Guide for Professionals to Complete Human Nourishment

SUSTAINABLE LIVESTOCK INTERGROUP

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As members of the Working Group “Human nutrition and consumer communication” of the Advisory Group for the “Sustainable Livestock Intergroup” of the European Union Parliament

https://sustainablelivestockintergroup.eu/

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Foreword

What people eat is shaped long before they sit down at the table. It is shaped by the professionals who plan menus, design recipes, stock kitchens, and decide what appears on a plate. Chefs, food service managers, restaurateurs, caterers, menu consultants and institutional buyers collectively determine the nutritional reality of hundreds of millions of meals served across Europe every day. Their choices ripple outward, influencing not only what customers consume in a given sitting, but what those customers come to expect, prefer, and consider normal. If any group holds practical power over the dietary trajectory of European populations, it is this one.

Yet food professionals are often left without a clear, scientifically grounded framework to guide their decisions. For decades, dietary advice has been dominated by food pyramids, plate models, and top-down prescriptions that were designed for individual consumers and public health campaigns, not for the people who actually compose meals at scale. Worse, much of this advice has drifted away from the evidence. Compliance has been dismal. Metabolic health across Europe has deteriorated. And a growing share of the food supply has shifted toward ultra-processed products that confuse the body and undermine the craft of real cooking.

This guide was written to offer something better. It is built on three pillars of scientific evidence: the nutrient density of foods, the consequences of how food is processed, and the evolutionary dietary heritage that shaped the human metabolism over two million years. Together, these dimensions form the Nourishment Table, a practical framework that food professionals can use to structure meals that genuinely nourish, rather than merely fill.

A central message of this guide is that animal-sourced foods, including meat, dairy, eggs and fish, are not dietary villains to be minimised. They are, on the contrary, nutritional cornerstones. The scientific evidence, when assessed rigorously and without ideological filters, shows that these foods deliver the most complete proteins, the most bioavailable iron and zinc, and various nutrients that may be hard to source from plant-only diets, such as vitamins A, D, and B12, choline, and long-chain omega-3 fatty. In Europe, animal-sourced foods provide approximately 80% of the bioavailable protein in the diet. This is not an accident of culture or habit; it reflects a deep alignment between human nutritional requirements and the foods that evolution equipped us to thrive on.

We are aware that these statements challenge a prevailing narrative. The past two decades have seen growing pressure on food professionals and policymakers to reduce animal-sourced foods in European diets, driven in large part by environmental concerns and, at times, by ideological commitments that are presented as settled science. We take these concerns seriously, but we also insist on intellectual honesty. The evidence for claimed health risks of unprocessed red meat remains of low to very low certainty. The environmental calculus is far more complex than simple comparisons of greenhouse gas emissions per kilogram of food suggest. And the nutritional consequences of removing or drastically reducing animal foods from European diets would be severe, particularly for vulnerable populations: children, the elderly, pregnant women, and the economically disadvantaged.

This guide does not advocate for any single dietary pattern. It advocates for nourishment, achieved through the wide diversity of traditional and ancestral food combinations that have sustained human civilisation. It places trust in the professional judgment of the people who feed others for a living. And it provides them with the scientific foundation to make those judgments with confidence.

We hope it proves useful in your kitchen.

Peer Ederer, Frédéric Leroy and Alice Stanton

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Main Messages

1. Food is more than fuel, it is the foundation of human prosperity, performance, and civilization itself. However, given that diets may also do the exact opposite by endangering health and wellbeing, there is a lot of confusion about what exactly constitutes “good food”. The Nourishment Table was created to provide clarity, based on rigorous scientific evidence.

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2. The Nourishment Table offers an easy-to-follow, powerful guide for food professionals, by focusing on the three dimensions that matter most in food choice: nutrient density, levels of food processing, and human-appropriate evolutionary needs, shaped over two million years of ancestral dietary domains of the ***Homo*** genus.

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3. The Nourishment Table encourages individuals to eat a diverse range of nourishing plant and animal-sourced foods to ensure sufficient consumption of high-quality protein, key vitamins, minerals, choline, long-chain omega-3 fatty acids and other bioactive compounds that protect the human metabolism, while avoiding foods that disrupt it. This advice is especially meaningful in life stages or populations with higher needs, such as the young, pregnant and lactating women, older adults, and the metabolically impaired or chronically diseased.

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4. Nutrient density is defined in terms of protein and essential micronutrients, vitamins, minerals and fatty acids per calories of that food choice. Proteins are the body’s vital building blocks. They provide the amino acids needed to renew 1–2% of the body every day. Quality matters: animal-derived proteins best match human needs, while plant proteins need to be carefully selected. But non-protein essential nutrients are equally important, especially vitamins B9, B12, D, and A, choline, iron, zinc, iodine, calcium and magnesium are often low in modern diets Therefore, diets which combine both plant and animal-sourced foods for their own unique ingredients and complimentary nutritional profiles, are best suited to ensure a wide range of such essential nutrients.

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5. Processing of food should not be demonised, it is what made humans, human. Cooking, fermenting, chopping, drying food and many other processing methods, allowed humans to outsource digestion, evolve large brains, and survive across seasons. Traditionally, these techniques have always been a means of increasing nutritional value, food safety, shelf life, and convenience, while generating desired textures and flavors. But when foods are broken into isolated parts and then reassembled into concoctions of starches, sugars, protein isolates, and/or oils, made hyperpalatable by using a long list of cosmetic additives, then processing goes too far. The senses become confused by the artificiality of it all.

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6. With ultra-processed foods (UPFs), the body's nutritional wisdom is overruled and metabolic responses misfire. This may be the result of the widening gap between the food's sensory information and its actual nutritional value (due to the ever-present use of fat and salt replacers, artificial sweeteners, added flavors and colors, ...). If the body does not receive the nutritional input promised by the senses, it may react wrongly, leading to overeating, even more so because such diets harm gut microbes and tend to be addictive mixtures of starch, sugar, salt, and fat. Wherever UPF's begin to dominate the diet, rates of obesity and cardiometabolic conditions rise. The principle is simple: ancestral or traditionally time-tested processed foods nourish; excessive industrial processing disrupts and deceives.

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7. Meat and animal fats were the evolutionary drivers of the human brain and metabolism. Agriculture brought carbohydrates, energy storage and larger populations, but only the introduction and enhancement of livestock and their "secondary products" (dairy in particular) restored nutritional balance and enabled the rise of cities, high civilization, and science. The same holds true today: healthy, resilient societies – and good kitchens – depend on a strong bond between nature and nutrition.

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8. For more than 70 years dietary guidelines in Europe have failed: Adoption rates of recommended diets are negligible, metabolic health of populations has deteriorated, the affordability of the most nutritious foods has decreased, and the share of ultra-processed, artificial foods has risen sharply. It is time for a different approach. Rather than pushing for restrictive diets with specific food groups and varying degrees of top-down, patronizing tonality, the Nourishment Table emphasizes individual choice. It sets out an evidence-based dietary framework, with a wide scope to adjust to regionally and culturally sensitive foods, allowing individuals to choose what they eat according to nutrient requirements, traditional diets and preferences.

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9. In Europe, on average 80% of (bioavailable) protein in the diet comes from animal-sourced foods, split equally between meat as one half, and dairy, eggs and fish as the other half. The only nutritionally viable alternative to replace this significant amount of protein from meats would be pulses, i.e. beans, peas, and lentils. Today, they make up less than 1% of this requirement. Supply would therefore have to increase around 60-fold, to fill this gap. The reason for this tiny consumption in Europe might partially be a result of "evolutionary wisdom". Most pulses are toxic to humans and only become edible after extensive washing and cooking. Many people are taste-averse to pulses, digest and tolerate them poorly (especially when intake would have to increase two orders of magnitude), or lack the culinary skills for their preparation. Therefore, calls to replace most meat with pulses in Europe are unrealistic.

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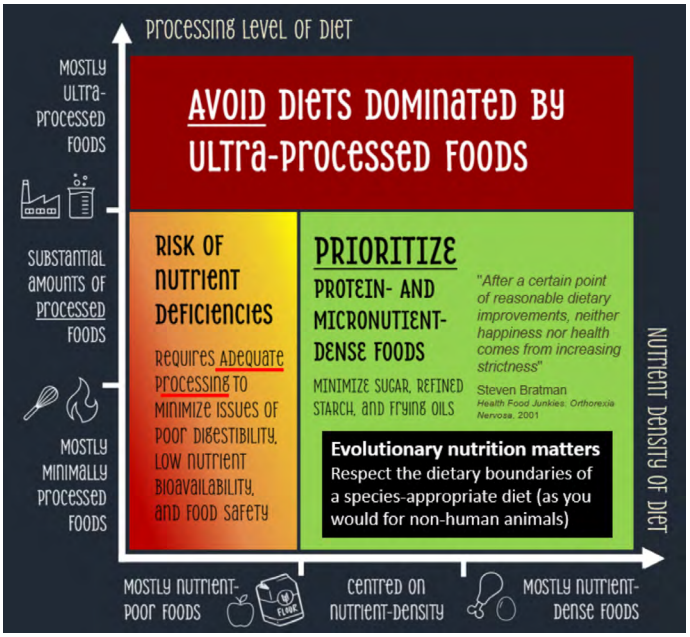
10. In Europe, protein derived from cereals is up to four times as expensive as from animal-sourced foods. In the case of fruits and vegetables (other than pulses) this rises to ten times more expensive. Both these food groups contain relatively small amounts of protein with their principal dietary role being to provide energy, fibre and micronutrients (vitamins and minerals).

BONUS POINT:
Given the significant environmental impact of producing food, it is right that policy pays attention to this critical issue.

Current food systems do contribute significantly to the climate, biodiversity water and land utilization crises. The world needs to invest both effort and funds in further analyses and improvements in sustainable production, transport, processing, storage, retailing practices and in minimising food loss and waste. However, the science behind each of these are yet to be well understood. The matter is complex, but many scientists agree that food choice has relatively little impact on carbon emissions or on the other environmental dimensions and is therefore not suitable as a quick fix.

What is certain is that even in Europe, the margin between adequate food/protein supply and the food system's ability to fully nourish populations remains very narrow. Outside of the high-income countries and China, malnourishment is a constant threat and so nutritional food security should be the overriding priority. Therefore a precautionary principle on food security and food safety needs to apply.

Figure 1: The Nourishment Table provides easy-to-follow, practical recommendations on how to structure a diet. Users can intuitively understand the two dimensions of nutrient density and food processing. The result offers a large variety of dietary patterns providing adequate nourishment, that can be flexibly adjusted to cultural, social and economic preferences.



The website www.Nourish-yourchoice.org provides many videos and articles on the subject of the Nourishment Table

Further material is also available on the website of https://www.aleph2020.org/human-health/the-nourishment-table#c1208.

Source: https://www.aleph2020.org/human-health/the-nourishment-table#c1208

The Nourishment Table

Back to the future of common-sense food

Why is yet another dietary framework needed? For good reasons! **The Nourishment Table revives timeless dietary wisdom** amid the pitfalls of modern food guides, urging a return to a more common sense and flexible approach to culturally attuned eating.

The dietary guides that have been in place for many decades, including the ubiquitous food pyramids and various concepts of "plates", have failed to evolve with evidence-based progress in the sciences. These frameworks are notoriously rigid, imposing universal prescriptions that are often at odds with personal tastes, cultural traditions, and lifestyle variances, leaving people confused and without a compelling motivation to change.

Despite decades of public health promotion efforts, they have not delivered, with obesity and chronic diseases surging. Compliance is minimal, surveys show only a fraction of adults meeting even basic fruits and vegetable targets. Compounding this problem, the foundations of a lot of dietary recommendations rest on low-certainty evidence unsuitable for strong, top-down recommendations. The Nourishment Table avoids these pitfalls. It is constructed on the two dimensions of Nutrient Density and Food Processing (more detail in the next sections).

The resulting matrix denotes green areas with nourishing dietary patterns, orange areas that require attention, and red areas with diets that should be avoided. One main feature of the Nourishment Table is that virtually all traditional ancestral domain diets fall right into the center of the green area, demonstrating **that people have been eating relatively adequately throughout much of human existence with a myriad of food combinations** – a wisdom that seemingly has gone missing in much of the modern era of food disorientation, including current dietary guidelines.

