striking that they are called "guardians of our health" elsewhere[476].

Even if these substances can have a specific restrictive effect on you, there are countless studies and evidence of their benefit for us humans. In other words, secondary plant metabolites are associated with mass health benefits. They regulate your blood sugar, have an antioxidant effect (okay, that's anti), improve your blood lipid levels or reduce your risk of certain cancers[477],[478]. Figure 36 depicts the cholesterol lowering effect researchers observed in a feeding experiment

with lupin protein.

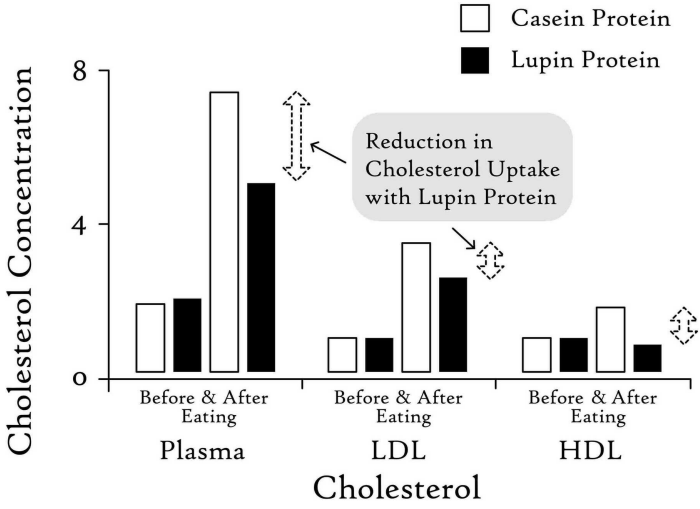

Figure 36 Impact of two different protein sources with different phytate levels on blood cholesterol concentration of pigs. Lupin protein with a higher content of phytate lowered blood cholesterol after four weeks of a cholesterol-rich diet. Phytate decreased cholesterol cell-uptake. (Modified after Radtke et al. 2014, doi: 10.1186/1743-7075-11-9).

Irony or what?

Secondary plant metabolites are often referred to as antinutrients, especially in the context of an examination of plant-based nutrition. However, they are healthy for humans and vital for the plant. If prepared incorrectly and in an unfavorable dose, they

can reduce the availability of nutrients for us, but also, secondary plant metabolites have many beneficial properties for humans. Only secondary plant metabolites make vegetables and fruit so healthy for us. Some researchers even ask the question: is there such a thing as antinutrients at all[479]?

The legitimate question is: if these substances are so anti and so bad, why aren't vegetables unhealthy? Why aren’t all vegans, who eat on average more vegetables and grains, as you can see in Figure 37, unhealthier? You can already see from this: no matter how "anti" the secondary plant substances are sometimes represented, the net effect of these vegetable foods is positive.

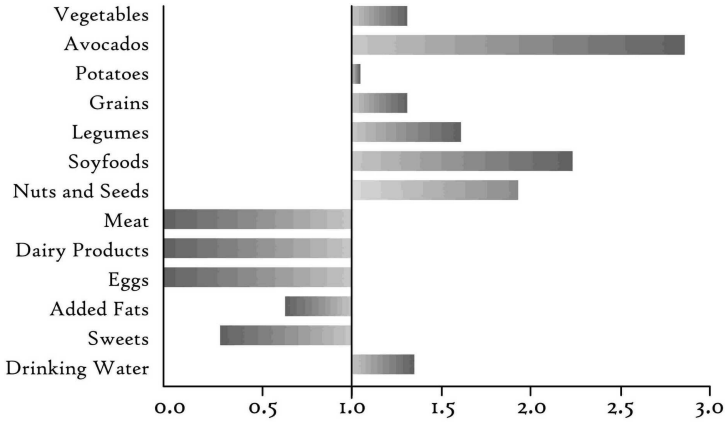

Figure 37 Relative quantities of consumed food groups by vegans compared to omnivores. (Modified after Orlich et al. 2014, doi: 10.1017/S000711451400261X).

It is so self-explanatory. Natural seeds, cereal grains or pulses are the backbone of a healthy, plant-based diet and should even be so in any diet. I just feel strange writing this. But that's where it's gotten to today, with the hysteria surrounding certain nutritional issues. Almost all people eat too little pulses, seeds and whole-grains. Nearly as many know about the "dangers" lurking in such foods. Is there a causal connection? I don't think that this information about antinutrients

is the reason for this unfavorable shift in diet. But these reports and information certainly do not contribute to improving the diet of the general population.

I take all this information and channel it into your HGMM. Even though secondary plant metabolites can be detrimental to your nutrient uptake, there are, as you will see in the pillar, plenty of ways to contain these properties. Using these methods, you will get the unbridled power of the plant nutrients.

Effect of antinutrients on protein digestibility

Digestibility refers to the ratio of amino acids taken up by the body in relation to those ingested in total with the diet.

Animal protein sources generally have a high digestibility of over 90 %[480], meaning that the body absorbs 90 % of the amino acids eaten from the animal food pulp. Untreated, plant-based protein sources such as corn, oats, beans, peas or potatoes range in digestibility from 45 % to 90 %[481],[482],[483]. Thus, on average, less amino acids are

absorbed by plant protein.

This reduced digestibility of plant protein sources depends, among other things, on the presence of antinutrients. As just seen, these can hinder the digestion and absorption of the protein. These individual substances can have the following effects on protein digestion:

- Trypsin inhibitors reduce protease activity and thus prevent the digestion and absorption of protein[484].
- Amylase inhibitors inhibit digestive enzymes that break down starch[485]; this prevents the absorption of simple sugars and other complexes formed with protein by the body[486].
- Tannins have a high affinity to the amino acids proline and histidine[487], which means they bind them preferentially and prevent a smooth absorption. They also inhibit digestive enzymes and bind other minerals such as zinc or iron[488].
- Lectins form complexes with proteins, proteases and amylases and can thus hinder protein degradation or facilitate autoimmune reactions[489],[490].

That way, all these substances can - the emphasis is on *can* - sabotage your protein intake. All these inhibitory properties refer to untreated, uncooked food. It's up to you whether protein and amino acids swim past you or whether you grab them. After all, you can do a lot for smooth absorption of the most critical macronutrient for muscle building through preparation.

With the right preparation, you have a significant impact on your plant protein sources and your digestion[491]. Or you use food where this has already happened. If you remove the antinutrients, these foods will have digestibility values up to 90 %, similar to those of animal protein sources[492].

Pillar Five: Digestibility

One of the three points that animal protein could win in the eleven-point competition against plant protein was digestibility. Wholesome plant foods naturally have a high content of secondary plant metabolites that can hinder digestion. I want to empower you to compensate for this disadvantage of plant protein, and that is why there is pillar five of HGMM. Here, you can learn how to increase the digestibility of plant protein in everyday life.

How to improve digestibility

This topic is no reason to go without pulses, grains or seeds. That would not be in the sense of optimal, plant-based nutrition for your muscle growth.

In addition to a high protein content of some,

plant-based food groups offer many other advantages. They have a high nutrient content and an abundance of fiber. Legumes combine so many benefits for you and your health that the consequence of regular consumption is a prolonged life expectancy through a significantly lower risk of cancer[493] and other diseases[494]. For whole-grains, there is clear evidence that they protect against colon cancer[495].

So, it is not reckless to consume pulses like soy and beans or whole-grains like wheat or rye. It is rather careless not to eat them. Unfortunately, the latter is the tenor, because very few people consume them at all or enough of them. In Europe, Asia and North America, the consumption of pulses is far below the recommendations; the same is true for whole-grain cereals for all parts of the world, as depicted in Figure 38[496].

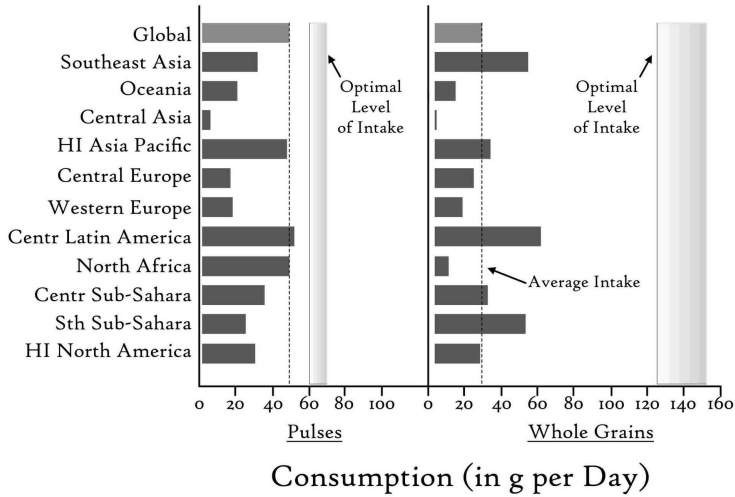

Figure 38 Consumption of pulses and whole grains in different parts of the world. Many regions do not consume the recommended minimum of pulses and whole grains. (Modified after GBD Diet Collaborators 2019, doi: 10.1016/S0140-6736(19)30041-8).

Enough with the praises. Now, what can you practically do to push digestion, protein intake, nutrient absorption and ultimately your muscle building even more?

Preparation is the key

This pillar focusses on the preparation of plant-based and protein-rich foods. With the following simple tricks, you can eliminate secondary plant metabolites or prevent them

from developing their inhibitory effect.

These tricks are soaking, germinating, boiling, and fermenting. Many people use these practical methods quite naturally integrated into their everyday life. Who eats pulses uncooked and bites their teeth out in the process? On the other hand, if someone has had a stomach ache after eating raw, ground beans for whatever reason, they would now know why. With these methods, you make the inhibitors harmless.

Soaking and cooking

Soaking and cooking is something that many already do when preparing pulses or cereal grains. It reduces the activity or occurrence of all inhibiting phytochemicals[497].

Since phytic acid is water-soluble, it diffuses to a large extent into the water in which the food is soaked or becomes inactivated[498],[499]. After soaking or cooking, you should, therefore, pour away the water with the dissolved secondary plant metabolites and not use it again. In order not to extract more minerals from the soaked food than

necessary, because these are also dissolved in the water, you can boil the grain or pulses in the soaking water if you then discard it.

The great thing about this method is that you not only reduce the content of the inhibiting plant substances, but you also improve some other nutrient content.

Soaking and boiling increased the total content of EAAs in chickpea[500] and kidney bean[501]. Studies show that the digestibility of many grains and seeds can be doubled by this treatment[502]. Additionally, boiling consistently reduced the content of trypsin inhibitors, tannins, saponins and phytic acid in other cereals and legumes[503],[504]. Figure 39 illustrates the effect of soaking and cooking on trypsin inhibitor activity.

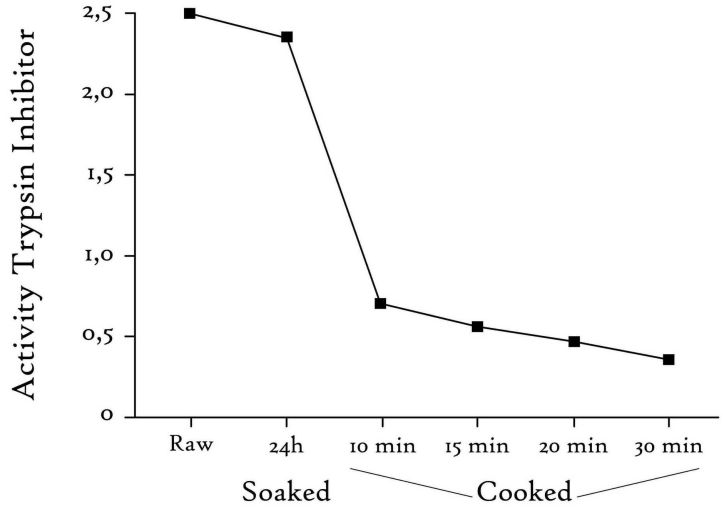

Figure 39 Effect of food preparation on trypsin inhibitor activity. The combination of soaking and cooking is effective. (Data from Wang et al. 2003, doi: 10.1002/jsfa.1531).

Remember, for your implementation: the combination of soaking and cooking works better than each step on its own. Cooking previously soaked or even germinated seeds ultimately inactivates most secondary metabolites.

The practical question is: how do you get soaked pulses?

You can do this in two ways: soak it yourself or buy it soaked.

If you buy ready-soaked beans or other pulses, they are usually pre-cooked and in a liquid in a glass or can. So, they are already perfectly prepared. Buying ready-soaked beans is faster, but it is also a lot more expensive. Soaked and ready-to-eat is for many pulses three to five times costlier than buying dry pulses, depending on the offer. So, how do you do it yourself? It is quite simple:

- For soaking, you need enough water; the grains or beans rise very much and need space and water. Depending on the quantity, there should be enough water over it.
- At best, you soak them overnight. Twelve hours are optimal - a few hours less should not be a problem. The bigger the seed, the longer. Lentils or grains usually need a few hours. Chickpeas or broad beans are best left overnight.
- For soaking, simply cover the vessel with a plate, lid or cloth. It is good if there is still some air coming in.
- The next day, you boil the seeds in the

soaking water. The soaking and boiling water is poured away only afterwards.

What should be soaked?

- All pulses: beans, peas, lentils, chickpeas;
- Cereals: whole-grains, i.e. whole, unprocessed grains;
- You don't have to soak peeled grains or any processed products. By peeling and sieving, the husk and all the plant substances that inhibit growth were already removed.
- Seeds: linseeds, chia seeds, sunflower seeds and so on;
- Nuts: almonds, cashews and so on.

<u>Let germinate</u>

Another tool that fundamentally enhances your food is germination. It is the continuation of the natural processes after soaking if you do not interrupt them by cooking. Germination not only prevents the digestion inhibiting processes in us, but it also makes any seed the superfood par excellence for us.

