



THE TRUTH ABOUT PLANT PROTEIN

November 2022

Proceedings from the e-symposium – *the truth about plant protein*. Five European experts present the latest evidence investigating plant proteins with regard to amino acid quality, human requirements, muscle protein synthesis for sports and in older adults, its environmental benefits and how to help consumers shift their dietary habits towards more plant protein foods.

Organised by the Alpro Foundation in partnership with MyNutriWeb.

E-symposium held on the 17th November 2022

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About

Alpro Foundation

Alpro Foundation has been a scientific platform for over 25 years dedicated to supporting research and the dissemination of evidence-based knowledge on plant-based nutrition and its impact on health and environment amongst academics, healthcare professionals and key stakeholders in nutrition.

The ultimate aim is to help drive the transition to more healthful plant-based diets for human and planetary health.

Underpinning Alpro Foundation's scientific integrity is an independent Scientific Advisory Board of seven leading academic experts who provide direction and advice and ensure the scientific credibility of the education tools.

Additionally, Alpro Foundation celebrates and supports innovative scientific research by providing research grants and awarding young scientists for plant-based nutrition research. Alpro Foundation's research grant scheme has resulted in over 34 scientific publications to date.

MyNutriWeb

MyNutriWeb's mission is to empower all professionals who act as change agents in food and health, through online learning. The MyNutriWeb team is made up of experts with over 20 years' experience in nutrition and health communications.

They offer CPD-accredited and free to attend and on-demand, online learning opportunities to enable health professionals to keep up-to-date with the latest scientific evidence and everyday practice. The learnings cover a broad range of hot nutrition and health topics presented by leading experts in the field in various formats including webinars, symposia, journal clubs and round tables.

Executive summary

- Many national and international dietary guidelines recommend a **shift in dietary pattern to increase the consumption of plant-based foods** alongside a reduction in animal proteins for both health and environmental sustainability.
- Plant proteins **contribute significantly to dietary protein** requirements as well as enhancing fibre and other nutrient intakes currently lacking in consumers dietary habits.
- Consideration of both **quantity and quality of protein** is necessary to ensure dietary needs, including the requirements for essential amino acids (EAAs), are met.
- Several **strategies can enhance the protein contribution from plant foods**. These include increasing portion size and digestibility, combining plant protein food sources in the diet, fortification of diets with specific amino acids and using combinations of plant to plant or plant to animal protein blends.
- With regard to **muscle health**, provided total dietary protein and in particular leucine intakes are met, **plant proteins support the anabolic response** in muscle in a comparable manner to animal proteins.
- There is a growing consensus that **older adults need higher intakes of protein and EAAs**. This can help counter the age-related anabolic resistance to muscle protein synthesis and may prevent a loss of muscle mass, strength, and function (sarcopenia). For older adults, nutrient dense plant proteins should be favoured and strategies to enhance the protein contribution from plant foods may be of particular value in this age group.
- Foods including **nuts** and **pulses**, such as soya, are particularly **useful as nutritious sources** of plant protein and have been shown to have comparatively low environmental impacts. They are especially useful when combining health and nutritional needs with sustainable dietary practices at a price which is affordable to the consumer.
- Current dietary intakes of **most consumers do not meet the recommendations of national and international food-based dietary guidelines** with regard to plant-based eating. To help shift consumer diets it is necessary to address motivation and barriers to change alongside a range of practical, tailored nutrition advice.

Introduction

The hot topic of plant protein was the theme of this year's Alpro Foundation online symposium (www.alprofoundation.org). Insightful presentations were delivered by five leading European experts on the nutritional quality of plant proteins and specific considerations in relation to health, the environmental impact as well as the practical implications on how to help consumers make the dietary shift.

Chairing the symposium were, [Professor Ian Rowland](#) from the University of Reading, chair of the Alpro Foundation Scientific Advisory Board, and [Elphee Medici](#), nutrition & sustainable diets consultant. In their opening remarks, the chairs highlighted that many national and international dietary guidelines recommend an increase in the consumption of plant-based foods and a reduction in animal-based foods for both health and environmental sustainability.¹

Providing clear, evidence-based information and addressing concerns from the public and health care professionals about the protein quality and quantity of plant-based diets is likely to be of prime importance if consumer dietary patterns are to shift in the desired direction.

¹ Willett W, Rockström J, Loken B, et al. Food in the Anthropocene: the EAT-Lancet Commission on healthy diets from sustainable food systems. *Lancet*. 2019; 393 (10170):447-492. doi: 10.1016/S0140-6736(18)31788-4

Understanding dietary protein quality and intake

In the opening session Dr Collen Deane, Lecturer in Muscle Cell Biology at the University of Southampton, gave an overview of protein biochemistry and function in human nutrition.

She began by explaining the fundamental structural role of protein in the body emphasising that around half of total protein in the body is concentrated in skeletal muscle and a regular intake of dietary protein is crucial for muscle maintenance and growth.² Proteins are also involved in the structure of the skeleton, enzymes, hormones and antibodies as well as the transport of essential molecules.

Proteins are composed of multiple building blocks known as amino acids. Some amino acids are classified as essential (EAAs) as they cannot be produced by the human body and must be obtained from the diet whilst others are classified as non-essential amino acids (NEAAs) as they can be synthesised in the body (see **Figure 1**). Dietary proteins contain a diverse mix of both EAAs and NEAAs.

Figure 1. Amino acid classification. Dietary proteins contain a diverse mix of both essential and non-essential amino acids.

Indispensable / essential*	Conditionally indispensable / essential**	Dispensable / non-essential***
Histidine	Arginine	Alanine
Isoleucine	Asparagine	Aspartate
Leucine	Cysteine	Glutamate
Lysine	Glutamine	
Methionine	Glycine	
Phenylalanine	Proline	
Threonine	Serine	
Tryptophan	Tyrosine	
Valine		

* Body cannot synthesise, and must be provided through the diet

** The body can normally synthesise, however during periods of stress, injury, rapid growth/development, periods of increased demands etc., these amino acids become essential, and they must be provided through diet

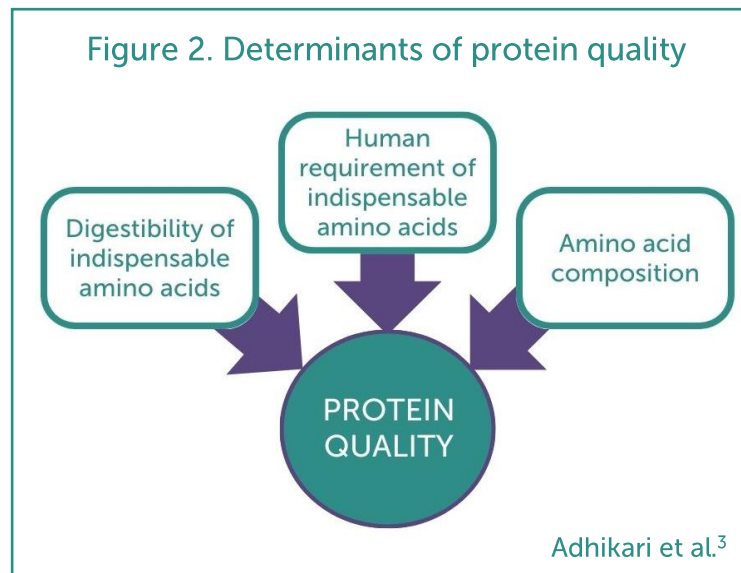
*** Amino acids the body can readily synthesise at any time

The quality of a protein is determined by three main factors: amino acid composition, digestibility of the EAAs, and human requirements (see **Figure 2**). Different systems are

² Phillips SM, Glover EI, Rennie MJ. Alterations of protein turnover underlying disuse atrophy in human skeletal muscle. J Appl Physiol. 2009; 107 (3):645-654.doi.org/10.1152/japplphysiol.00452.2009

used to score foods for protein quality each with strengths and limitations, all of which assess the quality of just one gram of a specific protein source in isolation rather than in combination with other dietary sources or the overall diet.³