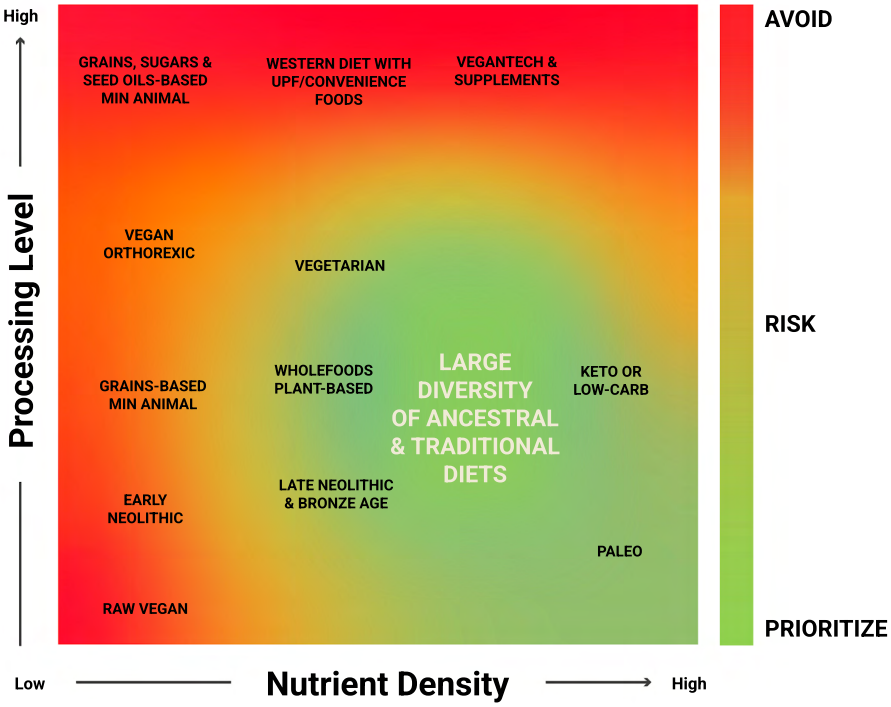
The peer-reviewed science publication on the Nourishment Table by Leroy et al., 2025: https://academic.oup.com/af/article/15/1/10/8106660

Chef's takeaway

Prioritize Nourishment:

The Nourishment Table provides the scientific evidence-based reason for the quality of traditional ancestral eating, a wisdom that has gone missing. Rather than following dietary fads that gain media attention but are rarely followed in practice – it offers a guideline that is practical, pragmatic and easily recognizable for common sense people.

Figure 2: The Nourishment Table characterizes dietary patterns, not food items. The priority patterns are nutrient dense and consist of moderately processed foods (green area). As the diet increases in processing and decreases in nutrient density, the risk of malnourishment goes up (orange area). The respective extremes of ultra-processed foods and nutrient-poor foods should be avoided (red area).



Source: https://www.nourish-yourchoice.org/

GLOSSARY OF DIETS

'Rich' = High Income Population / 'Poor' = Low Income Population

LARGE DIVERSITY OF ANCESTRAL & TRADITIONAL DIETS:

Large number of variations of diets that are found on every continent. These diets prioritize nutrient dense foods from animals and/ or vegetables in a main dish, with starch additions from either grains, tubers or beans for energy. Little or no sugar or processed seed oil utilization. Fruits and nuts may also be common, depending on the region. Wide variety of tarditional processing methods, but no food transformation towards ultra-processing.

Grains, sugars & seed oils-based, min animal:

Slightly more expensive diet than the minimum cost diet of only grains-based. Geared for more eating pleasure generated by sugars and oils. Leads not only to stunting but also to metabolic diseases such as diabetes, CVD, depression, certains cancers.

Vegan orthorexic:

A starvation diet that reduces body functions and is used as weight loss and psychological self-control method. It may serve as a smokescreen for orthorexia nervosa or anorexia nervosa. Can have severe long-term negative health consequences, and can be highly dangerous during pregnancy.

Grains-based, min animal:

Typical minimum cost diets for supplying enough calories but not enough nutrients in low-income populations. This diet compromises cognitive and physical development, especially in the young. Besides being deficient in important micronutrients and essential fatty acids, the low protein quality is a major concern (for instance for healthy aging).

Early neolithic:

The agricultural neolithic revolution 12000 years ago led to a relatively secure supply of grains-based calories. But the lost skills of hunting and gathering led to severe nutrient deficiency.

Raw vegan:

Based on raw vegetables and fruits, and for that reason suffering from low nutrient bioavailability and potential issues with antinutritional factors and plant toxins. Also tends to be energetically deficient. Very risky for vulnerable groups with elevated needs.

Western with UPF/convenience foods:

Hyper palatable, quasi- addictive overriding satiety foods leading to overeating, and paralleling an increased risk of chronic diseases. Plus, there is concern about the excessive use of additives (emulsifiers, colorants, preservatives, sweeteners, ...) which may potentially have long term negative health effects.

Wholefoods plant-based:

Usually avoidance of any animal products. Requires culinary skill to extract nutrients from a variety of vegetables through advanced processing skills. Not suitable for women (iron deficiency), or mentally stressful life situations (students, modern work life).

Vegetarian:

Same as ancestral, but without certain groups of animal foods, usually excluding (red) meat. Requires more culinary skill, may need more financial resources and less suitable for some people with elevated needs (ill, old, young, pregnant, lactating, genetically vulnerable).

Late neolithic & Bronze Age:

When sophisticated breeding techniques were applied to animals and crops around 6000 years ago, this brought back required nutrients to the neolithic and subsequent diets. Especially decisive was the introduction of secondary animal products (milk, eggs, wool). Only on that basis was it possible that urban culture civilization could unfold.

Vegantech & supplements:

Largely based on ultraprocessed foods with ample supplementation but unclear nutrient bioavailability profile and unknown long-term effects on metabolic health.

Keto or low-carb:

Usually based on nutrient-dense foods from both animal and plant origin, but minimizing carbohydrates and avoiding starchy staples and sugary foods. Often used therapeutically in the case of chronic diseases. In most cases based on minimally or moderately processed foods, but some keto version of UPFs exist.

Paleo:

The Paleo diet emphasizes eating whole, unprocessed foods similar to those available to our Palaeolithic ancestors, such as meats, fish, vegetables, fruits, nuts, and seeds. It minimizes modern agricultural products like grains, legumes, and refined sugars, and, usually, dairy. Although Paleo meals are narrow, modern interpretations of human evolutionary diets, they may promote better metabolic health, including improved blood sugar control and reduced inflammation. Variations, such as Paleo-Keto or Carnivore, are more restrictive but may offer tailored approaches for individual needs.

Nutrient density

The matter, that matters

Three basic factors help to understand human nourishment:

a) **ENERGY** - food intake needs to supply enough to sustain daily activity. Dietary energy is usually measured in calories, and requirements typically vary between 1600 and 2400 calories per day, per person, depending on factors such as activity, lifestyle, and size.

b). **MACRONUTRIENTS** – must be kept in balance. Protein is the cornerstone of a nourishing diet and should be consumed generously. But there is a practical and physiological ceiling starting at around one third of the calorific intake depending on context. Therefore, lipids and carbohydrates are needed to dilute protein calories. In contrast to fats and oils, which also bring in essential fatty acids and fat-soluble vitamins, carbs are not needed per se. They may serve as a source of energy and fibre. That said, harmful variants of both lipids and carbs should be avoided, which are usually brought into diets by highly processed staples (e.g. trans-fat and refined starches).

c). **MICRONUTRIENTS** - cannot be produced by the body itself and must come from food. It is therefore essential to consume enough micronutrients (vitamins and minerals) for the metabolism to function correctly. Preferably through whole foods. If the latter is not practical or difficult to achieve, fortification and supplementation become necessary.

Contrary to popular perceptions of a global food shortage, thanks to modern agricultural advances in technology, the global population is well supplied with calories for its energy demands. Some 600 grams of either maize, wheat or sugar easily supply 2400 calories, and are readily available in the form of breads, pastas, porridges, cakes, or sugared beverages around the world. In Africa, such 600-gram portions of carbohydrate foods cost around 0.5 Euro, whereas on average in Europe the retail price averages around 1 Euro for raw flour, or 2 Euro for its equivalent in processed bread or pasta. **Unless a country or a region is in civil war circumstances, then even the poorest of the poor can afford to fill their stomachs with enough energy from these sources.** These, however, are far from being nourishing options.

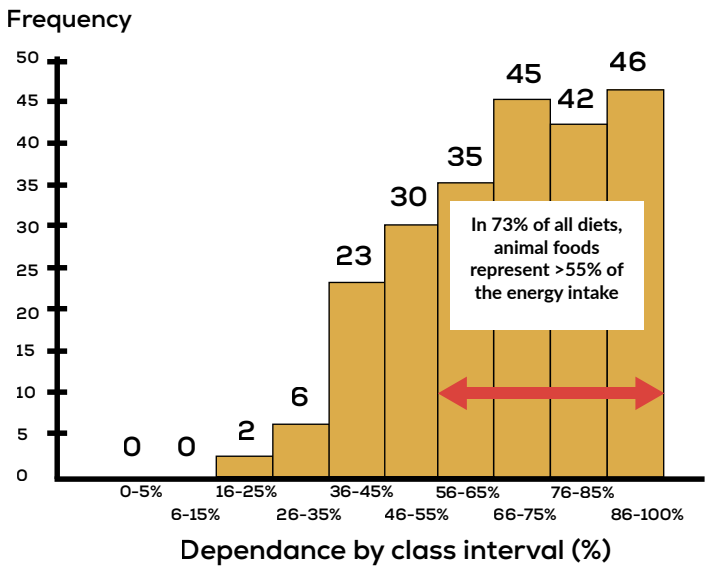
The real challenge today is to ensure that enough of the necessary essential amino acids, vitamins, and minerals that human bodies need to thrive are provided as well. A daily diet composed of only 600 grams of wheat products would deliver at best only 30% of daily protein requirements and even worse, would be seriously lacking in micronutrients. **That is why the left side of the Nourishment Table, where diets are primarily composed of low-nutrient staple foods and empty calories delivered by starchy and sugary foods as well as fats or oils, is indicated as hazardous.** Such a diet will incur severe metabolic health problems.

Diet compositions should first be oriented towards nutrient-dense foods that deliver adequate quantities of high-quality protein and bioavailable micronutrients – and only then be filled up with energy. Therefore, the middle and right-hand side of the Nourishment Table are displayed in green colors. **For most people, food items from meats, dairy, eggs, fish, and nutrient-dense vegetables will deliver around half of their required calories, so that the other half can easily be covered by a portion of pasta or bread, or from fats, each according to personal and cultural availability, needs, and preferences.** Only for a few, such as adolescent physically active young men, workers with high physical activity or athletes – i.e. a person whose daily energy demands exceeds 3000 calories, may an additional focus on calories be necessary.

On the need to eat animal-sourced foods to achieve nutrient density see Vieux et al., 2025: https://www.nature.com/articles/s41538-024-00249-y

The Nourishment Table's green zone leaves many options to achieve a sufficiently nutrient-dense diet composition. **The possibilities range from vegetarian diets to carnivore diets.** While the nutritional adequacy of both extremes requires more cautious planning, skills, and deliberation, both are in principle feasible. The middle ground is populated by thousands of traditional and ancestral diets from around the world with endless combinations of nutrient-rich foods, complemented with less nutrient-dense staples, which evolved over thousands of years of human civilization. Ancestral type diets usually had a minimum of one fourth to one third of their calories coming from animal-sourced foods, or put differently, about half of the protein intake. Going below that may compromise micronutrient adequacy.

Figure 3: The comprehensive investigation by Cordain et al., 2000 in 229 worldwide hunter-gatherer diets, showed that in most of these ancestral diets, animal foods represented more than 55% of total energy intake, and in virtually all of them more than 35%.



Source: Recreated from Cordain et al 2000

The Appendix on page 41 describes which proteins and micronutrients to look out for in nutrient density and why.

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Chef's takeaway
Nutrient Density:

A complete meal should first include nutrient dense foods from animals, fruits and vegetables to meet an adequate supply of all essential nutrients. Only then should energy-delivering carbs and fats be added to meet total dietary requirements.

Processing

The good, the bad and the ugly*

*Film title of Sergio Leone's film in 1966

Food processing: Humanity's built-in survival tool

Processing is simply any action that changes food from its raw state. That includes cutting, grinding, heating, fermenting, drying, smoking, salting, freezing, milling, mixing, pressing, fermenting or cooking – techniques that are used daily in household kitchens, by professional chefs and artisan food producers. What makes humans unique in the animal world is how far they have developed this ability. **No other species systematically pre-digests its food before eating it.**

By cooking and processing, humans learned to outsource part of their digestion: making nutrients easier to absorb and reducing the energy cost of running the digestive tract. This freed up energy to support unusually large and demanding brains. **Processing also solved another evolutionary challenge, food preservation. It allowed humans to store and transport food, survive winters, droughts, and migrations, and feed entire communities year-round.** There is nothing wrong with processing per se; in fact, it is one of the central reasons why the human species developed. What matters is ***how much*** and ***what kind*** of processing.

Chef's takeaway

The value of processing:

Cooking and processing make food safer, tastier, and easier to consume and digest. It allows storing and sharing of food across seasons, which meant survival. Processing is not the enemy; it is a uniquely human advantage. The key question is always: how far should it go?

Ultra-processing: when food begins to imitate food

Scientists still debate where "processing" ends, and "ultra-processing" begins. Different classification systems exist, but there is no universal agreement on the precise boundary or on why these foods harm health. **The safest way to describe it is you know it, when you see it.** Typically, original ingredients have been broken down into isolated parts – starches, sugars, refined fats and oils, and/or protein isolates – and then re-assembled with colorants, flavorings, and texturizers and emulsifiers into something that only imitates real food.

Whenever such artificial foods take over a diet, in any country or culture, rates of obesity, diabetes, and cardiometabolic illness rise sharply, and with them, premature deaths. The link is consistent even if the exact mechanism, whether nutrient imbalance, damage by refined carbohydrates and/or oxidation-prone seed oils, sensory-nutrient gaps, addictive properties, or disruption of the gut microbiota, is still being studied. The practical message is simple: the more meals that come from industrially reconstructed ingredients, the worse the population's health becomes.

On why UPF's should be avoided: by Monteiro 2024: https://www.bmj.com/content/384/bmj.q439

Chef's takeaway

Ultra-processed foods:

There is no ultimate definition, but you recognize them instantly, often as ready-to-eat "food look-alikes." Wherever they replace real cooking, illness and obesity rise. The reason is still being studied, but the pattern is clear: more ultra-processed food leads to worse health outcomes.

