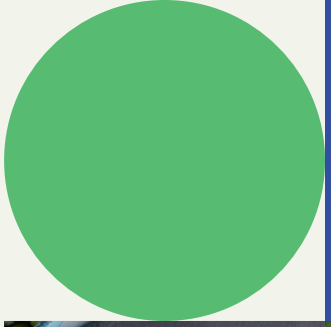
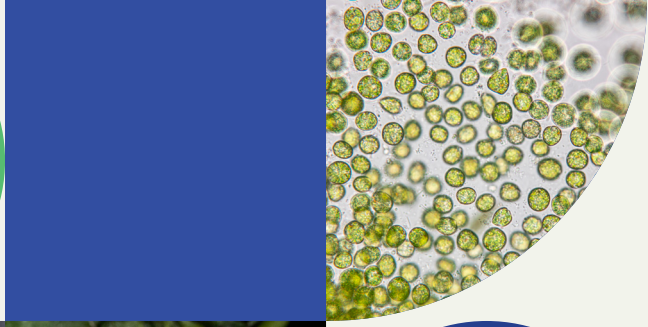


GIANT LEAPS

POLICY BRIEF 1

Achieving a healthy diet in a sustainable food system: the crucial role of protein intake and quality

2025

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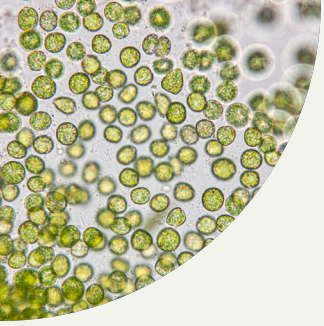


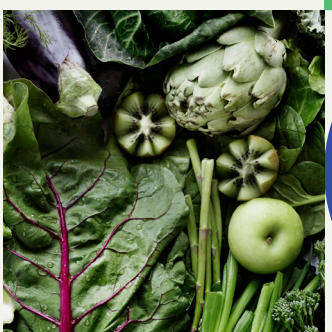
OBJECTIVE

This policy paper describes the impact of the dietary shift towards partly replacing animal-based to alternative proteins on human dietary protein intake. It serves as a call to accelerate and promote this transition, while maintaining the nutritional adequacy of the diet.

What are alternative proteins?

In this policy brief, and generally within the GIANT LEAPS project, alternative proteins are considered those that, as part of alternative protein foods, can (partly) replace traditional animal protein containing foods in European diets. In other words, alternative proteins are those that enable a shift towards healthy diets and a sustainable and climate-neutral food system. Alternative proteins cannot simply be defined as non-animal derived proteins, as some are animal-derived (e.g. insects). They include many different categories, such as plant-based proteins, micro- and macroalgae proteins, bacterial and fungal proteins, insect proteins, precision fermented proteins and cultured meat.

There is no universally accepted definition of alternative proteins. Aligned with the European Commission's perspective as articulated in the Food 2030 Research and Innovation – Pathways for action 2.0 report (pathway #4)[1] , GIANT LEAPS broadly considers the use of alternative protein sources in formulated foods such as meat and dairy substitutes, as well as other types of products including the increased consumption of alternative protein-containing whole foods (e.g. plant-based whole foods or insects).



KEY POLICY RECOMMENDATIONS

A **dietary shift** from animal-based foods to alternative protein foods involves multiple nutrition-related aspects, including protein adequacy and quality in the general population, adequate intake of other essential nutrients, and the needs of vulnerable groups requiring special attention. It also affects diet planning, the need to complement existing protein sources, food processing and highlights the importance of improved methods for assessing protein quality.