The ideal protein profile of the diet will depend on several factors including age, activity level, health status and personal dietary preference. Worldwide, many populations eat sufficient protein to meet and often exceed requirements, with plant proteins contributing more to overall intake than animal sources. Several areas of the world, including Asia and Africa, tend to have a much greater proportion of their protein from plant sources compared with Western diets.^{4,5}



Plant proteins offer potential advantages for health and nutritional profile of the diet as well as for the environment. However, using the standardised assessment methods (PDCAAS and DIAAS) they are often viewed as having a lower protein density and quality (lower digestibility and lower EAA content). Nevertheless, there are many ways of overcoming these potential limitations including processing to increase digestibility, fortification with specific amino acids, increasing or concentrating portion size eaten and combining different plant sources which reflects normal consumption practices of following a mixed and varied diet over the course of a day (see Figure 3).⁶

It is important to overcome some of the myths that plant proteins are incomplete or inferior to animal proteins. Protein quality is variable between plant sources and contribution to the diet depends on how a food is prepared as well as the overall mixture of plant proteins eaten. Protein foods are not consumed in isolation and normal consumption habits involve a combination of different proteins. Dietary protein combinations from different sources do not need to be consumed at the same meal but rather the balance over the day appears to be more important.⁷

Much research has focussed on the role of different proteins for muscle and bone health. Animal-derived protein is a potent anabolic driver which stimulates increases in muscle protein synthesis and promotes bone accretion and maintenance. EAAs, in particular leucine, drive this in muscle tissue.

³ Adhikari S, Schop M, de Boer IJM et al. Protein Quality in Perspective: A Review of Protein Quality Metrics and Their Applications. *Nutrients*. 2022;14 (5): 947. doi.org/10.3390/nu14050947

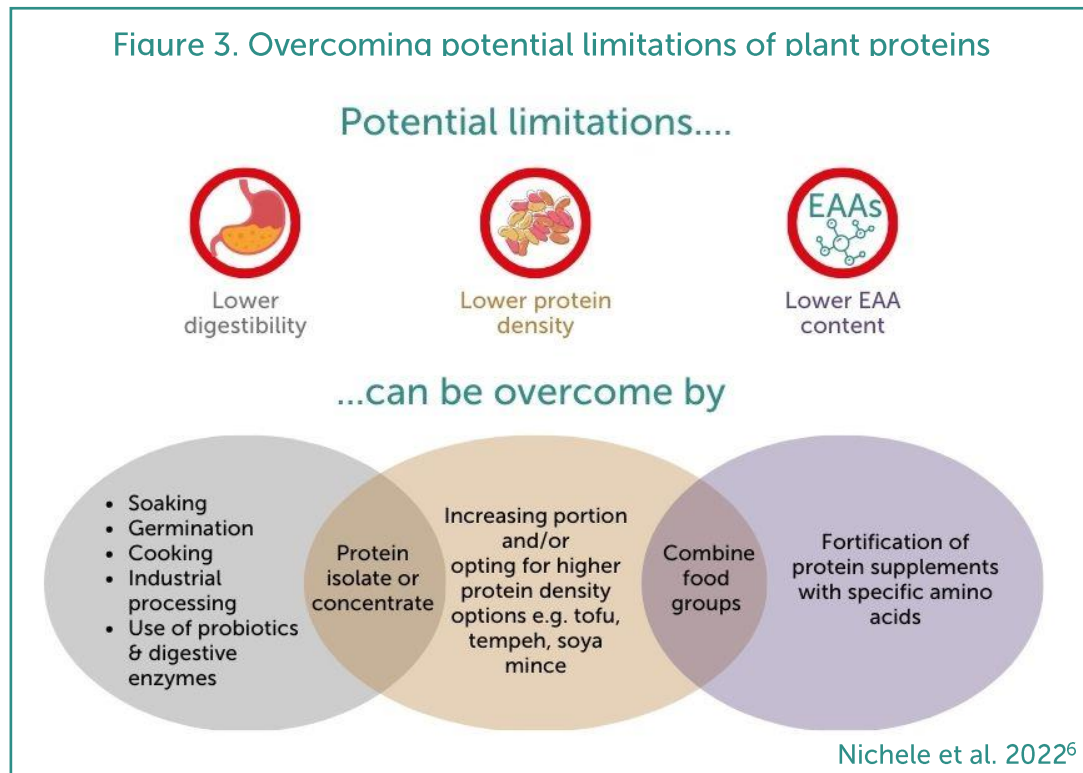
⁴ Ranganathan J, Vennard D, Waite R et al. Shifting Diets for a Sustainable Food Future: Creating a Sustainable Food Future, Instalment Eleven. <https://www.wri.org/research/shifting-diets-sustainable-food-future>. Accessed 26.11.22.

⁵ Berrazaga I, Micard V, Gueugneau M et al. The role of the anabolic properties of plant- versus animal-based protein sources in supporting muscle mass maintenance: a critical review. *Nutrients*. 2019;11(8):1825. doi: 10.3390/nu11081825

⁶ Nichele S, Stuart M, Phillips SM and Boaventura BCB. Plant-based food patterns to stimulate muscle protein synthesis and support muscle mass in humans: a narrative review. *App Physiol Nutr Metabo*. 2022; 47(7): 700-710. doi.org/10.1139/apnm-2021-0806

⁷ Young VR, Pellett PL. Plant proteins in relation to human protein and amino acid nutrition. *Am J Clin Nutr*. 1994 ;59(5):1203S-1212S. doi: 10.1093/ajcn/59.5.1203S

Figure 3. Overcoming potential limitations of plant proteins



Individual plant sources have a theoretical lower anabolic profile due to the lower EAA profile (including lower leucine content) and lower digestibility. However protein blends which combine plant proteins, such as pea, with animal proteins, such as whey, and those which combine mixtures of different plant proteins, such as cereals with pulses, are a viable and sustainable option. They can compensate for EAA imbalances in some plant protein sources and can help overcome the lower anabolic profile for muscle health of some plant foods in isolation.^{6,8}

Take home messages

Plant proteins play an important role in human nutrition and contribute significantly to dietary protein requirements. It is necessary to consider both quantity and quality of plant proteins to ensure dietary needs, including the requirement for essential amino acids, are met.

When considering quantity and quality of protein, consideration should be given to combined impact of consuming a variety of plant proteins throughout the course of the day.

There are many dietary approaches to enhance the protein contribution from plant foods and overcome potential limitations. These include processing to increase digestibility, increasing or concentrating portion size, combining food groups, fortification with specific amino acids and using protein blends.

⁸ Deane CS, Bass JJ, Crossland H. et al.. Animal, plant, collagen and blended dietary proteins: effects on musculoskeletal outcomes. *Nutrients*. 2020, 12(9): 2670.doi.org/10.3390/nu12092670



UNDERSTANDING DIETARY PROTEIN QUALITY & INTAKE

DR COLLEEN DEANE, UNIVERSITY OF SOUTHAMPTON

PROTEINS ARE MADE UP OF AMINO ACIDS AND SUPPORT MANY **ESSENTIAL FUNCTIONS** IN THE BODY - HORMONES, MUSCLE FUNCTION, DIGESTION, DNA TRANSCRIPTION AND MORE!

SOME AMINO ACIDS (ESSENTIAL AMINO ACIDS - EAA) **CANNOT** BE MADE BY THE BODY SO NEED TO BE OBTAINED THROUGH DIET.

PLANT-BASED DIETS HAVE CONSIDERABLE BENEFITS FOR BOTH HEALTH & PLANET, BUT **SOME** MAY FALL SHORT ON **PROTEIN QUALITY**.

PROTEIN INTAKES IN WESTERN COUNTRIES **FAR EXCEED** REQUIREMENTS, WITH HIGHER INTAKES OF ANIMAL PROTEIN.