Because:

1. Through the activity of enzymes, protein compounds are broken down during soaking and germination, making more soluble proteins available for plant growth[505].
2. After a few days of germination, the protein digestibility of beans was at a substantially higher level than before[506]. Germination can, in addition to raising the protein content, also increase the content of vitamin B, as well as the bioavailability of iron and calcium[507].
3. Germination releases minerals[508], certain amino acids[509] and vitamins[510], for example through activity of the phytase enzyme and concomitant degradation of phytic acid, as shown in Figure 40.
4. You shift the ratio of nutrients to energy by germination to your maximum advantage. During the germination process, energy-containing starch is digested in the

seed and used by the embryo for growth. Since starch usually makes up about 80 % of the seed, it loses quite a lot of energy or calories[511]. The bottom line is, that more nutrients in proportion to energy remain for you.

Germination means more minerals, more vitamins, more amino acids and at the same time, fewer calories[512]! Germination is an exceptional tool on your way to vegan optimized muscle building.

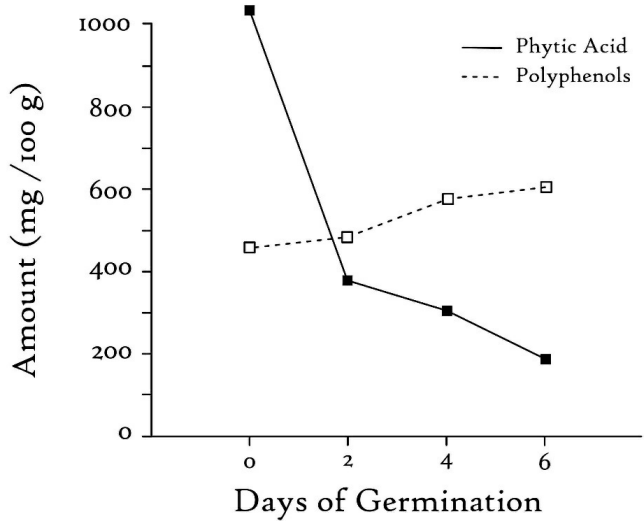

Figure 40 Effect of germination on plant metabolites phytic acid and polyphenols. Germination reduces the content of phytic acid. (Data from Sokrab et al. 2012, doi:

10.1016/j.jssas.2012.02.002).

How do you get germinated pulses, seeds and grains?

Soak the seed long enough for germination and then let it germinate; just like growing a plant, only without soil.

The principle is, you imitate nature. Water is the launch signal, similar to when you soak it. Afterwards, give the seed less water and more oxygen, in the dark, with time and without letting it dry out.

- If you soak for germination, a maximum of twelve hours in the water is recommended. Beyond this time, the germination capacity may decrease again.
- Pour off the water, because from now on the seed also needs oxygen. It must not dry out completely. This phase is the critical one, where you need some tact. Therefore, moisten it in the morning and evening or rinse it carefully and drain it again. With the right germination system, this is simple.
- Usually, it takes three to five days until they are ready to eat, depending on the type

of seed and how big you want the seedlings to be.

- What do you do with the seedling then? It's simple, just eat it! It's best fresh, and without heating, then all the nutrients are preserved. For example, you can use it in salads, smoothies or as a topping for all kinds of things.
- For storage, put them in a bowl in the refrigerator, where they should keep for a few days.

There are different methods. You can simply use a bowl or special germination jars or vessels. If you plan to germinate it regularly, I would recommend the latter.

What can you germinate?

In principle, you can germinate anything that has matured on a plant - even lentils. Any bean should be able to grow if you buy them dry. Just try it out! You can use all seeds, as long as they are untreated and clean.

Fermentation

Fermentation is another miracle application

that you should use regularly. Not only does it increase digestibility, but with fermentation, you increase the value of the food at every level. Here are some samples of what fermentation can do:

- Fermentation means the refinement of food by microorganisms such as bacteria, molds or yeasts. These microorganisms form enzymes, which in turn hydrolyze, i.e. break down, food components. This hydrolysis helps to break down antinutrients, such as phytic acid. Figure 41 illustrates the effect of fermentation on nutrient availability.
- The content of amino acids like isoleucine, methionine or cysteine can also be increased by fermentation[513]. In corn, fermentation increased the content of the EAAs histidine, isoleucine, leucine and lysine. The amount of the amino acids methionine, cysteine, tyrosine and phenylalanine were also increased by up to 3.5 g per 100 g protein. After treatment, the value of the most limiting amino acid increased from 72 % to 84 %[514] in one

trial.

- Fermentation increased the following parameters in corn: digestibility from 76.6 % to 86.8 % and protein quality from 55 % to 83 %. In rice, researchers were able to show that the protein content doubled after fermentation (with *Saccharomyces* ssp.)[515]. The increase in protein was contributed by the yeast biomass, which supplemented the amino acid lysine, which is the limiting amino acid in rice, as well as methionine and tryptophan. B vitamins such as B1, B2 and B6 were also enriched and phosphate bioavailability improved by fermentation with yeast.
- In the manufacture of tempeh, a popular soy-based protein source, soaking, peeling, boiling and fermenting reduced the trypsin content from 120000 units per g to 250 units per g[516].

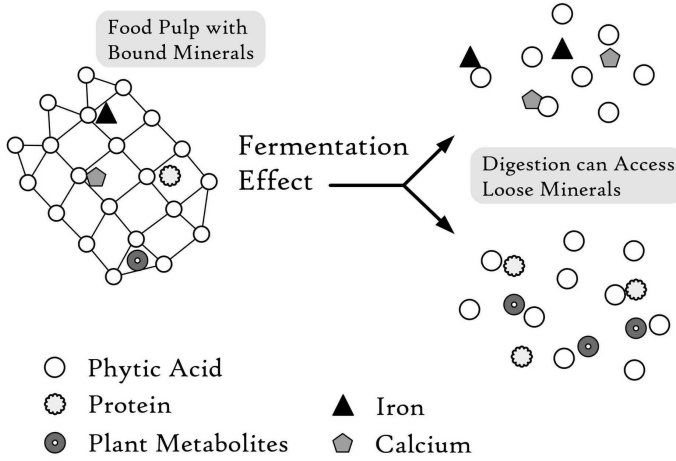

Figure 41 Effect of fermentation on nutrient availability. Fermentation breaks molecular bonds and renders higher availability to nutrients like protein, iron, or calcium. (Modified after Nkhata et al. 2018, doi: 10.1002/fsn3.846).

The same applies to fermentation as to soaking and germination. You can do it yourself or buy fermented food. Do-it-yourself is cheaper and possibly more natural and - with a little practice - as delicious as you would like it to be.

Since the fermentation process is different depending on the dish and the food and the description would be quite complicated, I'll leave this out. The topic fermentation could fill a book. My two tips for you here:

1. Try fermented foods or add the ones you know more often to your diet. These are, for example, tempeh, natto or sourdough bread.
2. Try fermenting yourself: lacto-fermented vegetables, vinegar making, kombucha to homemade tempeh and sauerkraut.

Tricks and tips for even better nutrient absorption

Tips and tricks are always welcome. That's why I have these for you too. These are quick wins that will take the digestibility to a new level and thus your success in vegan muscle building.

- *Consume vitamin C with your meal*. Ascorbic acid, for example, facilitates the absorption of iron, by reducing Fe^{3+} to the more soluble Fe^{2+}, the form required for transport in mucosal cells for absorption[517], [518].
- *Avoid tea and coffee before meals, after meals and especially at mealtimes*. It can be challenging if you are used to it. But, every

habit can be broken just as well. Substances such as tannins in coffee and tea can interfere with your digestion and therefore the absorption of nutrients.

- *You can use foods that no longer contain secondary plant metabolites, such as processed protein powders.* The disadvantage is that these foods are highly processed and therefore do not have much good stuff except plant protein. In individual cases, however, such a plant protein boost can be useful. For example, under lack of time or on the way from A to B, especially around workout time. By the separation of the antinutrients, protein sources such as soy protein isolate, pea protein concentrate, or wheat gluten reach digestibility values over 90 %, comparable to many animal protein sources[519]. You get a similar effect with the correct preparation of unprocessed plant protein sources.

Plant and animal digestibility en par

As you can see, you can achieve a great deal through the correct preparation of cereal

grains, pulses, nuts and seeds. The steps listed above are effective on their own; the combination of measures joins the advantages for you.

By these steps, the circulated disadvantages of vegan nutrition by secondary plant metabolites or antinutrients are reduced or completely switched off. Thus, plant and animal foods resemble themselves regarding antinutrients after this step and exhibit a comparable digestibility.

All in all, I can therefore always recommend soaking pulses, grains and seeds at least and to cook them depending on the food to improve the quality. Figure 42 shows how different treatment methods increase protein digestibility in pulses.

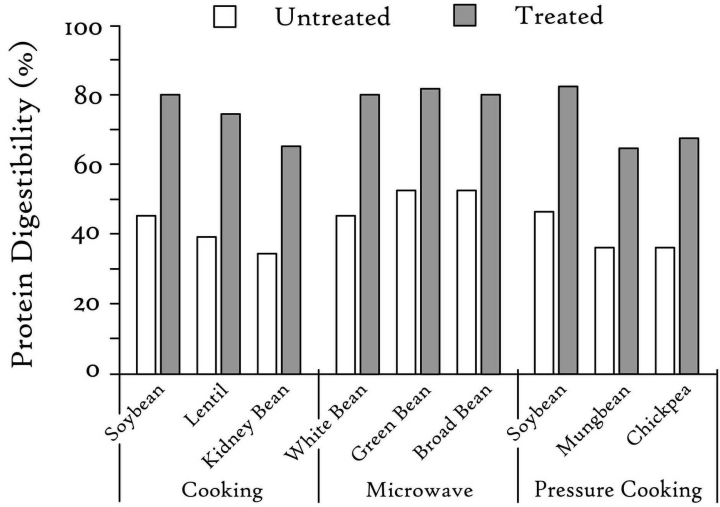

Figure 42 Impact of the preparation methods cooking, microwaving, and pressure cooking on protein digestibility. All treatments significantly increased the protein digestibility of the tested pulses. (Data from Drulyte and Orlien 2019, doi: 10.3390/foods8060224).

Prelude: Protein Evaluation

To evaluate protein, people have thought about what a good protein must be able to do. In the end, this can be reduced to two things. Your adequate protein should:

1. be easily digestible and absorbable;
2. have the individual amino acids in the right amounts as you need them to live.

Until here you have learned what it is about digestibility. In the end, this always means how much of the original material you have retained; how much of it has been absorbed into your blood. Many factors play a role in how you digest food. These factors include almost everything in and around food. Secondary plant metabolites, as well as macro and micronutrients, are essential

parameters in determining digestibility. You can see this from how secondary plant metabolites can influence the digestion of food and thus the digestion of protein.

How we get to the evaluation of protein and a single index like 0.89 or 1.09 as protein quality, you can see below. But, before we get that far, we need the second important factor in quality, besides digestibility: the amino acid composition.

What is the amino acid composition of a protein?

As you have heard above, protein consists of single amino acids. Every food that contains protein, which is the case with all natural foods, also has amino acids.

The decisive point for the evaluation of protein quality is how many of the nine EAAs are present in the food, more precisely, what quantity of each amino acid is present. If many of the EAAs are included in proportion, then the protein has good cards for an excellent rating. If, on the other hand, there are only a few of the urgently needed amino

acids that your body cannot produce itself, the rating will be worse.

How do you get to the evaluation of the protein quality?

The calculation of protein quality is possible via the two key figures digestibility and amino acid composition. After all, what's the point if the protein has a good composition, but you can't absorb it? Or what is the point if you can absorb 99 % of the protein you eat but do not have enough of all the amino acids to build protein from it? One figure is not worth much without the other. Only a combination can evaluate protein stably.

For the calculation, both key figures are packed into a formula and then a number comes out at the back. We don't go too deep with that, because that would be too much at this point. That way you know what we are talking about and you have something to look up if you want to go deeper.

The quality of the protein is given in numbers - the Digestible Indispensable Amino Acid Score (DIAAS). A DIAAS of 1.0 means that

all EAAs are present. A score below 1.0 means that at least one EAA is not enough, which in that case is called the limiting amino acid. Figure 43 indicates that cooked beans have a higher total protein content than milk but contain relatively less sulfur amino acids. Hence, sulfur containing amino acids are most limiting and determine a DIAAS below 1.0 in beans.

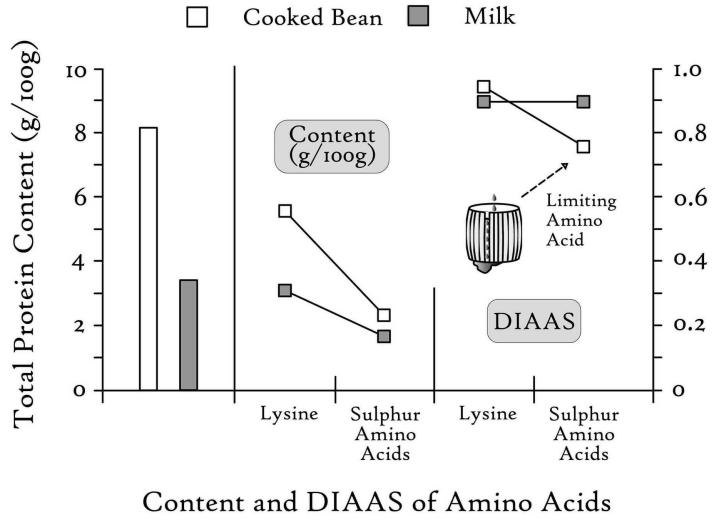

Figure 43 Comparison of bean and milk protein for total protein content, amino acid content, and digestible indispensable amino acid score (DIAAS). Cooked beans contain more total protein and amino acids lysine, cysteine, and methionine than milk protein. But concerning other contained amino acids, bean protein possesses less methionine and cysteine than necessary for a complete

amino acid composition. Hence methionine and cysteine are most limiting for protein synthesis and decisive for calculating the DIAAS. (Data from Ciuris et al. 2019, doi: 10.3390/nu11123016).