Why ultra-processed foods confuse the body

Despite a lack of scientific consensus, science is not flying blind. **Science has identified three likely reasons why ultra-processed diets damage health.** What remains uncertain is which of these factors, or which combinations, do the most harm.

1.**METABOLIC CONFUSION**: when food components are broken down and re-assembled with heavy doses of sugars, starches, fats, and salt, the digestive system no longer recognizes them as natural meals. The **evolutionary finely tuned self-regulation of hunger, absorption, hormonal and energy balance becomes disrupted, leading to a cascade of malfunctions, including energy toxicity, insulin resistance, and fatty liver.**

2. **SENSORY DECEPTION**: **From smell, bite, and appearance to taste and gut feedback, body sensors are trained to anticipate certain nutrients from flavors and textures.** Ultra-processed foods often trick these sensors, for example, artificially sweetened and flavored drinks imitate nutrient-rich fruits, only to deliver a sudden sugary imitation surge without the anticipated nutrients.

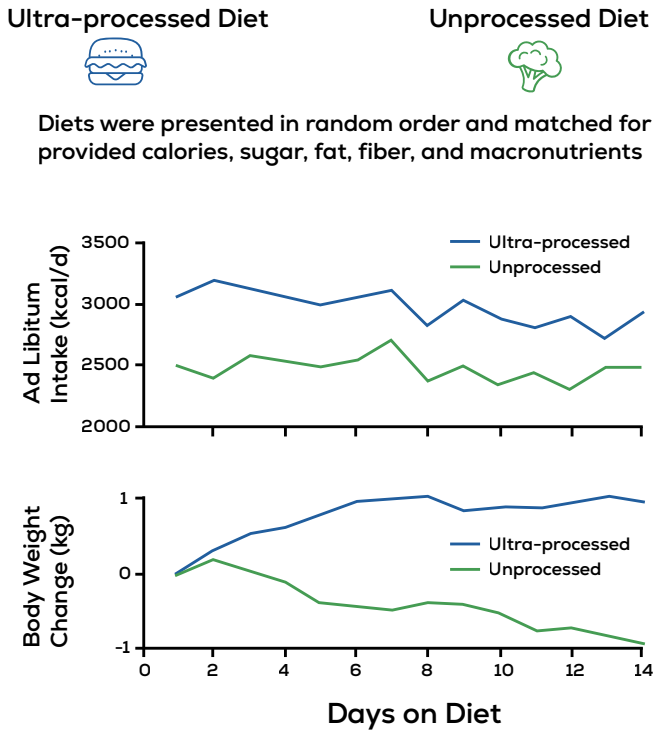
3. **INGREDIENT CONFUSION**: The sheer number of additives, stabilizers, emulsifiers, colorants, and processing aids in these foods, which for industrial or marketing reasons, are practically unavoidable. **Whether natural or synthetic makes little difference; they exist to satisfy texture, taste, and convenience requirements rather than nutrition.** Each is legally approved, yet their combined, long-term effects on gut health and bodily metabolism remain poorly studied and controversial among experts. Together these factors show that the harm from ultra-processed foods is not mysterious; it stems from how they mislead the body's self-regulation that evolved from eating natural foods.

Chef's takeaway

Why it matters:

Ultra-processed foods confuse digestion and satiety, fool the senses, upset metabolic responses, and overload the liver. Additives add another unknown burden. These products imitate food but do not behave like it inside the body. Real cooking keeps the body's natural control systems working as designed.

Figure 4: In their famous landmark publication, Hall et al., 2019 showed that consumption of ultra-processed food is associated with higher calorie intake and over-eating.



Source: Recreated from Hall et al. 2019, https://www.sciencedirect.com/science/article/pii/S1550413119302487

Figure 5: In his book 'Nourishment', Provenza presents his thesis of the wisdom body, a wisdom that links flavor-feedback relationships at a cellular level with biochemically rich foods to meet the body's nutritional and medicinal needs. Provenza explores the complexity of these relationships as he raises and answers thought-provoking questions about what we can learn from animals about nutritional wisdom.

Ancestral domains
Grandmother's wisdom

Meat – the food that made humanity

The shift toward eating meat was one of the decisive steps in human evolution. Some two million years ago, early humans moved from foraging fibrous plants and roots that required extensive digestion, to a hunter–scavenger-gathering lifestyle in savannah ecosystems, that provided dense packages of protein, minerals, and essential nutrients.

On the evolutionary background of meat in diets see: Leroy et al., 2023: https://academic.oup.com/af/article/13/2/11/7123475

Meat is uniquely nutrient-rich: it supplies a balanced spectrum of essential amino acids and fatty acids, vitamins (with B_{12} being particularly important) and highly absorbable iron and zinc in forms plants cannot easily provide. This transition to nutrient-dense diets allowed human ancestors to shorten their digestive tracts and invest the saved energy into developing larger brains and more complex social behavior. In other words, **meat was not simply "food" – it was the *biological enabler* of humanity's intelligence, cooperation, and mobility.** From an evolutionary perspective, the human species is designed to have animal foods as a central part of its diet, and its bodily functions are still witness to that.

Animal fat – the brain's silent partner

It was not only meat, but also animal fat, that made large-brained humans possible. **The brain is an energy-hungry organ, demanding about one-fifth of the body's total fuel, and it runs best on the steady, high-density energy that fats provide** (more than twice the calories per gram compared to carbs or proteins). In early environments, fat was rare and precious: marrow, organ fat, and fatty cuts were highly prized and shared. These fats supplied calories, lipid-soluble vitamins, and the long-chain fatty acids (DHA, EPA, arachidonic acid) essential for neural growth and function, as well as the other supporting nutrients found in animal foods (creatine, carnitine, niacin, iron, zinc, choline).

On the role of fat in evolution see: Ben-Dor et al., 2021: https://onlinelibrary.wiley.com/doi/10.1002/ajpa.24247

In modern nutrition, the same principle still applies, **adequate intake of natural animal fats support hormone balance, vitamin absorption, and stable energy levels.** Far from being an optional indulgence, animal fat was and arguably remains the metabolic foundation of the human brain's evolution and performance.

Agriculture, carbohydrates, and the return to balance

The Neolithic agricultural transition, about 10 000 years ago, transformed human diets. **For the first time, large populations came to rely heavily on carbohydrates from cultivated, processed and stored grains** – foods that had been much scarcer and at best seasonal in the Paleolithic era, especially during the Ice Ages. Agriculture allowed settlement and population growth but also brought nutritional imbalance: remains of early farmers often show shorter stature, weaker bones, and various signs of deficiency or harm compared with their hunting ancestors.

It took another leap – the improved domestication of livestock on a large scale roughly 5 000 years ago – to restore metabolic balance.

It took another leap – the improved domestication of livestock on a large scale roughly 5 000 years ago – to restore metabolic balance. Meat and animal fats once again becoming more widely available. With the important development of milk and dairy technology, humans regained the full spectrum of nutrients needed for sustained health and higher activity. Only then could cities, literacy, mathematics, and high civilization take off. The same principle holds true today: stable, prosperous societies have always relied on a food base that combines crop yields with the nutrient density coming from animal-sourced foods.

Chef's takeaway

Ancestral domains of nourishment:

- *Meat built humanity: it provided the complete nutrients that allowed smaller guts and bigger brains.*
- *Animal fats powered the brain: dense, stable energy and essential fatty acids made intelligence possible.*
- *Farming fed the crowds, but livestock restored health: early grain diets weakened people until milk, meat, and fat returned.*
- *Balanced menus still follow that logic: combine plant foods for energy and specific micronutrients with animal foods for nutritional completeness, strength, and resilience.*
- *The foundation of civilization – and good cooking – is the partnership between field and herd.*

Figure 6: A 1942 'Good Housekeeping' guide, where eating meat was common sense.

Are meats, and red meats in particular a threat to good health?

Meat – the food that made us human

There is a persistent discussion in society and in scientific circles that red meat can cause various non-infectious diseases and should therefore be avoided. At various times, **red meat has been blamed for causing diabetes, cardiovascular problems, obesity and even cancer.**

These are not just rumors. There is an extensive body of scientific literature which examines these relationships, and several renowned and vocal scientists, for instance, from Harvard University and the World Health Organisation warn against consumption of red meats based on these scientific investigations. **This is also the reason that many professionals in the medical community advise their patients against red meat consumption.**

Nonetheless, the authors of this guideline hold the strong scientific position that red meats are NOT dangerous to a person's health within the proper dietary context, and on the contrary have many important health benefits. The authors take this position because:

a). In the largest and most representative epidemiological study performed worldwide, the PURE investigation, both **red meat and saturated fat are not found to be associated with higher mortality rates**.

On the PURE results see: Mente et al., 2023 https://academic.oup.com/eurheartj/article/44/28/2560/7192512?login=true

b). A comprehensive review of all available scientific evidence on the subject conducted in Annals of Internal Medicine by the NutriRECS international consortium, using principles of evidence-based medicine (the GRADE approach), has shown that all of this evidence is of low to very-low certainty and **not suited for making strong top-down recommendations.**

On the status of scientific evidence about red meat see: Johnston et al., 2023: https://academic.oup.com/af/article/13/2/19/7123476 and Johnston et al., 2019: https://www.acpjournals.org/doi/10.7326/M19-1621

c). Even the strongest advocates for red meat danger, have never been able to prove causality of how red meat would cause disease. The only evidence they have are hypothetical mechanisms and statistical correlations. These have been shown multiple times to be **severely compromised by unobserved confounding effects** such as healthy user bias, specific dietary contexts that are atypical for the population at large, or too limited sampling populations.

On the use of poor metrics see: Stanton 2024: https://www.nature.com/articles/s41538-024-00249-y

d). It has been shown that advocates for avoiding red meat, **are often intellectually compromised with cultural, ideological or financial conflicts of interest.**

On the difference between scientific truth and scientific evidence see: Ederer 2024: https://connectsci.au/an/article/64/7/AN23331/20772/Perspective-on-scientific-truth-versus-scientific

e). **Red meat consumption has clearly proven health benefits,** rather than hypothetical disadvantages. These include a solid supply of heme-iron, vitamin B12 and excellent absorption of its proteins, among other nutritional benefits, which would need to be factored in during any risk assessment. Diets avoiding red meat can easily become deficient.

On the nutrient deficiencies in the EAT Lancet Planetary Health Diet see: Beal et al., 2023 https://www.thelancet.com/journals/lanplh/article/PIIS2542-51962300006-2/fulltext

f). The biosocial evolutionary history of Homo, for most of its time on Earth, **has been driven by the hunting of and consumption of red meat.** It makes very little sense that this evolutionary foundation would turn out to be dangerous to the human species.

On the role of fat in evolution see: Ben-Dor et al., 2021: https://onlinelibrary.wiley.com/doi/10.1002/ajpa.24247

Chef's takeaway

Meat, and in particular red meat, is safe.

There is no scientific evidence which has been able to prove the opposite. There exists plenty of scientific opinion and lots of noise. On closer inspection, much of this can be shown to be ideologically motivated. Unprocessed red meat is not dangerous, but is proven to have important health benefits, being rich in heme-iron, B12 and high-quality protein.

Protein availability in Europe

On average, on target

**** The following sections talk primarily about proteins. This is because protein prevalence in food has a "sentinel" quality. High protein-density correlates somewhat with other micronutrient densities. To reduce the complexity of the discussion, protein therefore serves as an imperfect proxy for nutrient-density. ****

The Appendix section explains that around 100 grams of adjusted (bioavailable) protein per person per day is an ideal figure to aim for – not too much, nor too little – to ensure the minimum desirable consumption of 60 grams per day (for a 75kg person). **According to FAO data, all European country's food systems supply circa such 100 grams. Figure 10** shows the composition of sources of protein and total amount for each of the 27+2 EU countries. In some countries with lower incomes in the East & South, availability may drop slightly below this level, but not to an alarming degree.

→ See Appendix on page 39

On the role of protein quality see: Wolfe et al., 2024: https://www.frontiersin.org/journals/nutrition/articles/10.3389/fnut.2024.1389664/full

"Being available per FAO data" means these are **the amount of protein (as food) that is ready for sale in retail or restaurants. However, from this point towards that food being usefully consumed, is a long way.** Some of this food will not be sold and thus becomes waste before reaching the customer. Some will be spoiled by the consumer and thrown away. During cooking, some will be trimmed, denatured or decomposed, so that the proteins and other nutrients lose potency, or are discarded. For example, the brown skins of cereals like wheat and rice that contain most micronutrients are typically discarded because of their perceived bad taste. Another example are the collagens, fats or organs in animal products that are often cut away, despite their high nutritional value. Even once the food makes it onto the plate, it may still become a leftover instead of being eaten. Or when eaten, various minor or major digestive disorders might prevent optimal uptake.

Furthermore – the above value is AVERAGE. **Such an average hides significant differences between different socio-economic strata of society, according to cultural/behavioral choice or seasonal variation.** It is therefore likely that there are segments of society who are chronically undersupplied with nutrients despite this average.