PROTEIN QUALITY IS DETERMINED BY 3 KEY FACTORS:

- 1 AMINO ACID COMPOSITION
- 2 DIGESTIBILITY OF EAA
- 3 REQUIREMENT OF EAA

BLEND PROTEINS

INCREASE PORTION SIZE

SOLUTIONS TO IMPROVE PLANT PROTEIN QUALITY

CONSIDER FORTIFICATION

SOAKING/ COOKING



Non- animal derived proteins in sports nutrition

Professor Benjamin Wall, from the Department of Public Health and Sport Science at the University of Exeter Medical School, explored the area of plant protein and muscle health in further depth.

Regulation of muscle mass in the body is a dynamic process and 1-2 % (300-600g) of total muscle tissue turnover takes place each day. Dietary protein and physical activity act synergistically to stimulate muscle protein synthesis. The postprandial rise in essential amino acids (EAAs), in particular leucine, is a major driver of this process.⁹

There is relative global consensus with regard to the amount of protein ingestion needed by active sports people to maximise muscle adaptation.¹⁰ Protein intakes above the usual recommended daily amounts (RDA) are advised with optimal levels at approximately 1.6g total protein per kg body mass per day. In addition, this intake should be spread throughout the day aiming for around 20g protein (including 3-3.5g leucine / 8-10 g EAA) per meal.¹⁰

In vivo human studies have shown that protein supplementation of the diet above RDA levels stimulates the muscle adaptive response to resistance exercise. The EAA composition of a dietary protein contributes to the differential muscle protein synthetic response seen with the ingestion of different foods.

Historically it has been suggested that animal proteins with a high content of EAAs and high digestibility score, such as milk whey protein, are more effective than plant proteins.^{11,12,13,14} However, with an increasing trend towards plant-based eating, the role of non-animal derived protein in supporting muscle protein synthesis has attracted more attention. There is an increasing challenge to the established and over simplified narrative that plant-based proteins are inferior to animal in this respect and suggests they offer a much untapped potential.¹⁵

Combinations of plant proteins can closely reflect the effect of animal-based proteins on muscle. For example, plant protein isolate blends combined from wheat, corn and pea, can stimulate muscle protein synthesis at a similar rate to that of an equivalent amount of milk protein (see [Figure 4](#)).^{16,17} Consumption of single protein isolates from

⁹ Burd NA, Tang JE, Moore DR, et al. Exercise training and protein metabolism: influences of contraction, protein intake, and sex-based differences. *J Appl Physiol*. 2009 ;106(5):1692-701. doi: 10.1152/japplphysiol.91351.2008

¹⁰ Morgan P, Breen L, Dirks M, et al. The BASES expert statement on protein recommendations for athletes: amount, type and timing. *Sport Ex Scientist*. 2022. 71. www.bases.org.uk/imgs/bases_tses_spring_2022_online_expert_statement683.pdf. Accessed 25.11.22

¹¹ Cermak NM, Res PT, de Groot LC, et al. Protein supplementation augments the adaptive response of skeletal muscle to resistance-type exercise training: a meta-analysis. *Am J Clin Nutr*. 2012 ;96(6):1454-64. doi: 10.3945/ajcn.112.037556

¹² Morton RW, Murphy KT, McKellar SR, et al. A systematic review, meta-analysis and meta-regression of the effect of protein supplementation on resistance training-induced gains in muscle mass and strength in healthy adults. *Br J Sports Med*. 2018 ;52(6):376-384. doi: 10.1136/bjsports-2017-097608

¹³ Witard OC, Jackman SR, Breen L, et al. Myofibrillar muscle protein synthesis rates subsequent to a meal in response to increasing doses of whey protein at rest and after resistance exercise. *Am J Clin Nutr*. 2014 ;99(1):86-95. doi: 10.3945/ajcn.112.055517

¹⁴ Tang JE, Moore DR, Kujbida GW, et al. Ingestion of whey hydrolysate, casein, or soy protein isolate: effects on mixed muscle protein synthesis at rest and following resistance exercise in young men. *J Appl Physiol*. 2009 ;107(3):987-92. doi: 10.1152/japplphysiol.00076.2009

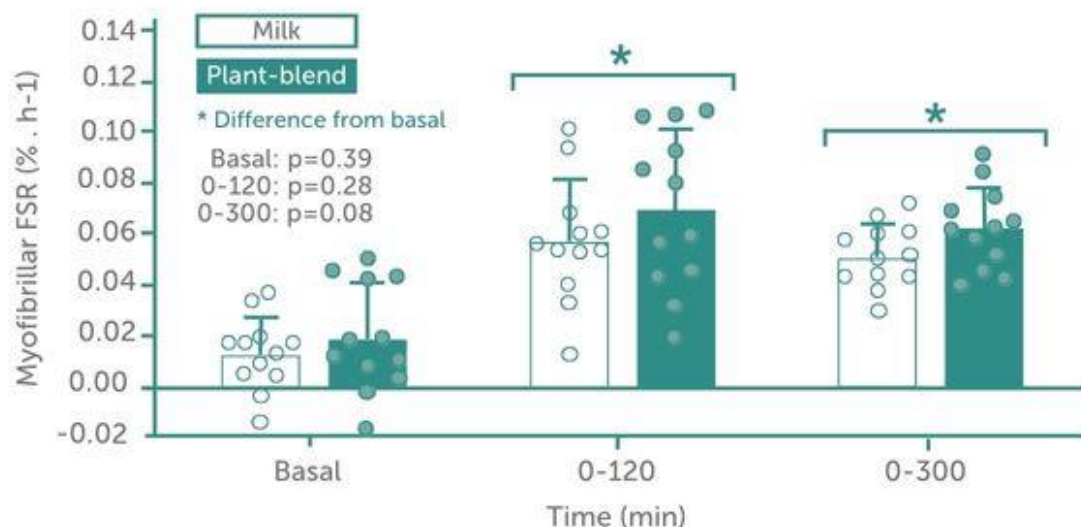
¹⁵ van der Heijden I, Monteyne AJ, Stephens FB, et al. Alternative dietary protein sources to support healthy and active skeletal muscle aging. *Nutr Rev* 2022; nuac049, doi.org/10.1093/nutrit/nuac049

¹⁶ Gorissen SHM, Crombag JJR, Senden JMG, et al. Protein content and amino acid composition of commercially available plant-based protein isolates. *Amino Acids*. 2018 ;50(12):1685-1695. doi: 10.1007/s00726-018-2640-5

¹⁷ Pinckaers PJM, Kouw IWK, Gorissen SHM, et al. The muscle protein synthetic response to the ingestion of a plant-derived protein blend does not differ from an equivalent amount of milk protein in healthy, young males. *J Nutr*. 2022 :nxac222. doi: 10.1093/jn/nxac222

wheat and potato have also been shown to stimulate muscle protein synthesis to a similar extent as milk protein.^{18,19} In addition, fungal derived mycoprotein, can stimulate post exercise muscle protein synthesis in omnivores (who also eat some animal derived protein) and in individuals consuming a vegan (100% plant-based) diet.^{20,21}

Figure 4. Muscle Protein synthesis (as measured by myofibrillar protein fractional synthetic rate FSR) following ingestion of milk vs plant protein blends



Pinckaers et al. 2022¹⁷

There is a growing body of evidence to support the view that for post-exercise muscle anabolism, once total protein needs and leucine intakes are met, the protein source is of little importance.^{22,23,24}

Unfortunately, there are few studies to determine the effects of plant proteins on muscle synthesis in those with lower total intakes of dietary protein. Studies are needed to determine the relevance of protein source in populations who are physically less active and older adults.

¹⁸ Pinckaers PJM, Hendriks FK, Hermans WJH, et al. Potato Protein Ingestion Increases Muscle Protein Synthesis Rates at Rest and during Recovery from Exercise in Humans. *Med Sci Sports Exerc.* 2022 ;54(9):1572-1581. doi: 10.1249/MSS.0000000000002937

¹⁹ Pinckaers PJM, Kouw IWK, Hendriks FK, et al. No differences in muscle protein synthesis rates following ingestion of wheat protein, milk protein, and their protein blend in healthy, young males. *Br J Nutr.* 2021 Dec 28;126(12):1832-1842. doi: 10.1017/S0007114521000635.