Why not measure muscle gain directly?

Practically, measuring the influence of protein on the muscles would be more vivid and direct than number calculation. A good or "successful" protein intake should result in measurable muscle maintenance and muscle growth. This way, researchers can even see how different proteins and amino acids affect the human body. They measure strength gain, which is measured, for example, utilizing a handshake. But does the handshake give you information about protein quality? Not really.

The person whose handshake was measured could simply have had a bad day, had an excellent breakfast or a hangover from yesterday. Each time the handshake would be different, but not because of the source of protein he ate before. In this case, what does it mean to have eaten before? Should the researchers then feed the people for two weeks only with this one protein source and isolate them entirely from everyday life?

Sport would indeed also falsify the result. These thoughts go on and on and are very familiar to researchers in the field of nutrition and many other life sciences. A good study design can compensate for some variables. Others make little sense.

Measuring something like the handshake is somewhat indirect. It, of course, does not give direct proof that more protein has been built into the muscles. But, how can you measure that?

Isotopes would be one possibility. You mark parts of the eaten protein and can then, as in the transillumination of a puzzle, see where the radioactive elements go, into the muscle or out of the body. This method of measuring muscle protein composition directly via radioactive isotopes is complex and expensive. It is also not practicable. For these reasons, there is the determination of the protein quality via DIAAS.

However, the protein quality does not directly indicate the anabolic potential, i.e. the potential to directly help you build muscle, but rather provides an estimate of your

theoretical amino acid requirements. It is primarily a matter of preventing a deficiency.

With this simple number, which DIAAS describes, you know what to do. For example, you know that a high rating in numbers means nothing more than good building material. Even if you only eat this one source of protein, the number tells you how likely it is that you can cover your amino acid needs with it alone.

Despite this benefit, they are theoretical values. We have no better methods to measure this directly on every human body, so we take these numbers. They make our lives easier for covering the basic need of protein. But, they do not tell us everything about the anabolic potential for muscle building.

All that glitters is not gold

To this theoretical figure, should we subdue our entire eating habits and life? What does DIAAS consist of again? Amino acid composition and digestibility. Is that all that makes your body build muscles? No,

certainly not. It is an essential prerequisite, but not all it needs.

Everything is relative. Finally, both numbers are only an attempt to describe the body or nature and to find an approximation for it. Since your body is wonderfully complex and sophisticated, we are still miles away from an error-free description.

Therefore, my suggestion: we optimize your nutrition with the HGMM based on this basic scientific knowledge but keep it practical and flexible for you. In the end, you will get a diet that is most promising for you and your muscles in the long run. More about this in the upcoming pillar six.

Pillar Six: Combination

The food combination plays a decisive role in plant-based protein. On one hand, there are foods with a lot of lysine but little methionine. On the other hand, there are foods with little lysine but a lot of methionine[520]. Figure 44 and Figure 45 show lysine and methionine contents for popular foods. What could be more evident than to optimize protein in the diet by combining? First, let's take a look at what combination does for you.

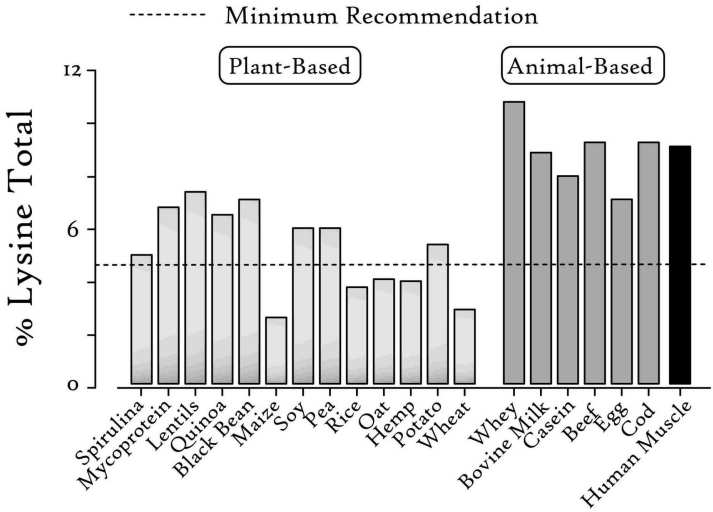

Figure 44 Lysine content of plant- and animal-based food. (Modified after van Vliet et al. 2015, doi: 10.3945/jn.114.204305).

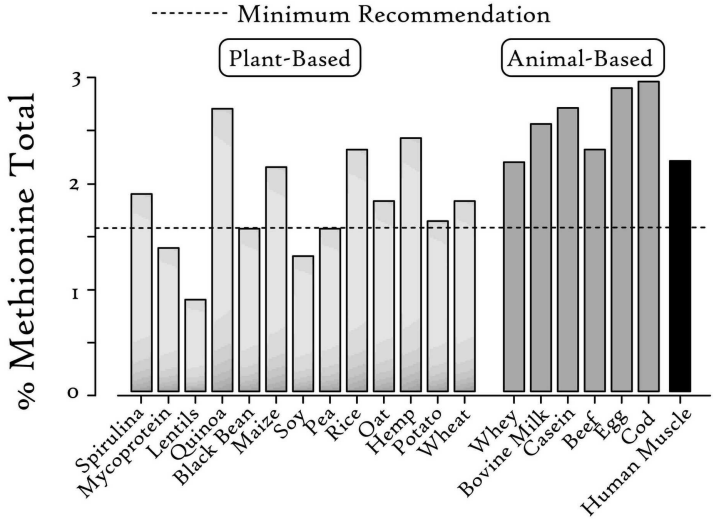

Figure 45 Methionine content of plant- and animal-based food. (Modified after van Vliet et al. 2015, doi: 10.3945/jn.114.204305).

Protein combinations to improve the amino acid composition

As soon as you take up too little of only one essential amino acid, other amino acids that should be used together with the missing one for the muscle build-up cannot be used. At that moment, not all the amino acid building blocks are available in your body. The amino acids that are available at this moment but in isolation, are therefore used for other purposes or end up in oxidation, i.e. breakdown[521]. For reference, find some popular protein powders with their most limiting amino acids and corresponding DIAAS values in Figure 46.

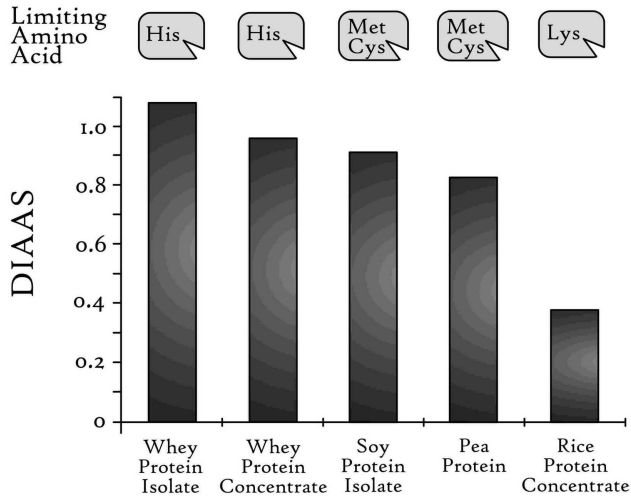

Figure 46 Digestible indispensable amino acid score (DIAAS) and limiting amino acids of whey, soy, pea, and rice protein. For legumes like soy and pea, the sulfur-containing amino acids methionine (met) and cysteine (cys) are limiting. For cereals like rice, lysine (lys) is often limiting, for whey histidine (his). (Data from Phillips et al. 2016, doi: 10.1186/s12986-016-0124-8).

This fact is often used as a justification for calling plant protein inferior or inadequate. Due to these very connections, many people believe that it is not possible to eat plant food for muscle building. This is not true, as you will see in a moment. Because: we combine! We combine automatically throughout the day by eating different foods, and we combine in the HGMM to optimize your

muscle growth.

Combination of which protein sources

Plant protein usually has a lower content of leucine and less EAAs than animal protein, as you have seen in the competition of plant versus animal protein above. Less EAAs does not mean that plant protein is not suitable for being healthy or building muscle. What do the muscle loaded horses, buffalos or gorillas eat again all year round? We all know that.

An important point that goes missing when considering the "plant protein source" in isolation is the synergistic effect that combined protein sources have. The combination means the complementary supplementation of protein sources with less of a particular amino acid by another protein source that has more of precisely this amino acid in relation. By combining two "low quality" plant protein sources, a complete meal is created, with a complete composition of EAAs. In terms of amino acid composition, this meal now has a very similar anabolic potential to a single animal protein

with a complete amino acid composition. Figure 47 visualizes how combinations of cereals and legumes increase the DIAAS.

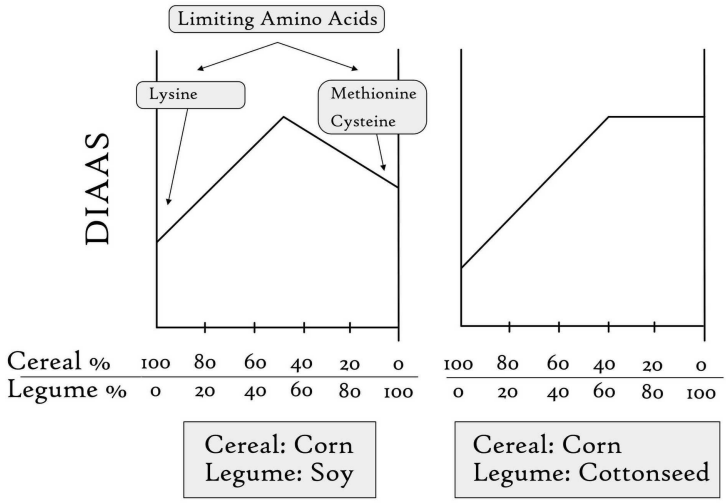

Figure 47 Complementary protein combination with cereals and legumes. Combination complements amino acid composition and increases the digestible indispensable amino acid score. (Modified after Young et al. 1994, doi: 10.1093/ajcn/59.5.1203S).

As you can see, the theoretical evaluation of protein should be treated with caution. After all, why should you be concerned about the protein quality of wheat with a DIAAS of 0.48[522] when you eat eight other plant protein sources in addition to wheat during the day?

Differentiate protein combination for health or muscle building

This point is crucial for the discussion of the benefits and especially for the practical action. The question is usually whether the protein sources all need to be combined in one meal. The assumption that this has to be done to be able to live healthy on a plant-based diet is firmly in the heads of many humans - and it is wrong.

One can live a healthy vegan lifestyle by combining all necessary amino acids over a whole day. Rice in the morning, bread at noon and tofu in the evening are therefore entirely sufficient. Now comes the “but”. That applies, however, only when we want to be supplied optimally with amino acids healthwise. Health is imperative, especially concerning plant-based nutrition. Even beyond health, it is important to explain these facts to people, because eating habits have far-reaching consequences, also for the environment and the animals.

We both want to take care of your health. But, we want to go an extra mile to make

your muscles grow optimally. The point is the temporary storage of the EAAs in the muscles. I assume you want to keep your muscles. In that case, you don't have an expendable store of amino acids like fat in fat cells and carbohydrates in liver and muscles. Amino acids are frequently being integrated into the muscles or removed from them again. I am sure you do not want to extract more amino acids than necessary from your muscles.

If you eat only rice as a source of protein in the morning and at noon, it can mean that you would be missing some lysine almost all day until dinner. However, your body compensates for this by drawing lysine from elsewhere - exactly where you don't want to be without it, in the anabolic processes for your muscle building. In the end, you are perfectly healthy if you eat a lysine-rich meal in the evening. However, your muscle building potential can be reduced and anything but optimized.

If your meals do not always provide enough EAAs at all times, the missing ones will be

deducted from the muscles and any anabolic processes. Such an eating plan is not unhealthy, but unfavorable for maximum muscle growth. It would mean a sufficient supply of amino acids in general and throughout the day, but not full potential for muscle building.

So, what is the consequence for your practice? You can make a big step forward in breast and bicep circumference if you make sure to eat a complete amino acid composition at every meal.

How to combine in practice

What foods should you eat to combine your amino acids into the perfect protein? The answer is to combine foods that have less of one amino acid and more of another. If you combine these foods cleverly, you cover all the EAAs.

In the next section, "System Protein Optimization", I have translated these facts into practical meal planning for you.

Sequel: Systematic Protein Optimization

With a smart meal plan, you can optimize the protein composition throughout the day, as well as the amount of protein. Mainly foods from the categories grains, pulses and high-protein foods are responsible for your amount of protein and the composition of your protein.

To get a complete amino acid composition, you need the combination of at least two of the three categories throughout the day. If you are looking to optimize for vegan muscle growth, these combinations will take place within one meal.

Listed systematically, possible optimal days for sufficient amino acid combinations throughout the day, which would guarantee you optimal health, could look like shown in Table 2.

Table 2 Potential meal compositions for optimal amino acid supply within one day.

	Day 1	**Day 2**
Meal 1	Grains + Legumes + High-Protein Food	Grains + Legumes
Meal 2	Grains + High-Protein Food	Grains + Legumes
Meal 3	Legumes	Grains + Legumes
	Day 3	**Day 4**
Meal 1	Legumes + High-Protein Food	Grains
Meal 2	Cereals + High-Protein Food	Legumes
Meal 3	Grains	High-Protein Food
	Day 5	**Day 6**
Meal 1	Grains	Grains
Meal 2	Legumes	High-Protein Food
Meal 3	Grains	Grains

If you want to optimize in the best possible way, are a passionate sportsman and want to get the most out of it for your muscle, days one, two and three are especially optimized according to the amino acid composition in each meal. There, you even combine within meals.