Recommendations

Nutritional monitoring & addressing special needs

1. Monitor protein adequacy and quality throughout the dietary shift
2. Monitor nutrient adequacy, extending beyond protein
3. Address the needs of vulnerable groups

Consumer engagement & behaviour

4. Encourage diversification of protein consumption while ensuring adequate nutrition
5. Implement diet planning and/or food fortification approaches to ensure overall nutrient quality

Tools and technologies

6. Utilise food processing to enhance protein digestibility
7. Develop validated screening methods to assess protein quality effectively

Call for Action

1. Engage consumers in the protein transition
2. Advance nutritional guidelines regarding protein requirements
3. Strengthen the business climate for alternative protein producers
4. Fund research to address knowledge gaps in protein transition

POLICY RECOMMENDATIONS

Recommendation 1: Monitor protein adequacy and quality throughout the dietary shift

A dietary shift from 60% animal-based to 60% alternative protein sources is unlikely to result in inadequate protein or indispensable amino acids intake among the European adult population, as most individuals consume more than the recommended amount of protein (EFSA 2012)[2]. However, due to protein quality and quantity differences between alternative and animal-based foods in general, both the quantity and quality of protein intake will decrease when animal products are reduced in the diet[2]. Research indicates that reducing animal protein to 30-40% of total protein intake can still meet nutritional requirements with appropriate dietary adjustments[3]. To verify this, and to check whether protein requirements are still met if animal protein intake would be further reduced in the future, ongoing monitoring of protein adequacy and quality by national food consumption surveys is essential during the dietary transition.

Recommendation 2: Monitor nutrient adequacy, extending beyond protein

When substituting animal-based foods with alternative protein-based foods, deficiencies in other nutrients may occur even when protein intake remains adequate. Therefore, the dietary shift should prioritise the entire nutrient package provided by various protein sources, rather than focusing solely on protein content. Expected favourable changes in nutrient intake include lower intake of calories and saturated fats, alongside increased intake of fibre, vitamins C and E, folate, and phytonutrients. Conversely, less favourable changes may involve decreased intake of B vitamins, iron, zinc, calcium and iodine. Consequently, monitoring should also include these at-risk nutrients to ensure overall dietary adequacy.

Recommendation 3: Address the needs of vulnerable groups

Specific population groups, such as young infants and children, pregnant and lactating women, older adults, and patients with specific health conditions are at a heightened risk of nutrient deficiencies, including protein. For these groups, it can be more challenging to consume enough nutrient-dense foods while their nutrient requirements may be higher. As the dietary shift progresses, the risk of inadequate protein and nutrient intakes among these vulnerable populations may further increase. Ensuring adequate nutrition for these groups is a key priority during the dietary transition.

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Recommendation 4: Encourage diversification of protein consumption while ensuring adequate nutrition

During the dietary shift, it is crucial not only to reduce consumption of animal-based foods, but also to replace animal-derived proteins appropriately. Diversification of protein consumption can be achieved by incorporating alternative protein sources such as grains, legumes, nuts, and seeds, as well as other protein sources like algae, fungi, insects, microbial proteins, and cell-based or (precision) fermented proteins, in order to:

✓ ensure adequate human nutrient and protein intake.

✓ facilitate the incorporation of alternative proteins into meals and enhance cultural acceptability.

Innovation in meat, egg and dairy substitutes that better mimic aspects of animal products can complement currently available alternative protein sources and whole foods, maximising the opportunity to offer consumers culturally acceptable options to replace animal-based foods. Establishing effective production systems and improving the sensory qualities of alternative protein containing products will still require significant investments and technological innovations.

Recommendation 5: Implement diet planning and/or food fortification approaches to ensure overall nutrient quality

Adequate diet planning can enhance protein quality through:

✓ Combining alternative protein foods with complementary amino acid composition in each meal (e.g. grains and legumes)

✓ Including animal-based proteins, which can help complement the amino acid profile of alternative proteins.

It is important to note that meal planning can improve the amino acid profile of the combined food within the meal but does not enhance digestibility (see Recommendation 6). Diet planning with smart combinations of foods can also improve overall (micro)nutrient composition. Additionally, fortifying alternative protein-based foods with essential nutrients, such as calcium, iron and B vitamins, can help ensure overall nutritional adequacy.