²⁰ Dunlop MV, Kilroe SP, Bowtell JL, et al. Mycoprotein represents a bioavailable and insulinotropic non-animal-derived dietary protein source: a dose-response study. *Br J Nutr.* 2017;118(9):673-685. doi: 10.1017/S0007114517002409

²¹ Monteyne AJ, Coelho MOC, Porter C, et al. Mycoprotein ingestion stimulates protein synthesis rates to a greater extent than milk protein in rested and exercised skeletal muscle of healthy young men: a randomized controlled trial. *Am J Clin Nutr.* 2020 ;112(2):318-333. doi: 10.1093/ajcn/nqaa092

²² Hevia-Larriain V, Gualano B, Longobardi I, et al. High-protein plant-based diet versus a protein-matched omnivorous diet to support resistance training adaptations: a comparison between habitual vegans and omnivores. *Sports Med.* 2021;51(6):1317-1330. doi: 10.1007/s40279-021-01434-9

²³ Lynch H.M, Buman MP, Dickinson JM, et al. No significant differences in muscle growth and strength development when consuming soy and whey protein supplements matched for leucine following a 12 week resistance training program in men and women: a randomized trial. *Int. J. Environ. Res. Public Health.* 2020; 17: 3871. doi.org/10.3390/ijerph17113871

²⁴ Messina M, Lynch H, Dickinson JM, Reed KE. No Difference Between the Effects of Supplementing With Soy Protein Versus Animal Protein on Gains in Muscle Mass and Strength in Response to Resistance Exercise. *Int J Sport Nutr Exerc Metab.* 2018 ;28(6):674-685. doi: 10.1123/ijsnem.2018-0071

Take home messages

There is an increasing challenge to the established narrative that plant-based proteins are inferior to animal-based with respect to muscle synthesis. This comes from a greater understanding of the theoretical potential of plant protein metabolism supported by recent human studies.

Provided total protein and leucine intakes are met, the protein source becomes less important than total intake. Equivalent quantities of plant protein isolates and blended plant proteins are able to support the anabolic response in muscle in a comparable manner to animal proteins.

More studies are needed to determine the relevance of protein sources at lower overall dietary intakes, in individuals with a sedentary lifestyle and in older populations.

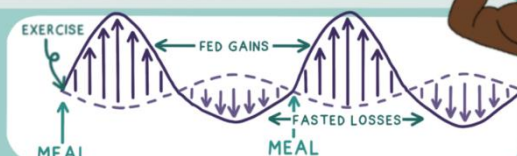


PLANT PROTEIN & SPORTS

PROFESSOR BENJAMIN WALL, UNIVERSITY OF EXETER



PROTEIN INTAKE AND RESISTANCE EXERCISE COMBINED STIMULATE MUSCLE PROTEIN SYNTHESIS (MPS).



ROBUST GUIDELINES ON PROTEIN INTAKES FOR SPORTS AND EXERCISE HAVE BEEN DERIVED FROM RESEARCH ON ANIMAL-BASED PROTEINS, BUT THERE IS NOW AN INCREASED FOCUS ON AND DEMAND FOR PLANT-BASED PROTEINS.

YOUNG ATHLETE IN
ENERGY BALANCE

**PER DAY: 1.6G/KG
BODYWEIGHT**

**PER MEAL: ~20G
PROTEIN (~3G LEUCINE
OR 8-10G EAA)**

EVERY 3-4 HOURS

THERE IS A BELIEF THAT
PLANT PROTEINS ARE
NOT AS EFFECTIVE AS
ANIMAL PROTEINS WITH
RESPECT TO MPS...

... BUT WHAT DOES
THE EVIDENCE SAY?

A GROWING BODY OF EVIDENCE SUGGESTS THAT PLANT PROTEINS CAN BE JUST AS ANABOLIC PROVIDED AMPLE PROTEIN AND SUFFICIENT LEUCINE IS CONSUMED!



Nutrition and plant proteins in later life

Prof. Lisette de Groot

Professor Lisette de Groot from Wageningen University in the Netherlands focussed on the role of plant proteins in the health of older adults.

It is well recognised that diet quality affects both mortality and morbidity in later life.^{25,26,27}

Specific nutritional concerns relate to bone, brain and muscle health. Of specific significance for older adults is the adequate intake of protein, and micronutrients including vitamins B12, and D of which animal foods are often a major dietary source.

Ageing is associated with anabolic resistance, a reduced muscle protein synthetic response to protein intake and exercise.²⁸ Age-related changes in muscle can contribute to sarcopenia, the loss of mass, strength and function that impairs weight-bearing abilities which can ultimately result in the loss of independence and disability. Sarcopenia has a high prevalence in older populations affecting health and quality of life.^{29,30,31,32}

Systematic reviews have shown that both resistance exercise and additional protein intake can influence anabolic resistance and help prevent sarcopenia in older adults.^{33,34,35} Professor de Groot presented a summary of her research from the ProMuscle project showing that protein supplementation of main meals is effective at increasing strength, mass and function of muscle in frail older adults.^{36,37}

There is a growing consensus that older adults should consume a higher quantity of high-quality dietary protein to preserve muscle function. Dietary surveys of older adults

²⁵ Haveman-Nies A, de Groot LCPGM, Burema J, et al. Dietary quality and lifestyle factors in relation to 10-year mortality in older Europeans: The SENECA Study. *Am J Epidemiol*. 2002; 156(10): 962–968. doi.org/10.1093/aje/kwf144

²⁶ Sofi F, Macchi C, Abbate R, et al. Mediterranean diet and health status: An updated meta-analysis and a proposal for a literature-based adherence score. *PHN*. 2014; 17(12): 2769–2782. doi:10.1017/S1368980013003169

²⁷ Jankovic N, Geelen A, Streppel MT, et al. Adherence to a healthy diet according to the World Health Organization guidelines and all-cause mortality in elderly adults from Europe and the United States. *Am J Epidemiol*. 2014;180(10):978–88. doi: 10.1093/aje/kwu229

²⁸ Burd NA, Gorissen SH, van Loon LJ. Anabolic resistance of muscle protein synthesis with aging. *Exerc Sport Sci Rev*. 2013 ; 41(3):169–73. doi: 10.1097/JES.0b013e318292f3d5

²⁹ Cruz-Jentoft AJ, Bahat G, Bauer J, et al. Sarcopenia: revised European consensus on definition and diagnosis. *Age Ageing*. 2019;48(1):16–31. doi: 10.1093/ageing/afy169

³⁰ Bamman MM, Ragan RC, Kim J et al. Myogenic protein expression before and after resistance loading in 26- and 64-yr-old men and women. *Appl Physiol*. 2004; 97(4): 1329–1337. doi.org/10.1152/jappphysiol.01387.2003

³¹ Hicks GE, Shardell M, Alley DE, et al. Absolute strength and loss of strength as predictors of mobility decline in older adults: The InCHIANTI Study. *J Gerontol Series A*. 2012;67A(1) :66–73. doi.org/10.1093/gerona/glr055

³² Mayhew AJ, Amog K, Phillips S, et al. The prevalence of sarcopenia in community-dwelling older adults, an exploration of differences between studies and within definitions: a systematic review and meta-analyses. *Age Ageing*. 2019 ;48(1):48–56. doi: 10.1093/ageing/afy106

³³ Churchward-Venne TA, Tieland M, Verdijk LB, et al. There are no non-responders to resistance-type exercise training in older men and women. *JAMDA*. 2015 ;16(5):P400–411. doi.org/10.1016/j.jamda.2015.01.071