Of course, you can also optimize your protein supply with other protein sources like the categories seeds or nuts. These do not make up the lion's share, because they are incredibly energy-dense, but they can help you to create variety and will surely aid your health.

Examples of traditional food combinations known from different cultures demonstrate that such food strategies were essential for surviving. You can find, for example, rice and soy (Asia) or rice and peas (South America or Africa). Even in cultivation, ancient civilizations such as in Mexico have implemented this principle and cultivated pumpkin, corn, and bean together as the "Three Sisters". The bond between these food items and humans was so strong that researchers speak of a co-evolution[523].

Speaking of food categories, the following foods from the listed categories are highly recommended.

Natural foods in the protein-rich food categories

You should master most of your diet with natural foods. Unprocessed food will not only give you the benefit of extreme nutrient density and high-quality protein, but also long-lasting energy and satiety, more health and wellbeing. For reference, have a look at the loss of nutrients from wholemeal to refined flour in Figure 48.

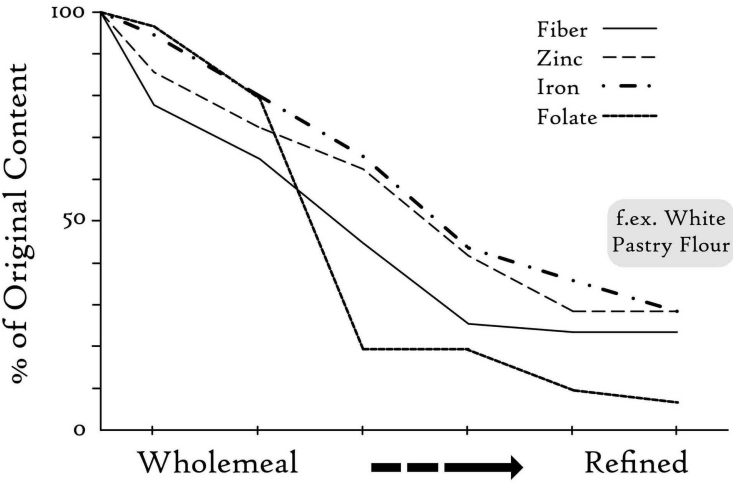

Figure 48 Impact of food processing on the mineral content of wheat flour. The content of most minerals and vitamins declines considerably with increasing flour processing. (Data from Slavin et al. 2000, doi: 10.1080/10408690091189176).

In the following, you will find a selection of whole foods for inspiration which does not

claim to be complete. I have also added recommended oils, as there are often misunderstandings with the selection of fat sources. You should prefer the listed oils due to their excellent fatty acid composition. They contain a beneficial ratio of omega-3 to omega-6 fatty acids or, like olive oil, lots of monounsaturated fatty acids, which are beneficial to health[524].

Cereals and pseudo-cereals plus others - complement the amino acid methionine[525]

Amaranth, bread, buckwheat, bulgur, spelt, barley, green spelt, oat grain, oat flake, oat bran, millet, crispbread, corn, quinoa, pasta al dente, pumpernickel, brown rice, wild rice, rye, wheat, seitan (gluten).

Remark: pseudo-cereals like amaranth, buckwheat or quinoa have higher lysine content than true cereals[526], most of the time, also higher leucine content. That is why you can use pseudo-cereals somewhat interchangeably between the categories cereals and legumes in terms of amino acid complementation[527].

Legumes - complement the amino acid lysine[528],[529]

French beans, broad beans, fava beans, spotted beans, kidney beans, lima beans, mungo beans, pinto beans, red beans, white beans, black beans, quail beans, peas, chickpeas, beluga lentils, yellow lentils, red lentils, black lentils, brown lentils, bean pasta, lentils pasta, sweet lupin.

High-protein foods - mostly complete amino acid composition of soy-based food, since soy has a DIAAS of 0.91 to 1.0[530],[531],[532]

Soy chips, soy curd, tempeh, textured soy, natural tofu, smoked tofu, silk tofu, tofu.

Nuts and seeds - complementary for variety, taste and health

Cashew, chia, peanut, pumpkin seed, linseed, almonds, olives, brazil nut, pecan, sesame, sunflower, walnut.

Oils - improve your Omega-3 to Omega-6 ratio

Hemp, linseed, olive, rapeseed.

Do not forget to eat plenty of veg and fruit! The vegan superpower comes as well from the fact that vegans eat much more veggies and fruits, supplying them with generous amounts of vitamins and phytonutrients.

Five meal templates optimized for maximum anabolic muscle response

Here, you get five meal configurations which already have optimal content of EAAs and leucine, using combinations of the food items listed above. You can use these as templates and basis for your meal planning. After this section with the five templates, I will show you how to design a protein bowl from scratch. But first, let's have a look at the templates.

As in the sample calculation for the optimal protein per meal in pillar four "Protein Amount", the meal templates are designed for at least 10 g EAAs including 2.5 g leucine. Depending on the amino acid content of the proteins used, the protein quantity usually settles at over 30 g per meal.

In terms of calories, the templates thus play out in the range of 310 to 620 calories. Since with this you have already covered all the protein you need for maximum anabolic response, the rest is up to you. Want a smaller meal with less energy? Then you're almost done. Do you want to put 700, 800 or even 1000 calories into your meal because of your meal frequency over the day? No problem. Just add appropriate amounts of the original ingredients or other foods.

Very important: these are templates; they provide you with the basis for planning your meal. The primary goal is to optimize the protein. Of course, you have already covered a lot of minerals with them, because they are "real" and mostly unprocessed food. Nevertheless, you should supplement the templates with plenty of fresh ingredients such as vegetables and fruit as well as seeds and nuts, according to your preferences. Through this variation and variety, you will get all the nutrients you need in total. More about that in the next section, when we design a protein bowl together.

Here are the templates:

---

100 g Kidney beans (dry weight)
200 g Corn drained

Example dish: *Chili sin carne*

427 kcal
30 g Protein
2.7 g Leucine
15.4 g EAAs

-

80 g Red lentils (dry weight)
100 g Pasta (dry weight)

Example dish: *lentils Bolognese*

543 kcal
32 g Protein
2.6 g Leucine
16.1 g EAAs

-

40 g Oats (dry weight)
40 g Quinoa (dry weight)
20 g Linseed
80 g Wheat germ

Example dish: *overnight oats*

620 kcal
36 g Protein
2.4 g Leucine
17.6 g EAAs

-

100 g White beans (dry weight)
80 g Amaranth (dry weight)

Example dish: *white beans in tomato sauce on amaranth*

559 kcal
32 g Protein
2.5 g Leucine
16.2 g EAAs

-

50 g Seitan / Wheat Gluten
100 g Peas (dry weight)

Example dish: *fried pan dish*

484 kcal
64 g Protein
4.2 g Leucine
25.7 g EAAs

Data source for templates: The Federal Food Key (Bundeslebensmittelschlüssel) of the German Federal Ministry of Food and Agriculture. It is a database for the nutrient content of almost 15,000 foods available on the market, developed as a standard tool for evaluating nutritional epidemiological studies and consumption surveys in the Federal Republic of Germany.

I am well aware that availability and preferences of food and meals vastly differ between continents, countries and even

regions. Thus, I tried to use most universal food items with the highest EAA and leucine contents as well as above-average nutrient content.

Without a doubt, you could call most of the food items listed here "superfood", as both the nutrient to calorie ratio and the content of individual beneficial substances are high. Linseeds, for example, are very high in lignans and ALA, the precursor of essential omega-3 fatty acids DHA and EPA. Whole-grains and pulses like lentils supply you with vast amounts of minerals like iron, zinc or potassium, or fibers.

However, if some ingredient is not your pair of shoes or too expensive or not available, exchange it for a similar item from the same category. The nutritional outcome will most likely be very similar. It is all about the system and combinations, not so much about the very sole item.

Creation of a simple, optimized protein bowl

Now, let's take a look at a typical protein

bowl, which you can make quickly and at your whim. Such simple dishes can be an essential pillar of your daily diet because you don't need to plan it out and can do whatever you feel like doing.

I found that many people are entirely dependent on recipes and the idea of a particular dish. They only know beans and maize as an ingredient of chili, but if tomatoes - as one ingredient of chili sin carne - are not in their fridge, they do not use the beans and maize because they are dish- or recipe-focused.

I want to inspire you to see that you do not need a delimited kind of dish to use food items or the ingredients listed in the five templates. I gave you a well-known example dish for each of the templates, but you can use the ingredients freely for anything you want. If it is your taste, make a soup out of it, a savory cake or put it in a mixer - make a paste out of it and put it on your sandwich, anything which suits you.

Bowl starting point protein

Back to bowling. Protein is usually the best starting point because it is essential for your vegan muscle dominance. Oftentimes, after choosing the sources of protein, a pattern is already established that will serve you as inspiration for the rest of your meal. The same applies to the five templates before. You can make chili sin carne out of beans and maize, but you could also use them for many other dishes.

For this purpose, we use grains and pulses for the bowl today; we choose wild rice and chickpeas. I already have humus in the back of my mind, which is made from chickpeas. We also have a taste for garlic today.

For the extra protein, we use a high-protein food. You might as well cover all the protein with grains and pulses. In our bowl today, we want to have a little more protein. That's why we choose tofu.

As you can see in the food categories, besides cereal grains, pulses and high-protein foods, there are still nuts, seeds and oils that you can use. Once you start, the choice will be more natural. If you know what you want, you

might as well fix it already. Since we want to make hummus out of the chickpeas, I recommend some sesame and a dash of linseed oil for the dressing.

As simple as that, we have ticked off the protein and optimized it. That way, you also optimize EAAs and leucine, if you use the given amounts in the templates.

The first intermediate result, what you now have on your plate:

- complex carbohydrates for long-lasting energy (wild rice and chickpeas);
- abundant plant-based protein with a complete amino acid composition (rice, chickpeas, tofu and sesame);
- the full package of minerals, such as potassium, calcium, iron or magnesium (sesame, chickpeas, wild rice);
- omega-3 fats (linseed oil).

Although you have already put together a banging' nutrient package here, there is more to come because there are still vegetables missing.

Now comes the green

Take what your heart desires! With vegetables, you make your meal colorful, juicy and tasty. It's best if you have a few different colors and something green. We still have yellow peppers, cucumber, baby spinach, tomatoes and broccoli in the fridge. So, why not? The principle of a bowl is freshness and flexibility. Fresh, natural foods usually go together, unless your personal preferences don't match. In this case, however, this selection harmonizes perfectly for us. We will eat most of it raw.

Now, you have three different colors on your plate: yellow (peppers), green (spinach and broccoli) and red (tomatoes), alongside a variety of vitamins, minerals and secondary plant metabolites. Finally, it goes to the spice and the binding.

Sauce, seasoning, binding

If you are a bowl beginner, some things may sound a little dry. One reason for that perception again might be your conditioning for classic recipes. Most of the time,

however, this is done by itself during the meal, because many ingredients are naturally quite juicy. If you want to create even more harmony and juiciness, you can make a delicious dressing or sauce. Use fresh herbs, dips and ingredients as you like and make your meal perfect!

Just a few single seeds, nuts or chopped herbs or a few dashes of dressing or lemon can have a beautiful effect. Today, we already have hummus made from chickpeas, sesame, garlic and linseed oil. But a tasty and light dressing made of apple cider vinegar, olive oil, fresh parsley and lemon fits over almost any vegetable and is delicious.

For a personal thrill, we also choose sauerkraut from the side dish and spice corner. We are totally into sauerkraut right now. No idea why, but we love it at the moment, especially since we discovered that organic sauerkraut is available from the jar and you can eat right out of it - delicious! Our bowl gets a generous tablespoon of sauerkraut. As you can see, you can playfully pick out what you are most in the mood for at

the moment and leave all conventions aside.

Let's take a look at how your bowl looks like in the end:

- You have wild rice, topped with fried tofu and a handsome heap of hummus.
- As another warm component besides the rice, you have some pieces of broccoli; accompanied by a salad of baby spinach leaves.
- Peppers, tomatoes and cucumber simply find their place in between on the bowl.
- A dressing of apple cider vinegar, olive oil, fresh parsley and lemon harmonizes the vegetables and the spinach.
- A good tablespoon of sauerkraut provides the additional acid and taste thrill.

And there goes the bowl!

Now, we have a ready meal, full of taste explosions from simple ingredients, with minimal effort - virtually created from nothing, at least recipe-wise. Everything is completely covered, your protein is optimized; macro- and micronutrients are

sufficiently available since we followed the rainbow.

Even though you probably won't find it on any menu in the world, this meal will suit your preferences and creativity: the best prerequisite for your food to taste good and for you to rock your vegan muscle growth.

Meal preparation

Still, it may sound like a lot if you are not a born chef, and you may be thinking that it will take a long time. But, I can promise you: after you have gone through this procedure a few times, the whole thing will become more natural and playfully fast. The cost-benefit ratio is maximally advantageous.

The preparation of the individual components of your bowl is relatively straightforward:

1. You prepare the wild rice according to the instructions until it is cooked;
2. You can soak and cook the chickpeas yourself or buy them ready-prepared. Puree them, adding sesame seeds, garlic and a little linseed oil. You may also add some water to make it fluffier;

3. Fry the tofu in a little oil until it is brown. Do not use hemp or linseed oil in the pan, since long-chain fatty acids like omega-3 are more heat-sensitive;
4. At the same time, you can blanch the broccoli until it is not quite raw anymore, but still very firm to bite;
5. Wash and chop the spinach, cucumber, tomato and peppers;
6. Mix the dressing of apple vinegar, olive oil, lemon juice and parsley in no time. You can even use it to decorate your plate or bowl.