On micronutrient deficiencies see : Beal & Ortenzi, 2022 : https://www.frontiersin.org/journals/nutrition/articles/10.3389/fnut.2022.806566/full

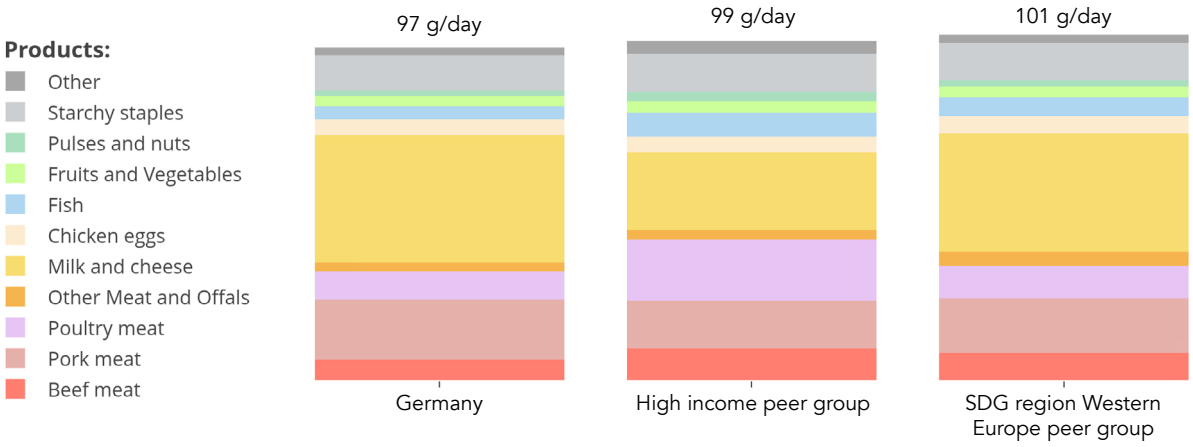
It has been shown for instance, that as much as one third of the European population suffers from micronutrient deficiencies in iron, calcium or vitamins C, D, E or B12 - even though on average they are just about, sufficiently available. A similar situation would occur with proteins, where an average availability according to recommended levels, would create large socio-economic pockets of deficiency.

In short – supplying a surplus AVAILABILITY of key nutrients is not a luxury, but a necessity given the need for sufficient nutrients to make it through to digestion across the population. All efforts to reduce food waste must be encouraged, but currently the effectiveness of such efforts are often overestimated, because of food safety concerns and food palatability needs.

In international comparison, European citizens are supplied with a similar level of proteins to other high-income countries in North America, Australia and the East Asian including mainland China (**Figure 8**). It is notable that East Asia provides a higher proportion of fruits and vegetables in their diets.

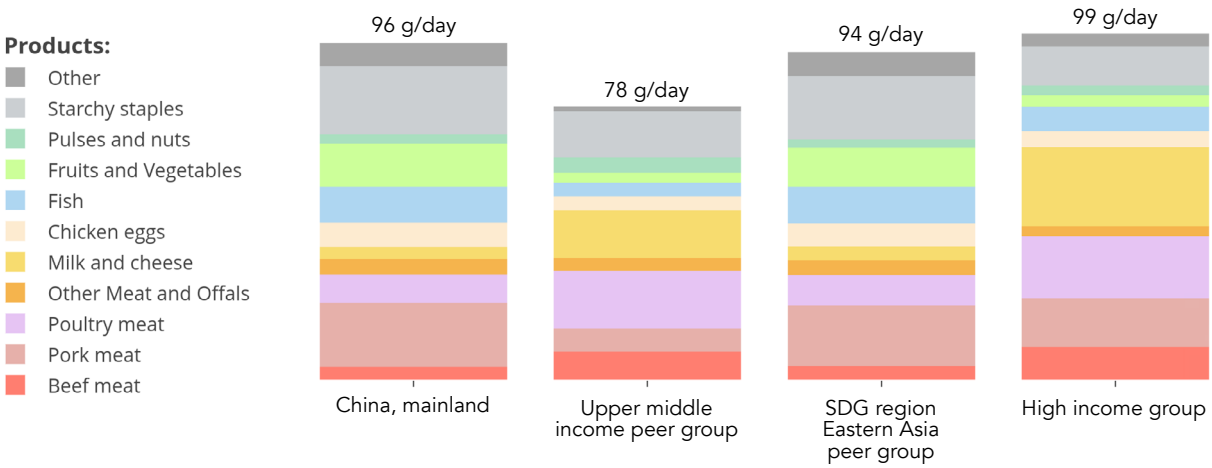
Figures 7 - 9: Amount of protein available in their respective food system per capita per day, for Germany, China mainland and India. Including comparison to their respective regional or income peer groups. Proteins are adjusted for bioavailability. Availability does not equal consumption, see text.

Figure 7: Adjusted Protein Composition in g/day per person, food available as per FAO, Germany 2022



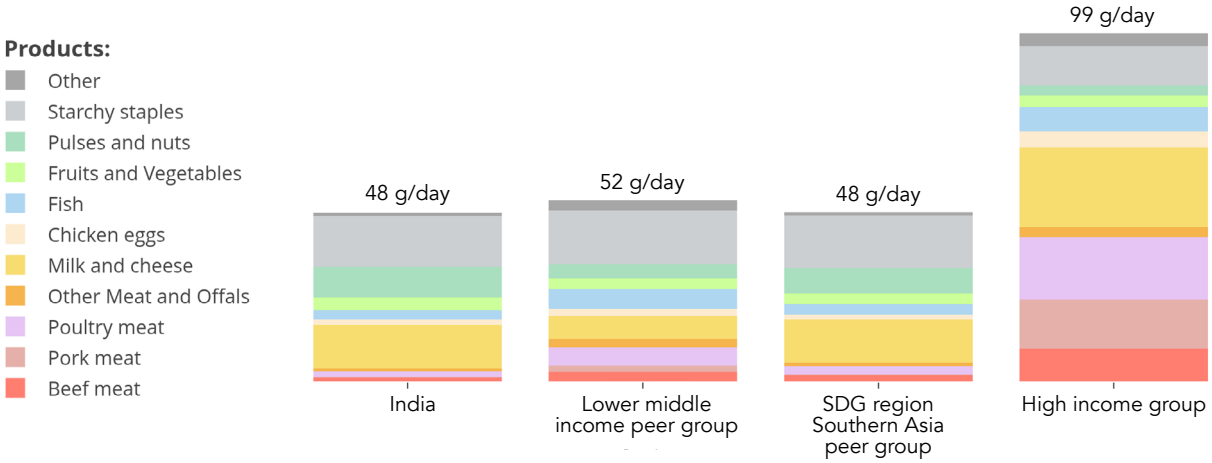
Source: GOALSciences analysis based on FAOStat data
https://goalsciences.org/food-system-explorer/world-map

Figure 8: Adjusted Protein Composition in g/day per person, food available as per FAO, China, mainland 2022



Source: GOALSciences analysis based on FAOStat data
https://goalsciences.org/food-system-explorer/world-map

Figure 9: Adjusted Protein Composition in g/day per person, food available as per FAO, India 2022



Source: GOALSciences analysis based on FAOStat data
https://goalsciences.org/food-system-explorer/world-map

By contrast, in India which is sometimes cited as a good example of a primarily “vegetarian” nation has a clear deficiency of protein and micronutrient availability. At an average of less than 50 grams per day, large sections of society are not properly nourished **(Figure 9)**. Even though consumption of pulses is three times higher in India compared to the high-income countries, this does not compensate for the severe deficiency of animal-sourced foods. The same is true for the entire group of South Asian countries. Other regions with lower middle-income countries, do marginally better due to supply of poultry products, but do not have the benefit of the level of supply of dairy products that are prevalent in Southern Asia.

Chef’s takeaway

Average protein availability in Europe is about right, not too much, nor too little

European citizens are on average adequately supplied with the key nutrient of proteins. In global comparison, Europe ranks among the best supplied nations. However, watch out for socioeconomic or cultural segments of society who might yet be undersupplied. Food professionals should make efforts to reduce food waste, including educating customers on the nutritional value of many food items that are often discarded, such as whole grain cereals, vegetable skins or collagen-rich and fat-rich tissue in meat products.

Sources of protein in European diets

The European composition of the bioavailable protein is met 80% from animal sources, with being split half by meats and half by dairy, eggs and fish, with some minor geographic variations. Vegetables and fruits contribute 3%, and pulses/nuts a further 3%. The remainder is derived from cereals, mostly wheat products in bread, pasta, and cakes. The proteins in the pulses/nuts group are mostly tree-derived nuts or groundnuts (peanuts).

In most European countries pulses make up less than 1% of protein supply. This category includes all beans, peas and lentils. Technically speaking, peanuts are also a pulse, but because of popular attribution, they are counted in the nuts category. **Fruits and vegetables contribute little to overall protein supply.** They are however a vital source of vitamins and minerals. Cereals provide proteins but with two significant drawbacks: protein in cereals has low bioavailability, and every energy unit from protein comes with up to 19 energy units from carbohydrates. The protein density of cereals is therefore low, especially compared to animal-sourced foods, where most of the energy is derived from protein, and only a small fraction from embedded sugars and fats.

It is perfectly possible to obtain enough protein from pulse-rich diets, i.e. beans, peas and lentils. The bioavailability and energy ratio is not as high as with animal-sourced foods but is sufficient to structure healthy meals from them. **However, around the world and throughout the ages, when people can afford to feed themselves with animal-sourced foods, they will abandon pulses from their diets.**

Advocates of plant-rich and animal-scarce diets popularly call for more vegetables and fruits to be eaten. When picturing carrots, iceberg and apples, this may sound “crunchy and healthy” but can be misleading. **What is often lost in the scientific fine print is that vegetarian diets require substantial amounts of pulses to be consumed for them to become nourishing.** In the case of Europe, the number of pulses eaten would need to increase 60-fold, if no meat was consumed. Vegetarian diet advocates usually do not spell this out. Typically, their recommendations get around this fact, by reducing the supply of protein from the 100 necessary grams to only 60 recommended grams per day on average, or even less. **This is achieved by assuming that food loss and waste can be reduced to zero and socio-economic equal distribution met.** However, delivering an average of only 60 grams of bioavailable protein per day will result in severe undernutrition in significant parts of the population.

On the need for generous protein supply to ensure adequate diets see: Ridoutt et al., 2025 https://www.mdpi.com/2674-0311/4/3/35

Even setting aside this unrealistic assumption of food waste – there is another problem with pulses as the core supplier of nutrients in a diet. Why is it a universal common reaction of people and cultures around the world, to turn to meat and other animal-sourced foods, as soon as they can afford not to have to eat the lower cost protein sources of beans, peas and lentils? **The answer probably lies in the fact that for many persons, pulses do not have an attractive flavor/taste, and that is for a good reason.**

Across many cultures, pulse-derived recipes are heavily salted, marinated, spiced, sugared or fermented to create an acceptable taste profile. Consider tofu or chilis as evidence. Evolutionary wisdom embedded in the sensory systems might be the cause: **pulses were rarely part of the evolutionary diet of the *homo* genus.** In addition to animal-sourced foods, meat, milk, eggs, insects and honey, the homo species also ate fruits, roots, and leaves, and therefore appreciates the taste of these foods. However, pulses are toxic to the homo sapiens species, and only an extensive amount of washing and cooking will eliminate the toxins. Their taste therefore "warns" against consumption.

Chef's takeaway

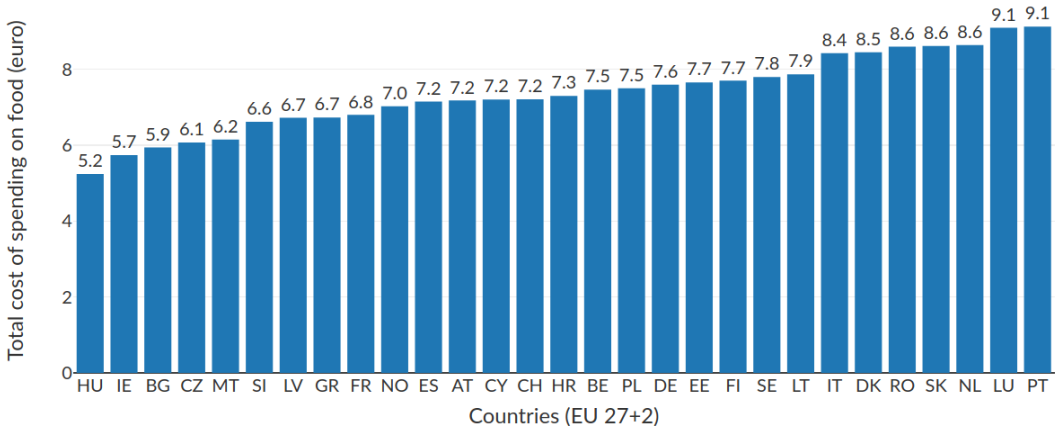
Beans, peas and lentils cannot replace the role of meat in a European diet

The cultural and evolutionary wisdom that is embedded in animal-sourced foods is deeply anchored in European societies. Replacing animal-sourced foods with pulses in a European diet is not likely to be a successful policy. This would require considerable forcing, which is undemocratic and violates the values of liberty that are the foundation of European society.