³⁴ Nunes EA, Colenso-Semple L, McKellar SR, et al. Systematic review and meta-analysis of protein intake to support muscle mass and function in healthy adults. *J Cachexia Sarcopenia Muscle*. 2022; 13(2) : 795–810. doi.org/10.1002/jcsm.12922

³⁵ Liao C, Tsao J, Wu Y, et al. Effects of protein supplementation combined with resistance exercise on body composition and physical function in older adults: a systematic review and meta-analysis. *Am J Clin Nutr*. 2017; 106(4) : 1078–1091. doi.org/10.3945/ajcn.116.143594

³⁶ van Dongen EJ, Leerlooijer JN, Steijns JM, et al. Translation of a tailored nutrition and resistance exercise intervention for elderly people to a real-life setting: adaptation process and pilot study. *BMC Geriatr*. 2017 ;17(1):25. doi: 10.1186/s12877-017-0413-8

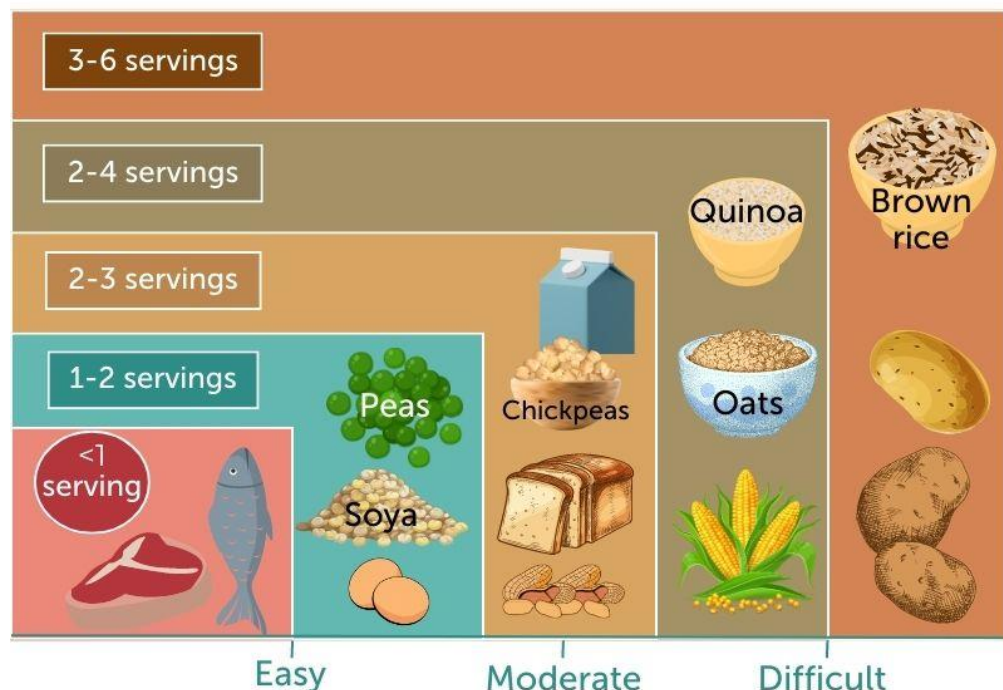
³⁷ Tieland M, Dirks ML, van der Zwaluw N, et al. Protein supplementation increases muscle mass gain during prolonged resistance-type exercise training in frail elderly people: a randomized, double-blind, placebo-controlled trial. *J Am Med Dir Assoc*. 2012;13(8):713–9. doi: 10.1016/j.jamda.2012.05.020

show that a greater proportion of protein comes from animal sources compared to plant sources.^{38,39,40,41}

Therefore, to shift intakes in older adults to include more plant protein sources, attention is needed with regard to their reduced ability to digest proteins and absorb EAAs into circulation.^{42,43}

Ageing can also affect food intake with some older adults experiencing poor appetite and early satiety (anorexia of ageing). As a result, consumption of larger portion sizes of foods with low nutrient density and high fibre content may be difficult.⁴⁴ For such individuals, in order to reduce the risk of malnutrition and/or specific micronutrient deficiencies, care is needed with the choice of plant protein source. Emphasis should be placed on those which are nutrient rich, such as pulses and beans and have a physical structure that is practical for older adults to consume (see Figure 5).⁴⁵

Figure 5. Categorical representation of the feasibility of ingesting 20g protein from selected whole food sources with the amount of food that needs to be consumed expressed as servings



Pinckaers et al. 2021⁴⁵

³⁸ Gingrich A, Spiegel A, Gradl JE, et al. Daily and per-meal animal and plant protein intake in relation to muscle mass in healthy older adults without functional limitations: an enable study. *Aging Clin Exp Res* 31, 1271–1281 (2019). doi.org/10.1007/s40520-018-1081-z

³⁹ Berner LA, Becker G, Wise M, et al. Characterization of dietary protein among older adults in the United States: amount, animal sources, and meal patterns. *J Acad Nutr Diet*. 2013;113(6):809-15. doi: 10.1016/j.jand.2013.01.014

⁴⁰ Tieland M, Borgonjen-Van den Berg KJ, van Loon LJ, et al. Dietary protein intake in community-dwelling, frail, and institutionalized elderly people: scope for improvement. *Eur J Nutr*. 2012 ;51(2):173-9. doi: 10.1007/s00394-011-0203-6

⁴¹ Hengeveld LM, Boer JMA, Gaudreau P, et al. Prevalence of protein intake below recommended in community-dwelling older adults: a meta-analysis across cohorts from the PROMISS consortium. *J Cachexia Sarcopenia Muscle*. 2020; 11(5): 1212-1222.doi.org/10.1002/jcsm.12580

⁴² Domić J, Grootswagers P, van Loon LJC, et al. Perspective: Vegan diets for older adults? a perspective on the potential impact on muscle mass and strength. *Adv Nutr*. 2022;13(3):712-725. doi: 10.1093/advances/nmac009

⁴³ Gorissen SHM, Trommelen J, Kouw IWK, et al. Protein type, protein dose, and age modulate dietary protein digestion and phenylalanine absorption kinetics and plasma phenylalanine availability in humans. *J Nutr*. 2020; 150(8):2041-2050. doi: 10.1093/jn/nxaa024

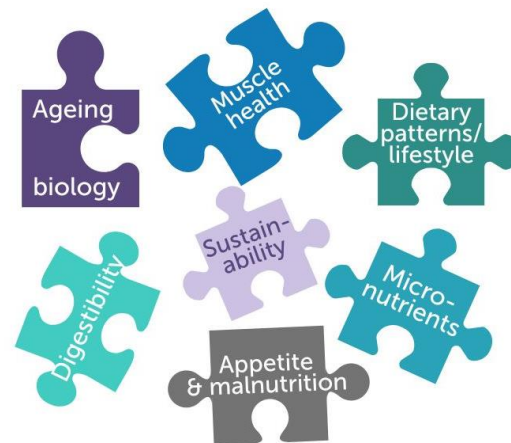
⁴⁴ Giezenaar C, Chapman I, Luscombe-Marsh N, et al. Ageing is associated with decreases in appetite and energy intake: a meta-analysis in healthy adults. *Nutrients*. 2016 ;8(1):28. doi: 10.3390/nu8010028

⁴⁵ Pinckaers PJM, Trommelen J, Snijders T et al. The Anabolic Response to Plant Based Protein Ingestion. *Sports Med*. 2021;51 (Suppl 1):559-574

There are effective strategies to help improve the anabolic properties of plant-based diets including supplementation and fortification with specific amino acids. The use of plant protein blends which has been shown to be of benefit in enhancing EAA profile and muscle synthesis in active young adults may also have applicability for the diets of older adults.⁴⁶

Population studies suggest that in practice many older adults are starting to shift towards more flexitarian and vegetarian dietary patterns.^{47,48,49} It is important to assess the quality of diets of elderly individuals to ensure they are able to meet their protein and essential micronutrient requirements especially in context of acute and long-term illness as well as those with reduced appetites. To fit the many pieces of the protein puzzle for later life together, dietary strategies and guidance need to be tailored and to consider the health and functional aspects of associated micronutrients, protein quality and quantity alongside sustainability (see Figure 6).