Ingredients that are suitable for storage, such as rice, chickpeas or hummus, you can prepare and pre-cook in batch and freeze them or put them in the fridge and use it for several days in a row.

To reach your target amount of protein per day or meal, it makes sense to calculate the ingredients and the macros. Once you have done this, you already know how it works. Do this for some of your favorite meals, and you have a reliable, always-at-hand supply of

vegan meals that perfectly supports your muscle growth.

Soy to lose your manhood or get sick

I have to add one or two words about soy since it is included in the bowl as tofu and the vegan go-to protein source of many. Soy is arguably the best plant-based protein source on earth. Compared to other pulses, which already have a high protein content, soybeans bring you even more protein, with protein contents of up to 35 % or even 40 %, depending on cultivar and growing conditions[533].

It is the only legume providing significant amounts of the omega-3 fatty acid ALA[534]. And it is not only the amount of protein in soy, which makes it a perfect protein supplier. Also, the composition and digestibility of soy amino acids are unique in legumes and plants[535].

However, I know many people do not want to eat soy. What a shame! Of course, everybody has their reason, and it might be the taste or a diagnosed soy allergy, where the former is a

personal preference and none of my business, the latter is a physiological condition, and the typical treatment is the avoidance of that allergen. But, there are many other arguments people use against soy, which are not accurate or twisted. To make it easier for you, here you have a shortlist of arguments against soy and what they are really about.

Soy leads to feminization and decreased fertility

Many people argue that the contained phytohormones, the isoflavones, reduce testosterone in the body, disturb hormone balance and lead to feminization and even impotence in men and impairment of fertility in both genders.

Isoflavones are similar in structure to human sex hormones from the group of estrogens and androgens. That structural kinship is why isoflavones are also called phytoestrogens.

These claims' origin lies in experiments with rats fed very high doses of isolated phytoestrogens and in experiments with in-vitro cell cultures[536],[537],[538]. Treatment with

isolated isoflavone compounds resulted in concentrations far above the levels that you can achieve through everyday diet and consumption of the whole food soy[539].

If you look at studies in humans, you will find a different result. Men with average soy consumption were not found to have increased estrogen levels. Also, that soy reduces testosterone was not observed[540]. In women, soy could even increase fertility[541].

One meta-analysis confirmed the previously stated and reported that soy protein intake up to 60 g per day - which is approximately 800 g of tofu - did not lead to testosterone alterations[542]. To put it in the words of a 2020 meta-study that examined 38 clinical trials on the effect of soy in humans: "no effects of soy or isoflavones on testosterone or estrogen levels in men were noted[543]."

Isoflavones are harmless about unfavorable changes in hormone levels. Not only that, isoflavones are considered to be extremely healthy. For example, these flavonoids can reduce unfavorable LDL and total cholesterol in the blood[544],[545] and thus the risk of

atherosclerosis.

Soy is unhealthy

Some say, soy is just unhealthy and avoid it for this spongy reason. But, there is no scientific basis for this claim. Contrarily, there is good evidence that the consumption of soy reduces the risk of prostate and breast cancers[546],[547],[548]. This could be reflected in a lower breast cancer rate in Asian countries. There, the preventive effect of soy and isoflavones by a reduced breast cancer risk might be epidemiologically tangible because many Asians regularly consume soy products with isoflavones[549].

Even with diagnosed breast cancer soy is safe, as the American Institute for Cancer Research states[550]. Soy is even said to have a beneficial effect on the course of the disease. Daily consumption of soy products, for example, improved the prognosis and recurrence after a breast cancer diagnosis[551], [552],[553],[554],[555], as illustrated in Figure 49.

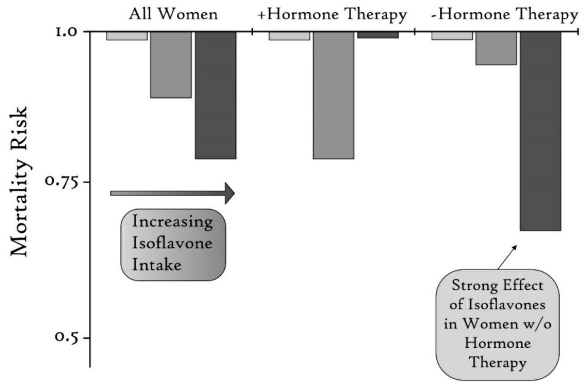

Figure 49 Impact of isoflavone intake on all-cause mortality in women with breast cancer. Isoflavones can reduce the mortality risk in women with breast cancer. Women not receiving hormonal treatment showed the most substantial risk reduction upon isoflavone intake. (Data from Zhang et al. 2017, doi: 10.1002/cncr.30615).

Moreover, soy and its bioactive properties can improve blood lipid profiles and enhance cardiovascular health[556].

Because of soy, the rain forest is cut down

Some also blame soy for the deforestation of the rainforests. That is true for now. Large parts of the rainforest in South America had to give way to soy fields. But, the reason is not the direct consumption of soy by humans, but the use of soy as animal feed.

As you have seen above in the section “Animal versus Plant Protein”, feeding animals is very inefficient. In the end, only three to eight percent of the calories or protein of the fed soy reach us, humans, via the resulting animal product[557]. Furthermore, only a fraction of the cultivated soy is consumed directly by humans. In Europe, for example, only 0.7 % of the soy is used for direct consumption[558]. In the end, this means that meat consumption is responsible for the immense demand for feed and soy.

I am sometimes allergic to misinformation, and soy is such a case. If there is indeed a medically confirmed soy allergy, it makes sense to avoid soy. Studies have shown that this affects an average of 0.3 % of the population[559]. If you are one of these 333 people, then you can maintain your muscles very well without soy. Otherwise, soy is something like your noble joker, which can almost guarantee your success.

In the short term, the higher leucine content in whey can lead to more robust muscle protein synthesis than soy. However, in the

long term, a meta investigation, including nine studies that ran longer than six weeks, could not find any differences in the effect on lean body mass between whey and soy protein[560].

Prelude: Carbohydrates And Fat

You've heard a lot about protein; now, I add the other two macronutrients: carbohydrates and fat. Here, you get the background for the next pillar, the exact nutrient timing. The necessary information about these macros will help you to create a healthy, protein-rich and plant-based diet.

Carbohydrates provide your energy

Unlike proteins, carbohydrates are not built into your body as a building material. The most important function of carbohydrates in the body is to provide energy. Carbohydrates are the fuel for your brain and muscles.

The smallest carbohydrate building block,

dextrose, technically called glucose, plays a central role. Glucose is used by the brain and muscles to produce energy. Pure glucose can be quickly converted into energy by the body and brain, hence, glucose is often used as a sweet for a weak circulation or the emergency treatment for hypoglycemia in diabetes patients.

Glucose is vital for the energy supply of your muscles. Without glucose, except in the particular case when your body is already adjusted to hunger metabolism and ketone bodies[561], you have no energy for your workout.

Carbohydrates are nothing more than individual or linked glucose particles

Carbohydrates are usually ingested through foods such as bread, potatoes or rice, which are rich in starch. Starch is a large molecule made up of many small glucose particles. In starch, the small glucose particles are woven together like patches in a larger carpet. Hundreds to thousands of glucose patches make up the starch carpet. Most

carbohydrates are made up of many small building blocks, just like proteins.

During digestion, enzymes break down starch into its glucose particles and make them available to you. This digestion process even begins in your mouth, through your digestive enzymes in your saliva. You have probably noticed that if you chew a piece of bread for a long time, it becomes sweeter and sweeter. That experienced sweetness is the glucose that is released from the starch.

Already here, an essential point for your practice becomes clear. If you eat food with a lot of sugar or more easily digestible carbohydrates than starch, glucose will also reach the bloodstream faster. With these processed carbohydrates, there are no or fewer connections of individual glucose patches, which your body has to break down. Glucose is immediately accessible because fewer glucose particles are connected to form a unit, more like single and shorter pieces and strands of fabric and less like a whole carpet.

The result is that the sugar in the blood rises fast, and insulin is released quickly and

forcefully. That sharp spike in blood sugar and insulin is why these carbohydrates are called "simple" because they are less chained together, and "fast" because they are digested more quickly. Figure 50 illustrates the different effects of simple and complex carbohydrates on blood glucose and insulin levels.

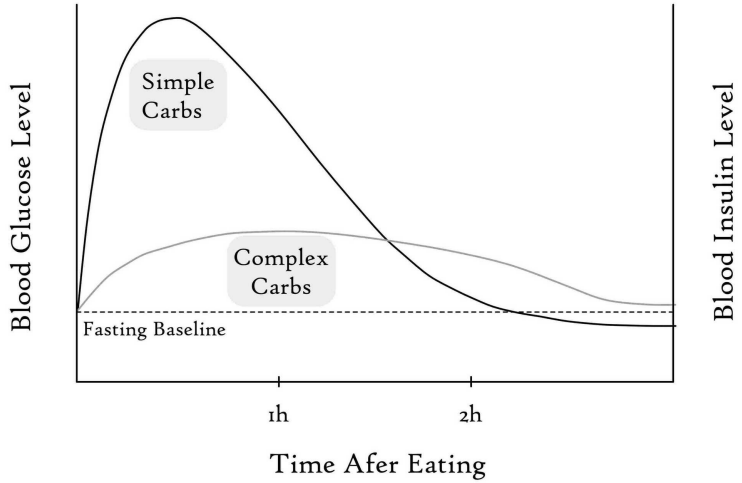

Figure 50 Impact of simple and complex carbohydrates on blood glucose and insulin levels. Simple carbohydrates lead to a sharp and brief spike in blood sugar and insulin. On the contrary, with complex carbohydrates, the body releases less blood sugar and insulin at once but spread over a more extended period. (Modified after Carneiro et al. 2020, doi: 10.3390/nu12102989).

You can take advantage of the rapid digestibility of simple carbohydrates for nutrient timing, as you will see in a moment.

You can store carbohydrates

During storage, it works exactly the opposite way as during digestion. As you digest carbohydrates, your body separates larger starch molecules into individual glucose particles. When your body has more glucose than it needs for energy, it stores glucose by building its own storage molecule. This starch-like form of glucose storage that the body creates itself to keep, is called glycogen. Let's look at the above example again for a plastic view.

Your body weaves a glycogen carpet from individual glucose patches from food, which it can roll up and store easily. The carpet is stored in your two main glycogen stores, the liver and the muscles.

The liver and muscles are capable of absorbing glycogen and using it as needed or rereleasing it. Therefore, you are not permanently dependent on eating

carbohydrates to have energy. Even if you don't eat carbohydrates for several hours, the glucose is remobilized from the glycogen in your liver, released into the blood and transported to your brain. Your body de-weaves the self-made glycogen carpet back into individual glucose patches that your organs can use.

However, this storage does not last forever and varies from person to person. On average, you can store one pound of glycogen, one-fifth of it in the liver, the rest in the muscles. If you no longer consume carbohydrates through food, your body's storage capacity is sufficient for about 24 h[562],[563]. If you do a lot of sport during this time and your muscles need a lot of energy, it can also go faster.

You have four grams of sugar in your blood

As soon as your brain or muscles need glucose, it is taken from your blood. It is vital that your blood sugar level, i.e. how much glucose is in your blood, is within a tight range. Otherwise, there can be unpleasant

health consequences, such as demonstrated by accompanying symptoms of diabetes - extreme weight loss, poor concentration, nervousness, confusion or unconsciousness[564],[565].

There are almost exactly four grams of glucose in your bloodstream at any given time. If there are more than four grams, it can damage your body. If it is less, organs like your brain can no longer live on it, and your circulation becomes unstable. The hormones glucagon (acts catabolic) and insulin (acts anabolic) are involved in this sophisticated mechanism that keeps the blood sugar level as constant as possible.

Insulin stores, glucagon mobilizes

As soon as you use up a lot of glucose, your blood glucose level drops. Your body is alarmed and needs to replenish. To do so, it releases the hormone glucagon. Glucagon has a catabolic effect, breaking down glucose storage in muscle and liver and releasing glucose into your bloodstream. The result: your blood glucose level returns to the

notorious four grams.

For your body to have access to this reservoir, there must, of course, be something in the storage. Insulin is mainly responsible for the storage of glucose from the blood into the cells. Insulin opens the gates that lead into the cells, which allows glucose and other substances such as amino acids to migrate into the cells.

With optimal nutrient timing, you want to make use of this storage function of insulin and take advantage of it at the decisive moment. Insulin not only acts on the storage of sugar but also helps other substances such as amino acids or nutrients to enter the cells. Before I come to the practical application of timing, let's take a look at the macronutrient fat for a moment.

Fats provide building material

The best-known function of fat in the body is probably to store energy. If you take in more energy in the form of calories than you currently need, this energy can be stored as fat in your fat tissues. When required, this

energy can be released from the fat tissues.

Your fat reservoir

There are different types of fatty tissue. The best known are the subcutaneous under the skin, the visceral around the organs or the brown fat tissue. Increased fat deposits are usually found on the abdomen in men, and often around the thighs and buttocks in women[566].

The visceral one is not visible at first, but a typical picture is a kind of bloated belly, where the fat is not tangible from the outside. A body shape with a high percentage of visceral abdominal fat resembles the shape of an apple. The visceral fat is the “dangerous” fat because it accumulates inside the abdomen and fattens the liver, for example. Brown fat is your best friend; infants and children have a lot of it[567]. It fulfils useful metabolic functions; for example, it increases energy metabolism. As you can see from this example, the fat deposits are much more than idle storage.