Protein affordability
who can pay and who pays

In 2024 the average EU+2 citizen spent € 7.50 per person per day on food (excluding alcohols), on a purchasing power parity adjusted basis (see methodology box). This ranges from € 5.24 in Hungary to € 9.12 in Portugal (per person per day) (**Figure 10**)

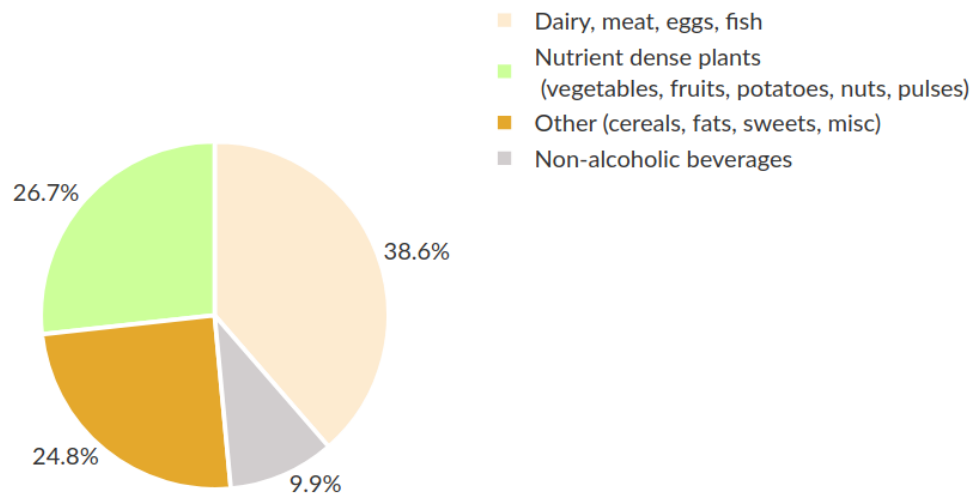
Figure 10: Average spending on food across Europe for household consumption per capita, per day 2024 (PPP-adjusted, without alcoholic beverages, no out-of-home)



Source: GOAL Sciences analysis based on Eurostat and FAOStat data

Of this amount, 39% or € 2.92 are spent on animal-sourced products of dairy, meat, eggs and fish; 27% or € 2.01 are spent on nutrient dense plants of vegetables, fruits, nuts and pulses; 25% or € 1.84 are spent on other foods of cereals, fats, sweets and miscellaneous; and 10% or € 0.72 are spent on non-alcoholic beverages (**Figure 11**)

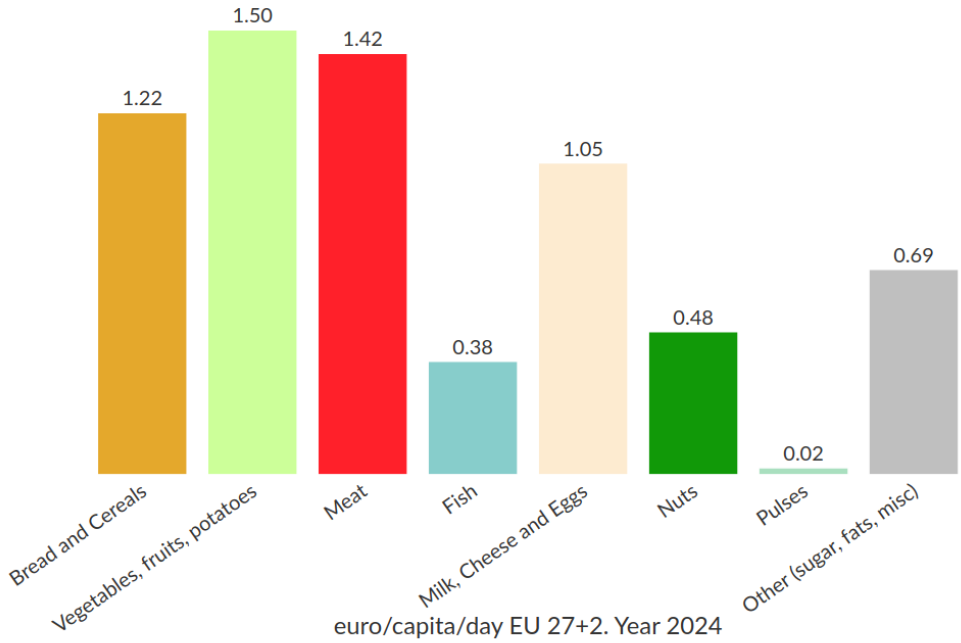
Figure 11: Split of European household consumption food spending by common food groups in percentage 2024.



Source: GOALSciences analysis based on Eurostat and FAOStat data

Figure 12 splits the non-beverage portion into finer categories in terms of Euro per day, which will then be used as the basis to consider the cost of food per bioavailable proteins.

Figure 12: Split of European household consumption food spending by food groups used for current analysis, per capita per day 2024 (PPP-adjusted, no out-of-home)



Source: GOALSciences analysis based on Eurostat and FAOStat data

Methodology explanation:

EU+2: All comparisons are conducted for the EU 27 countries plus Switzerland and Norway.
All prices in this chapter are in the unit of "Purchasing Power Parities" (PPPs), price level indices and real expenditures for ESA 2010 aggregates with reference year 2020, taken from **this website of Eurostat.**
What this means in short: all prices shown in this section are adjusted for different purchasing power in the respective countries and are expressed in prices of the year 2020. These prices are different across countries, because they reflect REAL differences in quality of purchased goods. They are NOT adjusted to reflect the same basket of goods, and they are also not adjusted for different overall real incomes. For instance, shown in **figure 15,** *the Dutch are spending nearly 195 Euro per kilogram of bioavailable protein contained in bread and cereals, whereas the Hungarians spend only 63 Euro. This recognises that the Dutch are spending more money for the same amount of bread, by buying higher value breads, more pastries, more expensive small serving sizes and in more expensive retail outlets. In* **figure 49** *this is then related to the different levels of disposable income in the countries. According to this metric, the Dutch spend 2.0% of their disposable income on bread and cereal products, and the Hungarians spend 1.2%, after adjusting for different purchasing power.*

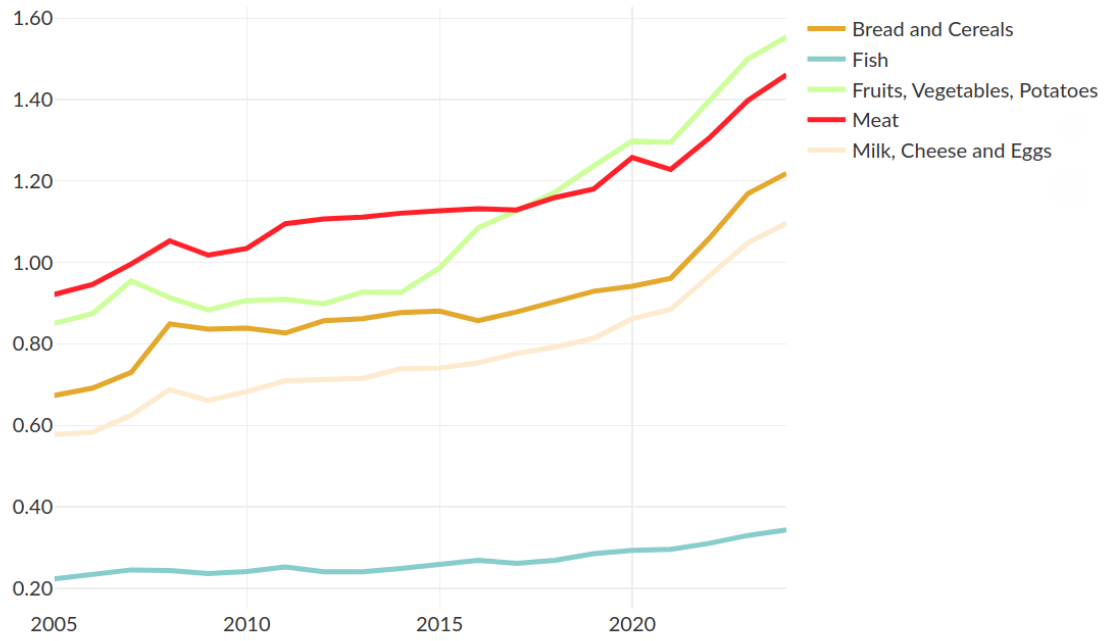
The Eurostat data records expenditure on household consumption only. So food eaten away from home is not included in this figure. There is much speculation about how much food is eaten outside the home, by who, on what and how it differs by countries. Some sources say that in rich countries, close to 60% of all meat products are eaten outside the home, and only 30% of all cereals. And that in poorer countries more food is consumed at home. This is almost certainly a misunderstanding between value of consumption and quantity of consumption. Dietary surveys record much lower values of food being eaten away from home, at around 20-25% for meat products, and around 15% for all other food items such as cereals, dairy products, fruits and vegetables. Males eat a few percent more of their food outside of home than females and regional differences also fluctuate, but only by a few percent. However, dietary surveys also have large margins of uncertainty.

Due to a lack of detailed reliable information, this analysis ignores this dimension. This means that the cost per kg of protein in **figure 14**, *is underestimated by a factor of 20-25% for meat, and around 15% for all other food categories. This changes nothing in the overall messages coming from these statistics.*

*Eurostat provides data for the first five categories over the past 20 years between the years 2005 and 2024 (***Figure 13***). The graphic shows how average prices across Europe have risen sharply by more than 20% in the four years between 2021 and 2024. However, as average nominal wage growth has risen similarly, this has not made much difference to the affordability of food in general.*

Eurostat: https://ec.europa.eu/eurostat/databrowser/view/prc_ppp_ind__custom_18413249/default/table?lang=en

Figure 13: 20-year development of European household consumption spending on protein-rich food groups, per capita per day 2005-2024 (PPP-adjusted, no out-of-home)

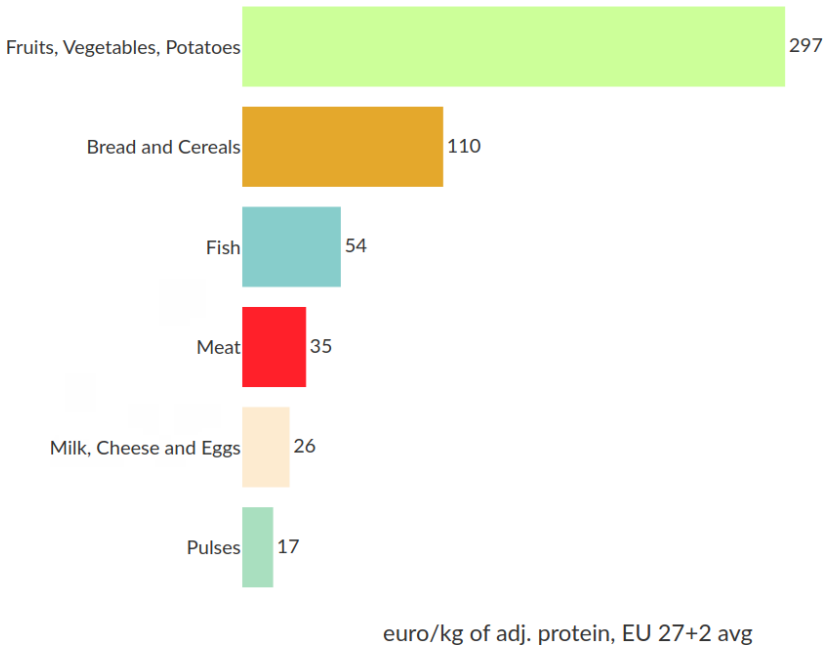


Source: GOALSciences analysis based on Eurostat and FAOStat data

Figure 14 compares these prices as a weighted average among the EU 27+2 countries for the six food categories shown above (without nuts).

The cheapest source of proteins are pulses at € 16.7 per kg of bioavailable proteins. Milk, cheese and eggs follow with € 26.5, followed by meat with € 35.1 and fish with € 54.1. The protein contained in breads and cereals averages € 109.7, four times more expensive than dairy products, and three times more expensive than meat products. Per kilogram of protein, fruits, vegetables and potatoes are almost 10 X more expensive than meat. That is not an argument against consumption of these food items. As mentioned before, they naturally contain very little protein, but protein is not the only reason they are consumed. Nuts are not shown as a separate item, because the data from FAOStat is too erratic to provide reliable statistics. However, it is certain that tree nuts are considerably more expensive than fruits and vegetables.