Recommendation 6: Utilise food processing to enhance protein digestibility

Many processing methods used in the production and preparation of alternative protein foods, including milling, germination, fermentation, enzymatic pre-treatment and extrusion, can positively impact protein digestibility, e.g. by improving protein solubility and reducing anti-nutritional factors like phytate and protein inhibitors. However, the impact of these processing methods is not yet fully understood for all alternative protein sources and, therefore, needs further investigation. It is essential to approach food processing consciously and rationally to achieve optimal results: improved digestibility and minimal losses of other beneficial components, such as dietary fibre and phytonutrients, while ensuring food safety.

Recommendation 7: Develop validated screening methods to assess protein quality efficiently

Comprehensive data on the protein quality of a wide range of (novel) foods and ingredients are essential for effective meal planning and research into effects of dietary changes. Currently, there is a limited availability of Digestible Indispensable Amino Acid Score (DIAAS) values derived from data on humans and animals. This is primarily due to high costs, ethical concerns (regarding animal testing) and practical limitations. To address these challenges, alternative non-animal methods for screening alternative protein products should become available, including validated ISO-certified laboratory-based (in vitro) models, to complement existing measurement methods.

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CALL FOR ACTION

The protein transition is progressing slowly, as both individuals and businesses face challenges in making this change. Increasing the consumption of alternative protein foods and other alternative protein sources requires significant changes in consumer dietary habits and the development of affordable and appealing food products that can effectively replace traditional animal-based options. Currently, these alternatives are often more expensive, creating an additional barrier to adoption. Accelerating the transition needs substantial investments to help consumers change their eating behaviours towards a healthy, more sustainable diet.
Policy makers are urged to prioritise the following aspects:

✓ Engage consumers

✓ Advance nutritional guidelines

✓ Promote a supportive business climate

✓ Continue funding research

Action 1: Engage consumers in the protein transition

The shift towards alternative protein sources will not occur spontaneously; it requires targeted efforts to educate and empower consumers, with particular attention towards vulnerable groups. These efforts include demonstrating how alternative proteins can meet their nutritional needs, provide enjoyable culinary experiences, and satisfy familiar tastes and textures associated with animal-based foods, such as:

✓ Public awareness campaigns to highlight the environmental and health benefits of alternative proteins

✓ Culinary education to teach how to prepare balanced meals using alternative proteins
- Emphasising complementary combinations like grains and legumes for complete nutrition
- Providing information about the use of alternative protein-containing whole foods and formulated foods, enabling consumers to leverage all available options in various situations and in relation to differences in convenience of use.

Action 2: Advance nutritional guidelines regarding protein requirements

The advancement of European Food Safety Authority (EFSA) and national dietary guidelines should include:

✓ A more precise reference indispensable amino acids (IAA) profile for calculating protein quality scored for different population groups, including young infants and children, older adults, pregnant and lactating women.

✓ A harmonised reference protein quality score with minimum acceptable values below 1 for various population groups (e.g. as proposed by Ackerl and coworkers[4]). A protein quality score of 0.9 is generally considered acceptable for most population groups.

✓ Acceptable consumption times (either the same meal or throughout the same day) for protein foods with complementary IAA composition. This approach will help ensure balanced daily protein intake for various population groups, in particular vulnerable populations.
In addition, it is important to acknowledge that nutritionally adequate alternatives to meat, egg, dairy, and fish can fit into a healthy and balanced diet and should be included in dietary guidelines.

Action 3: Strengthen the business climate for alternative protein producers

Political actions should prioritise subsidies for the sustainable farming of currently available alternative protein sources, such as legumes, whole grains, nuts, and seeds, over those for meat. Additionally, there is a need to stimulate the production of novel alternative protein sources, including fungi, microalgae, insects, cell-based and (precision) fermented proteins, and cellular meat, by supporting sustainable farming practices and industrial biotechnology.
Encouraging optimal processing steps for the incorporation of alternative protein sources into meat, egg, dairy, and fish alternatives is important for producing tasty, affordable, sustainable and nutritious foods. To achieve this, sustainable food business ecosystems must be established and supported, ranging from start-ups to scale-ups. Furthermore, repurposing or initiating subsidies is essential to create a business climate that embraces innovation and ensures the continuity of these advancements, e.g. by creating innovation hubs and funding public-private partnerships.