Fat is also an essential carrier for nutrients

such as fat-soluble vitamins. Without fat, it would be harder for you to absorb vitamin A, D, E or K. Like protein, fat is a building material in the body. As a component of the cell walls, fatty acids enable the cells to delimit themselves through their membrane, just like a controllable filter that only lets certain things in and out. Your brain consists of about 60 % fat[568]. If even your control center consists of so much fat, then fat must be essential for you.

Saturated and unsaturated

As with protein, it is not only the quantity but also the quality of the fat that matters. There are saturated fats, monounsaturated fats and polyunsaturated fats. Why these fats are divided into these classes, I do not want to go into detail here. The different role of these fats for your health and wellbeing is more critical:

- For the function of your cells, it makes a difference whether saturated or unsaturated fats are available for incorporation. Short-chain and unsaturated fats are more flexible

and allow cells to function differently than saturated, mostly animal fats[569];

- Trans fats are unhealthy. They occur in products of ruminant animals, such as cows, sheep, goats and camels or result from too strong heating or industrial processing of unsaturated, vegetable fatty acids[570];
- Saturated fats in our diet mostly originate from animal foods. Besides trans fats, you should also take a critical look at saturated fats.

Externally, you can distinguish saturated and unsaturated fats mostly by their condition at room temperature - at least everywhere where room temperatures are below 24°C. You will find foods with predominantly saturated fats in solid form, just like butter, lard or coconut fat.

Vegetable oils are liquid. They contain mainly unsaturated fats. Exceptions are industrially processed products and some plant-based fats such as coconut or palm fat. Some kinds of margarine, for example, advertise with a high proportion of unsaturated vegetable fats and at the same

time spread muse. Here, the natural, liquid state of the unsaturated fats was solidified by mechanical processes or additives.

Now, you have the basis for the effect of these macronutrients in nutrient timing.

Pillar Seven: Nutrient Timing

As you can see in the pillar amino acid combination, timing – in terms of combining at the right time - is a handy tool for muscle building. Although it is sufficient from a health point of view to combine during the day, you want maximum muscle growth. Hence, it makes sense to combine also within the meal. It depends on the timing within a day.

Exact nutrient timing

The definition of nutrient timing seems obvious: supplying nutrients at a specific time. If you have a long hike ahead of you, you will try to eat a good breakfast so that you have enough energy for the long walk. That is nutrient timing the classic way. Less sophisticated but mundane, practical and

effective. If you mess up the timing here and want to eat after the hike, then you will most likely feel the consequences through lack of energy.

For our purpose, the optimal muscle building, we will look at three main time points in the practical section for the absorption of nutrients: before, during and after training.

As you know, your workout is the beginning of the stimulus. That's when everything starts. This event is significant for your optimized muscle building. A study could show, as depicted in Figure 51, that it makes a difference whether you consume a protein shake in the morning and evening or well-timed around the workout. As demonstrated, the nutrient timing around training is crucial for muscle building[571].

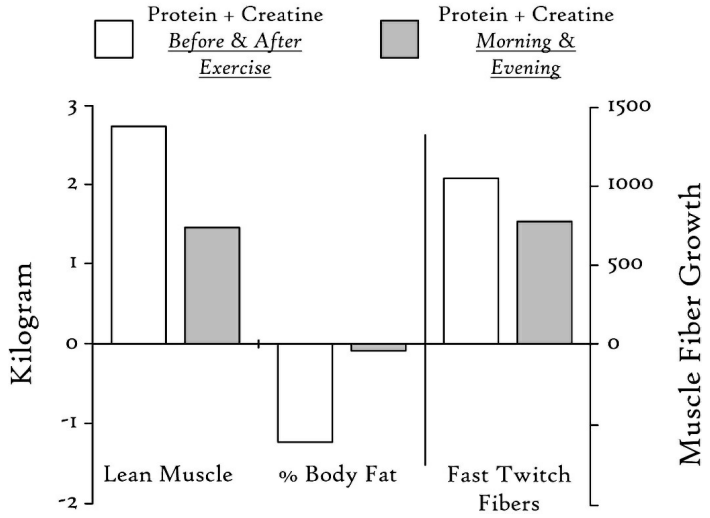

Figure 51 Comparison of the protein and creatine intake timepoints before and after a workout and in the morning and evening for muscle growth. Intake close around the exercise increased muscle growth and decreased body fat compared to workout-independent intake in the morning and evening. The supplement intake around the workout increased the growth of strength-related muscle fiber type 2. (Modified after Cribb et al. 2006, doi: 10.1249/01.mss.0000233790.08788.3e).

Not only protein is interesting for nutrient timing, but also the other two macronutrients, carbohydrates and fat. All three macros have very different properties and thus also influences on your body. You will discover these properties for timing in the following.

Protein timing

Why does adapted nutrient timing make sense at all? Why not eat optimally throughout the day, what should be specifically timed? That is a good question. Adapted timing makes sense through the following two points:

1. Protein triggers an anabolic stimulus that leads to muscle building;
2. This anabolic stimulus only lasts for a limited time.

The first point should be clear now. As you have seen, protein or individual amino acids are heavily involved in creating an anabolic environment in your body. Some amino acids are a direct building block; others, like leucine, trigger many other reactions that ultimately lead to muscle growth.

For the second point, we know from studies that there is an immediate anabolic effect after the consumption of protein. Now, you can ask the question, how long does it last? How long does your body vibrate in a muscle building mood due to the influence of the food and the protein in the food?

From the answer to this question comes the recommendation for your nutrient timing. To optimize your muscle building, you want to be in this anabolic area as long as possible and waste as little time as possible. By taking specific amounts of protein at a particular time, you can determine how strong the anabolic stimulus is and how long it lasts.

You take advantage of optimized anabolic stimuli through your meal frequency from pillar four. Here, we look at the timing of protein intake around the workout. In Figure 52 for example, you can see the variable impact of different protein sources on the velocity of blood leucine levels.

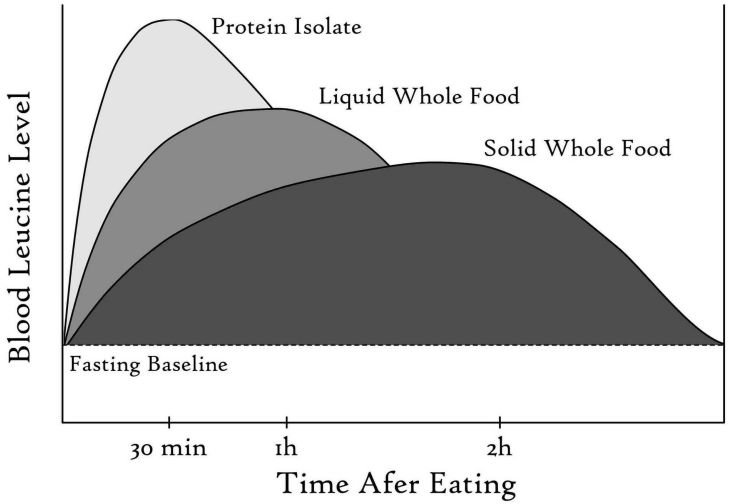

Figure 52 Impact of food types and the states liquid and solid on blood leucine levels. Protein isolate and liquid whole food (smoothie) lead to a sharper spike in leucine blood concentration than solid whole food. The food characteristics strongly influence uptake velocity and hence the availability of the amino acid leucine. (Data from Jäger et al. 2017, doi: 10.1186/s12970-017-0177-8).

Carbohydrate timing

Carbohydrate timing allows you to control the transport of nutrients into your cells by triggering the release of insulin. Of course, we are especially interested in the muscle cells around workout time. You can optimize the supply for your workout and regeneration after it.

You can control your insulin output through the targeted use of fast or simple carbohydrates. Through this technique, which is none, because most people unconsciously do this every day, insulin and blood sugar levels rise quickly and strongly[572].

The opposite of fast and simple carbohydrates are slow and complex ones. They are very starchy and are made up of many subunits. Since your digestive enzymes must first break the individual links between each particle of glucose, complex carbs are digested more slowly. Thus, the sugar ultimately flows less concentrated into the blood and over a more extended period. The same applies to insulin. In this way, the body regulates blood sugar more effectively.

This is what you want during intense physical exertion. You don't want your energy to dissipate like corn in a popcorn machine. You want your energy to flow over your whole workout like your morning maple syrup on a spoon over your entire plate.

But insulin is the double-edged sword in the hormone world

Insulin is significant for your energy supply and health because it regulates the constant four grams of glucose in your bloodstream. It also brings much-needed glucose and other nutrients to the cells of your organs and muscles - that cell-nourishing effect you want to use with the HGMM.

But, insulin is like a double-edged sword. On the one hand, it has a strong anabolic effect. On the other hand, in combination with excessive energy intake, it can lead to obesity and have other disadvantages for health and performance. If you misuse insulin, you will cut into your flesh. If you continuously have high concentrations of insulin in your blood, you are aligning your metabolism to "store" non-stop.

Insulin stimulates not only the absorption of glucose but also of other substances. It also leads to the storage of fatty acids in your adipose tissue[573]. In the extreme case of always high insulin and low glucagon concentrations, it would be inevitable to put on an excess of fat. It favors the increase of fat mass, to the point of overweight or even

obesity.

Also, the constant presence of insulin in your blood leads to a decrease in your insulin sensitivity, which is the beginning of a disastrous downward spiral. The body then releases even more insulin. The answer to more insulin is often even less insulin sensitivity, up to the point where the body develops insulin resistance. This spiral can eventually end in diabetes and fuel other diseases[574],[575].

Fat timing

Fat or certain fatty acids in the right proportion in the diet can have a health benefit. Qualitative and not quantitative fat consumption is important for building tissues like your muscles. Fat can also be useful for nutrient timing. To do this, we simply follow on from the previous section on complex carbohydrates. You certainly know the feeling after a very fatty meal, like a lump in the stomach. There's something heavy lying there that draws all your energy. It whispers to you that you should lie down now and not

eat so fat and a lot at once in the future.

That feeling you might have after fatty thanksgiving dinner comes from the properties of fat. It is insoluble in water, in contrary to hydrophilic protein and carbohydrates from your meal. While protein and carbohydrates are already digested in the mouth or stomach, fat is passed through and only utilized after the stomach. It is only in the back part of the entire digestive tract, the small intestine, your body's enzymes tackle that fat[576].

The reason why fat is attractive in nutrient timing is that all the macronutrients in your meal are processed as one food pulp. When you eat, you are usually chewing carbohydrates, protein and fat together. Fat is a part of the pulp, which may sound less delicious, but illustrates quite well how strongly all the components of the meal are connected. As a water-insoluble part of this mass that is digested late in the process, fat can slow down the digestion of protein and carbohydrates.

Fat, digestive hormones and compartments

Our body has evolved over thousands of years to make the most of the food it receives. The mechanisms our body uses ensure that such valuable and energy-rich components of food are optimally absorbed. One such mechanism that can slow down the overall digestion is the effect of amino acids and fat on digestive hormones, such as the release of cholecystokinin.

Fat is the macronutrient that is generally digested the slowest. When the food pulp leaves your stomach again, only 15 % of the contained fat has been digested[577]. Besides, like specific amino acids, it leads to the release of the digestive hormone cholecystokinin[578], which slows down the passage speed of the food and thus the digestion[579].

During digestion, the body strives to function as efficiently as possible. One principle here is the so-called compartmentalization. Roughly speaking, this means making one large space into several smaller ones, intending to achieve the best reaction conditions in each smaller area. Then it is

possible to create optimal reaction conditions in each compartment or area. These can be, for example, different temperatures, different enzymes, different pH-values or different amounts of substrate.

In this way, the body does the same with fat. The first compartment is the stomach. The fat should not be digested there, but only afterwards. If all the fat were to pass through to the small intestine at once, the ratio of fat - the substrate to be processed - to digestive juices would not be optimal. For this reason, the body uses its control over the stomach area. With the help of digestive hormones, the body lets the fat gradually pass through to the next compartment; the emptying of the stomach into the next digestive section is delayed[580],[581].

In this way, the body guarantees a more thorough and efficient digestion of fat in the next digestive compartment[582],[583],[584]. In Figure 53 you can see that even the fat type makes a difference for gastric emptying.

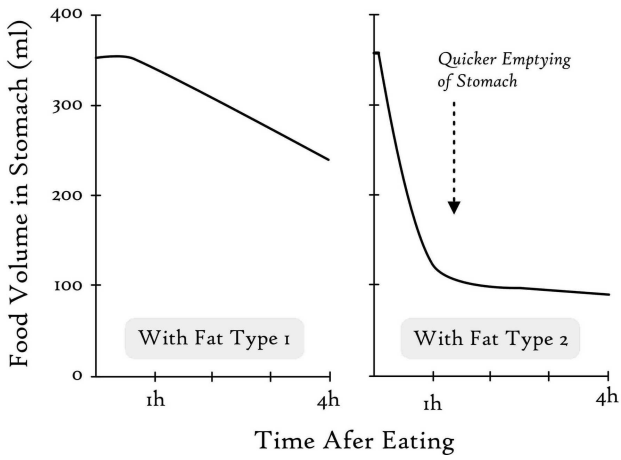

Figure 53 Influence of fat type on the speed of digestion. The presence and quantity of fat and the characteristics of the ingested fat molecules determine digestion velocity. (Data from Steingoetter et al. 201, doi: 10.3945/jn.116.237800).

So, what do we do with the fat?

After this fatty arch, we come back to the actual topic. You use fat to influence your digestion so that it brings you a positive effect. With nutrient timing, you want to optimize the availability of building blocks like amino acids for your muscles during and after workout. In the same way, you want to have power and energy when you need it, which is during workout and not before.