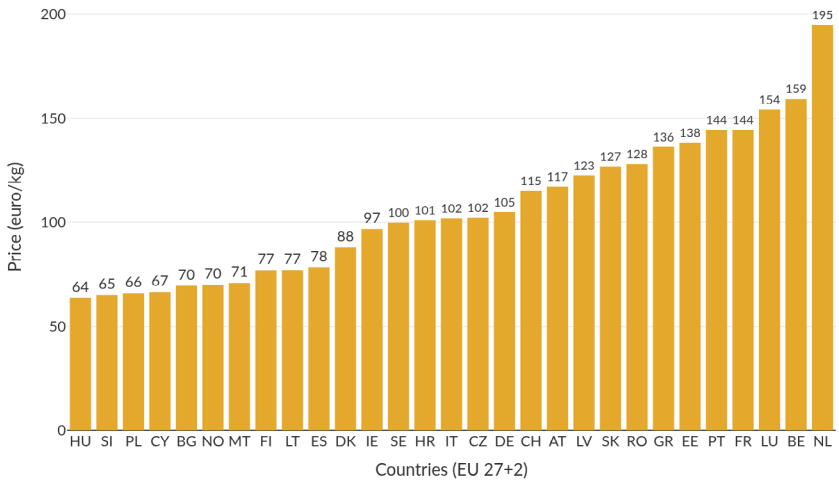
Figure 14: Cost of 1 kg of bioavailable protein as obtained from respective food groups in 2022, European average (PPP-adjusted, no out-of-home)



Source: GOAL Sciences analysis based on Eurostat and FAOStat data

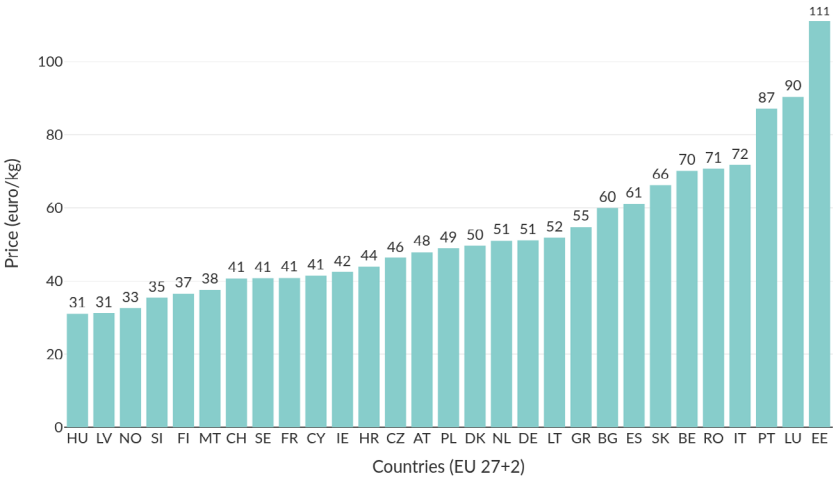
Figures 15 - 21: Cost of 1 kg of bioavailable protein as obtained from respective food groups in 2022, by food group and by country, European average (PPP-adjusted, no out-of-home)

Figure 15: Adj. protein kg price of Bread and Cereals in 2022



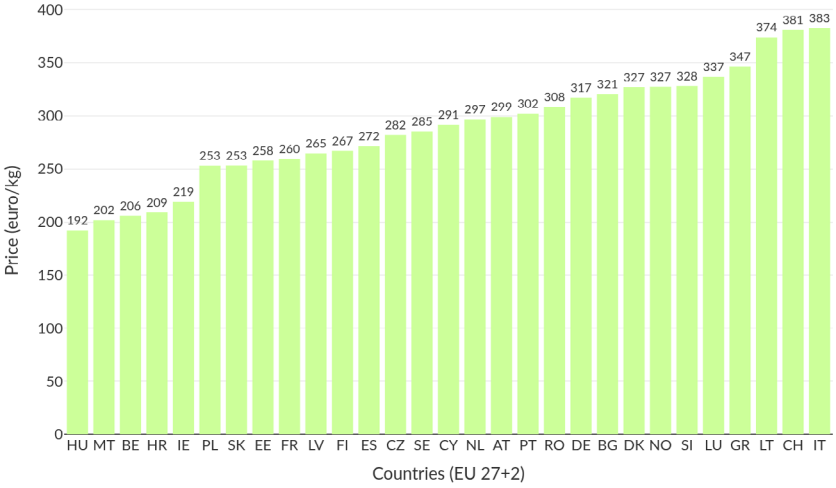
Source: GOAL Sciences analysis based on Eurostat and FAOStat data

Figure 16: Adj. protein kg price of Fish in 2022



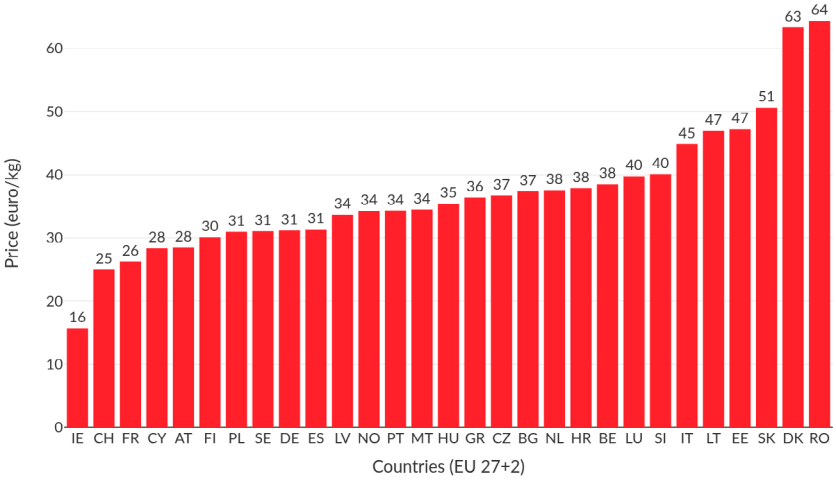
Source: GOAL Sciences analysis based on Eurostat and FAOStat data

Figure 17: Adj. protein kg price of Fruits, Vegetables, Potatoes in 2022



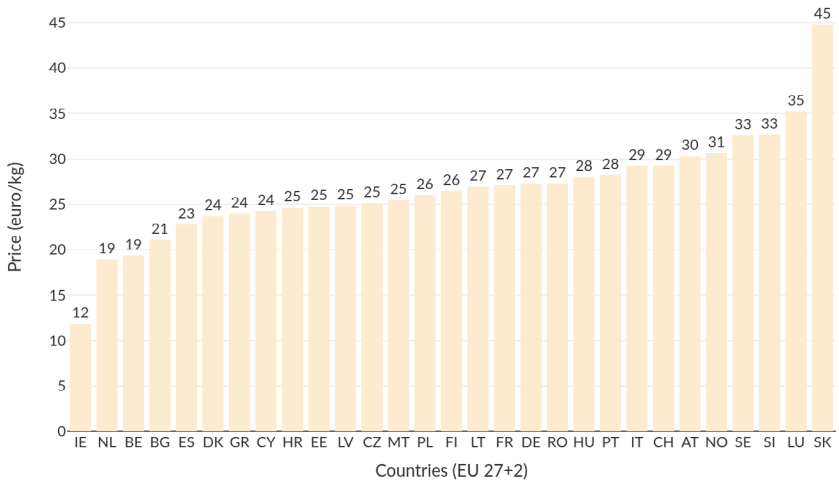
Source: GOAL Sciences analysis based on Eurostat and FAOStat data

Figure 18: Adj. protein kg price of Meat in 2022



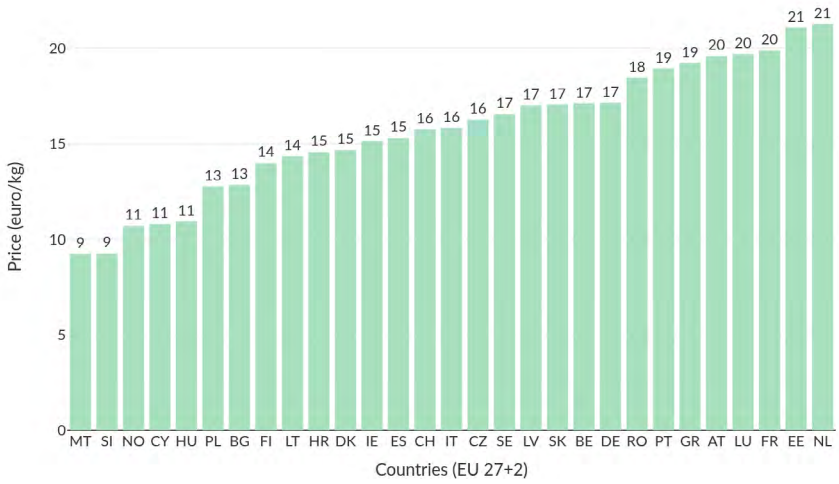
Source: GOAL Sciences analysis based on Eurostat and FAOStat data

Figure 19: Adj. protein kg price of Milk, Cheese and Eggs in 2022



Source: GOAL Sciences analysis based on Eurostat and FAOStat data

Figure 20: Adj. protein kg price of Pulses in 2022



Source: GOAL Sciences analysis based on Eurostat and FAOStat data

Figures 21 - 48: Amount of protein per capita per day, and respective costs in 2010 and 2022, per country (PPP-adjusted, no out-of-home)

KEY: **Bread and Cereals** **Pulses** **Fish** **Meat** **Nuts** **Fruits, Vegetables, Potatoes** **Milk, Cheese and Eggs**

Figure 21: Austria

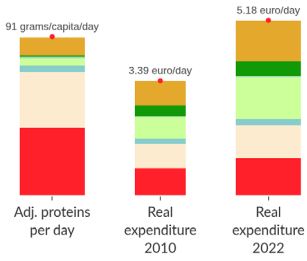


Figure 22: Belgium

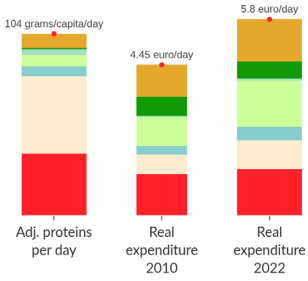


Figure 23: Bulgaria

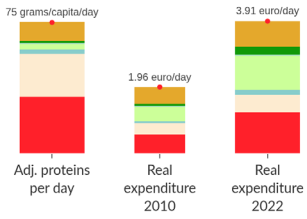


Figure 24: Croatia

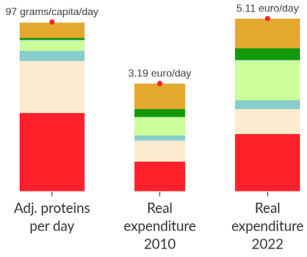


Figure 25: Cyprus

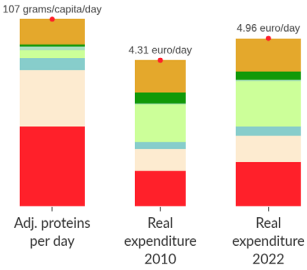


Figure 26: Czechia

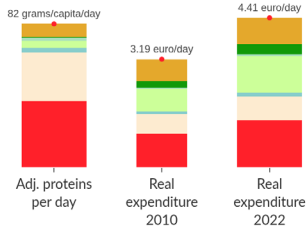


Figure 27: Denmark

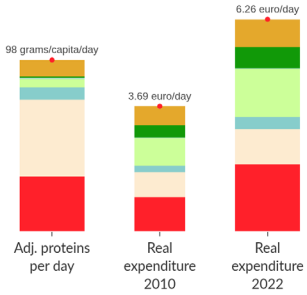


Figure 28: Estonia

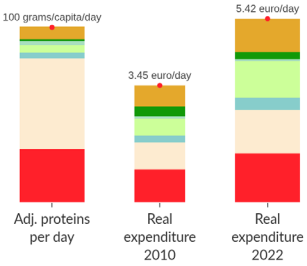


Figure 29: Finland

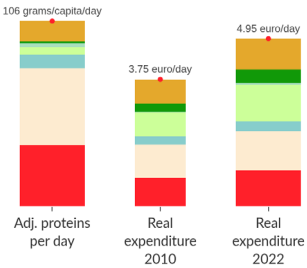


Figure 30: France

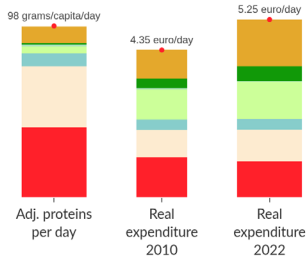


Figure 31: Germany

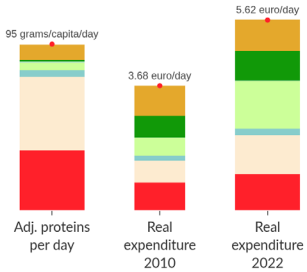


Figure 32: Greece

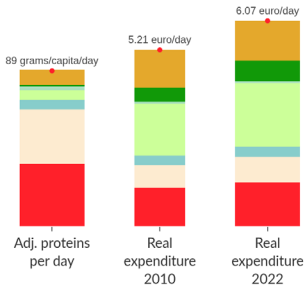


Figure 33: Hungary

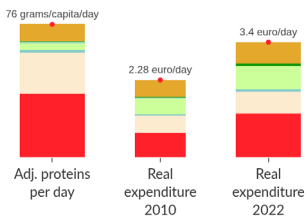


Figure 34: Ireland

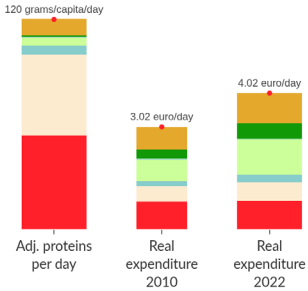


Figure 35: Italy

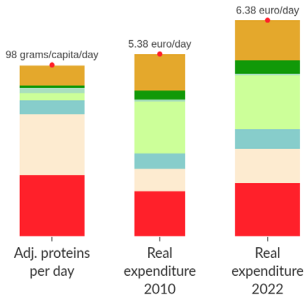
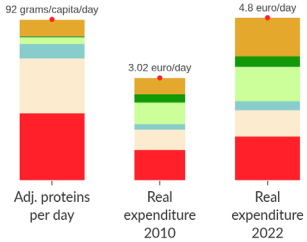


Figure 36: Latvia



Figures 21 - 48 shows for each EU 27+2 country how much protein and from which source is available to their citizens. As noted earlier, animal sourced foods dominate at about 80% of protein bioavailability. Despite them being only half as expensive as meat on a per kilogram of protein basis, pulses play only a negligible role in the European food supply. Overwhelmingly, the European population prefers to eat meat. The right side of the charts shows how much this basket of foods cost to the citizens of the countries on a per capita per day basis.