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Action 4: Continue funding research to address knowledge gaps in protein transition

Significant knowledge gaps remain in the field of protein transition, highlighting the need for continued research. Scientific studies are required to

✓ Assess the nutritional adequacy of farther-off transition scenarios, particularly those where animal protein constitutes less than 40% of the diet;

✓ Develop and validate physiologically relevant in vitro methods to assess protein quality across different population groups, focusing on accurately modelling nutrient bioaccessibility and bioavailability;

✓ Identify non-invasive biomarkers that can reliably indicate protein and indispensable amino acid adequacy or insufficiency in humans.

Addressing these gaps will provide valuable insights to guide the protein transition and ensure nutritional health.

BACKGROUND INFORMATION

Protein in relation to human and planetary health

Ensuring that everyone has access to nutritious and safe food is crucial for promoting health and preventing disease. As the global population grows, food production places increasing burden on climate, land use and water quality. This creates an urgent need for a sustainable food system that provides healthy diets and nutritious foods while reducing environmental impact. Achieving this requires a balance between:

✓ Nutritional adequacy (nutritional security),

✓ Safe and sufficient foods for all (food safety and security), and

✓ Production within planetary boundaries (sustainability).

The GIANT LEAPS project established that current European diets derive 64 to 72% of their protein from animal-based foods[5]. Due to the high environmental impact associated with animal food production, reducing this dietary proportion is vital[6]. Policy proposals in some European countries, such as the Netherlands[7] and Belgium[8], suggest a shift from 60% to 40% animal protein in the diet as a realistic target. Healthier diets imply a shift towards increased consumption of fruit, vegetables and whole grains, while reducing the intake of animal-based foods. This transition may lead to major changes in the intake of nutrients.