Figure 6. The protein puzzle in later life



Take home messages

Ageing is associated with a reduced muscle protein synthetic response to protein intake and exercise (anabolic resistance) which can contribute to loss of mass, strength and function (sarcopenia). There is a growing consensus that older adults should be advised to consume higher quantities of protein (in conjunction with resistance training) to preserve muscle function.

With a shift towards more plant-based eating – it is essential to ensure adequate intakes of total protein and EAA composition in the diets of older adults. Plant proteins which are both nutrient dense and practical for older adults to consume should be selected and strategies such as the use of plant protein blends and/or dietary supplementation and fortification of protein foods with specific amino acids may be of value to those with reduced appetites or increased requirements.

⁴⁶ Pinckaers PJM, Kouw IWK, Gorissen SHM, et al. The muscle protein synthetic response to the ingestion of a plant-derived protein blend does not differ from an equivalent amount of milk protein in healthy, young males. *J Nutr.* 2022; nxac222. doi: 10.1093/jn/nxac222

⁴⁷ Ocké MM, Buurma-Rethans EJM, De Boer EJ, et al. Diet of community-dwelling older adults. Dutch National Food Consumption Survey-Older adults 2010-2012. Bilthoven: RIVM; 2013. www.rivm.nl/bibliotheek/rapporten/050413001.pdf. Accessed 28.11.22

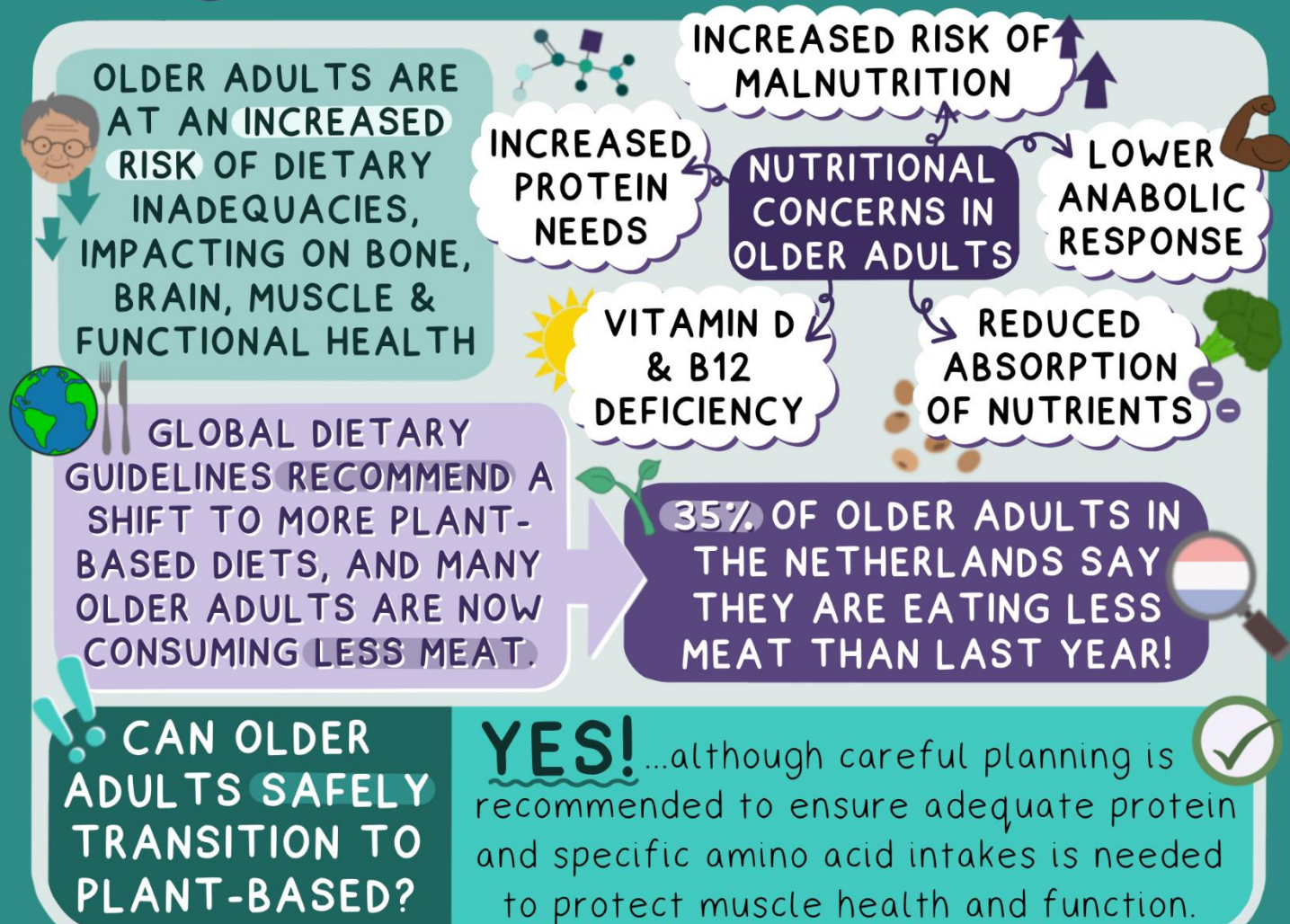
⁴⁸ Van Rossum C, Buurma-Rethans E, Vennemann F, Beukers M, Brants HA, De Boer E, et al. The diet of the Dutch: Results of the first two years of the Dutch National Food Consumption Survey 2012-2016. RIVM letter report 2016-0082. 2016. www.rivm.nl/bibliotheek/rapporten/2016-0082.pdf. Accessed 28.11.22

⁴⁹ Kloosterman RA, Akkermans M, Reep, C, et al. Climate change and energy transition: views and behaviour of the Dutch in 2020. Centraal Bureau voor de Statistiek; 2021. www.cbs.nl/nl-nl/longread/rapportages/2021/klimaatverandering-en-energietransitie-opvattingen-en-gedrag-van-nederlanders-in-2020. Accessed 28.11.22



NUTRITION AND PLANT PROTEINS IN LATER LIFE

PROFESSOR LISETTE DE GROOT, WAGENINGEN UNIVERSITY



Protein shift for planet-based diets

Dr Corné van Dooren

Dr van Dooren, Senior advisor on sustainable diets from the World Wildlife Fund for Nature (WWF) – The Netherlands focussed on the environmental aspects of including plant proteins in the diet.

He began by describing how the food system impacts on planetary health with major influences on biodiversity loss, soil degradation, ocean acidification, land use and deforestations as well as freshwater use.^{50,51} Agriculture is also one of the biggest contributors to greenhouse gas (GHG) emissions and global warming, primarily through livestock farming. Not surprisingly, expert opinion agrees that major changes in our food consumption patterns are necessary to address this.^{51,52,53}

Dr van Dooren outlined the WWF vision for a PLANET-BASED diet which protects and preserves nature while ensuring there is enough nutritious food for all current and future generations.⁵⁴

A combination of changes are needed to improve the environmental impact of our food system including reduction in food loss and waste and the adoption of nature-positive production practices. However dietary approaches are potentially the quickest action to achieve and can help facilitate the other approaches.