Fat helps to influence the availability of these

nutrients. Fat can affect the release of glucose and insulin after eating a meal. In the best case, this can be done in such a way that your energy is not burned all at once but is available evenly over the upcoming time - for example, throughout workout[585].

Dietary fibers

Dietary fibers are the fourth wheel on the wagon. They cannot be digested like the macronutrients fat, carbohydrates and protein. In the past, it was thought that they were simply co-formulants that the body could not digest. But today, we know more. Fiber is responsible for keeping you feeling full and satisfied for longer[586].

They also play a vital role as food for your roommates. For the bacteria in the microbiome in your intestine, fiber is the primary source of energy[587]. Fiber allows you to support certain bacteria in your microbiome and provides a greater variety of bacteria types[588],[589]. The great thing is that if you nurture and nourish these bacteria well, they give you something in return[590],[591].

Thus, a beneficial composition of bacteria in the intestine is associated with better physical[592],[593] and mental health[594],[595],[596].

Dietary fibers have, therefore, many advantages for you. For timing, the influence of the dietary fibers on your blood sugar is crucial. The additional consumption of fibers can delay and flatten the rise of the blood sugar - in other words, stabilize it[597].

So, you can use fiber as well as fat and the other macros for nutrient timing. With the help of well-thought-out use of macros and foods that fuel these effects, you can optimize your vegan muscle building. How this works in practice and how exactly this can look like in your everyday life, you will learn now.

Before and after workout

With the principles of nutrient distribution, within a meal and throughout the day, you can optimize hormone balance and thus performance and health. Nutrient-timing in the HGMM includes the targeted eating before sports and the snack after workout.

Regarding the total amount of protein per

meal and the resulting meal frequency, you have already experienced a particular nutrient timing. If you follow these guidelines, you have optimized your protein intake to a large extent for maximum muscle growth.

The specific nutrient timing in this chapter gives you three more useful inputs:

1. The correct use of the other two macronutrients fat and carbohydrates and dietary fiber;
2. The specific nutrient timing around the event that triggers your muscle building in the first place and sets the decisive growth stimulus - the workout;
3. Other components in your diet that you can use in a useful way.

It makes sense that you conscientiously implement the other pillars four, five and six, especially around your workout. If you consider the amount of protein, the digestibility and the combination with a meal window of 3-4 h, then you ensure the optimal supply over the workout and afterwards. With

the nutrient timing, you can top this.

Before the workout

Many athletes take care to consume a sufficient amount of carbohydrates in good time before exercise, simply to replenish the glycogen stores of the muscles and to have the maximum of this primary energy source available during sport under aerobic energy supply.

However, you fill the glycogen stores through your daily diet and not directly before the workout itself. Your daily diet should be balanced, contain enough complex carbohydrates, high-quality amino acids and essential fats, so that your basic level looks good.

The snack here is the so-called pre-workout meal, a snack that you take just before your workout. With this meal, you want to achieve the following:

- ensure optimal amino acid levels during workout;
- maximize energy during the workout;
- delay fatigue until after workout.

Amino acid level

If you have taken a well-combined protein meal 3-4 hours before the workout, then you are still well supplied in workout[598],[599]. In everyday life, however, this does not always work out so well with the exact timing, because who sets the clock, to take in the meal exactly three hours before the workout? Whether that works or not, with a little pre-workout snack, you can always improve or compensate.

That is why you use a complete protein for the snack. During workout, when your muscles have to work hard, you want to have all the amino acids you need for muscle building and protection. An adequate supply of amino acids during workout can prevent your body from tapping the muscle's protein stores and can prevent premature exhaustion[600],[601].

That's why your pre-workout snack contains a source of complete, plant-based protein.

Energy and fatigue

You want to power through your workout,

not be tired and never look impatiently at the clock. You don't want to be hungry, get hungry or feel weak or tired. Your performance and your power during the workout are crucial and all decisive for your success with muscle building. If you don't bring intensity and focus here, then no diet in the world can save you. This pillar can help you to get that power.

That is why you use a mixture of faster and slower digestible carbohydrates before workout. The fast-digestible carbohydrates provide blood sugar and insulin increase after 30 minutes; the slower digestible carbohydrates are released into your system throughout 2-3 hours. So, you make sure that you are in the bloom of power right at the beginning of the workout, but that this power also lasts for at least the entire workout.

Besides, you can influence your power not only with the type of carbohydrates, but also with fiber and fat. A noticeable portion of fibers in your meal slows down the release of sugar into your blood and spreads the rise in your blood sugar level over a more extended

time. The curve of the spike is flatter and broader, and your blood sugar is more stable. Fat in the meal has a similar effect - a less steep rise in blood glucose. Take a look at Figure 54 for illustration of the potential effect of the HGMM pre-workout pancake on blood levels of glucose, insulin and amino acids.

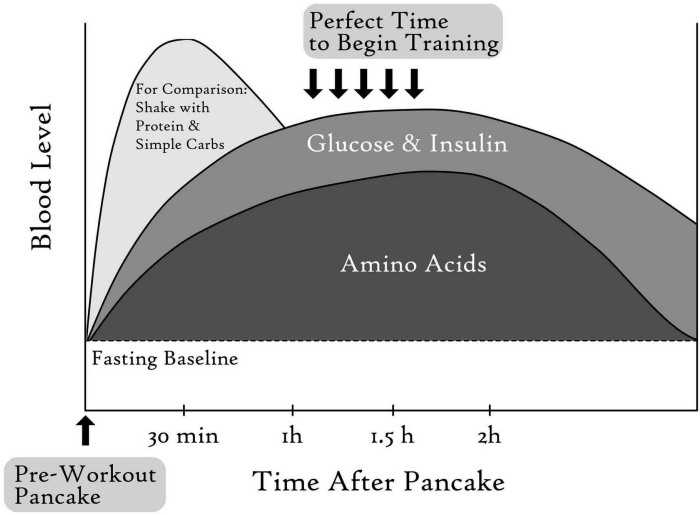

Figure 54 Potential impact of pre-workout pancake on blood levels of glucose, insulin, and amino acids. Based on amino acid and insulin blood levels, the optimal time to start the workout would be 90 minutes after pancake consumption. (Data from Jäger et al. 2017, doi: 10.1186/s12970-017-0177-8, Carneiro et al. 2020, doi: 10.3390/nu12102989 and Gentilcore et al. 2006, doi: 10.1210/jc.2005-2644).

Recipe for pre-workout pancake

To combine the properties of all these ingredients in a functional sports snack, I have a pancake for you. You can prepare it easily, transport it easily and eat it everywhere warm, cold or with toppings.

To time the effect perfectly before the workout, I have found that a time lag of 90 minutes before the workout is very effective. It depends on how you have eaten before and how much you have in your stomach. Be careful and don't eat the snack too close to your workout. In my experience, if you don't leave enough time before your workout, your digestion will draw enough energy to rob you of your power for the workout.

Pre-Workout Pancake

20 g Protein mixture like rice and pea
20 g Chia seeds
100 g Banana
40 g Wholemeal flour (wheat or spelt)
approximately 80 ml of water

Total

9.7 g EAA
1.8 g Leucine
7 g Fat
12 g Fibers
397 kcal

Since we use wholemeal flour, the dough is best be left soaking for a few hours before preparation.

A combination of simple and complex carbohydrates (banana and wholemeal flour) gives you power right from the start, but also ensures that you have plenty of long-lasting energy. Also, the fat from chia seeds and the fiber from wholemeal flour, chia seeds and banana slow down the digestive process of the carbohydrates, which prevents a peak in blood sugar and insulin. The result is that your power will be spread out more evenly.

The high-quality protein from the powder is digested quickly and makes amino acids available during workout for a continuous supply of EAAs, including leucine. By the way, 3.5 g of ALA from the chia seeds help you to manage your daily omega-3 fatty acid requirement.

You have a lot of variation possibilities. For example, use other fruits like berries or apples, other seeds like linseed - or other wholemeal flours. You can also use your preferences for protein, although it makes sense to look for a protein with a complete amino acid profile.

After the workout

Some athletes such as bodybuilders or strength athletes, i.e. sports that involve resistance training and hypertrophy, provide a combination of simple carbohydrates and protein after exercise to ensure that the muscle cells are optimally supplied.

Studies show that there is indeed something to this approach. Taking protein and carbohydrates together after workout has an anti-catabolic effect: the synthesis of muscle protein is stimulated again, and the breakdown of muscle protein by the catabolic metabolic state that is triggered by workout is weakened[602]. Protein alone was able to stimulate the synthesis of muscle protein[603], but was not as efficient as carbohydrates in

lowering cortisol levels[604]. Carbohydrates alone, in turn, act on cortisol but do not increase muscle protein synthesis[605]. Protein and carbohydrates are, therefore, an excellent team. Figure 55 shows the combined effects of exercise and the intake of carbohydrates and amino acids on muscle protein synthesis.

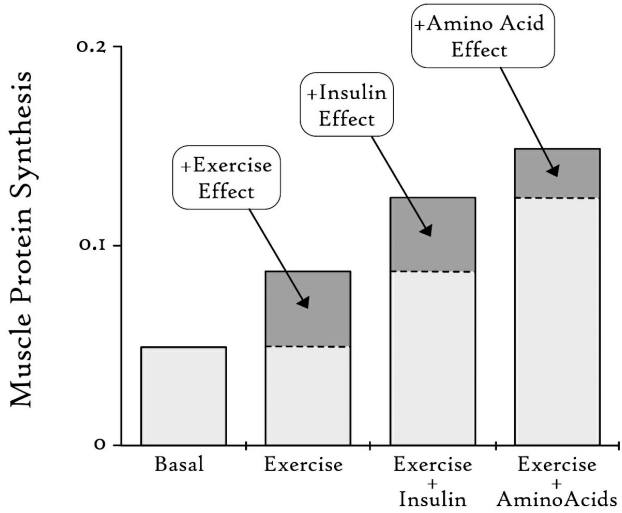

Figure 55 Depiction of additive effects of exercise, insulin, and amino acids on muscle protein synthesis. (Modified after Tipton and Wolfe 2001, doi: 10.1123/ijsnem.11.1.109).

The simple carbohydrates, for example, in the form of dextrose, ensure a strong insulin output and facilitate the influx of amino acids into the stressed muscle cells. The result is

that the regeneration phase remains effective and the regeneration time short[606].

Directly after the workout

As you've seen, protein and carbs in the shake after your workout can help reduce the breakdown of muscle tissue and help restart muscle protein synthesis. Another advantage of the combination is the quick refill of your glycogen stores in the muscles.

Recipe

- 40 g protein with a complete amino acid composition, for example rice and pea combination or soy protein;
- conditional: 0.6 g per kg body mass simple carbohydrates like dextrose or maltodextrin;
- conditional: creatine, in case you use it (also see next chapter “Supplements”).

Just like the pre-workout snack, the post-workout snack, which is a shake due to the speedy digestion of protein concentrates in liquid, is perfectly designed for maximum recovery and muscle growth. High-quality protein powder is digested faster than protein

from unprocessed food. Therefore, its use in the post-workout shake is optimal, at a time when you want the amino acids to reach your muscle cells as quickly as possible.

The official recommendation of the International Society of Sports Nutrition for this is 20 to 40 g of Protein[607]. Thirty-five to 40 g of protein are required to reach 2.5 g of leucine with rice and peas or soy protein, the dose that maximally boosts muscle protein build-up. At 40 g, it would be about 12 g EAAs and 2.5 g leucine, depending on the exact amino acid composition of your protein.

Carbohydrate supplementation is conditional, and you can decide if it is necessary for you. Simple carbohydrates, in combination with protein powder, can accelerate the recharging of your glycogen stores, as illustrated in Figure 56.

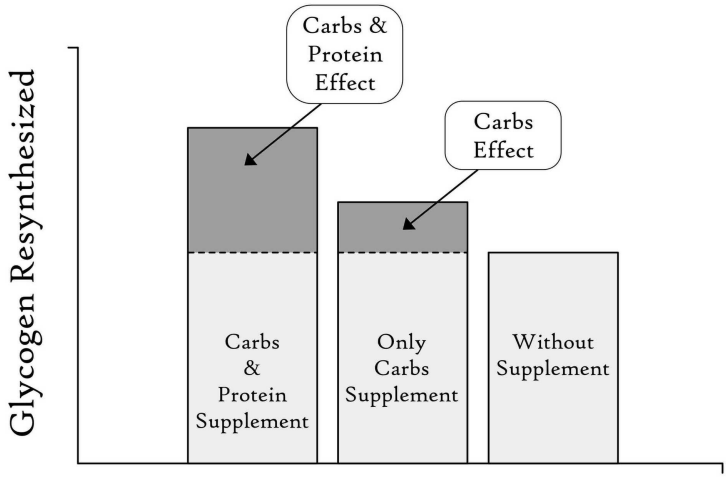

Figure 56 The effect of a carbohydrate and protein supplement on glycogen resynthesis. The combination of protein and carbohydrate led to maximum muscle glycogen resynthesis during six hours of recovery after one hour of exercise. Adding protein to carbohydrates could increase muscle glycogen resynthesis. (Modified after Berardi et al. 2006, doi: 10.1249/01.mss.0000222826.49358.f3).

However, research shows that carbohydrates are less useful in the post-workout shake when you:

- consume enough carbohydrates throughout the day, so your glycogen stores are always well filled;
- consume enough protein throughout the day, because then you will achieve the

maximum anabolic stimulus through protein alone, which carbohydrates in the shake no longer improve.

Conversely, if you are limiting carbohydrates during the day for any reason, if you are not eating enough protein - which is almost impossible with HGMM -, or if you want to start exercising again within a few hours of your workout, then adding carbohydrates to the shake may make sense to you[608],[609].

That way, the muscle glycogen that you have used up during workout is then replenished more quickly. Otherwise, you could save the calories from the sugar water in the shake and eat something real and tasty with another meal, for example, the next big feed after workout.