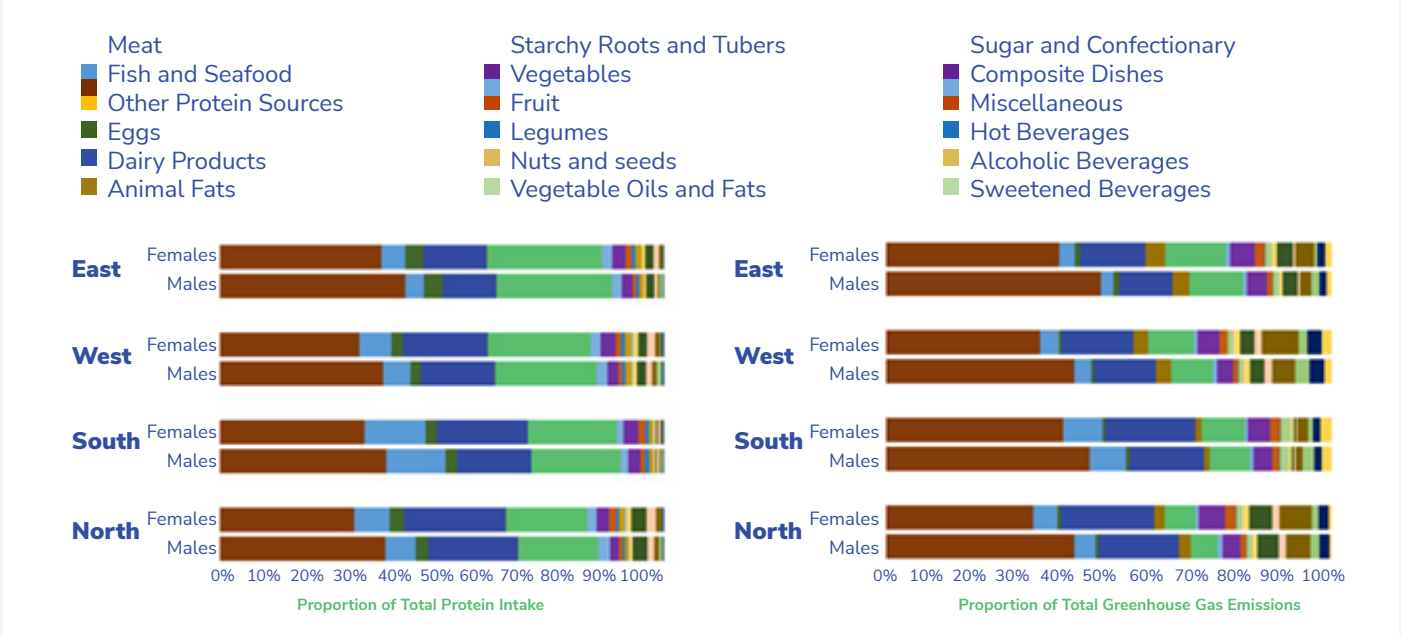

Figure 1. The current proportion of total protein intake in the European diet (A) and the proportion of total greenhouse gas emissions (B) in relation to major food groups [Daas, M. C., Biesbroek, S., van Asselt, E., Milana, M., & Van 't Veer, P. (2024). D7.1 Current and Future Diets. Zenodo. https://doi.org/10.5281/zenodo.15921740].

Proteins are essential macronutrients that support growth and health throughout life. They are composed of dispensable and indispensable amino acids that serve as the building blocks for tissues, organs, and cellular enzymes in the human body. Since the body cannot produce indispensable amino acids, they are considered essential nutrients that must be obtained through the diet.

The quantity and composition of protein, including their amino acids, vary between animal-based, plant-based and other alternative protein sources like fungi, insects, algae, microbes, and cultured meat.

✓ Animal-based proteins typically provide higher protein content, offer the optimal proportions of IAA required by the human body, and have better digestibility, making them excellent sources of high-quality protein.

✓ Plant-based or other alternative protein sources may have less balanced proportions of IAA and tend to have lower digestibility, meaning only a smaller portion of the amino acids consumed are absorbed by the body.

This implies that an appropriate food selection and diet planning is necessary to ensure an adequate protein and (indispensable) amino acids intake. Additionally, smart blending of alternative protein sources and food processing methods like milling and cooking can enhance protein quality. When these aspects are covered, plant-based and other alternative protein sources present great opportunities to enable the necessary dietary transition.

Sustainable Diets

Public health focuses on preventing disease, prolonging life, and promoting health through the organised efforts of society[9]. Sustainability broadens this goal from current populations to generations to come, defined by the UN Brundtland Commission as "meeting the needs of the present without compromising the ability of future generations to meet their own needs."[10] Aligned with this vision, the FAO defines sustainable diets as those produced by a sustainable food system, operating within a "safe and just space for humanity"[11]. These diets have low environmental impacts, promote food and nutrition security, and support healthy life for both present and future generations. Sustainable diets are protective of biodiversity and ecosystems, culturally appropriate, accessible, economically fair and affordable. They must also be nutritionally adequate, safe and healthy, while optimising natural and human resources[12].

Sustainable Food System

A food system encompasses the production, processing, and delivery of food to consumers. A sustainable food system produces healthy diets while respecting environmental, social, and economic limits. It guarantees food and nutrition security for current and future populations, all within the boundaries of the planetary ecosystem[a].

Protein Requirements and Population Reference Intakes

Protein requirements for growth and the maintenance of health throughout life are expressed in different ways and vary across population groups. In 2012, the EFSA Panel on Dietetic Products, Nutrition and Allergies established Average Requirements (AR) and Population Reference Intakes (PRI) for protein[13] for healthy individuals in a population. An AR represents the nutrient intake adequate for 50% of individuals in a population group, assuming a normal distribution of requirements. A PRI represents the nutrient intake adequate for virtually all individuals in a population group, taking into account their age and sex.

[a]A sustainable food system delivers food security and nutrition for all in such a way that the economic, social, and environmental bases to generate food security and nutrition for future generations are not compromised.

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Adults (including older adults)
AR: 0.66 g protein/kg of body weight per day and **PRI**: 0.83 g protein/kg of body weight per day.