Key dietary changes

1. Eat more healthful plant foods and less animal-based foods

Diets should reduce red and processed meat alongside the inclusion of some dairy foods, oily fish, pulses, nuts and wholegrains. Where eaten, meat and fish should be from sustainable sources. A reduction in animal-based products should be in line with sustainable food-based dietary guidelines and the EAT-Lancet report (see [Figure 7](#)).⁵²

2. Fresh and local above energy-dense nutrient-poor foods

3. Foods from a more sustainable method of agriculture such as organic farming

4. More variety and balance to the plate; nothing too much

Currently only nine food crops (rice, wheat, maize, potato, cassava, soya, palm oil, beet and cane sugar) account for two thirds of the harvest. Eating a variety of plant foods avoids monocultures and helps preserve biodiversity and soil quality. In context of balance, the avoidance of over consumption of food energy is important and has the second biggest impact on the environment after meat consumption.⁵⁵

⁵⁰ WWF. The Living Planet Report 2020. www.wwf.org.uk/sites/default/files/2020-09/LPR20_Full_report.pdf. Accessed 25.11.22

⁵¹ Poore J and Nemecek T. reducing food's environmental impacts through producers and consumers. *Science*. 2018; 360(6392): 987-992. doi.org/10.1126/science.aag0216

⁵² Willett W, Rockström J, Loken B, et al. Food in the Anthropocene: the EAT-Lancet Commission on healthy diets from sustainable food systems. *Lancet*. 2019 ; 393 (10170):447-492. doi: 10.1016/S0140-6736(18)31788-

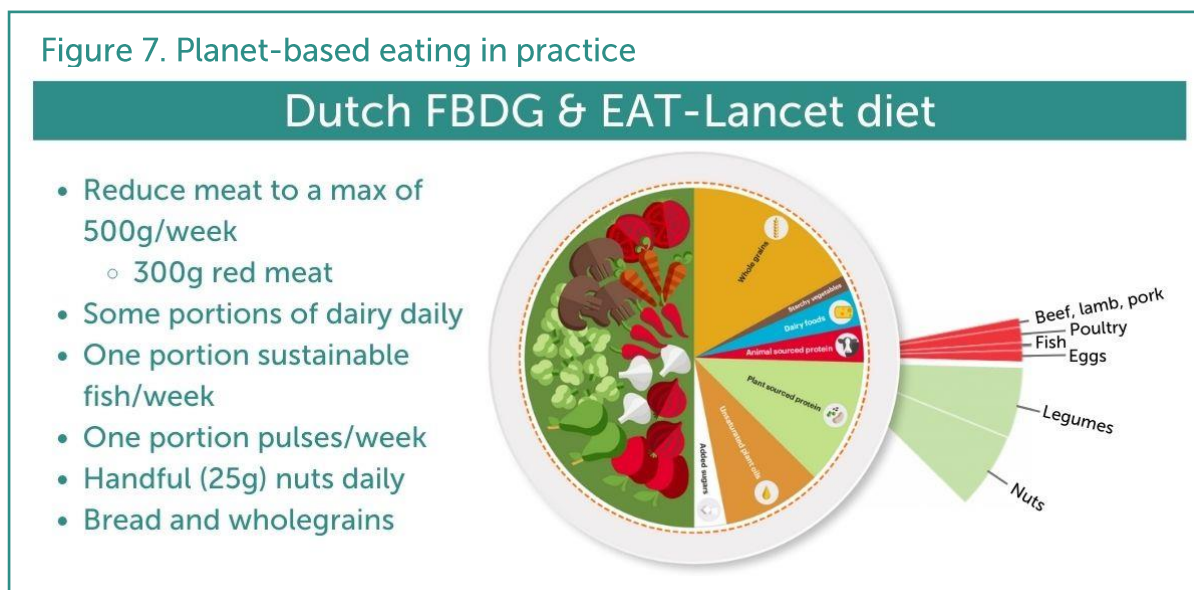
⁵³ World Health Organization, Food and Agriculture Organization of the United Nations WHO/ FAO .Sustainable healthy diets: guiding principles (who.int) 2019

⁵⁴ WWF. Planet based diet <https://planetbaseddiets.panda.org/> Accessed 25.11.22

⁵⁵ Vieux F, Darmon N, Touaz D et al.Greenhouse gas emissions of self-selected individual diets in France: Changing the diet structure or consuming less? *Ecol Econ* .2012;75: 91-101.doi.org/10.1016/j.ecolecon.2012.01.003

Dr van Dooren highlighted two plant foods as being of value to both health and sustainability. Nuts are an excellent source of a wide range of nutrients in addition to protein with a low impact on land use and biodiversity. There are opportunities to increase the nut harvest in many areas of the world.

Figure 7. Planet-based eating in practice



Pulses and beans including soya are also highly nutritious and exhibit an efficient protein delivery in relation to GHG emissions with low environmental impacts.⁵⁶ Soya scores highly in the Sustainable Nutrient Rich Foods index (SNRF); a measure which combines health-related nutritional impact of a food with environmental impact.⁵⁷

A significant percentage of the global soya crop is grown in the Amazon rainforest, but the majority of this soya is used for animal feed. Therefore, reducing the current demand for animal protein will automatically lower quantity of soya grown and consequently preserve the rainforest reducing the negative environmental impact. Soya grown directly for human consumption in the UK and Europe comes mainly from North America, Europe or Asia.

Some dietary patterns around the world such as those of the traditional Nordic and Mediterranean eating styles already successfully combine health with sustainability.

Dietary studies, such as the WWF-Belgium Eat 4 Change project, have shown that it is possible to change dietary practices to meet these principles at a price which is affordable to the consumer.⁵⁸

⁵⁶ Gonzalez A, Frostell B, Kanyama AC . Protein efficiency per unit energy and per unit greenhouse gas emissions: Potential contribution of diet choices to climate change mitigation. Food Policy. 2011; 36(5):562-570

⁵⁷ van Dooren C, Douma A, Aiking H et al. Proposing a Novel Index Reflecting Both Climate Impact and Nutritional Impact of Food Products. Ecol Econ. 2017;131: 389-398. doi.org/10.1016/j.ecolecon.2016.08.029

⁵⁸ WWF-Belgium Eat 4 Change <https://www.wwf.org.uk/eat4change> Accessed 25.11.22

Take home messages

The food system is a significant contributor to the current environment burden including GHG emission and global warming, loss of biodiversity, deforestation, ocean acidification and eutrophication as well as poor soil quality.

The global consensus is for a shift towards more healthful plant-based eating if we are to reduce the environmental and health burden of our current food system.

Both nuts and pulses such as soya are particularly useful as an excellent nutrient dense food source with a low environmental cost.

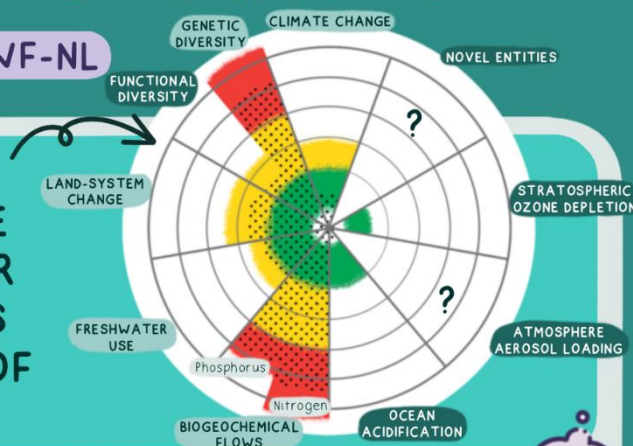
Studies have demonstrated that a healthful plant-based sustainable diet can be affordable by all consumers.



DR CORNÉ VAN DOOREN, WWF-NL

PROTEIN SHIFT FOR PLANET-BASED DIETS

AGRICULTURE IS THE BIGGEST CONTRIBUTOR TO CROSSING THE PLANETARY BOUNDRIES, A MAJOR EMITTER OF GREENHOUSE GASES (GHG) AND ALSO OCCUPIES 50% OF HABITABLE LAND ON EARTH!



WE NEED WIDE ADOPTION OF A PLANET-BASED DIET:



- ✓ EAT MORE PLANT-BASED & LESS ANIMAL-BASED
- ✓ OPT FOR FRESH & LOCAL
- ✓ CHOOSE FOOD FROM MORE SUSTAINABLE AGRICULTURE
- ✓ ENSURE YOUR PLATE HAS VARIATION & BALANCE

MANY PLANT FOODS HAVE A FAVOURABLE PROTEIN: GHG EMISSION RATIO COMPARED TO ANIMAL-BASED FOODS

SOME PLANT FOODS HAVE LIMITED AMINO ACID PROFILES, SO DIVERSITY IS KEY FOR BOTH NUTRITION & PLANET!