KEY: **Bread and Cereals** **Pulses** **Fish** **Meat**
Nuts **Fruits, Vegetables, Potatoes** **Milk, Cheese and Eggs**

Figure 37: Lithuania

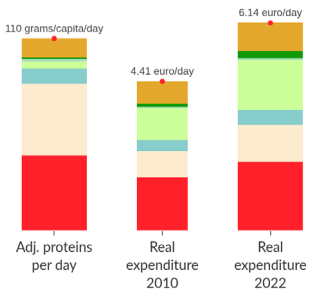


Figure 38: Luxembourg

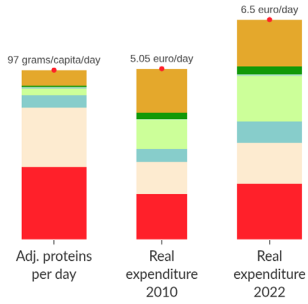


Figure 39: Malta

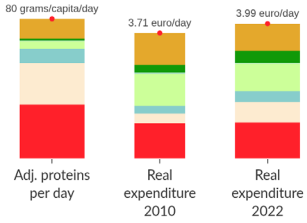


Figure 40: Netherlands

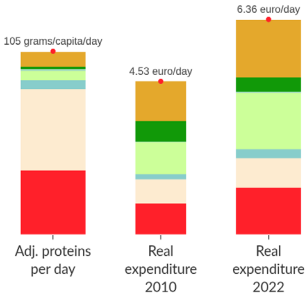


Figure 41: Poland

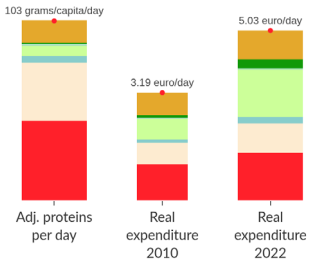


Figure 42: Portugal

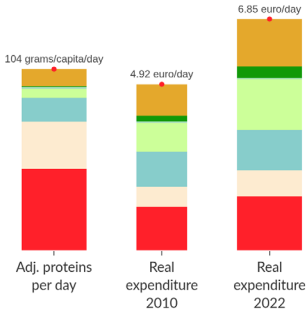


Figure 43: Romania

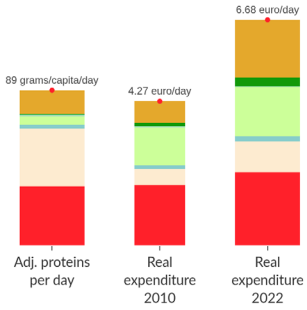


Figure 44: Slovakia

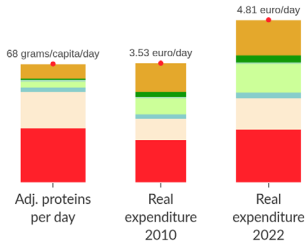


Figure 45: Slovenia

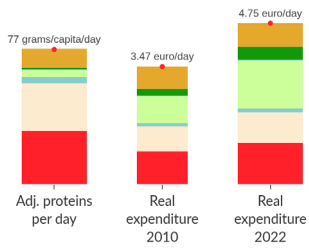


Figure 46: Spain

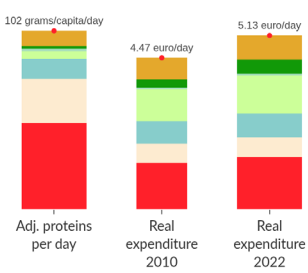


Figure 47: Sweden

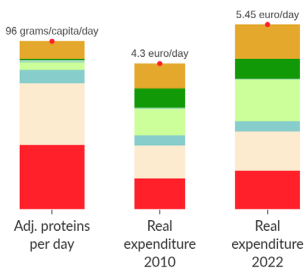
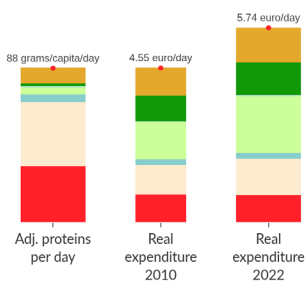


Figure 48: Switzerland

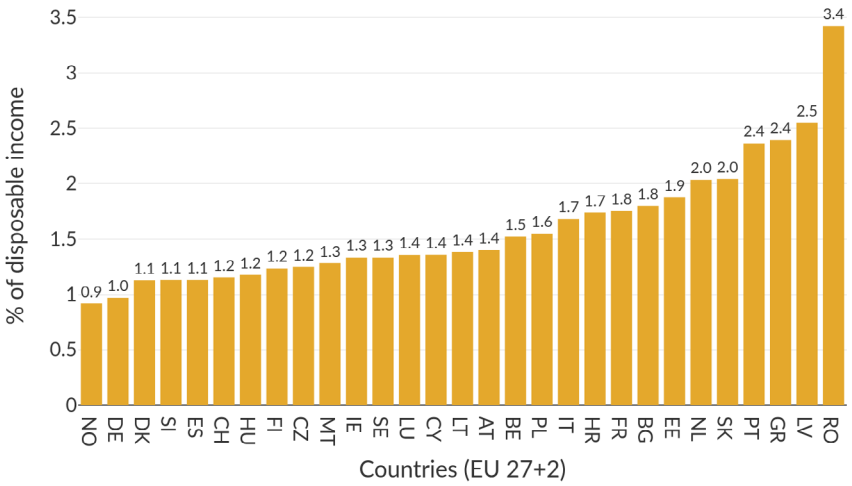


Which then leads to the final consideration of affordability. How much of the disposable income of European households is spent on nutrient dense foods? Figure 55 shows that Norway spends 5.4% of the disposable income on them, whereas Romanians spend 13.4%.

Here all the affordability charts, total and per food group

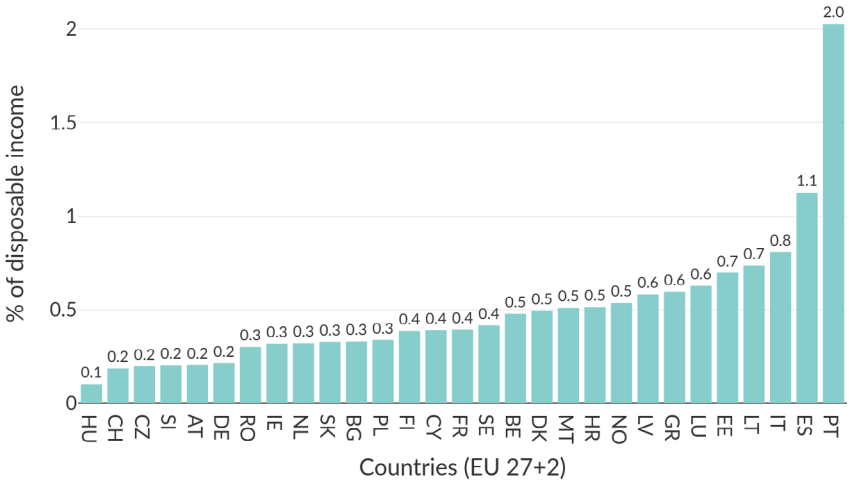
Figures 49 - : Share of spending in % on protein-containing food groups per net disposable income for each food group and each country (PPP-adjusted, no out-of-home)

Figure 49 : Breads and Cereals



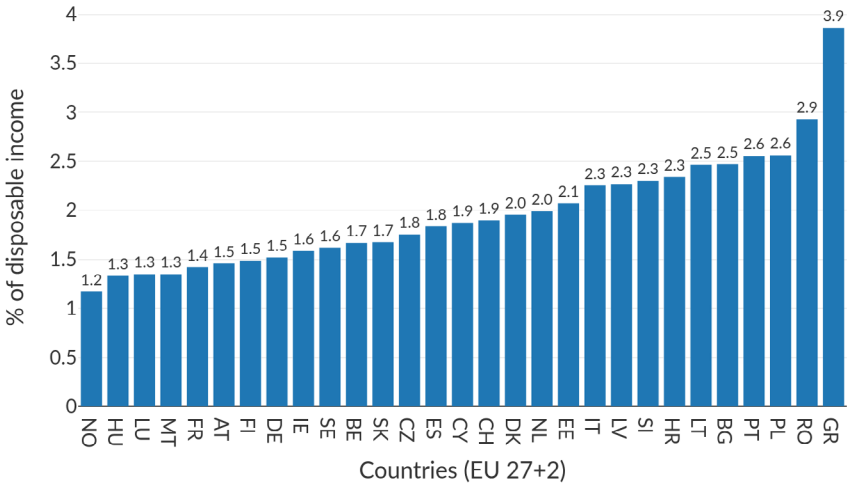
Source: GOAL Sciences analysis based on Eurostat and FAOStat data

Figure 50 : Fish



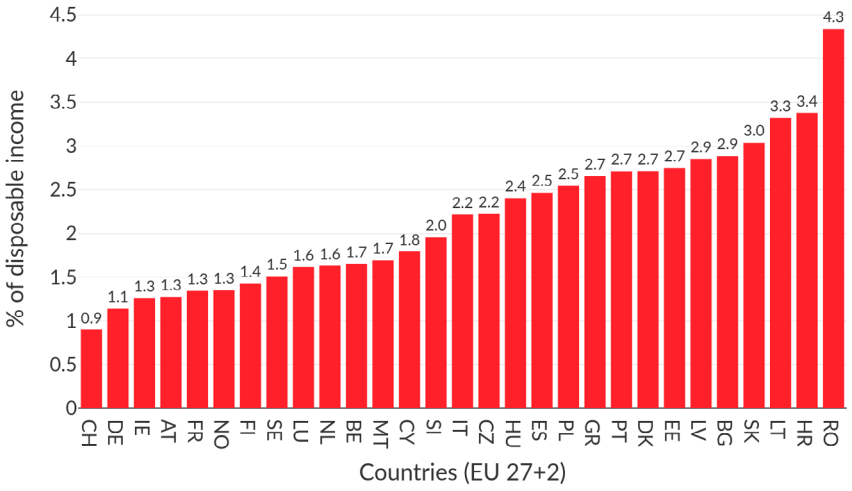
Source: GOAL Sciences analysis based on Eurostat and FAOStat data

Figure 51 : Fruits, Vegetables, Potatoes



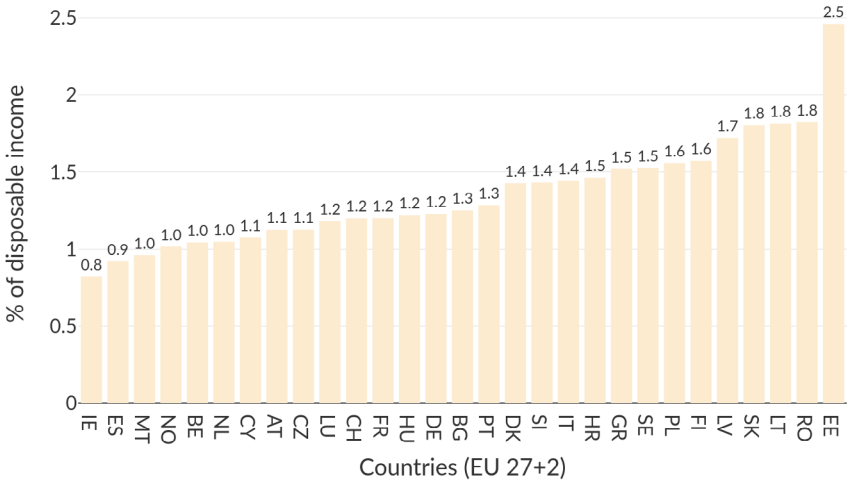
Source: GOAL Sciences analysis based on Eurostat and FAOStat data

Figure 52 : Meat



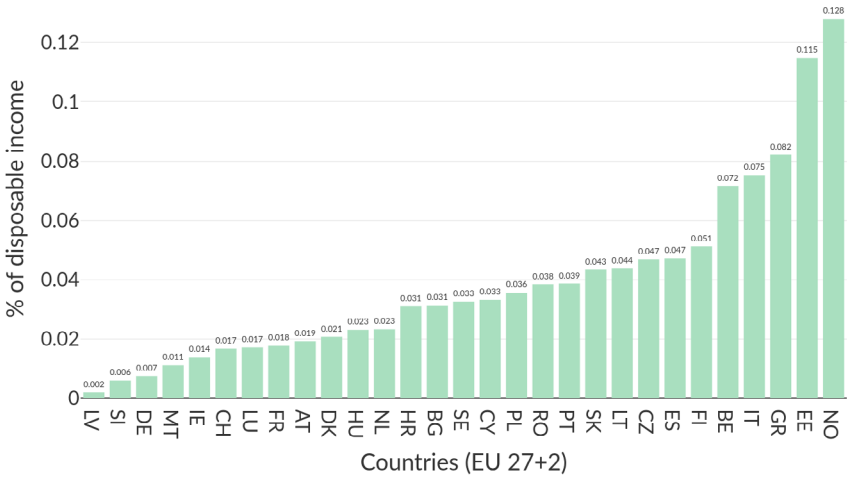
Source: GOAL Sciences analysis based on Eurostat and FAOStat data

Figure 53: Milk, Cheese and Eggs



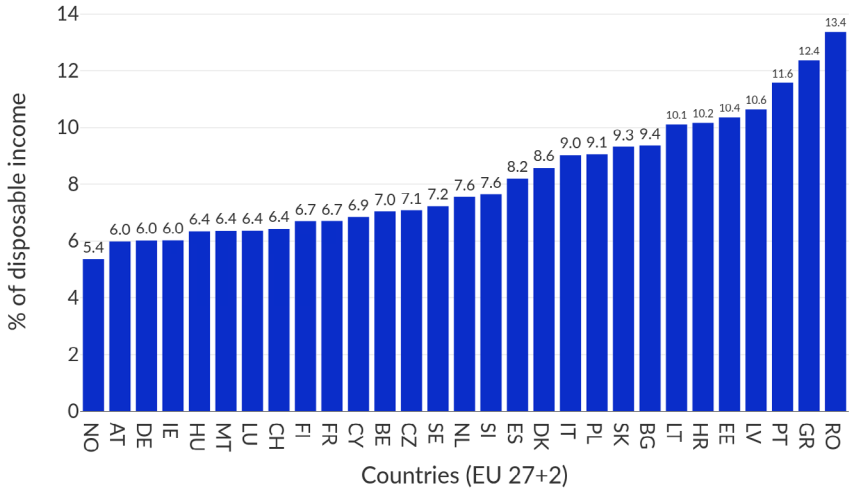
Source: GOAL Sciences analysis based on Eurostat and FAOStat data

Figure 54: Pulses



Source: GOAL Sciences analysis based on Eurostat and FAOStat data

Figure 55: Total



Source: GOAL Sciences analysis based on Eurostat and FAOStat data

What about the environmental burden?