Infants, children and adolescents
PRI: between 0.83 g and 1.31 g/kg of body weight per day, depending on age.

Pregnant women
PRI: additional intake of 1 g/day (1st trimester), 9 g/day (2nd trimester) and 28 g/day (3rd trimester).

Breast-feeding women
PRI: additional intake of 19 g/day during the first 6 months of lactation, and 13 g/day thereafter.

Figure 2. Protein requirements infographic according to ESFA 14 (subscribed).
PRI: Population Reference Intake. AR: Average Requirement.

Protein Intake

Most children and healthy adults (ages 1-65) in Europe consume more protein than the recommended PRI values. On average, adults consume between 0.8 and 1.25 g of protein/kg of body weight per day (EFSA 2012).

Protein Quality

Foods with a high protein quality have an indispensable amino acid composition that corresponds to the human reference profile and have a high protein digestibility[14]. The amino acid reference profile defines the amount of bioavailable indispensable amino acids required for the body growth and maintenance, as established by the World Health Organization (WHO)[15] for various age groups. High digestibility means that the protein can be easily broken down in the upper gastrointestinal tract, allowing amino acids to be absorbed by the body.

Measures of Protein Quality

Since 2013, the recommended method to assess protein quality is the Digestible Indispensable Amino Acid Score (DIAAS). DIAAS measures the true ileal digestibility of individual amino acids and compares them to the amino acid reference profile. DIAAS values are preferably derived from research data on humans and – in case of their absence – on animals[16].

Protein Quality of Different Food Sources

The amino acid composition can be improved by combining protein sources that complement each other (Figure 3). Additionally, food preparation methods like milling and cooking usually improve protein digestibility.

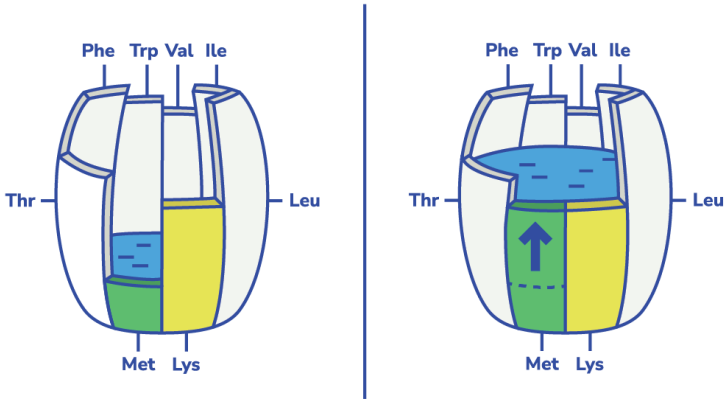

Figure 3: Liebig Barrel (illustration by GIANT LEAPS).

Left panel: Methionine is the limiting amino acid of a food or diet (barrel) defining the protein synthesis efficiency in the body (water level).
Right panel: Mixing complementary protein sources can improve the amino acid composition of a food or diet and enhance protein synthesis efficiency.

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ABOUT GIANT LEAPS

The EU-funded project GIANT LEAPS aims to accelerate the dietary shift towards a more sustainable and healthier food system, aligning with the EU Green Deal objectives and the Farm to Fork Strategy.
The ambition of GIANT LEAPS is to transform European diets by reducing the consumption of traditional animal proteins, targeting a goal where 50% of total protein dietary intake is derived from alternative protein sources – such as plants, microalgae, insects, and single-cell proteins – by 2030.
To achieve this goal, GIANT LEAPS employs a multi-actor approach, actively engaging with policymakers, production sectors, and European citizens. This collaboration fosters key innovations, methodologies, datasets and information that empower all stakeholders in the food system to make informed decisions, strategic investments, and sustainable choices. Ultimately, the Project seeks to facilitate a large-scale dietary shift towards alternative protein-rich foods, maximising both nutritional and environmental impacts.

DISCLAIMER

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This document is published prior to the completion of the formal review related to planned periodic or final reports for GIANT LEAPS under the HORIZON Europe funding framework. Adjustments may be made during the process, if deemed necessary.

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