Fat or fiber, on the other hand, should be avoided in post-workout snacks or shakes. Fat would slow down digestion, whereas the time immediately after workout is the only time when you want a swift absorption of nutrients.

First big meal after workout

Even if you take a post-workout shake or snack immediately after your workout, you will benefit from a complete meal within the next two hours after your workout[610],[611]. By eating a meal that corresponds to pillars four, five and six, you can improve your performance and muscle protein build-up until the next morning. You can also look at it from this angle: the shake has a direct effect on all processes that you have triggered by your workout. The purpose of the meal is to maintain your meal frequency of 3-4 hours to achieve maximum muscle building throughout the day. Therefore, you should take the next big meal after your workout seriously, despite the post-workout snack. Moreover, as shown in Figure 57, a post-workout meal could decrease exercise-related muscle protein losses.

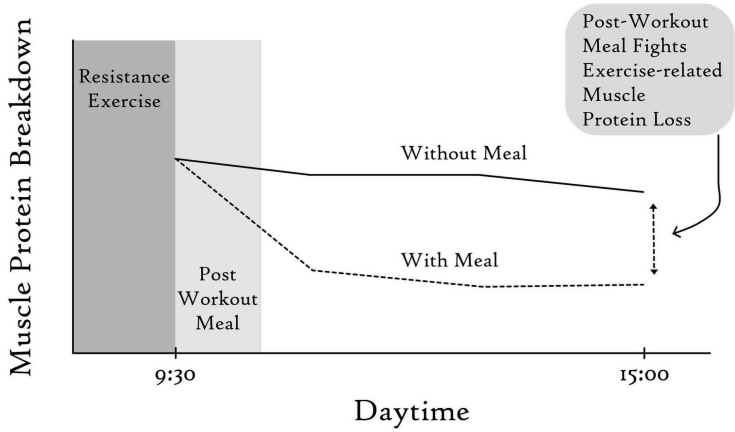

Figure 57 The effect of a post-workout meal on muscle protein breakdown after exercise. A post-workout meal up to two hours after a workout decreases the exercise-related muscle protein breakdown. (Modified after Kume and Yasuda 2020, doi: 10.3390/nu12041177.)

If you train hard, your muscle glycogen is probably not wholly replenished despite the addition of carbohydrates to the post-workout shake. So, if you feel like eating simple or processed carbohydrates during this meal, this is a good time to do so. It can even help you to regenerate your power more quickly.

You can see from a high glycemic index or in practice usually already by a look at the food, which carbohydrate sources are simple. For

example, sticky rice or very soft-cooked pasta (also sticky) have a very high glycemic index. Due to industrial processing, the removal of fiber or fat and cooking, the connections of the glucose particles were partially dissolved. As a result, your body gets to the individual building blocks quickly. Whole-grain cereals, on the other hand, still have a bite. It has an intact structure of glucose particles or starches and is therefore digested more slowly.

Otherwise, your first meal after workout should be of the same quality as all other meals. If you align it with the pillars, you are well on your way.

Bonus: Supplements

For me to consider and even recommend supplements, there must be one crucial prerequisite: the supplement has a proven direct or indirect effect on your performance or muscle growth.

Supplements are not everything

We can approach the topic here using the classic shake after workout. Some studies show that protein supplementation increases muscle growth that was first triggered by exercise. Now, two points should silence the cheers of every protein shake fan:

1. It is generally the case that supplementation has had a more significant effect on muscles in young and experienced athletes, less so in older and untrained athletes[612]. That

reduced effect can even go so far that supplementation only works for experienced athletes[613].

2. Supplementation has a measurable effect, but only a manageable share of the overall success.

These observations mean that protein shakes are worthwhile, if at all, only if you do sport regularly and pursue your goals ambitiously. Even if the protein shake unfolds a slight benefit for you, this is minimal compared to the influence of your everyday diet and training behavior. So, what is the take-home message for you?

Don't just rely on supplements

You should not rely on unnecessary and expensive supplements. They can indeed make a difference to your psyche and mentality. Still, they are less involved in your success than your basic lifestyle: training, eating, sleeping and stress.

Suppose you design your nutrition, training and regeneration optimally. In that case,

supplementation is just the icing on the cake and will not bring you success on its own. That knowledge is vital for classification of methods, to prevent disappointment and to save your wallet.

Food supplements that have been proven to work

If you are ambitious (I hope so) and your diet is optimized (I know that now), then the following tips are for you. You will be presented here only with supplements that have been shown to improve the performance of any kind. All marginal supplements and broscience products are deliberately excluded here.

Protein powder rush

Protein powders are highly processed foods. Industrial processing is why they are digested faster than most natural foods. In this way, they raise the amino acid level in your blood in a short time.

You can use protein powders in two ways. One is to improve your daily protein balance,

simply because it is convenient and practical; or directly after workout to start your regeneration immediately.

In general, I recommend a protein powder that contains all amino acids in sufficient quantity. Regarding long-term lean body mass gains, it makes no difference whether you supplement with soy, whey or other proteins[614]. Protein mixtures such as rice plus pea are ideal because they bring balanced amino acids. Protein from germinated or roasted ingredients would be even more preferable, since such pre-treatment can, as you know now, increase digestibility and bioavailability of amino acids in your body.

Creatine increases energy and cognitive performance

Creatine is one of the few supplements whose effectiveness has been unmistakably confirmed in numerous studies[615]. Creatine is a molecule that stores energy[616], this energy is used in an emergency to power your muscles. The human body produces creatine

itself because you need it not only for the energy supply in the flesh, but also for your brain function.

Creatine can help you to delay your muscle fatigue. Creatine phosphate is mainly used by your body when your muscles are under massive strain and high intensities[617]. So, it is more logical to be used for weight training than for easy jogging. Under intense resistance training, however, the correlation between creatine and muscle fatigue is strong.

A study with cyclists showed, as illustrated in Figure 58, that creatine led to a marked improvement in high intensity cycling bouts. Optimize the supply of creatine, and you can benefit in this area of your training[618].

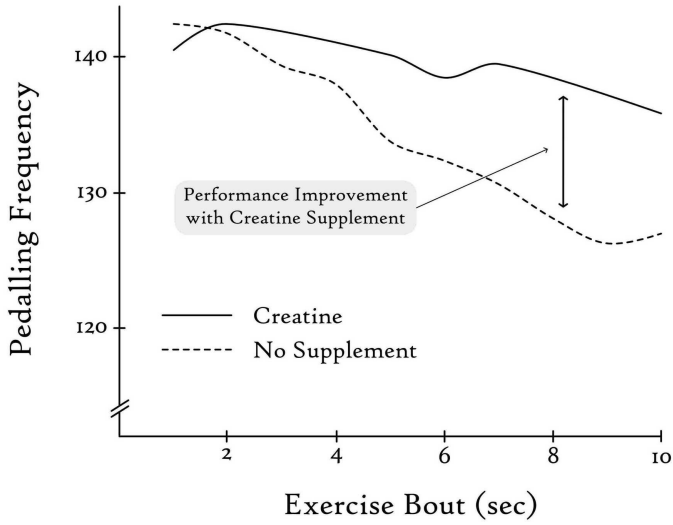

Figure 58 Impact of brief creatine supplementation on cycling performance. Creatine increased cycling performance compared to no creatine supplementation after six days of supplementation. Creatine allowed athletes to sustain their force longer throughout an intense bout of pedaling. (Modified after Balsom et al. 1994, doi: 10.2165/00007256-199418040-00005).

Creatine not only for muscles

More and more research also shows that supplementation with creatine can increase not only strength performance but also cognitive performance, for example memory, learning and recall[619]. Creatine slows down muscle breakdown as well. Indirectly, creatine can also promote muscle growth[620].

Besides, there is evidence that creatine has neuroprotective properties[621] and a beneficial effect in cardiovascular diseases[622].

All in all, with creatine, you have a supplement that potentially has many advantages. As creatine is mainly found in animal products such as meat, eggs and fish, vegetarians and vegans, in particular, can benefit from supplementation[623].

Taking creatine

There is often confusion about creatine intake. The majority of studies suggest that this is more a matter of taste or function, and none of the scenarios shown in Figure 59 harms health if there are no pre-existing conditions. If you require short term strength increases, an intake regimen with a pronounced loading phase could accelerate the onset of the effect[624]. Otherwise, a balanced, daily intake, as often recommended on the package is also advisable.

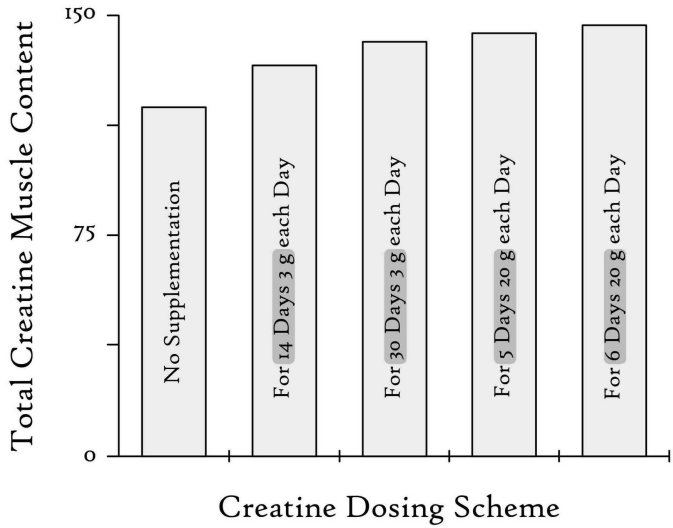

Figure 59 Creatine dosing schemes and their impact on creatine content in leg muscles. (Modified after Balsom et al. 1994, doi: 10.2165/00007256-199418040-00005).

Which creatine?

Creatine monohydrate is effective, cheap and, based on a reasonably broad range of studies, also safe. There is no reason to supplement substantially more expensive products that advertise higher purity or effectiveness - greetings to your wallet.

BCAAs

Branched-chain amino acids are the combination of the three branched-chain,

indispensable amino acids leucine, isoleucine and valine. As you know, leucine plays a vital role in muscle growth.

BCAA are three amino acids in isolated form, the same three amino acids that are also found in protein powder and any other protein. The difference with BCAA supplements is that they are isolated and concentrated. What does this mean in practice? When does BCAA make sense and for what?

Supplementation with BCAA before or after a workout can delay exhaustion during physical exertion, decrease muscle damage and accelerate recovery after workout[625]. Also, leucine is lifted above the threshold value in no time with a small spoon. However: as with protein powder, the BCAA effect is reduced if sufficient high-quality protein is otherwise supplied via the diet. That makes sense. If there are already enough amino acids, even more, will not bring any additional gain.

Nevertheless, you can use this food supplement if you want to ensure a sufficient

supply of amino acids.

During calorie deficit and on an empty stomach

The intake of BCAA is sometimes recommended while there is a calorie deficit. It can be a challenge to consume the same amount or more protein with less food and calories. During the diet and in the morning on an empty stomach for workout are good times for intake. Then BCAAs help to protect your muscles from breakdown. Some even use it when they deliberately fast to help protect the esteemed muscle protein.

If you chose from these three supplements, I would recommend creatine and a solid protein powder. Both are available for acceptable prices, and you can make use of these tools to increase your muscle potential. BCAAs are more expensive and somewhat replaceable, especially at the beginning of the training career. They can become valuable for specific applications as stated or for advanced athletes, who already aligned their life, including training, sleep and nutrition

perfectly with their goals of building muscle.

Afterword

The dogma is fading. Meat and milk are not necessary to build muscles. This insight is spreading more and more, not least through the efforts of many vegan athletes and celebrities.

Using plant-based diet to combine health and muscle growth was not always so evident and only step by step, more and more people take that for granted. Arnold Schwarzenegger won seven times the most celebrated title in bodybuilding, Mr. Olympia - 1970, 1971, 1972, 1973, 1974, 1975 and 1980. That was a time when muscle building without meat was impossible in people's minds. Muscle building without meat was frowned upon. Today, Schwarzenegger speaks out in favor of a plant-based diet and impressively substantiates these claims in the film Gamechangers.

With this book, I would like to contribute to this development. Although meat and milk are essential for the survival of giant companies in the animal industry, they are not critical to human health or muscle growth.

I hope the book could show that a wholesome plant-based diet offers optimal conditions for muscle building. With the unfavorable implementation of a plant-based diet, you can sabotage progress in muscle growth, which is valid for any diet you can think of. The Happy Green Muscle Method, therefore, goes one step further and optimizes a plant-based diet for muscle building. With the HGMM and this book, it is possible, within a purely vegan lifestyle, to build muscles at least as efficiently as with animal foods.

I wish you much fun and success with your goal to more muscle growth with a plant-based diet.

Hope to see you on happygreenmuscle.com

Best regards,

Sebastian.

Appendix

Final Request

One final, personal request: reviews are a vital part of products. Customers rely on your review when they are faced with the decision to perhaps buy this book too. Certain reviews were very likely the reason you are reading this book.

Please leave a review to make a lasting difference in the lives of other customers. By your rating, you make their decision easier to live a better life. They will be forever grateful to you!

To leave a review, log into your account and go to the product page of "Happy Green Muscle" scroll to the bottom and click on "Write a customer review."

Alternatively, you can go to My Account-My Orders and leave a review after clicking on the book title.

A book lives, and it lives mostly through you! Now thank you for buying and reviewing my book, and have fun implementing it!

About The Author

Sebastian Steinemann received his Ph.D. in plant breeding on the topics of molecular biology and genetics from the Technical University of Munich. He combines his insight from research and publishing in peer-reviewed journals with his passion for sports and plant-based nutrition. As a result, he authored "Happy Green Muscle" based on over 500 studies and his own experience.

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