The environmental burden of food production is considerable, but complex. To begin with, different dimensions of impact on climate, land, water utilization, and biodiversity must be considered. Different food production systems can have quite different impacts. For instance, while cattle are generally beneficial and often even essential for protection of biodiversity, generation of circular agriculture or water resources, they may be problematic for the climate, depending on soil carbon sequestration rates of a particular production system. In the official reporting of greenhouse gas emissions (GHG) of cattle, none of these aspects are acknowledged. Equally, the high productivity and therefore low environmental burden of European poultry production is barely mentioned.

What is clear, is that many of the claims of the environmental activist community that animal-sourced foods are too harmful for the environment and must therefore be heavily discouraged and restricted is exaggerated. Different environmental indicators need to be considered for differing production systems and how well they fit with the agricultural biome where the food is being produced.

Even more importantly, an accurate comparison of the environmental impact of animal and plant foods should be done based on the nutrients provided, for instance proteins. It makes little sense to compare foods on a per kilogram or per calorie basis. Such comparisons can be made with Nutritional Life-Cycle Analysis methodology. Two prominent examples are **the Sustainable Nutrition Initiative in New Zealand, or GAIN based in the United States.**

New Zealand: https://sustainablenutritioninitiative.com/

GAIN based in the United States: https://www.gainhealth.org/resources/reports-and-publications/gain-briefing-paper-ndeg16nourishing-people-and-planet-enviro

In Europe, GOALSciences is working on such a methodology and is presenting on-going results of its Production System Lens on its website.

https://goalsciences.org/food-system-explorer/animal-production-system-evaluator

Beyond the inherent complexity, high profile scientific investigations reveal that dietary patterns have only a minor impact on environmental burden. For instance, a widely cited and circulated FAO report on how livestock can reach climate neutrality until 2050, showed that dietary change makes little difference. **The FAO Report Pathways to lower emissions**:
This view is increasingly shared among the scientific community. **Bill Gates writes in his most recent Gates Notes of 28 October 2025.**

https://openknowledge.fao.org/items/b3f21d6d-bd6d-4e66-b8ca-63ce376560b5.

Bill Gates: https://www.gatesnotes.com/home/home-page-topic/reader/helping-the-worlds-poorest-adapt-to-climate-change)

"*It is time to put human welfare at the center of our climate strategies, which includes reducing the Green Premium to zero and improving agriculture and health in poor countries*". Clearly, Gates has come to the understanding that any climate policy, or environmental policy for that matter, that harms human welfare, is counterproductive.

Chef's takeaway

A nourishment recommendation should focus on the nutritional quality of foods. Environmental considerations are important, but they need to be solved in the domains of agricultural practices, innovation and technology. They cannot be resolved on the plate.

APPENDIX: DETAILS ON PROTEINS AND MICRONUTRIENTS

Proteins: The body's (re-)building blocks

Unlike dietary fats or carbohydrates, which mostly serve as energy sources, proteins are the body's main building blocks that ensure constant renewal. **Every day, about one to two percent of our tissues are broken down and rebuilt in a process called protein turnover** – muscles, skin, blood, nerves, the immune system and even bones are constantly regenerated. To keep that process running, the body needs a steady flow of amino acids, the raw material that makes up proteins. Energy from fats or starch can't substitute for these.

What matters is not only how much protein is eaten, but also what kind: the amino acid pattern should resemble the composition of human tissues. Animal-sourced proteins — such as meat, fish, eggs or dairy — naturally approximate the full mix in the right proportions, while most plant proteins are less complete in essential amino acids and may be harder to digest. For menu planning, this means that protein quality counts just as much as protein quantity.

Chef's takeaway

The role of proteins:

The body rebuilds itself every day and needs amino acids to achieve that. Fats and carbs give energy and build some of the materials, but only proteins supply the missing pieces, such as essential amino acids. Animal-sourced proteins naturally match what the body needs; plant proteins can work too but need more elevated consumption levels or careful combinations. When planning menus, think quality of protein, not just quantity.

Protein resupply: Why the body needs it every day

Unlike fat or carbs, the body cannot store protein for later use beyond what is present in the "amino acid pool" of blood and tissues. Once food has been digested and the amino acids absorbed, any excess is converted to energy, and its waste is then excreted – the next need must be met from the next meal. Because of the one to two percent of body protein that is broken down and rebuilt each day, a steady resupply is vital. When the diet falls short, the body recycles its own amino acids from tissue breakdown, but over time this leads to "wear and tear" as damaged or incomplete molecules are reused.

To avoid this slow decline, nutrition authorities recommend at least 0.8 g of protein per kilogram of body weight per day, and more in situations where digestive disorders, illness, young age, old age or pregnancy increase needs. **Therefore, a safer practical target is around 1.2 g per kilogram, which for a 75 kg person means roughly 90–100 g of protein per day.** An additional benefit is that hitting somewhat higher protein targets also has a satiating effect, helping to control appetite.

Chef's takeaway

Suggestions for daily protein supply:

*The body cannot store protein — it must come fresh every day. Aim for about **100 g of usable protein per person per day,** which also improves satiety and prevents overeating. That equals roughly **400–500 g of meat or fish** or would be obtained **by 700–800 g of egg, 800–900 g of beans or peas, or ~1.5 kg of wheat flour.** Of course, any combination of them will also work, and would be less one-sided and more nutritionally complete. Fruits and most vegetables contribute almost none but are useful for other reasons, including their complementary vitamin and mineral content.*

Protein balance: Why more is not more

Protein is vital, but it is not always a case of "the more, the better". **Each amino acid contains nitrogen, a highly reactive chemical element that the body must handle with care.** When eating more protein than needed for rebuilding, the excess amino acids are broken down and the nitrogen molecules are converted to urea, which must then be filtered out through the kidneys. Hence, the term Urin(e)ation. Unlike true carnivores such as cats or eagles, the human body has a limited capacity for this detoxification.

If protein consistently provides more than about 35-50 % of daily energy intake – roughly above 150 g of protein per day for most adults – wasting occurs with loss of body fat, while kidney damage or bone calcium loss may become a risk for vulnerable subjects. So, in nutrition, as in cooking, balance matters: sufficient protein to renew the body, but not so much that it turns into a burden. Well-designed "carnivore" or high-protein diets therefore include generous amounts of animal fat as an energy source, to avoid exceeding the safe protein threshold.

Chef's takeaway

Protein balance:

Protein is for building, not fueling.
*Too much of it forces the body to burn it and dump the waste through the kidneys. Keep protein below **30% of total calories** – for most adults, not more than **150 g per day**. Even carnivore-diets need to focus on animal **fat** for energy, so protein does not exceed these limits.*

Vitamins: The quiet gaps in modern and plant-heavy diets

Vitamins act as the body's small but essential helpers – they do not supply energy, but they make metabolic processes possible. Fruits and vegetables are often perceived in the public mind as vitamin bombs, but **in today's food environment, many of the vitamins that are most often lacking come from animal sources.**

Vitamin B_{12} is particularly critical: it is needed for nerve health and blood formation, yet it is found only in animal foods such as meat, fish, eggs, and dairy.. **Vitamin D is another common shortfall**; it is made in sunlight, but modern indoor life and northern climates leave many people deficient, and few plant foods contain any. Vitamin A in its ready-to-use form (retinol) occurs only in animal products like liver, butter, and egg yolk, while plants provide a precursor that the body uses inefficiently, especially in a low-fat dietary context.

Smaller gaps also appear for B_2, B_6, and K_2, which are important (among other reasons) for energy use and bone strength but can become scarce in strictly plant-based diets. **For chefs and menu planners, this means that carefully chosen animal-sourced ingredients are necessary to keep a menu truly and robustly nourishing.** Plants, on the other hand, are a more reliable source of vitamin C and folate (B9, also abundant in liver).

Chef's takeaway

Vitamins to watch:

*Key shortfalls today that are best obtained from animal-sourced foods include **B_{12}, D, A**, and sometimes **B_2, B_6, K_2**. These come mainly from **animal foods** or **fermented products**. Sunlight helps with vitamin D, but most people still need food sources. Plant menus bring their own set of vitamins, such as vitamin C and B9. Ideally serve meals with both animal and plant sources to provide a complete vitamin rich diet.*

Iron: The overlooked fatigue factor

Iron carries oxygen in the blood and fuels every cell's energy supply. **The body absorbs it far more efficiently from heme iron – the form found in red meats and organs – than from the non-heme iron in plants.** Plant iron is harder to use because it is bound to fibers and natural inhibitors, such as phytates, and absorption varies greatly between individuals depending on genetics, digestion, and vitamin C intake.

As a result, a surprising share of the population – especially women of child-bearing age – live with some degree of iron-deficiency anaemia without knowing it. **The signs are often mistaken for "just being tired": headaches, feeling cold, a pale skin, or low energy**. Anaemia is frequently underdiagnosed because it only shows clearly in blood tests under physical load, and routine checks may miss it. In menu planning, this means that dishes including red meats or iron-rich organs such as liver play an important role in keeping your guests alert, warm, and energetic.

Chef's takeaway

Iron matters:

*The most usable iron comes from **red meat and organs.** Some plants also have high iron levels, but it is harder to absorb, and uptake varies by person. Many people – especially women – are anaemic without realising it. Regularly include **iron-rich dishes** to help prevent fatigue and improve reproductive health.*

Zinc and iodine: Small minerals with big effects

Two nutrients needed in small amounts have some of the biggest impacts on how people feel and function. **Zinc is vital for wound healing, immunity, and taste perception, and it's needed for more than a hundred enzymes in the body**. It is found mainly in meat, shellfish, eggs, and cheese. Plant sources such as whole grains and legumes contain zinc too, but, as for iron, much of it is locked away by natural phytates, which block absorption.

Iodine keeps the thyroid working, the gland that controls metabolism, body temperature, and energy levels. Iodine is naturally concentrated in seafood, sea salt, and dairy, but much less in inland or plant-based foods. **Even small shortages can cause fatigue, weight fluctuation, or a feeling of chilliness.** Because modern supply chains have reduced traditional iodine sources (such as seafood and dairy fat), many populations are again drifting toward mild deficiency. For menu planning, regular consumption of seafood, dairy, and iodized salt helps cover both minerals and keep energy metabolism steady.

Chef's takeaway
Zinc & iodine:

Zinc supports immunity, healing, and sense of taste. Iodine fuels the thyroid, the body's energy regulator. Best sources are seafood, meat, eggs, and dairy. Plant foods provide little. Use iodized salt and include some seafood to achieve balance.

Calcium and magnesium: The foundation minerals

Beyond iron, zinc, and iodine, two other minerals quietly shape long-term health. **Calcium is the structural mineral – it builds bones and teeth but also keeps muscles and nerves working. It is abundant in dairy products, leafy vegetables, and some mineral waters, yet often low in plant-based diets**. Besides also being part of bones, magnesium acts as the body's spark plug, helping hundreds of enzyme reactions and stabilizing heart rhythm and mood. It is found in green vegetables, nuts, seeds, and whole grains, but refining and milling remove much of it.

Chef's takeaway
Key minerals:

Calcium for bones and nerves, mainly from dairy, leafy vegetables, and mineral water. Magnesium for energy and balance, from nuts, seeds, and greens.

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Peer EDERER is the founder and director of GOALSciences, the Global Observatory of Accurate Livestock Sciences, which has the mission to research and communicate scientific evidence about the role of animals in the global food system. He has an MBA degree from Harvard University, a PhD in financial economics, and holds an adjunct professorship for innovation studies. He has extensive experience in strategy advisory to private companies and public bodies in the global food system and is a frequent presenter on related topics. He has been engaged in scientific research in cooperation with globally leading universities from around the world and is a member of the Scientific Council of the World Farmers Organisation.

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Frédéric Leroy graduated as a bioengineer (Ghent University, 1998) and obtained a PhD in applied biological sciences at the Vrije Universiteit Brussel (VUB, 2002), where he now holds a professorship in food science and (bio)technology. He is primarily affiliated with the research group of Industrial Microbiology and Food Biotechnology (IMDO) and, additionally, with the research group of Interdisciplinary Historical Food Studies (FOST). His research deals with animal-source foods, food processing and technology, food fermentation and microbiology, human nutrition, food systems and sustainability, and interdisciplinary “food studies.”

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.The authors of this guideline are signatories to the Dublin Declaration and the Denver Call for Action: https://www.dublin-declaration.org/