THE ENVIRONMENTAL IMPACTS OF THE LOWEST-IMPACT ANIMAL PRODUCTS STILL EXCEED THOSE OF PLANT-BASED SUBSTITUTES!



How to help people move to a more plant-based diet

In the final session Dr Marie Ahluwalia, author and nutrition expert from Berlin, Germany, expanded on the theme of translating science into practice by exploring ways to effectively communicate messages about plant-based eating.

She summarised the evidence demonstrating a wide range plant-based dietary patterns are associated with improved health outcomes. Beneficial plant-based patterns included flexitarianism, with occasional consumption of meat and fish, through to veganism with the total avoidance of all animal products.^{59,60,61,62,63}

She highlighted that consumers have a long way to go to achieve current national and international dietary guidelines advising on plant-based eating with adequate energy, protein, and fibre alongside lower intakes of saturated fat, salt and sugar.^{64,65,66}

Major shifts in behaviour are needed to increase wholegrains, fruit, and vegetables alongside plant proteins from nuts, seeds, beans and pulses and foods made from these such as tofu and plant-based dairy alternatives.

Nutrition education is one of many behaviour strategies that is needed if we are to shift behaviour. Education and consensus in messaging is needed at multiple levels from one-to-one advice right through to governments and the media.

Motivation is a key driver behind behaviour and approaches might usefully include the benefits for animal welfare in addition to health and environmental advantages of plant-based eating.

To help facilitate dietary change, the tailoring of information to lifestyle and an emphasis on practical translation are key considerations. **Useful strategies might include:**

- Raising awareness that plant-based eating does not necessitate a total avoidance of animal foods. Rather it can include suggestions for plant-based swaps and ways to reduce meat via extending with plant proteins.
- Suggesting small changes or nudges in behaviour which can have big impacts such as the introduction of “meat-free” days during the week or simple swaps

⁵⁹ Storz MA. What makes a plant-based diet? a review of current concepts and proposal for a standardized plant-based dietary intervention checklist. *Eur J Clin Nutr.* 2022 ;76(6):789-800. doi: 10.1038/s41430-021-01023-z

⁶⁰ Satija A, Bhupathiraju SN, Rimm EB, et al. Plant-Based Dietary Patterns and Incidence of Type 2 Diabetes in US Men and Women: Results from Three Prospective Cohort Studies. *PLoS Med.* 2016;13(6):e1002039. doi:10.1371/journal.pmed.1002039

⁶¹ Song M, Fung TT, Hu FB, et al. Association of animal and plant protein intake with all-cause and cause-specific mortality. *JAMA Intern Med.* 2016;176(10):1453–1463. doi:10.1001/jamainternmed.2016.4182

⁶² Chen Z, Zuurmond MG, van der Schaft N, et al. Plant versus animal based diets and insulin resistance, prediabetes and type 2 diabetes: the Rotterdam Study. *Eur J Epidemiol.* 2018;33(9):883-893. doi:10.1007/s10654-018-0414-8

⁶³ Schwingshackl L, Schwedhelm C, Galbete C, et al. Adherence to Mediterranean diet and risk of cancer: an updated systematic review and meta-analysis. *Nutrients.* 2017; 9: E1063. doi: 10.3390/nu9101063

⁶⁴ Willett W, Rockström J, Loken B, et al. Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems. *Lancet.* 2019 ; 393 (10170):447-492. doi: 10.1016/S0140-6736(18)31788-4.

⁶⁵ Public Health England. A Quick Guide to the Government's Healthy Eating Recommendations (publishing.service.gov.uk) 2018. Accessed 26.11.22

⁶⁶ Scheelbeek P, Green R, Papier K, et al. Health impacts and environmental footprints of diets that meet the Eatwell Guide recommendations: analyses of multiple UK studies. *BMJ Open.* 2020 ;10(8):e037554. doi: 10.1136/bmjopen-2020-037554

from refined to whole grain options or dairy to fortified plant-based alternatives.

- Illustrating information with simple visual aids such as infographics, portion size diagrams or plate models.

It is also important to acknowledge and address barriers that consumers face.⁶⁷ **Primary barriers for consumers:**

- Taste
- Cost
- Access and availability of plant-based foods when shopping and eating out
- The time and skills needed for preparation of plant foods
- Nutritional adequacy in particular concerns around the protein quality of plant foods

Many barriers can be overcome with tailored, practical advice including shopping and cooking tips, recipes, and food tastings. Many of the plant-based meat and dairy alternatives available on the market are tasty, convenient and offer high-quality nutrition on a par with their unprocessed animal-based counterparts and help make plant-based eating more achievable for consumers.⁶⁸

Take home messages

Current dietary eating patterns do not meet the recommendations of national and international food-based diet guidelines for plant-based eating.

To help change people's diets it may be helpful to increase motivation, address barriers and to offer a broad range of practical, tailored nutrition advice.

Some key actions that can help shift behaviour include keeping the message simple, providing achievable practical tips such as swaps, making healthier and environmentally sustainable food more accessible and tackling their key barriers including taste, cost and convenience.

⁶⁷ Perez-Cueto F, Rini L, Faber I, et al. How barriers towards plant-based food consumption differ according to dietary lifestyle: Findings from a consumer survey in 10 EU countries. *Int J Gastro Food Sci* . 2022 ;29:100587.doi.org/10.1016/j.ijgfs.2022.100587

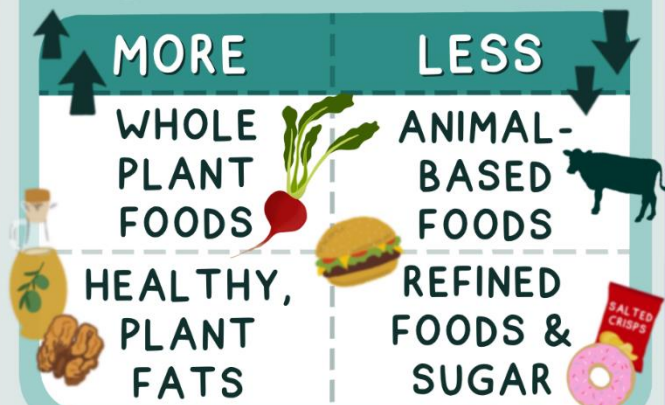
⁶⁸ Messina M, Sievenpiper JL, Williamson P et al. Perspective: Soy-based meat and dairy alternatives, despite classification as ultra-processed foods, deliver high-quality nutrition on par with unprocessed or minimally processed animal-based counterparts. *Adv in Nutr.*2022; 13(3,): 726–738. doi.org/10.1093/advances/nmac026



HOW TO HELP PEOPLE MOVE TO A MORE PLANT-BASED DIET

DR MARIE AHLUWALIA, MEDICAL DOCTOR & NUTRITIONIST

HEALTH PROMOTING & SUSTAINABLE DIETS ARE ALIGNED WITH PRINCIPLES OF PLANT-BASED EATING:



FOR BOTH HEALTH AND PLANET, WE NEED TO SUPPORT PEOPLE TO MAKE DIETARY CHANGE BY ADDRESSING BARRIERS & SHARING MOTIVATORS!

HOW TO SUPPORT CLIENTS TO MAKE DIETARY CHANGES

1 CONSIDER THE STARTING POINT



Make recommendations based on the current diet

2 EDUCATE ON THE BENEFITS



Focus on benefits of plant protein & aspects of taste

3 INCREASE ACCESS & AVAILABILITY



Consider convenience, supermarkets & communal eating



!! KEEP IT SIMPLE & OFFER TANGIBLE ADVICE THAT WILL BE MOST EFFECTIVE

4



[Click here to watch the symposium recording](#)

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